Inhoudsopgave

Bijlage 2j

Gegevens tijdelijke 150 kV verbinding

Ontwerp omleiding M53 en M54

Project:
Randstad 380 KV Noordring

Opdrachtgever:
TenneT TSO

Revisie	Datum	Wijzigingen ten opzichte van vorige revisie
00	14-02-2014	Eerste versie
01	04-04-2014	Revisie na keuze voor ondergrondse kabel

Documentnummer: R3N-OWR-0050

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Michaël Desmet	Cofely Fabricom
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Neem bij twijfel over de geldende versie contact op met de documentbeheerder.

Inhoudsopgave

Referentie lijst

Ref	Document naam
[A]	R3N-TEK-0163-00 Varianten aanp bovengronds 150kV trace tussen mast 121 en 124
[B]	R3N-TEK-00181-00.02 Portalen omleiding M54 en M53 (Grondkabel)
[C]	R3N-PLA-0005-01 VNB Plan
[D]	R3N-PLN-0001Planning
[E]	R3N-OWR-0052-01.01 berekening magnetische veldsterkte omleiding M53 en M54
[F]	R3N-OWR-0054-00.01 Controle berekeningen M52 en M55

1. INLEIDING

De komende jaren werken het ministerie van Economische Zaken en TenneT aan de aanleg van een nieuwe 380 kV hoogspanningsverbinding in de Randstad. De nieuwe verbinding stelt de voorziening van elektriciteit in de Randstad veilig.

Het ontwerptracé van de nieuwe Randstad 380 kV verbinding is sinds eind 2008 bekend. De plannen gaan uit van twee ringen, tussen Wateringen en Zoetermeer (de Zuidring) en tussen Zoetermeer en Beverwijk (de Noordring). Eind 2012 heeft Tennet de aanbesteding opgestart voor het gedeelte van de Noordring tussen station Vijfhuizen en Bleiswijk. Het contract is opgedeeld in twee percelen, waarbij de grens ligt bij Zuidelijke Ringvaart. Dit document heeft betrekking op perceel 2 (het zuidelijke gedeelte).

Het voorliggende document is onderdeel van het definitief ontwerp ten behoeve van de vergunningsaanvragen en behandelt:

- het ontwerp van een 3 circuit noodverbinding tussen mast 52-55 (150kV verbinding) ivm het kruisen van de nieuwe 150/380 verbinding mast 122-123 (oud 92-93).

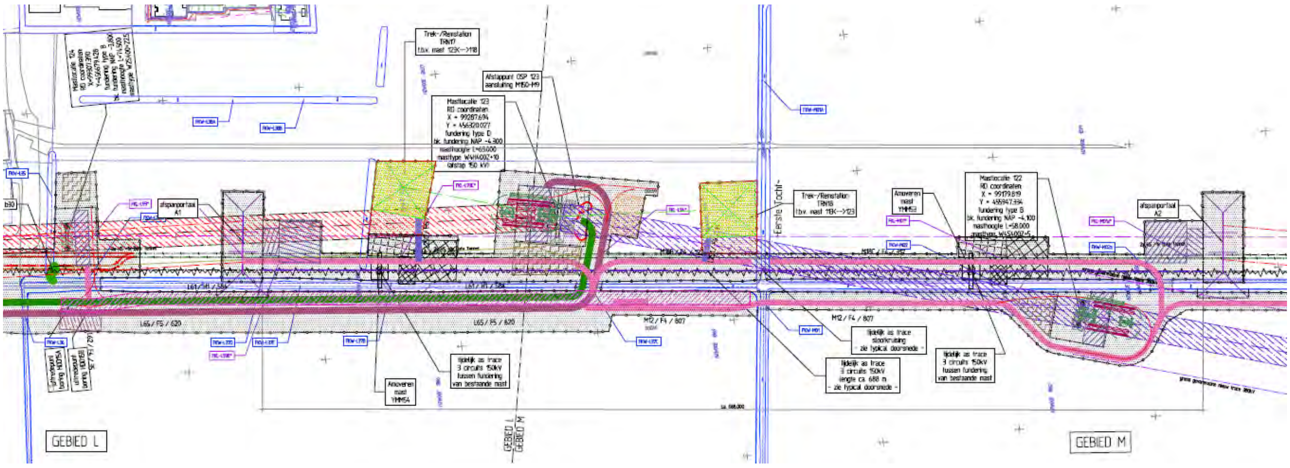
Na een vergelijkende studie is er geopteerd om de omleiding uit te voeren met een ondergrondse kabel in plaats van een luchtlijn. Alle wijzigingen zijn opgenomen in deze tweede revisie.

2. DRIE CIRCUIT TIJDELIJKE OMLEIDING AAN MAST 52-55

Situatie schets: Aan mast 53-54 zal de nieuwe 150/380kV lijn kruisen met de oude 150kV lijn. Omdat de nieuwe 150/380 kV lijn eerst moet worden opgebouwd vooraleer de oude 150kV lijn uit dienst genomen kan worden is er geopteerd voor een tijdelijke omlegging van de oude lijn tussen mast 52 en 55 zodat de nieuwe lijn zonder snijding van de oude lijn kan worden opgebouwd.

2.1. OMGEVINGSIMPACT

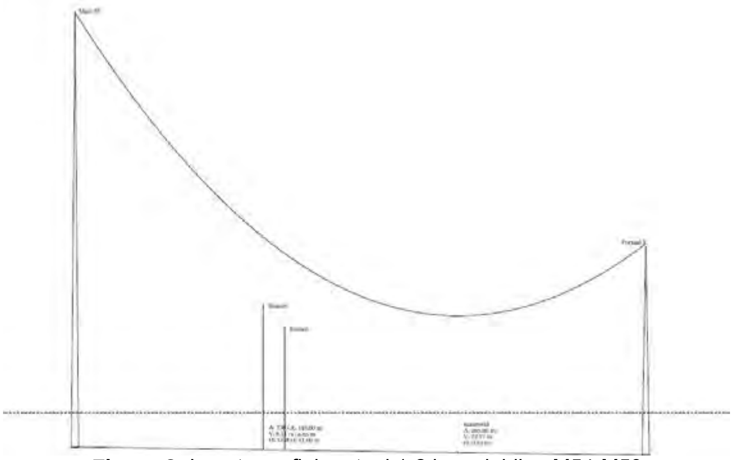
De omleiding komt tot stand door de geleiders tussen M52 en M55 te vervangen door een ondergrondse kabel. Daarvoor zullen er 2 OSP's worden gebouwd die de geleiders met de ondergrondse kabel verbindt. Voor de bouw van elk portaal wordt een werkgebied voorzien van 40 x 40m, daarbij voorzien we een aantal extra zones voor het laten zakken van de geleiders. Beide portalen worden na de werken afgezet met een omheining (~30 x 85 m). Zie ref [A] voor meer detail.



Figuur 1: Omgevingsimpact rond mast 53 – 54

2.2. LENGTEPROFIEL

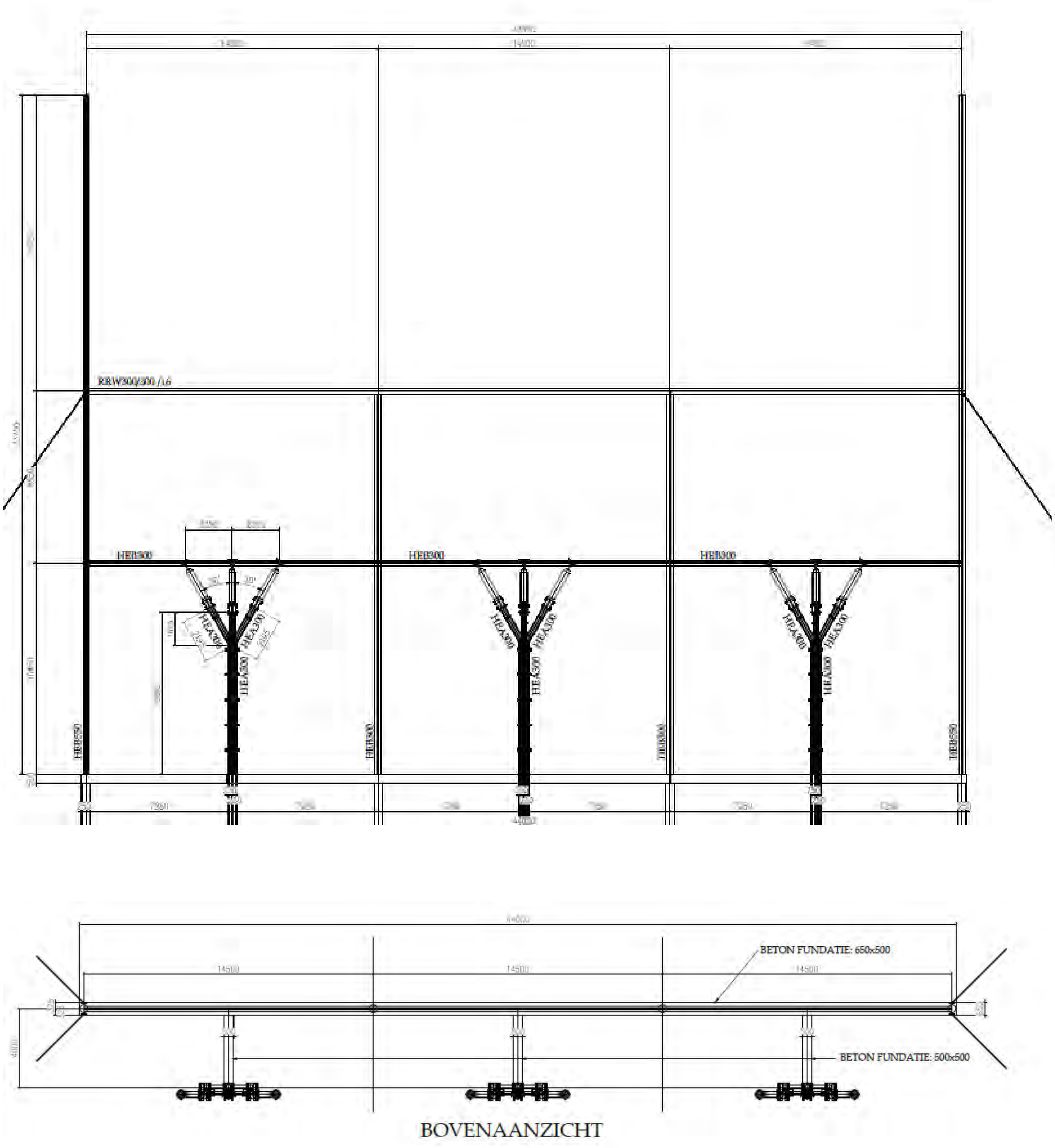
Voor de hoogte van de omleiding is er rekening gehouden met enkele bepalende obstakels: de Dorpsstraat, N209 en enkele bomen. De vrije ruimte onder de lijnen is altijd groter dan 7m zodat er geen gevaar is voor het verkeer. In bijlage het totale lengte profiel bijlage 1.



Figuur 2: Lengte profiel portaal 1-2 in omleiding M54-M53

2.3. MASTBEELD

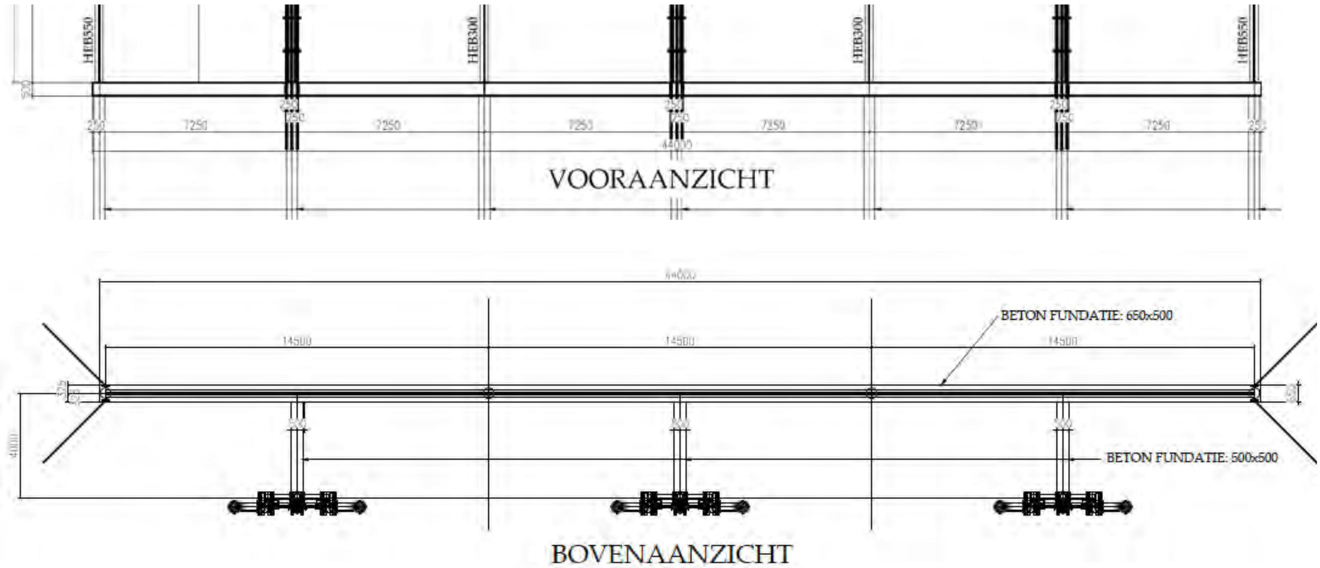
De OSP’s bestaan uit een portaal, waar de geleiders op afdalen, en drie kleinere structuren waarop de isolator stiften worden bevestigd. De portalen worden gefundeerd op palen en verankerd met tuikabels. Zie ref [B] voor de detail tekeningen. Er is voor deze opstelling gekozen met het oog op minimale onderlinge afstanden, hoek, methode van het overbrengen van de geleiders, ondergrondse leidingen, sloten, …



Figuur 3: Mastbeeld portaal

2.4. FUNDERING

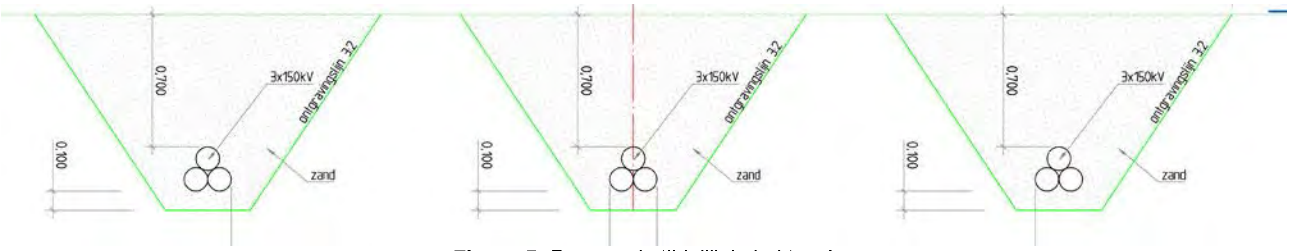
Als fundering worden er 7 stalen buispalen van ca. 17m (ϕ 356 mm) in de grond geheid met daarop een betonnen balk van 44 x 0,65 x 0,5m voor de lengte van het portaal met daarbij een verbinding naar de isolator structuren van 4x0,5x0,5m. De verbinding van het portaal naar de betonnen balk gebeurt middels ingestorte ankers. De dimensies van de fundering zullen in de volgende fase worden uitgewerkt en definitief vastgesteld. Zie ref [B] voor een overzicht.



Figuur 4: fundering

2.5. KABEL

TenneT stelt een kabel ter beschikking van het type 'E-YLKrvasdlwd 87/150KV 1x 1600mm² AL'. De kabel zal per circuit in driehoek worden ingegraven op een diepte van minimaal 0,7m. De circuits zullen met een onderlinge afstand van 2 m worden aangelegd. Het tracé van de ondergrondse kabel loopt gelijk met de hartlijn van de bestaande lijn (zie ref [B]).



Figuur 5: Doorsnede tijdelijk kabel tracé

2.6. VNB OMBOUWPLAN

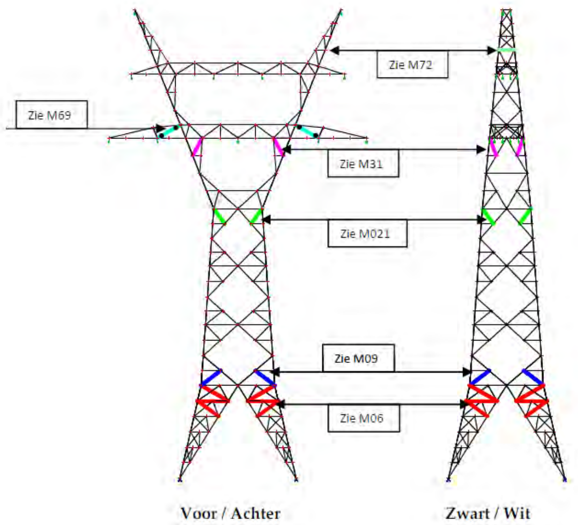
De werkmethode is op zo'n manier opgesteld dat er tijdens de werken ten alle tijden 1 circuit in dienst is en 1 in stand-by. Zie bijlage 2 voor de verschillende stappen en een visuele voorstelling. Voor de algemene planning zie ref [C] en [D].

2.7. MAGNEETVELD BEREKENING

Aangezien de omleiding afwijkt van de bestaande lijn zal er een EMC studie worden uitgevoerd. Zie ref [E] voor een quick scan die reeds is uitgevoerd en waaruit we kunnen concluderen dat maximale magnetische fluxdichtheid niet wordt overschreden conform de VROM-richtlijnen.

2.8. VERSTERKINGEN M52 EN M55

Door de kleine hoek en de afdaling naar de OSP's zullen de masten 52 en 55 op verschillende plaatsen in hun structuur versterkt moeten worden. Ook de funderingen zullen moeten aangepast worden. Meer details vindt u in ref [F].



Figuur 6: Versterkingen M55

Ook voor de fundering van masten 52 en 55 zijn er aanvullende maatregelen nodig. Bij de situatie waarbij de palen op trek komen te staan voldoen de huidige funderingen niet. Om de te grote trekspanningen op te vangen worden er extra groutankers geplaatst. Meer details vindt u in ref [F].

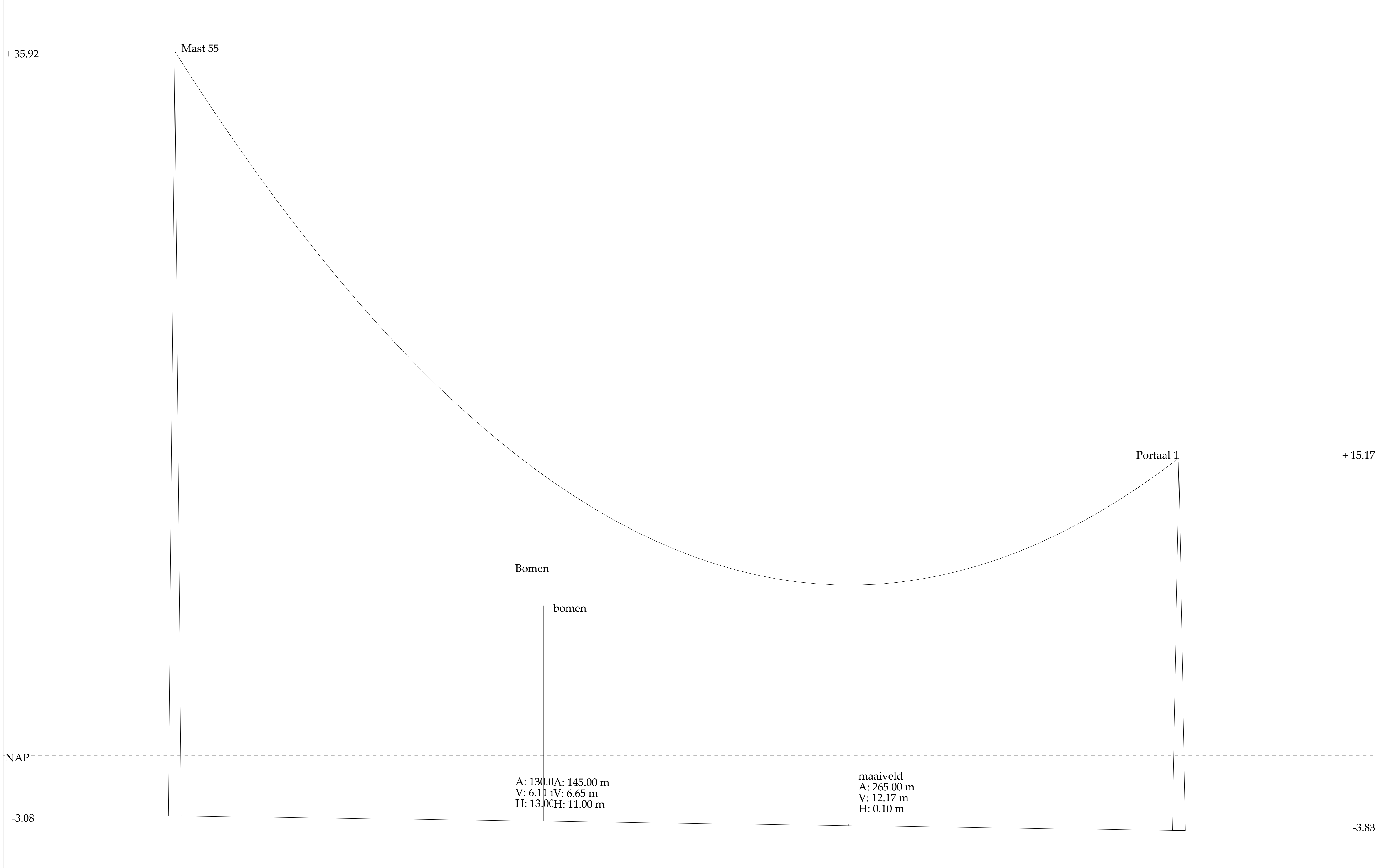
3. BIJLAGEN

Bijlage 1 Lengte profiel omleiding M54 en M53

Bijlage 2 VNB ombouwplan

BIJLAGE 1: LENGTE PROFIEL OMLEIDING MAST M54 M53

Bestand:	13039_55-port	Geleidertype :	CU185	Temperatuur :	70 °C	Veld :	1	Lengte :	395 m	Sch. hor. : 1 : 1350
Vak :		Plaats :	fase ondertr	Trekkracht :	21962 N	Doorh. t.o.v. hoogste mast :			27.23 m	Sch. vert.: 1 : 175

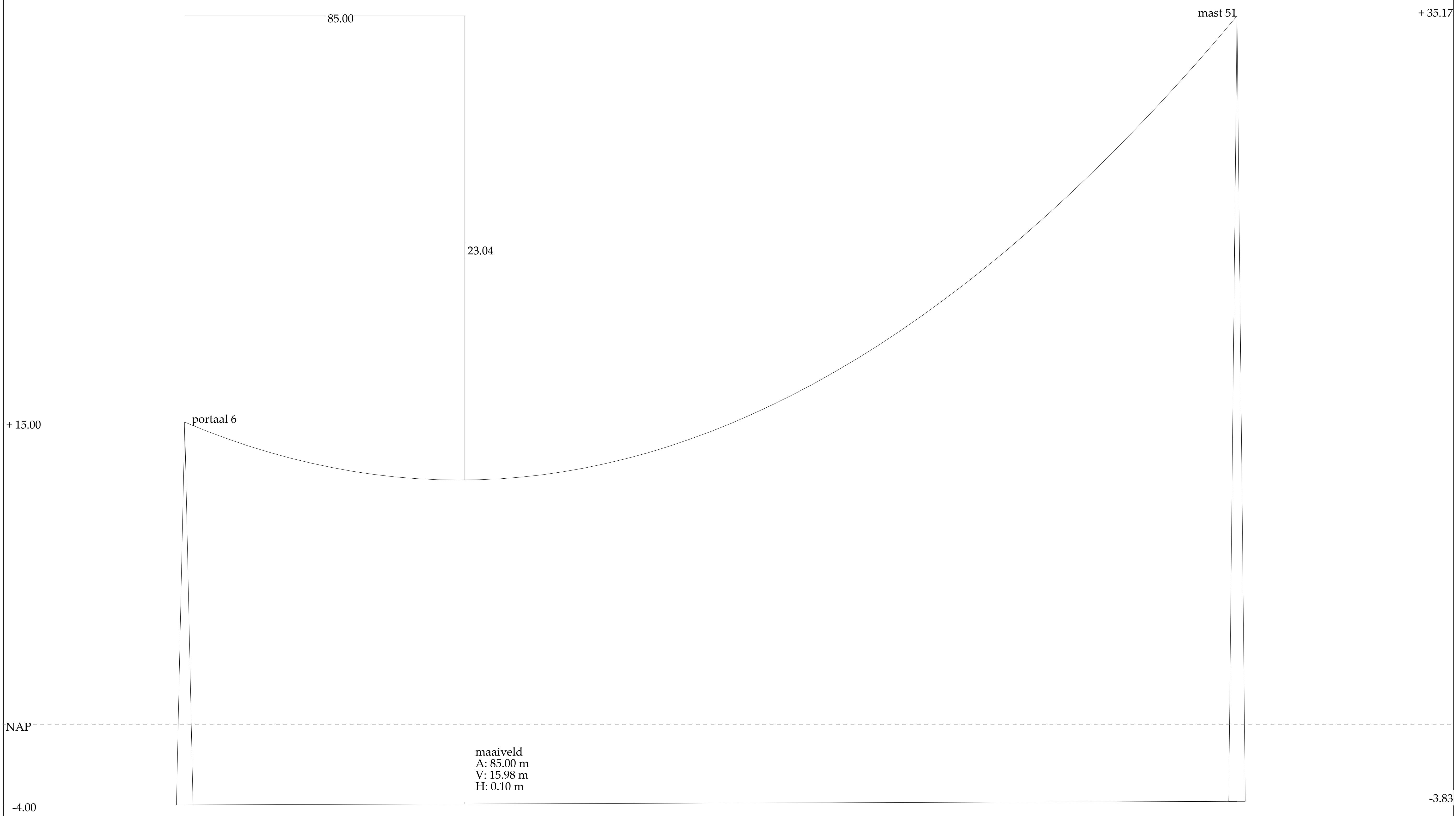


Naam hoogspanningslijn:
Omschrijving vak:

Omschrijving veld:
mast 55 - Port 1

D&C Software Zeegprogrammatuur versie 9.0

Bestand:	port6_mast51nw	Geleidertype :	Cu 185	Temperatuur :	70 °C	Veld : 1	Lengte : 319.25 m	Sch. hor. : 1 : 1100
Vak :		Plaats :	fase onndertr	Trekkracht :	20462 N	Doorh. t.o.v. hoogste mast :	23.04 m	Sch. vert.: 1 : 180



Naam hoogspanningslijn:
Omschrijving vak:

Omschrijving veld:
port1 - mast 51

D&C Software Zeegprogrammatuur versie 9.0

BIJLAGE 2: VNB OMBOUWPLAN

Scenario Omleiding M52-54

Optie Grondkabel

COFELY FABRICOM GDF SUEZ

<table>
<tr><th>Dag</th><th>Werk omschrijving</th><th>Schema</th><th>VNB</th></tr>
<tr><td>1</td><td rowspan="10">Versterken van mast lichaam M52 en M55</td><td rowspan="10">/</td><td rowspan="10">/</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td><td rowspan="5">Versterken 1 kant van mast kop M52 en M55</td><td rowspan="5">/</td><td rowspan="5">Wit + Grijs</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td rowspan="5">Versterken 2e kant van mast kop M52 en M55</td><td rowspan="5">/</td><td rowspan="5">Grijs + Zwart</td></tr>
<tr><td>17</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td><td rowspan="3">Montage eerste stuk portalen 1 en 2</td><td rowspan="3">Stap 1</td><td rowspan="3">Wit + Grijs</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td><td rowspan="3">Montage tweede stuk portalen 1 en 2</td><td rowspan="3">Stap 2</td><td rowspan="3">Grijs + Zwart</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td><td rowspan="3">OSP's voorbereiden voor het installeren van de kabel</td><td rowspan="3"></td><td rowspan="3">/</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
<tr><td>30</td><td rowspan="10">Trekken van kabels en bliksemdraden tussen portaal 1 en 5</td><td rowspan="22">Stap 4</td><td rowspan="10">/</td></tr>
<tr><td>31</td></tr>
<tr><td>32</td></tr>
<tr><td>33</td></tr>
<tr><td>34</td></tr>
<tr><td>35</td></tr>
<tr><td>36</td></tr>
<tr><td>37</td></tr>
<tr><td>38</td></tr>
<tr><td>39</td></tr>
<tr><td>40</td><td rowspan="6">Afwerken verankering portalen 1, 2, 4 en 5</td><td rowspan="6">/</td></tr>
<tr><td>41</td></tr>
<tr><td>42</td></tr>
<tr><td>43</td></tr>
<tr><td>44</td></tr>
<tr><td>45</td></tr>
<tr><td>46</td><td rowspan="3">Afwerken ophanging portaal 3</td><td rowspan="3">/</td></tr>
<tr><td>47</td></tr>
<tr><td>48</td></tr>
<tr><td>49</td><td rowspan="3">Plaatsen van afstand houders tussen portaal 1 en 5</td><td rowspan="3">/</td></tr>
<tr><td>50</td></tr>
<tr><td>51</td></tr>
<tr><td>52</td><td>Afstand houders circuit wit uit portaal M52-53 en M54-55 fietsen</td><td rowspan="4">Stap 5</td><td>Wit + Grijs</td></tr>
<tr><td>53</td><td rowspan="3">M52 (circuit wit) ombouwen van een ophanging naar een verankering (eventueel optuien) + op/af tuien aangrensende masten + Aardkabel naar beneden brengen</td><td rowspan="3">Wit + Grijs</td></tr>
<tr><td>54</td></tr>
<tr><td>55</td></tr>
<tr><td>56</td><td rowspan="3">Kabels van circuit wit naar beneden brengen en verankeren aan portaal 1 en 5 (fase per fase)</td><td rowspan="3">Stap 6</td><td rowspan="3">Wit + Grijs</td></tr>
<tr><td>57</td></tr>
<tr><td>58</td></tr>
<tr><td>59</td><td>Terug plaatsen afstand houders in circuit wit (M52 - portaal 1 en portaal 5 - M55)</td><td>Stap 7</td><td>Wit + Grijs</td></tr>
<tr><td>60</td><td>Controle TenneT voor indienstname circuit Wit</td><td></td><td></td></tr>
<tr><td>61</td><td>Afstand houders circuit grijs uit portaal M52-53 en M54-55 fietsen</td><td rowspan="4">Stap 8</td><td>Grijs + Zwart</td></tr>
<tr><td>62</td><td rowspan="3">M52 (circuit grijs) ombouwen van een ophanging naar een verankering (eventueel optuien) + op/af tuien aangrensende masten</td><td rowspan="3">Grijs + Zwart</td></tr>
<tr><td>63</td></tr>
<tr><td>64</td></tr>
</table>

Scenario Omleiding M52-54

Optie Grondkabel

COFELY FABRICOM GDF SUEZ

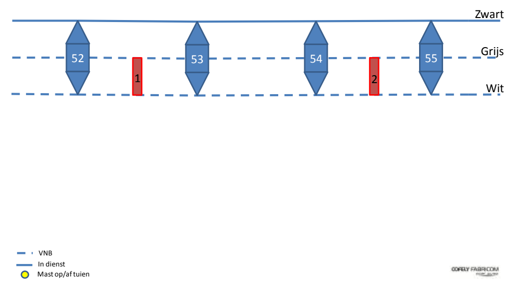
Dag	Werk omschrijving	Schema	VNB
65	Kabels van circuit Grijs naar beneden brengen en verankeren aan portaal 1 en 5 (fase per fase)	Stap 9	Grijs + Zwart
66			
67			
68	Terug plaatsen afstand houders in circuit Grijs (M52 - portaal 1 en portaal 5 - M55)	Stap 10	Grijs + Zwart
69	Afstand houders circuit Zwart uit portaal M52-53 en M54-55 fietsen	Stap 11	Grijs + Zwart
70	M52 (circuit zwart) ombouwen van een ophanging naar een verankering (eventueel optuien) + op/af tuien aangrensende masten + Aardkabel naar beneden brengen		Grijs + Zwart
71			
72			
73	Kabels van circuit zwart naar beneden brengen en verankeren aan portaal 1 en 5 (fase per fase)	Stap 12	Grijs + Zwart
74			
75			
76	Terug plaatsen afstand houders in circuit Zwart (M52 - portaal 1 en portaal 5 - M55)	Stap 13	Grijs + Zwart
77	Controle TenneT voor indienstname circuit Grijs + Zwart		Grijs + Zwart

COFELY FABRICOM
GDF SUEZ

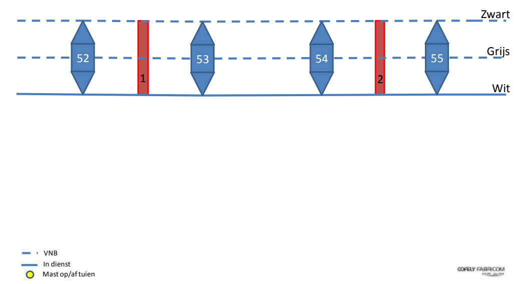
Scenario Omleiding M53-54

Optie: Grondkabel

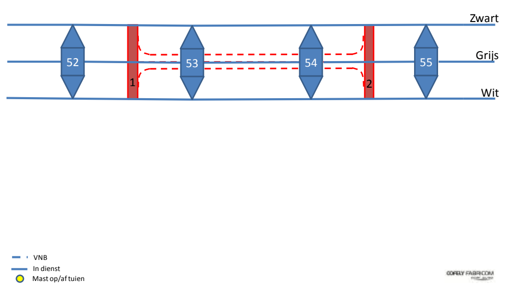
Stap 1: Montage eerste stuk OSP's



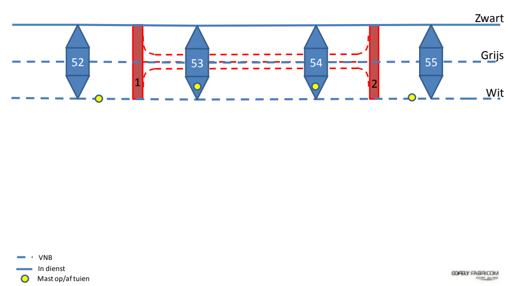
Stap 2: Montage tweede stuk OSP's



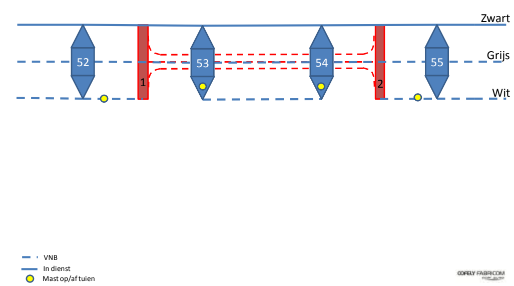
Stap 3: Trekken van grondkabel



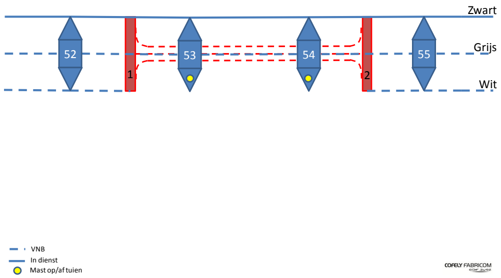
Stap 4: Voorbereiden circuit wit + eventuele aanpassingen M52



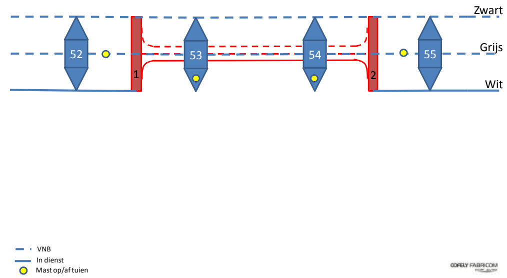
Stap 5: Overbrengen circuit wit



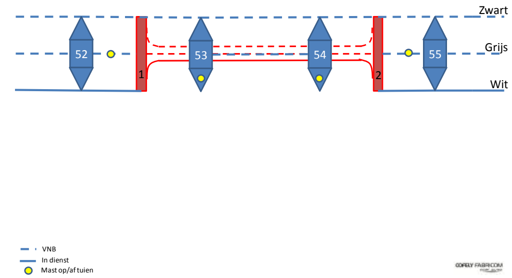
Stap 6: Afwerken circuit wit + controle Tennet



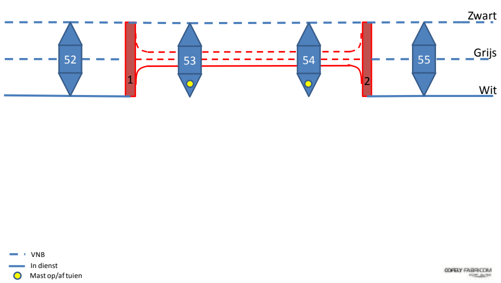
Stap 7: Voorbereiden circuit grijs, + eventuele aanpassingen M52



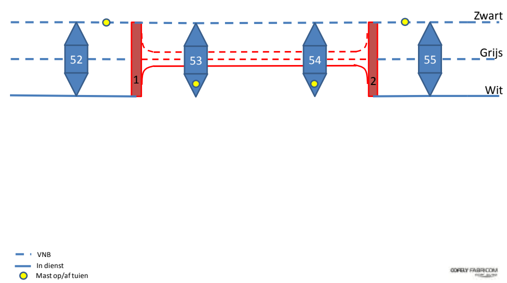
Stap 8: Overbrengen circuit grijs



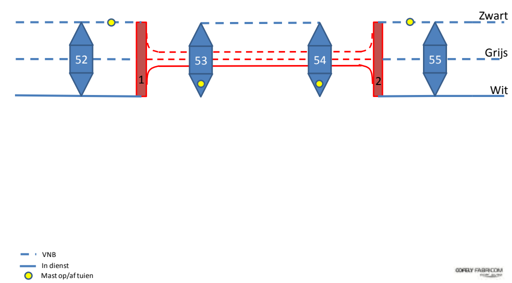
Stap 9: Afwerken circuit grijs + controle Tennet



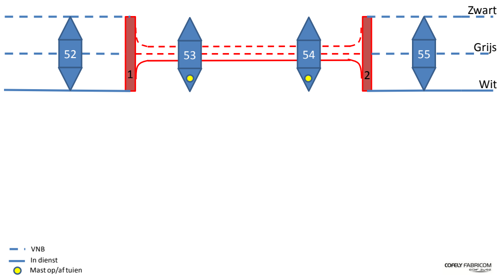
Stap 10: Voorbereiden circuit zwart, + eventuele aanpassingen M52



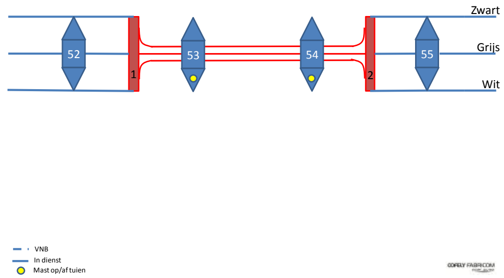
Stap 11: Overbrengen circuit zwart



Stap 12: Afwerken circuit zwart + controle Tennet



Stap 13: Omleiding in dienst + amoveren M53 en M54



Ontwerp omleiding M74

Project:
Randstad 380 kV Noordring

Opdrachtgever:
TenneT TSO

Revisie	Datum	Wijzigingen ten opzichte van vorige revisie
00	14-02-2014	Eerste versie
01	04-04-2014	Aangepast aan de hand van een nieuwe versie van de overzichtstekeningen
02	25-04-2014	Toevoeging aangepaste werkmethode voor het amoveren van de omleiding

Documentnummer: R3N-OWR-0051

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Eric van Rooijen	BAM
Rob Bakker	BAM
Erwin ten Cate	BAM
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Koen Pieters	Cofely Fabricom
Hein Pijnappel	Mott McDonald

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Neem bij twijfel over de geldende versie contact op met de documentbeheerder.

Inhoudsopgave

Referentie lijst

Ref	Document naam
[A]	R3N-TEK-0006-07 overzichtstekening blad 7 van 20 mast147-143; R3N-TEK-0123-07 overzichtstekening blad 6 van 20 mast75-74;
[B]	R3N-TEK-0182 Tijdelijke mast YMM74
[C]	R3N-PLA-0005-01 VNB Plan
[D]	R3N-PLN-0001 Planning
[E]	R3N-OWR-0055-00.01 Controle berekeningen M73 en M75

1. INLEIDING

De komende jaren werken het ministerie van Economische Zaken en TenneT aan de aanleg van een nieuwe 380 kV hoogspanningsverbinding in de Randstad. De nieuwe verbinding stelt de voorziening van elektriciteit in de Randstad veilig.

Het ontwerptracé van de nieuwe Randstad 380 kV verbinding is sinds eind 2008 bekend. De plannen gaan uit van twee ringen, tussen Wateringen en Zoetermeer (de Zuidring) en tussen Zoetermeer en Beverwijk (de Noordring). Eind 2012 heeft TenneT de aanbesteding opgestart voor het gedeelte van de Noordring tussen station Vijfhuizen en Bleiswijk. Het contract is opgedeeld in twee percelen, waarbij de grens ligt bij Zuidelijke Ringvaart. Dit document heeft betrekking op perceel 2 (het zuidelijke gedeelte).

Het voorliggende document is onderdeel van het definitief ontwerp ten behoeve van de vergunningsaanvragen en behandelt:

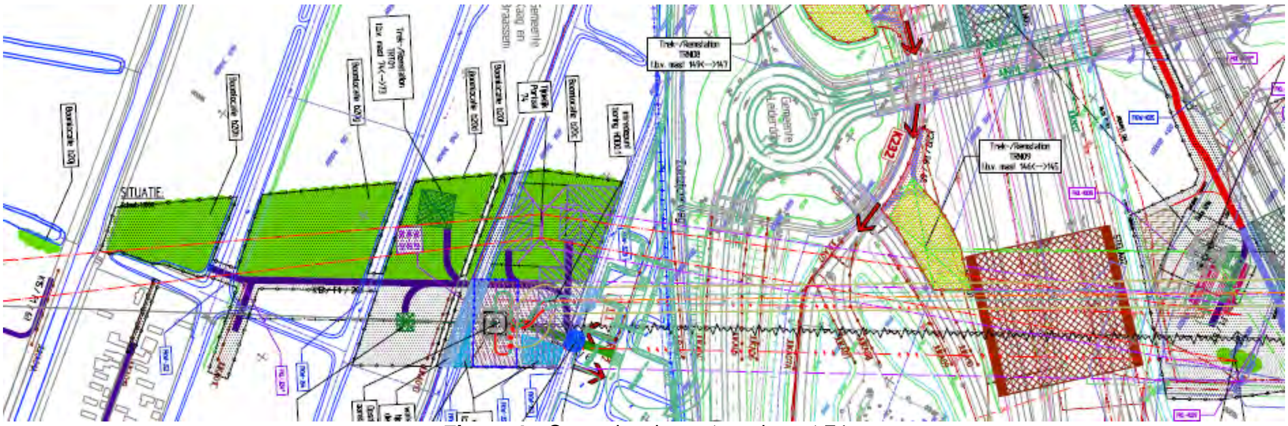
- Het ontwerp van een 3 circuit omleiding tussen mast 73 en mast 75 (150kV)

2. DRIE CIRCUIT TIJDELIJKE VERBINDING AAN MAST 074

Situatie schets: Aan mast 74 wordt de nieuwe ondergrondse 150kV lijn gekoppeld aan de bestaande 150kV luchtlijn naar Leiden. Mast 74 moet dus worden vrijgemaakt om van een half verankering te worden omgebouwd naar een OSP. De bestaande 150kV lijn zal hiervoor worden omgeleid via een tijdelijke mast aan de noordkant van oorspronkelijke lijn.

2.1. OMGEVINGSIMPACT

Voor het plaatsen van de tijdelijke mast zal er een oppervlakte van 50 x 50m moeten worden vrijgemaakt, ook onder de lijn moet er voldoende ruimte vrij zijn. Onder de lijn zal er een strook bomen moeten worden gekapt (groene zone). Zie ref [A] voor meer detail.

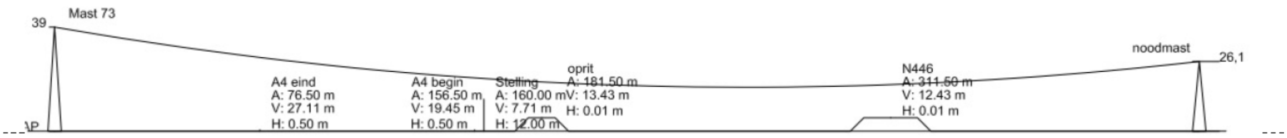


Figuur 1: Omgevingsimpact rond mast 74

Aangezien de lijnen van mast 74 naar de tijdelijke mast worden overgebracht zal het aantal beschermingen worden uitgebreid. Over de A4 (+ op-en afritten) zal er gewerkt worden met stellingen en netten. Langs de N446 wordt het aantal jukken verdubbeld en aan de volkstuintjes zullen er extra maatregelen getroffen worden.

2.2. LENGTEPROFIEL

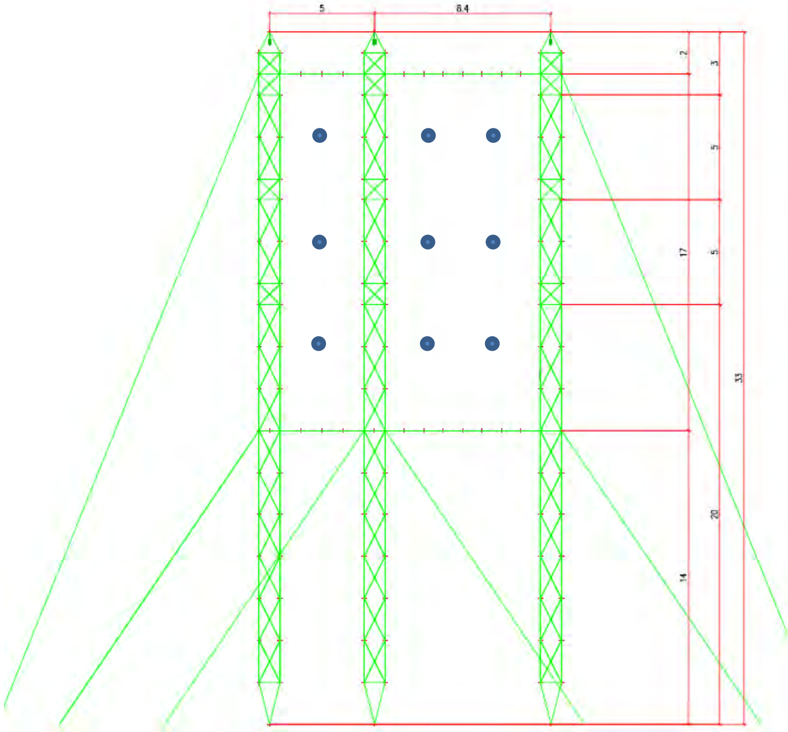
Voor de hoogte van de omleiding tussen M73 en de tijdelijke mast is er rekening gehouden met enkele bepalende obstakels: N446 (5m), Oprit A4 (5m) en de beschermingen over de A4 (12m). De kleinste tussen afstand is 7,71m wat voldoende is volgens de NEN norm. Zie bijlage 1 voor meer detail. In het portaal tijdelijke mast - M75 zullen er enkele bomen gekapt moeten worden.



Figuur 2: Lengte profiel Mast 73 – tijdelijke mast

2.3. MASTBEELD

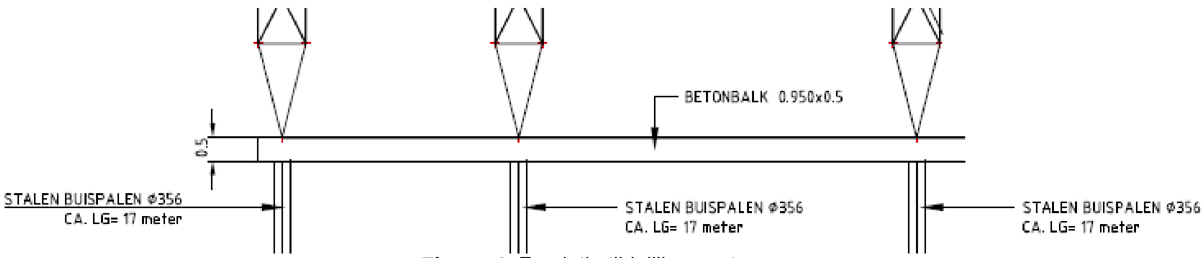
De tijdelijke mast zal bestaan uit een gesloten frame, verankerd met kabels naar de grond.
De drie circuits worden verticaal boven elkaar gemonteerd. Zie ref [B] voor een detail tekening met afmetingen. Er is voor deze opstelling gekozen met het oog op minimale onderlinge afstanden, obstakels, A4, locatie van de mast, hoek, methode van het overbrengen van de geleiders,…



Figuur 3: Mastbeeld tijdelijke mast

2.4. FUNDATIE

Als fundatie worden er 3 stalen buispalen van 17m (ϕ 356 mm) in de grond geheid met daarop een betonnen balk van 14,5 x 0,95 x 0,5m. De verbinding van het portaal naar de betonnen balk gebeurt middels ingestorte ankers. Zie ref [B] voor een overzicht.



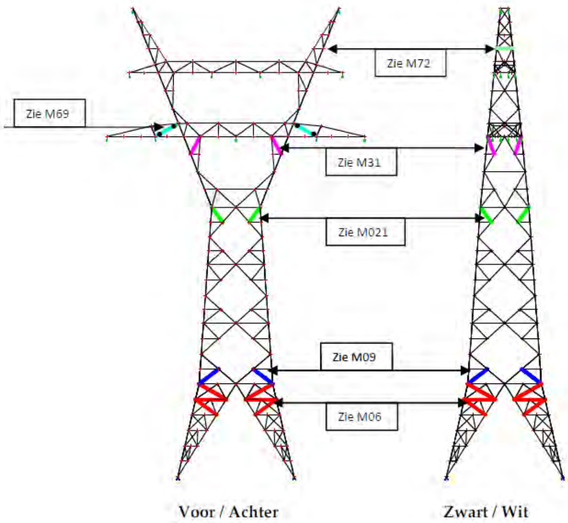
Figuur 4: Fundatie tijdelijke mast

2.5. VNB OMBOUWPLAN

De werkmethode is op zo'n manier opgesteld dat er tijdens de werken ten alle tijden 1 circuit in dienst is en 1 in stand-by. Zie bijlage 2 voor de verschillende stappen en een visuele voorstelling. Voor de algemene planning zie ref [C] en [D].

2.6. VERSTERKINGEN M73 EN M75

Door de hoek en het hoogte verschil die de omleiding naar het tijdelijk portaal te weeg brengt zullen masten 73 en 75 op verschillende plaatsen in hun structuur versterkt moeten worden.



Figuur 5: Versterkingen M55

Ook voor de fundering van masten 73 en 75 zijn er aanvullende maatregelen nodig. Bij de situatie waarbij de palen op trek komen te staan voldoen de huidige funderingen niet. Om de te grote trekspanningen op te vangen worden er extra grout ankers geplaatst. Meer details vindt u in ref [E].

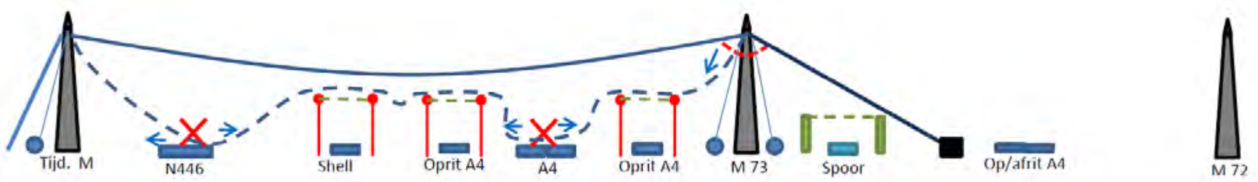
2.7. WERKMETHODE AMOVEREN OMLEIDING

Op het moment dat de ondergrondse kabels zijn geïnstalleerd zal de omleiding in zijn geheel worden verwijderd. Aangezien de geleiders tussen mast 72 en de tijdelijke mast zowel de A4 als de HSL kruist is er een aangepaste werkmethode uitgewerkt in samenspraak met de verschillende instanties.

Het amoveren zal in twee stappen verlopen. Eerst zullen de geleiders tussen M72 en M73 worden weggehaald, hiervoor worden er jukken aan weerskanten van de op en afritten geplaatst en stellingen aan de HSL, beide worden overspannen met netten. De geleiders worden één voor één gecontroleerd naar onderen gebracht en geknipt. Aangezien mast 73 niet sterk genoeg is om maar aan één kant geleiders te hebben hangen zal er voor elke verwijderde geleider een tui worden getrokken naar een ballast en zo de balans van de mast verzekeren.

Figuur 6: Fase 1 amoveren tussen M72 en M73

Voor het stuk tussen de mast 73 en het tijdelijke portaal zullen we de A4 voor enkele nachten omleiden via de op en afritten, de N446 zal tijdelijke worden gesperd. De op en afritten worden beschermd met netten zoals voorgesteld in het onderstaande schema. Wanneer de omleidingen zijn gerealiseerd worden de geleiders wederom gecontroleerd naar onderen gebracht en geknipt op verschillende plaatsen.



Figuur 7: Fase 2 amoveren tussen M73 en het tijdelijke portaal

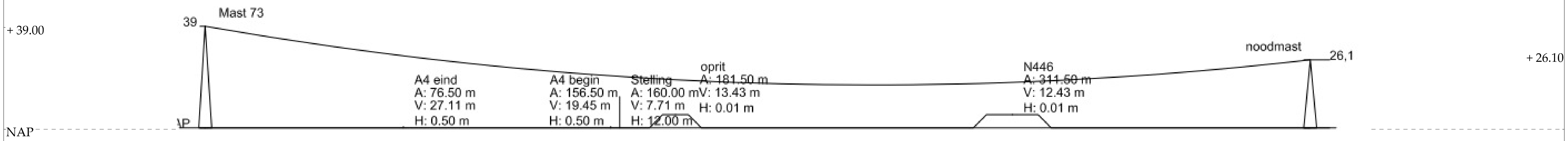
3. BIJLAGEN

Bijlage 1 Lengte profiel omleiding M74

Bijlage 2 VNB ombouwplan

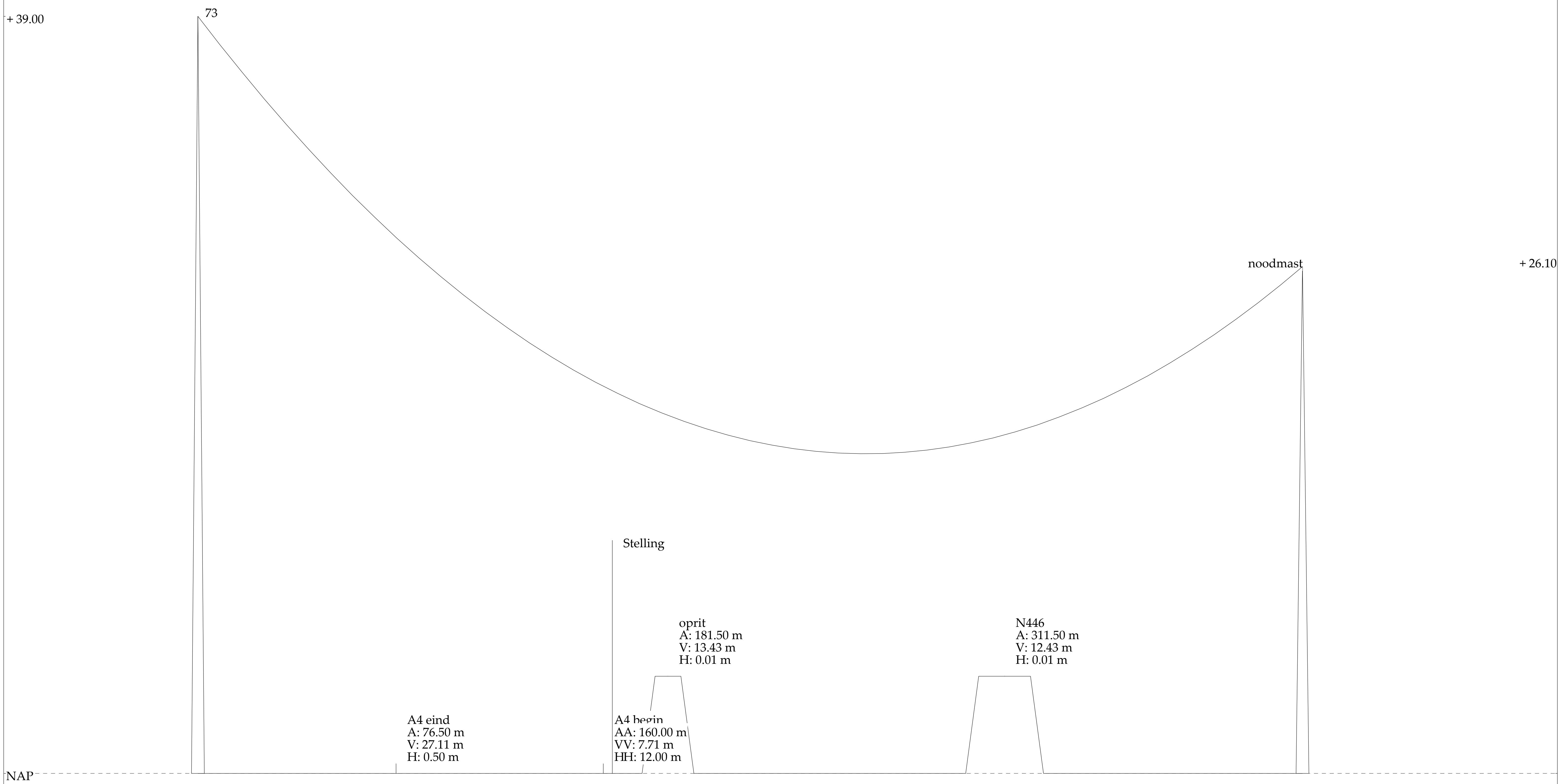
BIJLAGE 1: LENGTEPROFIEL OMLEIDING M74

Bestand:	13039a_nood_verhoogd	Geleidertype :	CU185	Temperatuur :	10 °C	Veld : 1	Lengte : 426.52 m	Sch. hor. :	1 : 1500
Vak :		Plaats :	fase ondertr	Trekkracht :	24895 N	Doorh. t.o.v. hoogste mast :	22.54 m	Sch. vert.:	1 : 1500



Naam hoogspanningslijn:
Omschrijving vak: 73 - 74
Omschrijving veld: 73 - 74
D&C Software Zeegprogrammatuur versie 9.0

Bestand:	13039a_nood_verhoogd	Geleidertype :	CU185	Temperatuur :	10 °C	Veld : 1	Lengte : 426.52 m	Sch. hor. :	1 : 1500
Vak :		Plaats :	fase ondertr	Trekkracht :	24895 N	Doorh. t.o.v. hoogste mast :	22.54 m	Sch. vert.:	1 : 200



Naam hoogspanningslijn:
Omschrijving vak: 73 - 74
Omschrijving veld:
73 - 74
D&C Software Zeegprogrammatuur versie 9.0

BIJLAGE 2: VNB OMBOUWPLAN

Scenario Omleiding M74

Dag	Werk omschrijving	Schema	VNB
1	Versterken van mast lichaam M73 en M75	/	/
2			
3			
4			
5			
6			
7			
8			
9			
10			
11	Versterken 1 kant van mast kop M73 en M75	/	Wit + Grijs
12			
13			
14			
15			
16	Versterken 2e kant van mast kop M73 en M75	/	Grijs + Zwart
17			
18			
19			
20			
21	Montage tijdelijke mast	Stap 1	/
22			
23			
24			
25			
26			
27			
28			
29			
30			
31	Afstand houders circuit wit uit portaal M73-74 en M74-75 fietsen	Stap 2	Wit + Grijs
32	Op poelie leggen van de 3 fase draden in circuit Wit		
33	Klaarmaken van de tuien		
34	Optuien Mast 75 Knippen van de fase kabel Kabel naar de grond brengen en persen van verlengstuk (tussen M73 en tijdelijke mast) Kabels in de tijdelijke mast hijsen	Stap 3/4	Wit + Grijs
35			
36			
37	Overbrengen aardkabel		
38	Afwerken van verankering circuit Wit tijdelijke mast	Stap 5	Wit + Grijs
39			
40	Afstand houders circuit wit terug plaatsen		
41	Controle TenneT voor indienstname circuit Wit		Wit + Grijs
42	Afstand houders circuit Grijs uit portaal M73-74 en M74-75 fietsen	Stap 6	Zwart + Grijs
43	Op poelie leggen van de 3 fase draden in circuit Grijs		
44	Klaarmaken van de tuien		
45	Optuien Mast 75 Knippen van de fase kabel Kabel naar de grond brengen en persen van verlengstuk (tussen M73 en tijdelijke mast) Kabels in de tijdelijke mast hijsen	Stap 7/8	Zwart + Grijs
46			
47			
48	Afwerken van verankering circuit Grijs tijdelijke mast	Stap 9	Zwart + Grijs
49			
50	Afstand houders circuit Grijs terug plaatsen		
51	Afstand houders circuit Zwart uit portaal M73-74 en M74-75 fietsen	Stap 10	Zwart + Grijs
52	Op poelie leggen van de 3 fase draden in circuit Zwart		
53	Klaarmaken van de tuien		
54	Optuien Mast 75 Knippen van de fase kabel Kabel naar de grond brengen en persen van verlengstuk (tussen M73 en tijdelijke mast) Kabels in de tijdelijke mast hijsen	Stap 11/12	Zwart + Grijs
55			
56			
57	Overbrengen aardkabel		
58	Afwerken van verankering circuit Zwart tijdelijke mast	Stap 13	Zwart + Grijs
59			
60	Afstand houders circuit Zwart terug plaatsen		
61	Controle TenneT voor indienstname circuit Grijs + Zwart		Zwart + Grijs

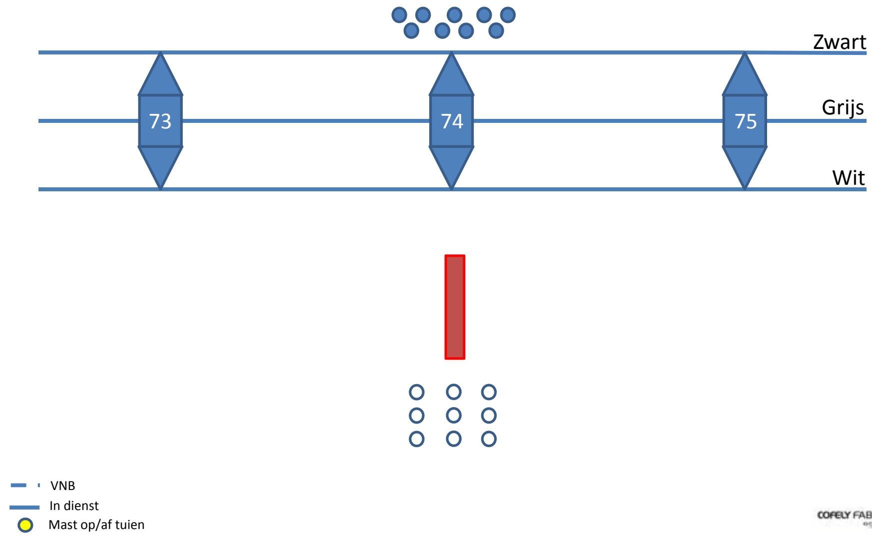
Scenario Omleiding M74

COFELY FABRICOM GDF SUEZ

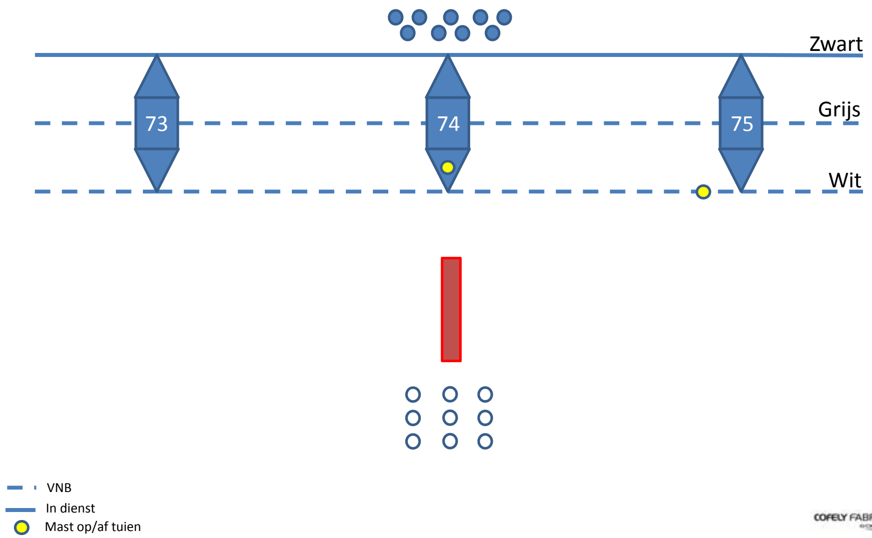
Dag	Werk omschrijving	Schema	VNB
Terugplaatsen kabels van tijdelijke mast naar nieuwe mast 74			
1	Afstand houders circuit Zwart uit portaal M73-tijdelijke mast en tijdelijke mast -M75 fietsen		Zwart + Grijs
2 3 4	Optuien Mast 75 Overbrengen circuit zwart + aardkabel naar nieuwe mast 74 (exclusief aansluiting op OSP)		Zwart + Grijs
5 6	Afwerken van verankering circuit Zwart nieuwe mast 74		Zwart + Grijs
7	Afstand houders circuit Zwart terug plaatsen		Zwart + Grijs
8	Afstand houders circuit Grijs uit portaal M73-tijdelijke mast en tijdelijke mast -M75 fietsen		Zwart + Grijs
9 10 11	Optuien Mast 75 Overbrengen circuit grijs naar nieuwe mast 74 (exclusief aansluiting op OSP)		Zwart + Grijs
12 13	Afwerken van verankering circuit Grijs nieuwe mast 74		Zwart + Grijs
14	Afstand houders circuit Grijs terug plaatsen		Zwart + Grijs
15	Controle TenneT voor indienstname circuit Grijs + Zwart		Zwart + Grijs
16	Afstand houders circuit Wit uit portaal M73-tijdelijke mast en tijdelijke mast -M75 fietsen		Grijs + Wit
17 18 19	Optuien Mast 75 Overbrengen circuit wit + aardkabel naar nieuwe mast 74 (exclusief aansluiting op OSP)		Grijs + Wit
20 21	Afwerken van verankering circuit Wit nieuwe mast 74		Grijs + Wit
22	Afstand houders circuit wit terug plaatsen		Grijs + Wit
23	Controle TenneT voor indienstname circuit Wit		Grijs + Wit

Scenario Omleiding M74

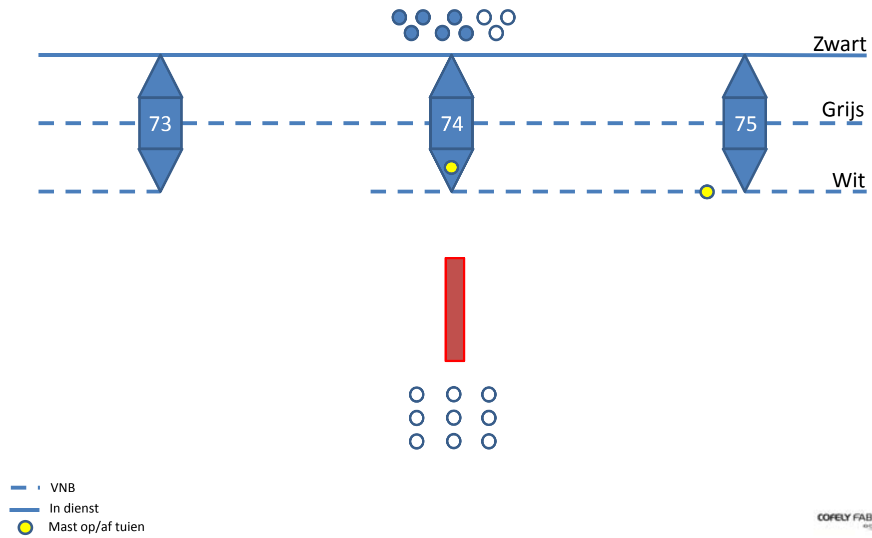
Stap 1: Montage tijdelijke mast



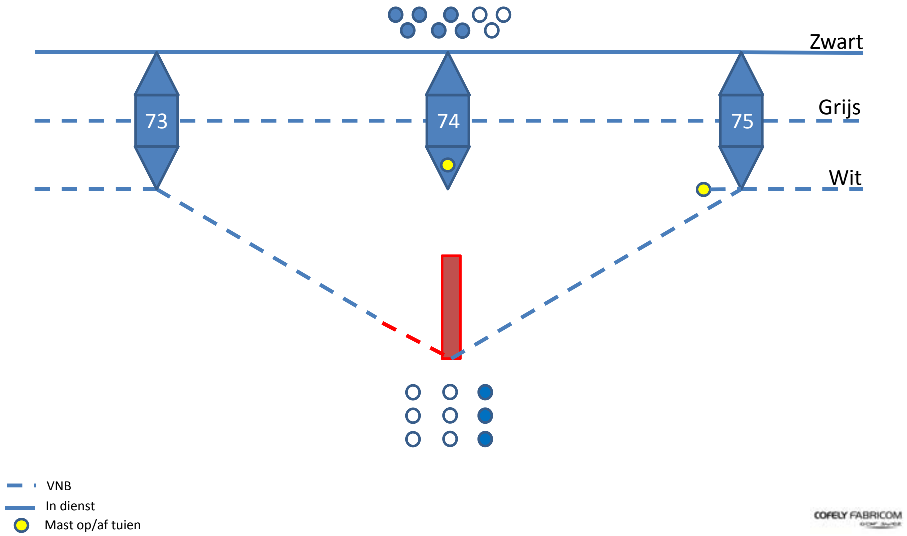
Stap 2: Voorbereiden circuit wit + eventueel versterken van M73



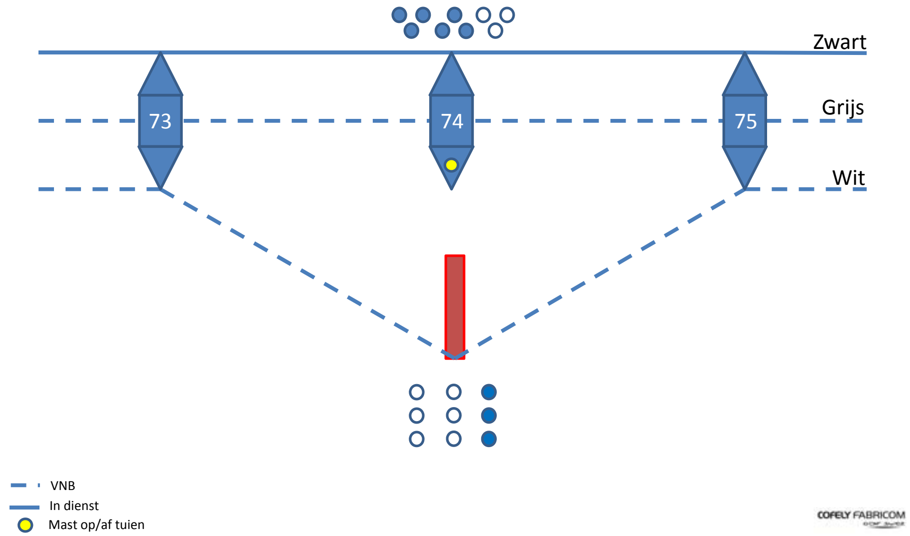
Stap 3: Knippen fase draden circuit wit



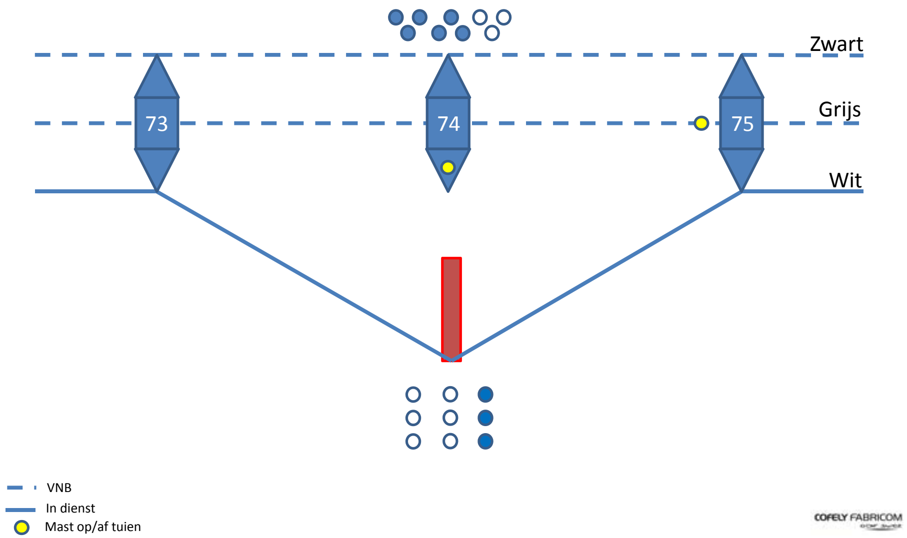
Stap 4: Overbrengen + verlengen circuit wit



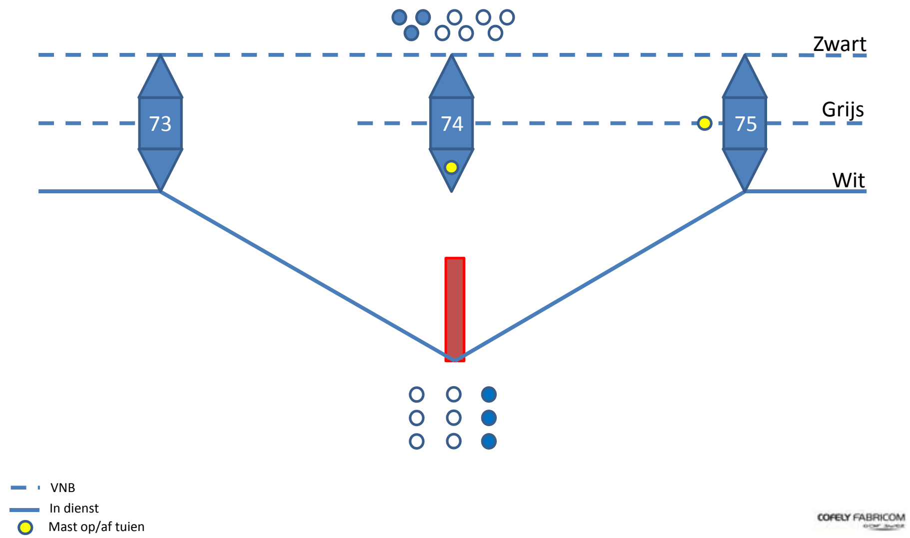
Stap 5: Afwerken circuit wit



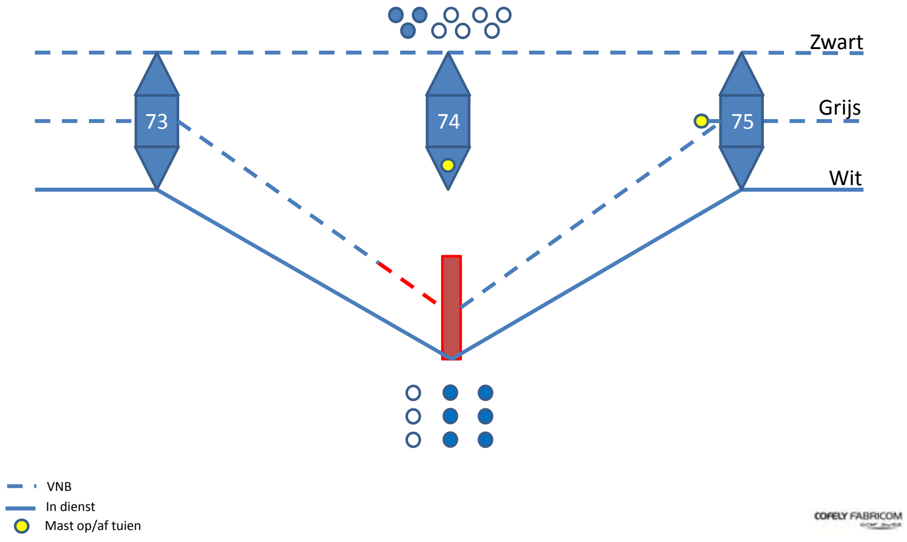
Stap 6: Voorbereiden circuit grijs + eventueel versterken van M73



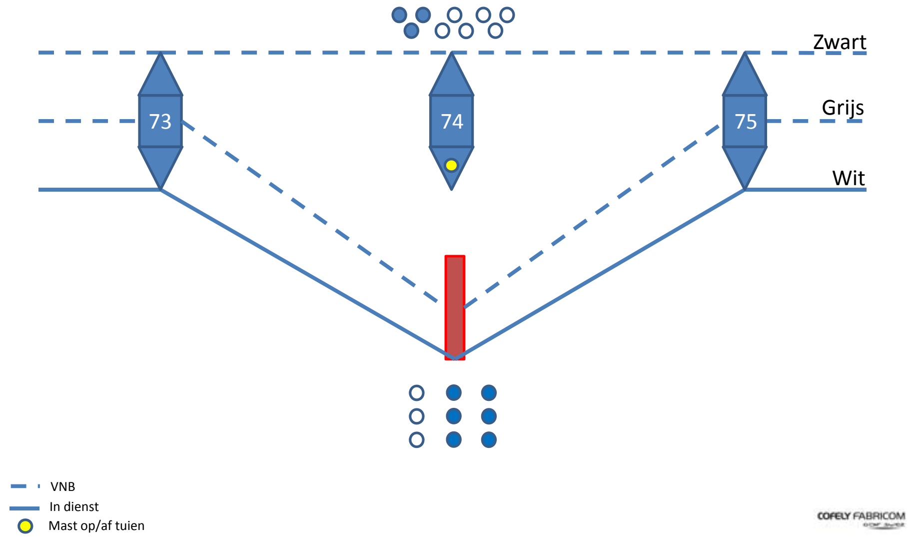
Stap 7: Knippen fase draden circuit grijs



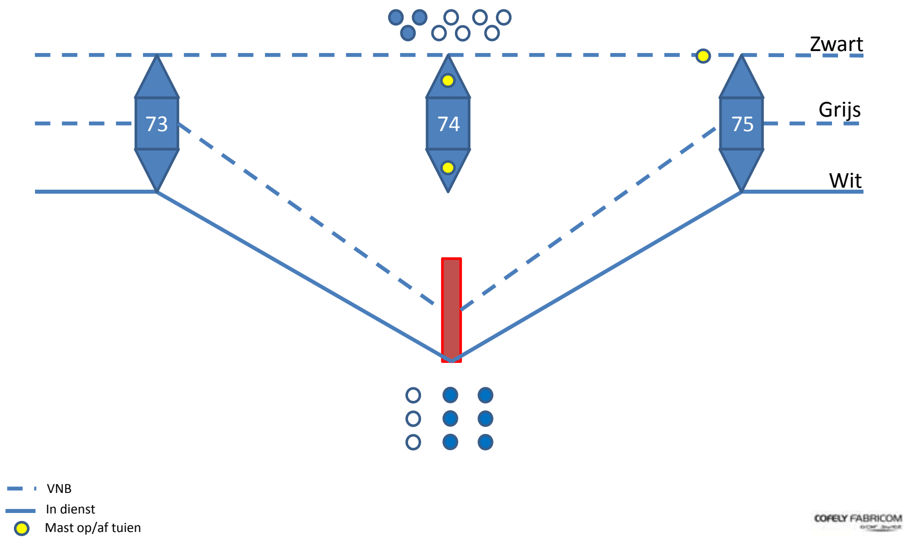
Stap 8: Overbrengen + verlengen circuit grijs



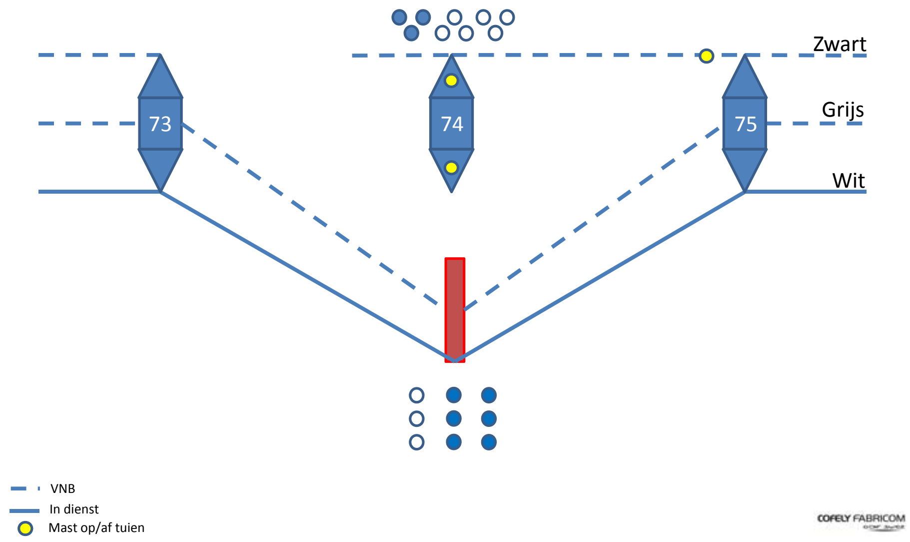
Stap 9: Afwerken circuit grijs



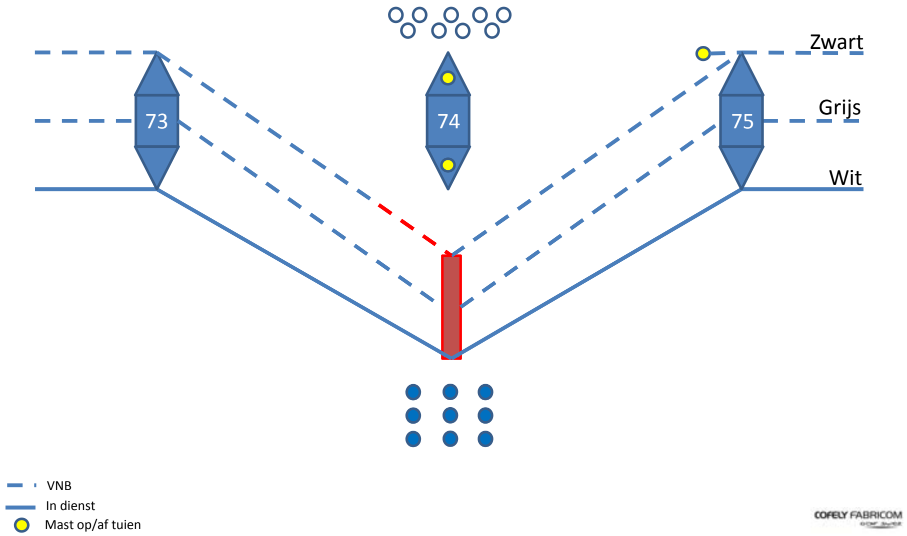
Stap 10: Voorbereiden circuit zwart + eventueel versterken van M73



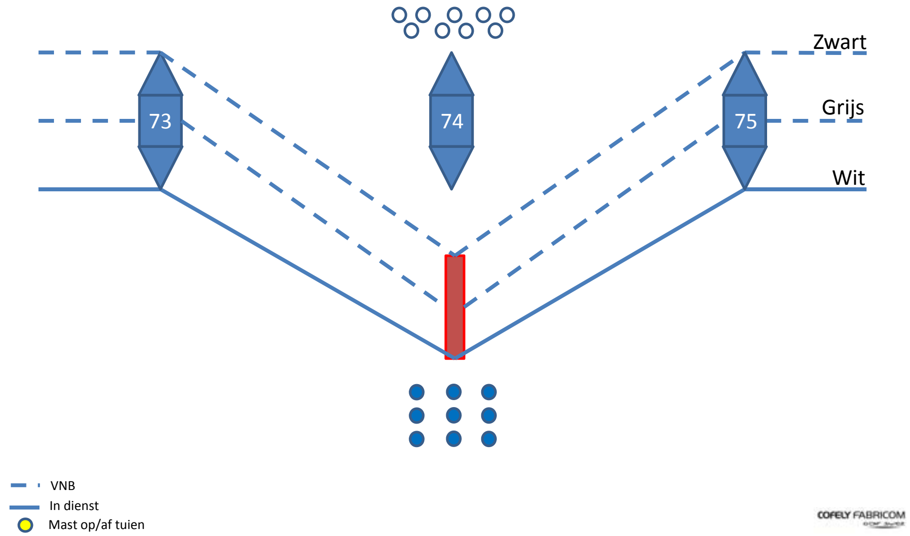
Stap 11: Knippen fase draden circuit zwart



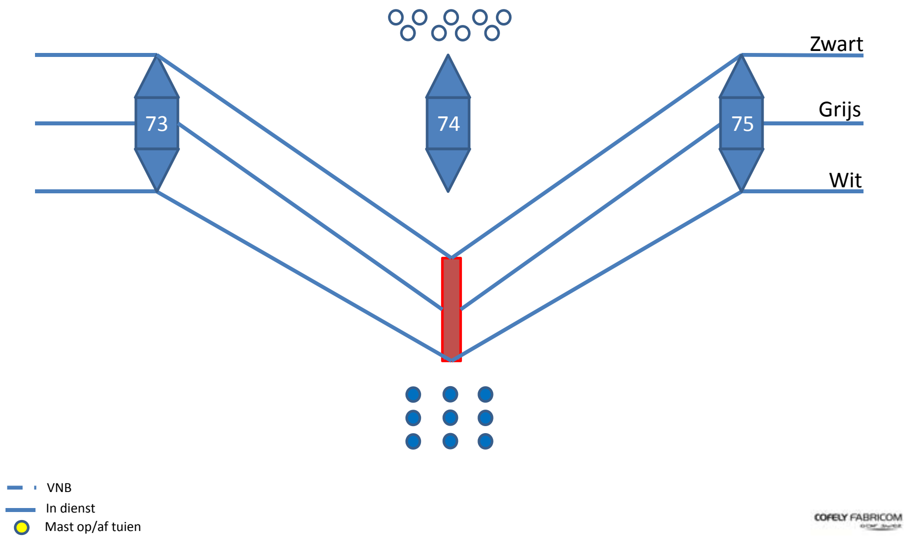
Stap 12: Overbrengen + verlengen circuit zwart



Stap 13: Afwerken circuit zwart



Stap 14: Omleiding in dienst



Berekening magnetische veldsterkte omleiding M53 en M54

Project:
Randstad 380 kV Noordring

Opdrachtgever:
TenneT TSO

Revisie	Datum	Wijzigingen ten opzichte van vorige revisie
00	14-02-2014	Eerste versie
01	04-04-2014	Ondergrondse kabel ipv luchtlijn

Documentnummer: R3N-OWR-0052

Opsteller	*Controleur*	*Vrijgever*
Koen Pieters Project Leider	Pieter de Jager Ontwerp Manager	Erik Duwel Project Manager

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Inhoudsopgave

1. INLEIDING

De komende jaren werken het ministerie van Economische Zaken en TenneT aan de aanleg van een nieuwe 380 kV hoogspanningsverbinding in de Randstad. De nieuwe verbinding stelt de voorziening van elektriciteit in de Randstad veilig.

Het ontwerptracé van de nieuwe Randstad 380 kV verbinding is sinds eind 2008 bekend. De plannen gaan uit van twee ringen, tussen Wateringen en Zoetermeer (de Zuidring) en tussen Zoetermeer en Beverwijk (de Noordring). Eind 2012 heeft Tennet de aanbesteding opgestart voor het gedeelte van de Noordring tussen station Vijfhuizen en Bleiswijk. Het contract is opgedeeld in twee percelen, waarbij de grens ligt bij Zuidelijke Ringvaart. Dit document heeft betrekking op perceel 2 (het zuidelijke gedeelte).

Het voorliggende document is onderdeel van het definitief ontwerp ten behoeve van de vergunningsaanvragen en behandelt:

- De berekening van de magnetische veldsterkte van de omleiding rond M54 en M53

2. BEREKENINGSNOTA

Berekening magnetische veldsterkte bypass-ontwerp t.b.v. TenneT-project Randstad 380kV Noordring

Kabelcircuits nabij Hazerswoude-dorp

D&C Engineering b.v.

Berekening veldsterkten

Opdrachtgever: D&C Engineering, dhr. J. Hollaar.
auteur: ir Eric W.M. Beeker / Beeker Consultancy
d.d. 31 maart 2014

Inleiding

TenneT wil binnen het project Randstad 380kV-Noordring een nieuwe hoogspanningslijn laten bouwen, in het nieuwe Wintrack-ontwerp. D&C Engineering onderzoekt momenteel een tijdelijke bypass-oplossing in de vorm van kabelcircuits nabij Hazerswoude-dorp. Daar de bypass relatief dichtbij woonhuizen gaat lopen, is de vraag gerezen, hoe groot de magnetische veldsterkten zijn. Dit rapport onderzoekt de consequenties voor het magnetisch veld van een dergelijke kabel-bypass.

Berekening magnetische veldsterkten

Hoogspanningskabels induceren een magnetisch veld in de directe omgeving. Richtlijnen zijn opgesteld en worden toegepast voor dergelijke lijnen over de gehele wereld, als voorgeschreven door de International Commission for non Ionizing Radiation (ICNIRP). Deze commissie past twee limieten toe waaraan mensen mogen worden blootgesteld. Een verschil wordt daarbij gemaakt tussen professionele en niet professioneel verblijvende personen. Deze waarden zijn:

- 500 µT voor continue blootstelling voor professionele werkzame personen en
- 100 µT voor continue blootstelling voor de bevolking.

Deze waarden worden berekend/gemeten 1 m boven maaiveldniveau, vanwege de positie van het menselijk hart. Naast deze instructies , heeft het Nederlandse ministerie van VROM in 2005 - op basis van het voorzorgsbeginsel - een advies voor het hoog-spannings-lijnenbeleid aan gemeenten, netbeheerders en provincies uitgebracht. In dat advies adviseert VROM gemeenten en netbeheerders zoveel als redelijkerwijs mogelijk is, te voorkomen dat er in de buurt van bovengrondse hoogspanningslijnen nieuwe situaties ontstaan waar kinderen langdurig[1] worden blootgesteld aan magnetische veldsterkten die jaargemiddeld boven 0,4 µT liggen. In dit advies is de manier vastgelegd om deze ‘zone waar het magnetische veld gemiddeld over een jaar boven de 0,4 µT ligt’, verder aangeduid als ‘specifieke magneetveldzone’, zo eenduidig en transparant mogelijk te berekenen.

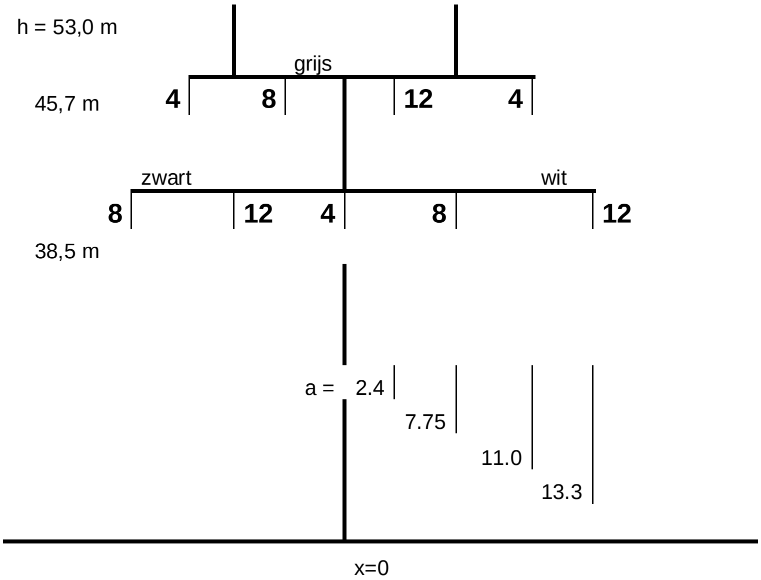
Voor 150 kV-, 110 kV- en 50 kV-hoogspanningslijnen wordt bij het bepalen van de rekenstroom uitgegaan van een enkelvoudige storingsreserve (het n-1-criterium). Dat betekent dat voor een hoogspanningslijn met twee of meer circuits van dezelfde spanning (150 kV, 110 kV of 50 kV) wordt gerekend met een rekenstroom ter grootte van 50% van de ontwerpstroom. Er is daarbij in dit specifieke geval van drie parallelle circuits gerekend met vier stroomrichting-combinaties bij de drie kabelverbindingen: ↑↑↑, ↑↑↓, ↑↓↑ en ↑↓↓.

Het nominale vermogen van de 150 kV-lijn Zoetermeer-Leiden is 300 MVA, de bijbehorende nominale stroom I_{nom} = 1155A. In de berekeningen is uitgegaan van een gelijke stroom door alle drie circuits van 577,5 A. De effecten van de kabelschermgeleiders zijn hierbij verwaarloosd.

---

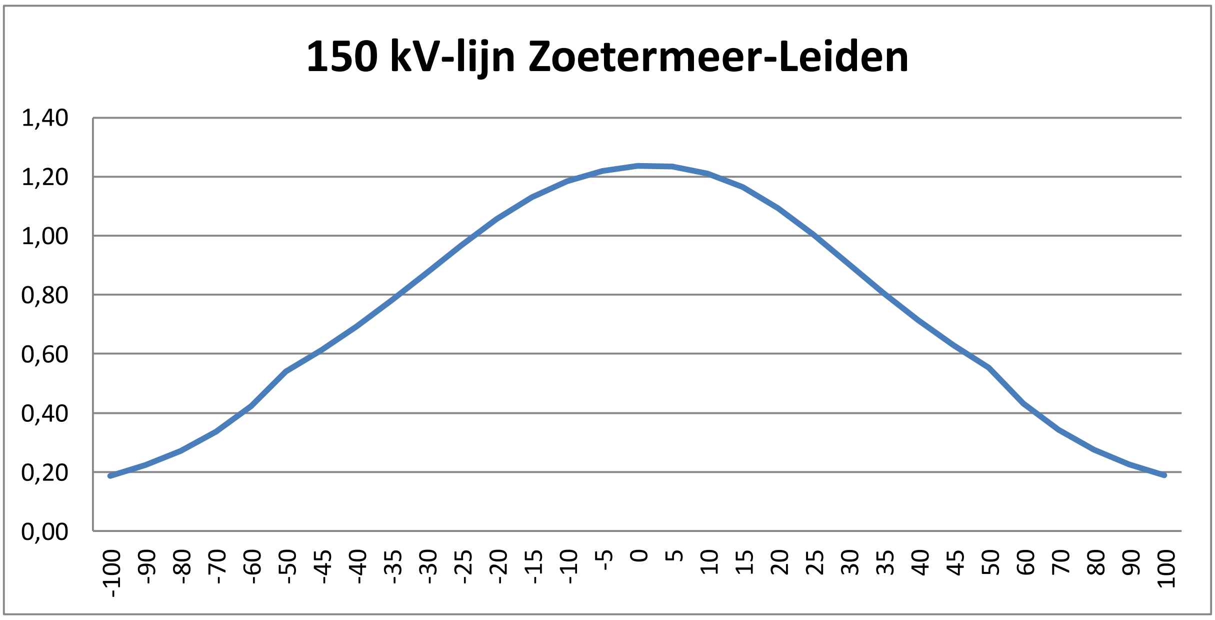
[1] De Commissie Elektromagnetische Velden van de Gezondheidsraad heeft in haar advies van 21 februari 2008 aangegeven dat een verblijf ‘gedurende minimaal een jaar met een verblijftijd van minimaal circa 14–18 uur per dag’ als langdurig kan worden beschouwd.

Ook is het magnetisch veld direct afhankelijk van de lijngeometrie, de op- en doorhangposities van de geleiders. Om een vergelijking van het effect op het magnetisch veld te kunnen maken, is uitgegaan van een gemiddelde steunmast van de huidige 150kV-lijn Zoetermeer-Leiden. Gerekend is met de parameters van de veel voorkomende steunmast met de traversen op een hoogte van 38,5 resp. 45,7 m boven maaiveld.



Figuur 1: geometrie steunmast/geleiderposities 150kV-lijn Zoetermeer-Leiden

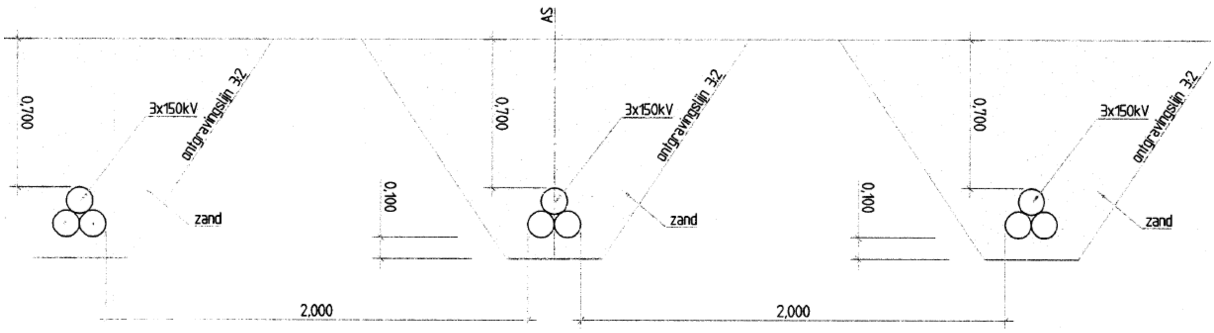
De resultaten van het magnetische veld of fluxdichtheid -berekening op maaiveldniveau als functie van de afstand loodrecht tot de lijn-as, zijn te vinden in Figuur 2 hieronder:



Figuur 2: De magnetische fluxdichtheid in [µT] van de 150kV lijn Zoetermeer-Leiden als functie van de afstand [m] loodrecht tot de lijnas.

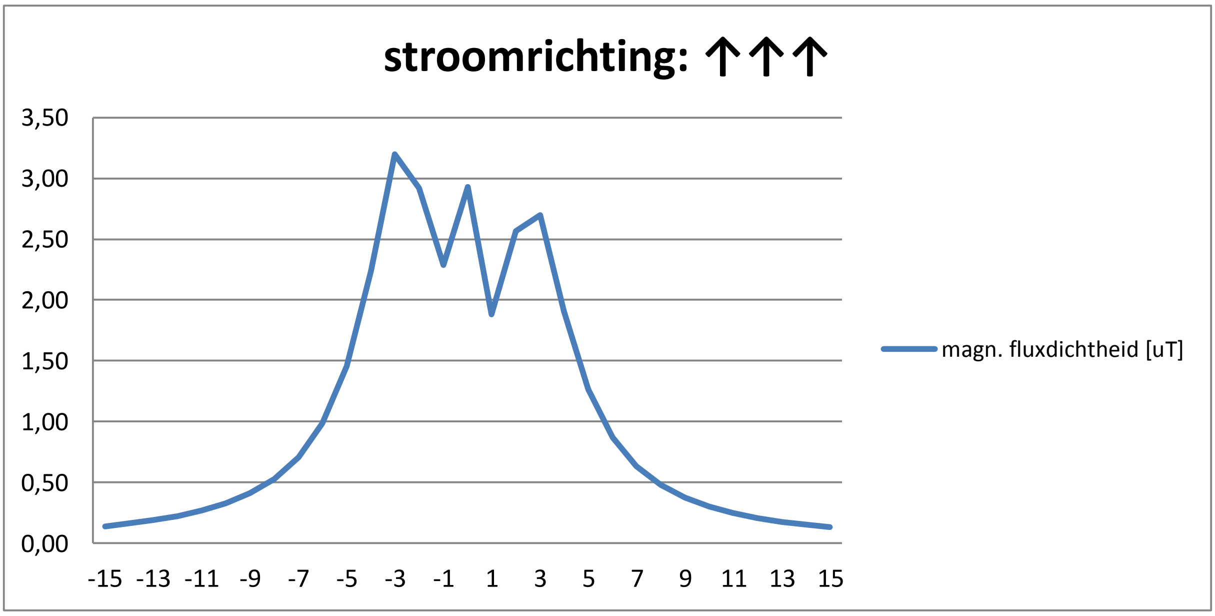
De maximum-waarde ligt op 1,2 µT, op de as van de hoogspanningslijn. De 0,4 µT-grenswaarde ligt hier +/- 60 m vandaan. De 'specifieke magneetveldzone' is hierbij dus 120 m.

Voor de tijdelijke verbinding wordt gebruik gemaakt van drie kabelcircuits, die alle drie (zwart, grijs en wit) horizontaal naast elkaar worden gelegd. Zie Figuur 3:



Figuur 3: geometrie van de kabelligging van de tijdelijke bypass 150kV-lijn Zoetermeer-Leiden

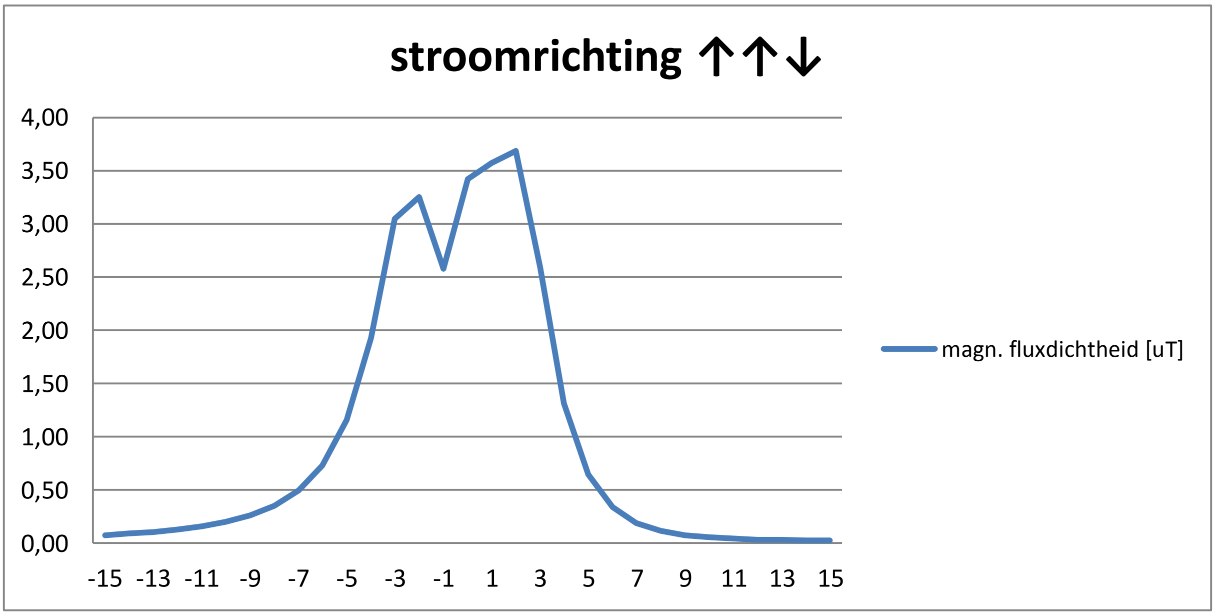
De magnetische fluxdichtheid van een dergelijke kabelligging op 1m boven maaiveldniveau als functie van de afstand loodrecht tot de lijn-as, is te vinden in Figuur 4:



Figuur 4: De magnetische fluxdichtheid in [µT] van de drie kabels gelegd in driehoek naast elkaar, als functie van de afstand [m] loodrecht tot de lijnas; stroomrichtingcombinatie: ↑↑↑.

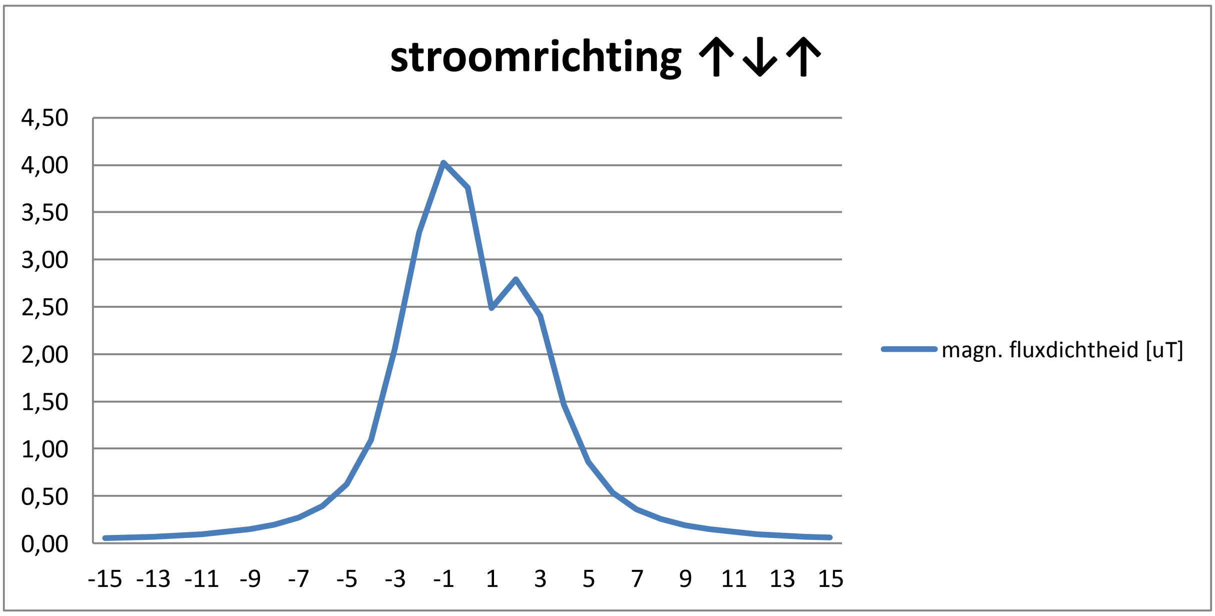
De maxima van de magnetische fluxdichtheid liggen hierbij iets hoger, op 3,2 µT op -3 m, resp. 2,9 µT op 0 m en 2,7 µT op 3 m van de centrale as. De 0,4 µT-waarde ligt op +/- 9m van de as. De ‘specifieke magneetveldzonebreedte’ is in deze oplossing dus verkleind naar 18 m!

Voor de andere drie stroomrichtingcombinaties ↑↑↓, ↑↓↑ en ↑↓↓ zijn de uitkomsten van de berekeningen weergegeven in de Figuren 5, 6 en 7 hieronder:



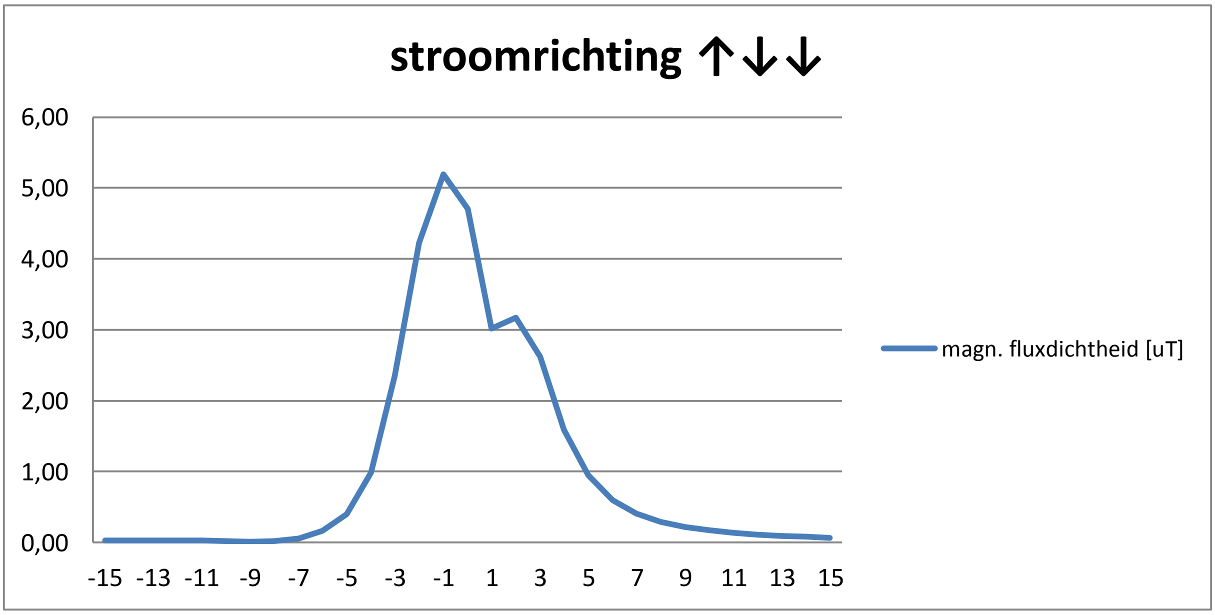
Figuur 5: idem als Figuur 4, echter met stroomrichtingcombinatie ↑↑↓

Het maximum van de magnetische fluxdichtheid ligt in deze stroomrichtingcombinatie op 3,7 µT op 2m van de centrale as. De 'specifieke magneetveldzonebreedte' is hierbij 13 m.



Figuur 6: idem als Figuur 4, echter met stroomrichtingcombinatie ↑↓↑

Het maximum van de magnetische fluxdichtheid ligt in deze stroomrichtingcombinatie op 4 µT op -1m. De 'specifieke magneetveldzonebreedte' is hierbij ook 13 m.



Figuur 7: idem als Figuur 4, echter met stroomrichtingcombinatie ↑↓↓

Het maximum van de magnetische fluxdichtheid ligt in deze stroomrichtingcombinatie op 5,2 µT op -1 m van de centrale as. De 'specifieke magneetveldzonebreedte' is hierbij verkleind naar 12 m!

Conclusie

TenneT wil in het kader van het project Randstad 380 Noord een nieuwe hoogspanningslijn laten bouwen, voornamelijk in het nieuwe Wintrack-ontwerp. D&C Engineering onderzoekt momenteel of het mogelijk is een noodverbinding in kabels tijdelijk te leggen nabij Hazerswoude-dorp. Onderzocht is hoe groot de specifieke magneetveld-zone is van een dergelijke oplossing.

In het specifieke geval van de kabelligging-geometrie van Figuur 4 nabij de woonhuizen aan de Breitnerlaan in Hazerswoude-dorp, is de afstand kabelas tot aan eerst dicht bij zijnde huisgevel ca. 160 m. De magnetische fluxdichtheid ligt bij gegeven kabelligging dan op 0,0004 µT. Conform de VROM-richtlijnen is dit akkoord.

Voor de tijdelijke oplossing worden kabels gebruikt van het type EYLKrvlwd $U_0/U/U_m$ = 87/150/170kV met een aluminium geleider van 1600 mm^2. De I_{nom} van een dergelijk 'single bonded' kabelcircuit is ingeval van dagmaat 0,45 m tot ander kabelcircuits: 1256 A. Dit kabeltype voldoet, mits eenzijdig geaard, daarmee aan de gestelde ontwerpnorm van de oorspronkelijke lijn: 1155 A.

Bronnen

[1] Gegevens verstrekt door D&C Engineering, o.a. tekening R3N-TEK-163 blad 001, d.d. 14-02-2014.

[2] RIVM, "Handreiking voor het berekenen van de breedte van de specifieke magneetveldzone bij bovengrondse hoogspanningslijnen", versie 3.1 d.d. 1 oktober 2013.

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Controle berekeningen M52 en M55

Project:
Randstad 380 kV Noordring

Opdrachtgever:
TenneT TSO

Revisie	Datum	Wijzigingen ten opzichte van vorige revisie
00	04-04-2014	Eerste versie

Documentnummer: R3N-OWR-0054

Opsteller	*Controleur*	*Vrijgever*
Koen Pieters Project Leider	Pieter de Jager Ontwerp Manager	Erik Duwel Project Manager

Distributie

Naam	Bedrijf
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Guido Volman	TenneT TSO
Intern	
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Pieter de Jager	BAM
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Erwin ten Cate	BAM
Michaël Desmet	Cofely Fabricom
Koen Pieters	Cofely Fabricom
Hein Pijnappel	Mott McDonald

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Neem bij twijfel over de geldende versie contact op met de documentbeheerder.

Inhoudsopgave

1. INLEIDING

De komende jaren werken het ministerie van Economische Zaken en TenneT aan de aanleg van een nieuwe 380 kV hoogspanningsverbinding in de Randstad. De nieuwe verbinding stelt de voorziening van elektriciteit in de Randstad veilig.

Het ontwerptracé van de nieuwe Randstad 380 kV verbinding is sinds eind 2008 bekend. De plannen gaan uit van twee ringen, tussen Wateringen en Zoetermeer (de Zuidring) en tussen Zoetermeer en Beverwijk (de Noordring). Eind 2012 heeft Tennet de aanbesteding opgestart voor het gedeelte van de Noordring tussen station Vijfhuizen en Bleiswijk. Het contract is opgedeeld in twee percelen, waarbij de grens ligt bij Zuidelijke Ringvaart. Dit document heeft betrekking op perceel 2 (het zuidelijke gedeelte).

Het voorliggende document is onderdeel van het definitief ontwerp ten behoeve van de vergunningsaanvragen en behandelt:

- De controle berekeningen van M52 en M55 ten behoeven van de omleiding rond M54 en M53

.

2. CONTROLE BEREKENING MAST 52

Postbus 1
2950 AA Alblasserdam
Nieuwland Parc 301-302
2952 DD Alblasserdam
T +31 (0) 78 - 691 9222
E info@dcengineering.nl
W www.dcengineering.nl

D&C ENGINEERING
design and construct

Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer

Onderwerp	:	Controleberekening mast 52, 150 kV-lijn Zoetermeer -Leiden
Opdrachtgever	:	Cofely Fabricom Koen Pieters
Referentienr	:	1303914509
Opgesteld	:	M. Glegola
Gecontroleerd	:	J.Hollaar
Goedgekeurd	:	J.Hollaar
Revisie	:	0
Datum	:	18-Feb-2014
D&C documentnr.	:	B.14008

Rev.	**Datum**	**Omschrijving**	**Opgesteld**	**Gecontr.**	**Goedgek.**
0	18-Feb-14	Ontwerpberekening	M.Glegola	J.Hollaar	J.Hollaar
A					

Inhoudsopgave

1 Algemeen

1.1 Inleiding

Door Cofely Fabricom is aan D&C engineering te Alblasserdam opdracht verstrekt voor o.a. het uitvoeren van een controleberekening voor mast nr.52 in de 150 kV-lijn Zoetermeer -Leiden. Mast 52 moet gecontroleerd worden, omdat rond de nieuwe 380kv-lijn een omleiding nodig is. Voor mast 53 komt een portaal waardoor de belasting op mast 52 wijzigd.
De berekeningen worden uitgevoerd conform de vigerende norm NEN-EN-50341-1 en 3.
Voor de geleiderbelasting vanuit de bliksemdraden wordt ijsgebied A aangehouden, conform afspraak (aanvullende eis van TenneT), zoals vermeld in: "Lijnen; Standaard programma van eisen; PVE.05.000;25 november 2010; versie 1.0".

1.2 Normen en tekeningen en documenten en andere uitgangspunten

Tekeningen :

Mast nr.52 in de 150 kV-lijn Zoetermeer -Leiden.	
tek.nr.	omschrijving
5703-21-E	Ondergedeelte mastlichaam masttype D-D
5703-20-D	Tussengedeelte mastlichaam masttype D-D
5703-19-E	Bovengedeelte mastlichaam masttype D-D
5703-17-C	Ondertraverse masttype D-D
5703-16-D	Ondertraverse masttype D-D
5703-14-A	Boventraverse masttype D-D
5703-13-G	Boventraverse masttype D-D

Normen:

NEN-EN 50341-1 : 2001
NEN-EN 50341-3 : 2001

Andere uitgangspunten:

Fundatiehoogte 0,50 m boven maaiveld.

1.3 Nadere bepalingen

De geleiderbelastingen en de benodigde verzwaringen van de mastconstructies worden berekend volgens NEN-EN 50341-1 en 3 met spanningscontroles volgens EC-3.

De mastconstructie wordt 3D doorgerekend.

De gestelde slankheidsrestricties in NEN-EN 50341-1 en 3 worden geacht niet van toepassing te zijn, omdat in sommige gevallen in het verleden grotere slankheden zijn toegestaan.

Voor de mastconstructie zal een maximum totaalspanning van 100% worden gehanteerd.

Er is gerekend dat er geen antenne-opstellingen in de te controleren mastconstructie aanwezig zijn.

De berekening is uitgevoerd met het rekenpakket Scia LTA programma 2013

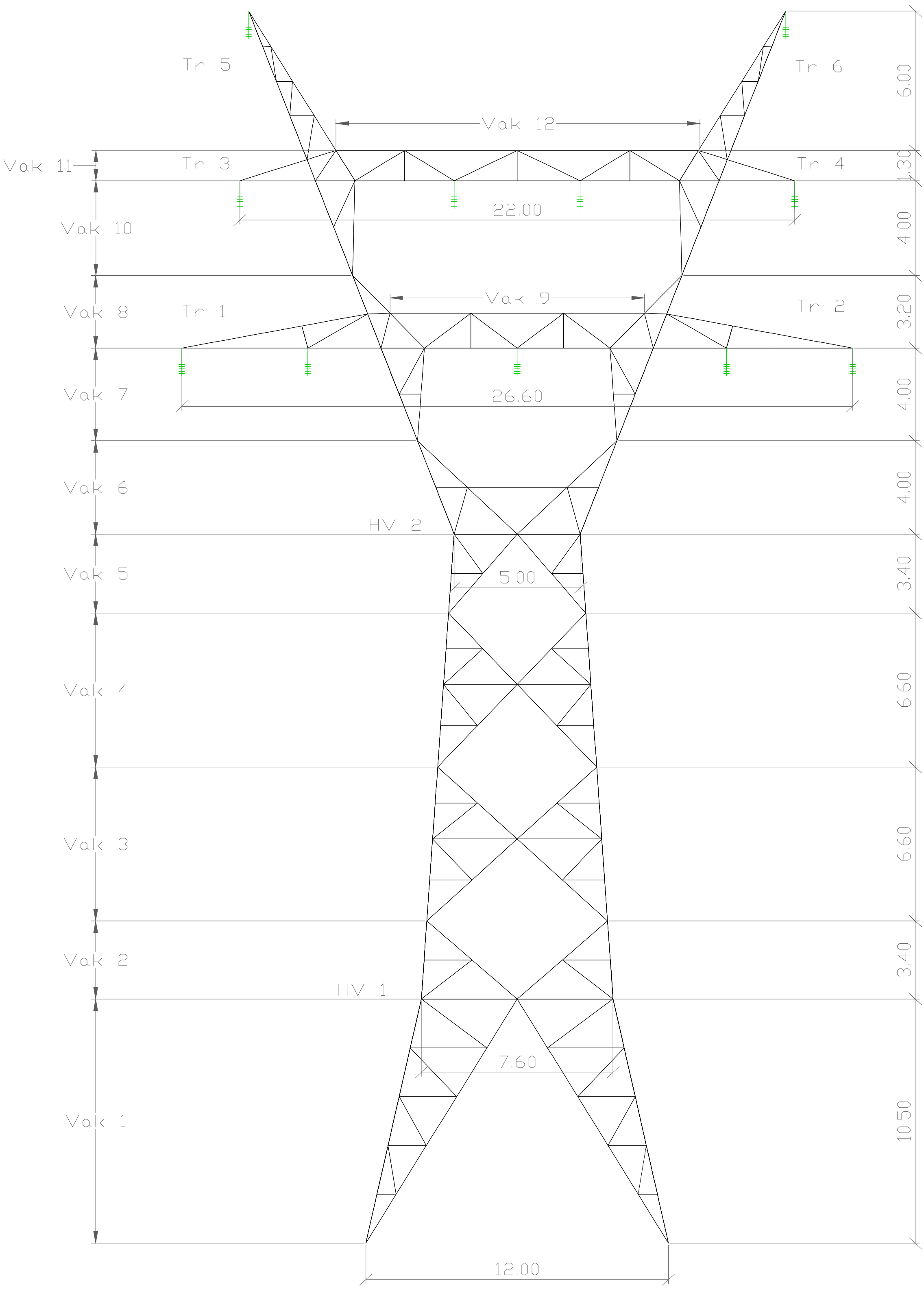
Voor de geleiderbelasting vanuit de bliksemdraden wordt gerekend met ijsgebied A.
Zie richtlijn van Tennet: "Lijnen; standaard programma van eisen; PVE.05.000;
25 november 2010; versie 1.0; artikel 5.3".

1.4 Materialen

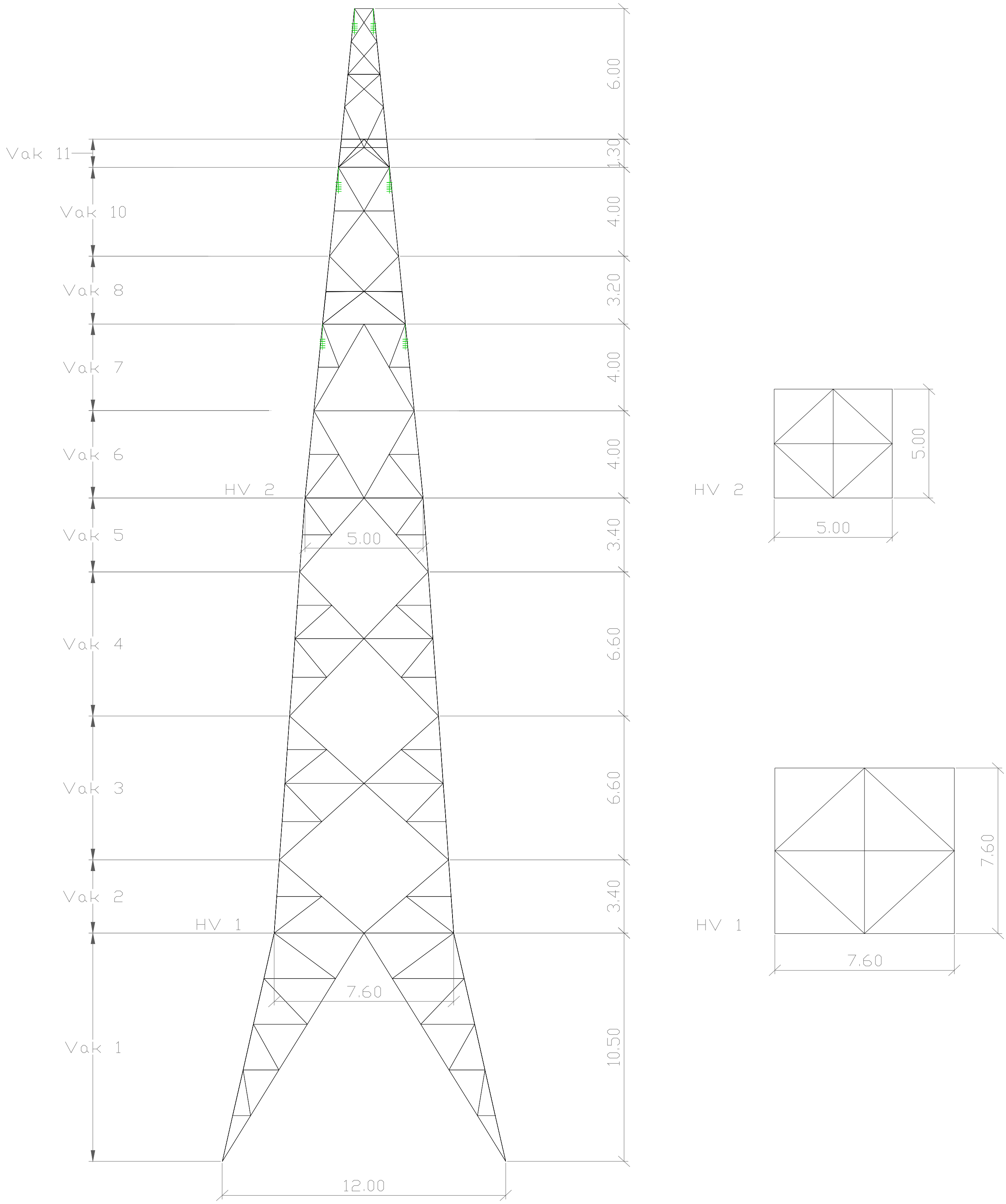
Materiaal randen	:	Fe360
Materiaal diagonalen	:	Fe360
Materiaal bouten	:	4.6 (8.8 nieuw)

1.5 Overzicht mast

1.5.1 Overzicht voorvlak mastlichaam



1.5.2 Overzicht zijvlak mastlichaam



2 Ontwerpgegevens mast

2.1 Ontwerpcode

De berekening is gebaseerd op NEN-en 50341-1 en -3-15
Bovengrondse hoogspanningslijnen.

2.2 Ontwerpgegevens

Lijnhoek	-	0°	
Windgebied	-	II	
Bebouwing	-	onbebouwd	
IJsgebied bliksemdraden	-	**A**	
IJsgebied fasedraden	-	B	
Toeslag eigengewicht	-	20%	
Totale hoogte van de mast	-	53,0 m	*)
Hoogte traverse 1	-	38,5 m	*)
Hoogte traverse 2	-	45,7 m	*)

Hoogte voet boven maaiveld	-	0,5 m	
Veldlengten	-	431,5/247,6 m	
Bliksemdraden	-	Br 50	(2x)
Factor β bliksemdraad	-	1,0	
Fasedraden	-	CU 185	(9 x 2-bundel)
Factor β fasedraad	-	0,8	
Boutklasse	-	8.8	
Materiaal mastranden	-	S235	
Materiaal overige mast	-	S235	
	-		

*) t.o.v. bovenzijde fundatiepoer

2.3 Geleidergegevens

		Br 50	CU 185
		Bliksemdraad	fasedraad
Eigen gewicht	N/m	4,43	16,62
Doorsnede	mm2	48,36	181,6
Diameter	mm	9	17,5
Elasticiteitsmod.	N/mm2	130000	130000
Lin. Uitzettingsc.	1/°C	0,000017	0,000017
Breeksterkte	N	28390,7	72760,5

2.4 Gegevens isolatoren

Dubbele afspanning

lengte isolatorketting 2 m
totale gewicht afspanning per zijde 2,5 kN
diameter isolator schaal 255 mm (voor wind 2/3*255mm =170mm)

2.5 Mastbelastingen uit geleiders

Voor belastingen uit de geleiders wordt verwezen naar bijlage A van dit rapport.

3 Berekening mast

3.1 Uitgangspunten berekening

Ontwerp-norm	NEN-EN 50341-3
Boutkwaliteit	4,6
Staalkwaliteit	S235
Toeslag eigengewicht	20%
Referentie periode	50 jaar

Voor verdere gegevens wordt verwezen naar hoofstuk 2.0

3.2 Berekening met behulp van computerprogramma

SCIA - ESA-Engineer - LTA

Voor de berekening van de mastconstructie wordt verwezen naar bijlage B van dit rapport.

4 Fundatie

4.1 Algemeen

Voor fundatiebelastingen zie Bijlage B:(maximale belastingen per knoop en Resultante op fundatie).
Deze belastingen zijn opgesteld en weergegeven conform NEN-EN 50341-1 en 3 november 2001; Bovengrondse hoogspanningslijnen.

Per fundatie-belastingweergave is dit opgegeven inclusief combinatie- en belastingfactoren.

Aan de hand van de bovengenoemde belastinggegevens en de sonderinggegevens kan de fundatie berekend worden.

4.2 Fundatie belastingen

Reacties

Lineaire berekening, Extreem : Globaal
Selectie : Alle
Klasse : All UGT

Steunpunt	BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Sn2/N3	1a/32	**-163,22**	168,84	**823,26**	0,00	0,00	0,00
Sn1/N1	1a/29	**162,34**	**169,61**	822,87	0,00	0,00	0,00
Sn3/N7	1a/34	-153,53	**-162,62**	778,67	0,00	0,00	0,00
Sn3/N7	1a-p/35	118,87	124,20	**-605,70**	0,00	0,00	0,00
Sn1/N1	1a/154	29,16	28,67	143,91	**0,00**	**0,00**	**0,00**

Resultante

Lineaire berekening, Extreem : Globaal
Selectie : Alle
Klasse : All UGT

BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
1a/7	351,35	13,34	496,66	-548,34	11545,30	27,15
1a/5	-358,43	13,34	496,66	-548,34	-11835,74	-27,15
1a/38	0,00	303,71	496,66	-9498,83	0,02	-2,97
1a/16	0,00	-282,82	496,66	8639,76	0,02	-8,84
3/37	-116,94	-45,36	600,55	955,91	-4155,55	-4,56
1a-p/28	-286,86	-217,81	372,50	6390,18	-9318,14	7,15
1a-p/39	0,00	-282,82	372,50	8640,37	0,02	-8,84
5a13/8	0,00	-40,94	414,88	1775,05	13,31	379,97
5a21/109	0,00	-40,94	414,88	1774,25	10,66	-379,96

Centraalpunt:

X [m]	Y [m]	Z [m]
0,000	0,000	0,000

Resultante op Fundering

Lineaire berekening, Extreem : Globaal
Selectie : Alle
Klasse : All UGT

BG	Steunpunt	Extreem	horiz. component [kN]	resultante [kN]	Hoek [deg]	helling(afschot) [-]	Rx [kN]	Ry [kN]	Rz [kN]
1a-p/28	Sn1/N1	Rx	**160,84**	583,95	2,09	-3,49	-109,51	-117,80	-561,37
1a/29	Sn1/N1	Rx	**234,78**	855,71	-178,75	3,50	162,34	169,61	822,87
1a/32	Sn2/N3	Rx	195,78	**550,71**	-101,48	-2,63	-163,22	-108,11	-514,74
1a/29	Sn1/N1	Rx	234,78	**855,71**	-178,75	3,50	162,34	169,61	822,87
1a/29	Sn1/N1	Rx	234,78	855,71	**-178,75**	3,50	162,34	169,61	822,87
1a/26	Sn2/N3	Ry	196,65	846,42	**104,16**	4,19	100,81	168,84	823,26
1a-p/28	Sn1/N1	Rx	160,84	583,95	2,09	**-3,49**	-109,51	-117,80	-561,37
1a/29	Sn3/N7	Rz	162,94	795,54	1,28	**4,78**	112,62	117,76	778,67
1a/32	Sn2/N3	Rx	195,78	550,71	-101,48	-2,63	**-163,22**	-108,11	-514,74
1a/29	Sn1/N1	Rx	234,78	855,71	-178,75	3,50	**162,34**	169,61	822,87
1a/34	Sn3/N7	Rx	223,65	616,67	-178,35	-2,57	-153,53	**-162,62**	-574,69
1a/29	Sn1/N1	Rx	234,78	855,71	-178,75	3,50	162,34	**169,61**	822,87
1a-p/28	Sn3/N7	Rz	214,67	642,61	-178,32	-2,82	-147,28	-156,18	**-605,70**
1a/26	Sn2/N3	Ry	196,65	846,42	104,16	4,19	100,81	168,84	**823,26**

4.3 Berekening Fundatie

De berekening van de fundatie, met de gegevens zoals de sonderingen, is een op zichzelf staande berekening, welke niet valt onder de scope van deze opdracht.

5 Resultaten

Uit de controleberekening van de mast volgen de volgende resultaten:
(Opmerking: De verschillende berekeningen zijn te vinden in de bijlagen B en C)

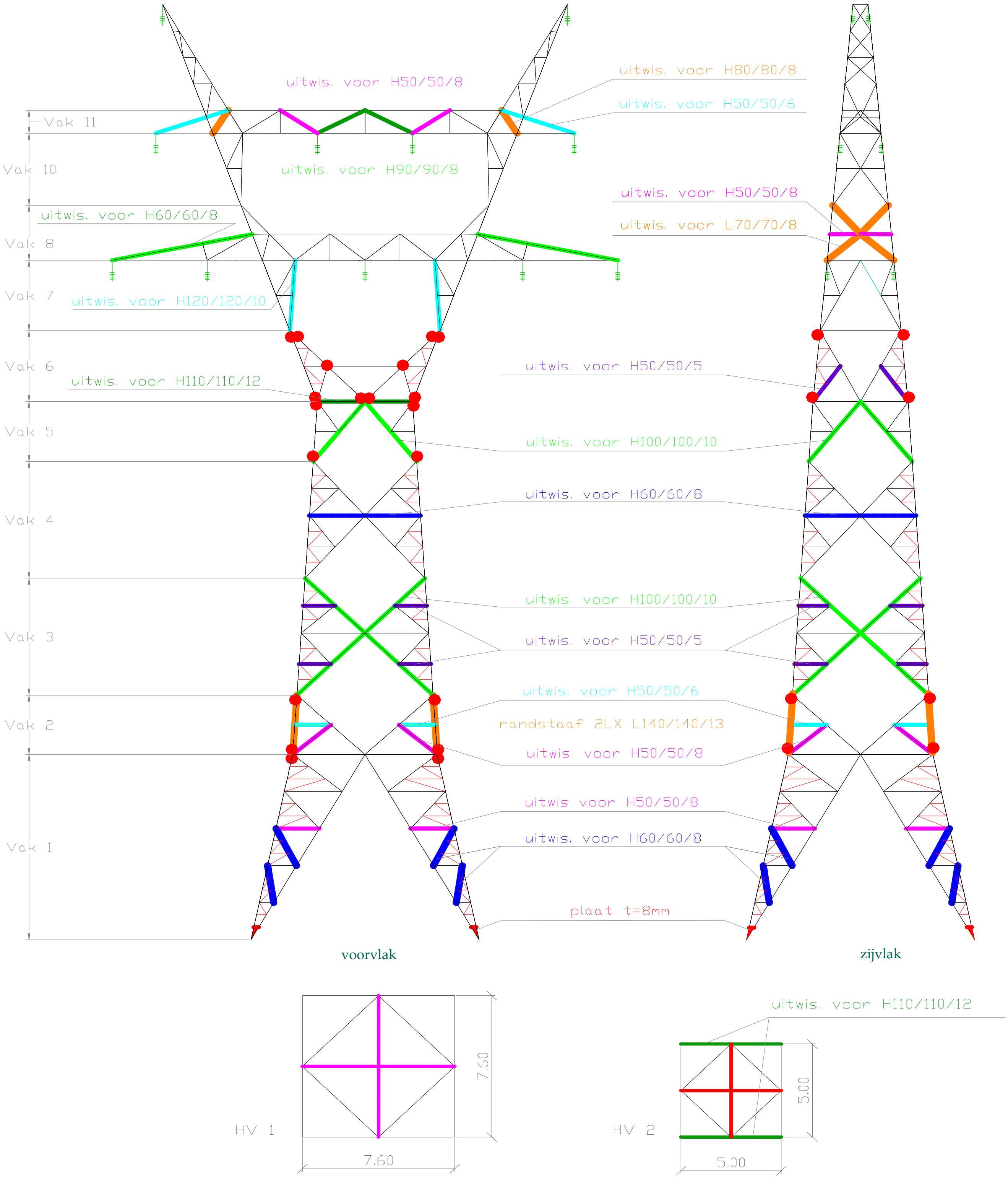
5.1 Overzicht spanningniveau's

Plaats		$UC_{tot,1}$	Verzwaring:			$UC_{tot,2}$
Vak 1 - randen	H150/150/14	133%	extra knikverkoters	L50/50/5		97%
			bouten visselen voor	kl 8,8		66%
Vak 1 - diagonalen	H180/90/10	55%				
Vak 1 - 1e en 2e hor knikverkorters	H50/40/5	92%				
Vak 1 - 3e hor. knikverkorters	H50/50/5	119%	uitwisselen voor	H50/50/8	kl8,8	78%
Vak 1 - 4e hor. knikverkorters	H60/60/6	92%				
Vak 1 1e en 2e schuine knikverkorters	H50/40/5	235%	uitwisselen voor	H60/60/8	kl8,8	85%
Vak 1 - 3e schuine knikverkorters	H50/40/5	164%	knikverkorters			61%
Vak 1 4e schuine knikverkorters	H50/50/5	145%	knikverkorters			74%
Vak 2 - randen	H140/140/13	159%	vlindersprofiel	2x 140/140/13	kl8,8	62%
Vak 2 - diagonalen	H100/75/7	95%				
Vak 2 - hor. kikverkorters	H50/40/5	115%	uitwisselen voor	H50/50/6	kl8,8	84%
Vak 2 schuin kikverkorter	H50/40/5	180%	uitwisselen voor	H50/50/8	kl8,8	90%
Vak3 randen	H140/140/13	137%	extra knikverkoters	H50/50/5	kl 8,8	96%
Vak 3 diagonalen	H100/75/7	123%	uitwisselen voor	H100/100/10	kl 8,8	92%
Vak 3 horizontaal	H70/70/6	74%				
Vak 3 hor. knikverkorters	H50/40/5	101%	uitwisselen voor	H50/50/5	kl 8,8	88%
Vak 3 - schuine knikverkorters	H50/40/5	117%	knikverkorters			47%
Vak 4 randen	H130/130/12	111%	extra knikverkoters	H50/50/5	kl 8,8	90%
Vak 4 diagonalen	H100/75/7	75%				
Vak 4 horizontaal	H60/60/5	105%	uitwisselen voor	H60/60/8	kl8,8	68%
Vak 4 hor. knikverkorters	H50/40/5	88%				
Vak 4 schuine knikverkorters	H50/40/5	70%				
Vak 5 randen	H130/130/12	113%	bouten uitwisselen voor		kl8,8	84%
Vak 5 diagonalen	H100/75/7	120%	uitwisselen voor	H100/100/10	kl8,8	89%
Vak 5 hor. knikverkorters	H50/40/5	76%				
Vak 5 schuine knikverkorters	H50/40/5	67%				
Vak 6 randen	H130/130/12	118%	extra knikverkoters	H50/50/5	kl 8,8	75%
Vak 6 diagonalen voor- en achtervlak	H150/150/14	112%	bouten uitwisselen voor		kl 8,8	68%
Vak 6 diagonalen zijvlak	H100/75/7	92%				
Vak 6 horizontaal	H130/130/12	13%				
Vak 6 hor. knikverkorters	H50/40/5	76%				
Vak 6 schuine knikverkorters voorvlak	H100/100/6	19%				
Vak 6 schuine knikverkorters zijvlak	H50/40/5	112%	uitwisselen voor	H50/50/5	kl 8,8	83%
Vak 7 randen	H130/130/12	60%				
Vak 7 diagonalen voor- en achtervlak	H120/80/8	128%	uitwisselen voor	H120/120/10	kl 8,8	80%
Vak 7 diagonalen zijvlak	H120/80/8	69%				
Vak 7 horizontaal zijvlak	H75/75/8	62%				
Vak 7 hor. knikverkorters	H50/40/5	52%				
Vak 7 schuine knikverkorters	H50/40/5	73%				

Plaats			$UC_{tot,1}$	Verzwaring:			$UC_{tot,2}$
Vak 8	randen	H120/80/8	88%				
Vak 8	diagonalen voor en achter vlak	H120/80/8	100%				
Vak 8	diagonalen zijvlak	H70/70/5	103%	uitwisselen voor	H70/70/8	kl 8,8	61%
Vak 8	hor. knikverkorters voorvlak	H130/130/10	75%				
Vak 8	hor. knikverkorters zijvlak	H50/40/5	135%	uitwisselen voor	H50/50/8	kl 8,8	76%
Vak 8	schuine knikverkorters voorvlak	H120/80/8	92%				
Vak 9	bovenrand	H130/130/12	52%				
Vak 9	onderrand	UNP160	68%				
Vak 9	diagonalen voor-en achtervlak	H100/100/8	88%				
Vak 9	diagonalen voor-en achtervlak	H120/120/8	84%				
Vak 9	verticalen		13%				
Vak 9	diagonalen ondervlak		49%				
Vak 10	randen	H100/100/6	99%				
Vak 10	diagonalen voor- en achtervlak	H120/80/8	72%				
Vak 10	diagonalen zijvlak	H80/80/10	95%				
Vak 10	hor. knikverkorters voorvlak	H45/30/5	68%				
Vak 10	hor. knikverkorters zijvlak	H45/45/5	83%				
Vak 10	schuine knikverkorters voorvlak	H50/40/5	22%				
Vak 11	randen	H80/80/6	34%				
Vak 11	diagonalen voor- en achtervlak	H75/75/7	90%				
Vak 11	schuine diagonalen zijvlak	H45/30/5	62%				
Vak 11	horizontaal zijvlak	H65/65/6	68%				
Vak 11	hor. voor en achtervlak	H50/40/5	112%	uitwisselen voor	H50/50/6	kl 8,8	82%
Vak 11	schuine diagonaal v.v en a.v	H80/80/6	107%	uitwisselen voor	H80/80/8	kl 8,8	80%
Vak 11	hor. knikverkorters zijvlak	H45/45/5	65%				
Vak 12	bovenrand	H100/100/8	76%				
Vak 12	onderrand	UNP120	64%				
Vak 12	diagonalen ondervlak	H55/55/5	95%				
Vak 12	diagonalen v.v en a.v	H100/100/6	72%				
Vak 12	diagonalenv.v en a.v	H90/90/6	120%	uitwisselen voor	H90/90/8	kl 8,8	81%
Vak 12	diagonalen v.v en a.v	H50/40/5	120%	uitwisselen voor	H50/50/8	kl 8,8	69%
HV 1	rand	H120/120/11	89%				
HV 1	diagonalen	H80/80/6	92%				
HV 1	kruis	H70/70/5	216%	uitwisselen voor	H80/80/10	kl 8,8	79%
HV 2	randen voor- en achtervlak	H110/110/10	140%	uitwisselen voor	H110/110/12	kl 8,8	85%
HV 2	randen zijvlak	H80/80/6	43%				
HV 2	diagonalen	H100/100/8	28%				
HV 2	kruis	H60/60/5	179%	uitwisselen voor	H60/60/10		95%

Plaats			$UC_{tot,1}$	Verzwaring:			$UC_{tot,2}$
Tr. 1 en 2	bovenrand	H65/50/5	131%	uitwisselen voor	H60/60/8	kl 8,8	80%
Tr. 1 en 2	onderrand	UNP160	83%				
Tr. 1 en 2	diagonalen v.v en a.v	H50/40/5	82%				
Tr. 1 en 2	diagonalen ondervlak	H75/75/6	71%				
Tr. 1 en 2	diagonalen ondervlak	H55/55/5	86%				
Tr. 3 en 4	bovenrand	H50/40/5	112%	uitwisselen voor	H50/50/6	kl 8,8	82%
Tr. 3 en 4	onderrand	UNP120	30%				
Tr. 3 en 4	diagonalen ondervlak	H50/50/5	50%				
Tr. 5 en 6	bovenrand	H65/50/6	89%				
Tr. 5 en 6	onderrand	H80/80/6	65%				
Tr. 5 en 6	diagonalen ondervlak	H45/45/5	67%				
Tr. 5 en 6	diagonalen ondervlak	H45/30/5	61%				
Tr. 5 en 6	diagonalen v.v en a.v.	H45/30/5	36%				

5.2 Overzicht verzwaring



Verzwaring :

Extra knikveroters	L50/50/5	bij randstaven	**Vaknr. 1; 3; 4 en 6**	voor- en achtervlak
Bouten wisselen voor	kl 8.8	bij randstaven	**Vaknr. 1; 2; 5 en 6**	voor- en achtervlak
		bij diagonalen	**Vaknr. 6**	voorvlak
Bouten	kl 8.8	bij alle nieuwe staven		

Bijlage A Geleiderbelastingen

Dossier/File

Order

Pagina/Page

D&C ENGINEERING
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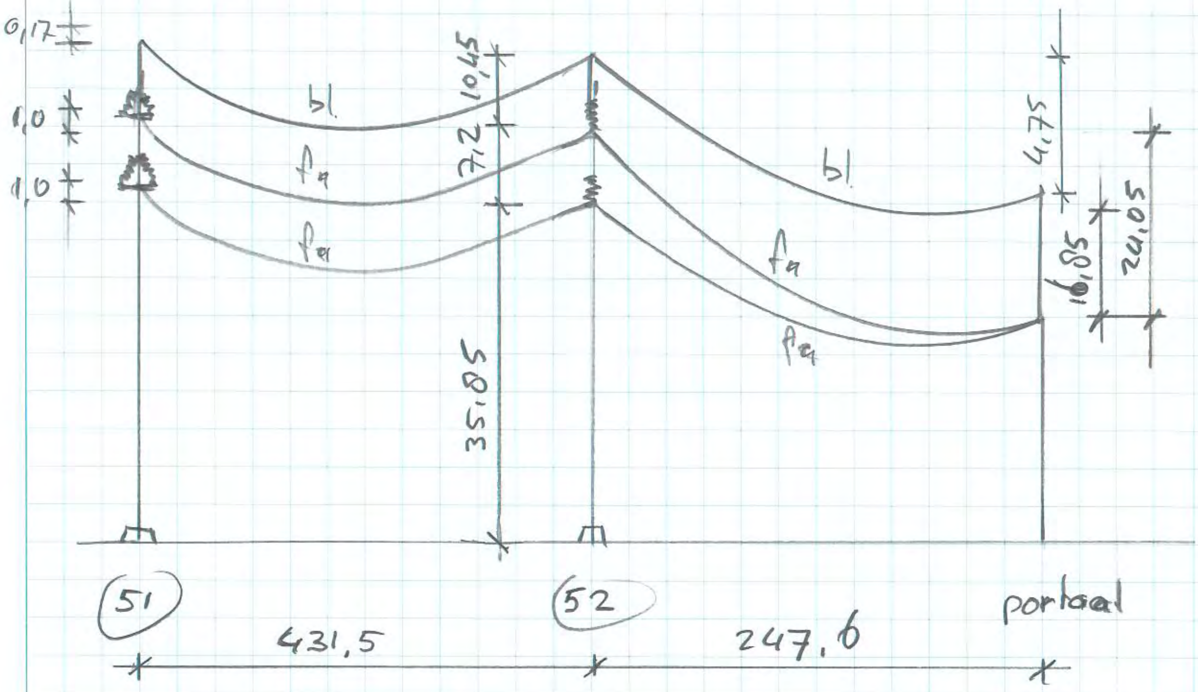


2 bundel Cu 185

fa_{bo} = eds = 24 %

fa_{ond} : eds = 24 %

bliksemdraad

Br 50 eds = 36,6

Revisie/Revision	0	A	B	C	D	E	F
Datum/Date							
Naam/Name							
Gecontroleerd/Checked							
Goedgekeurd/Approved							

KARAKTERISTIEKE GEGEVENS :

Naam hoogspanningslijn : 150 kV Zoetermeer - Leiden

Masttype : steunmast

Mastnaam : mast 52

Mastnummer : 52

Windgebied : II

Bebouwing : Onbebouwd

IJsgebied : A

Referentie periode : 50 jaar

		VELD 1		VELD 2
Minimum lijnhoek	[graden]	180		180
Maximum lijnhoek	[graden]	180		175.3
Veldlengte	[m]	432		248
Vaklengte	[m]		680	

* Belastingcombinaties en -factoren: NEN-EN 50341 -1 t/m -3, nov. 2001

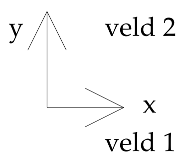
* Berekend worden de "Ultimate Limit State" belastingcombinaties, (table 4.2.11/NL.1)

(1a) Permanente belasting met extreme windbelasting
(1b) Permanente belasting met extreme koude
(3) Permanente belasting met extreme ijsbelasting
(4) Permanente belasting met onderhoudsbelasting
(5a) Permanente belasting met torsie
(6) Permanente belasting

* Alle belastingscomponenten zijn exclusief belastingsfactoren, uitgezonderd draadtrekkrachten jTrep

* Assenstelsel:

y = lijnrichting



INVOERGEGEVENS VOOR DRAAD No.: 1

Geleidersoort	:	bliksemdraad	
Geleidersoort + plaats	:	bliksemdr	
Geleiders veld 1 en 2	:	Br 50	
Eigen gewicht draad	[N/m] :	4.43	
Draaddoorsnede	[mm²] :	48.36	
Draaddiameter	[mm] :	9	
Elasticiteitsmodulus	[N/mm²] :	130000	
Uitzettingscoëfficiënt	[1/°C] :	0.000017	
Breekbelasting draad	[N] :	28390.7	
Maximum percentage breekbelasting	[%] :	100	
EDS percentage breekbelasting	[%] :	36.6	
Hoogte draadbevestiging	[m] :	53.5	

Eigen gewicht isolator	[kN] :	0	0
Lengte isolator	[m] :	0	0
Diameter isolatorschaal	[mm] :	0	0
Hoogte isolator boven maaiveld	[m] :	0	0
Hoogte verschil draadbevestiging (aangrenzende minus beschouwende mast) (hoger = positief)	[m] :	.17	-4.75

Mastnummer	:	52
Draadnummer	:	1
Geleidersoort + plaats	:	bliksemdr
Geleiders veld 1 en 2	:	Br 50
Veldlengte voor gewicht [m]	:	384.26

BELASTING COMPONENTEN [kN]		GELEIDER		ISOLATOR	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 0.96	- 0.75	0.00	0.00
Qijs;rep		- 3.24	- 2.54	0.00	0.00
Qonderhoud;rep		0.00	0.00		
BIJ MINIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	1.73	1.01	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	0.87	0.51	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	0.87	0.51	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	0.00	0.00
BIJ MAXIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	1.73	1.01	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	-0.04	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	-0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	0.87	0.47	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.02	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	0.87	0.55	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.02	0.00	0.00
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	10.08	5.94	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	5.04	2.97	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	5.04	2.97	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	0.00	0.00
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	10.08	5.92	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	-0.24	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	-0.01	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	5.04	2.72	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.11	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	5.04	3.21	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.13	0.00	0.00

Mastnummer : 52
Draadnummer : 1
Geleidersoort + plaats : bliksemdr
Geleiders veld 1 en 2 : Br 50

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2	
	Hoek t.o.v. lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	19.38	19.38	20.65	20.64
	0°	9.04	9.04	12.50	12.53
	45°	15.56	15.56	17.86	17.57
	-45°	15.56	15.56	17.86	18.14
jTrep bij combinatie (1b)	90°	10.61	10.61	15.96	15.96
	0°	9.80	9.80	15.20	15.21
	45°	10.22	10.22	15.60	15.57
	-45°	10.22	10.22	15.60	15.63
jTrep bij combinatie (3)	90°	41.31	41.31	36.18	36.18
	0°	34.87	34.87	31.51	31.52
	45°	38.33	38.33	34.04	33.85
	-45°	38.33	38.33	34.04	34.22
jTrep bij combinatie (4)	90°	9.94	9.94	13.68	13.68
	0°	9.16	9.16	12.80	12.81
	45°	9.56	9.56	13.26	13.22
	-45°	9.56	9.56	13.26	13.29
jTrep bij combinatie (5a)	90°	7.54		10.42	
jTrep bij combinatie (6)	90°	10.18		14.06	

KARAKTERISTIEKE GEGEVENS :

Naam hoogspanningslijn : 150 kV Zoetermeer - Leiden

Masttype : steunmast

Mastnaam : mast 52

Mastnummer : 52

Windgebied : II

Bebouwing : Onbebouwd

IJsgebied : B

Referentie periode : 50 jaar

		VELD 1		VELD 2
Minimum lijnhoek	[graden]	180		175.3
Maximum lijnhoek	[graden]	180		180
Veldlengte	[m]	432		248
Vaklengte	[m]		680	

* Belastingcombinaties en -factoren: NEN-EN 50341 -1 t/m -3, nov. 2001

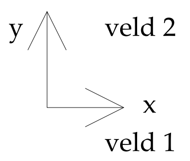
* Berekend worden de "Ultimate Limit State" belastingcombinaties, (table 4.2.11/NL.1)

(1a) Permanente belasting met extreme windbelasting
(1b) Permanente belasting met extreme koude
(3) Permanente belasting met extreme ijsbelasting
(4) Permanente belasting met onderhoudsbelasting
(5a) Permanente belasting met torsie
(6) Permanente belasting

* Alle belastingscomponenten zijn exclusief belastingsfactoren, uitgezonderd draadtrekkrachten jTrep

* Assenstelsel:

y = lijnrichting



INVOERGEGEVENS VOOR DRAAD No.: 1

Geleidersoort	:	fasedraad
Geleidersoort + plaats	:	fasedraad boven
Geleiders veld 1 en 2	:	CU185
Eigen gewicht draad	[N/m] :	16.62
Draaddoorsnede	[mm²] :	181.6
Draaddiameter	[mm] :	17.5
Elasticiteitsmodulus	[N/mm²] :	130000
Uitzettingscoëfficiënt	[1/°C] :	.000017
Breekbelasting draad	[N] :	72760.5
Maximum percentage breekbelasting	[%] :	100
EDS percentage breekbelasting	[%] :	24
Hoogte draadbevestiging	[m] :	43.05

Eigen gewicht isolator	[kN] :	2.5	2.5
Lengte isolator	[m] :	3.5	3.5
Diameter isolatorschaal	[mm] :	170	170
Hoogte isolator boven maaiveld	[m] :	46.20	46.20
Hoogte verschil draadbevestiging (aangrenzende minus beschouwende mast) (hoger = positief)	[m] :	1	-24.5

INVOERGEGEVENS VOOR DRAAD No.: 2

Geleidersoort	:	fasedraad
Geleidersoort + plaats	:	fasedraad onder
Geleiders veld 1 en 2	:	CU185
Eigen gewicht draad	[N/m] :	16.62
Draaddoorsnede	[mm²] :	181.6
Draaddiameter	[mm] :	17.5
Elasticiteitsmodulus	[N/mm²] :	130000
Uitzettingscoëfficiënt	[1/°C] :	.000017
Breekbelasting draad	[N] :	72760.5
Maximum percentage breekbelasting	[%] :	100
EDS percentage breekbelasting	[%] :	24
Hoogte draadbevestiging	[m] :	33.7

Eigen gewicht isolator	[kN] :	2.5	2.5
Lengte isolator	[m] :	3.5	3.5
Diameter isolatorschaal	[mm] :	170	170
Hoogte isolator boven maaiveld	[m] :	36.85	36.85
Hoogte verschil draadbevestiging (aangrenzende minus beschouwende mast) (hoger = positief)	[m] :	1	-16.5

Mastnummer : 52
Draadnummer : 1
Geleidersoort + plaats : fasedraad boven
Geleiders veld 1 en 2 : CU185
Veldlengte voor gewicht [m] : 441.37

BELASTING COMPONENTEN [kN]		GELEIDER		ISOLATOR	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 3.57	- 3.82	- 2.50	- 2.50
Qijs;rep		- 1.62	- 1.73	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	2.71	1.48	1.00	1.00
Qw;rep loodrecht lijn,	y	-0.00	-0.06	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	1.00	1.00
Qw;rep 45 graden (+y, +x),	x	1.36	0.68	0.71	0.71
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.03	0.71	0.71
Qw;rep 45 graden (-y, +x),	x	1.36	0.80	0.71	0.71
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.03	-0.71	-0.71
BIJ MAXIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	2.71	1.49	1.00	1.00
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	1.00	1.00
Qw;rep 45 graden (+y, +x),	x	1.36	0.74	0.71	0.71
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.71	0.71
Qw;rep 45 graden (-y, +x),	x	1.36	0.74	0.71	0.71
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.71	-0.71
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.94	3.79	1.00	1.00
Qw;rep loodrecht lijn,	y	-0.00	-0.16	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.01	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	1.00	1.00
Qw;rep 45 graden (+y, +x),	x	3.47	1.74	0.71	0.71
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.07	0.71	0.71
Qw;rep 45 graden (-y, +x),	x	3.47	2.05	0.71	0.71
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.08	-0.71	-0.71
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.94	3.80	1.00	1.00
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	1.00	1.00
Qw;rep 45 graden (+y, +x),	x	3.47	1.90	0.71	0.71
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.71	0.71
Qw;rep 45 graden (-y, +x),	x	3.47	1.90	0.71	0.71
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.71	-0.71

Mastnummer	:	52
Draadnummer	:	1
Geleidersoort + plaats	:	fasedraad boven
Geleiders veld 1 en 2	:	CU185

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

	Hoek t.o.v. lijnrichting	VELD 1 Min.lijnhoek	VELD 1 Max.lijnhoek	VELD 2 Min.lijnhoek	VELD 2 Max.lijnhoek
jTrep bij combinatie (1a)	90°	29.10	29.10	28.02	28.03
	0°	21.41	21.41	21.46	21.45
	45°	25.58	25.58	24.76	25.03
	-45°	25.58	25.58	25.29	25.03
jTrep bij combinatie (1b)	90°	22.53	22.53	24.04	24.04
	0°	22.15	22.15	23.71	23.71
	45°	22.34	22.34	23.86	23.88
	-45°	22.34	22.34	23.89	23.88
jTrep bij combinatie (3)	90°	36.58	36.58	35.79	35.79
	0°	33.36	33.36	33.15	33.14
	45°	35.01	35.01	34.40	34.50
	-45°	35.01	35.01	34.61	34.50
jTrep bij combinatie (4)	90°	26.97	26.97	26.16	26.16
	0°	26.56	26.56	25.78	25.78
	45°	26.77	26.77	25.96	25.97
	-45°	26.77	26.77	25.99	25.97
jTrep bij combinatie (5a)	90°	17.84		17.87	
jTrep bij combinatie (6)	90°	24.08		24.13	

Mastnummer	:	52
Draadnummer	:	2
Geleidersoort + plaats	:	fasedraad onder
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	407.47

BELASTING COMPONENTEN [kN]		GELEIDER		ISOLATOR	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 3.57	- 3.24	- 2.50	- 2.50
Qijs;rep		- 1.62	- 1.47	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	2.38	1.37	0.94	0.94
Qw;rep loodrecht lijn,	y	-0.00	-0.06	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.94	0.94
Qw;rep 45 graden (+y, +x),	x	1.19	0.63	0.66	0.66
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.03	0.66	0.66
Qw;rep 45 graden (-y, +x),	x	1.19	0.74	0.66	0.66
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.03	-0.66	-0.66
BIJ MAXIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	2.38	1.37	0.94	0.94
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.94	0.94
Qw;rep 45 graden (+y, +x),	x	1.19	0.68	0.66	0.66
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.66	0.66
Qw;rep 45 graden (-y, +x),	x	1.19	0.68	0.66	0.66
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.66	-0.66
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.08	3.49	0.94	0.94
Qw;rep loodrecht lijn,	y	-0.00	-0.14	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.01	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.94	0.94
Qw;rep 45 graden (+y, +x),	x	3.04	1.61	0.66	0.66
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.07	0.66	0.66
Qw;rep 45 graden (-y, +x),	x	3.04	1.89	0.66	0.66
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.08	-0.66	-0.66
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.08	3.50	0.94	0.94
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.94	0.94
Qw;rep 45 graden (+y, +x),	x	3.04	1.75	0.66	0.66
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.66	0.66
Qw;rep 45 graden (-y, +x),	x	3.04	1.75	0.66	0.66
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.66	-0.66

Mastnummer	:	52
Draadnummer	:	2
Geleidersoort + plaats	:	fasedraad onder
Geleiders veld 1 en 2	:	CU185

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

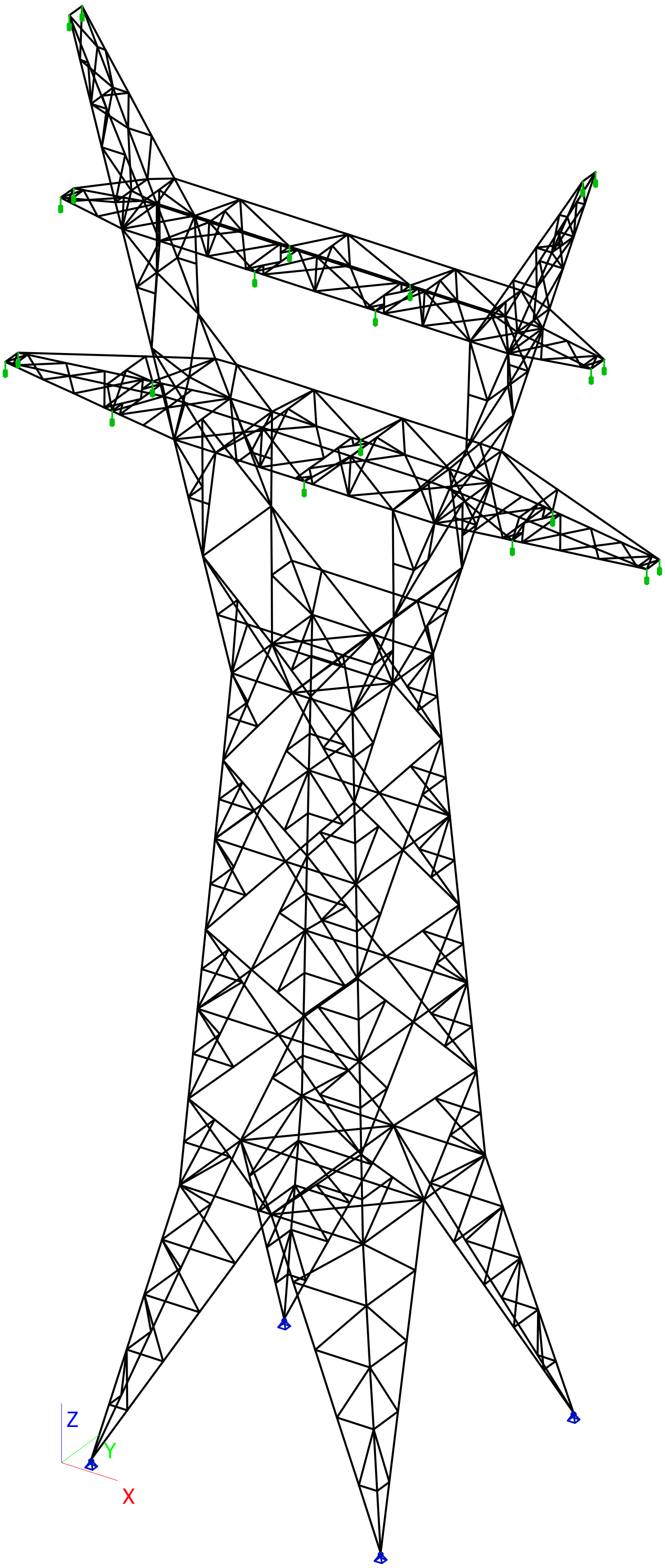
		VELD 1		VELD 2	
	Hoek t.o.v. lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	27.54	27.54	26.99	27.00
	0°	21.41	21.41	21.32	21.31
	45°	24.69	24.69	24.15	24.38
	-45°	24.69	24.69	24.61	24.38
jTrep bij combinatie (1b)	90°	22.44	22.44	23.85	23.85
	0°	22.15	22.15	23.56	23.56
	45°	22.30	22.30	23.70	23.71
	-45°	22.30	22.30	23.72	23.71
jTrep bij combinatie (3)	90°	35.86	35.86	35.18	35.19
	0°	33.36	33.36	32.94	32.93
	45°	34.64	34.64	33.99	34.09
	-45°	34.64	34.64	34.18	34.09
jTrep bij combinatie (4)	90°	26.88	26.88	26.94	26.94
	0°	26.56	26.56	26.63	26.62
	45°	26.72	26.72	26.77	26.79
	-45°	26.72	26.72	26.80	26.79
jTrep bij combinatie (5a)	90°	17.84		17.76	
jTrep bij combinatie (6)	90°	24.08		23.98	

Bijlage B Berekening Mast 52; Scia Engineer

Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 52
Omschrijving	Controle berekening
Auteur	MG
Datum	11-02-2014
Constructie	Algemeen XYZ
Nationale norm	EC - EN

1. Inhoudsopgave

2. Overzicht rekenmodel



3. Knoop

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K1	-8,904	-0,682	49,980
K2	-9,553	0,000	49,980
K3	-10,100	-0,541	51,489
K5	-9,553	0,682	49,980
K7	-10,100	0,541	51,489
K9	-9,553	-0,682	49,980
K13	-9,014	0,821	48,490
K15	-8,333	0,000	46,609
K17	-9,014	-0,821	48,490
K21	-9,764	0,543	51,470
K24	-8,905	0,682	49,980
K28	-8,045	0,821	48,490
K29	-8,333	0,996	46,609
K31	-9,764	-0,543	51,470
K38	-8,045	-0,821	48,490
K39	-8,333	-0,996	46,609
K43	-8,004	-1,081	45,700
K47	-7,279	0,000	43,700
K55	-7,279	-1,268	43,700
K56	-7,279	1,268	43,700
K61	-5,929	1,616	39,971
K63	-5,397	-1,753	38,500
K65	-5,929	-1,616	39,971
K67	-5,938	0,000	39,994
K69	-3,952	2,126	34,509
K70	-5,397	0,000	38,500
K72	-4,676	1,060	36,510
K75	-3,952	-2,126	34,509
K77	-4,678	-1,939	36,515
K78	-4,676	-1,060	36,510
K81	4,678	1,939	36,515
K82	3,814	1,939	36,514
K83	3,677	1,753	38,500
K90	-3,226	2,313	32,505
K91	-2,500	2,500	30,500
K93	0,000	2,500	30,500
K95	-3,226	1,063	32,505
K99	-2,500	0,000	30,500
K102	-2,500	-2,500	30,500
K103	-3,226	-1,063	32,505
K104	-3,226	-2,313	32,505
K109	0,000	-2,500	30,500
K111	3,226	2,313	32,505
K112	2,500	2,500	30,500
K115	8,904	0,682	49,980
K116	9,553	0,000	49,980
K117	8,904	-0,682	49,980
K118	10,100	-0,541	51,489
K120	9,553	0,682	49,980
K122	10,100	0,541	51,489
K124	9,553	-0,682	49,980
K128	9,014	0,821	48,490
K130	8,333	0,000	46,609
K132	9,014	-0,821	48,490
K136	9,764	0,543	51,470
K143	8,045	0,821	48,490
K144	8,333	0,996	46,609
K146	9,764	-0,543	51,470
K153	8,045	-0,821	48,490
K154	8,333	-0,997	46,609
K156	8,004	1,081	45,700
K158	8,004	-1,081	45,700
K162	7,279	0,000	43,700
K170	7,279	-1,268	43,700
K171	7,279	1,268	43,700
K173	-7,185	0,001	47,000

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K176	6,434	-1,080	45,700
K177	7,185	0,001	47,000
K186	-2,498	1,081	45,700
K190	-4,465	1,081	45,700
K191	-4,465	0,000	47,000
K194	-4,465	-1,081	45,700
K198	-6,435	-1,081	45,700
K201	-2,498	-1,081	45,700
K205	4,465	0,960	47,000
K206	6,435	1,081	45,700
K207	2,498	1,081	45,700
K211	4,465	1,081	45,700
K212	4,465	0,000	47,000
K215	4,465	-1,081	45,700
K217	4,465	-0,960	47,000
K219	6,435	-1,081	45,700
K222	2,498	-1,081	45,700
K224	0,000	1,081	45,700
K226	0,000	0,000	47,000
K227	0,000	-1,081	45,700
K233	-7,185	0,960	47,000
K235	-7,185	-0,960	47,000
K243	-6,480	1,268	43,700
K245	-6,480	-1,268	43,700
K254	-11,000	-0,400	45,700
K256	-10,647	0,400	53,000
K261	7,185	0,960	47,000
K264	11,000	0,400	45,700
K267	7,185	-0,960	47,000
K269	6,480	1,268	43,700
K271	6,480	-1,268	43,700
K282	11,000	-0,400	45,700
K284	10,647	0,400	53,000
K291	-3,677	1,753	38,500
K294	-5,042	1,614	39,996
K298	5,929	1,616	39,971
K301	5,397	1,753	38,500
K302	5,042	1,614	39,996
K306	-5,042	-1,614	39,996
K307	-3,677	-1,753	38,500
K311	-9,194	-0,811	45,700
K312	-10,645	0,481	45,700
K314	-9,194	0,811	45,700
K315	-10,645	-0,481	45,700
K325	-10,647	-0,400	53,000
K329	-2,145	-1,081	45,700
K332	-2,145	1,081	45,700
K335	-6,435	1,081	45,700
K337	-4,471	-1,081	45,700
K339	-2,861	1,081	45,700
K343	-2,861	-1,081	45,700
K345	-2,145	0,000	45,700
K352	9,194	-0,811	45,700
K353	10,645	0,481	45,700
K355	9,194	0,811	45,700
K356	10,645	-0,481	45,700
K372	2,855	1,081	45,700
K376	2,855	-1,081	45,700
K378	2,145	0,000	45,700
K382	2,145	-1,081	45,700
K384	2,145	1,081	45,700
K388	-8,004	1,081	45,700
K394	-1,837	1,753	38,500
K395	-1,840	0,000	39,996
K396	1,837	1,753	38,500
K397	1,840	0,000	39,996

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K400	-8,543	-0,008	39,449
K401	-8,297	-1,256	38,500
K403	-8,297	1,256	38,500
K404	-1,837	-1,753	38,500
K406	1,837	-1,753	38,500
K408	-1,840	-1,614	39,996
K409	-1,840	1,614	39,996
K410	1,840	-1,614	39,996
K411	1,840	1,614	39,996
K414	0,000	1,753	38,500
K420	-13,297	0,400	38,500
K423	-8,543	1,185	39,449
K424	13,297	0,400	38,500
K426	8,297	1,256	38,500
K428	8,543	1,185	39,449
K429	-13,297	-0,400	38,500
K433	-8,543	-1,185	39,449
K434	0,000	-1,753	38,500
K438	3,677	-1,753	38,500
K444	5,397	-1,753	38,500
K447	5,397	0,000	38,500
K448	4,676	1,060	36,510
K451	3,226	1,063	32,505
K456	3,952	-2,126	34,509
K458	13,297	-0,400	38,500
K459	5,929	-1,616	39,971
K460	8,297	-1,256	38,500
K462	8,543	-1,185	39,449
K469	4,678	-1,939	36,515
K470	4,676	-1,060	36,510
K473	-3,677	0,000	38,500
K493	-11,512	0,706	38,500
K494	-12,942	-0,461	38,500
K495	-10,082	0,951	38,500
K496	-11,512	-0,706	38,500
K497	-8,652	1,196	38,500
K498	-10,082	-0,951	38,500
K504	-12,942	0,461	38,500
K507	-8,652	-1,196	38,500
K515	-7,942	0,000	38,500
K519	-7,942	-1,317	38,500
K520	-7,942	1,317	38,500
K521	-6,838	-1,506	38,500
K522	-6,838	1,507	38,500
K527	3,677	0,000	38,500
K531	0,352	0,000	38,500
K532	-0,358	-0,886	38,500
K534	0,352	-1,753	38,500
K538	8,543	-0,008	39,449
K544	-0,358	1,753	38,500
K545	-0,358	-1,753	38,500
K546	5,938	0,000	39,994
K550	11,512	-0,706	38,500
K551	12,942	0,461	38,500
K552	10,082	-0,951	38,500
K553	11,512	0,706	38,500
K554	8,652	-1,196	38,500
K555	10,082	0,951	38,500
K561	12,942	-0,461	38,500
K564	8,652	1,196	38,500
K572	7,942	0,000	38,500
K576	7,942	1,317	38,500
K577	7,942	-1,317	38,500
K578	6,837	1,506	38,500
K579	6,837	-1,506	38,500
K589	-0,358	0,886	38,500

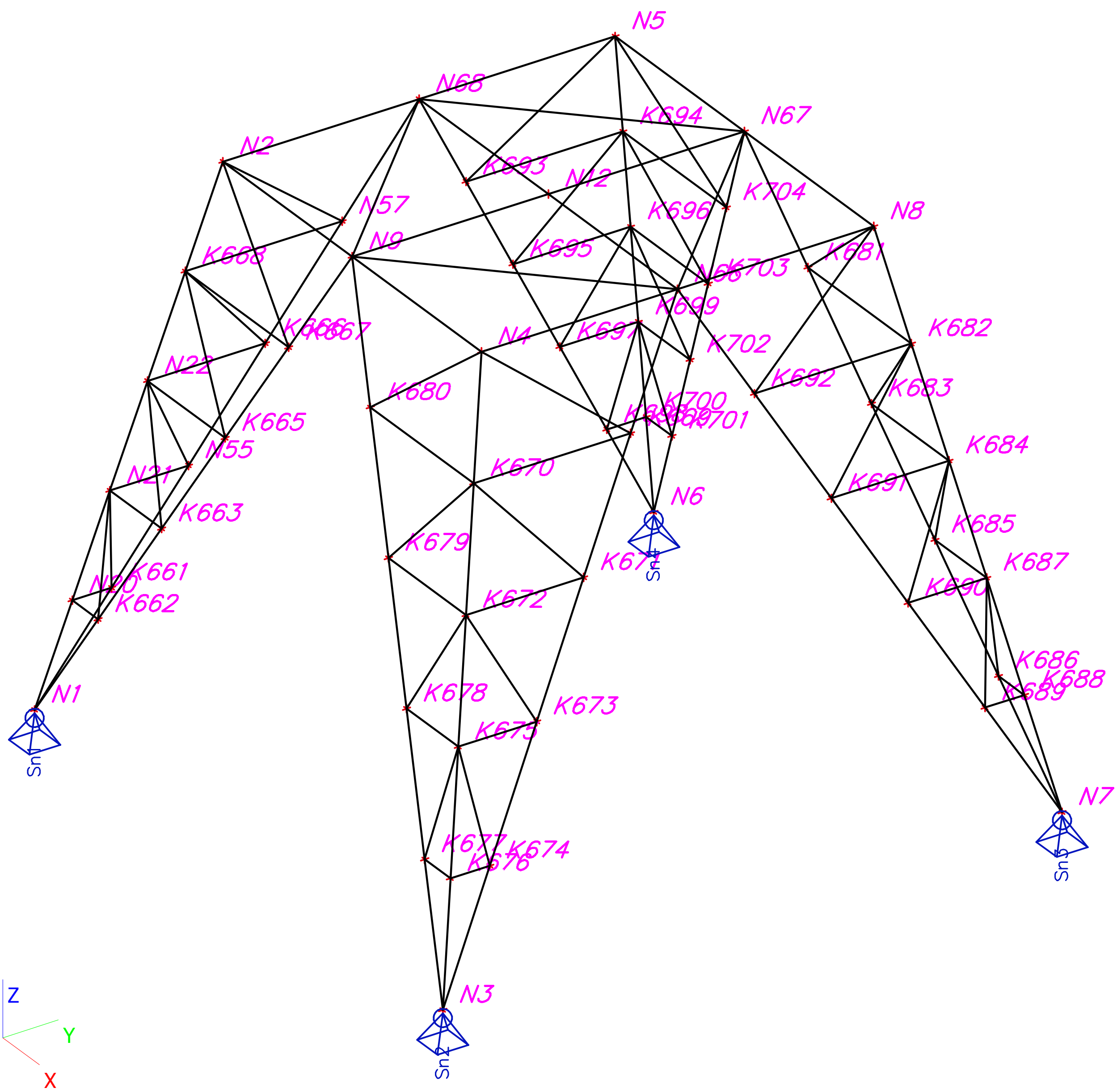
Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K591	0,352	1,753	38,500
K598	5,042	-1,614	39,996
K601	3,813	-1,939	36,514
K605	3,226	-1,063	32,505
K606	3,226	-2,313	32,505
K618	10,647	-0,400	53,000
K619	-6,526	-1,462	41,620
K620	-6,526	1,462	41,620
K621	6,526	1,462	41,620
K622	6,527	-1,462	41,621
K623	-4,465	0,960	47,000
N1	-6,000	-6,000	0,000
N2	-3,800	-3,800	10,500
N3	6,000	-6,000	0,000
N4	3,800	-3,800	10,500
N5	-3,800	3,800	10,500
N6	-6,000	6,000	0,000
N7	6,000	6,000	0,000
N8	3,800	3,800	10,500
N20	-5,560	-5,560	2,100
N21	-5,120	-5,120	4,200
N22	-4,680	-4,680	6,300
N55	-5,120	-3,600	4,200
N57	-4,240	-1,200	8,400
N59	-3,582	-3,582	13,860
N61	3,582	-3,582	13,860
N62	-3,582	3,582	13,860
N65	3,582	3,582	13,860
N9	0,000	-3,800	10,500
N66	3,800	0,000	10,500
N67	0,000	3,800	10,500
N68	-3,800	0,000	10,500
N69	-3,691	-3,691	12,180
N14	-1,791	-3,691	12,180
N15	3,691	-3,691	12,180
N16	1,791	-3,691	12,180
N17	3,691	-1,791	12,180
N18	3,691	1,791	12,180
N19	3,691	3,691	12,180
N70	1,791	3,691	12,180
N71	-1,791	3,691	12,180
N72	-3,691	3,691	12,180
N73	-3,691	1,791	12,180
N74	-3,691	-1,791	12,180
N76	-3,151	-3,151	20,480
N78	3,151	-3,151	20,480
N79	-3,151	3,151	20,480
N82	3,151	3,151	20,480
N83	-3,353	-3,353	17,382
N84	3,353	-3,353	17,382
N85	3,353	3,353	17,382
N86	-3,353	3,353	17,382
N87	1,791	-3,467	15,621
N88	3,467	-3,467	15,621
N89	3,467	-1,791	15,621
N90	3,467	1,791	15,621
N91	3,467	3,467	15,621
N92	1,791	3,467	15,621
N93	-1,791	3,467	15,621
N94	-3,467	3,467	15,621
N95	-3,467	1,791	15,621
N96	-3,467	-1,791	15,621
N97	-3,467	-3,467	15,621
N98	-1,791	-3,467	15,621
N99	1,576	-3,252	18,931
N100	3,252	-3,252	18,931
N101	3,252	-1,576	18,931
N102	3,252	1,575	18,931

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
N33	3,252	3,252	18,931
N103	1,576	3,252	18,931
N104	-1,576	3,252	18,931
N105	-3,252	3,252	18,931
N106	-3,252	1,575	18,931
N38	-3,252	-1,576	18,931
N107	-3,252	-3,252	18,931
N108	-1,576	-3,252	18,931
N114	-2,720	-2,721	27,100
N116	2,721	-2,721	27,100
N117	-2,720	2,720	27,100
N120	2,721	2,720	27,100
N121	-2,920	-2,920	24,033
N122	2,920	-2,920	24,033
N123	2,920	2,920	24,033
N124	-2,920	2,920	24,033
N125	1,576	-3,036	22,256
N126	3,036	-3,036	22,256
N127	3,036	-1,576	22,256
N128	3,036	1,575	22,256
N129	3,036	3,035	22,256
N130	1,576	3,035	22,256
N131	-1,576	3,035	22,256
N132	-3,036	3,035	22,256
N133	-3,036	1,575	22,256
N134	-3,036	-1,576	22,256
N135	-3,036	-3,036	22,256
N136	-1,576	-3,036	22,256
N137	1,361	-2,821	25,566
N138	2,821	-2,821	25,566
N139	2,821	-1,361	25,566
N140	2,821	1,360	25,566
N141	2,821	2,820	25,566
N142	1,361	2,820	25,566
N143	-1,360	2,820	25,566
N144	-2,820	2,820	25,566
N145	-2,820	1,360	25,566
N146	-2,820	-1,361	25,566
N147	-2,820	-2,821	25,566
N148	-1,360	-2,821	25,566
N149	2,920	0,000	24,033
N150	0,000	2,920	24,033
N151	-2,920	0,000	24,033
N152	0,000	-2,920	24,033
N156	2,500	-2,500	30,500
N165	-2,610	-2,611	28,800
N166	-1,360	-2,611	28,800
N167	1,360	-2,611	28,800
N168	2,610	-2,611	28,800
N169	2,610	-1,361	28,800
N170	2,610	1,360	28,800
N171	2,610	2,610	28,800
N172	1,361	2,610	28,800
N173	-1,360	2,610	28,800
N174	-2,610	2,610	28,800
N175	-2,610	1,360	28,800
N176	-2,610	-1,361	28,800
K624	-0,358	0,000	38,500
K625	2,500	-0,001	30,500
K626	-5,397	1,753	38,500
K627	-4,464	-0,960	47,000
K628	3,952	2,126	34,509
K629	-3,814	-1,939	36,515
K630	-3,814	1,939	36,515
N12	0,000	0,000	10,500
N183	0,000	0,000	30,500
N191	0,000	0,960	47,000
N192	0,000	-0,960	47,000

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K631	-11,000	0,400	45,700
K661	-5,560	-4,800	2,100
K662	-4,800	-5,560	2,100
K663	-3,600	-5,120	4,200
K665	-2,400	-4,680	6,300
K666	-4,680	-2,400	6,300
K667	-1,200	-4,240	8,400
K668	-4,240	-4,240	8,400
K669	4,240	-1,200	8,400
K670	4,240	-4,240	8,400
K671	4,680	-2,400	6,300
K672	4,680	-4,680	6,300
K673	5,120	-3,600	4,200
K674	5,560	-4,800	2,100
K675	5,120	-5,120	4,200
K676	5,560	-5,560	2,100
K677	4,800	-5,560	2,100
K678	3,600	-5,120	4,200
K679	2,400	-4,680	6,300
K680	1,200	-4,240	8,400
K681	1,200	4,240	8,400
K682	4,240	4,240	8,400
K683	2,400	4,680	6,300
K684	4,680	4,680	6,300
K685	3,600	5,120	4,200
K686	4,800	5,560	2,100
K687	5,120	5,120	4,200
K688	5,560	5,560	2,100
K689	5,560	4,800	2,100
K690	5,120	3,600	4,200
K691	4,680	2,400	6,300
K692	4,240	1,200	8,400
K693	-4,240	1,200	8,400
K694	-4,240	4,240	8,400
K695	-4,680	2,400	6,300
K696	-4,680	4,680	6,300
K697	-5,120	3,600	4,200
K698	-5,560	4,800	2,100
K699	-5,120	5,120	4,200
K700	-5,560	5,560	2,100
K701	-4,800	5,560	2,100
K702	-3,600	5,120	4,200
K703	-2,400	4,680	6,300
K704	-1,200	4,240	8,400
N247	0,000	-3,353	17,382
K706	3,353	0,000	17,382
K709	0,000	3,353	17,382
K712	-3,353	0,000	17,382
K714	-6,838	0,000	38,500
K715	6,837	0,000	38,500
K716	1,976	2,313	32,505
K717	-1,976	2,313	32,505
K718	-1,976	-2,313	32,505
K719	1,976	-2,313	32,505
K720	-4,678	1,939	36,515
K721	6,526	-1,462	41,620
K728	6,527	1,462	41,621
K729	8,684	0,000	45,700
K730	8,684	0,000	45,700
K731	8,297	-0,598	38,500
K732	8,297	0,598	38,500
K733	-0,003	-1,320	38,500
K734	-0,003	1,320	38,500
K735	-8,297	-0,598	38,500
K736	-8,297	0,598	38,500
K737	-2,498	-1,081	45,700
K738	-2,503	-0,541	45,700
K739	-2,503	0,541	45,700

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]	Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K740	-2,145	1,081	45,700	K742	2,500	-0,541	45,700
K741	2,498	-1,081	45,700	K743	2,500	0,541	45,700

4. Knoopnummers steunpunten



5. 1D-staaf

Naam	Laag	Doorsnede	Lengte [m]
B7	HorVerb1	CS75 - L120X11	7,600
B8	Vak2	CS100 - L100X75X7	4,916
B9	Vak1	CS3 - HFLue180x90x10	12,292
B10	Vak2	CS100 - L100X75X7	4,916
B11	HorVerb1	CS39 - ISEA80/80/6	5,374
B12	Vak2	CS100 - L100X75X7	4,916
B13	HorVerb1	CS39 - ISEA80/80/6	5,374
B14	Vak1	CS3 - HFLue180x90x10	12,292
B16	Vak1	CS3 - HFLue180x90x10	12,292
B17	HorVerb1	CS46 - ISEA70/70/5	3,800
B18	Vak1	CS3 - HFLue180x90x10	12,292
B22	Vak3	CS68 - L100X75X7	9,452
B26	Vak3	CS68 - L100X75X7	9,452
B31	Vak2	CS100 - L100X75X7	4,916
B32	Vak2	CS100 - L100X75X7	4,916
B33	Vak2	CS100 - L100X75X7	4,916
B34	Vak2	CS100 - L100X75X7	4,916
B36	Vak5	CS73 - L100X75X7	4,360
B37	Vak5	CS73 - L100X75X7	4,360
B38	Vak5	CS73 - L100X75X7	4,360
B39	Vak5	CS73 - L100X75X7	4,360
B73	Vak3	CS68 - L100X75X7	9,452
B74	Vak3	CS68 - L100X75X7	9,452
B75	Vak3	CS68 - L100X75X7	9,452
B76	Vak3	CS68 - L100X75X7	9,452
B89	Vak1	CS3 - HFLue180x90x10	12,292
B90	Vak1	CS3 - HFLue180x90x10	12,292
B91	Vak1	CS3 - HFLue180x90x10	12,292
B92	Vak1	CS3 - HFLue180x90x10	12,292
B93	Vak2	CS100 - L100X75X7	4,916
B94	Vak3	CS68 - L100X75X7	9,452
B95	Vak3	CS68 - L100X75X7	9,452
B98	Vak4	CS70 - L100X75X7	8,859
B99	Vak4	CS70 - L100X75X7	8,860
B100	Vak4	CS70 - L100X75X7	8,860
B101	Vak4	CS70 - L100X75X7	8,859
B102	Vak4	CS81 - L60X5	2,920
B103	Vak4	CS81 - L60X5	2,920
B104	Vak4	CS81 - L60X5	2,920
B105	Vak4	CS81 - L60X5	2,920
B106	Vak4	CS70 - L100X75X7	8,859
B107	Vak4	CS70 - L100X75X7	8,859
B108	Vak4	CS70 - L100X75X7	8,860
B109	Vak4	CS70 - L100X75X7	8,860
B110	Vak4	CS81 - L60X5	2,920
B111	Vak4	CS81 - L60X5	2,920
B112	Vak4	CS81 - L60X5	2,920
B113	Vak4	CS81 - L60X5	2,920
B114	Vak5	CS73 - L100X75X7	4,360
B115	Vak5	CS73 - L100X75X7	4,360
B116	Vak5	CS73 - L100X75X7	4,360
B117	Vak5	CS73 - L100X75X7	4,360
B118	HorVerb1	CS75 - L120X11	7,600
B119	HorVerb1	CS75 - L120X11	7,600
B120	HorVerb1	CS75 - L120X11	7,600
B121	HorVerb1	CS39 - ISEA80/80/6	5,374
B122	HorVerb1	CS39 - ISEA80/80/6	5,374
B123	HorVerb1	CS46 - ISEA70/70/5	7,600
B124	HorVerb1	CS46 - ISEA70/70/5	3,800
B129	HorVerb2	CS79 - L100X8	3,536
B130	HorVerb2	CS79 - L100X8	3,536
B131	HorVerb2	CS79 - L100X8	3,535
B132	HorVerb2	CS79 - L100X8	3,536
B133	HorVerb2	CS77 - L60X5	5,000
B134	HorVerb2	CS77 - L60X5	2,500
B135	HorVerb2	CS77 - L60X5	2,500
C1	Vak1	CS2 - L150X14	10,951
C2	Vak1	CS2 - L150X14	10,951
C3	Vak1	CS2 - L150X14	10,951
C4	Vak1	CS2 - L150X14	10,951
C5	Vak2	CS167 - 2LX (L140X13; 15)	3,374
C6	Vak2	CS167 - 2LX (L140X13; 15)	3,374
C7	Vak2	CS167 - 2LX (L140X13; 15)	3,374
C8	Vak2	CS167 - 2LX (L140X13; 15)	3,374
C9	Vak3	CS103 - HFLeq140x140x13	6,648
C10	Vak3	CS103 - HFLeq140x140x13	6,648
C11	Vak3	CS103 - HFLeq140x140x13	6,648
C12	Vak3	CS103 - HFLeq140x140x13	6,648
C13	Vak4	CS13 - HFLeq130x130x12	6,648
C14	Vak4	CS13 - HFLeq130x130x12	6,648
C15	Vak4	CS13 - HFLeq130x130x12	6,648
C16	Vak4	CS13 - HFLeq130x130x12	6,648
C17	Vak5	CS112 - HFLeq130x130x12	3,414
C18	Vak5	CS112 - HFLeq130x130x12	3,414
C19	Vak5	CS112 - HFLeq130x130x12	3,414
C20	Vak5	CS112 - HFLeq130x130x12	3,414
S1	CrossArm6	CS140 - L45X30X5	0,941
S2	CrossArm6	CS138 - L45X5	1,862
S3	CrossArm6	CS137 - L45X30X5	2,018
S4	CrossArm6	CS138 - L45X5	1,862
S5	CrossArm6	CS137 - L45X30X5	2,018
S6	CrossArm6	CS136 - L45X5	1,364
S7	CrossArm6	CS135 - L45X30X5	2,184
S8	CrossArm6	CS134 - L45X5	2,162
S9	CrossArm6	CS135 - L45X30X5	2,184
S10	CrossArm6	CS134 - L45X5	2,162
S11	CrossArm6	CS140 - L45X30X5	1,511
S12	CrossArm6	CS140 - L45X30X5	0,336
S13	CrossArm6	CS140 - L45X30X5	1,501
S14	CrossArm6	CS138 - L45X5	0,649
S15	CrossArm6	CS139 - L50X40X5	1,911
S16	CrossArm6	CS140 - L45X30X5	0,969
S17	CrossArm6	CS140 - L45X30X5	1,511
S18	CrossArm6	CS140 - L45X30X5	0,336
S19	CrossArm6	CS140 - L45X30X5	1,501
S20	CrossArm6	CS138 - L45X5	0,649
S21	CrossArm6	CS139 - L50X40X5	1,911
S22	CrossArm6	CS140 - L45X30X5	0,969
S23	Vak11	CS130 - L45X30X5	1,450
S24	Vak11	CS130 - L45X30X5	1,451
S25	Vak11	CS131 - L45X5	1,993
S26	Vak10	CS121 - L80X6	2,386
S27	Vak10	CS121 - L80X6	2,652
S28	Vak10	CS121 - L80X6	2,386
S29	Vak10	CS121 - L80X6	2,651
S30	Vak10	CS123 - L45X5	2,536
S31	Vak8	CS93 - L70x70x5	2,265
S33	Vak8	CS4 - L50X40X5	1,616
S34	Vak8	CS93 - L70x70x5	2,366
S35	Vak8	CS4 - L50X40X5	1,616
S36	Vak8	CS93 - L70x70x5	2,265
S38	Vak7	CS4 - L50X40X5	0,879
S41	Vak7	CS4 - L50X40X5	0,879
S42	Vak7	CS92 - L50X40X5	2,227
S43	Vak7l	CS4 - L50X40X5	0,864
S44	Vak7l	CS92 - L50X40X5	2,231
S46	Vak6	CS86 - L130X12	3,952
S47	Vak6	CS86 - L130X12	3,952
S49	Vak6	CS84 - L100x100x6	2,080
S51	Vak6	CS88 - L50X40X5	2,571
S52	Vak6	CS88 - L50X40X5	1,250
S54	Vak7	CS37 - HFLeq75x75x8	4,252
S55	Vak6	CS88 - L50X40X5	2,571
S56	Vak6	CS88 - L50X40X5	1,250

Naam	Laag	Doorsnede	Lengte [m]
S61	Vak6	CS84 - L100x100x6	2,080
S63	CrossArm5	CS140 - L45X30X5	0,941
S64	CrossArm5	CS140 - L45X30X5	0,941
S65	CrossArm5	CS138 - L45X5	1,862
S66	CrossArm5	CS137 - L45X30X5	2,018
S67	CrossArm5	CS138 - L45X5	1,862
S68	CrossArm5	CS137 - L45X30X5	2,018
S69	CrossArm5	CS136 - L45X5	1,364
S70	CrossArm5	CS135 - L45X30X5	2,184
S71	CrossArm5	CS134 - L45X5	2,162
S72	CrossArm5	CS135 - L45X30X5	2,184
S73	CrossArm5	CS134 - L45X5	2,162
S74	CrossArm5	CS140 - L45X30X5	1,511
S75	CrossArm5	CS140 - L45X30X5	0,336
S76	CrossArm5	CS140 - L45X30X5	1,501
S77	CrossArm5	CS138 - L45X5	0,649
S78	CrossArm5	CS139 - L50X40X5	1,911
S79	CrossArm5	CS140 - L45X30X5	0,969
S80	CrossArm5	CS140 - L45X30X5	1,511
S81	CrossArm5	CS140 - L45X30X5	0,336
S82	CrossArm5	CS140 - L45X30X5	1,501
S83	CrossArm5	CS138 - L45X5	0,649
S84	CrossArm5	CS139 - L50X40X5	1,911
S85	CrossArm5	CS140 - L45X30X5	0,969
S86	Vak11l	CS130 - L45X30X5	1,450
S87	Vak11l	CS130 - L45X30X5	1,451
S88	Vak11l	CS131 - L45X5	1,993
S89	Vak10l	CS121 - L80X6	2,386
S90	Vak10l	CS121 - L80X6	2,652
S91	Vak10l	CS121 - L80X6	2,386
S92	Vak10l	CS121 - L80X6	2,651
S93	Vak10l	CS123 - L45X5	2,536
S94	Vak11	CS128 - L60X6	1,851
S95	Vak11	CS128 - L60X6	1,849
S96	Vak11l	CS128 - L60X6	1,850
S97	Vak11l	CS128 - L60X6	1,849
S98	Vak11	CS127 - L50X5	1,920
S99	Vak11l	CS127 - L50X5	1,920
S100	Vak12d	CS24 - LS100X6	2,364
S101	Vak12c	CS146 - L50X40X5	2,361
S102	Vak12c	CS145 - L90x90x6	2,818
S103	Vak12c	CS149 - L50X40X5	1,691
S104	Vak12c	CS148 - L50X5	1,306
S105	Vak12c	CS149 - L50X40X5	1,691
S106	Vak12c	CS148 - L50X5	1,920
S107	Vak12d	CS24 - LS100X6	2,364
S108	Vak12c	CS148 - L50X5	1,306
S109	Vak12c	CS146 - L50X40X5	2,360
S110	Vak12c	CS145 - L90x90x6	2,819
S111	Vak12a	CS24 - LS100X6	2,363
S112	Vak12b	CS146 - L50X40X5	2,361
S113	Vak12b	CS145 - L90x90x6	2,819
S114	Vak12b	CS149 - L50X40X5	1,691
S115	Vak12b	CS148 - L50X5	1,306
S116	Vak12b	CS149 - L50X40X5	1,691
S117	Vak12b	CS148 - L50X5	1,920
S118	Vak12a	CS24 - LS100X6	2,363
S119	Vak12b	CS148 - L50X5	1,306
S120	Vak12b	CS146 - L50X40X5	2,361
S121	Vak12b	CS148 - L50X5	1,306
S122	Vak12b	CS149 - L50X40X5	1,691
S123	Vak12b	CS149 - L50X40X5	1,691
S124	Vak12b	CS148 - L50X5	1,920
S125	Vak12b	CS148 - L50X5	1,306
S126	Vak12b	CS145 - L90x90x6	2,819
S127	Vak12d	CS97 - L100X8	2,721
S129	Vak11	CS132 - L50X40X5	1,213
S130	CrossArm4	CS147 - L50X40X5	2,880
S131	Vak11	CS126 - L80x80x6	1,541

Naam	Laag	Doorsnede	Lengte [m]
S132	Vak11	CS126 - L80x80x6	1,541
S133	Vak10	CS7 - L45X30X5	0,799
S134	Vak10	CS7 - L45X30X5	0,800
S135	Vak10	CS96 - L120X80X8	4,098
S136	Vak10	CS122 - L50X40X5	2,179
S137	Vak11	CS132 - L50X40X5	1,213
S138	CrossArm4	CS147 - L50X40X5	2,880
S139	Vak11	CS125 - L75x75x6	1,506
S140	Vak10	CS96 - L120X80X8	4,099
S141	Vak11	CS125 - L75x75x6	1,506
S142	Vak11l	CS132 - L50X40X5	1,213
S143	CrossArm3	CS147 - L50X40X5	2,880
S144	Vak11l	CS126 - L80x80x6	1,541
S145	Vak11l	CS126 - L80x80x6	1,541
S146	Vak10l	CS7 - L45X30X5	0,800
S147	Vak10l	CS7 - L45X30X5	0,800
S148	Vak10l	CS96 - L120X80X8	4,098
S149	Vak10l	CS122 - L50X40X5	2,179
S150	Vak10l	CS122 - L50X40X5	2,179
S151	Vak11l	CS132 - L50X40X5	1,213
S152	CrossArm3	CS147 - L50X40X5	2,880
S153	Vak11l	CS125 - L75x75x6	1,506
S154	Vak10l	CS96 - L120X80X8	4,099
S155	Vak11l	CS125 - L75x75x6	1,506
S156	Vak8l	CS93 - L70x70x5	2,264
S159	Vak8	CS120 - ISEA130/130/10	0,888
S160	Vak8l	CS120 - ISEA130/130/10	0,888
S161	Vak9b	CS151 - HFLeq130x130x12	3,202
S162	Vak8l	CS155 - HFLue120x80x8	1,544
S164	Vak8	CS155 - HFLue120x80x8	1,544
S166	Vak8	CS120 - ISEA130/130/10	0,888
S167	CrossArm4	CS150 - L55x55x5	1,943
S168	CrossArm4	CS148 - L50X5	2,235
S169	CrossArm4	CS150 - L55x55x5	1,943
S170	CrossArm4	CS148 - L50X5	2,235
S171	CrossArm4	CS101 - UNP120	3,073
S172	CrossArm4	CS101 - UNP120	3,073
S173	CrossArm4	CS30 - UNP140	0,961
S175	CrossArm6	CS148 - L50X5	0,800
S177	Vak6	CS82 - L130X12	4,280
S178	Vak12c	CS15 - HFLeq60x60x5	3,046
S179	Vak12c	CS15 - HFLeq60x60x5	3,046
S180	Vak12d	CS150 - L55x55x5	2,672
S181	Vak12d	CS150 - L55x55x5	2,671
S182	Vak12d	CS15 - HFLeq60x60x5	2,921
S183	Vak12c	CS15 - HFLeq60x60x5	2,696
S184	Vak12d	CS15 - HFLeq60x60x5	2,925
S185	Vak12c	CS15 - HFLeq60x60x5	2,692
S186	Vak12c	CS149 - L50X40X5	1,297
S187	Vak12c	CS149 - L50X40X5	1,297
S188	Vak12c	CS30 - UNP140	2,163
S189	Vak12c	CS30 - UNP140	2,163
S190	CrossArm3	CS150 - L55x55x5	1,943
S191	CrossArm3	CS148 - L50X5	2,235
S192	CrossArm3	CS150 - L55x55x5	1,943
S193	CrossArm3	CS148 - L50X5	2,235
S194	CrossArm3	CS101 - UNP120	3,073
S195	CrossArm3	CS101 - UNP120	3,073
S196	CrossArm3	CS30 - UNP140	0,961
S198	Vak12a	CS150 - L55x55x5	2,672
S199	Vak12a	CS150 - L55x55x5	2,672
S200	Vak12a	CS15 - HFLeq60x60x5	2,925
S201	Vak12b	CS15 - HFLeq60x60x5	2,696
S202	Vak12a	CS15 - HFLeq60x60x5	2,925
S203	Vak12b	CS15 - HFLeq60x60x5	2,696
S204	Vak12b	CS149 - L50X40X5	1,294
S205	Vak12b	CS149 - L50X40X5	1,294
S206	Vak12b	CS15 - HFLeq60x60x5	3,046
S207	Vak12b	CS15 - HFLeq60x60x5	3,046

Naam	Laag	Doorsnede	Lengte [m]
S208	Vak12b	CS30 - UNP140	2,163
S209	Vak12b	CS30 - UNP140	2,163
S210	Vak12a	CS101 - UNP120	1,569
S211	Vak11l	CS129 - L65x65x6	2,163
S212	Vak11	CS129 - L65x65x6	2,163
S213	Vak12a	CS101 - UNP120	1,569
S214	Vak9c	CS156 - L50X5	2,305
S215	Vak9c	CS156 - L50X5	2,305
S216	CrossArm2	CS156 - L50X5	2,369
S217	CrossArm2	CS158 - L50X40X5	1,587
S218	CrossArm2	CS158 - L50X40X5	1,600
S219	Vak9c	CS156 - L50X5	2,305
S220	Vak9c	CS156 - L50X5	2,305
S221	Vak9c	CS156 - L50X5	3,227
S222	Vak9c	CS156 - L50X5	3,227
S223	CrossArm1	CS156 - L50X5	2,369
S224	Vak9c	CS154 - L100x100x8	2,376
S225	Vak9b	CS153 - L120x120x8	2,373
S226	Vak9c	CS154 - L100x100x8	2,376
S227	Vak9a	CS153 - L120x120x8	2,373
S228	CrossArm2	CS40 - L65X50X5	7,610
S229	CrossArm2	CS157 - L45X5	0,983
S231	CrossArm1	CS40 - L65X50X5	7,611
S232	CrossArm1	CS158 - L50X40X5	2,810
S233	CrossArm1	CS157 - L45X5	0,983
S235	CrossArm2	CS40 - L65X50X5	7,611
S236	CrossArm2	CS158 - L50X40X5	2,811
S237	CrossArm2	CS157 - L45X5	0,983
S239	Vak9c	CS154 - L100x100x8	2,376
S240	Vak9b	CS153 - L120x120x8	2,373
S241	Vak9c	CS154 - L100x100x8	2,376
S242	Vak9a	CS153 - L120x120x8	2,373
S243	Vak8l	CS93 - L70x70x5	2,366
S244	Vak8l	CS4 - L50X40X5	1,616
S245	Vak8l	CS93 - L70x70x5	2,366
S247	Vak7l	CS4 - L50X40X5	0,879
S248	Vak7l	CS92 - L50X40X5	2,227
S249	Vak6	CS88 - L50X40X5	2,571
S250	Vak6	CS88 - L50X40X5	1,250
S252	Vak7l	CS161 - L120X80X8	4,747
S253	CrossArm1	CS40 - L65X50X5	7,611
S254	CrossArm1	CS158 - L50X40X5	2,810
S255	CrossArm1	CS157 - L45X5	0,983
S257	Vak8l	CS4 - L50X40X5	1,616
S258	Vak8l	CS120 - ISEA130/130/10	0,888
S260	Vak7l	CS4 - L50X40X5	0,879
S263	Vak9b	CS95 - L75x75x6	2,542
S264	Vak9c	CS95 - L75x75x6	2,294
S265	Vak9b	CS95 - L75x75x6	2,456
S266	Vak9b	CS95 - L75x75x6	2,542
S267	Vak9c	CS95 - L75x75x6	2,294
S268	Vak9b	CS43 - L75x75x6	3,507
S270	Vak8	CS36 - ISEA70/70/5	1,753
S273	CrossArm2	CS159 - L55x55x5	1,845
S274	CrossArm2	CS159 - L55x55x5	2,188
S275	CrossArm2	CS159 - L55x55x5	2,579
S278	CrossArm2	CS159 - L55x55x5	1,845
S279	CrossArm2	CS159 - L55x55x5	2,188
S280	CrossArm2	CS159 - L55x55x5	2,579
S282	CrossArm2	CS152 - UNP140	0,921
S283	CrossArm2	CS152 - UNP140	2,391
S284	CrossArm2	CS94 - L50X5	1,390
S285	CrossArm2	CS94 - L50X5	1,391
S286	CrossArm2	CS152 - UNP140	2,635
S287	CrossArm2	CS43 - L75x75x6	3,013
S288	CrossArm2	CS95 - L75x75x6	2,269
S289	CrossArm2	CS144 - UNP160	8,015
S290	Vak9a	CS95 - L75x75x6	2,456
S291	Vak9a	CS95 - L75x75x6	2,542

Naam	Laag	Doorsnede	Lengte [m]
S292	Vak9c	CS95 - L75x75x6	2,298
S293	Vak9c	CS4 - L50X40X5	1,135
S294	Vak9c	CS4 - L50X40X5	1,121
S295	CrossArm1	CS144 - UNP160	8,015
S296	CrossArm1	CS158 - L50X40X5	1,587
S297	CrossArm1	CS158 - L50X40X5	1,600
S298	Vak8l	CS36 - ISEA70/70/5	3,507
S299	Vak9c	CS44 - UNP160	3,507
S300	Vak8l	CS93 - L70x70x5	2,265
S301	Vak7l	CS92 - L50X40X5	2,227
S302	CrossArm1	CS159 - L55x55x5	1,845
S303	CrossArm1	CS159 - L55x55x5	2,188
S304	CrossArm1	CS159 - L55x55x5	2,579
S307	CrossArm1	CS159 - L55x55x5	1,845
S308	CrossArm1	CS159 - L55x55x5	2,188
S309	CrossArm1	CS159 - L55x55x5	2,579
S311	CrossArm1	CS152 - UNP140	0,921
S312	CrossArm1	CS152 - UNP140	2,391
S313	CrossArm1	CS94 - L50X5	1,390
S314	CrossArm1	CS94 - L50X5	1,391
S315	CrossArm1	CS152 - UNP140	2,634
S316	CrossArm1	CS43 - L75x75x6	3,013
S317	CrossArm1	CS95 - L75x75x6	2,269
S318	Vak9a	CS95 - L75x75x6	2,456
S319	Vak9a	CS95 - L75x75x6	2,542
S320	Vak9c	CS95 - L75x75x6	2,298
S321	Vak9a	CS43 - L75x75x6	3,507
S322	Vak9c	CS4 - L50X40X5	1,135
S323	Vak9c	CS4 - L50X40X5	1,121
S324	Vak9c	CS44 - UNP160	3,507
S328	Vak8l	CS155 - HFLue120x80x8	1,544
S330	Vak7l	CS4 - L50X40X5	0,864
S331	Vak7l	CS92 - L50X40X5	2,231
S333	Vak6	CS88 - L50X40X5	2,571
S334	Vak6	CS88 - L50X40X5	1,250
S336	Vak6	CS84 - L100x100x6	2,080
S340	CrossArm1	CS144 - UNP160	8,015
S343	CrossArm5	CS12 - L50X5	0,800
S355	Vak6	CS82 - L130X12	4,280
S359	Vak10	CS90 - L100x100x6	4,356
S361	Vak11	CS124 - L80X6	0,970
S368	Vak8	CS143 - L130X12	3,331
S370	Vak10	CS90 - L100x100x6	4,356
S372	Vak11	CS124 - L80X6	0,970
S373	CrossArm6	CS133 - L80X6	6,823
S377	Vak8	CS141 - L120X80X8	2,030
S378	Vak8	CS141 - L120X80X8	2,206
S379	Vak8	CS141 - L120X80X8	2,030
S380	Vak8	CS141 - L120X80X8	2,205
S381	Vak8l	CS141 - L120X80X8	2,030
S382	Vak8l	CS141 - L120X80X8	2,206
S383	Vak8l	CS141 - L120X80X8	2,030
S384	Vak8l	CS141 - L120X80X8	2,205
S388	Vak9c	CS144 - UNP160	3,674
S390	Vak9a	CS144 - UNP160	1,840
S397	Vak7	CS92 - L50X40X5	2,227
S399	Vak8	CS36 - ISEA70/70/5	1,753
S400	Vak9b	CS95 - L75x75x6	2,456
S401	Vak8	CS93 - L70x70x5	2,366
S402	Vak8	CS143 - L130X12	3,331
S411	Vak10l	CS90 - L100x100x6	4,356
S413	Vak11l	CS124 - L80X6	0,970
S417	CrossArm5	CS133 - L80X6	6,823
S418	Vak6	CS82 - L130X12	4,280
S421	Vak8l	CS143 - L130X12	3,332
S425	Vak11l	CS124 - L80X6	0,970
S426	CrossArm5	CS133 - L80X6	6,823
S430	Vak7l	CS37 - HFLeq75x75x8	4,252
S441	Vak12a	CS101 - UNP120	1,970

Naam	Laag	Doorsnede	Lengte [m]	Naam	Laag	Doorsnede	Lengte [m]
S446	Vak12d	CS101 - UNP120	1,970	S612	Vak6	CS83 - L100X75X7	4,764
S447	Vak12d	CS101 - UNP120	1,568	S613	Vak6	CS83 - L100X75X7	4,765
S448	CrossArm2	CS158 - L50X40X5	2,810	S614	Vak6	CS83 - L100X75X7	4,765
S449	CrossArm6	CS140 - L45X30X5	0,941	S615	Vak7l	CS89 - L130X12	4,261
S450	Vak7	CS4 - L50X40X5	0,864	S616	Vak7l	CS89 - L130X12	4,261
S453	Vak7	CS4 - L50X40X5	0,864	S617	Vak7	CS89 - L130X12	4,261
S456	Vak10	CS122 - L50X40X5	2,179	S618	Vak7	CS89 - L130X12	4,261
S457	Vak8	CS155 - HFLue120x80x8	1,544	S619	Vak7	CS142 - L120X80X8	4,017
S458	Vak7	CS92 - L50X40X5	2,231	S620	Vak7l	CS142 - L120X80X8	4,017
S459	Vak7	CS92 - L50X40X5	2,231	S621	Vak7l	CS142 - L120X80X8	4,017
S460	Vak6	CS84 - L100x100x6	2,080	S622	Vak7	CS142 - L120X80X8	4,017
S461	Vak9c	CS156 - L50X5	1,503	S623	Vak7l	CS161 - L120X80X8	4,747
S462	Vak9c	CS156 - L50X5	1,503	S624	Vak7	CS161 - L120X80X8	4,747
S463	Vak9c	CS156 - L50X5	1,503	S625	Vak7	CS161 - L120X80X8	4,747
S464	Vak9c	CS156 - L50X5	1,503	S626	Vak10l	CS90 - L100x100x6	4,356
S465	CrossArm2	CS95 - L75x75x6	1,719	S627	Vak12a	CS97 - L100X8	2,720
S466	CrossArm1	CS95 - L75x75x6	2,269	S628	Vak12b	CS97 - L100X8	4,465
S467	HorVerb2	CS78 - L110X10	5,000	S629	Vak12c	CS97 - L100X8	4,464
S470	HorVerb2	CS113 - L80X6	5,000	S630	Vak12a	CS101 - UNP120	1,970
S472	HorVerb2	CS78 - L110X10	5,000	S631	Vak12b	CS101 - UNP120	4,465
S474	HorVerb2	CS113 - L80X6	5,000	S632	Vak12c	CS101 - UNP120	4,465
S482	CrossArm5	CS21 - ISUA65/50/6	6,950	S633	Vak12c	CS101 - UNP120	4,465
S483	CrossArm5	CS21 - ISUA65/50/6	6,950	S634	Vak12b	CS101 - UNP120	4,465
S484	CrossArm6	CS21 - ISUA65/50/6	6,950	S635	Vak12a	CS97 - L100X8	2,720
S485	CrossArm6	CS21 - ISUA65/50/6	6,950	S636	Vak12b	CS97 - L100X8	4,465
S486	CrossArm6	CS133 - L80X6	6,823	S637	Vak12c	CS97 - L100X8	4,464
S491	Vak9b	CS151 - HFLeq130x130x12	3,201	S638	Vak9a	CS151 - HFLeq130x130x12	3,202
S492	Vak9a	CS144 - UNP160	1,720	S639	Vak9c	CS151 - HFLeq130x130x12	3,680
S493	Vak9a	CS144 - UNP160	3,674	S640	Vak9c	CS151 - HFLeq130x130x12	3,680
S495	Vak12d	CS101 - UNP120	1,970	S641	Vak9a	CS151 - HFLeq130x130x12	3,202
S497	Vak12d	CS101 - UNP120	1,568	S642	Vak9b	CS144 - UNP160	1,840
S503	Vak12d	CS97 - L100X8	2,721	S643	Vak9b	CS144 - UNP160	1,720
S508	CrossArm3	CS30 - UNP140	0,800	S644	Vak9a	CS144 - UNP160	1,720
S509	CrossArm3	CS36 - ISEA70/70/5	0,950	S645	Vak9a	CS144 - UNP160	1,840
S510	CrossArm3	CS36 - ISEA70/70/5	0,950	S646	Vak8l	CS143 - L130X12	3,332
S511	CrossArm4	CS30 - UNP140	0,800	S647	CrossArm1	CS169 - RO10.2X1	0,000
S513	CrossArm4	CS36 - ISEA70/70/5	0,950	SB1	Vak1	CS4 - L50X40X5	0,760
S514	CrossArm4	CS36 - ISEA70/70/5	0,950	SB2	Vak1	CS4 - L50X40X5	0,760
S547	Vak9b	CS144 - UNP160	1,840	SB3	Vak1	CS4 - L50X40X5	2,169
S548	CrossArm2	CS38 - HFLeq80x80x8	0,799	SB4	Vak1	CS4 - L50X40X5	2,169
S549	CrossArm2	CS38 - HFLeq80x80x8	0,931	SB17	Vak1	CS4 - L50X40X5	1,520
S550	CrossArm2	CS38 - HFLeq80x80x8	0,931	SB18	Vak1	CS4 - L50X40X5	1,520
S551	CrossArm1	CS38 - HFLeq80x80x8	0,799	SB19	Vak1	CS4 - L50X40X5	2,402
S552	CrossArm1	CS38 - HFLeq80x80x8	0,931	SB20	Vak1	CS4 - L50X40X5	2,402
S553	CrossArm1	CS38 - HFLeq80x80x8	0,931	SB33	Vak1	CS102 - L50X5	2,280
S588	Vak3	CS104 - L70X6	3,353	SB34	Vak1	CS102 - L50X5	2,280
S589	Vak3	CS104 - L70X6	3,353	SB35	Vak1	CS60 - L50X5	3,371
S590	Vak3	CS104 - L70X6	3,353	SB36	Vak1	CS60 - L50X5	3,371
S591	Vak3	CS104 - L70X6	3,353	SB49	Vak2	CS63 - L50X40X5	1,900
S592	Vak3	CS104 - L70X6	3,353	SB50	Vak2	CS65 - L50X40X5	2,621
S593	Vak3	CS104 - L70X6	3,353	SB51	Vak2	CS63 - L50X40X5	1,900
S594	Vak3	CS104 - L70X6	3,353	SB52	Vak2	CS65 - L50X40X5	2,621
S595	Vak3	CS104 - L70X6	3,353	SB53	Vak2	CS63 - L50X40X5	1,900
S596	CrossArm2	CS95 - L75x75x6	1,719	SB54	Vak2	CS65 - L50X40X5	2,621
S597	CrossArm2	CS95 - L75x75x6	2,269	SB55	Vak2	CS63 - L50X40X5	1,900
S598	CrossArm1	CS95 - L75x75x6	1,719	SB56	Vak2	CS65 - L50X40X5	2,621
S599	CrossArm1	CS95 - L75x75x6	1,719	SB57	Vak2	CS63 - L50X40X5	1,900
S600	CrossArm2	CS144 - UNP160	8,015	SB58	Vak2	CS65 - L50X40X5	2,621
S601	Vak9b	CS144 - UNP160	1,720	SB59	Vak2	CS63 - L50X40X5	1,900
S602	Vak6	CS160 - L150X14	5,642	SB60	Vak2	CS65 - L50X40X5	2,621
S603	Vak6	CS160 - L150X14	5,642	SB61	Vak2	CS63 - L50X40X5	1,900
S604	Vak6	CS160 - L150X14	5,642	SB62	Vak2	CS65 - L50X40X5	2,621
S605	Vak6	CS160 - L150X14	5,642	SB63	Vak2	CS63 - L50X40X5	1,900
S606	Vak6	CS88 - L50X40X5	1,250	SB64	Vak2	CS65 - L50X40X5	2,621
S607	Vak6	CS88 - L50X40X5	1,250	SB65	Vak3	CS67 - L50X40X5	1,676
S608	Vak6	CS88 - L50X40X5	1,250	SB66	Vak3	CS67 - L50X40X5	1,676
S609	Vak6	CS88 - L50X40X5	1,250	SB67	Vak3	CS67 - L50X40X5	1,676
S610	Vak6	CS83 - L100X75X7	4,765	SB68	Vak3	CS67 - L50X40X5	1,676
S611	Vak6	CS82 - L130X12	4,280	SB69	Vak3	CS67 - L50X40X5	1,676

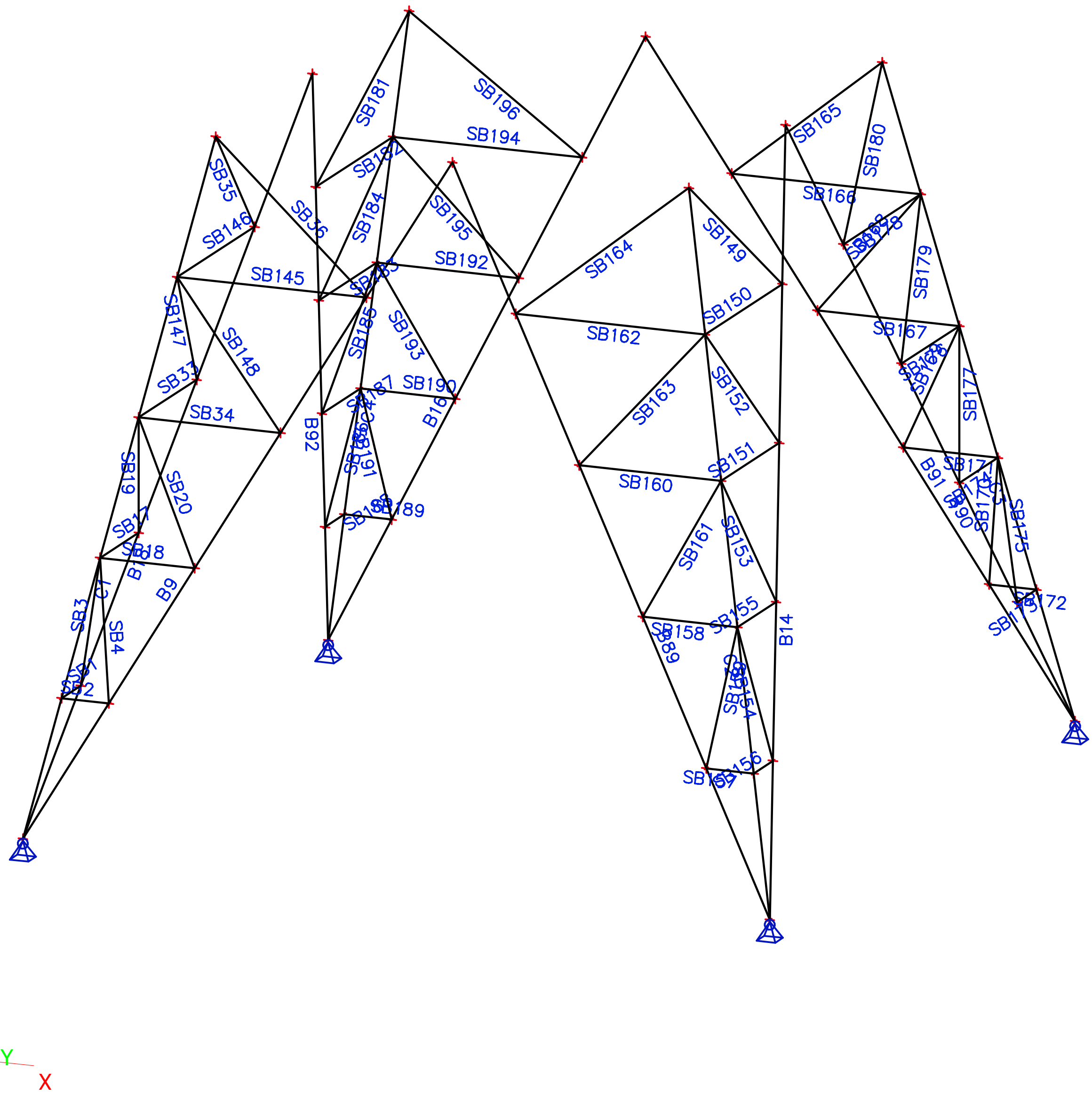
Naam	Laag	Doorsnede	Lengte [m]
SB70	Vak3	CS67 - L50X40X5	1,676
SB71	Vak3	CS67 - L50X40X5	1,676
SB72	Vak3	CS67 - L50X40X5	1,676
SB73	Vak3	CS66 - L50X40X5	2,356
SB74	Vak3	CS66 - L50X40X5	2,356
SB75	Vak3	CS66 - L50X40X5	2,356
SB76	Vak3	CS66 - L50X40X5	2,356
SB77	Vak3	CS66 - L50X40X5	2,356
SB78	Vak3	CS66 - L50X40X5	2,356
SB79	Vak3	CS66 - L50X40X5	2,356
SB80	Vak3	CS66 - L50X40X5	2,356
SB81	Vak3	CS66 - L50X40X5	2,360
SB82	Vak3	CS67 - L50X40X5	1,676
SB83	Vak3	CS66 - L50X40X5	2,360
SB84	Vak3	CS67 - L50X40X5	1,676
SB85	Vak3	CS66 - L50X40X5	2,360
SB86	Vak3	CS67 - L50X40X5	1,676
SB87	Vak3	CS66 - L50X40X5	2,360
SB88	Vak3	CS67 - L50X40X5	1,676
SB89	Vak3	CS66 - L50X40X5	2,360
SB90	Vak3	CS67 - L50X40X5	1,676
SB91	Vak3	CS66 - L50X40X5	2,360
SB92	Vak3	CS67 - L50X40X5	1,676
SB93	Vak3	CS66 - L50X40X5	2,360
SB94	Vak3	CS67 - L50X40X5	1,676
SB95	Vak3	CS66 - L50X40X5	2,360
SB96	Vak3	CS67 - L50X40X5	1,676
SB97	Vak4	CS69 - L50X40X5	1,460
SB98	Vak4	CS69 - L50X40X5	1,460
SB99	Vak4	CS69 - L50X40X5	1,460
SB100	Vak4	CS69 - L50X40X5	1,460
SB101	Vak4	CS69 - L50X40X5	1,460
SB102	Vak4	CS69 - L50X40X5	1,460
SB103	Vak4	CS69 - L50X40X5	1,460
SB104	Vak4	CS69 - L50X40X5	1,460
SB105	Vak4	CS71 - L50X40X5	2,231
SB106	Vak4	CS71 - L50X40X5	2,231
SB107	Vak4	CS71 - L50X40X5	2,231
SB108	Vak4	CS71 - L50X40X5	2,231
SB109	Vak4	CS71 - L50X40X5	2,231
SB110	Vak4	CS71 - L50X40X5	2,231
SB111	Vak4	CS71 - L50X40X5	2,231
SB112	Vak4	CS71 - L50X40X5	2,231
SB113	Vak4	CS71 - L50X40X5	2,190
SB114	Vak4	CS69 - L50X40X5	1,460
SB115	Vak4	CS71 - L50X40X5	2,190
SB116	Vak4	CS69 - L50X40X5	1,460
SB117	Vak4	CS71 - L50X40X5	2,190
SB118	Vak4	CS69 - L50X40X5	1,460
SB119	Vak4	CS71 - L50X40X5	2,190
SB120	Vak4	CS69 - L50X40X5	1,460
SB121	Vak4	CS71 - L50X40X5	2,190
SB122	Vak4	CS69 - L50X40X5	1,460
SB123	Vak4	CS71 - L50X40X5	2,190
SB124	Vak4	CS69 - L50X40X5	1,460
SB125	Vak4	CS71 - L50X40X5	2,190
SB126	Vak4	CS69 - L50X40X5	1,460
SB127	Vak4	CS71 - L50X40X5	2,190
SB128	Vak4	CS69 - L50X40X5	1,460
SB129	Vak5	CS20 - L50X40X5	1,250
SB130	Vak5	CS72 - L50X40X5	2,050
SB131	Vak5	CS20 - L50X40X5	1,250
SB132	Vak5	CS72 - L50X40X5	2,050
SB133	Vak5	CS20 - L50X40X5	1,250

Naam	Laag	Doorsnede	Lengte [m]
SB134	Vak5	CS72 - L50X40X5	2,049
SB135	Vak5	CS20 - L50X40X5	1,250
SB136	Vak5	CS72 - L50X40X5	2,050
SB137	Vak5	CS20 - L50X40X5	1,250
SB138	Vak5	CS72 - L50X40X5	2,050
SB139	Vak5	CS20 - L50X40X5	1,250
SB140	Vak5	CS72 - L50X40X5	2,050
SB141	Vak5	CS20 - L50X40X5	1,250
SB142	Vak5	CS72 - L50X40X5	2,050
SB143	Vak5	CS20 - L50X40X5	1,250
SB144	Vak5	CS72 - L50X40X5	2,050
SB145	Vak1	CS61 - L60X6	3,040
SB146	Vak1	CS61 - L60X6	3,040
SB147	Vak1	CS4 - L50X40X5	2,827
SB148	Vak1	CS4 - L50X40X5	2,827
SB149	Vak1	CS60 - L50X5	3,371
SB150	Vak1	CS61 - L60X6	3,040
SB151	Vak1	CS102 - L50X5	2,280
SB152	Vak1	CS4 - L50X40X5	2,827
SB153	Vak1	CS4 - L50X40X5	2,402
SB154	Vak1	CS4 - L50X40X5	2,169
SB155	Vak1	CS4 - L50X40X5	1,520
SB156	Vak1	CS4 - L50X40X5	0,760
SB157	Vak1	CS4 - L50X40X5	0,760
SB158	Vak1	CS4 - L50X40X5	1,520
SB159	Vak1	CS4 - L50X40X5	2,169
SB160	Vak1	CS102 - L50X5	2,280
SB161	Vak1	CS4 - L50X40X5	2,402
SB162	Vak1	CS61 - L60X6	3,040
SB163	Vak1	CS4 - L50X40X5	2,827
SB164	Vak1	CS60 - L50X5	3,371
SB165	Vak1	CS60 - L50X5	3,371
SB166	Vak1	CS61 - L60X6	3,040
SB167	Vak1	CS102 - L50X5	2,280
SB168	Vak1	CS4 - L50X40X5	2,827
SB169	Vak1	CS4 - L50X40X5	2,402
SB170	Vak1	CS4 - L50X40X5	2,169
SB171	Vak1	CS4 - L50X40X5	1,520
SB172	Vak1	CS4 - L50X40X5	0,760
SB173	Vak1	CS4 - L50X40X5	0,760
SB174	Vak1	CS4 - L50X40X5	1,520
SB175	Vak1	CS4 - L50X40X5	2,169
SB176	Vak1	CS102 - L50X5	2,280
SB177	Vak1	CS4 - L50X40X5	2,402
SB178	Vak1	CS61 - L60X6	3,040
SB179	Vak1	CS4 - L50X40X5	2,827
SB180	Vak1	CS60 - L50X5	3,371
SB181	Vak1	CS60 - L50X5	3,371
SB182	Vak1	CS61 - L60X6	3,040
SB183	Vak1	CS102 - L50X5	2,280
SB184	Vak1	CS4 - L50X40X5	2,827
SB185	Vak1	CS4 - L50X40X5	2,402
SB186	Vak1	CS4 - L50X40X5	2,169
SB187	Vak1	CS4 - L50X40X5	1,520
SB188	Vak1	CS4 - L50X40X5	0,760
SB189	Vak1	CS4 - L50X40X5	0,760
SB190	Vak1	CS4 - L50X40X5	1,520
SB191	Vak1	CS4 - L50X40X5	2,169
SB192	Vak1	CS102 - L50X5	2,280
SB193	Vak1	CS4 - L50X40X5	2,402
SB194	Vak1	CS61 - L60X6	3,040
SB195	Vak1	CS4 - L50X40X5	2,827
SB196	Vak1	CS60 - L50X5	3,371

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 52
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

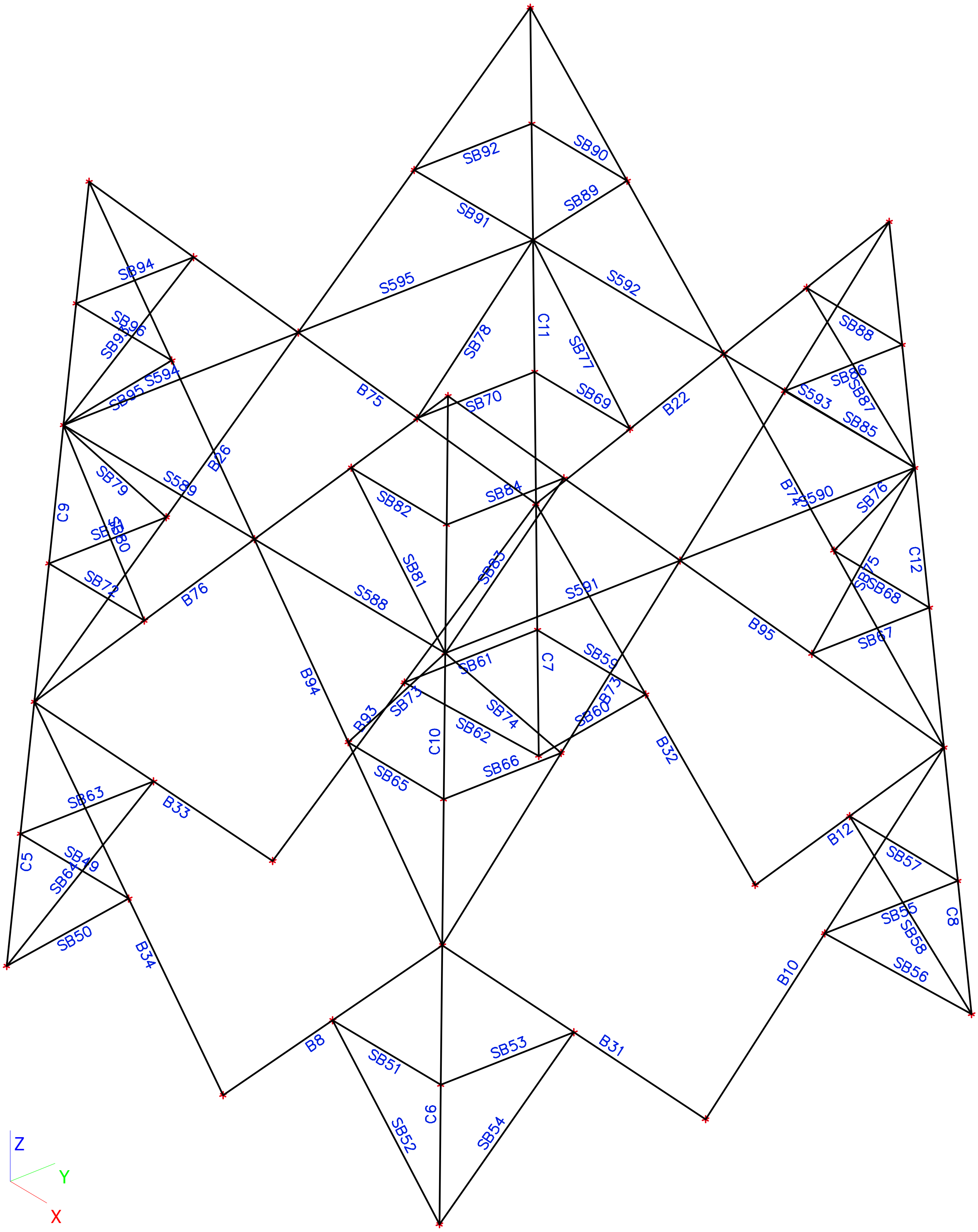
6. Staafnummers mastlichaam

6.1. Vak 1

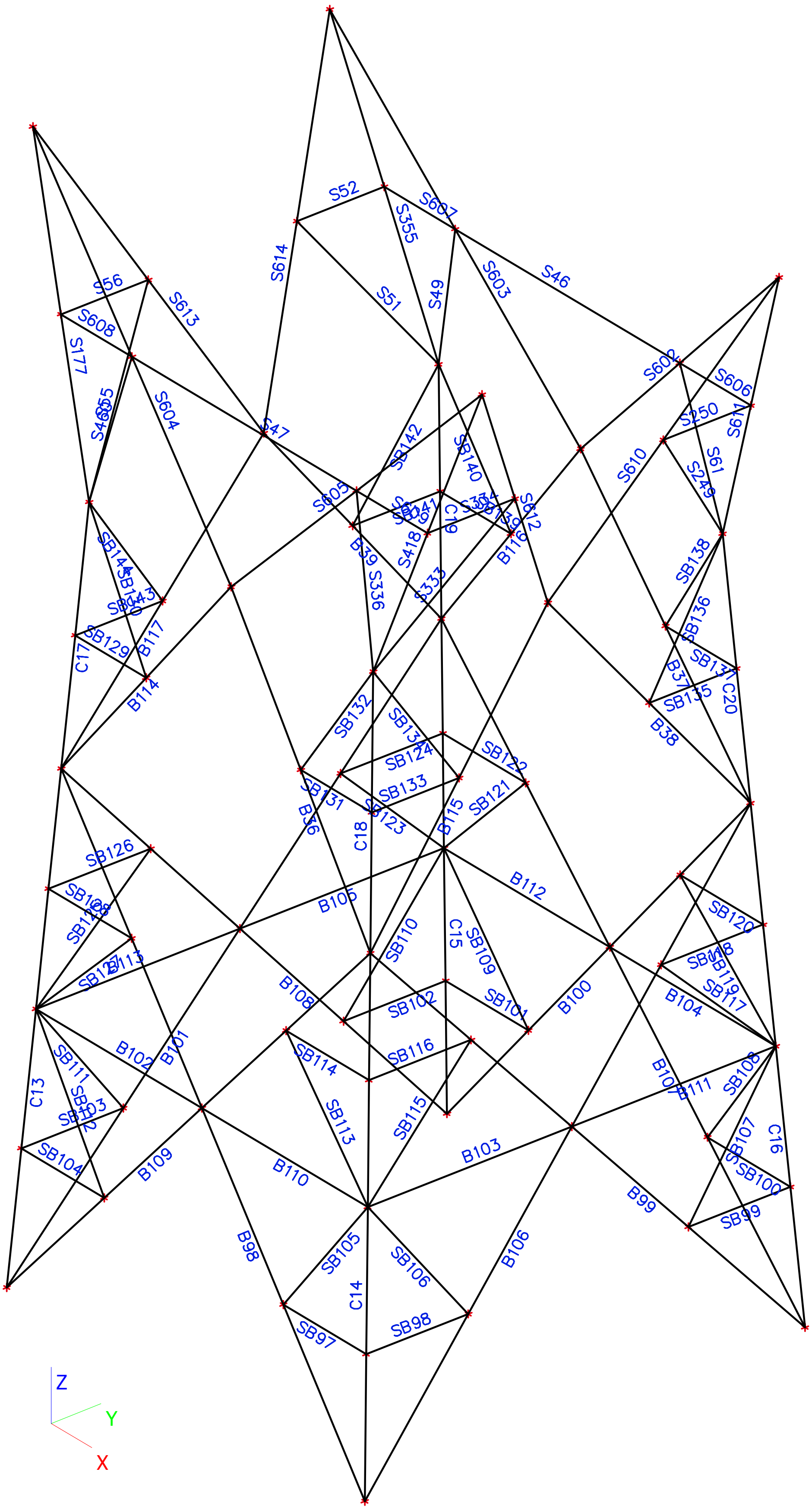


	Project	150 kV lijn Leiden - Zoetermeer
D&C ENGINEERING	Onderdeel	Berekening Mast 52
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

6.2. Vak 2 en 3

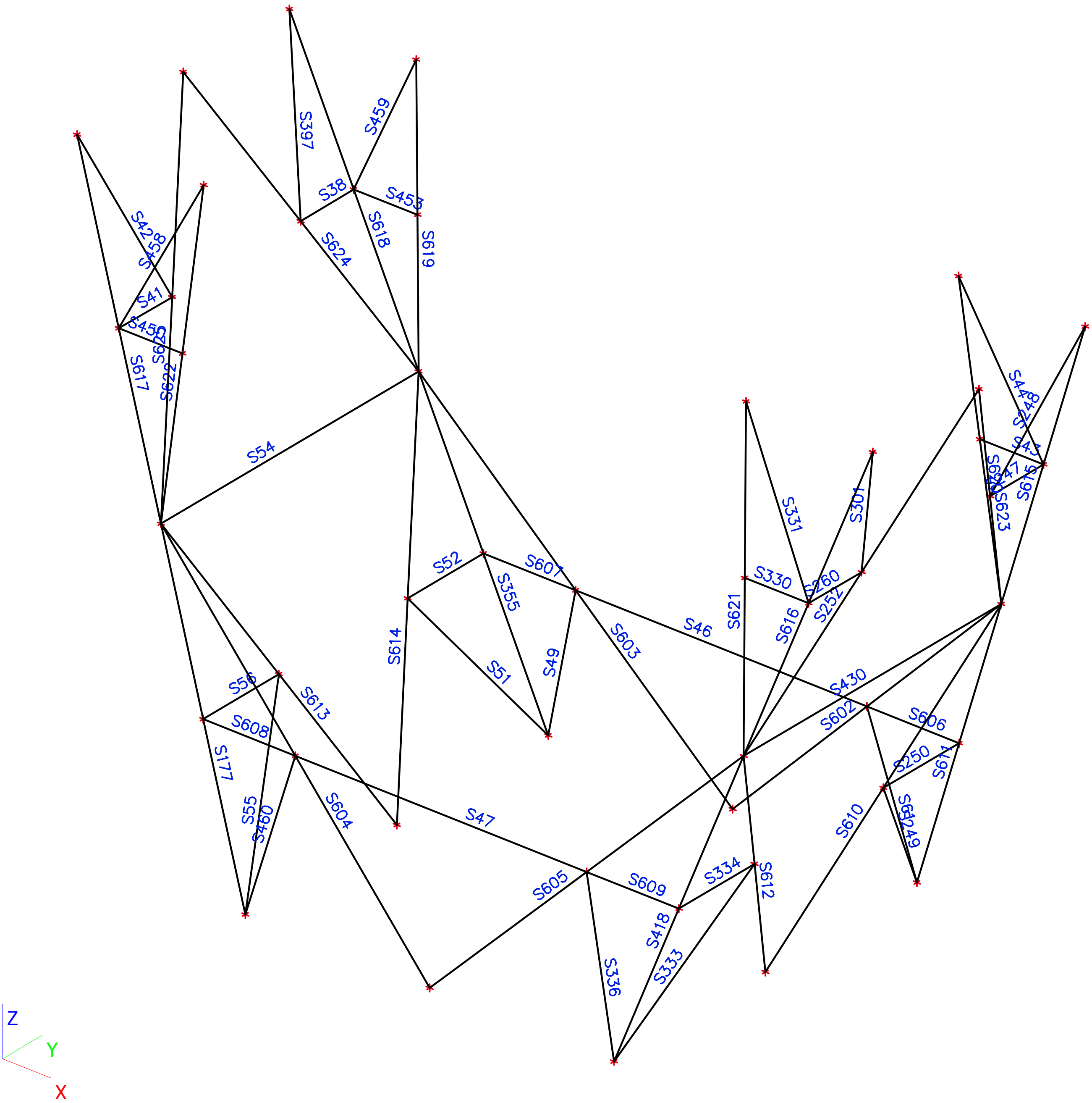


6.3. Vak 4 en 5



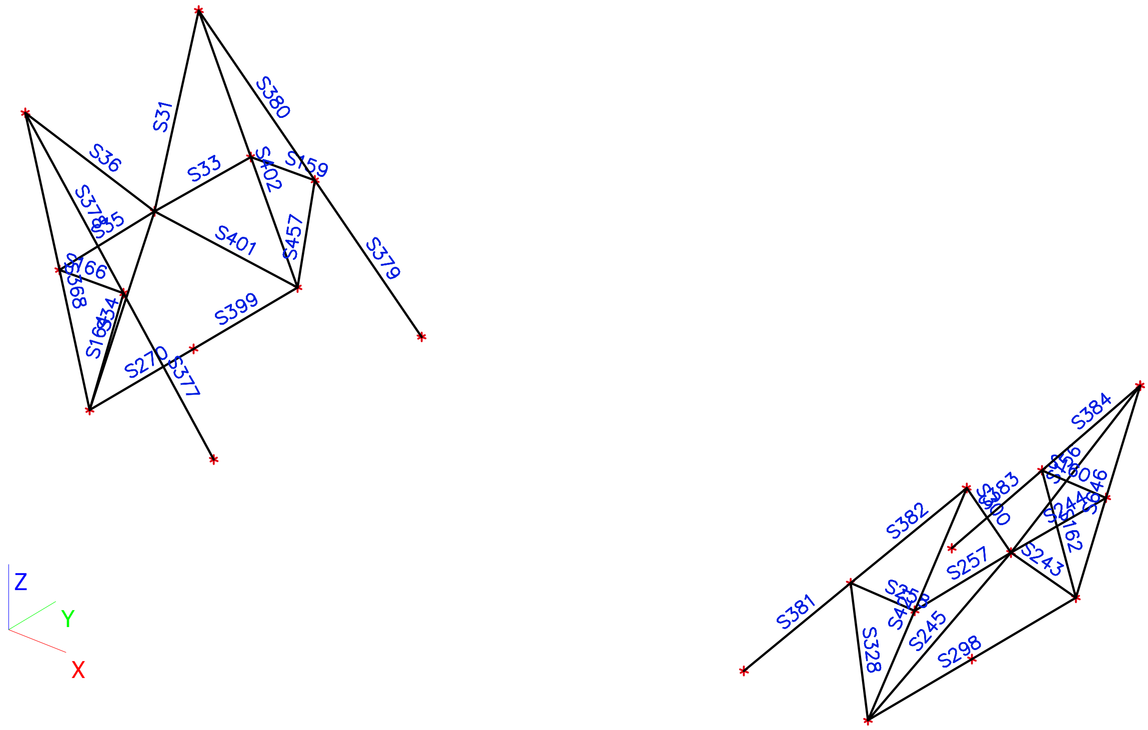
S52
S607
S355
S614
S603
S46
S51
S49
S56
S613
S608
S177
S604
S47
S606
S250
S61
S249
S610
SB142
SB140
C19
S605
S612
B116
B39
S418
S336
S333
SB138
SB136
B117
SB129
C17
B114
SB137
SB135
C20
B38
SB132
SB124
SB122
SB133
SB121
B115
SB123
C18
B36
SB126
B105
B112
SB120
SB110
C15
SB109
B108
SB102
SB101
B100
B104
B102
B101
SB111
SB114
SB116
C13
SB104
B109
B110
SB113
SB115
B103
B99
SB100
SB99
C16
SB106
B98
SB105
C14
SB106
SB97
SB98
Z
Y
X

6.4. Vak 6 en 7

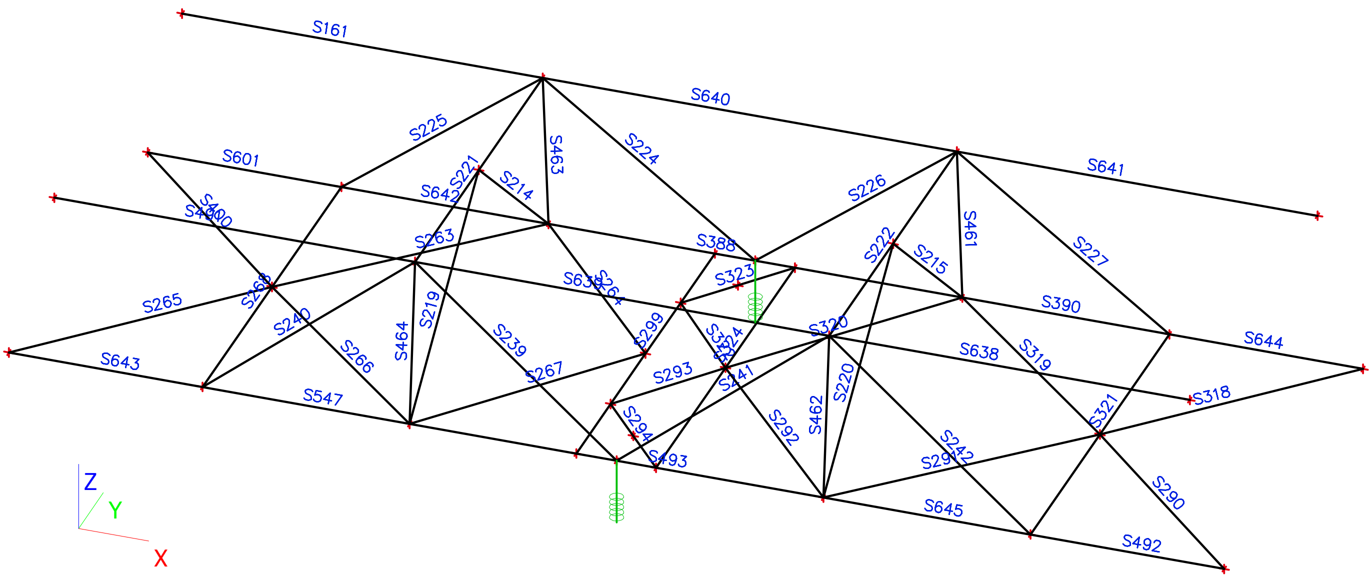


S397
S459
S38
S453
S618
S619
S624
S41
S617
S54
S52
S607
S355
S614
S51
S49
S603
S46
S621
S330
S331
S301
S260
S252
S616
S430
S602
S606
S250
S610
S56
S613
S608
S177
S55
S460
S604
S47
S605
S609
S334
S612
S418
S333
S336
S623
Z
Y
X

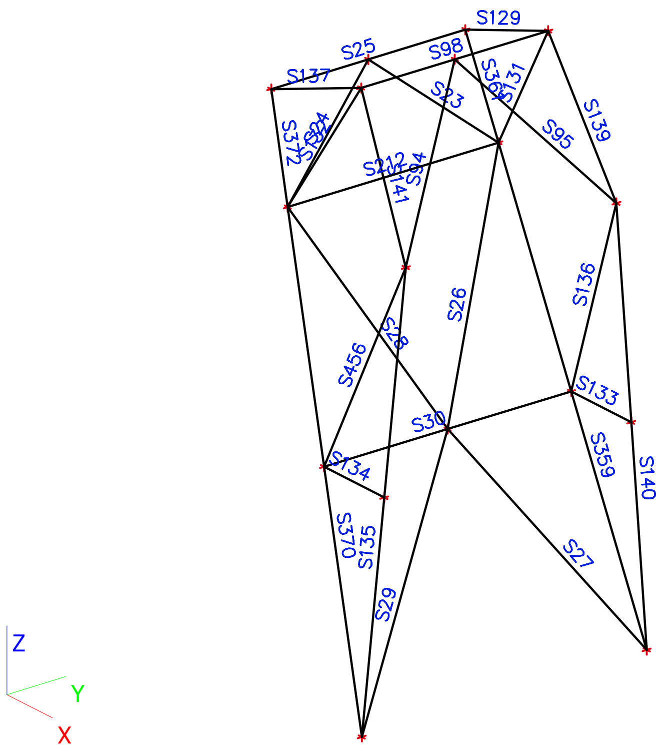
6.5. Vak 8 links en rechts



6.6. Vak 9



6.7. Vak 10 en 11 - rechts



Project	150 kV lijn Leiden - Zoetermeer
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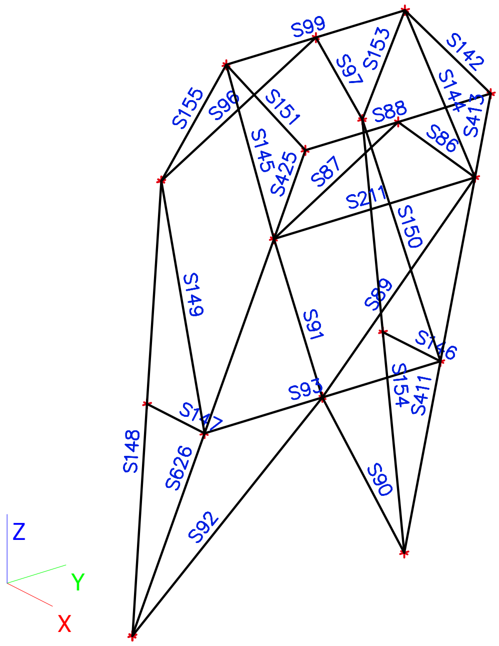
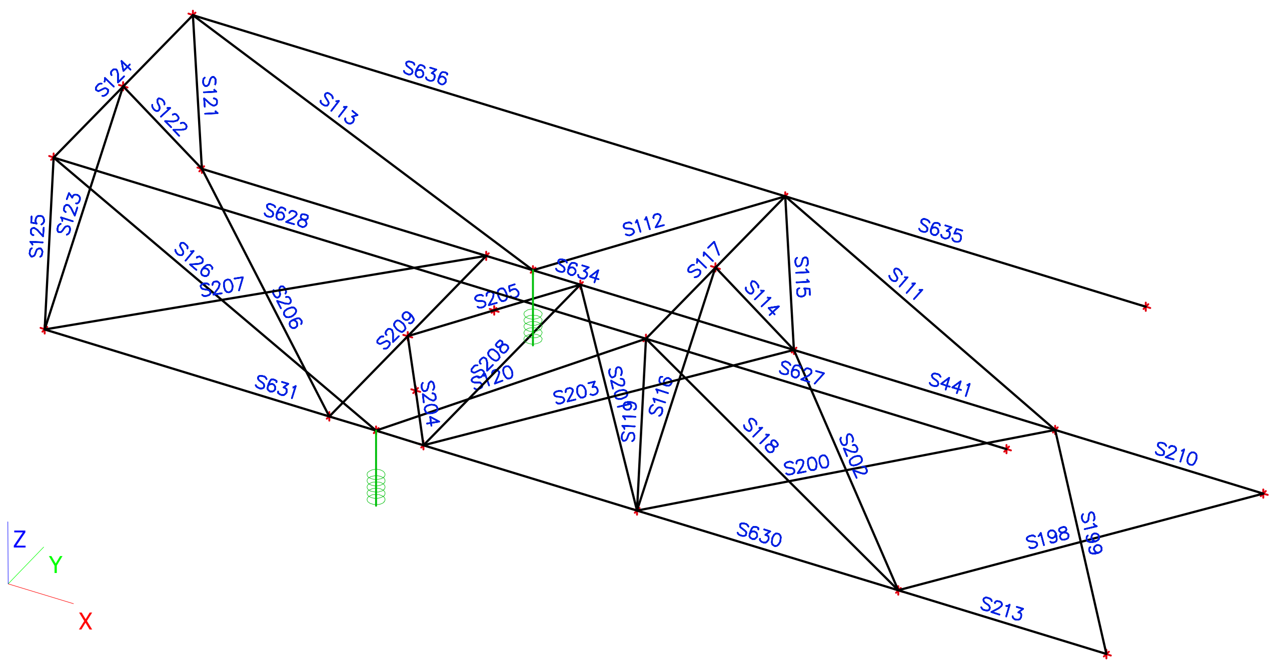
Nationale norm	EC - EN
Auteur	MG

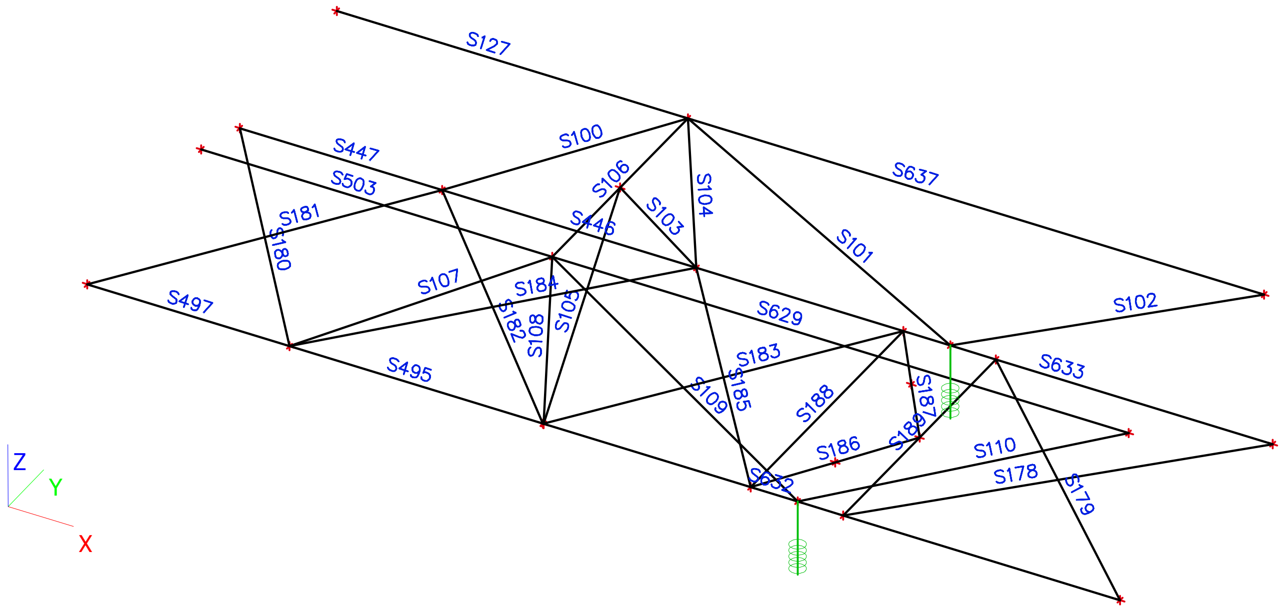
6.8. Vak 10l en 11l - links



6.9. Vak 12 a,12b,

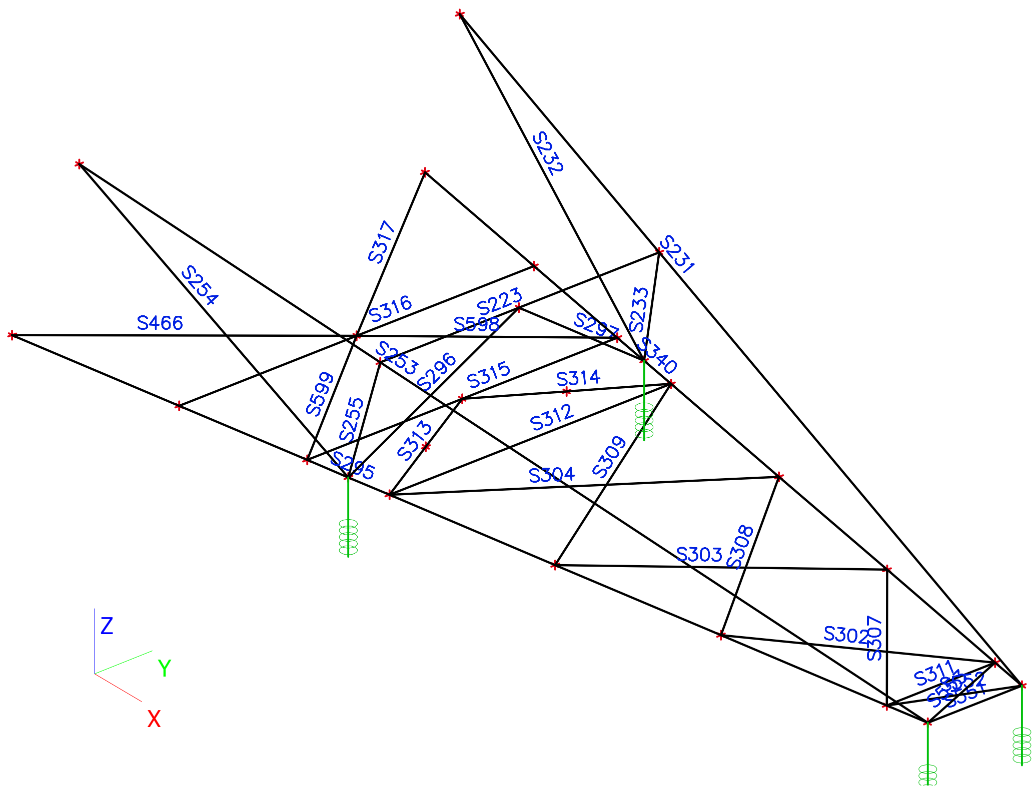


6.10. Vak 12a, 12b,

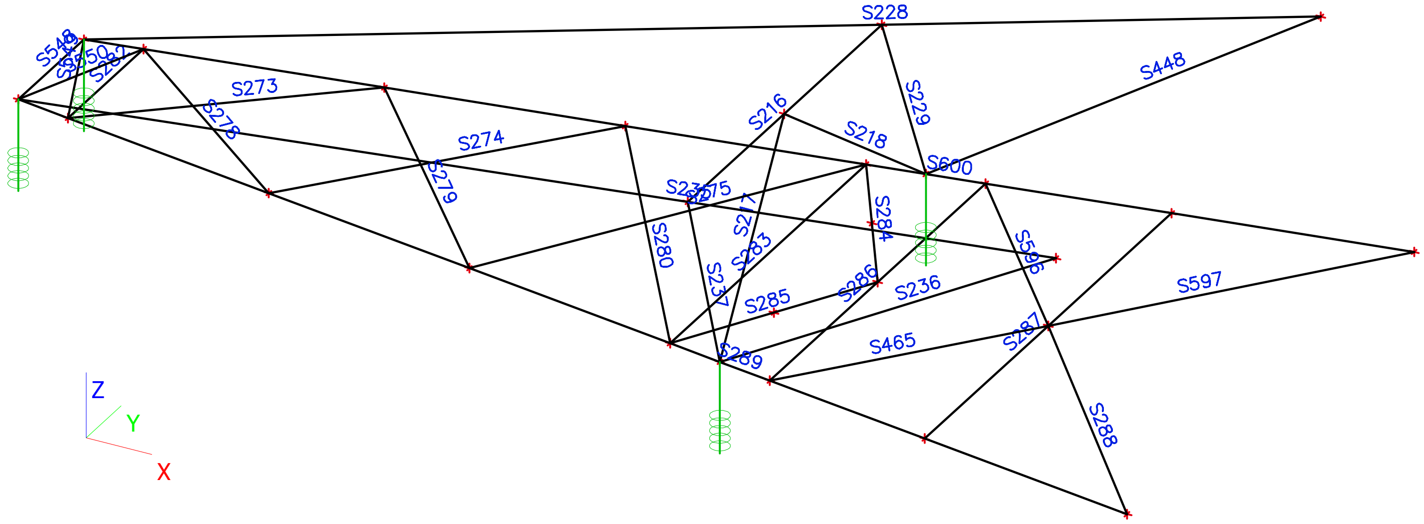


7. Staafnummers traverses

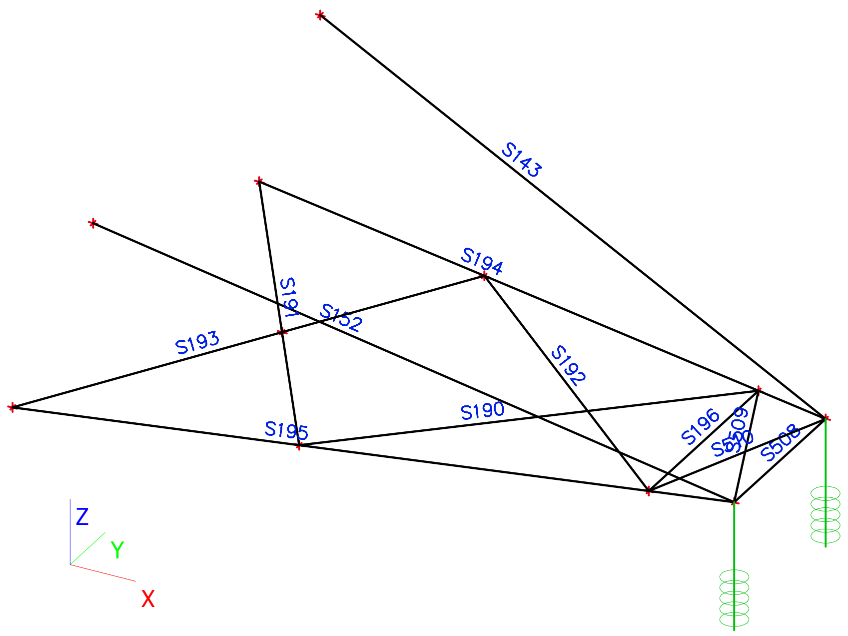
7.1. Traverse 1



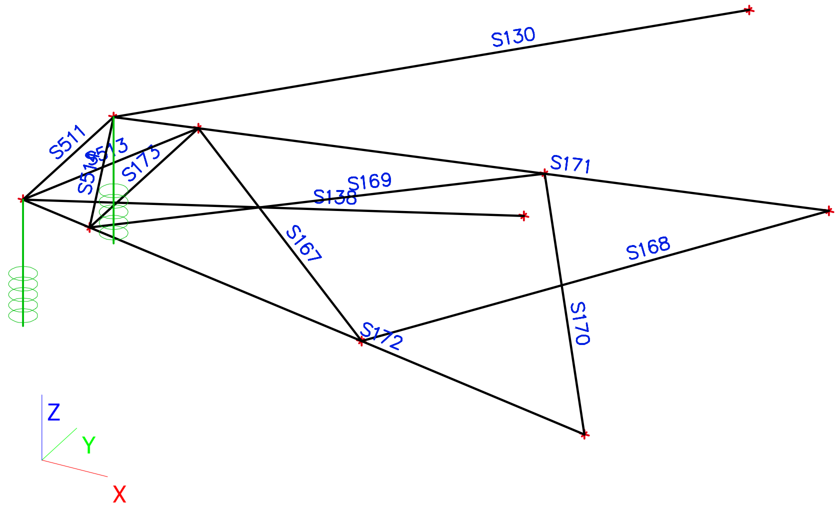
7.2. Traverse 2



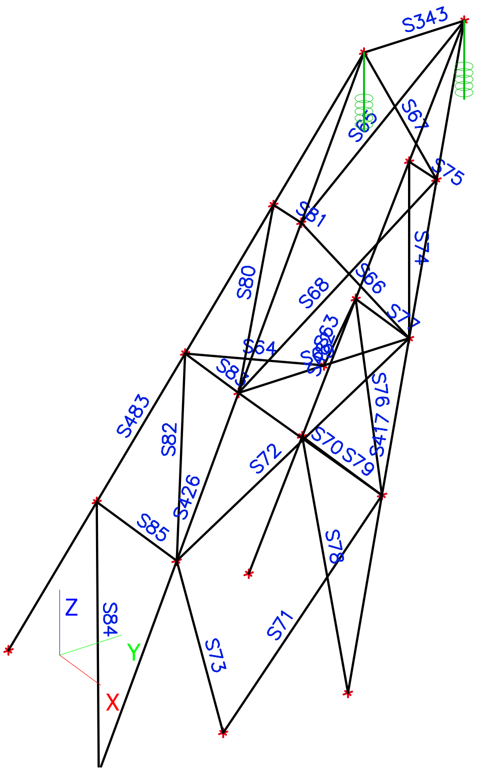
7.3. Traverse 3



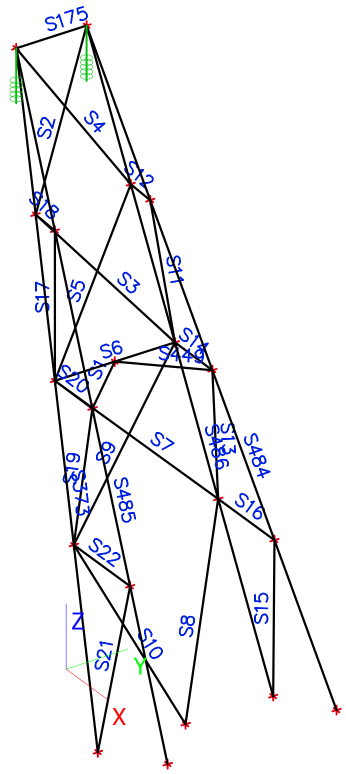
7.4. Traverse 4



7.5. Traverse 5

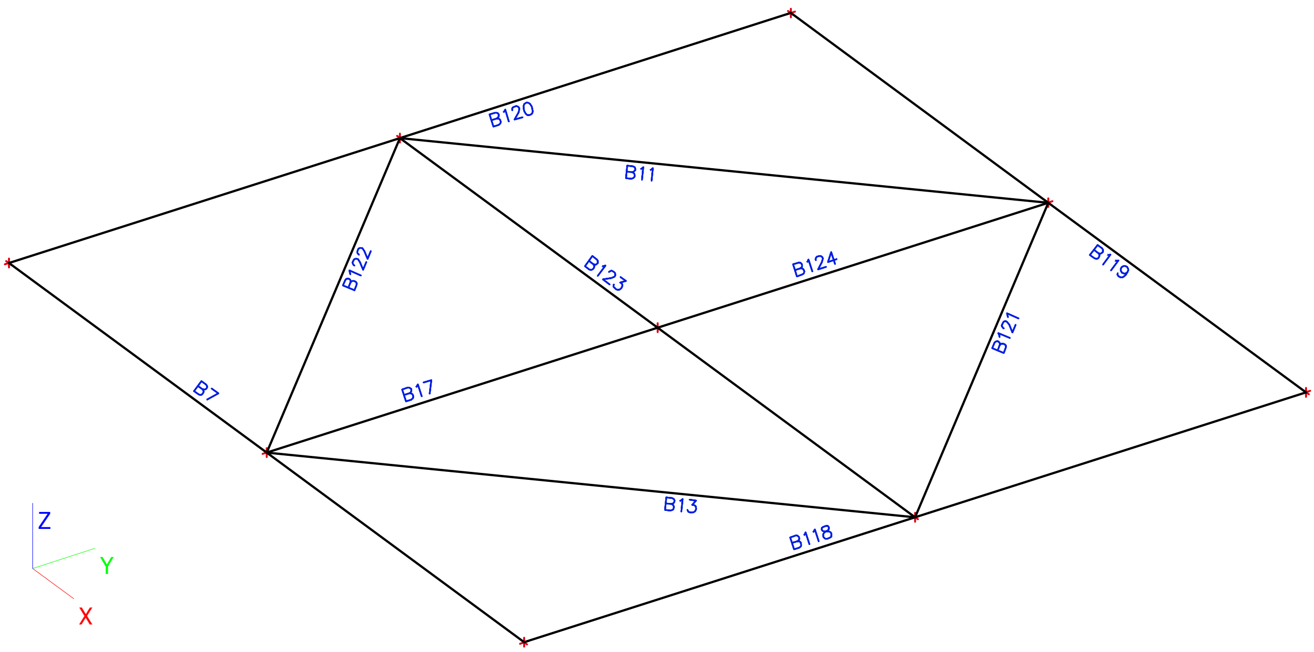


7.6. Traverse 6

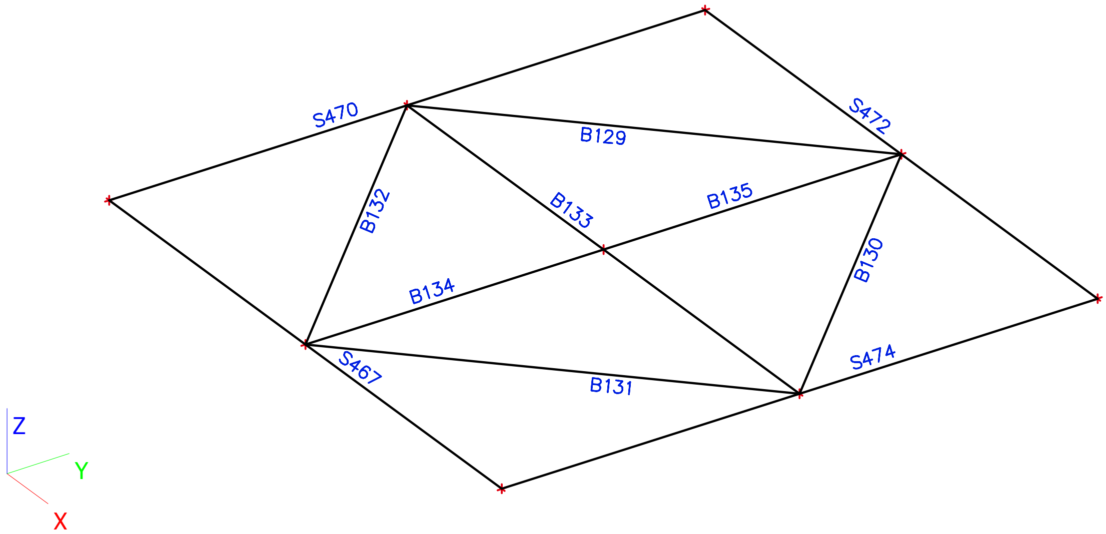


8. Staafnummers horizontale verbanden

8.1. Horizontaal verband 1



8.2. Horizontaal verband 2



9. Belastingsgevallen

Naam	Omschrijving	Actie type	Lastgroep	Belastingtype	Spec	Richting
6T	self weight of tower	Permanent	Perm	Eigen gewicht		-Z
6C	self weight of conductor	Permanent	Perm	Standaard		
W_x-y+	Wind	Variabel	LTA WIND	Statisch	Standaard	
W_x+y-	Wind	Variabel	LTA WIND	Statisch	Standaard	
W_x-y-	Wind	Variabel	LTA WIND	Statisch	Standaard	
W_x+y+	Wind	Variabel	LTA WIND	Statisch	Standaard	
W_y-	Wind	Variabel	LTA WIND	Statisch	Standaard	
W_y+	Wind	Variabel	LTA WIND	Statisch	Standaard	
W_x-	Wind	Variabel	LTA WIND	Statisch	Standaard	
W_x+	Wind	Variabel	LTA WIND	Statisch	Standaard	
WI_x+	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard	
WI_x-	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard	
WI_x+y+	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard	
WI_x-y+	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard	
WI_x+y-	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard	
WI_x-y-	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard	
WI_y+	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard	
WI_y-	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard	
Ice	IJs	Variabel	Ice	Statisch	Standaard	
4M	Maintenance	Variabel	Maint	Statisch	Onderhoudslasten	
4C0	Construction	Variabel	Construction	Statisch	Standaard	
4C1	Construction	Variabel	Construction	Statisch	Standaard	
4C2	Construction	Variabel	Construction	Statisch	Standaard	
4C3	Construction	Variabel	Construction	Statisch	Standaard	
4C4	Construction	Variabel	Construction	Statisch	Standaard	
4C5	Construction	Variabel	Construction	Statisch	Standaard	
4C6	Construction	Variabel	Construction	Statisch	Standaard	
4C7	Construction	Variabel	Construction	Statisch	Standaard	
4C8	Construction	Variabel	Construction	Statisch	Standaard	
4C9	Construction	Variabel	Construction	Statisch	Standaard	
4C10	Construction	Variabel	Construction	Statisch	Standaard	
4C11	Construction	Variabel	Construction	Statisch	Standaard	
SBS	SBS-load	Variabel	SBS	Statisch	Knikverkorterlasten	
Tuls-1a	Conductor tension	Permanent	Perm	Standaard		
Tuls-1b	Conductor tension	Permanent	Perm	Standaard		
Tuls-3	Conductor tension	Permanent	Perm	Standaard		
Tuls-4	Conductor tension	Permanent	Perm	Standaard		
Tuls-6	Conductor tension	Permanent	Perm	Standaard		
Tuls-5a_CI1	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI2	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI3	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI4	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI5	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI6	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI7	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI8	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI9	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI10	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI11	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI12	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI13	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI14	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI15	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI16	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI17	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI18	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI19	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI20	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI21	Conductor tension	Variabel	5a_CI	Statisch	Standaard	
Tuls-5a_CI22	Conductor tension	Variabel	5a_CI	Statisch	Standaard	

10. Combinaties

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
1a	wind;10	Omhullende -	W_x-y+ - Wind	1,50
			W_x+y- - Wind	1,50

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
1a	wind;10	Omhullende - uiterst	W_x-y- - Wind	1,50
			W_x+y+ - Wind	1,50
			W_y- - Wind	1,50
			W_y+ - Wind	1,50
			W_x- - Wind	1,50
			W_x+ - Wind	1,50
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-1a - Conductor tension	1,00
1a-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	1,50
			W_x+y- - Wind	1,50
			W_x-y- - Wind	1,50
			W_x+y+ - Wind	1,50
			W_y- - Wind	1,50
			W_y+ - Wind	1,50
			W_x- - Wind	1,50
			W_x+ - Wind	1,50
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-1a - Conductor tension	1,00
1b	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-1b - Conductor tension	1,00
1b-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-1b - Conductor tension	1,00
3	wind+ice	Omhullende - uiterst	Ice - IJs	1,50
			WI_x+ - Wind on tower and iced conductor line	0,45
			WI_x- - Wind on tower and iced conductor line	0,45
			WI_x+y+ - Wind on tower and iced conductor line	0,45
			WI_x+y- - Wind on tower and iced conductor line	0,45
			WI_x-y+ - Wind on tower and iced conductor line	0,45
			WI_x-y- - Wind on tower and iced conductor line	0,45
			WI_y+ - Wind on tower and iced conductor line	0,45
			WI_y- - Wind on tower and iced conductor line	0,45
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-3 - Conductor tension	1,00
3-p	wind+ice	Omhullende -	Ice - IJs	1,50
			WI_x+ - Wind on tower and iced conductor line	0,45
			WI_x- - Wind on tower and iced conductor line	0,45
			WI_x+y+ - Wind on tower and iced conductor line	0,45
			WI_x+y- - Wind on tower and iced conductor line	0,45
			WI_x-y+ - Wind on tower and iced conductor line	0,45
			WI_x-y- - Wind on tower and iced conductor line	0,45
			WI_y+ - Wind on tower and iced conductor line	0,45
			WI_y- - Wind on tower and iced conductor line	0,45
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
3-p	wind+ice	Omhullende - Uiterst	Tuls-3 - Conductor tension	1,00
4	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-4 - Conductor tension	1,00
			4C0 - Construction	1,50
			4C1 - Construction	1,50
			4C2 - Construction	1,50
			4C3 - Construction	1,50
			4C4 - Construction	1,50
			4C5 - Construction	1,50
			4C6 - Construction	1,50
			4C7 - Construction	1,50
			4C8 - Construction	1,50
			4C9 - Construction	1,50
			4C10 - Construction	1,50
			4C11 - Construction	1,50
4-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-4 - Conductor tension	1,00
			4C0 - Construction	1,50
			4C1 - Construction	1,50
			4C2 - Construction	1,50
			4C3 - Construction	1,50
			4C4 - Construction	1,50
			4C5 - Construction	1,50
			4C6 - Construction	1,50
			4C7 - Construction	1,50
			4C8 - Construction	1,50
			4C9 - Construction	1,50
			4C10 - Construction	1,50
			4C11 - Construction	1,50
6	permanent	Omhullende - uiterst	6T - self weight of tower	1,35
			6C - self weight of conductor	1,35
			Tuls-6 - Conductor tension	1,00
5a1	safety	Omhullende -	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_Cl2 - Conductor tension	0,80

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a1	safety	Omhullende - uiterst	Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a2	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI1 - Conductor tension	0,80
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a3	safety	Omhullende -	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 52
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a3	safety	Omhullende - uiterst	4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	0,80
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a4	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	0,80
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a5	safety	Omhullende -	6T - self weight of tower	1,20

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a5	safety	Omhullende -	6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	0,80
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a6	safety	Omhullende -	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	0,80
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00

Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 52
Omschrijving	Controle berekening
Nationale norm	EC - EN
Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a6	safety	Omhullende - Uiterst	Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a7	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	0,80
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a8	safety	Omhullende -	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	0,80
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 52
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a8	safety	Omhullende -	Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a9	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	0,80
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a10	safety	Omhullende -	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00

	Project	150 kV lijn Leiden - Zoetermeer
D&C ENGINEERING	Onderdeel	Berekening Mast 52
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a10	safety	Omhullende - uiterst	Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	0,80
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a11	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	0,80
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a12	safety	Omhullende -	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a12	safety	Omhullende - uiterst	4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	0,80
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a13	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	0,80
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a14	safety	Omhullende -	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a14	safety	Omhullende - Uiterst	Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	0,80
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a15	safety	Omhullende -	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	0,80
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a15	safety	Omhullende - uiterst	Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a16	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	0,80
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a17	safety	Omhullende -	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a17	safety	Omhullende - uiterst	Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	0,80
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a18	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	0,80
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a19	safety	Omhullende -	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00

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	Onderdeel	Berekening Mast 52
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a19	safety	Omhullende - uiterst	Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	0,80
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a20	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	0,80
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a21	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00

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	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a21	safety	Omhullende - uiterst	4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	0,80
			4C11 - Construction	1,00
5a22	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	0,80
			4C11 - Construction	1,00
5a23	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00

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	Onderdeel	Berekening Mast 52
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a23	safety	Omhullende - uiterst	4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	0,80
			4C11 - Construction	1,00

11. Resultaten

11.1. Interne krachten in staaf

Lineaire berekening, Extreem : Staaf, Systeem : Hoofd
Selectie : Alle
Klasse : All UGT

Staaf	BG	Geval beschrijving	N [kN]
B7	1a-p/28	wind;10	83,51
B7	1a/32	wind;10	-120,07
B8	1a-p/15	wind;10	-57,19
B8	1a/5	wind;10	65,16
B9	1a/7	wind;10	55,29
B9	1a/5	wind;10	-60,06
B10	1a-p/17	wind;10	-50,68
B10	1a/16	wind;10	48,92
B11	5a12/128	safety	1,80
B11	5a11/122	safety	-2,57
B12	1a-p/15	wind;10	-54,22
B12	1a/5	wind;10	62,27
B13	5a5/129	safety	1,74
B13	5a6/130	safety	-2,63
B14	1a-p/17	wind;10	36,01
B14	5a5/121	safety	-47,82
B16	1a/7	wind;10	59,16
B16	1a/5	wind;10	-63,81
B17	3/4	wind+ice	0,34
B17	1a-p/35	wind;10	0,09
B18	5a11/122	safety	-47,83
B18	1a-p/17	wind;10	35,54
B22	1a/7	wind;10	-63,40
B22	1a-p/14	wind;10	56,92
B26	1a/16	wind;10	47,62
B26	1a/38	wind;10	-53,04
B31	1a/38	wind;10	51,93
B31	1a-p/39	wind;10	-47,75
B32	1a/7	wind;10	61,11
B32	1a-p/14	wind;10	-55,31
B33	1a-p/39	wind;10	-47,16
B33	1a/38	wind;10	52,16
B34	1a/7	wind;10	63,83
B34	1a-p/14	wind;10	-58,24
B36	1a-p/15	wind;10	66,75
B36	1a/5	wind;10	-80,82
B37	1a-p/15	wind;10	61,56
B37	1a/5	wind;10	-75,61
B38	1a/16	wind;10	-52,02
B38	1a-p/17	wind;10	55,33
B39	1a-p/17	wind;10	56,01
B39	1a/16	wind;10	-50,97
B73	1a/38	wind;10	-52,82
B73	1a/16	wind;10	48,37
B74	1a/5	wind;10	-64,83
B74	1a-p/15	wind;10	55,77
B75	1a/38	wind;10	52,21
B75	1a/16	wind;10	-48,63
B76	1a/7	wind;10	-66,59
B76	1a-p/14	wind;10	60,39
B89	1a/5	wind;10	57,86
B89	1a/7	wind;10	-57,71
B90	1a/38	wind;10	-43,12
B90	5a5/55	safety	41,45
B91	1a/7	wind;10	-61,36
B91	1a/5	wind;10	61,67
B92	1a/38	wind;10	-42,78
B92	5a11/122	safety	41,40
B93	1a-p/17	wind;10	-51,05
B93	1a/16	wind;10	48,32

Staaf	BG	Geval beschrijving	N [kN]
B94	1a-p/15	wind;10	59,11
B94	1a/5	wind;10	-68,15
B95	1a/38	wind;10	51,67
B95	1a/16	wind;10	-49,28
B98	1a/7	wind;10	69,75
B98	1a-p/14	wind;10	-63,63
B99	1a/38	wind;10	52,76
B99	1a/16	wind;10	-48,90
B100	1a/5	wind;10	67,53
B100	1a-p/15	wind;10	-57,94
B101	1a/16	wind;10	47,62
B101	1a/38	wind;10	-53,65
B102	1a-p/35	wind;10	0,27
B102	1a/34	wind;10	-0,31
B103	1a-p/27	wind;10	0,25
B103	1a/26	wind;10	-0,31
B104	1a-p/28	wind;10	0,24
B104	1a/29	wind;10	-0,33
B105	1a-p/30	wind;10	0,23
B105	1a/32	wind;10	-0,34
B106	1a/16	wind;10	48,54
B106	1a/38	wind;10	-53,29
B107	1a/7	wind;10	65,95
B107	1a-p/14	wind;10	-59,69
B108	1a/38	wind;10	53,17
B108	1a/16	wind;10	-48,25
B109	1a/5	wind;10	71,84
B109	1a-p/15	wind;10	-62,36
B110	1a-p/14	wind;10	0,00
B110	1a/7	wind;10	0,00
B111	1a-p/39	wind;10	0,00
B111	1a/38	wind;10	0,00
B112	1a-p/15	wind;10	0,00
B112	1a/5	wind;10	0,00
B113	1a-p/17	wind;10	0,00
B113	1a/16	wind;10	0,00
B114	1a-p/14	wind;10	68,68
B114	1a/7	wind;10	-78,56
B115	1a-p/39	wind;10	50,07
B115	1a/38	wind;10	-57,26
B116	1a/7	wind;10	-73,65
B116	1a-p/14	wind;10	63,56
B117	1a/38	wind;10	-57,64
B117	1a-p/39	wind;10	49,01
B118	1a-p/35	wind;10	90,99
B118	1a/32	wind;10	-120,06
B119	1a-p/35	wind;10	91,02
B119	1a/34	wind;10	-112,52
B120	1a-p/27	wind;10	90,94
B120	1a/29	wind;10	-119,99
B121	5a5/129	safety	-2,55
B121	5a6/130	safety	1,82
B122	5a12/131	safety	-2,60
B122	5a11/132	safety	1,77
B123	3/4	wind+ice	-0,74
B123	1a-p/35	wind;10	-0,48
B124	3-p/9	wind+ice	0,01
B124	1a/29	wind;10	-0,26
B129	5a11/132	safety	-11,50
B129	5a12/128	safety	11,56

	Project	150 kV lijn Leiden - Zoetermeer
D&C ENGINEERING	Onderdeel	Berekening Mast 52
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Staaf	BG	Geval beschrijving	N [kN]
B130	5a6/133	safety	11,50
B130	5a5/57	safety	-11,54
B131	5a5/121	safety	11,50
B131	5a6/56	safety	-11,55
B132	5a12/128	safety	-11,64
B132	5a11/132	safety	11,41
B133	3-p/134	wind+ice	0,06
B133	1a/7	wind;10	0,30
B134	1a/7	wind;10	-0,20
B134	3-p/135	wind+ice	-0,03
B135	3-p/135	wind+ice	-0,19
B135	1a/7	wind;10	-0,42
C1	1a/29	wind;10	-904,67
C1	1a-p/28	wind;10	644,11
C2	1a-p/30	wind;10	625,50
C2	1a/32	wind;10	-905,23
C3	1a/34	wind;10	-850,73
C3	1a-p/35	wind;10	698,46
C4	1a/26	wind;10	-831,26
C4	1a-p/27	wind;10	698,07
C5	1a/29	wind;10	-865,21
C5	1a-p/28	wind;10	623,47
C6	1a/32	wind;10	-865,74
C6	1a-p/30	wind;10	605,55
C7	1a-p/27	wind;10	675,46
C7	1a/26	wind;10	-794,49
C8	1a-p/35	wind;10	675,83
C8	1a/34	wind;10	-813,25
C9	1a-p/28	wind;10	525,89
C9	1a/29	wind;10	-742,08
C10	1a-p/30	wind;10	509,47
C10	1a/32	wind;10	-741,00
C11	1a-p/27	wind;10	572,21
C11	1a/26	wind;10	-680,82
C12	1a-p/35	wind;10	571,36
C12	1a/34	wind;10	-695,64
C13	1a/29	wind;10	-594,28
C13	1a-p/28	wind;10	386,70
C14	1a/32	wind;10	-592,84
C14	1a-p/30	wind;10	373,22
C15	1a/26	wind;10	-544,98
C15	1a-p/27	wind;10	425,85
C16	1a/34	wind;10	-556,27
C16	1a-p/35	wind;10	424,24
C17	1a/29	wind;10	-453,34
C17	1a-p/28	wind;10	277,66
C18	1a-p/30	wind;10	266,73
C18	1a/32	wind;10	-449,33
C19	1a/26	wind;10	-419,48
C19	1a-p/27	wind;10	307,33
C20	1a/34	wind;10	-424,39
C20	1a-p/35	wind;10	303,78
S1	1a-p/17	wind;10	0,42
S1	1a/16	wind;10	-0,52
S2	5a1/18	safety	11,21
S2	3/6	wind+ice	-4,40
S3	3/6	wind+ice	2,98
S3	5a1/18	safety	-7,21
S4	3-p/20	wind+ice	7,84
S4	5a1/19	safety	-10,09
S5	3-p/21	wind+ice	-4,74
S5	5a1/19	safety	6,29
S6	3/23	wind+ice	2,03
S6	3-p/22	wind+ice	-1,44
S7	3-p/22	wind+ice	4,14
S7	5a1/24	safety	-4,89
S8	5a1/25	safety	6,43
S8	3/6	wind+ice	-6,08
S9	5a1/19	safety	4,91
S9	3/23	wind+ice	-3,67
S10	5a1/19	safety	-6,74
S10	3/23	wind+ice	4,98
S11	1a-p/27	wind;10	0,53
S11	1a/26	wind;10	-1,46
S12	3/6	wind+ice	0,42
S12	3-p/20	wind+ice	-0,15
S13	1a-p/27	wind;10	0,39
S13	1a/26	wind;10	-1,30
S14	1a-p/27	wind;10	-0,14
S14	1a/26	wind;10	0,58
S15	1a-p/27	wind;10	0,62
S15	1a/26	wind;10	-1,77
S16	1a/26	wind;10	0,95
S16	1a-p/27	wind;10	-0,30
S17	1a-p/27	wind;10	0,49
S17	3/6	wind+ice	-2,39
S18	3/6	wind+ice	0,71
S18	1a-p/28	wind;10	-0,19
S19	1a-p/28	wind;10	0,72
S19	1a/29	wind;10	-1,62
S20	1a/26	wind;10	0,65
S20	1a-p/27	wind;10	-0,17
S21	1a-p/28	wind;10	0,55
S21	1a/29	wind;10	-1,70
S22	1a-p/28	wind;10	-0,43
S22	1a/29	wind;10	1,04
S23	3/23	wind+ice	4,67
S23	1a-p/30	wind;10	-4,62
S24	1a-p/28	wind;10	4,31
S24	3/6	wind+ice	-6,50
S25	1a-p/17	wind;10	-5,90
S25	3/31	wind+ice	-13,81
S26	5a5/33	safety	30,20
S26	1a/32	wind;10	-44,58
S27	1a-p/35	wind;10	31,72
S27	1a/34	wind;10	-34,74
S28	1a-p/35	wind;10	35,46
S28	5a5/36	safety	-37,99
S29	1a-p/30	wind;10	26,46
S29	1a/32	wind;10	-42,22
S30	1a-p/27	wind;10	0,15
S30	1a/26	wind;10	-0,20
S31	1a/34	wind;10	25,23
S31	1a-p/35	wind;10	-24,42
S33	1a-p/28	wind;10	-9,60
S33	3/6	wind+ice	-21,27
S34	1a-p/35	wind;10	-25,60
S34	1a/34	wind;10	29,11
S35	1a-p/35	wind;10	-10,00
S35	3/37	wind+ice	-22,72
S36	1a-p/30	wind;10	-21,57
S36	1a/32	wind;10	31,08
S38	1a/26	wind;10	0,00
S38	1a/38	wind;10	0,00
S41	1a/5	wind;10	0,00
S41	1a/16	wind;10	0,00
S42	1a/34	wind;10	-0,99
S42	1a/29	wind;10	0,90
S43	1a/7	wind;10	0,00
S43	1a/7	wind;10	0,00
S44	1a/5	wind;10	-0,55
S44	1a/7	wind;10	1,02
S46	1a-p/14	wind;10	0,00
S46	1a/5	wind;10	0,00

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 52
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Staaf	BG	Geval beschrijving	N [kN]
S47	1a/5	wind;10	**0,00**
S47	1a/32	wind;10	**0,00**
S49	1a/26	wind;10	**-0,26**
S49	1a/26	wind;10	**0,00**
S51	1a/29	wind;10	**-0,09**
S51	1a/16	wind;10	**0,00**
S52	1a/16	wind;10	**0,00**
S52	1a-p/17	wind;10	**0,00**
S54	1a-p/14	wind;10	**3,98**
S54	1a/7	wind;10	**-4,92**
S55	1a/26	wind;10	**-0,09**
S55	1a/38	wind;10	**0,00**
S56	1a/16	wind;10	**0,00**
S56	1a/38	wind;10	**0,00**
S61	1a/34	wind;10	**0,00**
S61	1a/32	wind;10	**-0,26**
S63	1a-p/39	wind;10	**0,45**
S63	1a/38	wind;10	**-0,55**
S64	1a-p/17	wind;10	**0,39**
S64	1a/16	wind;10	**-0,48**
S65	5a3/40	safety	**11,28**
S65	3/4	wind+ice	**-4,92**
S66	3/41	wind+ice	**2,61**
S66	5a3/40	safety	**-7,16**
S67	3-p/43	wind+ice	**7,62**
S67	5a3/42	safety	**-9,80**
S68	5a3/42	safety	**6,28**
S68	3-p/44	wind+ice	**-4,92**
S69	3/45	wind+ice	**2,04**
S69	3-p/9	wind+ice	**-1,31**
S70	3-p/9	wind+ice	**4,19**
S70	5a3/46	safety	**-4,83**
S71	5a3/46	safety	**6,47**
S71	3-p/9	wind+ice	**-5,90**
S72	5a3/47	safety	**4,82**
S72	3/45	wind+ice	**-3,64**
S73	3/45	wind+ice	**5,08**
S73	5a3/47	safety	**-6,54**
S74	1a-p/30	wind;10	**0,36**
S74	1a/32	wind;10	**-1,53**
S75	1a/34	wind;10	**0,42**
S75	1a-p/35	wind;10	**-0,15**
S76	1a-p/35	wind;10	**0,81**
S76	1a/34	wind;10	**-1,70**
S77	1a/32	wind;10	**0,67**
S77	1a-p/30	wind;10	**-0,19**
S78	1a-p/35	wind;10	**0,61**
S78	1a/34	wind;10	**-1,78**
S79	1a/34	wind;10	**1,09**
S79	1a-p/35	wind;10	**-0,47**
S80	1a-p/30	wind;10	**0,68**
S80	3/4	wind+ice	**-1,86**
S81	3/4	wind+ice	**0,59**
S81	1a-p/30	wind;10	**-0,18**
S82	1a-p/30	wind;10	**0,44**
S82	1a/32	wind;10	**-1,37**
S83	1a/32	wind;10	**0,61**
S83	1a-p/30	wind;10	**-0,17**
S84	1a-p/30	wind;10	**0,72**
S84	1a/32	wind;10	**-1,85**
S85	1a/32	wind;10	**1,00**
S85	1a-p/30	wind;10	**-0,35**
S86	3/45	wind+ice	**4,64**
S86	1a-p/28	wind;10	**-4,94**
S87	1a-p/30	wind;10	**4,55**
S87	3/4	wind+ice	**-6,55**
S88	3/31	wind+ice	**-13,87**
S88	1a-p/17	wind;10	**-6,00**
S89	5a11/48	safety	**30,34**
S89	1a/29	wind;10	**-43,78**
S90	1a-p/27	wind;10	**31,51**
S90	1a/26	wind;10	**-34,48**
S91	1a-p/27	wind;10	**34,78**
S91	5a11/49	safety	**-37,87**
S92	1a-p/28	wind;10	**25,51**
S92	1a/29	wind;10	**-41,07**
S93	1a/26	wind;10	**0,30**
S93	1a-p/27	wind;10	**-0,18**
S94	1a-p/39	wind;10	**2,60**
S94	1a/38	wind;10	**-2,84**
S95	1a-p/17	wind;10	**2,66**
S95	1a/16	wind;10	**-2,77**
S96	1a-p/39	wind;10	**2,62**
S96	1a/38	wind;10	**-3,19**
S97	1a-p/17	wind;10	**2,94**
S97	1a/16	wind;10	**-2,87**
S98	1a-p/17	wind;10	**1,56**
S98	1a/16	wind;10	**-1,62**
S99	1a-p/17	wind;10	**1,68**
S99	1a/38	wind;10	**-1,84**
S100	1a-p/14	wind;10	**10,95**
S100	3/6	wind+ice	**-63,73**
S101	3/6	wind+ice	**59,90**
S101	1a-p/14	wind;10	**-13,79**
S102	1a/7	wind;10	**-42,12**
S102	1a-p/14	wind;10	**38,37**
S103	1a/16	wind;10	**-2,28**
S103	1a-p/17	wind;10	**2,09**
S104	1a-p/17	wind;10	**-0,66**
S104	1a/16	wind;10	**2,56**
S105	1a/38	wind;10	**-2,27**
S105	1a-p/39	wind;10	**2,11**
S106	1a-p/39	wind;10	**1,32**
S106	1a/16	wind;10	**-1,46**
S107	3/6	wind+ice	**-64,14**
S107	1a-p/14	wind;10	**12,94**
S108	1a-p/39	wind;10	**-0,71**
S108	1a/38	wind;10	**2,51**
S109	1a-p/14	wind;10	**-15,69**
S109	3/6	wind+ice	**60,44**
S110	1a-p/14	wind;10	**39,81**
S110	1a/7	wind;10	**-43,55**
S111	3/4	wind+ice	**-64,00**
S111	1a-p/15	wind;10	**10,32**
S112	3/4	wind+ice	**60,21**
S112	1a-p/15	wind;10	**-13,16**
S113	1a-p/15	wind;10	**37,61**
S113	1a/5	wind;10	**-42,90**
S114	1a-p/17	wind;10	**2,44**
S114	1a/16	wind;10	**-2,61**
S115	1a-p/17	wind;10	**-0,92**
S115	1a/16	wind;10	**2,79**
S116	1a-p/39	wind;10	**2,43**
S116	1a/38	wind;10	**-2,62**
S117	1a-p/17	wind;10	**1,53**
S117	1a/38	wind;10	**-1,68**
S118	1a-p/15	wind;10	**12,41**
S118	3/4	wind+ice	**-64,24**
S119	1a/38	wind;10	**2,76**
S119	1a-p/39	wind;10	**-0,94**
S120	3/4	wind+ice	**60,58**
S120	1a-p/15	wind;10	**-15,16**
S121	1a/16	wind;10	**3,15**
S121	1a-p/17	wind;10	**-0,99**

Staaf	BG	Geval beschrijving	N [kN]
S122	1a-p/17	wind;10	2,64
S122	1a/16	wind;10	-2,83
S123	1a-p/39	wind;10	2,63
S123	1a/38	wind;10	-2,83
S124	1a-p/17	wind;10	1,64
S124	1a/38	wind;10	-1,83
S125	1a/38	wind;10	3,09
S125	1a-p/39	wind;10	-1,05
S126	1a-p/15	wind;10	39,16
S126	1a/5	wind;10	-44,20
S127	1a/7	wind;10	114,43
S127	1a-p/14	wind;10	-70,42
S129	3/50	wind+ice	56,84
S129	1a-p/27	wind;10	29,12
S130	3/6	wind+ice	56,80
S130	1b-p/51	wind;-20	30,27
S131	1a-p/15	wind;10	71,02
S131	1a/5	wind;10	-107,06
S132	1a-p/15	wind;10	75,18
S132	1a/5	wind;10	-109,87
S133	1a/5	wind;10	-0,20
S133	1a-p/15	wind;10	0,17
S134	1a-p/14	wind;10	-0,12
S134	1a/7	wind;10	0,14
S135	1a/7	wind;10	-90,56
S135	1a-p/14	wind;10	72,75
S136	1a-p/15	wind;10	-0,29
S136	1a/5	wind;10	0,98
S137	1a-p/28	wind;10	27,67
S137	3/52	wind+ice	53,98
S138	3/31	wind+ice	53,82
S138	3-p/53	wind+ice	28,85
S139	1a-p/15	wind;10	-66,90
S139	1a/5	wind;10	80,48
S140	1a-p/14	wind;10	73,72
S140	1a/7	wind;10	-93,22
S141	1a/5	wind;10	78,33
S141	1a-p/15	wind;10	-63,96
S142	3/37	wind+ice	56,88
S142	1a-p/35	wind;10	28,96
S143	3/4	wind+ice	56,75
S143	1b-p/51	wind;-20	30,24
S144	1a-p/14	wind;10	72,99
S144	1a/7	wind;10	-105,98
S145	1a-p/14	wind;10	76,05
S145	1a/7	wind;10	-108,33
S146	1a-p/14	wind;10	0,16
S146	1a/7	wind;10	-0,21
S147	1a-p/14	wind;10	0,16
S147	1a/7	wind;10	-0,20
S148	1a-p/15	wind;10	71,21
S148	1a/5	wind;10	-91,76
S149	1a/7	wind;10	1,10
S149	1a-p/14	wind;10	-0,35
S150	1a/26	wind;10	1,61
S150	1a-p/27	wind;10	-0,58
S151	3/41	wind+ice	53,99
S151	1a-p/30	wind;10	27,67
S152	3-p/53	wind+ice	28,88
S152	3/31	wind+ice	53,87
S153	1a/7	wind;10	78,82
S153	1a-p/14	wind;10	-68,14
S154	1a-p/15	wind;10	71,45
S154	1a/5	wind;10	-94,58
S155	1a/7	wind;10	76,85
S155	1a-p/14	wind;10	-64,79
S156	1a/26	wind;10	25,14
S156	1a-p/27	wind;10	-24,40
S159	3/6	wind+ice	124,11
S159	1a-p/27	wind;10	65,72
S160	3/4	wind+ice	125,37
S160	1a-p/35	wind;10	65,32
S161	1a/7	wind;10	288,67
S161	1a-p/14	wind;10	-155,97
S162	1a-p/14	wind;10	178,66
S162	1a/7	wind;10	-198,75
S164	1a-p/15	wind;10	173,94
S164	1a/5	wind;10	-207,25
S166	1a-p/28	wind;10	69,36
S166	3/6	wind+ice	134,78
S167	5a5/55	safety	10,78
S167	5a6/54	safety	-17,76
S168	5a5/55	safety	-5,61
S168	5a6/54	safety	9,08
S169	5a5/33	safety	-17,88
S169	5a6/56	safety	10,66
S170	5a5/33	safety	9,14
S170	5a6/56	safety	-5,56
S171	5a6/56	safety	3,39
S171	5a5/10	safety	-72,52
S172	5a5/57	safety	5,15
S172	5a6/11	safety	-70,74
S173	1a/5	wind;10	1,14
S173	3-p/43	wind+ice	-3,84
S175	3/6	wind+ice	38,29
S175	4-p/58	maintenance	11,36
S177	1a-p/28	wind;10	296,68
S177	1a/29	wind;10	-475,06
S178	5a9/60	safety	6,94
S178	5a7/59	safety	-7,60
S179	5a10/62	safety	6,97
S179	5a8/61	safety	-7,61
S180	5a8/64	safety	12,27
S180	5a7/63	safety	-10,94
S181	5a7/65	safety	12,38
S181	1a/38	wind;10	-10,93
S182	5a7/65	safety	-13,55
S182	5a8/66	safety	11,83
S183	5a7/65	safety	12,18
S183	5a8/66	safety	-11,40
S184	5a7/63	safety	11,96
S184	5a8/64	safety	-13,45
S185	5a8/64	safety	12,06
S185	5a7/63	safety	-11,49
S186	5a9/60	safety	6,47
S186	5a10/62	safety	-46,89
S187	5a10/62	safety	6,42
S187	5a9/60	safety	-47,02
S188	1b/67	wind;-20	22,00
S188	5a9/60	safety	40,57
S189	1b/68	wind;-20	21,90
S189	5a9/60	safety	46,91
S190	5a12/13	safety	-17,60
S190	5a11/69	safety	10,78
S191	5a12/71	safety	9,03
S191	5a11/70	safety	-5,64
S192	5a11/49	safety	-17,74
S192	5a12/72	safety	10,68
S193	5a11/12	safety	9,07
S193	5a12/73	safety	-5,57
S194	5a11/74	safety	-69,47
S194	5a12/73	safety	3,38
S195	5a12/75	safety	-67,75
S195	5a11/69	safety	5,15

	Project	150 kV lijn Leiden - Zoetermeer
D&C ENGINEERING	Onderdeel	Berekening Mast 52
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Staaf	BG	Geval beschrijving	N [kN]
S196	3-p/20	wind+ice	-3,84
S196	3/6	wind+ice	1,13
S198	5a9/76	safety	-10,94
S198	1a-p/17	wind;10	12,77
S199	5a9/76	safety	12,39
S199	1a/38	wind;10	-11,48
S200	5a9/77	safety	-13,59
S200	5a10/78	safety	11,83
S201	5a9/77	safety	12,20
S201	5a10/78	safety	-11,38
S202	5a10/78	safety	-13,47
S202	5a9/77	safety	11,96
S203	5a9/77	safety	-11,50
S203	5a10/78	safety	12,07
S204	5a7/59	safety	6,43
S204	5a8/61	safety	-46,99
S205	5a7/59	safety	-47,14
S205	5a8/61	safety	6,36
S206	5a7/59	safety	6,93
S206	5a9/60	safety	-7,61
S207	5a8/61	safety	6,94
S207	5a10/62	safety	-7,64
S208	5a8/80	safety	40,94
S208	1b/79	wind;-20	22,21
S209	1b/68	wind;-20	21,78
S209	5a7/59	safety	46,60
S210	1a-p/15	wind;10	47,49
S210	1a/5	wind;10	-82,09
S211	3/6	wind+ice	18,75
S211	1a-p/14	wind;10	-1,92
S212	3/4	wind+ice	18,91
S212	1a-p/15	wind;10	-1,82
S213	1a-p/15	wind;10	45,58
S213	3/4	wind+ice	-89,16
S214	1a-p/17	wind;10	2,60
S214	1a/16	wind;10	-2,36
S215	1a-p/17	wind;10	2,28
S215	1a/16	wind;10	-2,98
S216	1a/38	wind;10	-0,09
S216	1a/38	wind;10	0,06
S217	1a/38	wind;10	-0,27
S217	1a-p/39	wind;10	0,08
S218	1a-p/17	wind;10	0,12
S218	1a/16	wind;10	-0,23
S219	1a-p/39	wind;10	2,05
S219	1a/38	wind;10	-2,92
S220	1a-p/39	wind;10	2,64
S220	1a/38	wind;10	-2,57
S221	1a/38	wind;10	-2,27
S221	1a-p/17	wind;10	1,89
S222	1a-p/39	wind;10	1,89
S222	1a/16	wind;10	-2,35
S223	1a/16	wind;10	-0,09
S223	1a-p/17	wind;10	0,04
S224	1a/7	wind;10	146,94
S224	1a-p/14	wind;10	-133,19
S225	1a-p/14	wind;10	127,80
S225	1a/7	wind;10	-148,81
S226	1a/5	wind;10	151,21
S226	1a-p/15	wind;10	-129,09
S227	1a/5	wind;10	-152,88
S227	1a-p/15	wind;10	123,57
S228	1a-p/28	wind;10	43,83
S228	3/52	wind+ice	80,84
S229	1a-p/27	wind;10	-0,29
S229	3/50	wind+ice	-0,46
S231	3/41	wind+ice	80,95

Staaf	BG	Geval beschrijving	N [kN]
S231	1a-p/39	wind;10	43,79
S232	3/50	wind+ice	39,02
S232	1a-p/27	wind;10	21,79
S233	1a-p/27	wind;10	-0,26
S233	1a/26	wind;10	-0,46
S235	1a-p/27	wind;10	46,55
S235	3/50	wind+ice	86,63
S236	3/41	wind+ice	41,84
S236	1a-p/30	wind;10	23,21
S237	1a-p/28	wind;10	-0,29
S237	3/52	wind+ice	-0,46
S239	1a/7	wind;10	149,47
S239	1a-p/14	wind;10	-134,56
S240	1a-p/14	wind;10	128,06
S240	1a/7	wind;10	-150,52
S241	1a/5	wind;10	153,45
S241	1a-p/15	wind;10	-130,66
S242	1a-p/15	wind;10	124,09
S242	1a/5	wind;10	-154,27
S243	1a/29	wind;10	30,78
S243	1a-p/28	wind;10	-22,26
S244	1a-p/39	wind;10	-9,34
S244	3/52	wind+ice	-21,50
S245	1a/26	wind;10	25,93
S245	1a-p/27	wind;10	-23,24
S247	1a/7	wind;10	0,00
S247	1a/38	wind;10	0,00
S248	1a/34	wind;10	0,54
S248	1a/7	wind;10	-0,83
S249	1a/16	wind;10	0,00
S249	1a/32	wind;10	-0,09
S250	1a/16	wind;10	0,00
S250	1a/38	wind;10	0,00
S252	1a-p/39	wind;10	59,66
S252	1a/38	wind;10	-70,61
S253	3/37	wind+ice	86,62
S253	1a-p/35	wind;10	46,55
S254	3/52	wind+ice	41,77
S254	1a-p/28	wind;10	23,14
S255	1a-p/28	wind;10	-0,26
S255	3/52	wind+ice	-0,47
S257	1a-p/35	wind;10	-9,89
S257	3/4	wind+ice	-22,50
S258	3/4	wind+ice	132,55
S258	1a-p/30	wind;10	69,83
S260	1a/16	wind;10	0,00
S260	1a/32	wind;10	0,00
S263	5a17/82	safety	8,35
S263	5a21/81	safety	-13,47
S264	5a13/83	safety	-8,41
S264	5a14/84	safety	11,22
S265	5a21/81	safety	-12,98
S265	5a17/82	safety	8,17
S266	5a18/85	safety	8,48
S266	5a13/83	safety	-13,21
S267	5a13/83	safety	11,14
S267	5a14/84	safety	-8,49
S268	1a/29	wind;10	-2,97
S268	1a-p/28	wind;10	2,86
S270	1a-p/39	wind;10	-15,12
S270	1a/38	wind;10	46,76
S273	5a13/83	safety	-17,94
S273	5a14/86	safety	14,25
S274	5a13/87	safety	-8,20
S274	5a14/84	safety	10,53
S275	5a13/83	safety	-8,09
S275	5a14/88	safety	4,99

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 52
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Staaf	BG	Geval beschrijving	N [kN]
S278	5a14/84	safety	**-18,21**
S278	5a13/87	safety	**13,98**
S279	5a14/86	safety	**-8,35**
S279	5a13/83	safety	**10,38**
S280	5a13/89	safety	**4,88**
S280	5a14/84	safety	**-8,19**
S282	1b/67	wind;-20	**-4,83**
S282	5a21/90	safety	**-13,92**
S283	5a17/82	safety	**43,22**
S283	1b-p/91	wind;-20	**24,03**
S284	5a14/84	safety	**-36,35**
S284	5a15/92	safety	**7,62**
S285	5a16/93	safety	**7,86**
S285	5a13/83	safety	**-36,28**
S286	1b-p/94	wind;-20	**23,74**
S286	5a14/84	safety	**47,82**
S287	5a14/95	safety	**-1,22**
S287	1b/67	wind;-20	**-0,53**
S288	5a15/96	safety	**13,25**
S288	5a16/93	safety	**-17,59**
S289	5a13/97	safety	**24,69**
S289	5a14/2	safety	**-139,96**
S290	5a18/98	safety	**-9,62**
S290	5a21/81	safety	**11,55**
S291	5a13/83	safety	**11,64**
S291	5a17/99	safety	**-10,17**
S292	5a17/99	safety	**8,34**
S292	5a13/83	safety	**-11,83**
S293	5a13/83	safety	**2,97**
S293	5a14/84	safety	**-6,82**
S294	5a22/100	safety	**-42,03**
S294	5a21/81	safety	**8,92**
S295	5a21/102	safety	**24,67**
S295	5a22/101	safety	**-134,76**
S296	1a-p/39	wind;10	**0,10**
S296	1a/38	wind;10	**-0,26**
S297	1a-p/17	wind;10	**0,09**
S297	1a/16	wind;10	**-0,28**
S298	1a-p/17	wind;10	**-20,87**
S298	1a/38	wind;10	**45,43**
S299	5a14/84	safety	**53,53**
S299	1b/103	wind;-20	**21,60**
S300	1a/29	wind;10	**28,58**
S300	1a-p/28	wind;10	**-19,54**
S301	1a/32	wind;10	**0,54**
S301	1a/7	wind;10	**-0,83**
S302	5a21/105	safety	**14,01**
S302	5a22/104	safety	**-18,11**
S303	5a21/107	safety	**10,27**
S303	5a22/106	safety	**-8,36**
S304	5a21/81	safety	**4,88**
S304	5a22/108	safety	**-8,14**
S307	5a22/106	safety	**14,30**
S307	5a21/107	safety	**-17,82**
S308	5a22/104	safety	**10,43**
S308	5a21/105	safety	**-8,19**
S309	5a22/100	safety	**5,00**
S309	5a21/109	safety	**-8,02**
S311	1b/79	wind;-20	**-4,88**
S311	5a14/110	safety	**-14,04**
S312	5a13/111	safety	**43,18**
S312	1b-p/94	wind;-20	**24,04**
S313	5a20/113	safety	**7,86**
S313	5a21/112	safety	**-36,23**
S314	5a19/114	safety	**7,62**
S314	5a22/100	safety	**-36,34**
S315	5a22/116	safety	**48,23**

Staaf	BG	Geval beschrijving	N [kN]
S315	1b-p/115	wind;-20	**23,72**
S316	1b/79	wind;-20	**-0,51**
S316	5a22/108	safety	**-1,22**
S317	5a20/118	safety	**13,01**
S317	5a19/117	safety	**-17,69**
S318	5a22/100	safety	**11,64**
S318	5a17/99	safety	**-9,53**
S319	5a21/81	safety	**11,54**
S319	5a18/98	safety	**-10,16**
S320	5a18/98	safety	**8,54**
S320	5a21/81	safety	**-11,63**
S321	1a-p/30	wind;10	**2,19**
S321	1a/32	wind;10	**-2,22**
S322	5a14/84	safety	**2,91**
S322	5a13/83	safety	**-6,88**
S323	5a22/100	safety	**8,87**
S323	5a21/81	safety	**-41,90**
S324	5a22/100	safety	**43,30**
S324	1b-p/94	wind;-20	**20,43**
S328	1a-p/14	wind;10	**181,65**
S328	1a/7	wind;10	**-202,53**
S330	1a/5	wind;10	**0,00**
S330	1a-p/15	wind;10	**0,00**
S331	1a/7	wind;10	**1,02**
S331	1a/5	wind;10	**-0,55**
S333	1a/38	wind;10	**0,00**
S333	1a/29	wind;10	**-0,09**
S334	1a/38	wind;10	**0,00**
S334	1a-p/39	wind;10	**0,00**
S336	1a/32	wind;10	**0,00**
S336	1a/32	wind;10	**-0,26**
S340	5a22/119	safety	**28,81**
S340	5a21/112	safety	**-129,10**
S343	3/4	wind+ice	**38,41**
S343	4-p/120	maintenance	**11,32**
S355	1a-p/27	wind;10	**328,32**
S355	1a/26	wind;10	**-443,56**
S359	1a-p/35	wind;10	**47,66**
S359	1a/34	wind;10	**-85,47**
S361	3-p/20	wind+ice	**25,54**
S361	5a1/123	safety	**-49,25**
S368	1a/29	wind;10	**-195,12**
S368	1a-p/28	wind;10	**74,47**
S370	3/4	wind+ice	**-87,14**
S370	1a-p/30	wind;10	**48,17**
S372	3/6	wind+ice	**-58,86**
S372	5a1/124	safety	**36,25**
S373	3/6	wind+ice	**-57,78**
S373	5a1/124	safety	**36,99**
S377	1a/5	wind;10	**197,50**
S377	1a-p/15	wind;10	**-151,21**
S378	1a-p/14	wind;10	**-72,78**
S378	1a/7	wind;10	**86,24**
S379	1a-p/15	wind;10	**-146,71**
S379	1a/5	wind;10	**192,81**
S380	1a/7	wind;10	**91,17**
S380	1a-p/14	wind;10	**-74,22**
S381	1a/7	wind;10	**192,62**
S381	1a-p/14	wind;10	**-156,14**
S382	1a/5	wind;10	**91,34**
S382	1a-p/15	wind;10	**-71,67**
S383	1a/7	wind;10	**187,82**
S383	1a-p/14	wind;10	**-152,68**
S384	1a/5	wind;10	**91,83**
S384	1a-p/15	wind;10	**-72,24**
S388	1a-p/14	wind;10	**94,59**
S388	1a/5	wind;10	**-158,07**

Staaf	BG	Geval beschrijving	N [kN]
S390	1a-p/35	wind;10	**77,25**
S390	1a/5	wind;10	**-154,17**
S397	1a/26	wind;10	**0,90**
S397	1a/32	wind;10	**-0,99**
S399	1a-p/17	wind;10	**-21,00**
S399	1a/16	wind;10	**42,05**
S400	1a-p/17	wind;10	**8,57**
S400	5a13/83	safety	**-12,83**
S401	1a/32	wind;10	**29,71**
S401	1a-p/30	wind;10	**-21,16**
S402	1a/26	wind;10	**-194,47**
S402	1a-p/27	wind;10	**83,91**
S411	1a-p/27	wind;10	**47,38**
S411	1a/26	wind;10	**-84,82**
S413	3-p/43	wind+ice	**25,76**
S413	5a3/46	safety	**-46,85**
S417	3-p/43	wind+ice	**26,30**
S417	5a3/46	safety	**-46,10**
S418	1a-p/30	wind;10	**285,18**
S418	1a/32	wind;10	**-475,23**
S421	1a-p/30	wind;10	**75,76**
S421	1a/32	wind;10	**-196,86**
S425	5a3/47	safety	**36,25**
S425	3/4	wind+ice	**-58,72**
S426	5a3/47	safety	**36,97**
S426	3/4	wind+ice	**-57,71**
S430	1a-p/15	wind;10	**3,94**
S430	1a/5	wind;10	**-4,89**
S441	1a/7	wind;10	**79,09**
S441	1a-p/14	wind;10	**-67,93**
S446	1a-p/15	wind;10	**-66,06**
S446	1a/5	wind;10	**80,20**
S447	1a-p/14	wind;10	**48,43**
S447	1a/7	wind;10	**-80,45**
S448	3/37	wind+ice	**39,07**
S448	1a-p/35	wind;10	**21,83**
S449	1a-p/39	wind;10	**0,35**
S449	1a/38	wind;10	**-0,46**
S450	1a/5	wind;10	**0,00**
S450	1a/5	wind;10	**0,00**
S453	1a/26	wind;10	**0,00**
S453	1a-p/14	wind;10	**0,00**
S456	1a/5	wind;10	**1,17**
S456	1a-p/15	wind;10	**-0,48**
S457	1a-p/15	wind;10	**175,53**
S457	1a/5	wind;10	**-204,52**
S458	1a/5	wind;10	**1,08**
S458	1a/29	wind;10	**-0,84**
S459	1a/5	wind;10	**1,08**
S459	1a/26	wind;10	**-0,84**
S460	1a-p/28	wind;10	**0,12**
S460	1a/29	wind;10	**-4,58**
S461	1a/26	wind;10	**3,25**
S461	1a-p/27	wind;10	**-1,60**
S462	1a/29	wind;10	**3,87**
S462	1a-p/28	wind;10	**-2,17**
S463	1a/34	wind;10	**3,09**
S463	1a-p/35	wind;10	**-1,58**
S464	1a/32	wind;10	**3,75**
S464	1a-p/30	wind;10	**-1,87**
S465	5a16/125	safety	**14,25**
S465	5a15/92	safety	**-17,30**
S466	5a19/127	safety	**12,65**
S466	5a20/126	safety	**-18,05**
S467	1a-p/28	wind;10	**115,06**
S467	1a/32	wind;10	**-186,64**
S470	1a/29	wind;10	**16,00**

Staaf	BG	Geval beschrijving	N [kN]
S470	1a-p/27	wind;10	-12,09
S472	1a-p/27	wind;10	127,74
S472	1a/34	wind;10	-176,04
S474	1a/32	wind;10	15,89
S474	1a-p/35	wind;10	-11,97
S482	3/4	wind+ice	26,69
S482	3-p/43	wind+ice	-13,46
S483	3/4	wind+ice	38,93
S483	3-p/43	wind+ice	-23,20
S484	3/6	wind+ice	26,43
S484	3-p/20	wind+ice	-13,47
S485	3/6	wind+ice	39,02
S485	3-p/20	wind+ice	-23,10
S486	3-p/20	wind+ice	26,10
S486	5a1/123	safety	-48,49
S491	1a/7	wind;10	295,26
S491	1a-p/14	wind;10	-154,77
S492	1a-p/15	wind;10	24,97
S492	1a/5	wind;10	-172,41
S493	1a-p/14	wind;10	89,12
S493	1a/5	wind;10	-170,29
S495	1a/5	wind;10	81,49
S495	1a-p/15	wind;10	-68,12
S497	1a-p/14	wind;10	46,76
S497	3/6	wind+ice	-89,11
S503	1a/7	wind;10	116,93
S503	1a-p/14	wind;10	-75,22
S508	1b-p/94	wind;-20	41,81
S508	5a4/136	safety	75,21
S509	5a12/13	safety	18,98
S509	5a11/69	safety	-7,55
S510	5a11/49	safety	19,09
S510	5a12/72	safety	-7,45
S511	5a17/137	safety	75,26
S511	1b-p/91	wind;-20	41,81
S513	5a6/138	safety	18,98
S513	5a5/33	safety	-7,61
S514	5a6/54	safety	-7,50
S514	5a5/36	safety	19,09
S547	1a-p/14	wind;10	72,28
S547	1a/7	wind;10	-163,57
S548	1b-p/91	wind;-20	35,61
S548	5a22/119	safety	63,71
S549	5a13/139	safety	27,51
S549	5a14/84	safety	-0,49
S550	5a14/140	safety	27,74
S550	5a13/83	safety	-0,29
S551	5a12/73	safety	63,74
S551	1b-p/94	wind;-20	35,66
S552	5a21/102	safety	27,84
S552	5a22/119	safety	-0,69
S553	5a21/102	safety	-0,47
S553	5a22/119	safety	28,10
S588	1a/26	wind;10	0,00
S588	1a-p/14	wind;10	0,00
S589	1a/29	wind;10	0,00
S589	1a-p/15	wind;10	0,00
S590	1a-p/39	wind;10	0,00
S590	1a/29	wind;10	0,00
S591	1a/32	wind;10	0,00
S591	1a/38	wind;10	0,00
S592	1a-p/15	wind;10	0,00
S592	1a/32	wind;10	0,00
S593	1a/34	wind;10	0,00
S593	1a-p/14	wind;10	0,00
S594	1a-p/17	wind;10	0,00
S594	1a/34	wind;10	0,00

Staaf	BG	Geval beschrijving	N [kN]
S595	1a/26	wind;10	0,00
S595	1a-p/39	wind;10	0,00
S596	5a15/96	safety	13,84
S596	5a16/93	safety	-17,70
S597	5a15/92	safety	-17,19
S597	5a16/125	safety	13,66
S598	5a19/127	safety	13,25
S598	5a20/126	safety	-18,14
S599	5a20/118	safety	13,60
S599	5a19/117	safety	-17,79
S600	5a14/141	safety	28,71
S600	5a13/8	safety	-134,23
S601	1a-p/14	wind;10	42,16
S601	1a/7	wind;10	-160,06
S602	1a-p/14	wind;10	216,54
S602	1a/7	wind;10	-217,08
S603	1a-p/15	wind;10	209,96
S603	1a/5	wind;10	-223,71
S604	1a-p/15	wind;10	211,38
S604	1a/5	wind;10	-227,40
S605	1a-p/14	wind;10	219,84
S605	1a/7	wind;10	-220,87
S606	1a-p/15	wind;10	0,00
S606	1a/5	wind;10	0,00
S607	1a/7	wind;10	0,00
S607	1a-p/14	wind;10	0,00
S608	1a/5	wind;10	0,00
S608	1a/26	wind;10	0,00
S609	1a-p/15	wind;10	0,00
S609	1a/5	wind;10	0,00
S610	1a/16	wind;10	50,11
S610	1a-p/17	wind;10	-55,17
S611	1a-p/35	wind;10	324,53
S611	1a/34	wind;10	-448,75
S612	1a-p/39	wind;10	-49,15
S612	1a/38	wind;10	56,10
S613	1a-p/39	wind;10	-48,85
S613	1a/38	wind;10	58,25
S614	1a/16	wind;10	49,78
S614	1a-p/17	wind;10	-57,04
S615	1a-p/27	wind;10	83,08
S615	1a/26	wind;10	-231,86
S616	1a/29	wind;10	-245,34
S616	1a-p/28	wind;10	76,13
S617	1a-p/30	wind;10	77,77
S617	1a/32	wind;10	-247,14
S618	1a/34	wind;10	-233,83
S618	1a-p/35	wind;10	84,54
S619	1a-p/15	wind;10	-207,01
S619	1a/5	wind;10	224,08
S620	1a/7	wind;10	217,57
S620	1a-p/14	wind;10	-213,97
S621	1a-p/14	wind;10	-217,36
S621	1a/7	wind;10	221,48
S622	1a-p/15	wind;10	-211,06
S622	1a/5	wind;10	227,63
S623	1a/16	wind;10	-60,88
S623	1a-p/17	wind;10	69,35
S624	1a/16	wind;10	-60,45
S624	1a-p/17	wind;10	71,35
S625	1a-p/39	wind;10	59,51
S625	1a/38	wind;10	-72,26
S626	1a-p/28	wind;10	48,66
S626	3/6	wind+ice	-87,27
S627	1a-p/15	wind;10	-73,59
S627	1a/5	wind;10	117,77
S628	1a-p/14	wind;10	21,64

Staaf	BG	Geval beschrijving	N [kN]
S628	1a/7	wind;10	-55,95
S629	1a-p/15	wind;10	21,41
S629	1a/5	wind;10	-56,65
S630	1a-p/14	wind;10	-68,93
S630	1a/7	wind;10	79,78
S631	1a/7	wind;10	98,27
S631	1a-p/14	wind;10	-66,38
S632	1a/5	wind;10	99,95
S632	1a-p/15	wind;10	-65,83
S633	1a-p/15	wind;10	-66,16
S633	1a/5	wind;10	88,69
S634	1a-p/14	wind;10	-67,75
S634	1a/7	wind;10	87,57
S635	1a/5	wind;10	116,66
S635	1a-p/15	wind;10	-69,60
S636	1a-p/14	wind;10	20,75
S636	1a/7	wind;10	-55,50
S637	1a-p/15	wind;10	19,36
S637	1a/5	wind;10	-55,26
S638	1a-p/15	wind;10	-149,07
S638	1a/5	wind;10	301,64
S639	3/31	wind+ice	92,34
S639	1a-p/39	wind;10	34,03
S640	1a-p/17	wind;10	32,10
S640	3/142	wind+ice	82,71
S641	1a/5	wind;10	295,62
S641	1a-p/15	wind;10	-150,01
S642	1a-p/14	wind;10	80,57
S642	1a/7	wind;10	-151,33
S643	1a-p/14	wind;10	30,72
S643	1a/7	wind;10	-170,13
S644	1a/5	wind;10	-161,74
S644	1a-p/35	wind;10	36,56
S645	1a-p/15	wind;10	66,19
S645	1a/5	wind;10	-166,05
S646	1a-p/35	wind;10	81,08
S646	1a/34	wind;10	-188,73
S648	5a22/101	safety	61,03
S648	1b-p/143	wind;-20	31,82
S649	1b-p/143	wind;-20	-19,19
S649	5a22/119	safety	-36,78
S650	5a21/81	safety	60,73
S650	5a20/144	safety	33,72
S651	5a20/144	safety	-20,31
S651	5a21/81	safety	-36,63
S652	5a14/2	safety	63,85
S652	1b/68	wind;-20	32,94
S653	1b/68	wind;-20	-20,99
S653	5a14/2	safety	-40,70
S654	5a13/8	safety	63,63
S654	1b/145	wind;-20	35,35
S655	1b/146	wind;-20	-22,58
S655	5a13/8	safety	-40,61
S656	5a14/2	safety	61,07
S656	1b-p/143	wind;-20	31,83
S657	1b-p/143	wind;-20	-19,19
S657	5a14/2	safety	-36,83
S658	5a13/8	safety	60,74
S658	5a16/147	safety	33,69
S659	5a16/147	safety	-20,29
S659	5a13/8	safety	-36,61
S660	5a9/148	safety	70,71
S660	1b/103	wind;-20	36,98
S661	1b/103	wind;-20	-22,33
S661	5a9/148	safety	-42,76
S662	5a10/149	safety	70,85
S662	1b/146	wind;-20	39,39

Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 52
Omschrijving	Controle berekening
Nationale norm	EC - EN
Auteur	MG

Staaf	BG	Geval beschrijving	N [kN]
S663	1b/146	wind;-20	-23,79
S663	5a10/149	safety	-42,84
S664	5a7/151	safety	70,49
S664	1b/150	wind;-20	36,86
S665	1b/68	wind;-20	-22,07
S665	5a7/151	safety	-42,19
S666	1b/152	wind;-20	39,27
S666	5a8/153	safety	70,64
S667	1b/152	wind;-20	-23,51
S667	5a8/153	safety	-42,28
SB1	1a/38	wind;10	0,00
SB1	1a-p/28	wind;10	0,00
SB2	1a-p/35	wind;10	0,00
SB2	1a/7	wind;10	0,00
SB3	1a/29	wind;10	-0,10
SB3	1a-p/28	wind;10	0,00
SB4	1a/29	wind;10	0,00
SB4	1a/29	wind;10	-0,10
SB17	1a-p/28	wind;10	0,00
SB17	1a/38	wind;10	0,00
SB18	1a/7	wind;10	0,00
SB18	1a-p/35	wind;10	0,00
SB19	1a/29	wind;10	-0,10
SB19	1a/38	wind;10	0,00
SB20	1a/7	wind;10	0,00
SB20	1a/29	wind;10	-0,10
SB33	1a/38	wind;10	0,00
SB33	1a-p/28	wind;10	0,00
SB34	1a-p/35	wind;10	0,00
SB34	1a/7	wind;10	0,00
SB35	1a/38	wind;10	0,00
SB35	1a/29	wind;10	-0,11
SB36	1a/29	wind;10	-0,11
SB36	1a/7	wind;10	0,00
SB49	1a-p/28	wind;10	0,00
SB49	1a/29	wind;10	0,00
SB50	1a/29	wind;10	0,00
SB50	1a/29	wind;10	-0,08
SB51	1a/32	wind;10	0,00
SB51	1a/32	wind;10	0,00
SB52	1a/32	wind;10	0,00
SB52	1a/32	wind;10	-0,08
SB53	1a-p/30	wind;10	0,00
SB53	1a/32	wind;10	0,00
SB54	1a/32	wind;10	0,00
SB54	1a/32	wind;10	-0,08
SB55	1a/34	wind;10	0,00
SB55	1a/34	wind;10	0,00
SB56	1a/34	wind;10	0,00
SB56	1a/34	wind;10	-0,08
SB57	1a-p/35	wind;10	0,00
SB57	1a/34	wind;10	0,00
SB58	1a/34	wind;10	0,00
SB58	1a/34	wind;10	-0,08
SB59	1a/26	wind;10	0,00
SB59	1a/26	wind;10	0,00
SB60	1a/26	wind;10	0,00
SB60	1a/26	wind;10	-0,08
SB61	1a-p/27	wind;10	0,00
SB61	1a/26	wind;10	0,00
SB62	1a/26	wind;10	0,00
SB62	1a/26	wind;10	-0,08
SB63	1a/29	wind;10	0,00
SB63	1a/29	wind;10	0,00
SB64	1a/29	wind;10	0,00
SB64	1a/29	wind;10	-0,08
SB65	1a/32	wind;10	0,00

Staaf	BG	Geval beschrijving	N [kN]
SB65	1a-p/30	wind;10	0,00
SB66	1a/16	wind;10	0,00
SB66	1a-p/17	wind;10	0,00
SB67	1a/34	wind;10	0,00
SB67	1a-p/35	wind;10	0,00
SB68	1a/7	wind;10	0,00
SB68	1a-p/14	wind;10	0,00
SB69	1a/26	wind;10	0,00
SB69	1a-p/14	wind;10	0,00
SB70	1a/32	wind;10	0,00
SB70	1a-p/39	wind;10	0,00
SB71	1a/29	wind;10	0,00
SB71	1a-p/28	wind;10	0,00
SB72	1a/5	wind;10	0,00
SB72	1a-p/15	wind;10	0,00
SB73	1a/29	wind;10	0,00
SB73	1a/26	wind;10	-0,08
SB74	1a/34	wind;10	0,00
SB74	1a/26	wind;10	-0,08
SB75	1a/32	wind;10	0,00
SB75	1a/29	wind;10	-0,08
SB76	1a/26	wind;10	0,00
SB76	1a/29	wind;10	-0,08
SB77	1a/34	wind;10	0,00
SB77	1a/32	wind;10	-0,08
SB78	1a/29	wind;10	0,00
SB78	1a/32	wind;10	-0,08
SB79	1a/26	wind;10	0,00
SB79	1a/34	wind;10	-0,08
SB80	1a/32	wind;10	0,00
SB80	1a/34	wind;10	-0,08
SB81	1a/32	wind;10	0,00
SB81	1a/32	wind;10	-0,07
SB82	1a-p/14	wind;10	0,00
SB82	1a/7	wind;10	0,00
SB83	1a/32	wind;10	0,00
SB83	1a/32	wind;10	-0,07
SB84	1a-p/39	wind;10	0,00
SB84	1a/38	wind;10	0,00
SB85	1a/34	wind;10	0,00
SB85	1a/34	wind;10	-0,07
SB86	1a-p/39	wind;10	0,00
SB86	1a/38	wind;10	0,00
SB87	1a/34	wind;10	0,00
SB87	1a/34	wind;10	-0,07
SB88	1a-p/15	wind;10	0,00
SB88	1a/5	wind;10	0,00
SB89	1a/26	wind;10	0,00
SB89	1a/26	wind;10	-0,07
SB90	1a-p/15	wind;10	0,00
SB90	1a/5	wind;10	0,00
SB91	1a/26	wind;10	0,00
SB91	1a/26	wind;10	-0,07
SB92	1a-p/17	wind;10	0,00
SB92	1a/16	wind;10	0,00
SB93	1a/29	wind;10	0,00
SB93	1a/29	wind;10	-0,07
SB94	1a-p/17	wind;10	0,00
SB94	1a/16	wind;10	0,00
SB95	1a/29	wind;10	0,00
SB95	1a/29	wind;10	-0,07
SB96	1a-p/14	wind;10	0,00
SB96	1a/7	wind;10	0,00
SB97	1a-p/14	wind;10	0,00
SB97	1a/7	wind;10	0,00
SB98	1a/16	wind;10	0,00
SB98	1a-p/17	wind;10	0,00

Staaf	BG	Geval beschrijving	N [kN]
SB99	1a-p/39	wind;10	0,00
SB99	1a/38	wind;10	0,00
SB100	1a/7	wind;10	0,00
SB100	1a-p/14	wind;10	0,00
SB101	1a-p/15	wind;10	0,00
SB101	1a/5	wind;10	0,00
SB102	1a/38	wind;10	0,00
SB102	1a-p/39	wind;10	0,00
SB103	1a-p/17	wind;10	0,00
SB103	1a/16	wind;10	0,00
SB104	1a/5	wind;10	0,00
SB104	1a-p/15	wind;10	0,00
SB105	1a/29	wind;10	0,00
SB105	1a/29	wind;10	-0,08
SB106	1a/34	wind;10	0,00
SB106	1a/5	wind;10	-0,08
SB107	1a/32	wind;10	0,00
SB107	1a/32	wind;10	-0,08
SB108	1a/26	wind;10	0,00
SB108	1a/16	wind;10	-0,08
SB109	1a/34	wind;10	0,00
SB109	1a/34	wind;10	-0,08
SB110	1a/29	wind;10	0,00
SB110	1a/7	wind;10	-0,08
SB111	1a/26	wind;10	0,00
SB111	1a/26	wind;10	-0,08
SB112	1a/32	wind;10	0,00
SB112	1a/32	wind;10	-0,08
SB113	1a/5	wind;10	0,00
SB113	1a/5	wind;10	-0,07
SB114	1a/5	wind;10	0,00
SB114	1a-p/15	wind;10	0,00
SB115	1a/32	wind;10	0,00
SB115	1a/32	wind;10	-0,07
SB116	1a-p/39	wind;10	0,00
SB116	1a/38	wind;10	0,00
SB117	1a/34	wind;10	0,00
SB117	1a/16	wind;10	-0,07
SB118	1a/16	wind;10	0,00
SB118	1a-p/17	wind;10	0,00
SB119	1a/5	wind;10	0,00
SB119	1a/5	wind;10	-0,07
SB120	1a-p/15	wind;10	0,00
SB120	1a/5	wind;10	0,00
SB121	1a/7	wind;10	0,00
SB121	1a/7	wind;10	-0,07
SB122	1a/7	wind;10	0,00
SB122	1a-p/14	wind;10	0,00
SB123	1a/16	wind;10	0,00
SB123	1a/16	wind;10	-0,07
SB124	1a-p/17	wind;10	0,00
SB124	1a/16	wind;10	0,00
SB125	1a/29	wind;10	0,00
SB125	1a/38	wind;10	-0,07
SB126	1a/38	wind;10	0,00
SB126	1a-p/39	wind;10	0,00
SB127	1a/7	wind;10	0,00
SB127	1a/7	wind;10	-0,07
SB128	1a-p/14	wind;10	0,00
SB128	1a/7	wind;10	0,00
SB129	1a/5	wind;10	0,00
SB129	1a-p/15	wind;10	0,00
SB130	1a/32	wind;10	0,00
SB130	1a/29	wind;10	-0,08
SB131	1a/5	wind;10	0,00
SB131	1a-p/15	wind;10	0,00
SB132	1a/29	wind;10	0,00

Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 52
Omschrijving	Controle berekening
Nationale norm	EC - EN
Auteur	MG

Staaf	BG	Geval beschrijving	N [kN]
SB132	1a/32	wind;10	**-0,08**
SB133	1a/16	wind;10	**0,00**
SB133	1a-p/17	wind;10	**0,00**
SB134	1a/34	wind;10	**0,00**
SB134	1a/32	wind;10	**-0,08**
SB135	1a/16	wind;10	**0,00**
SB135	1a-p/17	wind;10	**0,00**
SB136	1a/32	wind;10	**0,00**
SB136	1a/34	wind;10	**-0,08**
SB137	1a/7	wind;10	**0,00**
SB137	1a/5	wind;10	**0,00**
SB138	1a/26	wind;10	**0,00**
SB138	1a/34	wind;10	**-0,08**
SB139	1a/7	wind;10	**0,00**
SB139	1a/5	wind;10	**0,00**
SB140	1a/34	wind;10	**0,00**
SB140	1a/26	wind;10	**-0,08**
SB141	1a/38	wind;10	**0,00**
SB141	1a-p/39	wind;10	**0,00**
SB142	1a/29	wind;10	**0,00**
SB142	1a/26	wind;10	**-0,08**
SB143	1a/38	wind;10	**0,00**
SB143	1a-p/39	wind;10	**0,00**
SB144	1a/26	wind;10	**0,00**
SB144	1a/29	wind;10	**-0,08**
SB145	1a/7	wind;10	**0,00**
SB145	1a-p/35	wind;10	**0,00**
SB146	1a/38	wind;10	**0,00**
SB146	1a-p/28	wind;10	**0,00**
SB147	1a/38	wind;10	**0,00**
SB147	1a/29	wind;10	**-0,10**
SB148	1a/7	wind;10	**0,00**
SB148	1a/29	wind;10	**-0,10**
SB149	1a/38	wind;10	**0,00**
SB149	1a/32	wind;10	**-0,11**
SB150	1a/38	wind;10	**0,00**
SB150	1a-p/27	wind;10	**0,00**
SB151	1a/38	wind;10	**0,00**
SB151	1a-p/27	wind;10	**0,00**
SB152	1a/38	wind;10	**0,00**
SB152	1a/32	wind;10	**-0,10**
SB153	1a/38	wind;10	**0,00**
SB153	1a/32	wind;10	**-0,10**

Staaf	BG	Geval beschrijving	N [kN]
SB154	1a/32	wind;10	**0,00**
SB154	1a/32	wind;10	**-0,10**
SB155	1a/38	wind;10	**0,00**
SB155	1a-p/27	wind;10	**0,00**
SB156	1a/38	wind;10	**0,00**
SB156	1a-p/27	wind;10	**0,00**
SB157	1a/26	wind;10	**0,00**
SB157	1a/5	wind;10	**0,00**
SB158	1a/26	wind;10	**0,00**
SB158	1a/5	wind;10	**0,00**
SB159	1a-p/15	wind;10	**0,00**
SB159	1a/32	wind;10	**-0,10**
SB160	1a/26	wind;10	**0,00**
SB160	1a/5	wind;10	**0,00**
SB161	1a/5	wind;10	**0,00**
SB161	1a/32	wind;10	**-0,10**
SB162	1a/26	wind;10	**0,00**
SB162	1a/5	wind;10	**0,00**
SB163	1a/5	wind;10	**0,00**
SB163	1a/32	wind;10	**-0,10**
SB164	1a/5	wind;10	**0,00**
SB164	1a/32	wind;10	**-0,11**
SB165	1a/5	wind;10	**0,00**
SB165	1a/34	wind;10	**-0,11**
SB166	1a/5	wind;10	**0,00**
SB166	1a/34	wind;10	**0,00**
SB167	1a/5	wind;10	**0,00**
SB167	1a/34	wind;10	**0,00**
SB168	1a/5	wind;10	**0,00**
SB168	1a/34	wind;10	**-0,10**
SB169	1a/5	wind;10	**0,00**
SB169	1a/34	wind;10	**-0,10**
SB170	1a/5	wind;10	**0,00**
SB170	1a/34	wind;10	**-0,10**
SB171	1a/5	wind;10	**0,00**
SB171	1a/34	wind;10	**0,00**
SB172	1a/5	wind;10	**0,00**
SB172	1a/34	wind;10	**0,00**
SB173	1a/29	wind;10	**0,00**
SB173	1a/16	wind;10	**0,00**
SB174	1a/29	wind;10	**0,00**
SB174	1a/16	wind;10	**0,00**
SB175	1a-p/35	wind;10	**0,00**

Staaf	BG	Geval beschrijving	N [kN]
SB175	1a/34	wind;10	**-0,10**
SB176	1a/29	wind;10	**0,00**
SB176	1a/16	wind;10	**0,00**
SB177	1a/16	wind;10	**0,00**
SB177	1a/34	wind;10	**-0,10**
SB178	1a/29	wind;10	**0,00**
SB178	1a/16	wind;10	**0,00**
SB179	1a/16	wind;10	**0,00**
SB179	1a/34	wind;10	**-0,10**
SB180	1a/16	wind;10	**0,00**
SB180	1a/34	wind;10	**-0,11**
SB181	1a/16	wind;10	**0,00**
SB181	1a/26	wind;10	**-0,11**
SB182	1a/16	wind;10	**0,00**
SB182	1a/26	wind;10	**0,00**
SB183	1a/16	wind;10	**0,00**
SB183	1a/26	wind;10	**0,00**
SB184	1a/16	wind;10	**0,00**
SB184	1a/26	wind;10	**-0,10**
SB185	1a/16	wind;10	**0,00**
SB185	1a/26	wind;10	**-0,10**
SB186	1a/16	wind;10	**0,00**
SB186	1a/26	wind;10	**-0,10**
SB187	1a/16	wind;10	**0,00**
SB187	1a/26	wind;10	**0,00**
SB188	1a/16	wind;10	**0,00**
SB188	1a/26	wind;10	**0,00**
SB189	1a-p/27	wind;10	**0,00**
SB189	1a/7	wind;10	**0,00**
SB190	1a-p/27	wind;10	**0,00**
SB190	1a/7	wind;10	**0,00**
SB191	1a-p/14	wind;10	**0,00**
SB191	1a/26	wind;10	**-0,10**
SB192	1a-p/27	wind;10	**0,00**
SB192	1a/7	wind;10	**0,00**
SB193	1a/7	wind;10	**0,00**
SB193	1a/26	wind;10	**-0,10**
SB194	1a-p/27	wind;10	**0,00**
SB194	1a/7	wind;10	**0,00**
SB195	1a/7	wind;10	**0,00**
SB195	1a/26	wind;10	**-0,10**
SB196	1a/7	wind;10	**0,00**
SB196	1a/26	wind;10	**-0,11**

11.2. Reacties

Lineaire berekening, Extreem : Knoop
Selectie : Alle
Klasse : All UGT

Steunpunt	BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Sn1/N1	1a-p/28	**-109,51**	**-117,80**	**-561,37**	0,00	0,00	0,00
Sn1/N1	1a/29	**162,34**	**169,61**	**822,87**	0,00	0,00	0,00
Sn1/N1	1a/154	29,16	28,67	143,91	**0,00**	**0,00**	**0,00**
Sn2/N3	1a/32	**-163,22**	**168,84**	**823,26**	0,00	0,00	0,00
Sn2/N3	1a-p/30	**107,06**	**-114,55**	**-545,81**	0,00	0,00	0,00
Sn2/N3	1a/154	-29,18	28,68	143,95	**0,00**	**0,00**	**0,00**
Sn3/N7	1a/34	**-153,53**	**-162,62**	**778,67**	0,00	0,00	0,00
Sn3/N7	1a-p/35	**118,87**	**124,20**	**-605,70**	0,00	0,00	0,00
Sn3/N7	1a/154	-20,87	-22,86	104,38	**0,00**	**0,00**	**0,00**
Sn4/N6	1a-p/27	**-117,96**	**124,94**	**-605,31**	0,00	0,00	0,00
Sn4/N6	1a/26	**149,34**	**-160,93**	**762,48**	0,00	0,00	0,00
Sn4/N6	1a/154	20,88	-22,89	104,42	**0,00**	**0,00**	**0,00**

11.3. Resultante op Fundering

Lineaire berekening, Extreem : Nee
Selectie : Alle
Klasse : All UGT

BG	Steunpunt	Extreem	horiz. component [kN]	resultante [kN]	Hoek [deg]	helling(afschot) [-]	Rx [kN]	Ry [kN]	Rz [kN]
1a-p/28	Sn1/N1	Rx	160,84	583,95	2,09	-3,49	-109,51	-117,80	-561,37
1a/29	Sn1/N1	Rx	234,78	855,71	-178,75	3,50	162,34	169,61	822,87
1a-p/28	Sn1/N1	Ry	160,84	583,95	2,09	-3,49	-109,51	-117,80	-561,37
1a/29	Sn1/N1	Ry	234,78	855,71	-178,75	3,50	162,34	169,61	822,87
1a-p/28	Sn1/N1	Rz	160,84	583,95	2,09	-3,49	-109,51	-117,80	-561,37
1a/29	Sn1/N1	Rz	234,78	855,71	-178,75	3,50	162,34	169,61	822,87
1a/32	Sn2/N3	Rx	195,78	550,71	-101,48	-2,63	-163,22	-108,11	-514,74
1a-p/30	Sn2/N3	Rx	194,51	815,72	101,61	4,07	107,06	162,40	792,19
1a-p/27	Sn2/N3	Ry	194,33	579,37	-98,88	-2,81	-156,97	-114,55	-545,81
1a/26	Sn2/N3	Ry	196,65	846,42	104,16	4,19	100,81	168,84	823,26
1a-p/27	Sn2/N3	Rz	194,33	579,37	-98,88	-2,81	-156,97	-114,55	-545,81
1a/26	Sn2/N3	Rz	196,65	846,42	104,16	4,19	100,81	168,84	823,26
1a/34	Sn3/N7	Rx	223,65	616,67	-178,35	-2,57	-153,53	-162,62	-574,69
1a-p/35	Sn3/N7	Rx	171,92	767,17	1,26	4,35	118,87	124,20	747,66
1a/34	Sn3/N7	Ry	223,65	616,67	-178,35	-2,57	-153,53	-162,62	-574,69
1a-p/35	Sn3/N7	Ry	171,92	767,17	1,26	4,35	118,87	124,20	747,66
1a-p/28	Sn3/N7	Rz	214,67	642,61	-178,32	-2,82	-147,28	-156,18	-605,70
1a/29	Sn3/N7	Rz	162,94	795,54	1,28	4,78	112,62	117,76	778,67
1a-p/27	Sn4/N6	Rx	194,37	635,75	97,63	-3,11	-117,96	-154,48	-605,31
1a/26	Sn4/N6	Rx	190,64	785,95	-96,57	4,00	149,34	118,49	762,48
1a/32	Sn4/N6	Ry	195,90	606,78	100,23	-2,93	-111,71	-160,93	-574,29
1a-p/30	Sn4/N6	Ry	189,95	755,72	-93,87	3,85	143,08	124,94	731,46
1a-p/27	Sn4/N6	Rz	194,37	635,75	97,63	-3,11	-117,96	-154,48	-605,31
1a/26	Sn4/N6	Rz	190,64	785,95	-96,57	4,00	149,34	118,49	762,48

11.4. Controle UNP profilen

11.4.1. Traverse 1 en 2 - onderrand

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - Onderrand Trav. 1en 2
Klasse : All UGT

Staalcontrole							
Staaf	css	BG	mat	dx [m]	Algehele toetsing [-]	Doorsnedetoetsing [-]	Stabiliteittoetsing [-]
S289	CS144 - UNP160	5a14/2	S 235	2,943	0,83	0,64	0,83

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - Onderrand Trav. 1en 2
Klasse : All UGT

Staalcontrole

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf S289	8,015 m	UNP160	S 235	5a14/2	0,83 -

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	15,73
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	43,99

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,48
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	19,17

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp
Kritische controle op positie 2.943 m

Interne krachten	Berekende	Eenheid
N,Ed	-95,83	kN
Vy,Ed	10,57	kN
Vz,Ed	1,72	kN
T,Ed	0,02	kNm
My,Ed	-3,69	kNm
Mz,Ed	-2,98	kNm

Drukcontrole
Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	2,4000e-03	m^2
Nc,Rd	564,00	kN
Eenheidscontrole	0,17	-

Torsiecontrole
Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	2,4	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,02	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 52
Omschrijving	Controle berekening
Nationale norm	EC - EN
Auteur	MG

Staalcontrole

Afschuivingscontrole voor Vy

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,3650e-03	m^2
Vpl,y,Rd	185,20	kN
Eenheidscontrole	0,06	-

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,2240e-03	m^2
Vpl,z,Rd	166,07	kN
Eenheidscontrole	0,01	-

Controle buigend moment voor My

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	1,3760e-04	m^3
Mpl,y,Rd	32,34	kNm
Eenheidscontrole	0,11	-

Controle buigend moment voor Mz

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	3,5200e-05	m^3
Mpl,z,Rd	8,27	kNm
Eenheidscontrole	0,36	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht

Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	564,00	kN
Mpl,y,Rd	32,34	kNm
Mpl,z,Rd	8,27	kNm

Eenheidscontrole (6.2) = 0,17 + 0,11 + 0,36 = 0,64 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.

De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Classificatie voor staafknikontwerp

Beslissende positie voor stabiliteitsclassificatie: 2,943 m

Classificatie van interne drukonderdelen

Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	15,73
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	43,99

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen

Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,48
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	19,17

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp

Buigingsknik Controle

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	geschoord	geschoord	
Systeemlengte L	5.073	0.360	m
lef/lsys k	1.00	1.00	
Kniklengte Lcr	5.050	0.360	m
Kritische Euler belastingen Ncr	751.90	13647.68	kN
Slankheid	81.34	19.09	
Relatieve slankheid Lambda	0.87	0.20	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.62	1.00	
Knikweerstand Nb,Rd	350.13	563.05	kN

Tabel van waarden		
A	2.4000e-03	m^2

Tabel van waarden		
Knikweerstand Nb,Rd	350.13	kN
Eenheidscontrole	0.27	-

Torsieknikcontrole

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	0.360	m
Ncr,T	11372.81	kN
Ncr,TF	737.76	kN
Relatieve slankheid Lambda,T	0.87	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	2.4000e-03	m^2
Reductie factor Chi	0.62	
Knikweerstand Nb,Rd	347.24	kN
Eenheidscontrole	0.28	-

Kipcontrole

Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	1.1600e-04	m^3
Elastisch critisch moment Mcr	1034.71	kNm
Relatieve slankheid Lambda,LT	0.16	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	0.360	m
k	1.00	
kw	1.00	
C1	1.09	
C2	0.00	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging

Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)

Interactie Methode 2

Tabel van waarden		
kyy	0.457	
kyz	0.603	
kzy	0.997	
kzz	0.603	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	2.4000e-03	m^2
Wy	1.1600e-04	m^3
Wz	1.8300e-05	m^3
NRk	564.00	kN
My,Rk	27.26	kNm
Mz,Rk	4.30	kNm
My,Ed	-3.69	kNm
Mz,Ed	-2.98	kNm
Interactie Methode 2		
Psi y	-0.012	
Psi z	-0.279	
Cmy	0.400	
Cmz	0.591	
CmLT	0.933	

Eenheidscontrole (6.61) = 0.27 + 0.06 + 0.42 = 0.75

Eenheidscontrole (6.62) = 0.28 + 0.13 + 0.42 = 0.83

Plooicontrole

in knikveld 1

Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	18.533

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.

De staaf voldoet aan de stabiliteitscontrole.

11.4.2. Traverse 2 en 3 - onderrand

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - Onderrand Trav. 3 en 4
Klasse : All UGT

Staalcontrole							
Staaf	css	BG	mat	dx [m]	Algehele toetsing [-]	Doorsnedetoetsing [-]	Stabiliteittoetsing [-]
S171	CS101 - UNP120	5a5/10	S 235	0,000	0,30	0,20	0,30

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - Onderrand Trav. 3 en 4
Klasse : All UGT

Staalcontrole

EN 1993-1-1 Norm Controle

Nationale bijlage: Nederlandse NEN-EN NA

Staaf S171	3,073 m	UNP120	S 235	5a5/10	0,30 -

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Classificatie voor doorsnede-ontwerp

Volgens EN 1993-1-1 artikel 5.5.2

Classificatie van interne drukonderdelen

Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	12,00
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	44,59

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen

Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,33
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,89

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp

Kritische controle op positie 0.000 m

Interne krachten	Berekende	Eenheid
N,Ed	-72,52	kN
Vy,Ed	0,00	kN
Vz,Ed	0,45	kN
T,Ed	0,00	kNm
My,Ed	-0,36	kNm
Mz,Ed	-0,01	kNm

Drukcontrole

Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	1,7000e-03	m^2
Nc,Rd	399,50	kN
Eenheidscontrole	0,18	-

Torsiecontrole

Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,9	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,01	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	9,9000e-04	m^2
Vpl,y,Rd	134,32	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	8,5400e-04	m^2
Vpl,z,Rd	115,87	kN
Eenheidscontrole	0,00	-

Controle buigend moment voor My

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	7,2600e-05	m^3
Mpl,y,Rd	17,06	kNm
Eenheidscontrole	0,02	-

Controle buigend moment voor Mz

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	2,1200e-05	m^3
Mpl,z,Rd	4,98	kNm
Eenheidscontrole	0,00	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht

Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	399,50	kN
Mpl,y,Rd	17,06	kNm
Mpl,z,Rd	4,98	kNm

Eenheidscontrole (6.2) = 0,18 + 0,02 + 0,00 = 0,20 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Classificatie voor staafknikontwerp

Beslissende positie voor stabiliteitsclassificatie: 0,000 m

Classificatie van interne drukonderdelen

Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	12,00
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	44,59

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen

Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,33
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,89

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp

Buigingsknik Controle

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	geschoord	geschoord	
Systeemlengte L	3.073	1.220	m
lef/lsys k	1.00	0.69	
Kniklengte Lcr	3.068	0.843	m
Kritische Euler belastingen Ncr	801.34	1259.81	kN
Slankheid	66.31	52.88	
Relatieve slankheid Lambda	0.71	0.56	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.72	0.81	
Knikweerstand Nb,Rd	288.01	322.40	kN

Tabel van waarden		
A	1.7000e-03	m^2
Knikweerstand Nb,Rd	288.01	kN
Eenheidscontrole	0.25	-

Torsieknikcontrole

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	1.220	m
Ncr,T	1349.67	kN

Tabel van waarden		
Ncr,TF	624.96	kN
Relatieve slankheid Lambda,T	0.80	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	1.7000e-03	m^2
Reductie factor Chi	0.66	
Knikweerstand Nb,Rd	264.65	kN
Eenheidscontrole	0.27	-

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	6.0700e-05	m^3
Elastisch critisch moment Mcr	119.48	kNm
Relatieve slankheid Lambda,LT	0.35	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.220	m
k	1.00	
kw	1.00	
C1	2.22	
C2	0.06	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging
Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)
Interactie Methode 2

Tabel van waarden		
kyy	0.443	
kyz	0.943	
kzy	0.970	
kzz	0.943	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	1.7000e-03	m^2
Wy	6.0700e-05	m^3
Wz	1.1100e-05	m^3
NRk	399.50	kN
My,Rk	14.26	kNm
Mz,Rk	2.61	kNm
My,Ed	-0.36	kNm
Mz,Ed	-0.01	kNm
Interactie Methode 2		
Psi y	-0.071	
Psi z	0.690	
Cmy	0.400	
Cmz	0.876	
CmLT	0.458	

Eenheidscontrole (6.61) = 0.25 + 0.01 + 0.00 = 0.27
Eenheidscontrole (6.62) = 0.27 + 0.02 + 0.00 = 0.30

Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	14.571

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.
De staaf voldoet aan de stabiliteitscontrole.

11.4.3. Vak 9 - onderrand

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - Onderrand: Vak 9
Klasse : All UGT

Staalcontrole							
Staaf	css	BG	mat	dx [m]	Algehele toetsing [-]	Doorsnedetoetsing [-]	Stabiliteittoetsing [-]
S492	CS144 - UNP160	1a/5	S 235	1,720	0,68	0,48	0,68

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - Onderrand: Vak 9

Klasse : All UGT

Staalcontrole

EN 1993-1-1 Norm Controle

Nationale bijlage: Nederlandse NEN-EN NA

Staaf S492	**1,720 m**	**UNP160**	**S 235**	**1a/5**	**0,68 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Classificatie voor doorsnede-ontwerp

Volgens EN 1993-1-1 artikel 5.5.2

Classificatie van interne drukonderdelen

Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	15,73
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	55,22

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen

Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,48
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,92

=> Uitkragende flenzen klasse 1

=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp

Kritische controle op positie 1.720 m

Interne krachten	Berekende	Eenheid
N,Ed	-172,41	kN
Vy,Ed	0,10	kN
Vz,Ed	-3,09	kN
T,Ed	0,00	kNm
My,Ed	-4,92	kNm
Mz,Ed	0,18	kNm

Drukcontrole

Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	2,4000e-03	m^2
Nc,Rd	564,00	kN
Eenheidscontrole	0,31	-

Torsiecontrole

Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,2	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,3650e-03	m^2
Vpl,y,Rd	185,20	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,2240e-03	m^2
Vpl,z,Rd	166,07	kN
Eenheidscontrole	0,02	-

Controle buigend moment voor My

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	1,3760e-04	m^3

Staalcontrole

Mpl,y,Rd	32,34	kNm
Eenheidscontrole	0,15	-

Controle buigend moment voor Mz

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	3,5200e-05	m^3
Mpl,z,Rd	8,27	kNm
Eenheidscontrole	0,02	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht

Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	564,00	kN
Mpl,y,Rd	32,34	kNm
Mpl,z,Rd	8,27	kNm

Eenheidscontrole (6.2) = 0,31 + 0,15 + 0,02 = 0,48 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.

De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Classificatie voor staafknikontwerp

Beslissende positie voor stabiliteitsclassificatie: 0,000 m

Classificatie van interne drukonderdelen

Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	15,73
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	42,00

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen

Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,48
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	14,00

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp

Buigingsknik Controle

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	geschoord	geschoord	
Systeemlengte L	1.720	1.720	m
lef/lsys k	0.96	0.83	
Kniklengte Lcr	1.650	1.432	m
Kritische Euler belastingen Ncr	7042.50	862.57	kN
Slankheid	26.58	75.94	
Relatieve slankheid Lambda	0.28	0.81	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.96	0.66	
Knikweerstand Nb,Rd	540.21	370.40	kN

Tabel van waarden		
A	2.4000e-03	m^2
Knikweerstand Nb,Rd	370.40	kN
Eenheidscontrole	0.47	-

Torsieknikcontrole

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	1.720	m
Ncr,T	1486.49	kN
Ncr,TF	1391.77	kN
Relatieve slankheid Lambda,T	0.64	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	2.4000e-03	m^2
Reductie factor Chi	0.76	
Knikweerstand Nb,Rd	430.61	kN
Eenheidscontrole	0.40	-

Kipcontrole

Staalcontrole

Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	1.1600e-04	m^3
Elastisch critisch moment Mcr	131.03	kNm
Relatieve slankheid Lambda,LT	0.46	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.720	m
k	1.00	
kw	1.00	
C1	1.82	
C2	0.01	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging

Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)

Interactie Methode 2

Tabel van waarden		
kyy	0.616	
kyz	1.030	
kzy	0.944	
kzz	1.030	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	2.4000e-03	m^2
Wy	1.1600e-04	m^3
Wz	1.8300e-05	m^3
NRk	564.00	kN
My,Rk	27.26	kNm
Mz,Rk	4.30	kNm
My,Ed	-4.92	kNm
Mz,Ed	0.18	kNm
Interactie Methode 2		
Psi y	0.000	
Psi z	0.000	
Cmy	0.584	
Cmz	0.840	
CmLT	0.584	

Eenheidscontrole (6.61) = 0.32 + 0.11 + 0.04 = 0.47

Eenheidscontrole (6.62) = 0.47 + 0.17 + 0.04 = 0.68

Plooicontrole

in knikveld 1

Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	18.533

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.

De staaf voldoet aan de stabiliteitscontrole.

11.4.4. Vak 12 - onderrand

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - Onderrand: Vak 12
Klasse : All UGT

Staalcontrole

Staaf	css	BG	mat	dx [m]	Algehele toetsing [-]	Doorsnedetoetsing [-]	Stabiliteittoetsing [-]
S631	CS101 - UNP120	3-p/9	S 235	2,498	0,64	0,41	0,64

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - Onderrand: Vak 12
Klasse : All UGT

Staalcontrole

EN 1993-1-1 Norm Controle

Nationale bijlage: Nederlandse NEN-EN NA

Staaf S631	**4,465 m**	**UNP120**	**S 235**	**3-p/9**	**0,64 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Staalcontrole

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Classificatie voor doorsnede-ontwerp

Volgens EN 1993-1-1 artikel 5.5.2

Classificatie van uitkragende flenzen

Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,33
Grenswaarde klasse 1	224,09
Grenswaarde klasse 2	248,99
Grenswaarde klasse 3	29,24

=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp

Kritische controle op positie 2.498 m

Interne krachten	Berekende	Eenheid
N,Ed	-33,56	kN
Vy,Ed	-5,36	kN
Vz,Ed	-0,11	kN
T,Ed	0,00	kNm
My,Ed	0,33	kNm
Mz,Ed	1,51	kNm

Drukcontrole

Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	1,7000e-03	m^2
Nc,Rd	399,50	kN
Eenheidscontrole	0,08	-

Torsiecontrole

Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,3	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	9,9000e-04	m^2
Vpl,y,Rd	134,32	kN
Eenheidscontrole	0,04	-

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	8,5400e-04	m^2
Vpl,z,Rd	115,87	kN
Eenheidscontrole	0,00	-

Controle buigend moment voor My

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	7,2600e-05	m^3
Mpl,y,Rd	17,06	kNm
Eenheidscontrole	0,02	-

Controle buigend moment voor Mz

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	2,1200e-05	m^3
Mpl,z,Rd	4,98	kNm
Eenheidscontrole	0,30	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht

Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	399,50	kN
Mpl,y,Rd	17,06	kNm
Mpl,z,Rd	4,98	kNm

Eenheidscontrole (6.2) = 0,08 + 0,02 + 0,30 = 0,41 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.

Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.

De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Classificatie voor staafknikontwerp

Beslissende positie voor stabiliteitsclassificatie: 2,145 m

Classificatie van interne drukonderdelen

Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	12,00
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	45,55

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen

Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,33
Grenswaarde klasse 1	26,62
Grenswaarde klasse 2	29,58
Grenswaarde klasse 3	19,14

=> Uitkragende flenzen klasse 1

=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp

Buigingsknik Controle

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	geschoord	geschoord	
Systeemlengte L	1.967	0.710	m
lef/lsys k	0.98	0.85	
Kniklengte Lcr	1.922	0.602	m
Kritische Euler belastingen Ncr	2042.28	2467.42	kN
Slankheid	41.54	37.79	
Relatieve slankheid Lambda	0.44	0.40	
Limiet slankheid Lambda,0	0.20	0.20	

De slankheid of de normaalkracht is van die aard dat een Buigingsknikcontrole niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.1.2(4)

Torsieknikcontrole

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	0.710	m
Ncr,T	2147.57	kN
Ncr,TF	1331.44	kN
Relatieve slankheid Lambda,T	0.55	
Limiet slankheid Lambda,0	0.20	

De slankheid of de normaalkracht is van die aard dat Torsie (-Buig) Knik effecten mogen verwaarloosd worden volgens EN 1993-1-1 artikel 6.3.1.2(4)

Kipcontrole

Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	6.0700e-05	m^3
Elastisch critisch moment Mcr	142.14	kNm
Relatieve slankheid Lambda,LT	0.32	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	0.710	m
k	1.00	
kw	1.00	
C1	1.22	
C2	0.02	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging

Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)

Interactie Methode 2

Tabel van waarden		
kyy	0.409	
kyz	0.887	
kzy	0.997	
kzz	0.887	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	1.7000e-03	m^2
Wy	6.0700e-05	m^3
Wz	1.1100e-05	m^3
NRk	399.50	kN
My,Rk	14.26	kNm
Mz,Rk	2.61	kNm
My,Ed	-0.60	kNm

Staalcontrole

Tabel van waarden		
Mz,Ed	1.52	kNm
Interactie Methode 2		
Psi y	-0.550	
Psi z	0.865	
Cmy	0.400	
Cmz	0.869	
CmLT	0.843	

Eenheidscontrole (6.61) = 0.08 + 0.02 + 0.52 = 0.62
Eenheidscontrole (6.62) = 0.08 + 0.04 + 0.52 = 0.64

Plooicontrole

in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	14.571

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.
De staaf voldoet aan de stabiliteitscontrole.

11.5. Controle verzwaarde randstaaf van Vak 2

11.5.1. Randen : Vak 2

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - Randstaven: Vak 2
Klasse : All UGT

Staalcontrole

Staaf	css	BG	mat	dx [m]	Algehele toetsing [-]	Doorsnedetoetsing [-]	Stabiliteittoetsing [-]
C6	CS167 - 2LX	1a/32	S 235	0,000	0,57	0,53	0,57

11.5.2. Randen : Vak 2

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - Randstaven: Vak 2
Klasse : All UGT

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf C6	3,374 m	2LX (L140X13; 15)	S 235	1a/32	0,57 -

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

Waarschuwing: Sterktereductie gerelateerd aan de dikte wordt niet ondersteund voor dit type doorsnede.

...::DOORSNEDE CONTROLE::...

Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Waarschuwing: Classificatie wordt niet ondersteund voor dit type doorsnede.
De doorsnede wordt gecontroleerd als elastisch, klasse 3.

Kritische controle op positie 0.000 m

As definitie :
- hoofd y- as in deze normcontrole verwijst naar de hoofd z as in Scia Engineer
- hoofd z- as in deze normcontrole verwijst naar de hoofd y as in Scia Engineer

Interne krachten	Berekende	Eenheid
N,Ed	-865,74	kN
Vy,Ed	0,00	kN
Vz,Ed	-0,12	kN
T,Ed	0,00	kNm
My,Ed	0,00	kNm
Mz,Ed	0,00	kNm

Drukcontrole
Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	6,9912e-03	m^2
Nc,Rd	1642,93	kN
Eenheidscontrole	0,53	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.19)

Tau,Vz,Ed	8,2	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,06	-

Opmerking: Er is geen afschuifoppervlak opgegeven voor deze doorsnede/bouwwijze, waardoor de plastische afschuifweerstand niet kan worden bepaald. Het gevolg is dat de elastische afschuifweerstand volgens EN 1993-1-1 artikel 6.2.6(4) wordt getoetst.

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1(5) en formule (6.1)

Elastische toetsing		
Vezel	1	
Sigma,N,Ed	123,8	MPa
Sigma,My,Ed	0,0	MPa
Sigma,Mz,Ed	0,0	MPa
Sigma,tot,Ed	123,8	MPa
Tau,Vy,Ed	0,0	MPa
Tau,Vz,Ed	8,2	MPa
Tau,t,Ed	0,0	MPa
Tau,tot,Ed	8,2	MPa
Sigma,von Mises,Ed	124,7	MPa
Eenheidscontrole	0,53	-

De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Buigingsknik Controle
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Slankheidsgegevens (EN 50341-1) voor : Staaf met symmetrische schoren		
L	1.687	m
ivv	53.85	mm
Knikkromme	c	
Kritische slankheid	31.33	
Effectieve slankheid	0.33	
Knikfactor (omega_buc)	0.93	
UC slankheid	0.26	
Limiet slankheid	120.00	

Tabel van waarden		
A	6.9912e-03	m^2
Knikweerstand Nb,Rd	1531.10	kN
Eenheidscontrole	0.57	-

Torsieknikcontrole
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	1.687	m
Ncr,T	14629.28	kN
Ncr,TF	16249.59	kN
Relatieve slankheid Lambda,T	0.34	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	6.9912e-03	m^2
Reductie factor Chi	0.93	
Knikweerstand Nb,Rd	1529.81	kN
Eenheidscontrole	0.57	-

Controle druk en buiging
Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)
Interactie Methode 2

Tabel van waarden		
kyy	0.779	
kyz	0.779	
kzy	0.979	
kzz	0.779	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	6.9912e-03	m^2
Wy	3.0936e-04	m^3
Wz	2.0480e-04	m^3
NRk	1642.93	kN
My,Rk	72.70	kNm
Mz,Rk	48.13	kNm
My,Ed	-0.11	kNm
Mz,Ed	0.00	kNm

Tabel van waarden		
Interactie Methode 2		
Psi y	0.000	
Psi z	0.000	
Cmy	0.700	
Cmz	0.700	
CmLT	0.700	

Eenheidscontrole (6.61) = 0.57 + 0.00 + 0.00 = 0.57
Eenheidscontrole (6.62) = 0.57 + 0.00 + 0.00 = 0.57

De staaf voldoet aan de stabiliteitscontrole.

Bijlage C Controle staven mastlichaam

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-900,0* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*696,7* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : ***H150/150/14*** (*1)

h	=	*150*	mm	I_y	=	*8453963*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*78326*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*200966*	mm^3
y_s	=	*42,1*	mm	i_y	=	*45,8*	mm
A_{bruto}	=	*4031*	mm^2	i_v	=	*29,1*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2190*	mm	No. bolts / end / flange	=	*5*	**(Per flange !)**
$L_{v;cr}$	=	*2190*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a{*}L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*75*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,81**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**75**	**< 120**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,31**	**> 1 !!**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**1,33**	**> 1 !!**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,60**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,33 = 133%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - randen* — verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-900,0* kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*696,7* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0* kN	
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0* kN	

Angle profile : *H150/150/14* (*1)

h	=	*150* mm	I_y	=	*8453963* mm^4
b	=	*150* mm	$W_{y;el;eff.1}$	=	*78326* mm^3
t_f	=	*14* mm	$W_{y;el;eff.2}$	=	*200966* mm^3
y_s	=	*42,1* mm	i_y	=	*45,8* mm
A_{bruto}	=	*4031* mm^2	i_v	=	*29,1* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*730* mm	No. bolts / end / flange	=	*5* (Per flange !)
$L_{v;cr}$	=	*730* mm	Type of bolts M / "	=	*24*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*40* mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*75* mm
$L_{perpendicular force}$	=	*0* mm	Edge distance bolt e2	=	*40* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*
Column profile?	=	*2* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*14* mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,81** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **25** < 120

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,97** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,66** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,60** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,97 = 97%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-65,7	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	63,4	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN
Angle profile :		H180/90/10 (*1)					
h	=	180	mm	I_y	=	8803399	mm^4
b	=	90	mm	$W_{y;el;eff.1}$	=	54516	mm^3
t_f	=	10	mm	$W_{y;el;eff.2}$	=	475424	mm^3
y_s	=	18,5	mm	i_y	=	58,0	mm
A_{bruto}	=	2621	mm^2	i_v	=	19,2	mm
Material :							
Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	12292	mm	No. bolts / end / flange	=	2	
$L_{v;cr}$	=	2458	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	40	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	10	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,22** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **212** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,55** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,48** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,49** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,55 = 55%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - 1e en 2e hor knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-8,8* kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*8,8* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50* mm	I_y	=	*103800*	mm^4
b	=	*40* mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7* mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427* mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1520* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1520* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1520* mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,23** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,92** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **181** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,39** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,49** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,48** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,92 = 92%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - 3e hor. knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-8,8* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*8,8* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2280*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2280*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*2280*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,23** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **1,19** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **237** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,57** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,70** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,48** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **U.C$_{max}$ = 1,19 = 119%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - 3e hor. knikverkorters* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-8,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*8,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :			*H50/50/8*	(*1)				
h		=	*50*	mm	I_y	=	*162828*	mm^4
b		=	*50*	mm	$W_{y;el;eff.1}$	=	*4684*	mm^3
t_f		=	*8*	mm	$W_{y;el;eff.2}$	=	*10685*	mm^3
y_s		=	*15,2*	mm	i_y	=	*14,8*	mm
A_{bruto}		=	*741*	mm^2	i_v	=	*9,6*	mm
Material :								
Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:								
$L_{y;cr}$		=	*2280*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$		=	*2280*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)		=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)		=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$		=	*2280*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?		=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate		=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,15**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,78**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**238**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,37**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,47**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,15**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,48**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,78 = 78%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - 4e hor. knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-8,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*8,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* (*1)

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3040*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3040*	mm	Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*3040*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,20** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,92** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **263** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,48** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,58** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,48** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,92 = 92%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *1e en 2e schuine knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-25,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*25,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=		kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2169* mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$	=	*2169* mm	Type of bolts	M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	e1	=	*25* mm
a*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt	e2	=	*22* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2		=	*2*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,67**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**258**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**2,14**	**> 1 !!**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**2,35**	**> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,42**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**1,37**	**> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 2,35 = 235%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *1e,2e schuine knikverkorters L50/40/5* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	-25,1	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	25,1	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=		kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H60/60/8 (*1)

h	=	60	mm	I_y	=	291532	mm^4
b	=	60	mm	$W_{y;el;eff.1}$	=	6890	mm^3
t_f	=	8	mm	$W_{y;el;eff.2}$	=	16481	mm^3
y_s	=	17,7	mm	i_y	=	18,0	mm
A_{bruto}	=	903	mm^2	i_v	=	11,5	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2169	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	723	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	25	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	22	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	10	mm	Dubble strap joint no=1, yes=2	=	2	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,42** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **121** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,27** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,49** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,21** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,85** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - 3e schuine knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-10,9* kN		***Combined forces diagonal:***		
Tension: N_{Sd}	=	*10,9* kN		$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0* kN
$F_{perpend.;s;d}$	=	*0* kN		$N_{comb2;c;s;d}$ (max. compression)	=	*0* kN

Angle profile : *H50/40/5* (*1)

h	=	*50* mm	I_y	=	*103800* mm^4
b	=	*40* mm	$W_{y;el;eff.1}$	=	*2638* mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*9746* mm^3
y_s	=	*10,7* mm	i_y	=	*15,6* mm
A_{bruto}	=	*427* mm^2	i_v	=	*8,4* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2827* mm	No. bolts / end / flange	=	*1*
$L_{v;cr}$	=	*2827* mm	Type of bolts M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*25* mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*70* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*22* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*7* mm	Dubble strap joint no=1, yes=2	=	*2*

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,29**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**336**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,53**	**> 1 !!**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**1,64**	**> 1 !!**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,18**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,59**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,64 = 164%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - 3e schuine knikverkorters* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-10,9*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*10,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2827*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*723*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,29** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **181** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,49** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,61** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,18** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,59** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,61 = 61%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *4e schuine knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-9,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*9,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3371*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3371*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,26**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**351**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,32**	**> 1 !!**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**1,45**	**> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,16**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,53**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,45 = 145%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *4e schuine knikverkorters* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-9,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*9,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3371*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1124*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,26** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **223** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,56** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,74** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,16** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,53** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,74 = 74%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 - randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-860,7* kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*673,2* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H140/140/13* (*1)

h	=	*140* mm	I_y	=	*6385392*	mm^4
b	=	*140* mm	$W_{y;el;eff.1}$	=	*63366*	mm^3
t_f	=	*13* mm	$W_{y;el;eff.2}$	=	*162768*	mm^3
y_s	=	*39,2* mm	i_y	=	*42,7*	mm
A_{bruto}	=	*3495* mm^2	i_v	=	*27,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1687* mm	No. bolts / end / flange	=	*4*	**(Per flange !)**
$L_{v;cr}$	=	*1687* mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*40*	mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*75*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,92** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **62** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,30** **> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,59** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,78** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,59 = 159%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 - diagonalen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-57,8* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*64,3* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/75/7* (*1)

h	=	*100*	mm	I_y	=	*1179878*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s	=	*18,3*	mm	i_y	=	*31,5*	mm
A_{bruto}	=	*1187*	mm^2	i_v	=	*15,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2458*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2458*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*45*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*13*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,59**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**154**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,71**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,89**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,95**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,92**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,95 = 95%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 - hor. kikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	-7,5 kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	7,5 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)		=	0 kN
	$F_{perpend.;s;d}$	=	1,5 kN	$N_{comb2;c;s;d}$ (max. compression)		=	0 kN

Angle profile : H50/40/5 (*1)

h	=	50 mm	I_y	=	103800 mm^4
b	=	40 mm	$W_{y;el;eff.1}$	=	2638 mm^3
t_f	=	5 mm	$W_{y;el;eff.2}$	=	9746 mm^3
y_s	=	10,7 mm	i_y	=	15,6 mm
A_{bruto}	=	427 mm^2	i_v	=	8,4 mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1900 mm	No. bolts / end / flange	=	1
$L_{v;cr}$	=	1900 mm	Type of bolts M / "	=	16
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt e1	=	25 mm
a^*L_{tot} (with comb. buckling)	=	0 mm	Centre-centre spacing bolt s1	=	70 mm
$L_{perpendicular\ force}$	=	1900 mm	Edge distance bolt e2	=	40 mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6
Column profile?	=	1 no=1, yes=2	Rolled screw threads	=	1
Thickness tie plate	=	13 mm	Dubble strap joint no=1, yes=2	=	1

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,08**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**1,15**	**> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**226**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,50**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,59**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,25**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,28**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,15 = 115%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 - hor. kikverkorters* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-7,5* kN		***Combined forces diagonal:***			
Tension: N_{Sd}	=	*7,5* kN		$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0* kN	
$F_{perpend.;s;d}$	=	*1,5* kN		$N_{comb2;c;s;d}$ (max. compression)	=	*0* kN	

Angle profile : *H50/50/6* (*1)

h	=	*50* mm	I_y	=	*128406* mm^4
b	=	*50* mm	$W_{y;el;eff.1}$	=	*3612* mm^3
t_f	=	*6* mm	$W_{y;el;eff.2}$	=	*8883* mm^3
y_s	=	*14,5* mm	i_y	=	*15,0* mm
A_{bruto}	=	*569* mm^2	i_v	=	*9,6* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1900* mm	No. bolts / end / flange	=	*1*
$L_{v;cr}$	=	*1900* mm	Type of bolts M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*25* mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*70* mm
$L_{perpendicular force}$	=	*1900* mm	Edge distance bolt e2	=	*40* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*13* mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,07** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,84** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **198** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,29** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,39** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,12** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,23** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,84 = 84%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2* *schuin kikverkorter*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-13,7* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*13,7* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0* kN	
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0* kN	

Angle profile : *H50/40/5* (*1)

h	=	*50* mm	I_y	=	*103800* mm^4
b	=	*40* mm	$W_{y;el;eff.1}$	=	*2638* mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*9746* mm^3
y_s	=	*10,7* mm	i_y	=	*15,6* mm
A_{bruto}	=	*427* mm^2	i_v	=	*8,4* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2621* mm	No. bolts / end / flange	=	*1*
$L_{v;cr}$	=	*2621* mm	Type of bolts M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*25* mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*70* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*40* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*13* mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,15** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **312** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,66** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,80** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,45** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,51** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,80 = 180%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 - schuin kikverkorter* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-13,7*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*13,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/8* (*1)

h	=	*50*	mm	I_y	=	*162828*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*4684*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*10685*	mm^3
y_s	=	*15,2*	mm	i_y	=	*14,8*	mm
A_{bruto}	=	*741*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2621*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2621*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*13*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,10**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**274**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,75**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,90**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,23**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,32**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,90 = 90%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14008
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 52

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak3* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-744,9* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*574,4* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)		=	*0* kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)		=	*0* kN

Angle profile : *H140/140/13* (*1)

h	=	*140* mm	I_y	=	*6385392* mm^4
b	=	*140* mm	$W_{y;el;eff.1}$	=	*63366* mm^3
t_f	=	*13* mm	$W_{y;el;eff.2}$	=	*162768* mm^3
y_s	=	*39,2* mm	i_y	=	*42,7* mm
A_{bruto}	=	*3495* mm^2	i_v	=	*27,2* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1768* mm	No. bolts / end / flange		=	*4* **(Per flange !)**
$L_{v;cr}$	=	*1768* mm	Type of bolts	M / "	=	*24*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	e1	=	*40* mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt	s1	=	*75* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt	e2	=	*40* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*2* no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate	=	*14* mm	Dubble strap joint no=1, yes=2		=	*1*

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,79**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**65**	**< 120**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,15**	**> 1 !!**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**1,37**	**> 1 !!**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,67**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 1,37 = 137%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak3 - randen* *verzwaard*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-744,9 kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	574,4 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0 kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H140/140/13 (*1)

h	=	140 mm	I_y	=	6385392	mm^4
b	=	140 mm	$W_{y;el;eff.1}$	=	63366	mm^3
t_f	=	13 mm	$W_{y;el;eff.2}$	=	162768	mm^3
y_s	=	39,2 mm	i_y	=	42,7	mm
A_{bruto}	=	3495 mm^2	i_v	=	27,2	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	884 mm	No. bolts / end / flange	=	4	(Per flange !)
$L_{v;cr}$	=	884 mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt e1	=	40	mm
$a*L_{tot}$ (with comb. buckling)	=	0 mm	Centre-centre spacing bolt s1	=	75	mm
$L_{perpendicular\ force}$	=	0 mm	Edge distance bolt e2	=	40	mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	2 no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	14 mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,79	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	33	< 120
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,96	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,69	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,67	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,96 = 96%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3* *diagonalen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-67,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*60,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/75/7* (*1)

h	=	*100*	mm	I_y	=	*1179878*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s	=	*18,3*	mm	i_y	=	*31,5*	mm
A_{bruto}	=	*1187*	mm^2	i_v	=	*15,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5028* mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$	=	*2514* mm	Type of bolts	M / "	=	*24*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	e1	=	*45* mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate	=	*7* mm	Dubble strap joint no=1, yes=2		=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,68** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **159** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,87** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,23** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,00** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,05** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,23 = 123%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3 - diagonalen* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-67,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*60,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100*	mm	I_y	=	*1766764*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2*	mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5028*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2514*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*45*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,48** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **166** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,89** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,50** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,92** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,92 = 92%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3* *horizontaal*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-7,4*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*5,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/6* (*1)

h	=	*70*	mm	I_y	=	*368840*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*7272*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*19129*	mm^3
y_s	=	*19,3*	mm	i_y	=	*21,3*	mm
A_{bruto}	=	*813*	mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3353*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3353*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*3353*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,06**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,74**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**248**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,31**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,38**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,25**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,18**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,74 = 74%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3* *hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-7,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*7,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1676*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*1676*	mm	Type of bolts	M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1676*	mm	Edge distance bolt	e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,10** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **1,01** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **199** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,40** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,48** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,25** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,28** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,01 = 101%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3* *hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-7,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*7,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* [*1]

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1676* mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$	=	*1676* mm	Type of bolts	M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	e1	=	*25* mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$	=	*1676* mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*8,8*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate	=	*7* mm	Dubble strap joint no=1, yes=2		=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,10** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,88** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **174** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,28** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,38** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,12** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,28** < 1

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,88 = 88%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3 -* *schuine knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-10,5* kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*10,5* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* [(*1)]

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2356*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*2356*	mm	Type of bolts	M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt	e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,14**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**280**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,05**	**> 1 !!**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**1,17**	**> 1 !!**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,35**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,39**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 1,17 = 117%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3 - schuine knikverkorters* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd} =	*-10,52*	kN	***Combined forces diagonal:***			
Tension: N_{Sd} =	*10,52*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* [(*1)]

h =	*50*	mm	I_y	=	*103800*	mm^4
b =	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f =	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s =	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto} =	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510 =	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$ =	*2356*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$ =	*1178*	mm	Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$ =	*0*	mm	End distance bolt e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$ =	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$ =	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force =	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile? =	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate =	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,14** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **151** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,34** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,47** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,35** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,47 = 47%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-590,2* kN		***Combined forces diagonal:***		
Tension: N_{Sd}	=	*423,4* kN		$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0* kN
$F_{perpend.;s;d}$	=	*0* kN		$N_{comb2;c;s;d}$ (max. compression)	=	*0* kN

Angle profile : *H130/130/12* (*1)

h	=	*130* mm	I_y	=	*4721746* mm^4
b	=	*130* mm	$W_{y;el;eff.1}$	=	*50442* mm^3
t_f	=	*12* mm	$W_{y;el;eff.2}$	=	*129742* mm^3
y_s	=	*36,4* mm	i_y	=	*39,7* mm
A_{bruto}	=	*2997* mm^2	i_v	=	*25,2* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1784* mm	No. bolts / end / flange	=	*4* **(Per flange !)**
$L_{v;cr}$	=	*1784* mm	Type of bolts M / "	=	*24*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*40* mm
$a{*}L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*75* mm
$L_{perpendicular force}$	=	*0* mm	Edge distance bolt e2	=	*40* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*2* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*14* mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,69**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**71**	**< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,11**	**> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**1,09**	**> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,53**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,11 = 111%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4 - randen* *verzwaard*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-590,2*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*423,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*892*	mm	No. bolts / end / flange	=	*4*	(Per flange !)
$L_{v;cr}$	=	*892*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*75*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = 0,69 < 1

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = n.v.t. < 1

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = 35 < 120

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = 0,90 < 1

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = n.v.t. < 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = n.v.t. < 1

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = n.v.t. < 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = n.v.t. < 1

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = 0,54 < 1

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = 0,53 < 1

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,90 = 90%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *diagonalen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-64,0* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*71,4* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)		=	*0* kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)		=	*0* kN

Angle profile : *H100/75/7* (*1)

h	=	*100* mm	I_y	=	*1179878* mm^4
b	=	*75* mm	$W_{y;el;eff.1}$	=	*14444* mm^3
t_f	=	*7* mm	$W_{y;el;eff.2}$	=	*64418* mm^3
y_s	=	*18,3* mm	i_y	=	*31,5* mm
A_{bruto}	=	*1187* mm^2	i_v	=	*15,9* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4754* mm	No. bolts / end / flange		=	*4*
$L_{v;cr}$	=	*2377* mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$	=	*0* mm	End distance bolt	e1	=	*45* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0* mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*8,8*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate	=	*7* mm	Dubble strap joint no=1, yes=2		=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,48** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **151** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,75** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,13** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,31** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,75 = 75%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *hor. knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-4,5*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*4,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* [(*1)]

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1460*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1460*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1460*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,06** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,88** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **174** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,19** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,23** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,15** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,17** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,88 = 88%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *schuine knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-6,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*6,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2231*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2231*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,09** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,00** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **265** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,61** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,70** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,23** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,26** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **$U.C_{max}$ = 0,70 = 70%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-458,2*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*310,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1707*	mm	No. bolts / end / flange	=	*3*	**(Per flange !)**
$L_{v;cr}$	=	*1707*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,51**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**68**	**< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,84**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**1,13**	**> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,69**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 1,13 = 113%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *randen* *verzwaard*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-458,2*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*310,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* [(*1)]

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1707*	mm	No. bolts / end / flange	=	*3*	**(Per flange !)**
$L_{v;cr}$	=	*1707*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,51** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **68** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,84** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,56** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,69** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,84 = 84%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-80,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*69,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :			*H100/75/7*	(*1)				
h		=	*100*	mm	I_y	=	*1179878*	mm^4
b		=	*75*	mm	$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f		=	*7*	mm	$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s		=	*18,3*	mm	i_y	=	*31,5*	mm
A_{bruto}		=	*1187*	mm^2	i_v	=	*15,9*	mm
Material :								
Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:								
$L_{y;cr}$		=	*4360*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$		=	*2180*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)		=	*0*	mm	End distance bolt e1	=	*45*	mm
$a*L_{tot}$ (with comb. buckling)		=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$		=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?		=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate		=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	
					Staggered holes no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,78** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **138** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,82** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,20** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,18** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,20** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,20 = 120%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5 - diagonalen* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	-80,3	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	69,1	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$ =	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H100/100/10 (*1)

h	=	100	mm	I_y	=	1766764	mm^4
b	=	100	mm	$W_{y;el;eff.1}$	=	24615	mm^3
t_f	=	10	mm	$W_{y;el;eff.2}$	=	62597	mm^3
y_s	=	28,2	mm	i_y	=	30,4	mm
A_{bruto}	=	1915	mm^2	i_v	=	19,3	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	4360 mm	No. bolts / end / flange		=	1
$L_{v;cr}$	=	2180 mm	Type of bolts	M / "	=	24
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt	e1	=	45 mm
$a*L_{tot}$ (with comb. buckling)	=	0 mm	Centre-centre spacing bolt	s1	=	70 mm
$L_{perpendicular\ force}$	=	0 mm	Edge distance bolt	e2	=	35 mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	8,8
Column profile?	=	1 no=1, yes=2	Rolled screw threads		=	1
Thickness tie plate	=	12 mm	Dubble strap joint no=1, yes=2		=	1
			Staggered holes no=1, yes=2		=	1

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,55** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **144** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,54** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,89** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,59** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,84** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,89 = 89%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *hor. knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-4,6*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*4,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1250*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1250*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1250*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,06** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,76** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **149** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,15** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,19** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,15** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,17** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,76 = 76%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *schuine knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-7,54	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	7,54	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H50/40/5 (*1)

h	=	50	mm	I_y	=	103800	mm^4
b	=	40	mm	$W_{y;el;eff.1}$	=	2638	mm^3
t_f	=	5	mm	$W_{y;el;eff.2}$	=	9746	mm^3
y_s	=	10,7	mm	i_y	=	15,6	mm
A_{bruto}	=	427	mm^2	i_v	=	8,4	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2050	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2050	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	25	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	7	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,10** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,00** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **244** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,67** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,25** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,28** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,67 = 67%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-480,4*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*332,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2140*	mm	No. bolts / end / flange	=	*3*	**(Per flange !)**
$L_{v;cr}$	=	*2140*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,54** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **85** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,03** **> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,18** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,72** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,18 = 118%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 - randen* *verzwaard*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-480,4*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*332,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1070*	mm	No. bolts / end / flange	=	*3*	(Per flange !)
$L_{v;cr}$	=	*1070*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,54** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **42** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,75** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,59** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,72** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,75 = 75%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *diagonalen voor- en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-226,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*220,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/150/14* (*1)

h	=	*150*	mm	I_y	=	*8453963*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*78326*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*200966*	mm^3
y_s	=	*42,1*	mm	i_y	=	*45,8*	mm
A_{bruto}	=	*4031*	mm^2	i_v	=	*29,1*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2821*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2821*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*1*	
				Staggered holes no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,30** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **97** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,41** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,12** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,68** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,12 = 112%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 - diagonalen voor- en achtervlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-226,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*220,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H150/150/14*	(*1)				
h	=	*150*	mm	I_y	=	*8453963*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*78326*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*200966*	mm^3
y_s	=	*42,1*	mm	i_y	=	*45,8*	mm
A_{bruto}	=	*4031*	mm^2	i_v	=	*29,1*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*2821*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2821*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*1*	
				Staggered holes no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,30** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **97** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,41** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,56** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,68** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,68 = 68%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *diagonalen zijvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-56,5*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*59,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/75/7* (*1)

h	=	*100*	mm	I_y	=	*1179878*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s	=	*18,3*	mm	i_y	=	*31,5*	mm
A_{bruto}	=	*1187*	mm^2	i_v	=	*15,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2382*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2382*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,66**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**150**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,65**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,83**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,87**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,92**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,92 = 92%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *horizontaal*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	-2,2	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	2,2	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H130/130/12 (*1)

h	=	130	mm	I_y	=	4721746	mm^4
b	=	130	mm	$W_{y;el;eff.1}$	=	50442	mm^3
t_f	=	12	mm	$W_{y;el;eff.2}$	=	129742	mm^3
y_s	=	36,4	mm	i_y	=	39,7	mm
A_{bruto}	=	2997	mm^2	i_v	=	25,2	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	3952	mm	No. bolts / end / flange	=	2	
$L_{v;cr}$	=	3952	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	3952	mm	Edge distance bolt e2	=	20	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	12	mm	Dubble strap joint no=1, yes=2	=	1	
				Staggered holes no=1, yes=2	=	2	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,13** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **157** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,01** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,02** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,07** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,13 = 13%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-4,80*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*4,80*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1250*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1250*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1250*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,06**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,76**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**149**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,15**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,20**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,16**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,18**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,76 = 76%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *schuine knikverkorters voorvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	-19,17	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	19,17	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$ =	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H100/100/6 (*1)

h	=	100	mm	I_y	=	680089	mm^4
b	=	100	mm	$W_{y;el;eff.1}$	=	11071	mm^3
t_f	=	6	mm	$W_{y;el;eff.2}$	=	29775	mm^3
y_s	=	22,8	mm	i_y	=	26,0	mm
A_{bruto}	=	1006	mm^2	i_v	=	16,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2080	mm	No. bolts / end / flange	=	2	
$L_{v;cr}$	=	2080	mm	Type of bolts M / "	=	24	
$L_{tot\ (with\ comb.\ buckling)}$	=	0	mm	End distance bolt e1	=	50	mm
$a*L_{tot\ (with\ comb.\ buckling)}$	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	7	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,19** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **125** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,19** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,14** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,17** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,19 = 19%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *schuine knikverkorters zijvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-8,64*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*8,64*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2571*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2571*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,12**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**306**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,01**	**> 1 !!**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**1,12**	**> 1 !!**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,29**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,16**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,12 = 112%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: Vak 6 - schuine knikverkorters zijvlak — verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-8,64 kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	8,64 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0 kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H50/50/5 (*1)

h	=	50 mm	I_y	=	109643	mm^4
b	=	50 mm	$W_{y;el;eff.1}$	=	3049	mm^3
t_f	=	5 mm	$W_{y;el;eff.2}$	=	7811	mm^3
y_s	=	14,0 mm	i_y	=	15,1	mm
A_{bruto}	=	480 mm^2	i_v	=	9,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2571 mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2571 mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt e1	=	50	mm
$a*L_{tot}$ (with comb. buckling)	=	0 mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular force}$	=	0 mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1 no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	7 mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,12** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **268** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,70** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,83** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,14** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,16** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,83 = 83%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-244,5*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*83,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2119*	mm	No. bolts / end / flange	=	*3*	**(Per flange !)**
$L_{v;cr}$	=	*2119*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,14**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**84**	**< 120**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,52**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,60**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,25**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,60 = 60%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		D&C ENGINEERING
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7* *diagonalen voor- en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-217,9*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*227,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/80/8* [(*1)]

h	=	*120*	mm	I_y	=	*2256520*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*22266*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*120944*	mm^3
y_s	=	*18,7*	mm	i_y	=	*38,2*	mm
A_{bruto}	=	*1549*	mm^2	i_v	=	*17,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4017*	mm	No. bolts / end / flange	=	*6*	
$L_{v;cr}$	=	*2009*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,14** **> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **117** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,28** **> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,56** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,74** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 1,28 = 128%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7 - diagonalen voor- en achtervlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	-217,9	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	227,0	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H120/120/10 (*1)

h	=	120	mm	I_y	=	3129382	mm^4
b	=	120	mm	$W_{y;el;eff.1}$	=	36027	mm^3
t_f	=	10	mm	$W_{y;el;eff.2}$	=	94438	mm^3
y_s	=	33,1	mm	i_y	=	36,7	mm
A_{bruto}	=	2318	mm^2	i_v	=	23,3	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	4017	mm	No. bolts / end / flange		=	6	
$L_{v;cr}$	=	2009	mm	Type of bolts	M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt	e1	=	35	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt	s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt	e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads		=	1	
Thickness tie plate	=	10	mm	Dubble strap joint no=1, yes=2		=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,74** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **109** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,80** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,28** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,59** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,80 = 80%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7* *diagonalen zijvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	-72,3	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	71,4	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : *H120/80/8* (*1)

h	=	120	mm	I_y	=	2256520	mm^4
b	=	80	mm	$W_{y;el;eff.1}$	=	22266	mm^3
t_f	=	8	mm	$W_{y;el;eff.2}$	=	120944	mm^3
y_s	=	18,7	mm	i_y	=	38,2	mm
A_{bruto}	=	1549	mm^2	i_v	=	17,2	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress	$f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	4747	mm	No. bolts / end / flange		=	2
$L_{v;cr}$	=	2009	mm	Type of bolts	M / "	=	24
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt	e1	=	35 mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt	s1	=	70 mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt	e2	=	35 mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	4,6
Column profile?	=	1	no=1, yes=2	Rolled screw threads		=	1
Thickness tie plate	=	10	mm	Dubble strap joint no=1, yes=2		=	1

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,44** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **124** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,48** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,53** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,69** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,69 = 69%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7* *horizontaal zijvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-7,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*6,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H75/75/8* (*1)

h	=	*75*	mm	I_y	=	*588737*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*10964*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*27635*	mm^3
y_s	=	*21,3*	mm	i_y	=	*22,7*	mm
A_{bruto}	=	*1147*	mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4252*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*4252*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*4252*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,05** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,62** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **295** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,30** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,36** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,16** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,11** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,62 = 62%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7* *hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-2,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*2,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* [(*1)]

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*860*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*860*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a{*}L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*860*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,03** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,52** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **102** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,04** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,06** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,08** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,09** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,52 = 52%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7* *schuine knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	-7,2	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	7,2	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN
Angle profile :		H50/40/5 (*1)					
h	=	50	mm	I_y	=	103800	mm^4
b	=	40	mm	$W_{y;el;eff.1}$	=	2638	mm^3
t_f	=	5	mm	$W_{y;el;eff.2}$	=	9746	mm^3
y_s	=	10,7	mm	i_y	=	15,6	mm
A_{bruto}	=	427	mm^2	i_v	=	8,4	mm
Material :							
Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	2227	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2227	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	25	mm
$a{*}L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	7	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,10** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **265** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,64** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,73** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,24** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,27** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,73 = 73%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-196,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*84,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/80/8* (*1)

h	=	*120*	mm	I_y	=	*2256520*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*22266*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*120944*	mm^3
y_s	=	*18,7*	mm	i_y	=	*38,2*	mm
A_{bruto}	=	*1549*	mm^2	i_v	=	*17,2*	mm

Material :

Mat. qual. Fe360 / Fe510 = *Fe360* Permissible stress $f_{y;d}$ = *235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1570*	mm	No. bolts / end / flange	=	*4*	**(Per flange !)**
$L_{v;cr}$	=	*1570*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*125*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,29** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **91** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,88** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,36** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,21** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,88 = 88%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *diagonalen voor en achter vlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-158,6* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*198,3* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)		=	*0* kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)		=	*0* kN

Angle profile : *H120/80/8* (*1)

h	=	*120* mm	I_y	=	*2256520* mm^4
b	=	*80* mm	$W_{y;el;eff.1}$	=	*22266* mm^3
t_f	=	*8* mm	$W_{y;el;eff.2}$	=	*120944* mm^3
y_s	=	*18,7* mm	i_y	=	*38,2* mm
A_{bruto}	=	*1549* mm^2	i_v	=	*17,2* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2030* mm	No. bolts / end / flange	=	*6*
$L_{v;cr}$	=	*2030* mm	Type of bolts M / "	=	*24*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*35* mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*70* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*35* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**1,00**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**118**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,94**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,49**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,64**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,00 = 100%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *diagonalen zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-25,8* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*31,7* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/5* (*1)

h	=	*70* mm	I_y	=	*268391*	mm^4
b	=	*70* mm	$W_{y;el;eff.1}$	=	*5609*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*14898*	mm^3
y_s	=	*18,0* mm	i_y	=	*20,3*	mm
A_{bruto}	=	*651* mm^2	i_v	=	*13,0*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2366* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2366* mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,46**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**182**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,76**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**1,03**	**> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,67**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,97**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,03 = 103%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check section: *Vak 8 - diagonalen zijvlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	-25,8	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	31,7	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H70/70/8 (*1)

h	=	70	mm	I_y	=	474882	mm^4
b	=	70	mm	$W_{y;el;eff.1}$	=	9522	mm^3
t_f	=	8	mm	$W_{y;el;eff.2}$	=	23596	mm^3
y_s	=	20,1	mm	i_y	=	21,1	mm
A_{bruto}	=	1065	mm^2	i_v	=	13,5	mm

Material :

Mat. qual. Fe360 / Fe510 = Fe360 Permissible stress $f_{y;d}$ = 235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2366	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2366	mm	Type of bolts M / "	=	20	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	30	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	8	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,29** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **176** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,44** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,61** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,34** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,60** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,61 = 61%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *hor. knikverkorters voorvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*134,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/10* (*1)

h	=	*130*	mm	I_y	=	*3872340*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*41938*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*109995*	mm^3
y_s	=	*35,2*	mm	i_y	=	*39,4*	mm
A_{bruto}	=	*2493*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*888*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*888*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular force}$	=	*888*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,41** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,03** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **35** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,50** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,75** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,75 = 75%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *hor. knikverkorters zijvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-22,7*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*0,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H50/40/5*	(*1)				
h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*1616*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1616*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1616*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,98** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **192** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,13** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,35** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,75** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,35 = 135%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *hor. knikverkorters zijvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-22,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*5,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : ***H50/50/8*** (*1)

h	=	*50*	mm	I_y	=	*162828*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*4684*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*10685*	mm^3
y_s	=	*15,2*	mm	i_y	=	*14,8*	mm
A_{bruto}	=	*741*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1616*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1616*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular force}$	=	*1616*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,05	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	0,55	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	169	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,51	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	0,76	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,38	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,28	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : $U.C_{max}$ = 0,76 = **76%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *schuine knikverkorters voorvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-208,83	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	183,27	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H120/80/8 (*1)

h	=	120	mm	I_y	=	2256520	mm^4
b	=	80	mm	$W_{y;el;eff.1}$	=	22266	mm^3
t_f	=	8	mm	$W_{y;el;eff.2}$	=	120944	mm^3
y_s	=	18,7	mm	i_y	=	38,2	mm
A_{bruto}	=	1549	mm^2	i_v	=	17,2	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1544	mm	No. bolts / end / flange	=	5	
$L_{v;cr}$	=	1544	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	7	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,92** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **90** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,92** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,62** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,82** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,92 = 92%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9* *bovenrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-158,3*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*303,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3202*	mm	No. bolts / end / flange	=	*0*	
$L_{v;cr}$	=	*3202*	mm				
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm				mm
$a*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm				mm
$L_{perpendicular\ force}$	=	*0*	mm				mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)				
Column profile?	=	*1*	no=1, yes=2				

Summary checks :

Only the stresses in the sections has to be checked.

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,43**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**127**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,52**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**n.v.t.**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**n.v.t.**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,52 = 52%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14008
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 52

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9* *diagonalen voor-en achtervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	-135,5 kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	155,0 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0 kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H100/100/8 (*1)

h	=	100 mm	I_y	=	1448424	mm^4
b	=	100 mm	$W_{y;el;eff.1}$	=	19942	mm^3
t_f	=	8 mm	$W_{y;el;eff.2}$	=	52924	mm^3
y_s	=	27,4 mm	i_y	=	30,6	mm
A_{bruto}	=	1551 mm^2	i_v	=	19,4	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2373 mm	No. bolts / end / flange	=	3	
$L_{v;cr}$	=	2373 mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt e1	=	40	mm
$a*L_{tot}$ (with comb. buckling)	=	0 mm	Centre-centre spacing bolt s1	=	80	mm
$L_{perpendicular\ force}$	=	0 mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1 no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	10 mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,73** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **123** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,84** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,76** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,88** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,88 = 88%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9* *diagonalen voor-en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-155,2*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*129,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/120/8* (*1)

h	=	*120*	mm	I_y	=	*1911566*	mm^4
b	=	*120*	mm	$W_{y;el;eff.1}$	=	*24300*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*64520*	mm^3
y_s	=	*29,6*	mm	i_y	=	*33,5*	mm
A_{bruto}	=	*1705*	mm^2	i_v	=	*21,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2373*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2373*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,58** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **111** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,79** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,76** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,84** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **U.C$_{max}$ = 0,84 = 84%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9* *verticalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	*-3,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*3,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1503*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1503*	mm	Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,05**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**156**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,09**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,13**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,12**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,13**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,13 = 13%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9* *diagonalen ondervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-18,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*15,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H75/75/6* (*1)

h	=	*75*	mm	I_y	=	*455710*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*8351*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*22305*	mm^3
y_s	=	*20,4*	mm	i_y	=	*22,8*	mm
A_{bruto}	=	*875*	mm^2	i_v	=	*14,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2456*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2456*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,19**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**170**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,35**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,49**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,38**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,40**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,49 = 49%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-87,4*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*48,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/6* [*1]

h	=	*100*	mm	I_y	=	*680089*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*11071*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*29775*	mm^3
y_s	=	*22,8*	mm	i_y	=	*26,0*	mm
A_{bruto}	=	*1006*	mm^2	i_v	=	*16,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2220*	mm	No. bolts / end / flange	=	*2*	**(Per flange !)**
$L_{v;cr}$	=	*2220*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*135*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*55*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,27** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **133** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,99** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,32** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,26** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,99 = 99%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *diagonalen voor- en achtervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-94,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*74,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/80/8* [(*1)]

h	=	*120*	mm	I_y	=	*2256520*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*22266*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*120944*	mm^3
y_s	=	*18,7*	mm	i_y	=	*38,2*	mm
A_{bruto}	=	*1549*	mm^2	i_v	=	*17,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4098*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2090*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,45** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **122** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,70** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,72** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,72 = 72%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *diagonalen zijvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-44,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*35,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/10* (*1)

h	=	*80*	mm	I_y	=	*875033*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*15449*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*37458*	mm^3
y_s	=	*23,4*	mm	i_y	=	*24,1*	mm
A_{bruto}	=	*1511*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2651*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2651*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,25** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **172** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,52** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,73** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,95** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,67** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,95 = 95%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		D&C ENGINEERING
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *hor. knikverkorters voorvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-0,87* kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*0,87* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0* kN
$F_{perpend.;s;d}$	=	*1,5* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0* kN

Angle profile : *H45/30/5* (*1)

h	=	*45* mm	I_y	=	*69843* mm^4
b	=	*30* mm	$W_{y;el;eff.1}$	=	*1877* mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*8962* mm^3
y_s	=	*7,8* mm	i_y	=	*14,1* mm
A_{bruto}	=	*352* mm^2	i_v	=	*6,4* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*799* mm	No. bolts / end / flange	=	*1*
$L_{v;cr}$	=	*799* mm	Type of bolts M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*25* mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*70* mm
$L_{perpendicular\ force}$	=	*799* mm	Edge distance bolt e2	=	*35* mm
Position perpendicular force	=	*1* (⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*7* mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,01** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,68** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **125** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,03** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,03** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,03** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,03** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,68 = 68%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *hor. knikverkorters zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	-0,87	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	0,87	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$ =	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H45/45/5 (*1)

h	=	45	mm	I_y	=	78410	mm^4
b	=	45	mm	$W_{y;el;eff.1}$	=	2435	mm^3
t_f	=	5	mm	$W_{y;el;eff.2}$	=	6129	mm^3
y_s	=	12,8	mm	i_y	=	13,5	mm
A_{bruto}	=	430	mm^2	i_v	=	8,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1268	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	1268	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	25	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	1268	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	5	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,01** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,83** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **147** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,03** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,04** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,03** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,03** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,83 = 83%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *schuine knikverkorters voorvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-2,24*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*2,24*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2179*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2179*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,03** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **259** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,19** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,22** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,07** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,08** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,22 = 22%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52	**Sheet nr. :**	11

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-58,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*36,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/6* (*1)

h	=	*80*	mm	I_y	=	*521007*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*9280*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*24509*	mm^3
y_s	=	*21,3*	mm	i_y	=	*23,9*	mm
A_{bruto}	=	*914*	mm^2	i_v	=	*15,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*970*	mm	No. bolts / end / flange	=	*2*	**(Per flange !)**
$L_{v;cr}$	=	*970*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*75*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,23** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **64** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,34** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,22** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,24** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,34 = 34%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *diagonalen voor- en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-67,9	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	80,8	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H75/75/7 (*1)

h	=	75	mm	I_y	=	523536	mm^4
b	=	75	mm	$W_{y;el;eff.1}$	=	9673	mm^3
t_f	=	7	mm	$W_{y;el;eff.2}$	=	25075	mm^3
y_s	=	20,9	mm	i_y	=	22,7	mm
A_{bruto}	=	1012	mm^2	i_v	=	14,4	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1506	mm	No. bolts / end / flange	=	2	
$L_{v;cr}$	=	1506	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	8	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,80** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **104** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,54** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,60** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,90** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,90 = 90%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *schuine diagonaal v.v en a.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-116,6 kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	82,2 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0 kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN
Angle profile :		H80/80/6 (*1)				
h	=	80 mm	I_y	=	521007	mm^4
b	=	80 mm	$W_{y;el;eff.1}$	=	9280	mm^3
t_f	=	6 mm	$W_{y;el;eff.2}$	=	24509	mm^3
y_s	=	21,3 mm	i_y	=	23,9	mm
A_{bruto}	=	914 mm^2	i_v	=	15,3	mm
Material :						
Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2
Geometry section and bolts:						
$L_{y;cr}$	=	1541 mm	No. bolts / end / flange	=	2	
$L_{v;cr}$	=	1541 mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt e1	=	35	mm
$a*L_{tot}$ (with comb. buckling)	=	0 mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	1541 mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1 no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	8 mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,89**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**101**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,99**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,86**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**1,07**	**> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,07 = 107%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14008
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 52

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *schuine diagonaal v.v en a.v* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-116,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*82,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* (*1)

h	=	*80*	mm	I_y	=	*722469*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6*	mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1541*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1541*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a{*}L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1541*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,66** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **100** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,73** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,43** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,80** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,80 = 80%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *schuine diagonalen zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-6,7*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*4,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H45/30/5* (*1)

h	=	*45*	mm	I_y	=	*69843*	mm^4
b	=	*30*	mm	$W_{y;el;eff.1}$	=	*1877*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*8962*	mm^3
y_s	=	*7,8*	mm	i_y	=	*14,1*	mm
A_{bruto}	=	*352*	mm^2	i_v	=	*6,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1451*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1451*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,06**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**227**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,54**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,62**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,22**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,13**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,62 = 62%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *horizontaal zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-2,7*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*18,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H65/65/6* (*1)

h	=	*65*	mm	I_y	=	*291871*	mm^4
b	=	*65*	mm	$W_{y;el;eff.1}$	=	*6215*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*16182*	mm^3
y_s	=	*18,0*	mm	i_y	=	*19,7*	mm
A_{bruto}	=	*753*	mm^2	i_v	=	*12,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2163*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2163*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a{*}L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*2163*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,20** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,56** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **173** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,06** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,09** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,60** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,68** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,68 = 68%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *hor. voor en achtervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*0,0* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*56,9* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50* mm	I_y	=	*103800*	mm^4
b	=	*40* mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7* mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427* mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1231* mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*1231* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**1,12**	**> 1 !!**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**146**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,00**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,47**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,77**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,12 = 112%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *hor. voor en achtervlakjvlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*56,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H50/50/6*	(*1)				
h	=	*50*	mm	I_y	=	*128406*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3612*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*8883*	mm^3
y_s	=	*14,5*	mm	i_y	=	*15,0*	mm
A_{bruto}	=	*569*	mm^2	i_v	=	*9,6*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*1231*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*1231*	mm	Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,82** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **128** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,24** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,65** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,82 = 82%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *hor. knikverkorters zijvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-13,88*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*0,00*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H45/45/5* (*1)

h	=	45	mm	I_y	=	78410	mm^4
b	=	45	mm	$W_{y;el;eff.1}$	=	2435	mm^3
t_f	=	5	mm	$W_{y;el;eff.2}$	=	6129	mm^3
y_s	=	12,8	mm	i_y	=	13,5	mm
A_{bruto}	=	430	mm^2	i_v	=	8,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*996*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*996*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	25	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	*996*	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,65** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **116** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,30** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,51** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,46** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,24** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,65 = 65%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12* *bovenrand*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-75,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*117,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/8* (*1)

h	=	*100*	mm	I_y	=	*1448424*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*19942*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*52924*	mm^3
y_s	=	*27,4*	mm	i_y	=	*30,6*	mm
A_{bruto}	=	*1551*	mm^2	i_v	=	*19,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2750*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2750*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,59** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **142** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,55** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,58** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,76** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,76 = 76%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12* *diagonalen ondervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-14,1* kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*11,3* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H55/55/5* (*1)

h	=	*55*	mm	I_y	=	*147150*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*3697*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9685*	mm^3
y_s	=	*15,2*	mm	i_y	=	*16,6*	mm
A_{bruto}	=	*532*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1500*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1500*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,43**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**142**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,33**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,50**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,21**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,95**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,95 = 95%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12* *diagonalen v.v en a.v*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-63,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*13,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/6* (*1)

h	=	*100* mm	I_y	=	*680089*	mm^4
b	=	*100* mm	$W_{y;el;eff.1}$	=	*11071*	mm^3
t_f	=	*6* mm	$W_{y;el;eff.2}$	=	*29775*	mm^3
y_s	=	*22,8* mm	i_y	=	*26,0*	mm
A_{bruto}	=	*1006* mm^2	i_v	=	*16,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2363* mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2363* mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0* mm	End distance bolt e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0* mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,13**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**142**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,72**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,47**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,58**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,72 = 72%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12* *diagonalenv.v en a.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-46,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*43,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H90/90/6* (*1)

h	=	*90*	mm	I_y	=	*605764*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*10255*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*27352*	mm^3
y_s	=	*22,1*	mm	i_y	=	*25,1*	mm
A_{bruto}	=	*965*	mm^2	i_v	=	*16,0*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2819*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2819*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,46** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **176** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,88** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,20** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,69** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,81** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,20 = 120%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12 - diagonalen voor-en achtervlak L90x6* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-46,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*43,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H90/90/8* (*1)

h	=	*90*	mm	I_y	=	*1043824*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*16050*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*41812*	mm^3
y_s	=	*25,0*	mm	i_y	=	*27,4*	mm
A_{bruto}	=	*1389*	mm^2	i_v	=	*17,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2819*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2819*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,35** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **162** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,53** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,75** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,69** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,81** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,81 = 81%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12* *diagonalen v.v en a.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-15,5* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*60,9* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)		=	*0* kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)		=	*0* kN

Angle profile : *H50/40/5* (*1)

h	=	*50* mm	I_y	=	*103800* mm^4
b	=	*40* mm	$W_{y;el;eff.1}$	=	*2638* mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*9746* mm^3
y_s	=	*10,7* mm	i_y	=	*15,6* mm
A_{bruto}	=	*427* mm^2	i_v	=	*8,4* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2361* mm	No. bolts / end / flange		=	*3*
$L_{v;cr}$	=	*2361* mm	Type of bolts	M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	e1	=	*25* mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt	s1	=	*50* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt	e2	=	*22* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2		=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,20** **> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **281** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,06** **> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,67** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,10** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 1,20 = 120%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14008
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 52

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12 - diagonalen voor-en achtervlak L50x40x5* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-15,5* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*60,9* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)		=	*0* kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)		=	*0* kN

Angle profile : ***H50/50/8*** (*1)

h	=	*50* mm	I_y	=	*162828* mm^4
b	=	*50* mm	$W_{y;el;eff.1}$	=	*4684* mm^3
t_f	=	*8* mm	$W_{y;el;eff.2}$	=	*10685* mm^3
y_s	=	*15,2* mm	i_y	=	*14,8* mm
A_{bruto}	=	*741* mm^2	i_v	=	*9,6* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2361* mm	No. bolts / end / flange	=	*3*
$L_{v;cr}$	=	*2361* mm	Type of bolts M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*25* mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50* mm
$L_{perpendicular force}$	=	*0* mm	Edge distance bolt e2	=	*22* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,68**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**246**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,50**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,34**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,69**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,69 = 69%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 1* *rand*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-120,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*92,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/120/11* (*1)

h	=	*120*	mm	I_y	=	*3406399*	mm^4
b	=	*120*	mm	$W_{y;el;eff.1}$	=	*39406*	mm^3
t_f	=	*11*	mm	$W_{y;el;eff.2}$	=	*101512*	mm^3
y_s	=	*33,6*	mm	i_y	=	*36,6*	mm
A_{bruto}	=	*2537*	mm^2	i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3800*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*3800*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*3800*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,34** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,15** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **163** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,63** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,89** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,59** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] **:** **$U.C_{max}$ = 0,89 = 89%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 1* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-2,7*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*1,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H80/80/6* (*1)					
h	=	*80*	mm	I_y	=	*521007*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*9280*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*24509*	mm^3
y_s	=	*21,3*	mm	i_y	=	*23,9*	mm
A_{bruto}	=	*914*	mm^2	i_v	=	*15,3*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*5374*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*5374*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*5374*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,02**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,92**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**352**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,19**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,22**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,06**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,05**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,92 = 92%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: HV 2 kruis

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	-0,8	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	0,3	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H70/70/5 (*1)

h	=	70	mm	I_y	=	268391	mm^4
b	=	70	mm	$W_{y;el;eff.1}$	=	5609	mm^3
t_f	=	5	mm	$W_{y;el;eff.2}$	=	14898	mm^3
y_s	=	18,0	mm	i_y	=	20,3	mm
A_{bruto}	=	651	mm^2	i_v	=	13,0	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	7600 mm	No. bolts / end / flange		=	1
$L_{v;cr}$	=	7600 mm	Type of bolts	M / "	=	20
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt		=	30 mm
$a*L_{tot}$ (with comb. buckling)	=	0 mm	Centre-centre spacing bolt	s1	=	70 mm
$L_{perpendicular\ force}$	=	7600 mm	Edge distance bolt	e2	=	35 mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	4,6
Column profile?	=	1 no=1, yes=2	Rolled screw threads		=	1
Thickness tie plate	=	12 mm	Dubble strap joint no=1, yes=2		=	1

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **2,16** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **585** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,21** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,23** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,02** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,01** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 2,16 = 216%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 2* *kruis* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-0,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*0,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H80/80/10*	(*1)				
h	=	*80*	mm	I_y	=	*875033*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*15449*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*37458*	mm^3
y_s	=	*23,4*	mm	i_y	=	*24,1*	mm
A_{bruto}	=	*1511*	mm^2	i_v	=	*15,4*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*7600*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*7600*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*7600*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,00**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,79**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**493**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,07**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,07**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,01**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,01**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,79 = 79%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 2* *randen voor- en achtervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-189,7*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*130,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H110/110/10*	(*1)				
h	=	*110*	mm	I_y	=	*2386992*	mm^4
b	=	*110*	mm	$W_{y;el;eff.1}$	=	*30108*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*77703*	mm^3
y_s	=	*30,7*	mm	i_y	=	*33,6*	mm
A_{bruto}	=	*2115*	mm^2	i_v	=	*21,3*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*2500*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2500*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*2500*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,58** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,13** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **117** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,82** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,40** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,02** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,40 = 140%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 2* *randen voor- en achtervlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-189,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*130,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H110/110/12* (*1)

h	=	*110*	mm	I_y	=	*2798302*	mm^4
b	=	*110*	mm	$W_{y;el;eff.1}$	=	*35661*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*88748*	mm^3
y_s	=	*31,5*	mm	i_y	=	*33,4*	mm
A_{bruto}	=	*2511*	mm^2	i_v	=	*21,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2500*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2500*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	=	*35*	mm
$a{*}L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*2500*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,49** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,11** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **117** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,69** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,70** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,85** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 2* *randen zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-12,3*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*16,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/6* (*1)

h	=	*80*	mm	I_y	=	*521007*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*9280*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*24509*	mm^3
y_s	=	*21,3*	mm	i_y	=	*23,9*	mm
A_{bruto}	=	*914*	mm^2	i_v	=	*15,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2500*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2500*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*2500*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,20**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,43**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**164**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,22**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,31**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,35**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,41**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,43 = 43%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 2* *diagonalen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-2,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/8* (*1)

h	=	*100*	mm	I_y	=	*1448424*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*19942*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*52924*	mm^3
y_s	=	*27,4*	mm	i_y	=	*30,6*	mm
A_{bruto}	=	*1551*	mm^2	i_v	=	*19,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3535*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3535*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*3535*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,02** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,28** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **183** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,03** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,05** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,06** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,04** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,28 = 28%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 2* *kruis*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-0,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*0,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/5* (*1)

h	=	*60*	mm	I_y	=	*193708*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*4447*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*11785*	mm^3
y_s	=	*16,4*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*582*	mm^2	i_v	=	*11,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5000*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*5000*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*5000*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,01**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**1,79**	**> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**432**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,13**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,15**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,02**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,02**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,79 = 179%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		D&C ENGINEERING
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 2* *kruis*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-0,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*0,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H60/60/10* (*1)					
h	=	*60*	mm	I_y	=	*349321*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*8408*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*18928*	mm^3
y_s	=	*18,5*	mm	i_y	=	*17,8*	mm
A_{bruto}	=	*1107*	mm^2	i_v	=	*11,5*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*5000*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*5000*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular force}$	=	*5000*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,00**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,95**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**434**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,07**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,08**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,02**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,01**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,95 = 95%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 1 en 2 bovenrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*86,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H65/50/5* [(*1)]

h	=	*65*	mm	I_y	=	*230454*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*4389*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*18449*	mm^3
y_s	=	*12,5*	mm	i_y	=	*20,4*	mm
A_{bruto}	=	*554*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4911*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*4911*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,31** **> 1 !!**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **466** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,46** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,96** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 1,31 = 131%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check section: *Traverse 1 en 2 bovenrand* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*0,0*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*86,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H60/60/8* (*1)					
h	=	*60*	mm	I_y	=	*291532*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*6890*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*16481*	mm^3
y_s	=	*17,7*	mm	i_y	=	*18,0*	mm
A_{bruto}	=	*903*	mm^2	i_v	=	*11,5*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*4911*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*4911*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,80**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**426**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,00**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,23**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,60**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,80 = 80%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 1 en 2 diagonalen v.v en a.v*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*41,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2810*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2810*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,82** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **334** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,46** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,76** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,82 = 82%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 1 en 2 diagonalen ondervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-18,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*15,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H75/75/6* (*1)

h	=	*75*	mm	I_y	=	*455710*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*8351*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*22305*	mm^3
y_s	=	*20,4*	mm	i_y	=	*22,8*	mm
A_{bruto}	=	*875*	mm^2	i_v	=	*14,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2269*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2269*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,35**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**157**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,31**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,44**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,60**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,71**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,71 = 71%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14008

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 52

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 1 en 2 diagonalen ondervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-16,8* kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*15,7* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H55/55/5* (*1)

h	=	*55* mm	I_y	=	*147150*	mm^4
b	=	*55* mm	$W_{y;el;eff.1}$	=	*3697*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*9685*	mm^3
y_s	=	*15,2* mm	i_y	=	*16,6*	mm
A_{bruto}	=	*532* mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1300* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1300* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,42** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **123** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,32** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,52** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,56** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,86** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,86 = 86%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 3 en 4 bovenrand*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*56,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2880*	mm	No. bolts / end / flange		=	*4*	
$L_{v;cr}$	=	*2880*	mm	Type of bolts	M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt	e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**1,12**	**> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**343**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,00**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,47**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,77**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,12 = 112%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 3 en 4 bovenrand* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*56,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/6* (*1)

h	=	*50*	mm	I_y	=	*128406*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3612*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*8883*	mm^3
y_s	=	*14,5*	mm	i_y	=	*15,0*	mm
A_{bruto}	=	*569*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2880*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2880*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,82** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **300** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,24** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,64** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,82 = 82%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 3 en 4 diagonalen ondervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-5,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*9,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1300*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1300*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,24** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **135** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,14** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,22** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,30** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,50** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,50 = 50%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6 bovenrand*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-23,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*39,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H65/50/6* (*1)

h	=	*65*	mm	I_y	=	*271004*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*5202*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*21006*	mm^3
y_s	=	*12,9*	mm	i_y	=	*20,3*	mm
A_{bruto}	=	*658*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3452*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1726*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,57** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **170** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,65** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,89** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,89 = 89%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6 diagonalen ondervlak* *L45/45/5*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-6,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*6,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H45/45/5* (*1)

h	=	*45*	mm	I_y	=	*78410*	mm^4
b	=	*45*	mm	$W_{y;el;eff.1}$	=	*2435*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*6129*	mm^3
y_s	=	*12,8*	mm	i_y	=	*13,5*	mm
A_{bruto}	=	*430*	mm^2	i_v	=	*8,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2162*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2162*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,17**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**251**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,55**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,67**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,23**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,35**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,67 = 67%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6 diagonalen ondervlak* *L45/30/5*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-10,1*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*11,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H45/30/5* (*1)

h	=	*45*	mm	I_y	=	*69843*	mm^4
b	=	*30*	mm	$W_{y;el;eff.1}$	=	*1877*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*8962*	mm^3
y_s	=	*7,8*	mm	i_y	=	*14,1*	mm
A_{bruto}	=	*352*	mm^2	i_v	=	*6,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1092*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1092*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,30** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **171** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,49** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,59** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,37** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,61** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,61 = 61%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6 diagonalen v.v en a.v.*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-2,4*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*1,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H45/30/5* (*1)

h	=	*45*	mm	I_y	=	*69843*	mm^4
b	=	*30*	mm	$W_{y;el;eff.1}$	=	*1877*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*8962*	mm^3
y_s	=	*7,8*	mm	i_y	=	*14,1*	mm
A_{bruto}	=	*352*	mm^2	i_v	=	*6,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1911*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1911*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,03** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **299** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,33** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,36** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,08** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,06** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,36 = 36%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	5-feb-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

3. CONTROLE BEREKENING MAST 55

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W www.dcengineering.nl

D&C ENGINEERING
design and construct

Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer

Onderwerp	:	Controleberekening mast 55, 150 kV-lijn Zoetermeer -Leiden
Opdrachtgever	:	Cofely Fabricom Koen Pieters
Referentienr	:	1303914509
Opgesteld	:	S. Al Mashta
Gecontroleerd	:	J.Hollaar
Goedgekeurd	:	J.Hollaar
Revisie	:	0
Datum	:	18-Feb-2014
D&C documentnr.	:	B.14009

SGS
Quality Masters
GECERTIFICEERD ISO 9001:2008

H:\Projecten\13.039 Fabricom vervangen mast 74 150 kV-lijn Leiden-Zoetermeer\1303914509, noodmast P74 etc\02 - Documenten\Mast 55\B14009_rev0a.xlsx

Rev.	Datum	Omschrijving	Opgesteld	Gecontr.	Goedgek.
0	18-Feb-14	Controleberekening mast 55, 150 kV-lijn Zoetermeer -Leiden	S. Al Mashta	J.Hollaar	J.Hollaar
A					

Inhoudsopgave

1 Algemeen

1.1 Inleiding

Door Cofely Fabricom is aan D&C engineering te Alblasserdam opdracht verstrekt voor o.a. het uitvoeren van een controleberekening voor mast nr.55 in de 150 kV-lijn Zoetermeer -Leiden. Mast 55 moet gecontroleerd worden, omdat rond de nieuwe 380kv-lijn een omleiding nodig is. Voor mast 54 komt een portaal waardoor de belasting op mast 55 wijzigd.
De berekeningen worden uitgevoerd conform de vigerende norm NEN-EN-50341-1 en 3.
Voor de geleiderbelasting vanuit de bliksemdraden wordt ijsgebied A aangehouden, conform afspraak (aanvullende eis van TenneT), zoals vermeld in: "Lijnen; Standaard programma van eisen; PVE.05.000;25 november 2010; versie 1.0".

1.2 Normen en tekeningen en documenten en andere uitgangspunten

Tekeningen :

Mast nr.55 in de 150 kV-lijn Zoetermeer -Leiden.	
tek.nr.	omschrijving
6775-5-E	Onderstuk HU
6775-6-D	Onderste tussenstuk HU
6775-7-E	Tweede tussenstuk HU
6775-8-E	Eerste bovenstuk HU
6775-9-D	Tweede bovenstuk HU
6775-10-E	Ondertraverse HU
6775-11-E	Bovenste traverse HU

Normen:

NEN-EN 50341-1 : 2001
NEN-EN 50341-3 : 2001

Andere uitgangspunten:

Fundatiehoogte 0,50 m boven maaiveld.

1.3 Nadere bepalingen

De geleiderbelastingen en de benodigde verzwaringen van de mastconstructies worden berekend volgens NEN-EN 50341-1 en 3 met spanningscontroles volgens EC-3.

De mastconstructie wordt 3D doorgerekend.

De gestelde slankheidsrestricties in NEN-EN 50341-1 en 3 worden geacht niet van toepassing te zijn, omdat in sommige gevallen in het verleden grotere slankheden zijn toegestaan.

Voor de mastconstructie zal een maximum totaalspanning van 100% worden gehanteerd.

Er is gerekend dat er geen antenne-opstellingen in de te controleren mastconstructie aanwezig zijn.

De berekening is uitgevoerd met het rekenpakket Scia LTA programma 2013

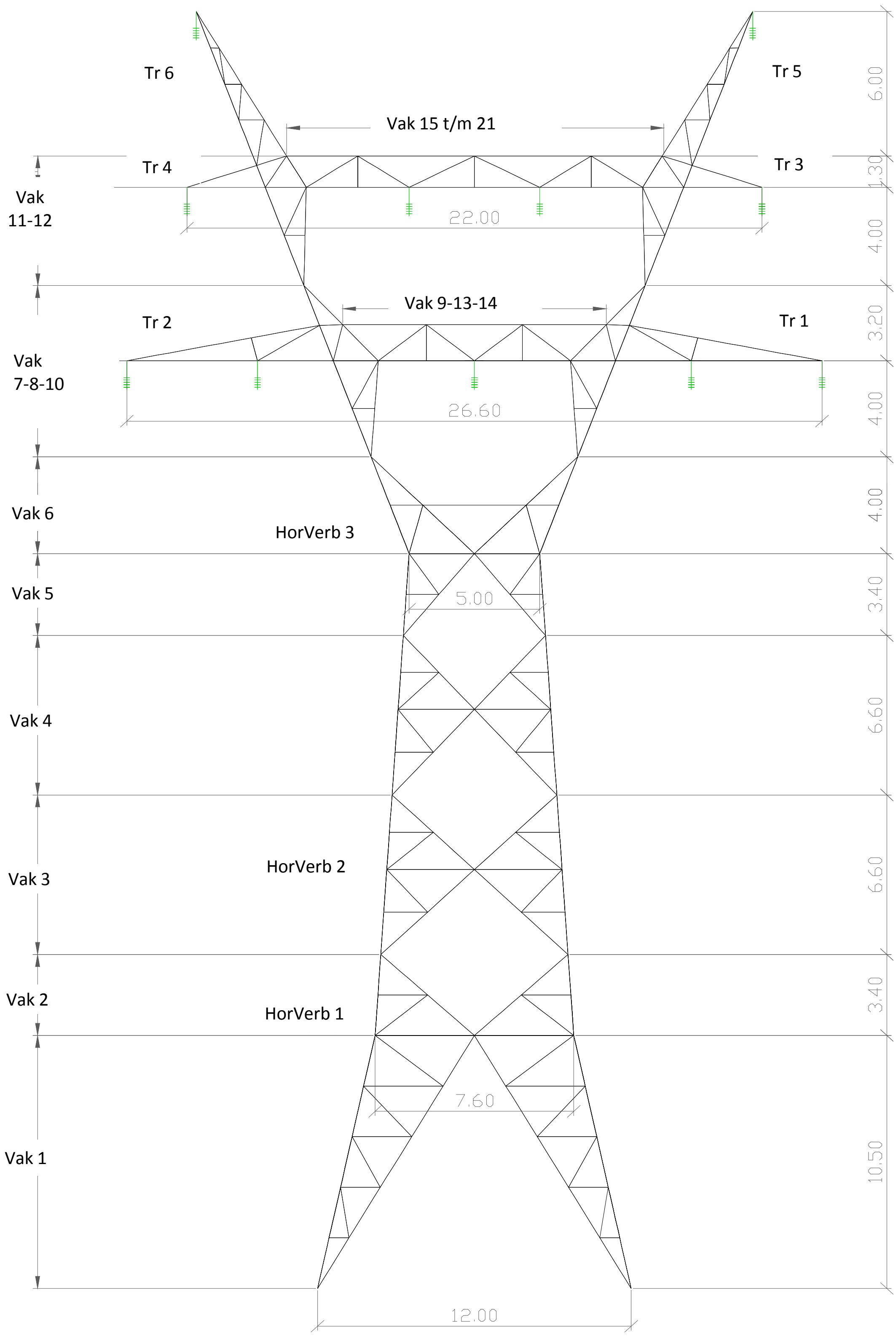
Voor de geleiderbelasting vanuit de bliksemdraden wordt gerekend met ijsgebied A.
Zie richtlijn van Tennet: "Lijnen; standaard programma van eisen; PVE.05.000;
25 november 2010; versie 1.0; artikel 5.3".

1.4 Materialen

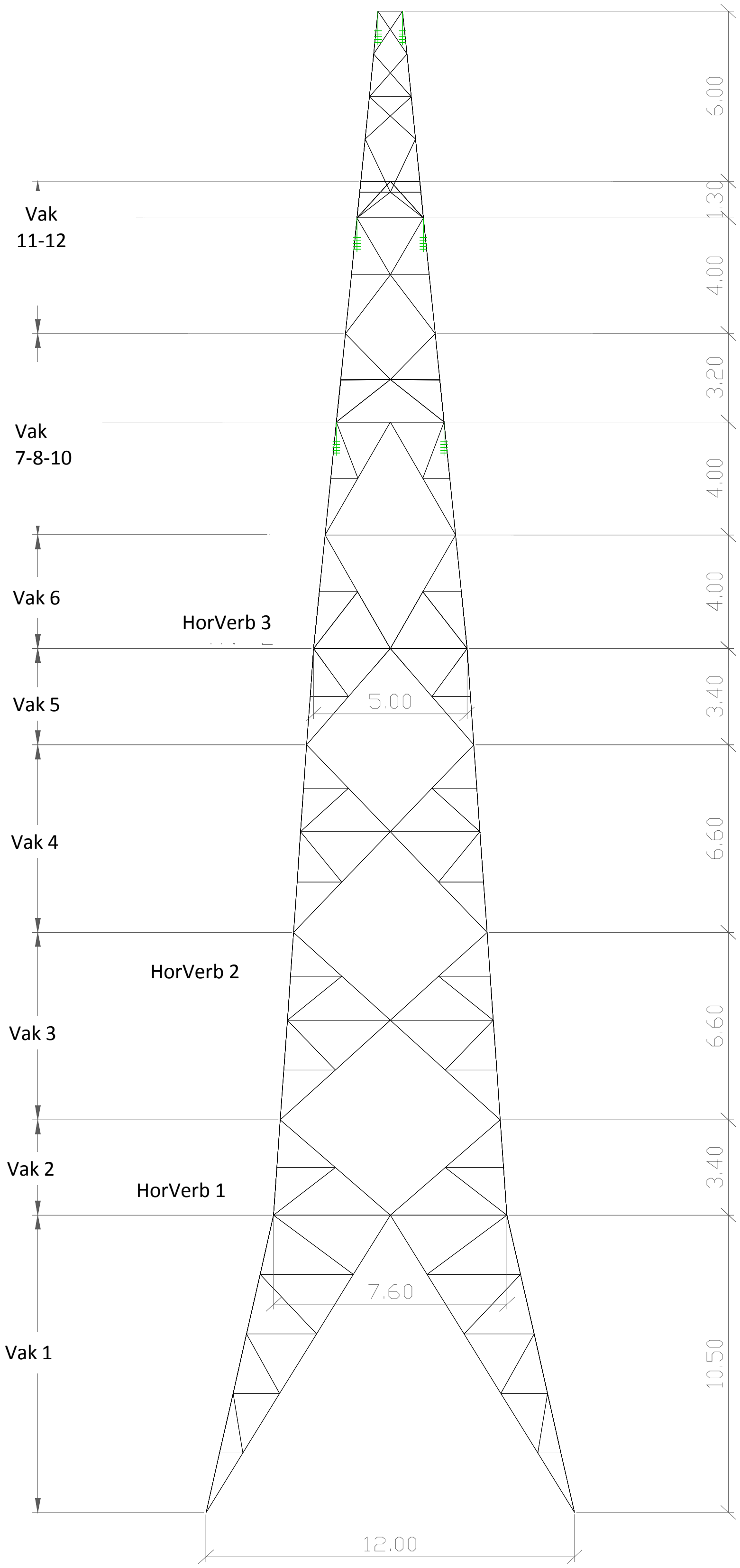
Materiaal randen	:	Fe360	(Fe510 nieuw)
Materiaal diagonalen	:	Fe360	(Fe510 nieuw)
Materiaal bouten	:	4.6	(8.8 nieuw)

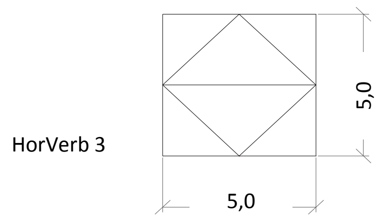
1.5 Overzicht mast

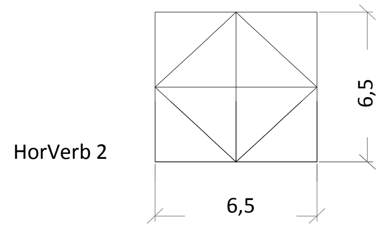
1.5.1 Overzicht voorvlak mastlichaam

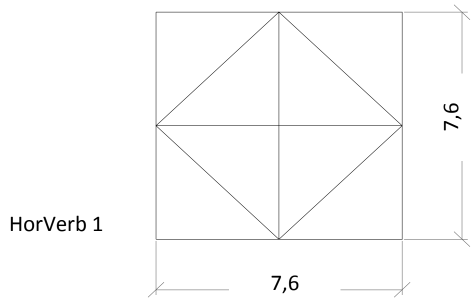


1.5.2 Overzicht zijvlak mastlichaam









2 Ontwerpgegevens mast

2.1 Ontwerpcode

De berekening is gebaseerd op NEN-en 50341-1 en -3-15
Bovengrondse hoogspanningslijnen.

2.2 Ontwerpgegevens

Lijnhoek	-	179,38° -174,70°	
Windgebied	-	II	
Bebouwing	-	onbebouwd	
IJsgebied bliksemdraden	-	**A**	
IJsgebied fasedraden	-	B	
Toeslag eigengewicht	-	20%	
Totale hoogte van de mast	-	53,0 m	*)
Hoogte traverse 1	-	38,5 m	*)
Hoogte traverse 2	-	45,7 m	*)
Hoogte voet boven maaiveld	-	0,5 m	
Veldlengten	-	319 - 421 m	
Bliksemdraden	-	Br 50	(2x)
Factor β bliksemdraad	-	1,0	
Fasedraden	-	CU 185	(9 x 2-bundel)
Factor β fasedraad	-	0,8	
Boutklasse	-	8.8	
Materiaal mastranden	-	S235	
Materiaal overige mast	-	S235	
	-		

*) t.o.v. bovenzijde fundatiepoer

2.3 Geleidergegevens

		Br 50	CU 185
		Bliksemdraad	fasedraad
Eigen gewicht	N/m	4,43	16,62
Doorsnede	mm2	48,36	181,6
Diameter	mm	9	17,5
Elasticiteitsmod.	N/mm2	130000	130000
Lin. Uitzettingsc.	1/°C	0,000017	0,000017
Breeksterkte	N	28390,7	72760,5

2.4 Gegevens isolatoren

Dubbele afspanning

lengte isolatorketting	2	m	
totale gewicht afspanning per zijde	2,5	kN	
diameter isolator schaal	255	mm	(voor wind 2/3*255mm =170mm)

2.5 Mastbelastingen uit geleiders

Voor belastingen uit de geleiders wordt verwezen naar bijlage A van dit rapport.

3 Berekening mast

3.1 Uitgangspunten berekening

Ontwerp-norm	NEN-EN 50341-3
Boutkwaliteit	4.6
Staalkwaliteit	S235
Toeslag eigengewicht	20%
Referentie periode	50 jaar

Voor verdere gegevens wordt verwezen naar hoofstuk 2.0

3.2 Berekening met behulp van computerprogramma

SCIA - ESA-Engineer - LTA

Voor de berekening van de mastconstructie wordt verwezen naar bijlage B van dit rapport.

4 Fundatie

4.1 Algemeen

Voor fundatiebelastingen zie Bijlage B:(maximale belastingen per knoop en Resultante op fundatie).
Deze belastingen zijn opgesteld en weergegeven conform NEN-EN 50341-1 en 3 november 2001; Bovengrondse hoogspanningslijnen.

Per fundatie-belastingweergave is dit opgegeven inclusief combinatie- en belastingfactoren.

Aan de hand van de bovengenoemde belastinggegevens en de sonderinggegevens kan de fundatie berekend worden.

4.2 Fundatie belastingen

Reacties

Lineaire berekening, Extreem : Globaal
Selectie : Alle
Klasse : All UGT

Steunpunt	BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Sn3/N306	sp3F/26	**-302,70**	-235,69	**1430,16**	0,00	0,00	0,00
Sn1/N248	sp3R/64	**290,70**	222,11	1357,34	0,00	0,00	0,00
Sn3/N306	sp1aF/180	-298,87	**-240,62**	1406,93	0,00	0,00	0,00
Sn1/N248	sp1aR/200	289,03	**230,80**	1352,01	0,00	0,00	0,00
Sn1/N248	sp3F-p/2	-226,89	-166,25	**-1083,93**	0,00	0,00	0,00
Sn1/N248	1a/201	34,57	24,49	131,50	**0,00**	**0,00**	**0,00**

Resultante op Fundering

Lineaire berekening, Extreem : Globaal
Selectie : Alle
Klasse : All UGT

BG	Steunpunt	Extreem	horiz. component [kN]	resultante [kN]	Hoek [deg]	helling(afschot) [-]	Rx [kN]	Ry [kN]	Rz [kN]
sp3F/206	Sn3/N306	Rz	**10,54**	1430,20	30,15	135,64	2,70	10,19	1430,16
sp3F/26	Sn3/N306	Rx	**384,41**	386,53	173,05	-0,11	-302,70	-236,95	-40,45
sp1aF/203	Sn2/N298	Ry	214,95	**283,06**	125,93	-0,86	-33,87	-212,27	-184,17
sp3F/206	Sn3/N306	Rz	10,54	**1430,20**	30,15	135,64	2,70	10,19	1430,16
sp1aR-p/205	Sn3/N306	Rz	148,16	1036,96	**-179,63**	-6,93	-104,09	-105,43	-1026,33
sp1aF/180	Sn3/N306	Ry	383,69	425,81	**173,84**	-0,48	-298,87	-240,62	-184,65
sp1aR-p/205	Sn3/N306	Rz	148,16	1036,96	-179,63	**-6,93**	-104,09	-105,43	-1026,33
sp3F/206	Sn3/N306	Rz	10,54	1430,20	30,15	**135,64**	2,70	10,19	1430,16
sp3F/26	Sn3/N306	Rx	384,41	386,53	173,05	-0,11	**-302,70**	-236,95	-40,45
sp3R/64	Sn1/N248	Rx	366,69	1409,20	172,55	3,71	**290,70**	223,50	1360,66
sp1aF/180	Sn3/N306	Ry	383,69	425,81	173,84	-0,48	-298,87	**-240,62**	-184,65
sp1aR/200	Sn1/N248	Ry	369,88	1401,69	173,61	3,66	289,03	**230,80**	1352,01
sp3F-p/2	Sn1/N248	Rx	281,65	1119,92	-8,67	-3,85	-226,89	-166,87	**-1083,93**
sp3F/206	Sn3/N306	Rz	10,54	1430,20	30,15	135,64	2,70	10,19	**1430,16**

4.3 Berekening Fundatie

De berekening van de fundatie, met de gegevens zoals de sonderingen, is een op zichzelf staande berekening, welke niet valt onder de scope van deze opdracht.

5 Resultaten

Uit de controleberekening van de mast volgen de volgende resultaten:
(Opmerking: De verschillende berekeningen zijn te vinden in de bijlagen B en C)

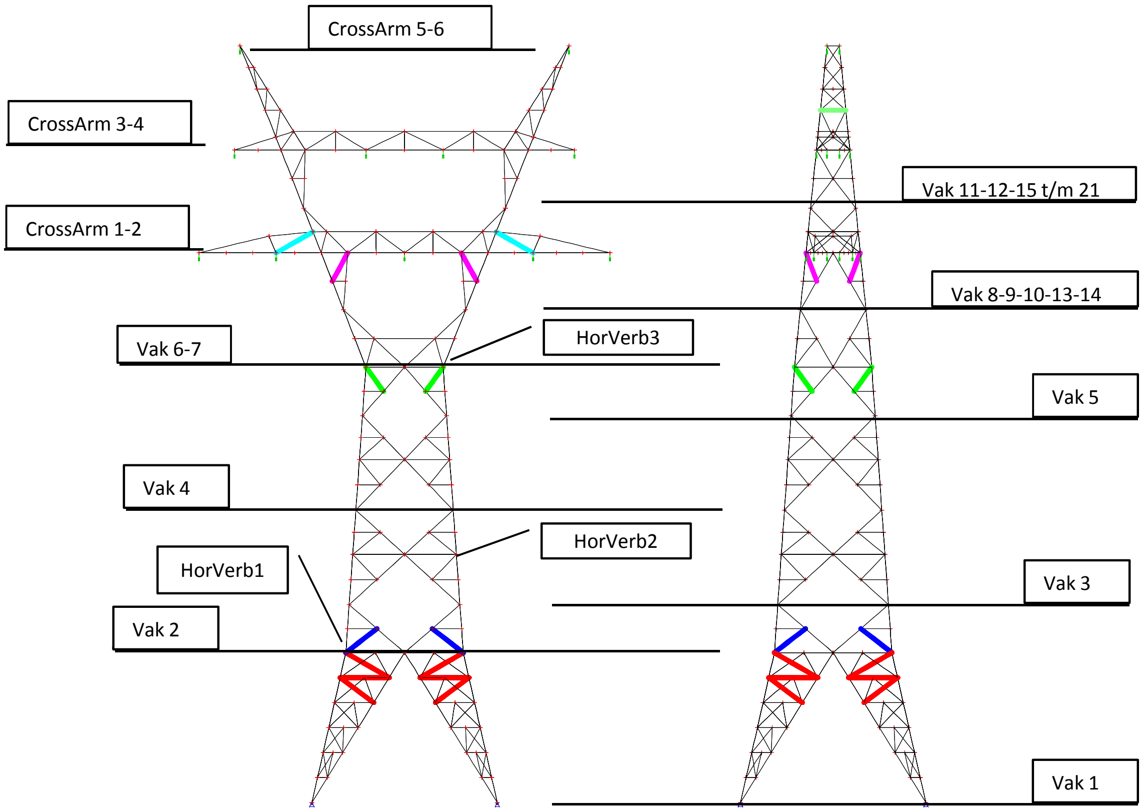
5.1 Overzicht spanningniveau's

Sheet nr.	Vak	Staaf type	Doorsnede	Staalkwal. N/mm^2	Lengte (m) $L_{y;cr}$	Lengte (m) $L_{v;cr}$	Bout type	Kwalit.	Aantal bouten	Max. U.C. verbinding	Max. druk N_{Ed} (kN)	U.C	Max. trek N_{Ed} (kN)	U.C	Punt last $F_{per;sd}$ (kN)	U.C	Opmerkingen
M01	Vak 1	Randen L200x200x26	H200/200/26	235	1825	1825	M 30	4,6	10	**0,77**	-1657,72	**0,82**	1344,49	**0,64**	0,00	**n.v.t.**	
M02	Vak 1	Diagonalen L130x13x12	H130/130/12	235	2048	2048	M 24	4,6	4	**1,00**	-271,75	**0,56**	256,83	**0,58**	0,00	**n.v.t.**	
M03	Vak 1	Horizontale En verticale Knikverkorters L50x50x5	H50/50/5	235	2409	2409	M 16	4,6	1	**0,08**	-2,13	**0,19**	2,13	**0,05**	1,50	**0,94**	
M04	Vak 1	Horizontale en Verticale Knikverkorters L60x60x6	H60/60/6	235	2533	2533	M 16	4,6	1	**0,46**	-13,95	**0,69**	13,95	**0,25**	1,50	**0,76**	
M05	Vak 1	Horizontale en Verticale Knikverkorters L55x55x6	H55/55/6	235	4478	4478	M 16	4,6	1	**0,10**	-3,02	**0,49**	3,02	**0,05**	1,50	**0,81**	
M06	Vak 1	Horizontale en Verticale Knikverkorters L65x65x7	H65/65/7	235	3322	3322	M 16	4,6	1	**0,79**	-23,73	**1,24**	23,73	**0,28**	1,50	**0,74**	**Staven uitwisselen in L70x70x7, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V06**
M07	Vak 2	Randen L200x200x26	H200/200/26	235	1690	1690	M 30	4,6	10	**0,73**	-1568,46	**0,76**	1291,38	**0,62**	0,00	**n.v.t.**	
M08	Vak 2	Horizontale Knikverkorters L55x55x6	H55/55/6	235	1900	1900	M 16	4,6	1	**0,69**	-20,89	**0,85**	20,89	**0,38**	1,50	**0,69**	
M09	Vak 2	Schuine Knikverkorters L55x55x6	H55/55/6	235	2620	2620	M 16	4,6	1	**0,96**	-28,83	**1,82**	28,83	**0,52**	0,00	**n.v.t.**	**Staven uitwisselen in L70x70x7, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V09**
M10	Vak 2	Verticale verbanden L150x100x10	H150/100/10	235	4916	2458	M 24	4,6	3	**0,82**	-167,32	**0,62**	150,52	**0,42**	0,00	**n.v.t.**	
M11	Vak 3	Randen L200x200x26	H200/200/26	235	1786	1786	M 30	4,6	10	**0,68**	-1473,98	**0,72**	1210,73	**0,58**	0,00	**n.v.t.**	
M12	Vak 3	Horizontale Knikverkorters L55x55x6	H55/55/6	235	1676	1676	M 16	4,6	1	**0,29**	-8,74	**0,31**	8,74	**0,16**	1,50	**0,61**	
M13	Vak 3	Verticale Knikverkorters L55x55x6	H55/55/6	235	2360	2360	M 16	4,6	1	**0,34**	-10,16	**0,57**	10,16	**0,18**	0,00	**n.v.t.**	
M14	Vak 3	Verticale verbanden L150x100x12	H150/100/12	235	5028	2514	M 24	4,6	4	**0,73**	-181,18	**0,58**	197,44	**0,46**	0,00	**n.v.t.**	
M15	Vak 4	Randen L200x200x20	H200/200/20	235	1784	1784	M 30	4,6	10	**0,55**	-1185,13	**0,58**	952,01	**0,46**	0,00	**n.v.t.**	
M16	Vak 4	Horizontale Knikverkorters L50x50x5	H50/50/5	235	1460	1460	M 16	4,6	1	**0,34**	-9,47	**0,41**	9,47	**0,21**	1,50	**0,82**	
M16a	Vak 4	Horizontale staven L60x60x6	H60/60/6	235	2920	2920	M 16	4,6	1	**0,17**	-4,40	**0,27**	4,79	**0,09**	1,50	**0,88**	
M17	Vak 4	Verticale Knikverkorters L50x50x5	H50/50/5	235	2080	2080	M 16	4,6	1	**0,26**	-7,32	**0,51**	7,32	**0,16**	0,00	**n.v.t.**	
M18	Vak 4	Verticale verbanden L150x100x14	H150/100/14	235	4755	2377	M 24	4,6	4	**0,89**	-242,51	**0,63**	223,83	**0,46**	0,00	**n.v.t.**	
M19	Vak 5	Randen L200x200x20	H200/200/20	235	1784	1784	M 30	4,6	12	**0,76**	-981,56	**0,48**	769,91	**0,37**	0,00	**n.v.t.**	
M20	Vak 5	Horizontale Knikverkorters L50x50x5	H50/50/5	235	1250	1250	M 16	4,6	1	**0,58**	-16,33	**0,59**	16,33	**0,35**	1,50	**0,65**	
M21	Vak 5	Verticale Knikverkorters L50x50x5	H50/50/5	235	1720	1720	M 16	4,6	1	**1,05**	-29,39	**1,52**	29,39	**0,64**	0,00	**n.v.t.**	**Staven uitwisselen in L55x55x6, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V21**
M21a	Vak 5	Verticale verbanden L150x100x12	H150/100/12	235	4360	2180	M 24	4,6	5	**0,82**	-262,06	**0,71**	279,54	**0,66**	0,00	**n.v.t.**	
M22	Vak 6	Randen L200x200x16	H200/200/16	235	1784	1784	M 30	4,6	12	**0,73**	-939,90	**0,46**	764,96	**0,37**	0,00	**n.v.t.**	
M23	Vak 6	Verticale verbanden L150x100x12	H150/100/12	235	4765	2382	M 24	4,6	5	**0,58**	-195,42	**0,59**	194,50	**0,46**	0,00	**n.v.t.**	
M24	Vak 6	Horizontale Knikverkorters L50x50x5	H50/50/5	235	1250	1250	M 16	4,6	1	**0,42**	-9,75	**0,35**	11,67	**0,25**	1,50	**0,65**	
M25	Vak 6	Horizontale vrband L130x130x12	H130/130/12	235	3950	3950	M 24	4,6	2	**0,84**	-114,52	**0,48**	74,60	**0,14**	1,50	**0,12**	
M26	Vak 6	Vertical Knikverkorters L90x90x9	H90/90/9	235	2076	2076	M 24	4,6	2	**0,78**	-106,31	**0,64**	66,20	**0,34**	0,00	**n.v.t.**	
M27	Vak 6	Vertical Knikverkorters L50x50x5	H50/50/5	235	2571	2571	M 24	4,6	2	**0,10**	-14,20	**0,80**	10,49	**0,20**	0,00	**n.v.t.**	
M28	Vak 6	Verticale verbanden L180x180x16	H180/180/16	235	5642	2825	M 30	4,6	5	**0,60**	-322,86	**0,46**	301,42	**0,39**	0,00	**n.v.t.**	
M29	Vak 7-8-9-10-13-14	Randen L200x200x16	H200/200/16	235	4261	2141	M 30	4,6	6	**0,98**	-633,51	**0,37**	385,56	**0,18**	0,00	**n.v.t.**	
M30	Vak 7-8-9-10-13-14	Horizontale Knikverkorters L50x50x5	H50/50/5	235	880	880	M 16	4,6	1	**0,36**	-10,02	**0,27**	10,02	**0,22**	1,50	**0,46**	
M31	Vak 7-8-9-10-13-14	Verticale Knikverkorters L50x50x5	H50/50/5	235	2050	2050	M 16	4,6	1	**0,59**	-17,33	**1,16**	16,47	**0,36**	0,00	**n.v.t.**	**Staven uitwisselen in L55x55x6, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V31**
M32	Vak 7-8-9-10-13-14	Verticale verbanden L150x100x12	H150/100/12	235	4017	2019	M 30	4,6	4	**0,68**	-249,08	**0,62**	292,52	**0,79**	0,00	**n.v.t.**	
M33	Vak 7-8-9-10-13-14	Verticale verbanden L200x100x14	H200/100/14	235	4747	2380	M 24	4,6	5	**0,84**	-283,32	**0,62**	272,81	**0,45**	0,00	**n.v.t.**	
M34	Vak 7-8-9-10-13-14	Verticale verbanden L130x130x12	H130/130/12	235	4236	2206	M 30	4,6	3	**0,88**	-197,64	**0,55**	284,93	**0,73**	0,00	**n.v.t.**	
M35	Vak 7-8-9-10-13-14	Verticale verbanden L90x90x9	H90/90/9	235	4621	2366	M 20	4,6	2	**0,81**	-70,81	**0,74**	76,54	**0,33**	0,00	**n.v.t.**	
M36	Vak 7-8-9-10-13-14	Boven randen L160x160x15	H160/160/15	235	3680	3680	M 30	4,6	4	**0,98**	-214,88	**0,43**	346,36	**0,59**	0,00	**n.v.t.**	
M37	Vak 7-8-9-10-13-14	Horizontale verbanden L60x60x6	H60/60/6	235	3232	1616	M 16	4,6	1	**0,82**	-24,72	**1,00**	24,72	**0,34**	0,00	**n.v.t.**	
M38	Vak 7-8-9-10-13-14	Horizontale verbanden L100x10x10	H100/100/10	235	3507	3507	M 30	4,6	2	**0,68**	-110,32	**0,88**	145,43	**0,75**	0,00	**n.v.t.**	
M39	Vak 7-8-9-10-13-14	Horizontale en verticale Knikverkorters L50x50x5	H50/50/5	235	3227	3227	M 16	4,6	1	**0,12**	-3,40	**0,48**	3,40	**0,07**	0,00	**n.v.t.**	
M40	Vak 7-8-9-10-13-14	Verticale Knikverkorters L65x50x5	H65/50/5	235	1503	1503	M 20	4,6	1	**0,16**	-4,34	**0,13**	6,15	**0,15**	0,00	**n.v.t.**	
M41	Vak 7-8-9-10-13-14	Schuine verbanden L130x130x12	H130/130/12	235	2376	2376	M 24	4,6	4	**0,69**	-187,24	**0,45**	185,01	**0,44**	0,00	**n.v.t.**	
M42	Vak 7-8-9-10-13-14	Horizontale kruizen L90x90x9	H90/90/9	235	2540	2540	M 30	4,6	1	**0,79**	-47,70	**0,61**	47,51	**0,50**	0,00	**n.v.t.**	

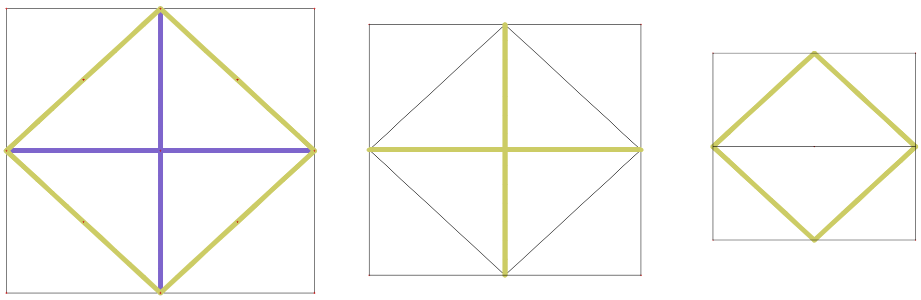
M43	Vak 10-11-12-15-t_m 21	Randen L140x140x13	H140/140/13	235	4356	2220	M 24	4,6	8	**0,78**	-422,37	**0,25**	317,23	**0,15**	0,00	**n.v.t.**	
M44	Vak 10-11-12-15-t_m 21	Horizontale Knikverkorters L50x50x5	H50/50/5	235	2536	1268	M 16	4,6	1	**0,08**	-2,21	**0,11**	2,21	**0,05**	0,00	**n.v.t.**	
M45	Vak 10-11-12-15-t_m 21	Verticale Knikverkorters L50x50x5	H50/50/5	235	2179	2179	M 16	4,6	1	**0,13**	-3,37	**0,25**	3,56	**0,08**	0,00	**n.v.t.**	
M46	Vak 10-11-12-15-t_m 21	Verticale verbanden L150x100x10	H150/100/10	235	4099	2089	M 24	4,6	2	**0,88**	-119,40	**0,36**	93,04	**0,29**	0,00	**n.v.t.**	
M47	Vak 10-11-12-15-t_m 21	Verticale verbanden L110x110x10	H110/110/10	235	5030	2651	M 20	4,6	3	**0,91**	-128,02	**0,83**	118,97	**0,35**	0,00	**n.v.t.**	
M48	Vak 10-11-12-15-t_m 21	Boven randen L120x120x11	H120/120/11	235	4465	4465	M 24	4,6	3	**0,75**	-102,18	**0,67**	152,02	**0,41**	0,00	**n.v.t.**	
M49	Vak 10-11-12-15-t_m 21	Boven randen L60x60x6	H60/60/6	235	1213	1213	M 20	4,6	3	**0,46**	0,00	**0,00**	60,86	**0,68**	0,00	**n.v.t.**	
M50	Vak 10-11-12-15-t_m 21	Horiz.-vert. en schuine Knikverkort. L50x50x5	H50/50/5	235	1993	1993	M 16	4,6	1	**0,46**	-13,75	**0,89**	11,11	**0,24**	1,50	**0,66**	
M51	Vak 10-11-12-15-t_m 21	Schuine verbanden L90x90x9	H90/90/9	235	1506	1506	M 24	4,6	3	**0,48**	-86,31	**0,37**	97,66	**0,42**	0,00	**n.v.t.**	
M52	Vak 10-11-12-15-t_m 21	Schuine verbanden L100x100x10	H100/100/10	235	2819	2819	M 24	4,6	3	**0,41**	-82,64	**0,50**	50,97	**0,18**	0,00	**n.v.t.**	
M53	Vak 10-11-12-15-t_m 21	Schuine verbanden L75x75x8	H75/75/8	235	2819	2819	M 24	4,6	2	**0,58**	-24,28	**0,36**	78,90	**0,52**	0,00	**n.v.t.**	
M54	Vak 10-11-12-15-t_m 21	Horizontale kruizen L60x60x6	H60/60/6	235	3100	1652	M 16	4,6	2	**0,67**	-40,40	**0,96**	39,76	**0,47**	0,00	**n.v.t.**	
M55	HorVerb1	Staven L150x150x14	H150/150/14	235	3800	3800	M 24	4,6	4	**0,84**	-227,23	**0,58**	185,17	**0,30**	1,50	**0,08**	
M56	HorVerb1	Staven L70x70x7	H70/70/7	235	5374	5374	M 20	4,6	2	**0,11**	-10,60	**0,58**	8,57	**0,08**	1,50	**1,02**	**Staven uitwisselen in L150x150x10, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V56**
M57	HorVerb1	Staven L75x75x8	H75/75/8	235	3800	3800	M 16	4,6	1	**0,06**	-1,81	**0,07**	1,81	**0,01**	1,50	**1,11**	**Staven uitwisselen in L75x75x8, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V57**
M58	HorVerb2	Staven L65x65x7	H65/65/7	235	3353	3353	M 16	4,6	1	**0,00**	0,00	**0,00**	0,00	**0,00**	1,50	**0,74**	
M59	HorVerb2	Staven L70x70x7	H70/70/7	235	4741	4741	M 20	4,6	2	**0,19**	-18,02	**0,80**	17,77	**0,16**	1,50	**0,90**	
M60	HorVerb2	Staven L60x60x6	H60/60/6	235	3353	3353	M 24	4,6	4	**0,00**	-0,27	**0,01**	0,08	**0,00**	1,50	**2,03**	**Staven uitwisselen in L75x75x8, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V60**
M61	HorVerb3	Staven L150x150x14	H150/150/14	235	2500	2500	M 30	4,6	4	**0,83**	-355,69	**0,58**	292,00	**0,50**	1,50	**0,05**	
M62	HorVerb3	Staven L90x90x9	H90/90/9	235	3536	3536	M 20	4,6	1	**1,08**	-50,62	**0,99**	49,64	**0,40**	1,50	**0,31**	**Bouten uitwisselen in kwaliteit 8.8, zie berekening sheet V62**
M63	HorVerb3	Staven L75x75x8	H75/75/8	235	5000	5000	M 16	4,6	1	**0,02**	-0,09	**0,01**	0,59	**0,00**	1,50	**0,73**	
M64	CrossArm 1-2	Bovern Randen	H100/100/10	235	4732	4732	M 24	4,6	3	**0,42**	0,00	**0,00**	85,65	**0,30**	0,00	**n.v.t.**	
M65	CrossArm 1-2	Horiz.-vert. en schuine Knikverkort. L50x50x5	H50/50/5	235	1888	1888	M 16	4,6	1	**0,45**	-13,56	**0,82**	2,05	**0,04**	0,00	**n.v.t.**	
M66	CrossArm 1-2	Horizontale kruizen L65x65x7	H65/65/7	235	2073	1600	M 20	4,6	2	**0,51**	-45,09	**0,52**	37,23	**0,37**	0,00	**n.v.t.**	
M67	CrossArm 1-2	Horizontale kruizen L55x55x6	H55/55/6	235	2713	1600	M 16	4,6	2	**0,36**	-18,04	**0,45**	21,49	**0,29**	0,00	**n.v.t.**	
M68	CrossArm 1-2	Horizontale kruizen L80x80x8	H80/80/8	235	4190	2445	M 16	4,6	2	**0,97**	-58,73	**0,80**	36,86	**0,24**	0,00	**n.v.t.**	
M69	CrossArm 1-2	Schuine verbanden L60x60x6	H80/80/8	235	4190	2445	M 16	4,6	2	**1,09**	0,00	**0,00**	65,96	**0,42**	0,00	**n.v.t.**	**Bouten uitwisselen in kwaliteit 8.8, zie berekening sheet V69**
M70	CrossArm 3-4	Boven renden L80x80x8	H80/80/8	235	2880	2880	M 20	4,6	3	**0,43**	0,00	**0,00**	61,01	**0,36**	0,00	**n.v.t.**	
M71	CrossArm 3-4	Horizontale kruizen L60x60x6	H65/65/7	235	2347	2347	M 16	4,6	2	**0,65**	-39,39	**0,73**	32,96	**0,31**	0,00	**n.v.t.**	
M72	CrossArm 5-6	Randen L80x80x8	H80/80/8	235	3350	2008	M 20	4,6	2	**1,23**	-115,31	**1,13**	81,75	**0,54**	0,00	**n.v.t.**	**Knikverkorters aanbrengen L50x50x5, en bouten uitwisselen in kwaliteit 8.8, zie berekening sheet V72**
M73	CrossArm 5-6	Schuine randen L100x75x7	H100/75/7	235	6950	1726	M 20	4,6	2	**0,63**	-42,19	**0,82**	59,45	**0,41**	0,00	**n.v.t.**	
M74	CrossArm 5-6	Horizontale en schuine knikverkorters L50x50x5	H50/50/5	235	1910	1910	M 16	4,6	1	**0,10**	-2,90	**0,18**	2,90	**0,06**	1,50	**0,51**	
M75	CrossArm 5-6	Verticale verbanden1 L50x50x5	H50/50/5	235	2162	2162	M 16	4,6	1	**0,49**	-13,65	**1,00**	13,63	**0,30**	0,00	**n.v.t.**	
M76	CrossArm 5-6	Verticale verbanden2 L50x50x5	H50/50/5	235	2184	1155	M 16	4,6	1	**0,70**	-20,99	**0,95**	19,63	**0,43**	0,00	**n.v.t.**	
	Vak 9-13-14 + CrossArm1-2	Ondre randen UNP200	UNP200	Zie uitvoer computerberekening SCIA						**0,66**							
		Dwars liggers HEB200	HEB200	Zie uitvoer computerberekening SCIA						**0,11**							
	Vak 15 t_m 21 + CrossArm3-4	Ondre randen UNP180	UNP180	Zie uitvoer computerberekening SCIA						**0,43**							
		Dwars liggers HEB180	HEB180	Zie uitvoer computerberekening SCIA						**0,05**							
V06	Vak 1	Horizontale en Verticale Knikverkorters L70x70x7	H70/70/7	355	3322	3322	M 16	8,8	1	**0,39**	-23,73	**0,96**	23,73	**0,20**	1,50	**0,42**	
V09	Vak 2	Schuine Knikverkorters L70x70x7	H70/70/7	355	2620	2620	M 16	8,8	1	**0,61**	-28,83	**0,80**	28,83	**0,32**	0,00	**n.v.t.**	
V21	Vak 5	Verticale Knikverkorters L55x55x6	H55/55/6	355	1720	1720	M 16	8,8	1	**0,62**	-29,39	**0,93**	29,39	**0,38**	0,00	**n.v.t.**	
V31	Vak 8-9-10-13-14	Verticale Knikverkorters L55x55x6	H55/55/6	355	2050	2050	M 16	8,8	1	**0,41**	-17,33	**0,72**	16,47	**0,21**	0,00	**n.v.t.**	
V56	HorVerb1	Staven L150x150x10	H150/150/10	355	5374	5374	M 20	8,8	2	**0,06**	-10,50	**0,09**	8,48	**0,02**	1,50	**0,16**	
V57	HorVerb1	Staven L75x75x8	H75/75/8	355	3800	3800	M 16	8,8	1	**0,03**	-1,81	**0,07**	1,81	**0,01**	1,50	**0,73**	
V60	HorVerb2	Staven L75x75x8	H75/75/8	355	3353	3353	M 24	8,8	4	**0,00**	-0,27	**0,00**	0,08	**0,00**	1,50	**0,65**	
V62	HorVerb3	Staven L90x90x9	H90/90/9	235	3536	3536	M 20	8,8	1	**0,72**	-50,62	**0,99**	49,64	**0,40**	1,50	**0,31**	
V69	CrossArm 1-2	Schuine verbanden L60x60x6	H80/80/8	235	4190	2445	M 16	8,8	2	**0,74**	0,00	**0,00**	65,96	**0,42**	0,00	**n.v.t.**	
V72	CrossArm 5-6	Randen L80x80x8	H80/80/8	235	2008	2008	M 20	8,8	2	**0,99**	-115,31	**0,96**	81,75	**0,54**	0,00	**n.v.t.**	

5.2 Overzicht Verzwaring

5.2.1 Overzicht van de Mast



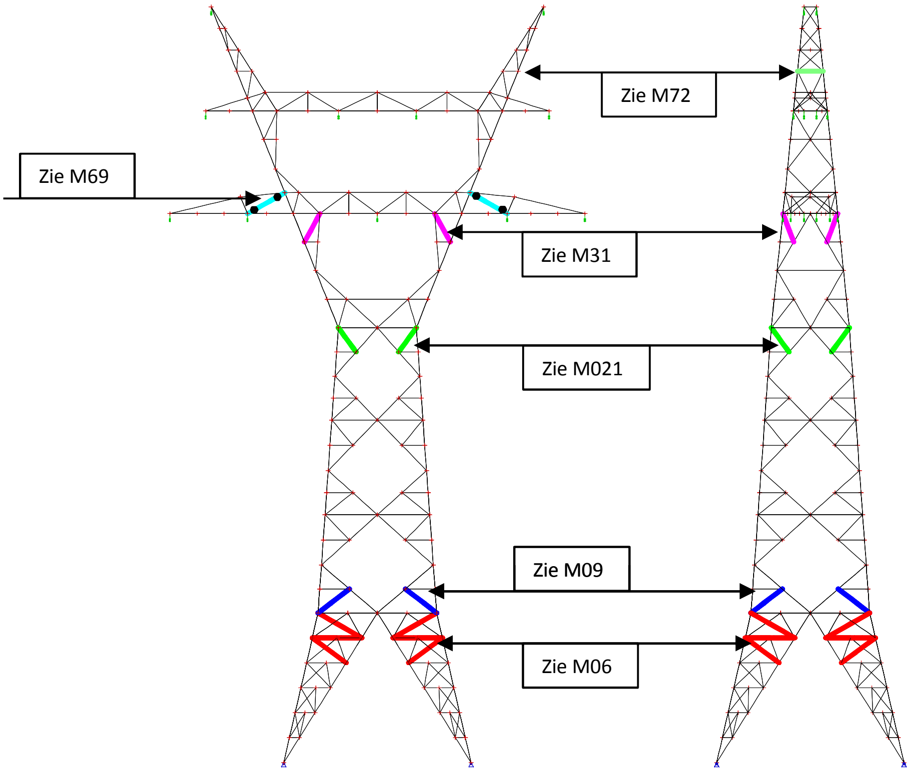
Voor / Achter **Zwart / Wit**



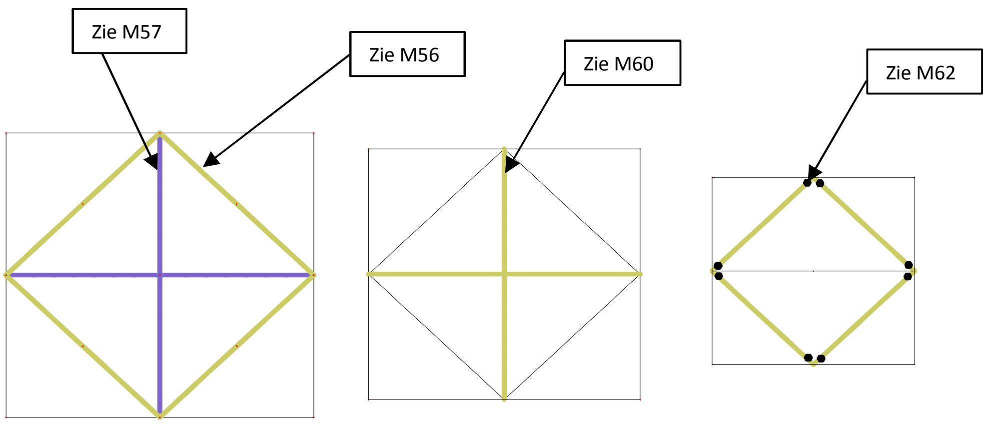
Bovenaanzicht Horizontale windverbanden

HorVerb1 **HorVerb2** **HorVerb3**

5.2.2 Uit te wisselen onderdelen van de mast



Voor / Achter **Zwart / Wit**



Bovenaanzicht Horizontale windverbanden

HorVerb1 **HorVerb2** **HorVerb3**

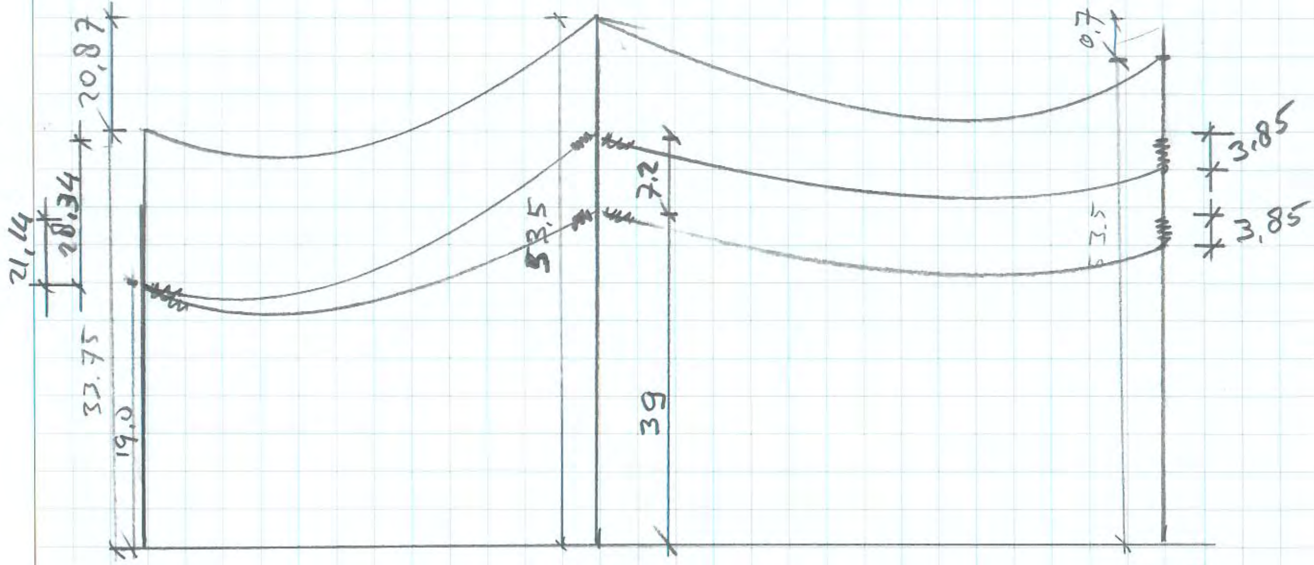
Bijlage A Geleiderbelastingen

Dossier/File

Order

Pagina/Page

D&C ENGINEERING
design and construct



port. 319 M55 421 M56

-4,217 -3,08 -3,82

fasedraden

Cu185 eds = 24 %

bliksem draden

Br 50 eds = 36,6 %

Revisie/Revision	0	A	B	C	D	E	F
Datum/Date							
Naam/Name							
Gecontroleerd/Checked							
Goedgekeurd/Approved							

KARAKTERISTIEKE GEGEVENS :

Naam hoogspanningslijn	: 150 kV Zoetermeer - Leiden
Masttype	: hoekmast
Mastnaam	: mast 55
Mastnummer	: 55
Windgebied	: II
Bebouwing	: Onbebouwd
IJsgebied	: B
Referentie periode	: 50 jaar

		VELD 1		VELD 2
Minimum lijnhoek	[graden]	179.38		174.7
Maximum lijnhoek	[graden]	179.38		179.38
Veldlengte	[m]	319		421
Vaklengte	[m]		740	

* Belastingcombinaties en -factoren: NEN-EN 50341 -1 t/m -3, nov. 2001

* Berekend worden de "Ultimate Limit State" belastingcombinaties, (table 4.2.11/NL.1)

(1a) Permanente belasting met extreme windbelasting
(1b) Permanente belasting met extreme koude
(3) Permanente belasting met extreme ijsbelasting
(4) Permanente belasting met onderhoudsbelasting
(5a) Permanente belasting met torsie
(6) Permanente belasting

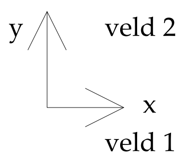
* Berekend worden de "Special Limit State" belastingcombinaties, (table 4.2.11/NL.3)

(1a) Permanente belasting met extreme windbelasting
(1b) Permanente belasting met extreme koude
(3) Permanente belasting met extreme ijsbelasting
(4) Permanente belasting met onderhoudsbelasting

* Alle belastingscomponenten zijn exclusief belastingsfactoren, uitgezonderd draadtrekkrachten jTrep

* Assenstelsel:

y = lijnrichting



INVOERGEGEVENS VOOR DRAAD No.: 1

Geleidersoort	:	fasedraad	
Geleidersoort + plaats	:	fasedr boven	
Geleiders veld 1 en 2	:	CU185	
Eigen gewicht draad	[N/m] :	16.62	
Draaddoorsnede	[mm²] :	181.6	
Draaddiameter	[mm] :	17.5	
Elasticiteitsmodulus	[N/mm²] :	130000	
Uitzettingscoëfficiënt	[1/°C] :	.000017	
Breekbelasting draad	[N] :	72760.5	
Maximum percentage breekbelasting	[%] :	100	
EDS percentage breekbelasting	[%] :	24	
Hoogte draadbevestiging	[m] :	46.2	

Eigen gewicht isolator	[kN] :	2.5	2.5
Lengte isolator	[m] :	2	2
Diameter isolatorschaal	[mm] :	170	170
Hoogte isolator boven maaiveld	[m] :	46.20	46.20
Hoogte verschil draadbevestiging (aangrenzende minus beschouwende mast) (hoger = positief)	[m] :	-28.34	-3.85

INVOERGEGEVENS VOOR DRAAD No.: 2

Geleidersoort	:	fasedraad
Geleidersoort + plaats	:	fasedr onder
Geleiders veld 1 en 2	:	CU185
Eigen gewicht draad	[N/m] :	16.62
Draaddoorsnede	[mm²] :	181.6
Draaddiameter	[mm] :	17.5
Elasticiteitsmodulus	[N/mm²] :	130000
Uitzettingscoëfficiënt	[1/°C] :	.000017
Breekbelasting draad	[N] :	72760.5
Maximum percentage breekbelasting	[%] :	100
EDS percentage breekbelasting	[%] :	24
Hoogte draadbevestiging	[m] :	39

Eigen gewicht isolator	[kN] :	2.5	2.5
Lengte isolator	[m] :	2	2
Diameter isolatorschaal	[mm] :	170	170
Hoogte isolator boven maaiveld	[m] :	39	39
Hoogte verschil draadbevestiging (aangrenzende minus beschouwende mast) (hoger = positief)	[m] :	1	-16.5

Mastnummer	:	55
Draadnummer	:	1
Geleidersoort + plaats	:	fasedr boven
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	472.95

BELASTING COMPONENTEN [kN]

		GELEIDER		ISOLATOR	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 4.24	- 3.68	- 2.50	- 2.50
Qijs;rep		- 1.92	- 1.67	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	1.85	2.65	0.57	0.57
Qw;rep loodrecht lijn,	y	0.01	-0.12	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.01	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	0.93	1.21	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	0.01	-0.06	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	0.91	1.45	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	0.00	-0.07	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	1.85	2.66	0.57	0.57
Qw;rep loodrecht lijn,	y	0.01	-0.01	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	0.93	1.32	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	0.01	-0.01	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	0.91	1.34	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	0.00	-0.01	-0.40	-0.40
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	4.73	6.78	0.57	0.57
Qw;rep loodrecht lijn,	y	0.03	-0.31	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.01	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	2.39	3.08	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	0.01	-0.14	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	2.34	3.71	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	0.01	-0.17	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	4.73	6.80	0.57	0.57
Qw;rep loodrecht lijn,	y	0.03	-0.04	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	2.39	3.36	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	0.01	-0.02	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	2.34	3.44	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	0.01	-0.02	-0.40	-0.40

Mastnummer	:	55
Draadnummer	:	1
Geleidersoort + plaats	:	fasedr boven
Geleiders veld 1 en 2	:	CU185

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2	
	Hoek t.o.v. lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	28.10	28.10	29.16	29.17
	0°	21.56	21.56	21.43	21.42
	45°	25.12	25.12	25.27	25.58
	-45°	25.05	25.05	25.98	25.67
jTrep bij combinatie (1b)	90°	23.26	23.26	22.58	22.58
	0°	22.94	22.94	22.20	22.20
	45°	23.10	23.10	22.37	22.39
	-45°	23.10	23.10	22.41	22.39
jTrep bij combinatie (3)	90°	36.13	36.13	36.60	36.61
	0°	33.48	33.48	33.37	33.37
	45°	34.85	34.85	34.88	35.01
	-45°	34.82	34.82	35.18	35.05
jTrep bij combinatie (4)	90°	26.00	26.00	26.91	26.91
	0°	25.64	25.64	26.49	26.49
	45°	25.82	25.82	26.68	26.70
	-45°	25.82	25.82	26.72	26.70
jTrep bij combinatie (5a)	90°	17.97		17.85	
jTrep bij combinatie (6)	90°	24.26		24.09	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

		VELD 1		VELD 2	
	Hoek t.o.v. lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	23.25	23.25	23.58	23.59
	0°	21.56	21.56	21.42	21.41
	45°	22.44	22.44	22.43	22.52
	-45°	22.42	22.42	22.63	22.54
jTrep bij combinatie (1b)	90°	23.14	23.14	22.44	22.44
	0°	22.94	22.94	22.20	22.20
	45°	23.04	23.04	22.31	22.32
	-45°	23.04	23.04	22.33	22.32
jTrep bij combinatie (3)	90°	26.47	26.47	26.88	26.88
	0°	24.09	24.09	24.01	24.00
	45°	25.32	25.32	25.36	25.48
	-45°	25.30	25.30	25.62	25.51
jTrep bij combinatie (4)	90°	25.57	25.57	26.02	26.02
	0°	25.34	25.34	25.75	25.75
	45°	25.46	25.46	25.87	25.88
	-45°	25.46	25.46	25.90	25.88

Mastnummer : 55
Draadnummer : 2
Geleidersoort + plaats : fasedr onder
Geleiders veld 1 en 2 : CU185
Veldlengte voor gewicht [m] : 407.89

BELASTING COMPONENTEN [kN]

		GELEIDER VELD 1	GELEIDER VELD 2	ISOLATOR VELD 1	ISOLATOR VELD 2
Grep		- 2.61	- 4.22	- 2.50	- 2.50
Qijs;rep		- 1.18	- 1.91	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	2.03	2.17	0.55	0.55
Qw;rep loodrecht lijn,	y	0.01	-0.10	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.02	0.99	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	0.01	-0.05	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.00	1.19	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	0.01	-0.05	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	2.03	2.17	0.55	0.55
Qw;rep loodrecht lijn,	y	0.01	-0.01	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.02	1.08	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	0.01	-0.01	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.00	1.10	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	0.01	-0.01	-0.39	-0.39
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.19	5.54	0.55	0.55
Qw;rep loodrecht lijn,	y	0.03	-0.26	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.01	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	2.62	2.52	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	0.01	-0.12	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	2.57	3.03	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	0.01	-0.14	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.19	5.56	0.55	0.55
Qw;rep loodrecht lijn,	y	0.03	-0.03	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	2.62	2.75	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	0.01	-0.01	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	2.57	2.81	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	0.01	-0.02	-0.39	-0.39

Mastnummer	:	55
Draadnummer	:	2
Geleidersoort + plaats	:	fasedr onder
Geleiders veld 1 en 2	:	CU185

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2	
	Hoek t.o.v. lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	28.72	28.72	27.05	27.06
	0°	21.21	21.21	21.57	21.56
	45°	25.35	25.35	24.23	24.45
	-45°	25.27	25.27	24.73	24.51
jTrep bij combinatie (1b)	90°	22.96	22.96	22.60	22.60
	0°	22.58	22.58	22.34	22.34
	45°	22.77	22.77	22.46	22.47
	-45°	22.77	22.77	22.48	22.47
jTrep bij combinatie (3)	90°	36.03	36.03	35.80	35.81
	0°	32.92	32.92	33.59	33.59
	45°	34.54	34.54	34.62	34.71
	-45°	34.51	34.51	34.82	34.73
jTrep bij combinatie (4)	90°	28.38	28.38	26.21	26.21
	0°	27.97	27.97	25.93	25.92
	45°	28.18	28.18	26.05	26.06
	-45°	28.18	28.18	26.08	26.07
jTrep bij combinatie (5a)	90°	17.67		17.96	
jTrep bij combinatie (6)	90°	23.86		24.25	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

		VELD 1		VELD 2	
	Hoek t.o.v. lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	23.18	23.18	23.04	23.05
	0°	21.21	21.21	21.56	21.56
	45°	22.23	22.23	22.25	22.31
	-45°	22.21	22.21	22.38	22.32
jTrep bij combinatie (1b)	90°	22.81	22.81	22.50	22.50
	0°	22.58	22.58	22.34	22.34
	45°	22.70	22.70	22.41	22.42
	-45°	22.69	22.69	22.43	22.42
jTrep bij combinatie (3)	90°	26.47	26.47	26.14	26.14
	0°	23.69	23.69	24.17	24.16
	45°	25.14	25.14	25.08	25.17
	-45°	25.11	25.11	25.27	25.19
jTrep bij combinatie (4)	90°	27.13	27.13	25.55	25.55
	0°	26.87	26.87	25.37	25.37
	45°	27.00	27.00	25.45	25.46
	-45°	27.00	27.00	25.47	25.46

KARAKTERISTIEKE GEGEVENS :

Naam hoogspanningslijn	: 150 kV Zoetermeer - Leiden
Masttype	: hoekmast
Mastnaam	: mast 55
Mastnummer	: 55
Windgebied	: II
Bebouwing	: Onbebouwd
IJsgebied	: A
Referentie periode	: 50 jaar

		VELD 1		VELD 2
Minimum lijnhoek	[graden]	179.38		179.38
Maximum lijnhoek	[graden]	179.38		174.7
Veldlengte	[m]	319		421
Vaklengte	[m]		740	

* Belastingcombinaties en -factoren: NEN-EN 50341 -1 t/m -3, nov. 2001

* Berekend worden de "Ultimate Limit State" belastingcombinaties, (table 4.2.11/NL.1)

(1a) Permanente belasting met extreme windbelasting
(1b) Permanente belasting met extreme koude
(3) Permanente belasting met extreme ijsbelasting
(4) Permanente belasting met onderhoudsbelasting
(5a) Permanente belasting met torsie
(6) Permanente belasting

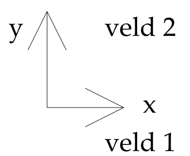
* Berekend worden de "Special Limit State" belastingcombinaties, (table 4.2.11/NL.3)

(1a) Permanente belasting met extreme windbelasting
(1b) Permanente belasting met extreme koude
(3) Permanente belasting met extreme ijsbelasting
(4) Permanente belasting met onderhoudsbelasting

* Alle belastingscomponenten zijn exclusief belastingsfactoren, uitgezonderd draadtrekkrachten jTrep

* Assenstelsel:

y = lijnrichting



INVOERGEGEVENS VOOR DRAAD No.: 1

Geleidersoort	:	bliksemdraad
Geleidersoort + plaats	:	bliksemdr
Geleiders veld 1 en 2	:	Br 50
Eigen gewicht draad	[N/m] :	4.43
Draaddoorsnede	[mm²] :	48.36
Draaddiameter	[mm] :	9
Elasticiteitsmodulus	[N/mm²] :	130000
Uitzettingscoëfficiënt	[1/°C] :	0.000017
Breekbelasting draad	[N] :	28390.7
Maximum percentage breekbelasting	[%] :	100
EDS percentage breekbelasting	[%] :	36.6
Hoogte draadbevestiging	[m] :	53.5

Eigen gewicht isolator	[kN] :	0	0
Lengte isolator	[m] :	0	0
Diameter isolatorschaal	[mm] :	0	0
Hoogte isolator boven maaiveld	[m] :	0	0
Hoogte verschil draadbevestiging (aangrenzende minus beschouwende mast) (hoger = positief)	[m] :	-20.87	-.7

Mastnummer	:	55
Draadnummer	:	1
Geleidersoort + plaats	:	bliksemdr
Geleiders veld 1 en 2	:	Br 50
Veldlengte voor gewicht [m]	:	526.35

BELASTING COMPONENTEN [kN]

		GELEIDER		ISOLATOR	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 1.39	- 0.95	0.00	0.00
Qijs;rep		- 4.71	- 3.21	0.00	0.00
Qonderhoud;rep		0.00	0.00		
BIJ MINIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	1.23	1.68	0.00	0.00
Qw;rep loodrecht lijn,	y	0.01	-0.01	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	-0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	0.62	0.83	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	0.00	-0.00	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	0.61	0.85	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	0.00	-0.00	0.00	0.00
BIJ MAXIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	1.23	1.67	0.00	0.00
Qw;rep loodrecht lijn,	y	0.01	-0.08	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	-0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	0.62	0.76	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	0.00	-0.04	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	0.61	0.91	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	0.00	-0.04	0.00	0.00
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	7.07	9.75	0.00	0.00
Qw;rep loodrecht lijn,	y	0.04	-0.05	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	-0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	3.57	4.82	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	0.02	-0.03	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	3.50	4.93	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	0.02	-0.03	0.00	0.00
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	7.07	9.72	0.00	0.00
Qw;rep loodrecht lijn,	y	0.04	-0.45	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	-0.02	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	3.57	4.42	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	0.02	-0.20	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	3.50	5.32	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	0.02	-0.25	0.00	0.00

Mastnummer	:	55
Draadnummer	:	1
Geleidersoort + plaats	:	bliksemdr
Geleiders veld 1 en 2	:	Br 50

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2	
	Hoek t.o.v. lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	21.68	21.68	19.57	19.56
	0°	12.58	12.58	9.32	9.36
	45°	18.50	18.50	15.74	15.36
	-45°	18.42	18.42	15.84	16.21
jTrep bij combinatie (1b)	90°	15.57	15.57	10.98	10.98
	0°	14.80	14.80	10.17	10.17
	45°	15.21	15.21	10.58	10.55
	-45°	15.20	15.20	10.59	10.63
jTrep bij combinatie (3)	90°	40.32	40.32	41.31	41.30
	0°	35.37	35.37	35.03	35.04
	45°	38.05	38.05	38.37	38.11
	-45°	37.99	37.99	38.43	38.68
jTrep bij combinatie (4)	90°	13.69	13.69	10.23	10.23
	0°	12.75	12.75	9.45	9.45
	45°	13.24	13.24	9.84	9.81
	-45°	13.23	13.23	9.85	9.88
jTrep bij combinatie (5a)	90°	10.48		7.76	
jTrep bij combinatie (6)	90°	14.15		10.48	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

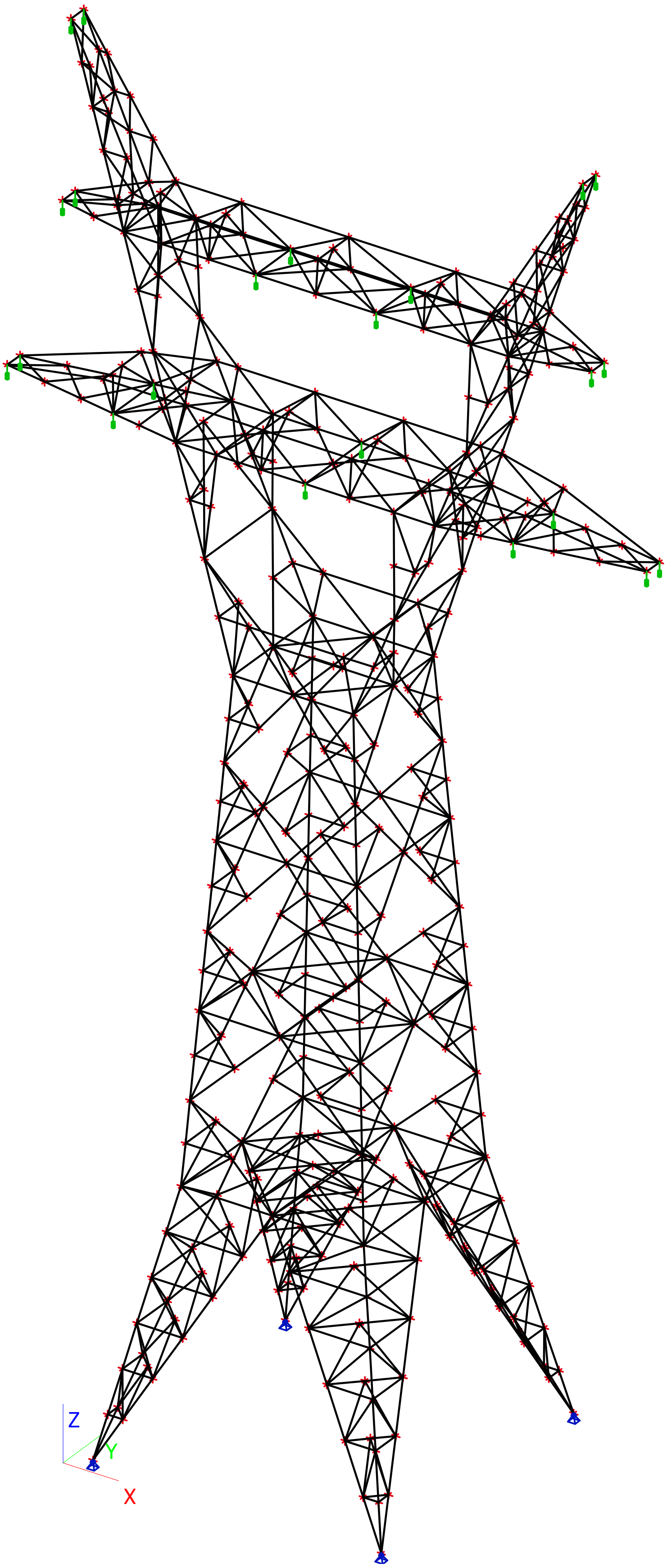
		VELD 1		VELD 2	
	Hoek t.o.v. lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	13.68	13.68	12.24	12.23
	0°	12.58	12.58	9.32	9.32
	45°	12.90	12.90	10.90	10.78
	-45°	12.88	12.88	10.93	11.05
jTrep bij combinatie (1b)	90°	15.12	15.12	10.65	10.64
	0°	14.80	14.80	10.17	10.17
	45°	14.97	14.97	10.41	10.39
	-45°	14.96	14.96	10.41	10.43
jTrep bij combinatie (3)	90°	20.58	20.58	21.54	21.52
	0°	9.05	9.05	8.96	9.01
	45°	16.32	16.32	16.73	16.26
	-45°	16.21	16.21	16.86	17.31
jTrep bij combinatie (4)	90°	13.29	13.29	9.91	9.91
	0°	12.75	12.75	9.45	9.45
	45°	13.03	13.03	9.68	9.66
	-45°	13.02	13.02	9.69	9.71

Bijlage B Berekening Mast 55; Scia Engineer

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 55
Omschrijving	- ontwerpberekening
Auteur	- SMA
Datum	18.02.2014
Constructie	Algemeen XYZ
Nationale norm	EC - EN

1. Inhoudsopgave

2. Overzicht rekenmodel



3. Knoop

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K1	-8,904	-0,682	49,980
K2	-9,553	0,000	49,980
K3	-10,100	-0,541	51,489
K5	-9,553	0,682	49,980
K7	-10,100	0,541	51,489
K9	-9,553	-0,682	49,980
K13	-9,014	0,821	48,490
K15	-8,333	0,000	46,609
K17	-9,014	-0,821	48,490
K21	-9,764	0,543	51,470
K24	-8,905	0,682	49,980
K28	-8,045	0,821	48,490
K29	-8,333	0,996	46,609
K31	-9,764	-0,543	51,470
K38	-8,045	-0,821	48,490
K39	-8,333	-0,996	46,609
K43	-8,004	-1,081	45,700
K47	-7,279	0,000	43,700
K55	-7,279	-1,268	43,700
K56	-7,279	1,268	43,700
K61	-5,929	1,616	39,971
K63	-5,397	-1,753	38,500
K65	-5,929	-1,616	39,971
K67	-5,938	0,000	39,994
K69	-3,952	2,126	34,509
K70	-5,397	0,000	38,500
K71	-4,678	1,939	36,515
K72	-4,676	1,060	36,510
K75	-3,952	-2,126	34,509
K77	-4,678	-1,939	36,515
K78	-4,676	-1,060	36,510
K81	4,678	1,939	36,515
K82	3,814	1,939	36,514
K83	3,677	1,753	38,500
K86	-1,974	2,323	32,501
K87	1,974	2,323	32,501
K88	-1,974	-2,323	32,501
K89	1,974	-2,323	32,501
K90	-3,226	2,313	32,505
K91	-2,500	2,500	30,500
K93	0,000	2,500	30,500
K95	-3,226	1,063	32,505
K99	-2,500	0,000	30,500
K102	-2,500	-2,500	30,500
K103	-3,226	-1,063	32,505
K104	-3,226	-2,313	32,505
K109	0,000	-2,500	30,500
K111	3,226	2,313	32,505
K112	2,500	2,500	30,500
K115	8,904	0,682	49,980
K116	9,553	0,000	49,980
K117	8,904	-0,682	49,980
K118	10,100	-0,541	51,489
K120	9,553	0,682	49,980
K122	10,100	0,541	51,489
K124	9,553	-0,682	49,980
K128	9,014	0,821	48,490
K130	8,333	0,000	46,609
K132	9,014	-0,821	48,490
K136	9,764	0,543	51,470
K143	8,045	0,821	48,490
K144	8,333	0,996	46,609
K146	9,764	-0,543	51,470
K153	8,045	-0,821	48,490
K154	8,333	-0,997	46,609
K156	8,004	1,081	45,700
K158	8,004	-1,081	45,700

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K162	7,279	0,000	43,700
K170	7,279	-1,268	43,700
K171	7,279	1,268	43,700
K173	-7,185	0,001	47,000
K177	7,185	0,001	47,000
K186	-2,498	1,081	45,700
K191	-4,465	0,000	47,000
K194	-4,465	-1,081	45,700
K198	-6,435	-1,081	45,700
K201	-2,498	-1,081	45,700
K205	4,465	0,960	47,000
K206	6,435	1,081	45,700
K207	2,498	1,081	45,700
K211	4,465	1,081	45,700
K212	4,465	0,000	47,000
K215	4,465	-1,081	45,700
K217	4,465	-0,960	47,000
K219	6,435	-1,081	45,700
K222	2,498	-1,081	45,700
K224	0,000	1,081	45,700
K226	0,000	0,000	47,000
K227	0,000	-1,081	45,700
K233	-7,185	0,960	47,000
K235	-7,185	-0,960	47,000
K243	-6,480	1,268	43,700
K245	-6,480	-1,268	43,700
K254	-11,000	-0,400	45,700
K256	-10,647	0,400	53,000
K261	7,185	0,960	47,000
K264	11,000	0,400	45,700
K267	7,185	-0,960	47,000
K269	6,480	1,268	43,700
K271	6,480	-1,268	43,700
K282	11,000	-0,400	45,700
K284	10,647	0,400	53,000
K291	-3,677	1,753	38,500
K294	-5,042	1,614	39,996
K298	5,929	1,616	39,971
K301	5,397	1,753	38,500
K302	5,042	1,614	39,996
K306	-5,042	-1,614	39,996
K307	-3,677	-1,753	38,500
K311	-9,475	-0,747	45,700
K314	-9,475	0,747	45,700
K325	-10,647	-0,400	53,000
K335	-6,435	1,081	45,700
K388	-8,004	1,081	45,700
K394	-1,837	1,753	38,500
K395	-1,840	0,000	39,996
K396	1,837	1,753	38,500
K397	1,840	0,000	39,996
K400	-8,778	-0,008	39,672
K401	-8,316	-1,253	38,500
K404	-1,837	-1,753	38,500
K406	1,837	-1,753	38,500
K408	-1,840	-1,614	39,996
K409	-1,840	1,614	39,996
K410	1,840	-1,614	39,996
K411	1,840	1,614	39,996
K414	0,000	1,753	38,500
K420	-13,297	0,400	38,500
K423	-8,778	1,174	39,672
K424	13,297	0,400	38,500
K426	8,316	1,253	38,500
K428	8,778	1,174	39,672
K429	-13,297	-0,400	38,500
K433	-8,778	-1,174	39,672

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K434	0,000	-1,753	38,500
K438	3,677	-1,753	38,500
K444	5,397	-1,753	38,500
K447	5,397	0,000	38,500
K448	4,676	1,060	36,510
K451	3,226	1,063	32,505
K456	3,952	-2,126	34,509
K458	13,297	-0,400	38,500
K459	5,929	-1,616	39,971
K460	8,316	-1,253	38,500
K462	8,778	-1,174	39,672
K469	4,678	-1,939	36,515
K470	4,676	-1,060	36,510
K473	-3,677	0,000	38,500
K493	-11,540	0,701	38,500
K496	-11,540	-0,701	38,500
K521	-7,103	-1,461	38,500
K522	-7,103	1,461	38,500
K527	3,677	0,000	38,500
K531	0,000	0,000	38,500
K538	8,778	-0,008	39,672
K546	5,938	0,000	39,994
K550	11,540	-0,701	38,500
K552	9,833	-0,993	38,500
K553	11,540	0,701	38,500
K555	9,833	0,993	38,500
K598	5,042	-1,614	39,996
K601	3,813	-1,939	36,514
K605	3,226	-1,063	32,505
K606	3,226	-2,313	32,505
K618	10,647	-0,400	53,000
K619	-6,526	-1,462	41,620
K620	-6,526	1,462	41,620
K621	6,526	1,462	41,620
K622	6,527	-1,462	41,621
K623	-4,465	0,960	47,000
N2	-3,800	-3,800	10,500
N4	3,800	-3,800	10,500
N5	-3,800	3,800	10,500
N8	3,800	3,800	10,500
N59	-3,582	-3,582	13,860
N61	3,582	-3,582	13,860
N62	-3,582	3,582	13,860
N65	3,582	3,582	13,860
N9	0,000	-3,800	10,500
N66	3,800	0,000	10,500
N67	0,000	3,800	10,500
N68	-3,800	0,000	10,500
N69	-3,691	-3,691	12,180
N14	-1,791	-3,691	12,180
N15	3,691	-3,691	12,180
N16	1,791	-3,691	12,180
N17	3,691	-1,791	12,180
N18	3,691	1,791	12,180
N19	3,691	3,691	12,180
N70	1,791	3,691	12,180
N71	-1,791	3,691	12,180
N72	-3,691	3,691	12,180
N73	-3,691	1,791	12,180
N74	-3,691	-1,791	12,180
N76	-3,151	-3,151	20,480
N78	3,151	-3,151	20,480
N79	-3,151	3,151	20,480
N82	3,151	3,151	20,480
N87	1,791	-3,467	15,621
N88	3,467	-3,467	15,621
N89	3,467	-1,791	15,621

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 55
Omschrijving	- ontwerpberekening
Nationale norm	EC - EN
Auteur	- SMA

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
N90	3,467	1,791	15,621
N91	3,467	3,467	15,621
N92	1,791	3,467	15,621
N93	-1,791	3,467	15,621
N94	-3,467	3,467	15,621
N95	-3,467	1,791	15,621
N96	-3,467	-1,791	15,621
N97	-3,467	-3,467	15,621
N98	-1,791	-3,467	15,621
N99	1,576	-3,252	18,931
N100	3,252	-3,252	18,931
N101	3,252	-1,576	18,931
N102	3,252	1,575	18,931
N33	3,252	3,252	18,931
N103	1,576	3,252	18,931
N104	-1,576	3,252	18,931
N105	-3,252	3,252	18,931
N106	-3,252	1,575	18,931
N38	-3,252	-1,576	18,931
N107	-3,252	-3,252	18,931
N108	-1,576	-3,252	18,931
N114	-2,720	-2,721	27,100
N116	2,721	-2,721	27,100
N117	-2,720	2,720	27,100
N120	2,721	2,720	27,100
N121	-2,920	-2,920	24,033
N122	2,920	-2,920	24,033
N123	2,920	2,920	24,033
N124	-2,920	2,920	24,033
N125	1,576	-3,036	22,256
N126	3,036	-3,036	22,256
N127	3,036	-1,576	22,256
N128	3,036	1,575	22,256
N129	3,036	3,035	22,256
N130	1,576	3,035	22,256
N131	-1,576	3,035	22,256
N132	-3,036	3,035	22,256
N133	-3,036	1,575	22,256
N134	-3,036	-1,576	22,256
N135	-3,036	-3,036	22,256
N136	-1,576	-3,036	22,256
N137	1,361	-2,821	25,566
N138	2,821	-2,821	25,566
N139	2,821	-1,361	25,566
N140	2,821	1,360	25,566
N141	2,821	2,820	25,566
N142	1,361	2,820	25,566
N143	-1,360	2,820	25,566
N144	-2,820	2,820	25,566
N145	-2,820	1,360	25,566
N146	-2,820	-1,361	25,566
N147	-2,820	-2,821	25,566
N148	-1,360	-2,821	25,566
N149	2,920	0,000	24,033
N150	0,000	2,920	24,033
N151	-2,920	0,000	24,033
N152	0,000	-2,920	24,033
N156	2,500	-2,500	30,500
N165	-2,610	-2,611	28,800
N166	-1,360	-2,611	28,800
N167	1,360	-2,611	28,800
N168	2,610	-2,611	28,800
N169	2,610	-1,361	28,800

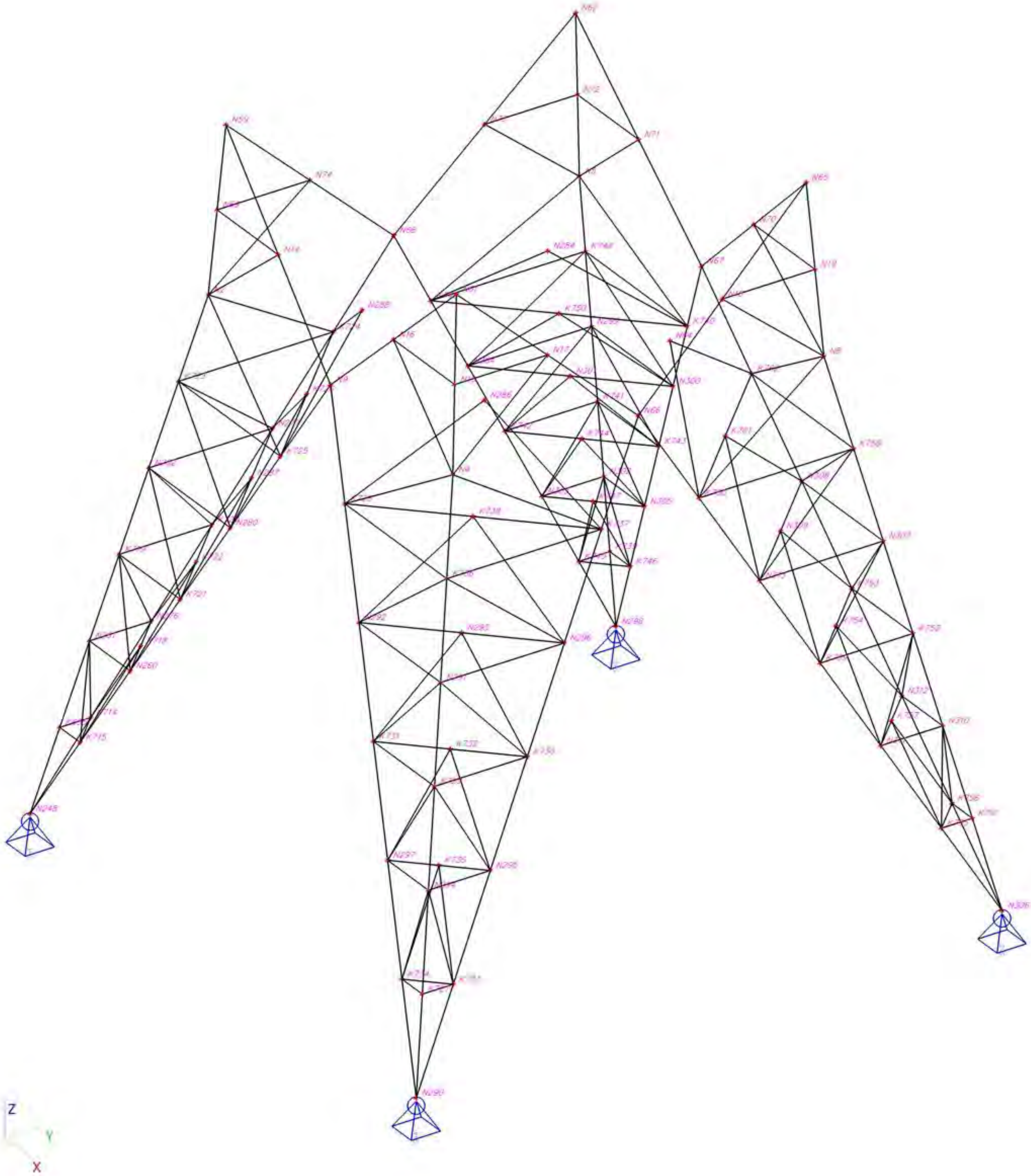
Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
N170	2,610	1,360	28,800
N171	2,610	2,610	28,800
N172	1,361	2,610	28,800
N173	-1,360	2,610	28,800
N174	-2,610	2,610	28,800
N175	-2,610	1,360	28,800
N176	-2,610	-1,361	28,800
K625	2,500	-0,001	30,500
K626	-5,397	1,753	38,500
K627	-4,465	-0,960	47,000
K628	3,952	2,126	34,509
K629	-3,814	-1,939	36,515
K630	-3,814	1,939	36,515
N183	0,000	0,000	30,500
N191	0,000	0,960	47,000
N192	0,000	-0,960	47,000
K631	-11,000	0,400	45,700
N247	0,000	-3,353	17,382
K705	3,353	3,353	17,382
K706	3,353	0,000	17,382
K707	3,353	-3,353	17,382
K708	-3,353	3,353	17,382
K709	0,000	3,353	17,382
K711	-3,353	-3,353	17,382
K712	-3,353	0,000	17,382
N248	-6,000	-6,000	0,000
N260	-4,000	-5,267	3,500
N261	-5,267	-5,267	3,500
N262	-4,533	-4,533	7,000
N276	-5,267	-4,000	3,500
N277	-4,533	-2,000	7,000
N280	-2,000	-4,533	7,000
N64	1,900	1,900	10,500
N284	-1,900	1,900	10,500
N286	1,900	-1,900	10,500
N287	-3,267	-3,267	7,000
N288	-1,900	-1,900	10,500
N289	0,000	0,000	10,500
K655	-5,633	-5,633	1,750
K714	-5,633	-5,000	1,750
K715	-5,000	-5,633	1,750
K718	-4,633	-4,633	3,500
K719	-4,900	-4,900	5,250
K720	-4,900	-3,000	5,250
K721	-3,000	-4,900	5,250
K722	-3,950	-3,950	5,250
K723	-4,167	-4,167	8,750
K724	-4,167	-1,000	8,750
K725	-1,000	-4,167	8,750
K726	-2,583	-2,583	8,750
N290	6,000	-6,000	0,000
K727	5,633	-5,633	1,750
K728	1,000	-4,167	8,750
N291	4,533	-4,533	7,000
N292	2,000	-4,533	7,000
N293	3,267	-3,267	7,000
K729	4,900	-4,900	5,250
K730	4,900	-3,000	5,250
K731	3,000	-4,900	5,250
K732	3,950	-3,950	5,250
N294	5,267	-5,267	3,500
N295	5,267	-4,000	3,500
K733	5,633	-5,000	1,750

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K734	5,000	-5,633	1,750
K735	4,633	-4,633	3,500
N296	4,533	-2,000	7,000
K736	4,167	-4,167	8,750
K737	4,167	-1,000	8,750
K738	2,583	-2,583	8,750
N297	4,000	-5,267	3,500
N298	-6,000	6,000	0,000
K739	-5,633	5,633	1,750
K740	-1,000	4,167	8,750
N299	-4,533	4,533	7,000
N300	-2,000	4,533	7,000
N301	-3,267	3,267	7,000
K741	-4,900	4,900	5,250
K742	-4,900	3,000	5,250
K743	-3,000	4,900	5,250
K744	-3,950	3,950	5,250
N302	-5,267	5,267	3,500
N303	-5,267	4,000	3,500
K745	-5,633	5,000	1,750
K746	-5,000	5,633	1,750
K747	-4,633	4,633	3,500
N304	-4,533	2,000	7,000
K748	-4,167	4,167	8,750
K749	-4,167	1,000	8,750
K750	-2,583	2,583	8,750
N305	-4,000	5,267	3,500
N306	6,000	6,000	0,000
K751	5,633	5,633	1,750
N307	4,533	4,533	7,000
N308	2,000	4,533	7,000
N309	3,267	3,267	7,000
K752	4,900	4,900	5,250
K753	3,000	4,900	5,250
K754	3,950	3,950	5,250
N310	5,267	5,267	3,500
N311	5,267	4,000	3,500
K755	5,633	5,000	1,750
K756	5,000	5,633	1,750
K757	4,633	4,633	3,500
K758	4,167	4,167	8,750
N312	4,000	5,267	3,500
K759	4,900	3,000	5,250
N313	4,533	2,000	7,000
K760	4,167	1,000	8,750
K761	2,583	2,583	8,750
K762	1,000	4,167	8,750
K763	0,000	0,000	17,382
K765	-7,103	0,001	38,500
K767	-9,833	-0,993	38,500
K768	-9,833	0,993	38,500
K774	7,103	0,002	38,500
K775	7,103	-1,461	38,500
K776	7,103	1,461	38,500
K780	9,475	-0,747	45,700
K781	9,475	0,747	45,700
K783	6,527	1,462	41,621
K785	6,526	-1,462	41,620
K786	-8,316	1,253	38,500
K787	-4,465	1,081	45,700

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 55
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- SMA

4. Knoopnummers

4.1. Knoopnummers steunpunten



5. 1D-staaf

Laag	Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type
CrossArm1	S253	CS137 - L100X10	4,732	Lijn	K462	K458	Balk (80)	standaard
CrossArm1	S234	CS137 - L100X10	2,898	Lijn	K298	K428	Balk (80)	standaard
CrossArm1	S254	CS138 - L60X6	2,827	Lijn	K459	K460	Kolom (100)	standaard
CrossArm1	S256	CS137 - L100X10	2,898	Lijn	K459	K462	Balk (80)	standaard
CrossArm1	S255	CS139 - L50X5	1,262	Lijn	K462	K460	Kolom (100)	standaard
CrossArm1	S233	CS139 - L50X5	1,262	Lijn	K428	K426	Kolom (100)	standaard
CrossArm1	S601	CS133 - L50X5	2,922	Lijn	K775	K776	Balk (80)	standaard
CrossArm1	S602	CS134 - L80X8	2,448	Lijn	K444	K774	Balk (80)	standaard
CrossArm1	S223	CS139 - L50X5	2,348	Lijn	K462	K428	Balk (80)	standaard
CrossArm1	S232	CS138 - L60X6	2,827	Lijn	K298	K426	Kolom (100)	standaard
CrossArm1	S231	CS137 - L100X10	4,732	Lijn	K428	K424	Balk (80)	standaard
CrossArm1	S295	CS44 - UNP200	8,015	Lijn	K444	K458	Balk (80)	standaard
CrossArm1	S309	CS135 - L55X6	2,711	Lijn	K426	K552	Balk (80)	standaard
CrossArm1	S308	CS135 - L55X6	2,405	Lijn	K555	K550	Balk (80)	standaard
CrossArm1	S312	CS132 - HEB200	2,506	Lijn	K426	K460	Balk (80)	standaard
CrossArm1	S551	CS132 - HEB200	0,799	Lijn	K424	K458	Balk (80)	standaard
CrossArm1	S340	CS44 - UNP200	8,015	Lijn	K301	K424	Balk (80)	standaard
CrossArm1	S307	CS136 - L65X7	2,073	Lijn	K553	K458	Balk (80)	standaard
CrossArm1	S297	CS139 - L50X5	1,782	Lijn	K538	K426	Kolom (100)	standaard
CrossArm1	S296	CS139 - L50X5	1,771	Lijn	K538	K460	Kolom (100)	standaard
CrossArm1	S302	CS136 - L65X7	2,073	Lijn	K550	K424	Balk (80)	standaard
CrossArm1	S304	CS135 - L55X6	2,711	Lijn	K460	K555	Balk (80)	standaard
CrossArm1	S303	CS135 - L55X6	2,405	Lijn	K552	K553	Balk (80)	standaard
CrossArm1	S603	CS134 - L80X8	1,745	Lijn	K460	K774	Balk (80)	standaard
CrossArm1	S605	CS134 - L80X8	2,445	Lijn	K774	K301	Balk (80)	standaard
CrossArm1	S604	CS134 - L80X8	1,743	Lijn	K774	K426	Balk (80)	standaard
CrossArm2	S238	CS137 - L100X10	2,898	Lijn	K65	K433	Balk (80)	standaard
CrossArm2	S279	CS135 - L55X6	2,405	Lijn	K767	K493	Balk (80)	standaard
CrossArm2	S218	CS139 - L50X5	1,782	Lijn	K400	K786	Kolom (100)	standaard
CrossArm2	S237	CS139 - L50X5	1,262	Lijn	K433	K401	Kolom (100)	standaard
CrossArm2	S230	CS137 - L100X10	2,898	Lijn	K61	K423	Balk (80)	standaard
CrossArm2	S229	CS139 - L50X5	1,262	Lijn	K423	K786	Kolom (100)	standaard
CrossArm2	S228	CS137 - L100X10	4,732	Lijn	K423	K420	Balk (80)	standaard
CrossArm2	S274	CS135 - L55X6	2,405	Lijn	K768	K496	Balk (80)	standaard
CrossArm2	S273	CS136 - L65X7	2,073	Lijn	K493	K429	Balk (80)	standaard
CrossArm2	S548	CS132 - HEB200	0,799	Lijn	K429	K420	Balk (80)	standaard
CrossArm2	S275	CS135 - L55X6	2,710	Lijn	K786	K767	Balk (80)	standaard
CrossArm2	S217	CS139 - L50X5	1,771	Lijn	K400	K401	Kolom (100)	standaard
CrossArm2	S216	CS139 - L50X5	2,348	Lijn	K433	K423	Balk (80)	standaard
CrossArm2	S278	CS136 - L65X7	2,073	Lijn	K496	K420	Balk (80)	standaard
CrossArm2	S235	CS137 - L100X10	4,732	Lijn	K433	K429	Balk (80)	standaard
CrossArm2	S395	CS44 - UNP200	8,015	Lijn	K626	K420	Balk (80)	standaard
CrossArm2	S289	CS44 - UNP200	8,015	Lijn	K63	K429	Balk (80)	standaard
CrossArm2	S600	CS134 - L80X8	2,445	Lijn	K765	K626	Balk (80)	standaard
CrossArm2	S599	CS134 - L80X8	1,743	Lijn	K765	K786	Balk (80)	standaard
CrossArm2	S236	CS138 - L60X6	2,827	Lijn	K65	K401	Kolom (100)	standaard
CrossArm2	S287	CS133 - L50X5	2,922	Lijn	K521	K522	Balk (80)	standaard
CrossArm2	S288	CS134 - L80X8	2,447	Lijn	K63	K765	Balk (80)	standaard
CrossArm2	S280	CS135 - L55X6	2,711	Lijn	K401	K768	Balk (80)	standaard
CrossArm2	S283	CS132 - HEB200	2,506	Lijn	K401	K786	Balk (80)	standaard
CrossArm2	S448	CS138 - L60X6	2,827	Lijn	K61	K786	Balk (80)	standaard
CrossArm2	S465	CS134 - L80X8	1,745	Lijn	K401	K765	Balk (80)	standaard
CrossArm3	S193	CS148 - L60X6	2,347	Lijn	K158	K781	Balk (80)	standaard
CrossArm3	S194	CS149 - UNP180	3,073	Lijn	K156	K264	Balk (80)	standaard
CrossArm3	S195	CS149 - UNP180	3,073	Lijn	K158	K282	Balk (80)	standaard
CrossArm3	S508	CS146 - HEB180	0,800	Lijn	K282	K264	Balk (80)	standaard
CrossArm3	S143	CS147 - L80X8	2,880	Lijn	K144	K264	Balk (80)	standaard
CrossArm3	S152	CS147 - L80X8	2,880	Lijn	K154	K282	Balk (80)	standaard
CrossArm3	S190	CS148 - L60X6	1,908	Lijn	K780	K264	Balk (80)	standaard
CrossArm3	S192	CS148 - L60X6	1,908	Lijn	K781	K282	Balk (80)	standaard
CrossArm3	S191	CS148 - L60X6	2,347	Lijn	K156	K780	Balk (80)	standaard
CrossArm4	S170	CS148 - L60X6	2,347	Lijn	K43	K314	Balk (80)	standaard
CrossArm4	S169	CS148 - L60X6	1,908	Lijn	K314	K254	Balk (80)	standaard
CrossArm4	S171	CS149 - UNP180	3,073	Lijn	K388	K631	Balk (80)	standaard
CrossArm4	S511	CS146 - HEB180	0,800	Lijn	K254	K631	Balk (80)	standaard
CrossArm4	S172	CS149 - UNP180	3,073	Lijn	K43	K254	Balk (80)	standaard
CrossArm4	S168	CS148 - L60X6	2,347	Lijn	K388	K311	Balk (80)	standaard

Laag	Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type
CrossArm4	S130	CS147 - L80X8	2,880	Lijn	K29	K631	Balk (80)	standaard
CrossArm4	S138	CS147 - L80X8	2,880	Lijn	K39	K254	Balk (80)	standaard
CrossArm4	S167	CS148 - L60X6	1,908	Lijn	K311	K631	Balk (80)	standaard
CrossArm5	S69	CS12 - L50X5	1,364	Lijn	K124	K120	Balk (80)	standaard
CrossArm5	S73	CS130 - L50X5	2,162	Lijn	K130	K132	Kolom (100)	standaard
CrossArm5	S70	CS12 - L50X5	2,184	Lijn	K128	K124	Kolom (100)	standaard
CrossArm5	S72	CS12 - L50X5	2,184	Lijn	K132	K120	Kolom (100)	standaard
CrossArm5	S71	CS130 - L50X5	2,162	Lijn	K130	K128	Kolom (100)	standaard
CrossArm5	S68	CS12 - L50X5	2,018	Lijn	K124	K122	Kolom (100)	standaard
CrossArm5	S414	CS131 - L80X8	6,823	Lijn	K284	K144	Kolom (100)	standaard
CrossArm5	S426	CS131 - L80X8	6,823	Lijn	K154	K618	Kolom (100)	standaard
CrossArm5	S343	CS160 - HEB120	0,800	Lijn	K618	K284	Balk (80)	standaard
CrossArm5	S67	CS12 - L50X5	1,862	Lijn	K122	K618	Kolom (100)	standaard
CrossArm5	S66	CS12 - L50X5	2,018	Lijn	K120	K118	Kolom (100)	standaard
CrossArm5	S65	CS12 - L50X5	1,862	Lijn	K118	K284	Kolom (100)	standaard
CrossArm5	S74	CS7 - L50X5	1,511	Lijn	K136	K120	Kolom (100)	standaard
CrossArm5	S77	CS7 - L50X5	0,649	Lijn	K115	K120	Balk (80)	standaard
CrossArm5	S83	CS7 - L50X5	0,649	Lijn	K117	K124	Balk (80)	standaard
CrossArm5	S82	CS7 - L50X5	1,501	Lijn	K117	K132	Kolom (100)	standaard
CrossArm5	S84	CS7 - L50X5	1,911	Lijn	K153	K154	Kolom (100)	standaard
CrossArm5	S85	CS7 - L50X5	0,969	Lijn	K153	K132	Balk (80)	standaard
CrossArm5	S482	CS21 - L100X75X7	6,950	Polylijn	K284	K261	Kolom (100)	standaard
CrossArm5	S483	CS21 - L100X75X7	6,950	Lijn	K267	K618	Kolom (100)	standaard
CrossArm5	S76	CS7 - L50X5	1,501	Lijn	K115	K128	Kolom (100)	standaard
CrossArm5	S79	CS7 - L50X5	0,969	Lijn	K143	K128	Balk (80)	standaard
CrossArm5	S75	CS7 - L50X5	0,336	Lijn	K136	K122	Balk (80)	standaard
CrossArm5	S80	CS7 - L50X5	1,511	Lijn	K146	K124	Kolom (100)	standaard
CrossArm5	S78	CS7 - L50X5	1,911	Lijn	K143	K144	Kolom (100)	standaard
CrossArm5	S81	CS7 - L50X5	0,336	Lijn	K146	K118	Balk (80)	standaard
CrossArm6	S12	CS7 - L50X5	0,336	Lijn	K21	K7	Balk (80)	standaard
CrossArm6	S13	CS7 - L50X5	1,501	Lijn	K24	K13	Kolom (100)	standaard
CrossArm6	S9	CS12 - L50X5	2,184	Lijn	K17	K5	Kolom (100)	standaard
CrossArm6	S373	CS131 - L80X8	6,823	Lijn	K325	K39	Kolom (100)	standaard
CrossArm6	S11	CS7 - L50X5	1,511	Lijn	K21	K5	Kolom (100)	standaard
CrossArm6	S10	CS130 - L50X5	2,162	Lijn	K15	K17	Kolom (100)	standaard
CrossArm6	S8	CS130 - L50X5	2,162	Lijn	K15	K13	Kolom (100)	standaard
CrossArm6	S5	CS12 - L50X5	2,018	Lijn	K9	K7	Kolom (100)	standaard
CrossArm6	S4	CS12 - L50X5	1,862	Lijn	K7	K325	Kolom (100)	standaard
CrossArm6	S7	CS12 - L50X5	2,184	Lijn	K13	K9	Kolom (100)	standaard
CrossArm6	S6	CS12 - L50X5	1,364	Lijn	K9	K5	Balk (80)	standaard
CrossArm6	S18	CS7 - L50X5	0,336	Lijn	K31	K3	Balk (80)	standaard
CrossArm6	S486	CS131 - L80X8	6,823	Lijn	K29	K256	Kolom (100)	standaard
CrossArm6	S17	CS7 - L50X5	1,511	Lijn	K31	K9	Kolom (100)	standaard
CrossArm6	S484	CS21 - L100X75X7	6,950	Lijn	K233	K256	Kolom (100)	standaard
CrossArm6	S485	CS21 - L100X75X7	6,950	Polylijn	K325	K235	Kolom (100)	standaard
CrossArm6	S14	CS7 - L50X5	0,649	Lijn	K24	K5	Balk (80)	standaard
CrossArm6	S2	CS12 - L50X5	1,862	Lijn	K3	K256	Kolom (100)	standaard
CrossArm6	S16	CS7 - L50X5	0,969	Lijn	K28	K13	Balk (80)	standaard
CrossArm6	S15	CS7 - L50X5	1,911	Lijn	K28	K29	Kolom (100)	standaard
CrossArm6	S175	CS160 - HEB120	0,800	Lijn	K325	K256	Balk (80)	standaard
CrossArm6	S19	CS7 - L50X5	1,501	Lijn	K1	K17	Kolom (100)	standaard
CrossArm6	S20	CS7 - L50X5	0,649	Lijn	K1	K9	Balk (80)	standaard
CrossArm6	S21	CS7 - L50X5	1,911	Lijn	K38	K39	Kolom (100)	standaard
CrossArm6	S3	CS12 - L50X5	2,018	Lijn	K5	K3	Kolom (100)	standaard
CrossArm6	S22	CS7 - L50X5	0,969	Lijn	K38	K17	Balk (80)	standaard
HorVerb1	B183	CS6 - L150X14	7,600	Lijn	N8	N5	Balk (80)	standaard
HorVerb1	B186	CS117 - L75X8	7,600	Polylijn	N68	N66	vakwerkdiagonaal (90)	standaard
HorVerb1	B187	CS117 - L75X8	3,800	Lijn	N289	N67	vakwerkdiagonaal (90)	standaard
HorVerb1	B184	CS6 - L150X14	7,600	Lijn	N5	N2	Balk (80)	standaard
HorVerb1	B185	CS117 - L75X8	3,800	Lijn	N9	N289	vakwerkdiagonaal (90)	standaard
HorVerb1	B88	CS118 - L70X7	5,374	Lijn	N67	N66	vakwerkdiagonaal (90)	standaard
HorVerb1	B160	CS118 - L70X7	5,374	Lijn	N66	N9	vakwerkdiagonaal (90)	standaard
HorVerb1	B86	CS118 - L70X7	5,374	Lijn	N9	N68	vakwerkdiagonaal (90)	standaard
HorVerb1	B87	CS118 - L70X7	5,374	Lijn	N68	N67	vakwerkdiagonaal (90)	standaard
HorVerb1	B181	CS6 - L150X14	7,600	Lijn	N2	N4	Balk (80)	standaard
HorVerb1	B182	CS6 - L150X14	7,600	Lijn	N4	N8	Balk (80)	standaard
HorVerb2	S591	CS104 - L65X7	3,353	Lijn	K706	K707	Balk (80)	standaard
HorVerb2	S590	CS104 - L65X7	3,353	Lijn	K705	K706	Balk (80)	standaard
HorVerb2	S589	CS104 - L65X7	3,353	Lijn	N247	K711	Balk (80)	standaard

Laag	Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type
HorVerb2	S593	CS104 - L65X7	3,353	Lijn	K709	K705	Balk (80)	standaard
HorVerb2	S594	CS104 - L65X7	3,353	Lijn	K711	K712	Balk (80)	standaard
HorVerb2	S595	CS104 - L65X7	3,353	Lijn	K712	K708	Balk (80)	standaard
HorVerb2	S592	CS104 - L65X7	3,353	Lijn	K708	K709	Balk (80)	standaard
HorVerb2	S588	CS104 - L65X7	3,353	Lijn	K707	N247	Balk (80)	standaard
HorVerb2	S526	CS59 - L70/7	4,741	Lijn	K712	K709	Balk (80)	standaard
HorVerb2	S596	CS121 - L60X6	3,353	Lijn	K763	K709	Balk (80)	standaard
HorVerb2	S597	CS121 - L60X6	6,705	Lijn	K712	K706	Balk (80)	standaard
HorVerb2	S527	CS59 - L70/7	4,741	Lijn	K709	K706	Balk (80)	standaard
HorVerb2	S533	CS121 - L60X6	3,353	Lijn	N247	K763	Balk (80)	standaard
HorVerb2	S529	CS59 - L70/7	4,741	Lijn	N247	K712	Balk (80)	standaard
HorVerb2	S528	CS59 - L70/7	4,741	Lijn	K706	N247	Balk (80)	standaard
HorVerb3	S470	CS78 - L150X14	2,500	Lijn	K99	K91	Balk (80)	standaard
HorVerb3	S469	CS78 - L150X14	2,500	Lijn	K102	K99	Balk (80)	standaard
HorVerb3	S468	CS78 - L150X14	2,500	Lijn	K109	K102	Balk (80)	standaard
HorVerb3	S471	CS78 - L150X14	2,500	Lijn	K91	K93	Balk (80)	standaard
HorVerb3	S473	CS78 - L150X14	2,501	Lijn	K112	K625	Balk (80)	standaard
HorVerb3	S472	CS78 - L150X14	2,500	Lijn	K93	K112	Balk (80)	standaard
HorVerb3	S474	CS78 - L150X14	2,499	Lijn	K625	N156	Balk (80)	standaard
HorVerb3	S467	CS78 - L150X14	2,500	Lijn	N156	K109	Balk (80)	standaard
HorVerb3	B129	CS79 - L90X9	3,536	Lijn	K99	K93	vakwerkdiagonaal (90)	standaard
HorVerb3	B130	CS79 - L90X9	3,536	Lijn	K93	K625	vakwerkdiagonaal (90)	standaard
HorVerb3	B131	CS79 - L90X9	3,535	Lijn	K625	K109	vakwerkdiagonaal (90)	standaard
HorVerb3	B133	CS77 - L75X8	5,000	Polylijn	K99	K625	vakwerkdiagonaal (90)	standaard
HorVerb3	B132	CS79 - L90X9	3,536	Lijn	K99	K109	vakwerkdiagonaal (90)	standaard
Vak1	SB279	CS115 - L60X6	2,355	Lijn	K721	N262	vertikaal windverband (0)	standaard
Vak1	SB280	CS115 - L60X6	2,355	Lijn	K720	N262	vertikaal windverband (0)	standaard
Vak1	B192	CS8 - L50X5	2,409	Lijn	K720	N287	vertikaal windverband (0)	standaard
Vak1	B193	CS8 - L50X5	2,409	Lijn	K721	N287	vertikaal windverband (0)	standaard
Vak1	B194	CS120 - L55X6	4,478	Lijn	K725	K724	vertikaal windverband (0)	standaard
Vak1	B196	CS120 - L55X6	3,002	Lijn	K724	N288	vertikaal windverband (0)	standaard
Vak1	B179	CS120 - L55X6	2,684	Lijn	N280	K726	vertikaal windverband (0)	standaard
Vak1	B180	CS120 - L55X6	2,684	Lijn	N277	K726	vertikaal windverband (0)	standaard
Vak1	SB281	CS119 - L65X7	3,167	Lijn	K723	K724	vertikaal windverband (0)	standaard
Vak1	SB282	CS119 - L65X7	3,167	Lijn	K725	K723	vertikaal windverband (0)	standaard
Vak1	B195	CS120 - L55X6	3,002	Lijn	K725	N288	vertikaal windverband (0)	standaard
Vak1	B191	CS8 - L50X5	2,687	Lijn	K721	K720	vertikaal windverband (0)	standaard
Vak1	B189	CS8 - L50X5	2,049	Lijn	K714	K718	vertikaal windverband (0)	standaard
Vak1	B188	CS8 - L50X5	0,896	Lijn	K715	K714	vertikaal windverband (0)	standaard
Vak1	SB274	CS115 - L60X6	0,633	Lijn	K715	K655	vertikaal windverband (0)	standaard
Vak1	SB250	CS115 - L60X6	2,533	Lijn	N262	N277	vertikaal windverband (0)	standaard
Vak1	SB275	CS115 - L60X6	1,808	Lijn	K715	N261	vertikaal windverband (0)	standaard
Vak1	B190	CS8 - L50X5	2,049	Lijn	K715	K718	vertikaal windverband (0)	standaard
Vak1	B159	CS114 - L130X12	12,292	Lijn	N248	N68	vakwerkdiagonaal (90)	standaard
Vak1	C29	CS113 - L200X26	10,951	Lijn	N248	N2	Kolom (100)	standaard
Vak1	B154	CS114 - L130X12	12,292	Lijn	N248	N9	vakwerkdiagonaal (90)	standaard
Vak1	SB273	CS115 - L60X6	0,633	Lijn	K655	K714	vertikaal windverband (0)	standaard
Vak1	SB249	CS115 - L60X6	1,267	Lijn	N261	N276	vertikaal windverband (0)	standaard
Vak1	SB241	CS115 - L60X6	1,267	Lijn	N260	N261	vertikaal windverband (0)	standaard
Vak1	B85	CS120 - L55X6	3,583	Lijn	N280	N277	vertikaal windverband (0)	standaard
Vak1	B84	CS8 - L50X5	1,791	Lijn	N260	N276	vertikaal windverband (0)	standaard
Vak1	SB277	CS115 - L60X6	1,900	Lijn	K719	K720	vertikaal windverband (0)	standaard
Vak1	SB278	CS115 - L60X6	1,900	Lijn	K721	K719	vertikaal windverband (0)	standaard
Vak1	B178	CS8 - L50X5	2,191	Lijn	N276	K722	vertikaal windverband (0)	standaard
Vak1	B177	CS8 - L50X5	2,191	Lijn	N260	K722	vertikaal windverband (0)	standaard
Vak1	SB260	CS119 - L65X7	2,809	Lijn	N277	K723	vertikaal windverband (0)	standaard
Vak1	SB259	CS115 - L60X6	2,002	Lijn	N276	K719	vertikaal windverband (0)	standaard
Vak1	SB252	CS115 - L60X6	2,533	Lijn	N280	N262	vertikaal windverband (0)	standaard
Vak1	SB276	CS115 - L60X6	1,808	Lijn	K714	N261	vertikaal windverband (0)	standaard
Vak1	SB272	CS115 - L60X6	2,002	Lijn	N260	K719	vertikaal windverband (0)	standaard
Vak1	SB261	CS119 - L65X7	2,809	Lijn	N280	K723	vertikaal windverband (0)	standaard
Vak1	SB342	CS119 - L65X7	2,809	Lijn	N313	K758	vertikaal windverband (0)	standaard
Vak1	SB341	CS119 - L65X7	3,167	Lijn	K758	K760	vertikaal windverband (0)	standaard
Vak1	SB340	CS115 - L60X6	1,808	Lijn	K755	N310	vertikaal windverband (0)	standaard
Vak1	B245	CS120 - L55X6	2,684	Lijn	N313	K761	vertikaal windverband (0)	standaard
Vak1	SB344	CS119 - L65X7	3,322	Lijn	K760	N8	vertikaal windverband (0)	standaard
Vak1	B246	CS120 - L55X6	3,002	Lijn	K760	N64	vertikaal windverband (0)	standaard
Vak1	SB343	CS119 - L65X7	3,322	Lijn	K762	N8	vertikaal windverband (0)	standaard
Vak1	B241	CS8 - L50X5	1,791	Lijn	N312	N311	vertikaal windverband (0)	standaard

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Laag	Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type
Vak1	SB338	CS115 - L60X6	1,267	Lijn	N310	N311	vertikaal windverband (0)	standaard
Vak1	SB337	CS115 - L60X6	1,267	Lijn	N312	N310	vertikaal windverband (0)	standaard
Vak1	B242	CS8 - L50X5	0,896	Lijn	K756	K755	vertikaal windverband (0)	standaard
Vak1	SB339	CS115 - L60X6	1,808	Lijn	K756	N310	vertikaal windverband (0)	standaard
Vak1	B244	CS8 - L50X5	2,049	Lijn	K756	K757	vertikaal windverband (0)	standaard
Vak1	B243	CS8 - L50X5	2,049	Lijn	K755	K757	vertikaal windverband (0)	standaard
Vak1	B247	CS120 - L55X6	3,002	Lijn	K762	N64	vertikaal windverband (0)	standaard
Vak1	B224	CS8 - L50X5	2,687	Lijn	K743	K742	vertikaal windverband (0)	standaard
Vak1	SB316	CS115 - L60X6	2,355	Lijn	K743	N299	vertikaal windverband (0)	standaard
Vak1	SB317	CS115 - L60X6	2,355	Lijn	K742	N299	vertikaal windverband (0)	standaard
Vak1	SB315	CS115 - L60X6	1,900	Lijn	K743	K741	vertikaal windverband (0)	standaard
Vak1	B222	CS8 - L50X5	2,191	Lijn	N305	K744	vertikaal windverband (0)	standaard
Vak1	B223	CS8 - L50X5	2,191	Lijn	N303	K744	vertikaal windverband (0)	standaard
Vak1	SB314	CS115 - L60X6	1,900	Lijn	K741	K742	vertikaal windverband (0)	standaard
Vak1	B227	CS8 - L50X5	1,791	Lijn	N305	N303	vertikaal windverband (0)	standaard
Vak1	B228	CS8 - L50X5	0,896	Lijn	K746	K745	vertikaal windverband (0)	standaard
Vak1	B229	CS8 - L50X5	2,049	Lijn	K745	K747	vertikaal windverband (0)	standaard
Vak1	SB319	CS115 - L60X6	1,267	Lijn	N302	N303	vertikaal windverband (0)	standaard
Vak1	B225	CS8 - L50X5	2,409	Lijn	K742	N301	vertikaal windverband (0)	standaard
Vak1	B226	CS8 - L50X5	2,409	Lijn	K743	N301	vertikaal windverband (0)	standaard
Vak1	SB318	CS115 - L60X6	1,267	Lijn	N305	N302	vertikaal windverband (0)	standaard
Vak1	SB325	CS115 - L60X6	0,633	Lijn	K751	K755	vertikaal windverband (0)	standaard
Vak1	B232	CS114 - L130X12	12,292	Lijn	N306	N66	vakwerkdiagonaal (90)	standaard
Vak1	B231	CS114 - L130X12	12,292	Lijn	N306	N67	vakwerkdiagonaal (90)	standaard
Vak1	SB326	CS115 - L60X6	0,633	Lijn	K756	K751	vertikaal windverband (0)	standaard
Vak1	B235	CS120 - L55X6	4,478	Lijn	K762	K760	vertikaal windverband (0)	standaard
Vak1	B234	CS120 - L55X6	2,684	Lijn	N308	K761	vertikaal windverband (0)	standaard
Vak1	B233	CS120 - L55X6	3,583	Lijn	N308	N313	vertikaal windverband (0)	standaard
Vak1	SB321	CS115 - L60X6	1,808	Lijn	K745	N302	vertikaal windverband (0)	standaard
Vak1	SB320	CS115 - L60X6	1,808	Lijn	K746	N302	vertikaal windverband (0)	standaard
Vak1	B230	CS8 - L50X5	2,049	Lijn	K746	K747	vertikaal windverband (0)	standaard
Vak1	SB322	CS119 - L65X7	3,167	Lijn	K748	K749	vertikaal windverband (0)	standaard
Vak1	C32	CS113 - L200X26	10,951	Lijn	N306	N8	Kolom (100)	standaard
Vak1	SB324	CS119 - L65X7	3,322	Lijn	K749	N5	vertikaal windverband (0)	standaard
Vak1	SB323	CS119 - L65X7	2,809	Lijn	N304	K748	vertikaal windverband (0)	standaard
Vak1	SB327	CS119 - L65X7	3,167	Lijn	K762	K758	vertikaal windverband (0)	standaard
Vak1	B238	CS8 - L50X5	2,687	Lijn	K753	K759	vertikaal windverband (0)	standaard
Vak1	SB334	CS115 - L60X6	1,900	Lijn	K753	K752	vertikaal windverband (0)	standaard
Vak1	SB333	CS115 - L60X6	1,900	Lijn	K752	K759	vertikaal windverband (0)	standaard
Vak1	SB335	CS115 - L60X6	2,355	Lijn	K753	N307	vertikaal windverband (0)	standaard
Vak1	B240	CS8 - L50X5	2,409	Lijn	K753	N309	vertikaal windverband (0)	standaard
Vak1	B239	CS8 - L50X5	2,409	Lijn	K759	N309	vertikaal windverband (0)	standaard
Vak1	SB336	CS115 - L60X6	2,355	Lijn	K759	N307	vertikaal windverband (0)	standaard
Vak1	SB330	CS115 - L60X6	2,002	Lijn	N311	K752	vertikaal windverband (0)	standaard
Vak1	SB329	CS115 - L60X6	2,533	Lijn	N308	N307	vertikaal windverband (0)	standaard
Vak1	SB328	CS115 - L60X6	2,533	Lijn	N307	N313	vertikaal windverband (0)	standaard
Vak1	SB331	CS119 - L65X7	2,809	Lijn	N308	K758	vertikaal windverband (0)	standaard
Vak1	B237	CS8 - L50X5	2,191	Lijn	N311	K754	vertikaal windverband (0)	standaard
Vak1	B236	CS8 - L50X5	2,191	Lijn	N312	K754	vertikaal windverband (0)	standaard
Vak1	SB332	CS115 - L60X6	2,002	Lijn	N312	K752	vertikaal windverband (0)	standaard
Vak1	SB293	CS115 - L60X6	2,002	Lijn	N297	K729	vertikaal windverband (0)	standaard
Vak1	B205	CS8 - L50X5	2,191	Lijn	N297	K732	vertikaal windverband (0)	standaard
Vak1	B206	CS8 - L50X5	2,191	Lijn	N295	K732	vertikaal windverband (0)	standaard
Vak1	SB292	CS119 - L65X7	2,809	Lijn	N292	K736	vertikaal windverband (0)	standaard
Vak1	SB289	CS115 - L60X6	2,533	Lijn	N291	N296	vertikaal windverband (0)	standaard
Vak1	SB290	CS115 - L60X6	2,533	Lijn	N292	N291	vertikaal windverband (0)	standaard
Vak1	SB291	CS115 - L60X6	2,002	Lijn	N295	K729	vertikaal windverband (0)	standaard
Vak1	SB297	CS115 - L60X6	2,355	Lijn	K730	N291	vertikaal windverband (0)	standaard
Vak1	B208	CS8 - L50X5	2,409	Lijn	K730	N293	vertikaal windverband (0)	standaard
Vak1	B209	CS8 - L50X5	2,409	Lijn	K731	N293	vertikaal windverband (0)	standaard
Vak1	SB296	CS115 - L60X6	2,355	Lijn	K731	N291	vertikaal windverband (0)	standaard
Vak1	SB294	CS115 - L60X6	1,900	Lijn	K729	K730	vertikaal windverband (0)	standaard
Vak1	SB295	CS115 - L60X6	1,900	Lijn	K731	K729	vertikaal windverband (0)	standaard
Vak1	B207	CS8 - L50X5	2,687	Lijn	K731	K730	vertikaal windverband (0)	standaard
Vak1	B204	CS120 - L55X6	3,002	Lijn	K737	N286	vertikaal windverband (0)	standaard
Vak1	B198	CS114 - L130X12	12,292	Lijn	N290	N66	vakwerkdiagonaal (90)	standaard
Vak1	SB285	CS115 - L60X6	0,633	Lijn	K727	K733	vertikaal windverband (0)	standaard
Vak1	SB286	CS115 - L60X6	0,633	Lijn	K734	K727	vertikaal windverband (0)	standaard
Vak1	B197	CS114 - L130X12	12,292	Lijn	N290	N9	vakwerkdiagonaal (90)	standaard

Laag	Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type
Vak1	SB283	CS119 - L65X7	3,322	Lijn	K725	N2	vertikaal windverband (0)	standaard
Vak1	SB284	CS119 - L65X7	3,322	Lijn	K724	N2	vertikaal windverband (0)	standaard
Vak1	C30	CS113 - L200X26	10,951	Lijn	N290	N4	Kolom (100)	standaard
Vak1	SB287	CS119 - L65X7	3,167	Lijn	K728	K736	vertikaal windverband (0)	standaard
Vak1	B203	CS120 - L55X6	3,002	Lijn	K728	N286	vertikaal windverband (0)	standaard
Vak1	SB288	CS119 - L65X7	3,322	Lijn	K728	N4	vertikaal windverband (0)	standaard
Vak1	B202	CS120 - L55X6	4,478	Lijn	K728	K737	vertikaal windverband (0)	standaard
Vak1	B199	CS120 - L55X6	3,583	Lijn	N292	N296	vertikaal windverband (0)	standaard
Vak1	B200	CS120 - L55X6	2,684	Lijn	N292	K738	vertikaal windverband (0)	standaard
Vak1	B201	CS120 - L55X6	2,684	Lijn	N296	K738	vertikaal windverband (0)	standaard
Vak1	B219	CS120 - L55X6	4,478	Lijn	K740	K749	vertikaal windverband (0)	standaard
Vak1	SB307	CS119 - L65X7	3,167	Lijn	K740	K748	vertikaal windverband (0)	standaard
Vak1	B220	CS120 - L55X6	3,002	Lijn	K740	N284	vertikaal windverband (0)	standaard
Vak1	B218	CS120 - L55X6	2,684	Lijn	N304	K750	vertikaal windverband (0)	standaard
Vak1	SB306	CS115 - L60X6	0,633	Lijn	K746	K739	vertikaal windverband (0)	standaard
Vak1	B216	CS120 - L55X6	3,583	Lijn	N300	N304	vertikaal windverband (0)	standaard
Vak1	B217	CS120 - L55X6	2,684	Lijn	N300	K750	vertikaal windverband (0)	standaard
Vak1	SB311	CS115 - L60X6	2,002	Lijn	N303	K741	vertikaal windverband (0)	standaard
Vak1	SB312	CS119 - L65X7	2,809	Lijn	N300	K748	vertikaal windverband (0)	standaard
Vak1	SB313	CS115 - L60X6	2,002	Lijn	N305	K741	vertikaal windverband (0)	standaard
Vak1	SB310	CS115 - L60X6	2,533	Lijn	N300	N299	vertikaal windverband (0)	standaard
Vak1	SB308	CS119 - L65X7	3,322	Lijn	K740	N5	vertikaal windverband (0)	standaard
Vak1	B221	CS120 - L55X6	3,002	Lijn	K749	N284	vertikaal windverband (0)	standaard
Vak1	SB309	CS115 - L60X6	2,533	Lijn	N299	N304	vertikaal windverband (0)	standaard
Vak1	SB305	CS115 - L60X6	0,633	Lijn	K739	K745	vertikaal windverband (0)	standaard
Vak1	B212	CS8 - L50X5	2,049	Lijn	K733	K735	vertikaal windverband (0)	standaard
Vak1	B213	CS8 - L50X5	2,049	Lijn	K734	K735	vertikaal windverband (0)	standaard
Vak1	SB300	CS115 - L60X6	1,808	Lijn	K734	N294	vertikaal windverband (0)	standaard
Vak1	B211	CS8 - L50X5	0,896	Lijn	K734	K733	vertikaal windverband (0)	standaard
Vak1	SB298	CS115 - L60X6	1,267	Lijn	N297	N294	vertikaal windverband (0)	standaard
Vak1	SB299	CS115 - L60X6	1,267	Lijn	N294	N295	vertikaal windverband (0)	standaard
Vak1	B210	CS8 - L50X5	1,791	Lijn	N297	N295	vertikaal windverband (0)	standaard
Vak1	C31	CS113 - L200X26	10,951	Lijn	N298	N5	Kolom (100)	standaard
Vak1	B214	CS114 - L130X12	12,292	Lijn	N298	N67	vakwerkdiagonaal (90)	standaard
Vak1	B215	CS114 - L130X12	12,292	Lijn	N298	N68	vakwerkdiagonaal (90)	standaard
Vak1	SB304	CS119 - L65X7	3,322	Lijn	K737	N4	vertikaal windverband (0)	standaard
Vak1	SB301	CS115 - L60X6	1,808	Lijn	K733	N294	vertikaal windverband (0)	standaard
Vak1	SB302	CS119 - L65X7	3,167	Lijn	K736	K737	vertikaal windverband (0)	standaard
Vak1	SB303	CS119 - L65X7	2,809	Lijn	N296	K736	vertikaal windverband (0)	standaard
Vak2	SB59	CS63 - L55X6	1,900	Lijn	N72	N71	vertikaal windverband (0)	standaard
Vak2	SB60	CS65 - L55X6	2,621	Lijn	N5	N71	vertikaal windverband (0)	standaard
Vak2	SB61	CS63 - L55X6	1,900	Lijn	N73	N72	vertikaal windverband (0)	standaard
Vak2	SB58	CS65 - L55X6	2,621	Lijn	N8	N70	vertikaal windverband (0)	standaard
Vak2	SB55	CS63 - L55X6	1,900	Lijn	N19	N18	vertikaal windverband (0)	standaard
Vak2	SB56	CS65 - L55X6	2,621	Lijn	N8	N18	vertikaal windverband (0)	standaard
Vak2	SB57	CS63 - L55X6	1,900	Lijn	N70	N19	vertikaal windverband (0)	standaard
Vak2	B32	CS100 - L150X100X10	4,916	Lijn	N67	N62	vakwerkdiagonaal (90)	standaard
Vak2	B33	CS100 - L150X100X10	4,916	Lijn	N68	N59	vakwerkdiagonaal (90)	standaard
Vak2	B34	CS100 - L150X100X10	4,916	Lijn	N9	N59	vakwerkdiagonaal (90)	standaard
Vak2	B31	CS100 - L150X100X10	4,916	Lijn	N66	N61	vakwerkdiagonaal (90)	standaard
Vak2	SB62	CS65 - L55X6	2,621	Lijn	N5	N73	vertikaal windverband (0)	standaard
Vak2	SB63	CS63 - L55X6	1,900	Lijn	N69	N74	vertikaal windverband (0)	standaard
Vak2	SB64	CS65 - L55X6	2,621	Lijn	N2	N74	vertikaal windverband (0)	standaard
Vak2	B8	CS100 - L150X100X10	4,916	Lijn	N9	N61	vakwerkdiagonaal (90)	standaard
Vak2	B10	CS100 - L150X100X10	4,916	Lijn	N66	N65	vakwerkdiagonaal (90)	standaard
Vak2	B12	CS100 - L150X100X10	4,916	Lijn	N67	N65	vakwerkdiagonaal (90)	standaard
Vak2	C8	CS113 - L200X26	3,374	Lijn	N8	N65	Kolom (100)	standaard
Vak2	C5	CS113 - L200X26	3,374	Lijn	N2	N59	Kolom (100)	standaard
Vak2	C6	CS113 - L200X26	3,374	Lijn	N4	N61	Kolom (100)	standaard
Vak2	C7	CS113 - L200X26	3,374	Lijn	N5	N62	Kolom (100)	standaard
Vak2	SB52	CS65 - L55X6	2,621	Lijn	N4	N16	vertikaal windverband (0)	standaard
Vak2	SB53	CS63 - L55X6	1,900	Lijn	N17	N15	vertikaal windverband (0)	standaard
Vak2	SB54	CS65 - L55X6	2,621	Lijn	N4	N17	vertikaal windverband (0)	standaard
Vak2	SB51	CS63 - L55X6	1,900	Lijn	N15	N16	vertikaal windverband (0)	standaard
Vak2	B93	CS100 - L150X100X10	4,916	Lijn	N68	N62	vakwerkdiagonaal (90)	standaard
Vak2	SB49	CS63 - L55X6	1,900	Lijn	N14	N69	vertikaal windverband (0)	standaard
Vak2	SB50	CS65 - L55X6	2,621	Lijn	N2	N14	vertikaal windverband (0)	standaard
Vak3	B95	CS68 - L150X100X12	9,452	Lijn	N65	N78	vakwerkdiagonaal (90)	standaard
Vak3	B94	CS68 - L150X100X12	9,452	Lijn	N61	N76	vakwerkdiagonaal (90)	standaard

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Laag	Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type
Vak3	B26	CS68 - L150X100X12	9,452	Lijn	N59	N79	vakwerkdiagonaal (90)	standaard
Vak3	B22	CS68 - L150X100X12	9,452	Lijn	N62	N82	vakwerkdiagonaal (90)	standaard
Vak3	C10	CS113 - L200X26	6,648	Lijn	N61	N78	Kolom (100)	standaard
Vak3	C9	CS113 - L200X26	6,648	Lijn	N59	N76	Kolom (100)	standaard
Vak3	C12	CS113 - L200X26	6,648	Lijn	N65	N82	Kolom (100)	standaard
Vak3	C11	CS113 - L200X26	6,648	Lijn	N62	N79	Kolom (100)	standaard
Vak3	SB84	CS67 - L55X6	1,676	Lijn	N101	N100	vertikaal windverband (0)	standaard
Vak3	SB85	CS66 - L55X6	2,360	Lijn	K705	N102	vertikaal windverband (0)	standaard
Vak3	SB82	CS67 - L55X6	1,676	Lijn	N100	N99	vertikaal windverband (0)	standaard
Vak3	SB83	CS66 - L55X6	2,360	Lijn	K707	N101	vertikaal windverband (0)	standaard
Vak3	SB86	CS67 - L55X6	1,676	Lijn	N33	N102	vertikaal windverband (0)	standaard
Vak3	SB89	CS66 - L55X6	2,360	Lijn	K708	N104	vertikaal windverband (0)	standaard
Vak3	SB90	CS67 - L55X6	1,676	Lijn	N105	N104	vertikaal windverband (0)	standaard
Vak3	SB87	CS66 - L55X6	2,360	Lijn	K705	N103	vertikaal windverband (0)	standaard
Vak3	SB88	CS67 - L55X6	1,676	Lijn	N103	N33	vertikaal windverband (0)	standaard
Vak3	SB75	CS66 - L55X6	2,356	Lijn	N90	K705	vertikaal windverband (0)	standaard
Vak3	SB76	CS66 - L55X6	2,356	Lijn	N92	K705	vertikaal windverband (0)	standaard
Vak3	SB73	CS66 - L55X6	2,356	Lijn	N87	K707	vertikaal windverband (0)	standaard
Vak3	SB74	CS66 - L55X6	2,356	Lijn	N89	K707	vertikaal windverband (0)	standaard
Vak3	SB77	CS66 - L55X6	2,356	Lijn	N93	K708	vertikaal windverband (0)	standaard
Vak3	SB80	CS66 - L55X6	2,356	Lijn	N98	K711	vertikaal windverband (0)	standaard
Vak3	SB81	CS66 - L55X6	2,360	Lijn	K707	N99	vertikaal windverband (0)	standaard
Vak3	SB78	CS66 - L55X6	2,356	Lijn	N95	K708	vertikaal windverband (0)	standaard
Vak3	SB79	CS66 - L55X6	2,356	Lijn	N96	K711	vertikaal windverband (0)	standaard
Vak3	SB71	CS67 - L55X6	1,676	Lijn	N97	N96	vertikaal windverband (0)	standaard
Vak3	SB70	CS67 - L55X6	1,676	Lijn	N95	N94	vertikaal windverband (0)	standaard
Vak3	B76	CS68 - L150X100X12	9,452	Lijn	N59	N78	vakwerkdiagonaal (90)	standaard
Vak3	SB72	CS67 - L55X6	1,676	Lijn	N98	N97	vertikaal windverband (0)	standaard
Vak3	SB69	CS67 - L55X6	1,676	Lijn	N94	N93	vertikaal windverband (0)	standaard
Vak3	SB66	CS67 - L55X6	1,676	Lijn	N89	N88	vertikaal windverband (0)	standaard
Vak3	SB65	CS67 - L55X6	1,676	Lijn	N88	N87	vertikaal windverband (0)	standaard
Vak3	SB68	CS67 - L55X6	1,676	Lijn	N92	N91	vertikaal windverband (0)	standaard
Vak3	SB67	CS67 - L55X6	1,676	Lijn	N91	N90	vertikaal windverband (0)	standaard
Vak3	SB93	CS66 - L55X6	2,360	Lijn	K711	N38	vertikaal windverband (0)	standaard
Vak3	SB94	CS67 - L55X6	1,676	Lijn	N107	N38	vertikaal windverband (0)	standaard
Vak3	SB91	CS66 - L55X6	2,360	Lijn	K708	N106	vertikaal windverband (0)	standaard
Vak3	SB92	CS67 - L55X6	1,676	Lijn	N106	N105	vertikaal windverband (0)	standaard
Vak3	SB95	CS66 - L55X6	2,360	Lijn	K711	N108	vertikaal windverband (0)	standaard
Vak3	B74	CS68 - L150X100X12	9,452	Lijn	N65	N79	vakwerkdiagonaal (90)	standaard
Vak3	B75	CS68 - L150X100X12	9,452	Lijn	N62	N76	vakwerkdiagonaal (90)	standaard
Vak3	SB96	CS67 - L55X6	1,676	Lijn	N108	N107	vertikaal windverband (0)	standaard
Vak3	B73	CS68 - L150X100X12	9,452	Lijn	N61	N82	vakwerkdiagonaal (90)	standaard
Vak4	B111	CS81 - L60X6	2,920	Lijn	N123	N149	vertikaal windverband (0)	standaard
Vak4	B110	CS81 - L60X6	2,920	Lijn	N122	N152	vertikaal windverband (0)	standaard
Vak4	B113	CS81 - L60X6	2,920	Lijn	N121	N151	vertikaal windverband (0)	standaard
Vak4	B112	CS81 - L60X6	2,920	Lijn	N124	N150	vertikaal windverband (0)	standaard
Vak4	SB114	CS69 - L50X5	1,460	Lijn	N138	N137	vertikaal windverband (0)	standaard
Vak4	SB113	CS71 - L50X5	2,190	Lijn	N122	N137	vertikaal windverband (0)	standaard
Vak4	SB115	CS71 - L50X5	2,190	Lijn	N122	N139	vertikaal windverband (0)	standaard
Vak4	SB117	CS71 - L50X5	2,190	Lijn	N123	N140	vertikaal windverband (0)	standaard
Vak4	SB116	CS69 - L50X5	1,460	Lijn	N139	N138	vertikaal windverband (0)	standaard
Vak4	SB112	CS71 - L50X5	2,231	Lijn	N136	N121	vertikaal windverband (0)	standaard
Vak4	SB108	CS71 - L50X5	2,231	Lijn	N130	N123	vertikaal windverband (0)	standaard
Vak4	SB107	CS71 - L50X5	2,231	Lijn	N128	N123	vertikaal windverband (0)	standaard
Vak4	SB109	CS71 - L50X5	2,231	Lijn	N131	N124	vertikaal windverband (0)	standaard
Vak4	SB111	CS71 - L50X5	2,231	Lijn	N134	N121	vertikaal windverband (0)	standaard
Vak4	SB110	CS71 - L50X5	2,231	Lijn	N133	N124	vertikaal windverband (0)	standaard
Vak4	SB125	CS71 - L50X5	2,190	Lijn	N121	N146	vertikaal windverband (0)	standaard
Vak4	SB124	CS69 - L50X5	1,460	Lijn	N145	N144	vertikaal windverband (0)	standaard
Vak4	SB126	CS69 - L50X5	1,460	Lijn	N147	N146	vertikaal windverband (0)	standaard
Vak4	SB128	CS69 - L50X5	1,460	Lijn	N148	N147	vertikaal windverband (0)	standaard
Vak4	SB127	CS71 - L50X5	2,190	Lijn	N121	N148	vertikaal windverband (0)	standaard
Vak4	SB123	CS71 - L50X5	2,190	Lijn	N124	N145	vertikaal windverband (0)	standaard
Vak4	SB119	CS71 - L50X5	2,190	Lijn	N123	N142	vertikaal windverband (0)	standaard
Vak4	SB118	CS69 - L50X5	1,460	Lijn	N141	N140	vertikaal windverband (0)	standaard
Vak4	SB120	CS69 - L50X5	1,460	Lijn	N142	N141	vertikaal windverband (0)	standaard
Vak4	SB122	CS69 - L50X5	1,460	Lijn	N144	N143	vertikaal windverband (0)	standaard
Vak4	SB121	CS71 - L50X5	2,190	Lijn	N124	N143	vertikaal windverband (0)	standaard
Vak4	B101	CS70 - L150X100X14	8,859	Lijn	N76	N117	vakwerkdiagonaal (90)	standaard

	Project	- 150 kV lijn Leiden - Zoetermeer
D&C ENGINEERING	Onderdeel	- berekening Mast 55
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- SMA

Laag	Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type
Vak4	B100	CS70 - L150X100X14	8,860	Lijn	N79	N120	vakwerkdiagonaal (90)	standaard
Vak4	B102	CS81 - L60X6	2,920	Lijn	N152	N121	vertikaal windverband (0)	standaard
Vak4	B104	CS81 - L60X6	2,920	Lijn	N150	N123	vertikaal windverband (0)	standaard
Vak4	B103	CS81 - L60X6	2,920	Lijn	N149	N122	vertikaal windverband (0)	standaard
Vak4	B99	CS70 - L150X100X14	8,860	Lijn	N82	N116	vakwerkdiagonaal (90)	standaard
Vak4	C14	CS13 - L200X20	6,648	Lijn	N78	N116	Kolom (100)	standaard
Vak4	C13	CS13 - L200X20	6,648	Lijn	N76	N114	Kolom (100)	standaard
Vak4	C15	CS13 - L200X20	6,648	Lijn	N79	N117	Kolom (100)	standaard
Vak4	B98	CS70 - L150X100X14	8,859	Lijn	N78	N114	vakwerkdiagonaal (90)	standaard
Vak4	C16	CS13 - L200X20	6,648	Lijn	N82	N120	Kolom (100)	standaard
Vak4	SB103	CS69 - L50X5	1,460	Lijn	N135	N134	vertikaal windverband (0)	standaard
Vak4	SB102	CS69 - L50X5	1,460	Lijn	N133	N132	vertikaal windverband (0)	standaard
Vak4	SB104	CS69 - L50X5	1,460	Lijn	N136	N135	vertikaal windverband (0)	standaard
Vak4	SB106	CS71 - L50X5	2,231	Lijn	N127	N122	vertikaal windverband (0)	standaard
Vak4	SB105	CS71 - L50X5	2,231	Lijn	N125	N122	vertikaal windverband (0)	standaard
Vak4	SB101	CS69 - L50X5	1,460	Lijn	N132	N131	vertikaal windverband (0)	standaard
Vak4	SB97	CS69 - L50X5	1,460	Lijn	N126	N125	vertikaal windverband (0)	standaard
Vak4	B105	CS81 - L60X6	2,920	Lijn	N151	N124	vertikaal windverband (0)	standaard
Vak4	SB98	CS69 - L50X5	1,460	Lijn	N127	N126	vertikaal windverband (0)	standaard
Vak4	SB100	CS69 - L50X5	1,460	Lijn	N130	N129	vertikaal windverband (0)	standaard
Vak4	SB99	CS69 - L50X5	1,460	Lijn	N129	N128	vertikaal windverband (0)	standaard
Vak4	B107	CS70 - L150X100X14	8,859	Lijn	N82	N117	vakwerkdiagonaal (90)	standaard
Vak4	B106	CS70 - L150X100X14	8,859	Lijn	N78	N120	vakwerkdiagonaal (90)	standaard
Vak4	B109	CS70 - L150X100X14	8,860	Lijn	N76	N116	vakwerkdiagonaal (90)	standaard
Vak4	B108	CS70 - L150X100X14	8,860	Lijn	N79	N114	vakwerkdiagonaal (90)	standaard
Vak5	SB139	CS20 - L50X5	1,250	Lijn	N174	N173	vertikaal windverband (0)	standaard
Vak5	SB140	CS72 - L50X5	2,050	Lijn	N173	K91	vertikaal windverband (0)	standaard
Vak5	SB141	CS20 - L50X5	1,250	Lijn	N175	N174	vertikaal windverband (0)	standaard
Vak5	SB138	CS72 - L50X5	2,050	Lijn	N172	K112	vertikaal windverband (0)	standaard
Vak5	SB135	CS20 - L50X5	1,250	Lijn	N171	N170	vertikaal windverband (0)	standaard
Vak5	SB136	CS72 - L50X5	2,050	Lijn	N170	K112	vertikaal windverband (0)	standaard
Vak5	SB137	CS20 - L50X5	1,250	Lijn	N172	N171	vertikaal windverband (0)	standaard
Vak5	B37	CS73 - L150X100X12	4,360	Lijn	N120	K93	vakwerkdiagonaal (90)	standaard
Vak5	B38	CS73 - L150X100X12	4,360	Lijn	N120	K625	vakwerkdiagonaal (90)	standaard
Vak5	B39	CS73 - L150X100X12	4,360	Lijn	N117	K99	vakwerkdiagonaal (90)	standaard
Vak5	B36	CS73 - L150X100X12	4,360	Lijn	N116	K109	vakwerkdiagonaal (90)	standaard
Vak5	SB142	CS72 - L50X5	2,050	Lijn	N175	K91	vertikaal windverband (0)	standaard
Vak5	SB143	CS20 - L50X5	1,250	Lijn	N165	N176	vertikaal windverband (0)	standaard
Vak5	SB144	CS72 - L50X5	2,050	Lijn	N176	K102	vertikaal windverband (0)	standaard
Vak5	B114	CS73 - L150X100X12	4,360	Lijn	N114	K109	vakwerkdiagonaal (90)	standaard
Vak5	B115	CS73 - L150X100X12	4,360	Lijn	N116	K625	vakwerkdiagonaal (90)	standaard
Vak5	B116	CS73 - L150X100X12	4,360	Lijn	N117	K93	vakwerkdiagonaal (90)	standaard
Vak5	C20	CS112 - L200X20	3,414	Lijn	N120	K112	Kolom (100)	standaard
Vak5	C17	CS112 - L200X20	3,414	Lijn	N114	K102	Kolom (100)	standaard
Vak5	C18	CS112 - L200X20	3,414	Lijn	N116	N156	Kolom (100)	standaard
Vak5	C19	CS112 - L200X20	3,414	Lijn	N117	K91	Kolom (100)	standaard
Vak5	SB132	CS72 - L50X5	2,050	Lijn	N167	N156	vertikaal windverband (0)	standaard
Vak5	SB133	CS20 - L50X5	1,250	Lijn	N169	N168	vertikaal windverband (0)	standaard
Vak5	SB134	CS72 - L50X5	2,049	Lijn	N169	N156	vertikaal windverband (0)	standaard
Vak5	SB131	CS20 - L50X5	1,250	Lijn	N168	N167	vertikaal windverband (0)	standaard
Vak5	B117	CS73 - L150X100X12	4,360	Lijn	N114	K99	vakwerkdiagonaal (90)	standaard
Vak5	SB129	CS20 - L50X5	1,250	Lijn	N166	N165	vertikaal windverband (0)	standaard
Vak5	SB130	CS72 - L50X5	2,050	Lijn	N166	K102	vertikaal windverband (0)	standaard
Vak6	S336	CS84 - L90X9	2,076	Lijn	N156	K89	Kolom (100)	standaard
Vak6	S47	CS86 - L130X12	6,452	Polylijn	K104	K606	Balk (80)	standaard
Vak6	S355	CS82 - L200X16	2,140	Lijn	K90	K69	Kolom (100)	standaard
Vak6	S334	CS130 - L50X5	1,250	Lijn	K606	K605	Balk (80)	standaard
Vak6	S341	CS82 - L200X16	2,140	Lijn	K112	K111	Kolom (100)	standaard
Vak6	S49	CS84 - L90X9	2,076	Lijn	K91	K86	Kolom (100)	standaard
Vak6	S48	CS86 - L130X12	6,452	Polylijn	K111	K90	Balk (80)	standaard
Vak6	S365	CS82 - L200X16	2,140	Lijn	K104	K75	Kolom (100)	standaard
Vak6	S481	CS83 - L150X100X12	4,765	Lijn	K69	K99	Kolom (100)	standaard
Vak6	S249	CS85 - L50X5	2,571	Lijn	K112	K451	Kolom (100)	standaard
Vak6	S479	CS83 - L150X100X12	4,764	Lijn	K456	K625	Kolom (100)	standaard
Vak6	S480	CS83 - L150X100X12	4,765	Lijn	K75	K99	Kolom (100)	standaard
Vak6	S418	CS82 - L200X16	2,140	Lijn	K606	K456	Kolom (100)	standaard
Vak6	S333	CS85 - L50X5	2,571	Lijn	N156	K605	Kolom (100)	standaard
Vak6	S250	CS130 - L50X5	1,250	Lijn	K111	K451	Balk (80)	standaard
Vak6	S431	CS82 - L200X16	2,140	Lijn	K111	K628	Balk (80)	standaard

Laag	Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type
Vak6	S349	CS35 - L180X16	5,642	Polylijn	K109	K456	Balk (80)	standaard
Vak6	S347	CS35 - L180X16	5,642	Polylijn	K93	K628	Balk (80)	standaard
Vak6	S56	CS130 - L50X5	1,250	Lijn	K104	K103	Balk (80)	standaard
Vak6	S351	CS35 - L180X16	5,642	Polylijn	K109	K75	Balk (80)	standaard
Vak6	S176	CS82 - L200X16	2,140	Lijn	K91	K90	Kolom (100)	standaard
Vak6	S177	CS82 - L200X16	2,140	Lijn	K102	K104	Kolom (100)	standaard
Vak6	S61	CS84 - L90X9	2,076	Lijn	K112	K87	Kolom (100)	standaard
Vak6	S51	CS85 - L50X5	2,571	Lijn	K91	K95	Kolom (100)	standaard
Vak6	S52	CS130 - L50X5	1,250	Lijn	K90	K95	Balk (80)	standaard
Vak6	S342	CS82 - L200X16	2,140	Lijn	N156	K606	Kolom (100)	standaard
Vak6	S460	CS84 - L90X9	2,076	Lijn	K88	K102	Balk (80)	standaard
Vak6	S55	CS85 - L50X5	2,571	Lijn	K102	K103	Kolom (100)	standaard
Vak6	S405	CS83 - L150X100X12	4,765	Lijn	K628	K625	Kolom (100)	standaard
Vak6	S345	CS35 - L180X16	5,642	Polylijn	K93	K69	Balk (80)	standaard
Vak7	S397	CS92 - L50X5	2,227	Lijn	K626	K72	Balk (80)	standaard
Vak7	S398	CS82 - L200X16	2,119	Lijn	K626	K71	Balk (80)	standaard
Vak7	S458	CS92 - L50X5	2,231	Lijn	K307	K77	Balk (80)	standaard
Vak7	S454	CS90 - L150X100X12	4,017	Polylijn	K69	K291	Balk (80)	standaard
Vak7	S453	CS4 - L50X5	0,864	Lijn	K71	K630	Balk (80)	standaard
Vak7	S459	CS92 - L50X5	2,231	Lijn	K291	K71	Balk (80)	standaard
Vak7	S356	CS82 - L200X16	2,141	Lijn	K69	K71	Kolom (100)	standaard
Vak7	S366	CS82 - L200X16	2,141	Lijn	K75	K77	Kolom (100)	standaard
Vak7	S54	CS37 - L75X8	4,252	Lijn	K75	K69	Balk (80)	standaard
Vak7	S451	CS90 - L150X100X12	4,017	Lijn	K75	K307	Balk (80)	standaard
Vak7	S367	CS82 - L200X16	2,119	Lijn	K77	K63	Kolom (100)	standaard
Vak7	S38	CS4 - L50X5	0,879	Lijn	K71	K72	Balk (80)	standaard
Vak7	S37	CS91 - L150X15	4,747	Lijn	K69	K70	Kolom (100)	standaard
Vak7	S450	CS4 - L50X5	0,864	Lijn	K77	K629	Balk (80)	standaard
Vak7	S42	CS92 - L50X5	2,227	Lijn	K78	K63	Kolom (100)	standaard
Vak7	S41	CS4 - L50X5	0,879	Lijn	K77	K78	Balk (80)	standaard
Vak7	S40	CS91 - L150X15	4,747	Lijn	K75	K70	Kolom (100)	standaard
Vak8	S44	CS92 - L50X5	2,231	Lijn	K81	K83	Kolom (100)	standaard
Vak8	S252	CS91 - L150X15	4,747	Lijn	K456	K447	Kolom (100)	standaard
Vak8	S260	CS4 - L50X5	0,879	Lijn	K469	K470	Balk (80)	standaard
Vak8	S247	CS4 - L50X5	0,878	Lijn	K81	K448	Balk (80)	standaard
Vak8	S248	CS92 - L50X5	2,227	Lijn	K448	K301	Kolom (100)	standaard
Vak8	S301	CS92 - L50X5	2,227	Lijn	K470	K444	Kolom (100)	standaard
Vak8	S332	CS90 - L150X100X12	4,017	Lijn	K456	K438	Kolom (100)	standaard
Vak8	S43	CS4 - L50X5	0,864	Lijn	K81	K82	Balk (80)	standaard
Vak8	S330	CS4 - L50X5	0,864	Lijn	K469	K601	Balk (80)	standaard
Vak8	S331	CS92 - L50X5	2,231	Lijn	K469	K438	Kolom (100)	standaard
Vak8	S408	CS82 - L200X16	2,119	Lijn	K81	K301	Kolom (100)	standaard
Vak8	S433	CS90 - L150X100X12	4,017	Polylijn	K628	K83	Balk (80)	standaard
Vak8	S435	CS91 - L150X15	4,747	Lijn	K628	K447	Balk (80)	standaard
Vak8	S432	CS82 - L200X16	2,141	Lijn	K628	K81	Balk (80)	standaard
Vak8	S420	CS82 - L200X16	2,119	Lijn	K469	K444	Kolom (100)	standaard
Vak8	S419	CS82 - L200X16	2,141	Lijn	K456	K469	Kolom (100)	standaard
Vak8	S430	CS37 - L75X8	4,252	Lijn	K456	K628	Balk (80)	standaard
Vak9	S491	CS127 - L160X15	3,201	Lijn	K306	K408	Balk (80)	standaard
Vak9	S225	CS142 - L130X12	2,373	Lijn	K291	K409	Kolom (100)	standaard
Vak9	S265	CS143 - L90X9	2,456	Lijn	K473	K63	Balk (80)	standaard
Vak9	S400	CS143 - L90X9	2,456	Lijn	K626	K473	Balk (80)	standaard
Vak9	S266	CS143 - L90X9	2,542	Lijn	K404	K473	Balk (80)	standaard
Vak9	S240	CS142 - L130X12	2,373	Lijn	K307	K408	Kolom (100)	standaard
Vak9	S268	CS145 - L50X5	3,507	Lijn	K307	K291	Balk (80)	standaard
Vak9	S625	CS44 - UNP200	3,560	Polylijn	K626	K394	Balk (80)	standaard
Vak9	S612	CS44 - UNP200	3,560	Lijn	K404	K63	Balk (80)	standaard
Vak9	S488	CS127 - L160X15	3,202	Lijn	K294	K409	Balk (80)	standaard
Vak9	S263	CS143 - L90X9	2,542	Lijn	K394	K473	Balk (80)	standaard
Vak10	S34	CS93 - L90X9	2,366	Lijn	K63	K67	Kolom (100)	standaard
Vak10	S421	CS82 - L200X16	1,571	Lijn	K444	K459	Kolom (100)	standaard
Vak10	S258	CS126 - L160X15	0,888	Lijn	K598	K459	Balk (80)	standaard
Vak10	S257	CS125 - L60X6	3,232	Polylijn	K298	K459	Balk (80)	standaard
Vak10	S487	CS89 - L140X13	1,761	Lijn	K61	K620	Balk (80)	standaard
Vak10	S162	CS124 - UNP200	1,544	Lijn	K302	K301	Kolom (100)	standaard
Vak10	S164	CS124 - UNP200	1,544	Lijn	K306	K63	Kolom (100)	standaard
Vak10	S166	CS126 - L160X15	0,888	Lijn	K306	K65	Balk (80)	standaard
Vak10	S156	CS93 - L90X9	2,264	Lijn	K546	K621	Kolom (100)	standaard
Vak10	S159	CS126 - L160X15	0,888	Lijn	K294	K61	Balk (80)	standaard

Laag	Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type
Vak10	S160	CS126 - L160X15	0,888	Lijn	K302	K298	Balk (80)	standaard
Vak10	S457	CS124 - UNP200	1,544	Lijn	K626	K294	Balk (80)	standaard
Vak10	S243	CS93 - L90X9	2,366	Lijn	K301	K546	Kolom (100)	standaard
Vak10	S245	CS93 - L90X9	2,366	Lijn	K444	K546	Kolom (100)	standaard
Vak10	S422	CS89 - L140X13	1,761	Lijn	K459	K622	Kolom (100)	standaard
Vak10	S368	CS82 - L200X16	1,570	Lijn	K63	K65	Kolom (100)	standaard
Vak10	S36	CS93 - L90X9	2,265	Lijn	K67	K619	Kolom (100)	standaard
Vak10	S35	CS125 - L60X6	3,232	Polylijn	K65	K61	Balk (80)	standaard
Vak10	S409	CS82 - L200X16	1,571	Lijn	K301	K298	Kolom (100)	standaard
Vak10	S402	CS82 - L200X16	1,570	Lijn	K626	K61	Balk (80)	standaard
Vak10	S369	CS89 - L140X13	1,761	Lijn	K65	K619	Kolom (100)	standaard
Vak10	S328	CS124 - UNP200	1,544	Lijn	K444	K598	Kolom (100)	standaard
Vak10	S606	CS89 - L140X13	1,761	Lijn	K298	K783	Kolom (100)	standaard
Vak10	S381	CS122 - L130X12	4,236	Polylijn	K438	K622	Balk (80)	standaard
Vak10	S383	CS122 - L130X12	4,235	Polylijn	K83	K621	Balk (80)	standaard
Vak10	S379	CS122 - L130X12	4,235	Polylijn	K291	K620	Balk (80)	standaard
Vak10	S401	CS93 - L90X9	2,366	Lijn	K626	K67	Balk (80)	standaard
Vak10	S377	CS122 - L130X12	4,236	Polylijn	K307	K619	Balk (80)	standaard
Vak10	S31	CS93 - L90X9	2,265	Lijn	K67	K620	Kolom (100)	standaard
Vak10	S300	CS93 - L90X9	2,265	Lijn	K546	K622	Kolom (100)	standaard
Vak10	S298	CS36 - L100X10	3,507	Lijn	K301	K444	Balk (80)	standaard
Vak10	S598	CS36 - L100X10	3,507	Lijn	K626	K63	Balk (80)	standaard
Vak11	S30	CS129 - L50X5	2,536	Lijn	K55	K56	Balk (80)	standaard
Vak11	S456	CS129 - L50X5	2,179	Lijn	K55	K198	Balk (80)	standaard
Vak11	S359	CS89 - L140X13	2,220	Lijn	K620	K56	Kolom (100)	standaard
Vak11	S360	CS89 - L140X13	2,135	Lijn	K56	K388	Kolom (100)	standaard
Vak11	S29	CS96 - L110X10	2,651	Lijn	K619	K47	Kolom (100)	standaard
Vak11	S136	CS129 - L50X5	2,179	Lijn	K335	K56	Kolom (100)	standaard
Vak11	S140	CS128 - L150X100X10	4,099	Lijn	K620	K335	Kolom (100)	standaard
Vak11	S371	CS89 - L140X13	2,135	Lijn	K43	K55	Kolom (100)	standaard
Vak11	S133	CS129 - L50X5	0,799	Lijn	K243	K56	Balk (80)	standaard
Vak11	S134	CS129 - L50X5	0,800	Lijn	K245	K55	Balk (80)	standaard
Vak11	S135	CS128 - L150X100X10	4,098	Lijn	K619	K198	Kolom (100)	standaard
Vak11	S27	CS96 - L110X10	2,652	Lijn	K620	K47	Kolom (100)	standaard
Vak11	S370	CS89 - L140X13	2,220	Lijn	K55	K619	Kolom (100)	standaard
Vak11	S26	CS96 - L110X10	2,386	Lijn	K47	K388	Kolom (100)	standaard
Vak11	S28	CS96 - L110X10	2,386	Lijn	K47	K43	Kolom (100)	standaard
Vak12	S92	CS96 - L110X10	2,651	Lijn	K622	K162	Kolom (100)	standaard
Vak12	S90	CS96 - L110X10	2,652	Lijn	K621	K162	Kolom (100)	standaard
Vak12	S91	CS96 - L110X10	2,386	Lijn	K162	K158	Kolom (100)	standaard
Vak12	S93	CS129 - L50X5	2,536	Lijn	K170	K171	Balk (80)	standaard
Vak12	S154	CS128 - L150X100X10	4,099	Lijn	K621	K206	Kolom (100)	standaard
Vak12	S146	CS129 - L50X5	0,800	Lijn	K269	K171	Balk (80)	standaard
Vak12	S424	CS89 - L140X13	2,135	Lijn	K170	K158	Kolom (100)	standaard
Vak12	S411	CS89 - L140X13	2,221	Lijn	K171	K621	Kolom (100)	standaard
Vak12	S149	CS129 - L50X5	2,179	Lijn	K219	K170	Kolom (100)	standaard
Vak12	S147	CS129 - L50X5	0,800	Lijn	K271	K170	Balk (80)	standaard
Vak12	S607	CS89 - L140X13	2,221	Lijn	K170	K785	Kolom (100)	standaard
Vak12	S150	CS129 - L50X5	2,179	Lijn	K206	K171	Kolom (100)	standaard
Vak12	S89	CS96 - L110X10	2,386	Lijn	K162	K156	Kolom (100)	standaard
Vak12	S148	CS128 - L150X100X10	4,098	Lijn	K622	K219	Kolom (100)	standaard
Vak12	S412	CS89 - L140X13	2,135	Lijn	K156	K171	Kolom (100)	standaard
Vak13	S290	CS143 - L90X9	2,456	Lijn	K527	K444	Balk (80)	standaard
Vak13	S291	CS143 - L90X9	2,542	Lijn	K406	K527	Balk (80)	standaard
Vak13	S227	CS142 - L130X12	2,373	Lijn	K83	K411	Kolom (100)	standaard
Vak13	S620	CS127 - L160X15	3,202	Lijn	K410	K598	Balk (80)	standaard
Vak13	S319	CS143 - L90X9	2,542	Lijn	K396	K527	Balk (80)	standaard
Vak13	S321	CS145 - L50X5	3,507	Lijn	K83	K438	Balk (80)	standaard
Vak13	S242	CS142 - L130X12	2,373	Lijn	K438	K410	Kolom (100)	standaard
Vak13	S624	CS44 - UNP200	3,560	Lijn	K396	K301	Balk (80)	standaard
Vak13	S618	CS127 - L160X15	3,202	Lijn	K411	K302	Balk (80)	standaard
Vak13	S615	CS44 - UNP200	3,560	Lijn	K444	K406	Balk (80)	standaard
Vak13	S619	CS127 - L160X15	3,680	Lijn	K408	K410	Balk (80)	standaard
Vak13	S318	CS143 - L90X9	2,456	Lijn	K527	K301	Balk (80)	standaard
Vak14	S616	CS140 - L50X5	3,227	Lijn	K408	K409	Balk (80)	standaard
Vak14	S617	CS127 - L160X15	3,680	Lijn	K409	K411	Balk (80)	standaard
Vak14	S621	CS140 - L50X5	3,227	Lijn	K410	K411	Balk (80)	standaard
Vak14	S292	CS143 - L90X9	2,539	Lijn	K531	K406	Balk (80)	standaard
Vak14	S320	CS143 - L90X9	2,539	Lijn	K531	K396	Balk (80)	standaard

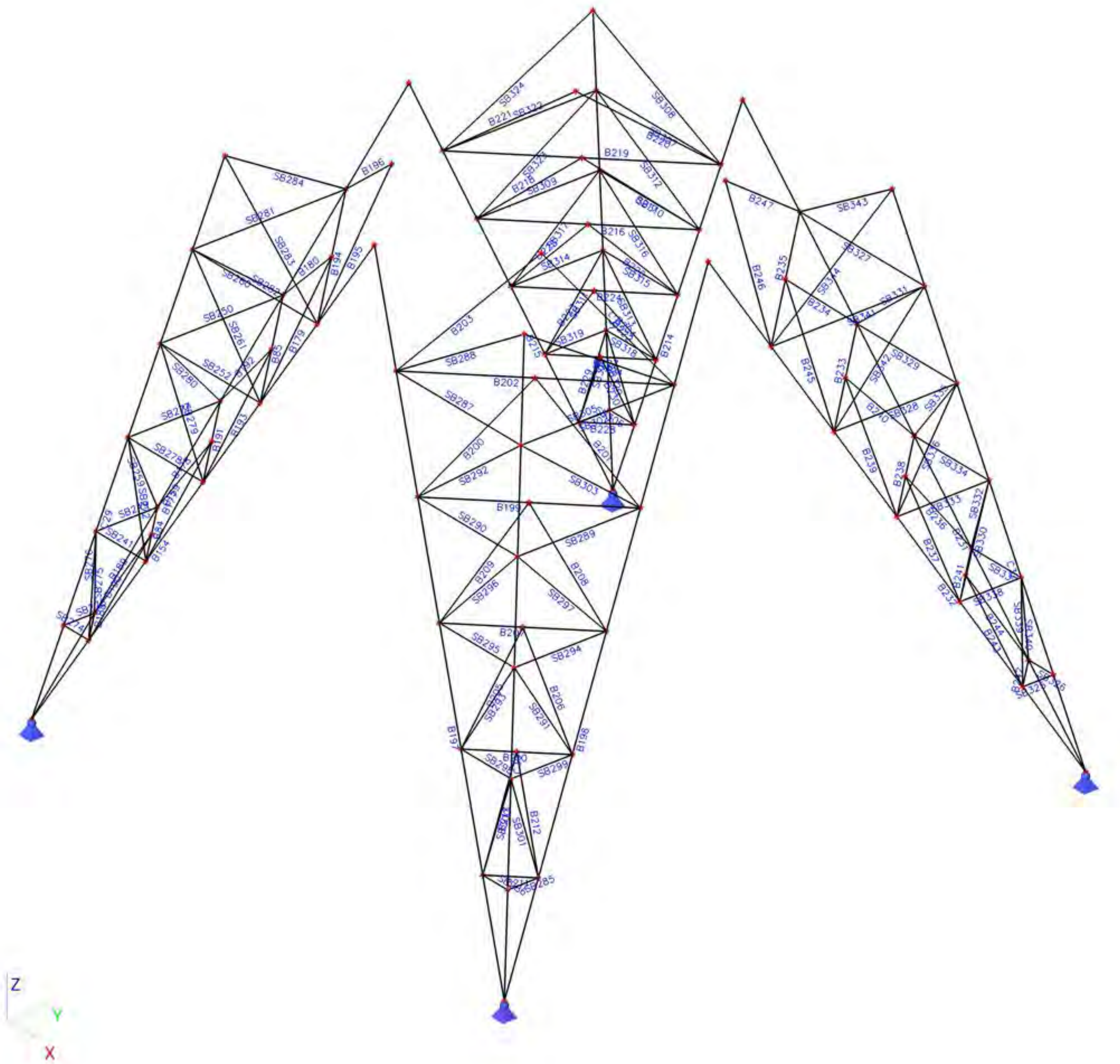
	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 55
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- SMA

Laag	Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type
Vak14	S264	CS143 - L90X9	2,539	Lijn	K531	K394	Balk (80)	standaard
Vak14	S267	CS143 - L90X9	2,539	Lijn	K531	K404	Balk (80)	standaard
Vak14	S464	CS141 - L65X50X5	1,503	Lijn	K404	K408	Balk (80)	standaard
Vak14	S463	CS141 - L65X50X5	1,503	Lijn	K409	K394	Balk (80)	standaard
Vak14	S324	CS144 - HEB200	3,507	Lijn	K414	K434	Balk (80)	standaard
Vak14	S547	CS44 - UNP200	3,674	Lijn	K406	K404	Balk (80)	standaard
Vak14	S219	CS140 - L50X5	2,305	Lijn	K404	K395	Kolom (100)	standaard
Vak14	S220	CS140 - L50X5	2,305	Lijn	K406	K397	Kolom (100)	standaard
Vak14	S214	CS140 - L50X5	2,305	Lijn	K394	K395	Kolom (100)	standaard
Vak14	S215	CS140 - L50X5	2,305	Lijn	K396	K397	Kolom (100)	standaard
Vak14	S239	CS142 - L130X12	2,376	Lijn	K408	K434	Kolom (100)	standaard
Vak14	S241	CS142 - L130X12	2,376	Lijn	K410	K434	Kolom (100)	standaard
Vak14	S224	CS142 - L130X12	2,376	Lijn	K409	K414	Kolom (100)	standaard
Vak14	S226	CS142 - L130X12	2,376	Lijn	K411	K414	Kolom (100)	standaard
Vak14	S461	CS141 - L65X50X5	1,503	Lijn	K396	K411	Balk (80)	standaard
Vak14	S386	CS44 - UNP200	3,674	Lijn	K394	K396	Balk (80)	standaard
Vak14	S462	CS141 - L65X50X5	1,503	Lijn	K410	K406	Balk (80)	standaard
Vak15	S86	CS151 - L50X5	1,450	Lijn	K156	K130	Kolom (100)	standaard
Vak15	S199	CS148 - L60X6	2,672	Lijn	K206	K158	Balk (80)	standaard
Vak15	S211	CS4 - L50X5	2,163	Lijn	K158	K156	Balk (80)	standaard
Vak15	S155	CS158 - L90X9	1,506	Lijn	K219	K267	Kolom (100)	standaard
Vak15	S153	CS158 - L90X9	1,506	Lijn	K206	K261	Kolom (100)	standaard
Vak15	S151	CS156 - L60X6	1,213	Lijn	K267	K154	Balk (80)	standaard
Vak15	S198	CS148 - L60X6	2,672	Lijn	K219	K156	Balk (80)	standaard
Vak15	S97	CS152 - L50X5	1,849	Lijn	K206	K177	Kolom (100)	standaard
Vak15	S96	CS152 - L50X5	1,851	Lijn	K219	K177	Kolom (100)	standaard
Vak15	S87	CS151 - L50X5	1,451	Lijn	K158	K130	Kolom (100)	standaard
Vak15	S88	CS151 - L50X5	1,993	Lijn	K154	K144	Balk (80)	standaard
Vak15	S99	CS152 - L50X5	1,920	Lijn	K267	K261	Balk (80)	standaard
Vak15	S609	CS149 - UNP180	1,569	Lijn	K219	K158	Balk (80)	standaard
Vak15	S425	CS89 - L140X13	0,970	Lijn	K158	K154	Kolom (100)	standaard
Vak15	S413	CS89 - L140X13	0,970	Lijn	K144	K156	Kolom (100)	standaard
Vak15	S610	CS149 - UNP180	1,569	Lijn	K206	K156	Balk (80)	standaard
Vak15	S145	CS150 - L100X10	1,541	Lijn	K267	K158	Kolom (100)	standaard
Vak15	S144	CS150 - L100X10	1,541	Lijn	K261	K156	Kolom (100)	standaard
Vak15	S142	CS156 - L60X6	1,213	Lijn	K261	K144	Balk (80)	standaard
Vak16	S626	CS149 - UNP180	1,970	Lijn	K215	K219	Balk (80)	standaard
Vak16	S634	CS157 - L120X11	2,720	Lijn	K217	K267	Balk (80)	standaard
Vak16	S202	CS148 - L60X6	2,925	Lijn	K211	K219	Balk (80)	standaard
Vak16	S641	CS149 - UNP180	1,970	Lijn	K206	K211	Balk (80)	standaard
Vak16	S200	CS148 - L60X6	2,925	Lijn	K215	K206	Balk (80)	standaard
Vak16	S637	CS157 - L120X11	2,720	Lijn	K205	K261	Balk (80)	standaard
Vak16	S639	CS153 - L50X5	1,920	Lijn	K217	K205	Balk (80)	standaard
Vak16	S118	CS154 - L100X10	2,363	Lijn	K217	K219	Kolom (100)	standaard
Vak16	S115	CS153 - L50X5	1,306	Lijn	K211	K205	Kolom (100)	standaard
Vak16	S119	CS153 - L50X5	1,306	Lijn	K215	K217	Kolom (100)	standaard
Vak16	S114	CS153 - L50X5	1,691	Lijn	K211	K212	Kolom (100)	standaard
Vak16	S111	CS154 - L100X10	2,363	Lijn	K205	K206	Kolom (100)	standaard
Vak16	S116	CS153 - L50X5	1,691	Lijn	K215	K212	Kolom (100)	standaard
Vak17	S206	CS148 - L60X6	3,304	Lijn	K222	K224	Balk (80)	standaard
Vak17	S203	CS148 - L60X6	2,923	Lijn	K222	K211	Balk (80)	standaard
Vak17	S113	CS154 - L100X10	2,819	Lijn	N191	K207	Balk (80)	standaard
Vak17	S112	CS155 - L75X8	2,361	Lijn	K207	K205	Kolom (100)	standaard
Vak17	S629	CS149 - UNP180	4,465	Lijn	K227	K215	Balk (80)	standaard
Vak17	S207	CS148 - L60X6	3,304	Lijn	K227	K207	Balk (80)	standaard
Vak17	S209	CS146 - HEB180	2,163	Lijn	K222	K207	Balk (80)	standaard
Vak17	S636	CS157 - L120X11	4,465	Lijn	N191	K205	Balk (80)	standaard
Vak17	S642	CS149 - UNP180	4,465	Lijn	K211	K224	Balk (80)	standaard
Vak17	S126	CS154 - L100X10	2,819	Lijn	N192	K222	Balk (80)	standaard
Vak17	S201	CS148 - L60X6	2,923	Lijn	K207	K215	Balk (80)	standaard
Vak17	S633	CS157 - L120X11	4,465	Lijn	N192	K217	Balk (80)	standaard
Vak17	S120	CS155 - L75X8	2,361	Lijn	K222	K217	Kolom (100)	standaard
Vak18	S125	CS153 - L50X5	1,306	Lijn	N192	K227	Kolom (100)	standaard
Vak18	S123	CS153 - L50X5	1,691	Lijn	K227	K226	Kolom (100)	standaard
Vak18	S121	CS153 - L50X5	1,306	Lijn	N191	K224	Kolom (100)	standaard
Vak18	S122	CS153 - L50X5	1,691	Lijn	K224	K226	Kolom (100)	standaard
Vak18	S179	CS148 - L60X6	3,304	Lijn	K227	K186	Balk (80)	standaard
Vak18	S189	CS146 - HEB180	2,163	Lijn	K201	K186	Balk (80)	standaard
Vak18	S638	CS153 - L50X5	1,920	Lijn	N192	N191	Balk (80)	standaard

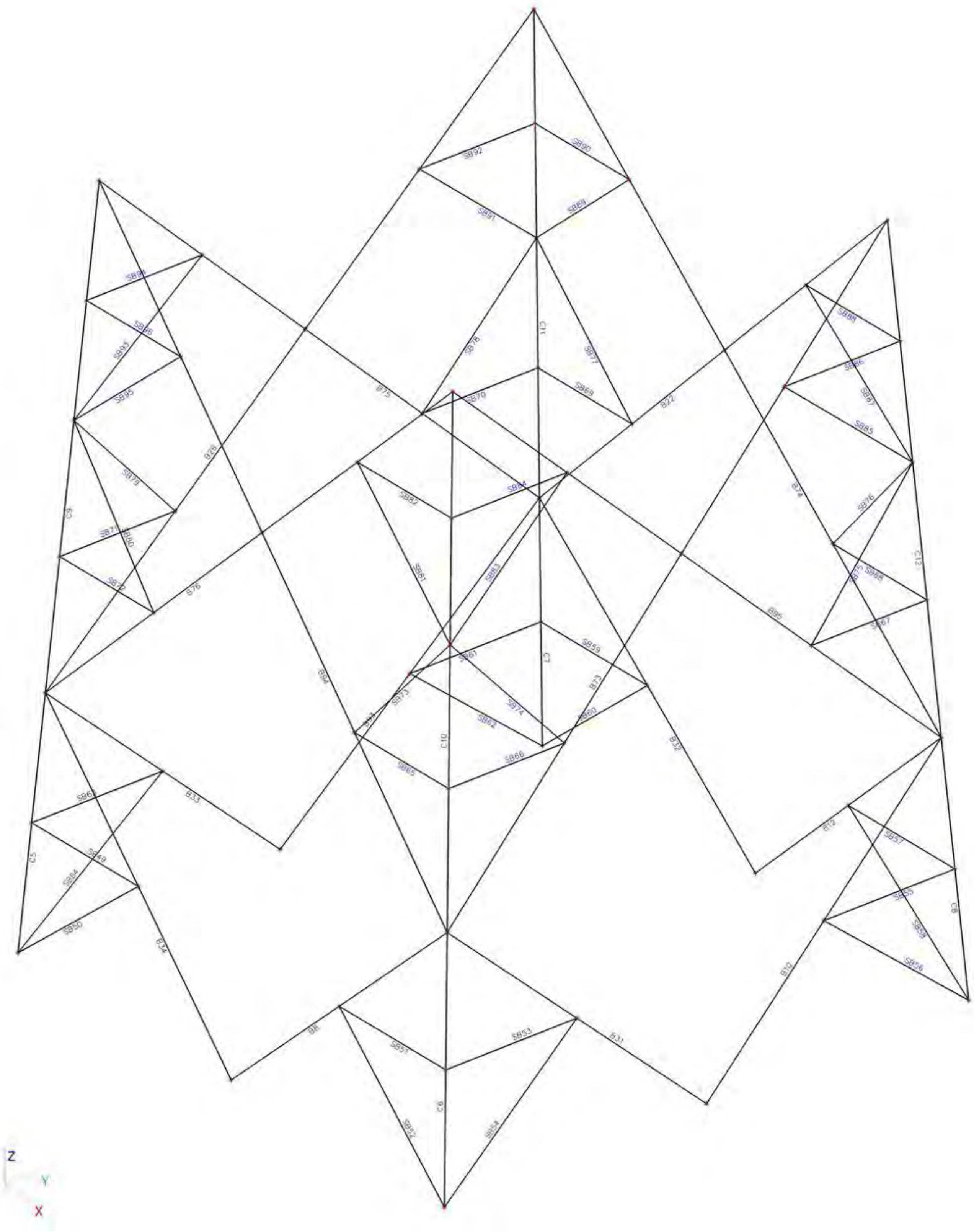
Laag	Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type
Vak18	S101	CS155 - L75X8	2,361	Lijn	K186	K623	Kolom (100)	standaard
Vak18	S185	CS148 - L60X6	2,923	Lijn	K201	K787	Balk (80)	standaard
Vak18	S640	CS149 - UNP180	4,465	Lijn	K224	K787	Balk (80)	standaard
Vak18	S183	CS148 - L60X6	2,923	Lijn	K186	K194	Balk (80)	standaard
Vak18	S178	CS148 - L60X6	3,304	Lijn	K201	K224	Balk (80)	standaard
Vak18	S110	CS154 - L100X10	2,819	Lijn	N192	K201	Balk (80)	standaard
Vak18	S109	CS155 - L75X8	2,361	Lijn	K201	K627	Kolom (100)	standaard
Vak18	S628	CS149 - UNP180	4,465	Lijn	K194	K227	Balk (80)	standaard
Vak18	S635	CS157 - L120X11	4,464	Lijn	K623	N191	Balk (80)	standaard
Vak18	S102	CS154 - L100X10	2,818	Lijn	N191	K186	Balk (80)	standaard
Vak18	S632	CS157 - L120X11	4,465	Lijn	K627	N192	Balk (80)	standaard
Vak19	S608	CS149 - UNP180	1,970	Lijn	K198	K194	Balk (80)	standaard
Vak19	S631	CS153 - L50X5	1,920	Lijn	K627	K623	Balk (80)	standaard
Vak19	S182	CS148 - L60X6	2,926	Lijn	K194	K335	Balk (80)	standaard
Vak19	S445	CS149 - UNP180	1,970	Lijn	K787	K335	Balk (80)	standaard
Vak19	S107	CS154 - L100X10	2,364	Lijn	K627	K198	Kolom (100)	standaard
Vak19	S105	CS153 - L50X5	1,691	Lijn	K194	K191	Kolom (100)	standaard
Vak19	S503	CS157 - L120X11	2,720	Lijn	K235	K627	Balk (80)	standaard
Vak19	S108	CS153 - L50X5	1,306	Lijn	K194	K627	Kolom (100)	standaard
Vak19	S100	CS154 - L100X10	2,364	Lijn	K623	K335	Kolom (100)	standaard
Vak19	S184	CS148 - L60X6	2,925	Lijn	K787	K198	Balk (80)	standaard
Vak19	S104	CS153 - L50X5	1,306	Lijn	K787	K623	Kolom (100)	standaard
Vak19	S103	CS153 - L50X5	1,691	Lijn	K787	K191	Kolom (100)	standaard
Vak19	S501	CS157 - L120X11	2,721	Lijn	K233	K623	Balk (80)	standaard
Vak20	S23	CS151 - L50X5	1,450	Lijn	K388	K15	Kolom (100)	standaard
Vak20	S139	CS158 - L90X9	1,506	Lijn	K335	K233	Kolom (100)	standaard
Vak20	S137	CS156 - L60X6	1,213	Lijn	K235	K39	Balk (80)	standaard
Vak20	S24	CS151 - L50X5	1,451	Lijn	K43	K15	Kolom (100)	standaard
Vak20	S98	CS152 - L50X5	1,920	Lijn	K235	K233	Balk (80)	standaard
Vak20	S141	CS158 - L90X9	1,506	Lijn	K198	K235	Kolom (100)	standaard
Vak20	S95	CS152 - L50X5	1,849	Lijn	K335	K173	Kolom (100)	standaard
Vak20	S497	CS149 - UNP180	1,568	Lijn	K43	K198	Balk (80)	standaard
Vak20	S94	CS152 - L50X5	1,851	Lijn	K198	K173	Kolom (100)	standaard
Vak20	S129	CS156 - L60X6	1,213	Lijn	K233	K29	Balk (80)	standaard
Vak20	S372	CS89 - L140X13	0,970	Lijn	K39	K43	Kolom (100)	standaard
Vak20	S361	CS89 - L140X13	0,970	Lijn	K388	K29	Kolom (100)	standaard
Vak20	S181	CS148 - L60X6	2,671	Lijn	K335	K43	Balk (80)	standaard
Vak20	S180	CS148 - L60X6	2,672	Lijn	K198	K388	Balk (80)	standaard
Vak20	S25	CS151 - L50X5	1,993	Lijn	K39	K29	Balk (80)	standaard
Vak20	S132	CS150 - L100X10	1,541	Lijn	K235	K43	Kolom (100)	standaard
Vak20	S131	CS150 - L100X10	1,541	Lijn	K233	K388	Kolom (100)	standaard
Vak20	S447	CS149 - UNP180	1,568	Lijn	K335	K388	Balk (80)	standaard
Vak20	S212	CS4 - L50X5	2,163	Lijn	K43	K388	Balk (80)	standaard

6. Staafnummers mastlichaam

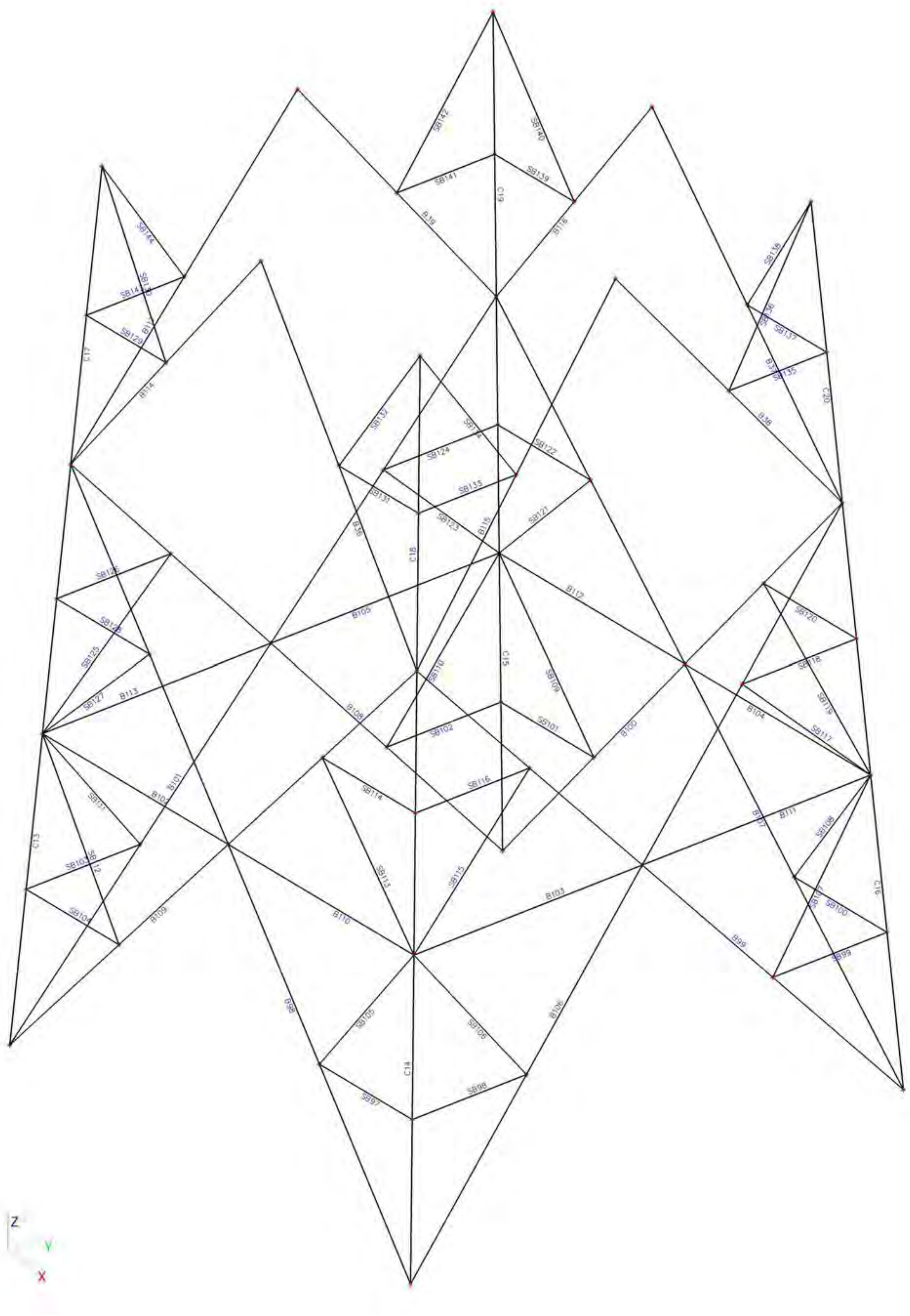
6.1. Vak 1



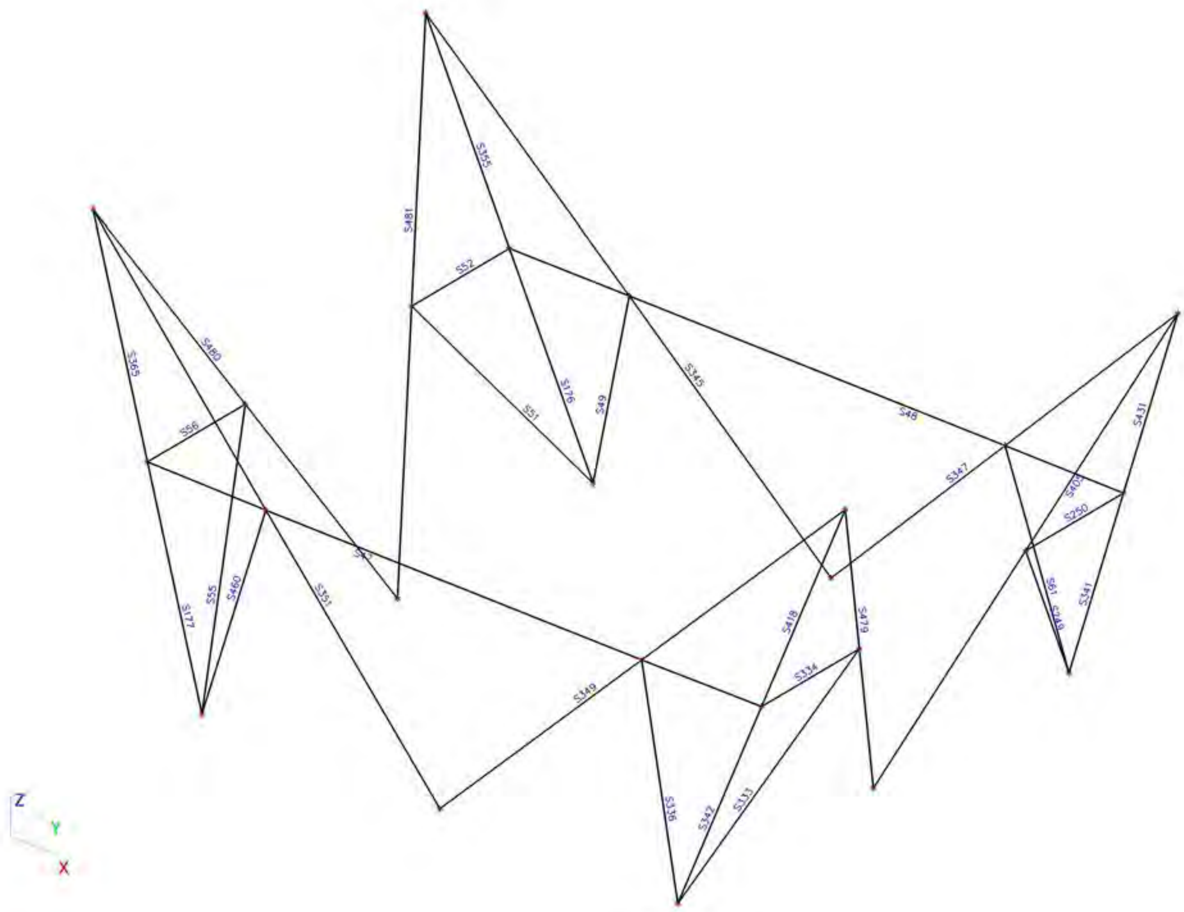
6.2. Vak 2+3



6.3. Vak 4+5



6.4. Vak 6



S355
S481
S52
S480
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S176
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S51
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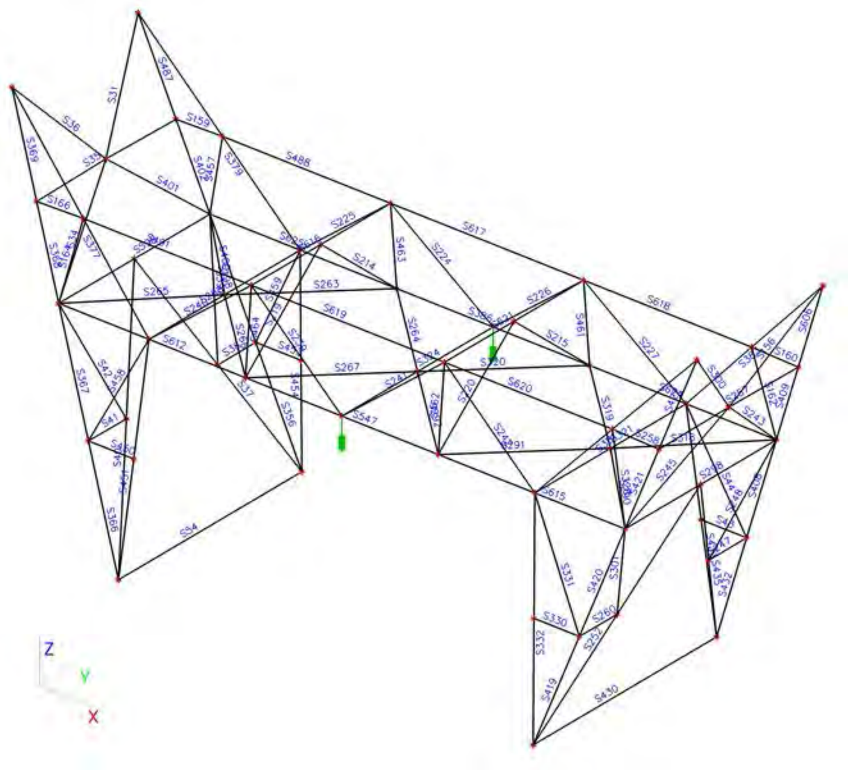
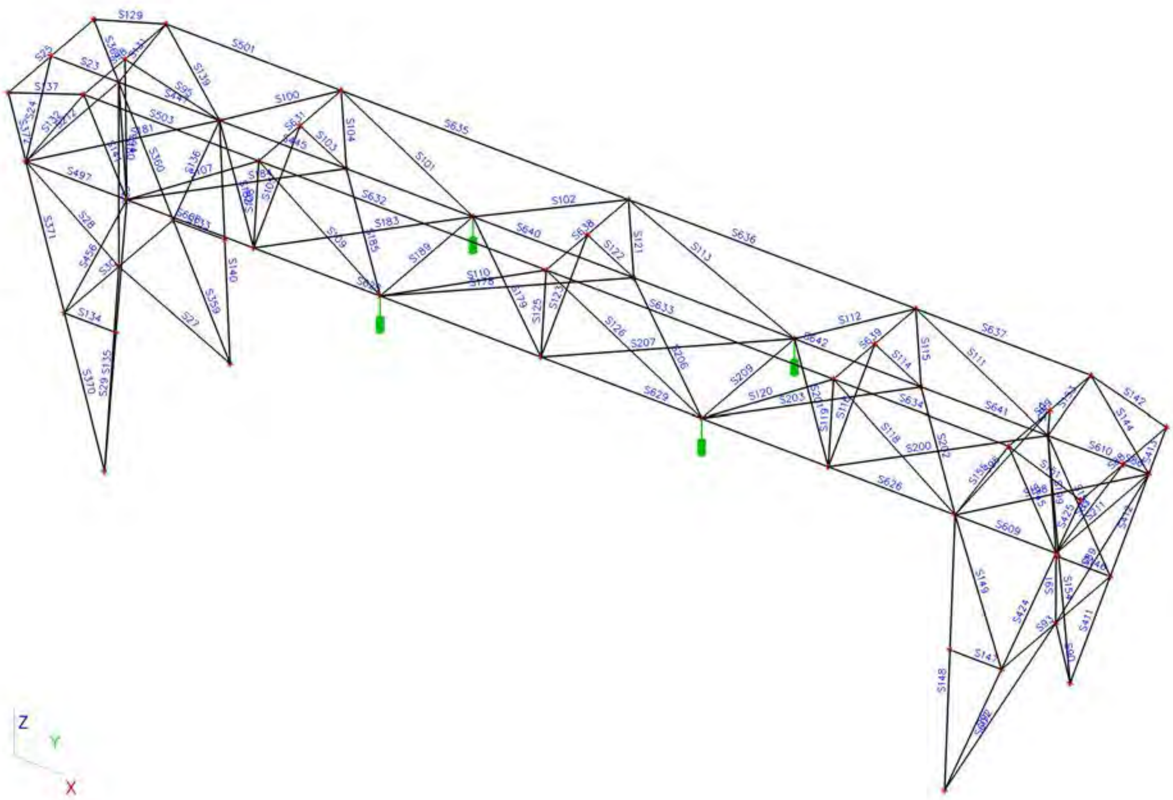
S48
S431
S347
S409
S250
S55
S460
S177
S51
S61
S249
S341
S418
S479
S334
S349
S336
S342
S333
Z
Y
X

6.5. Vak 7+8+9+10+13+14

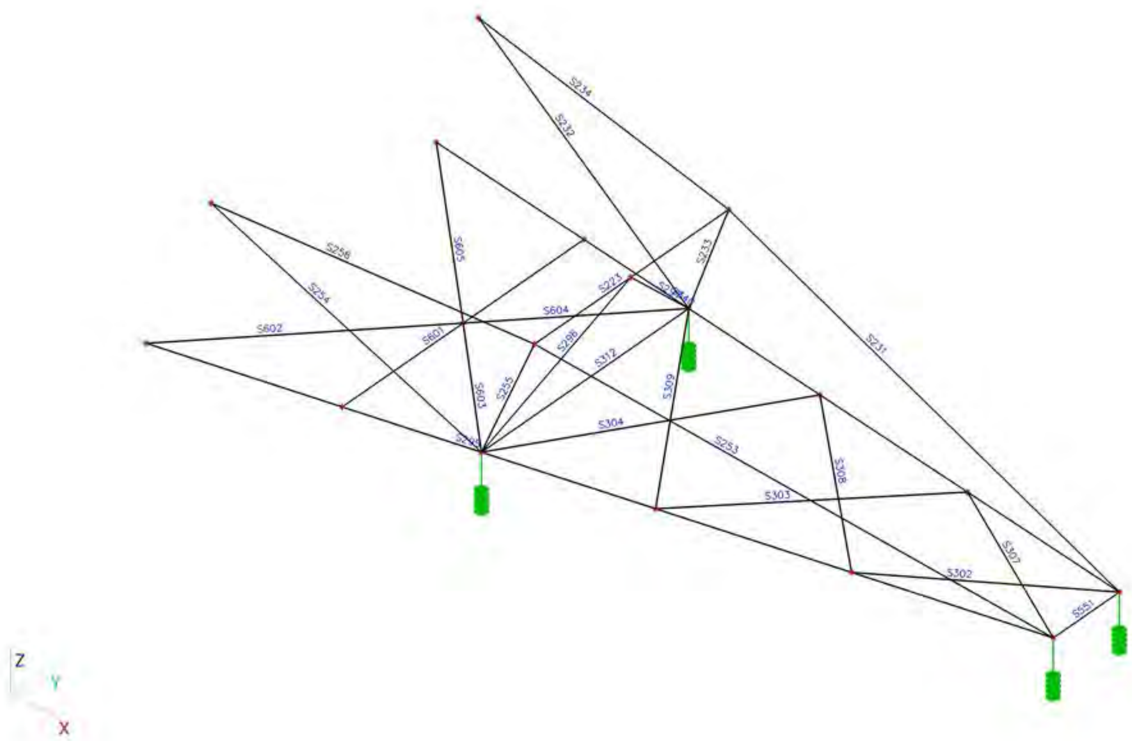


6.6. Vak 11+12+15 t/m 21

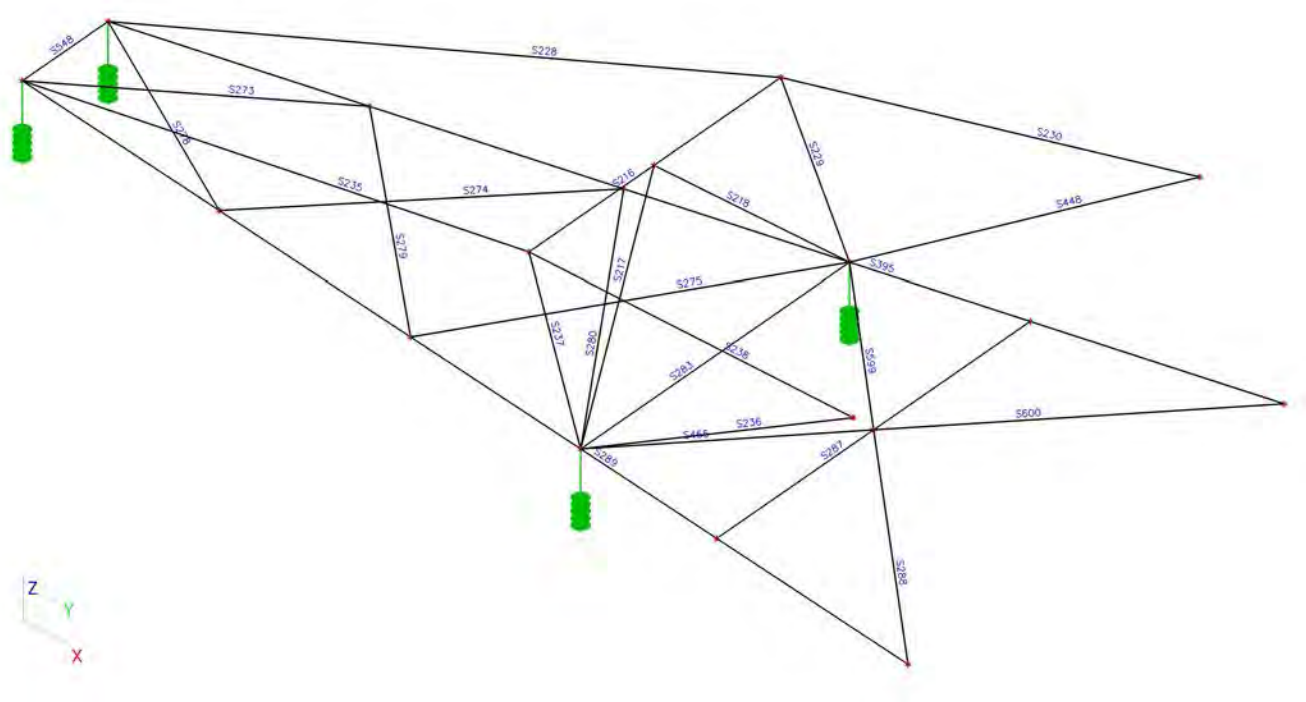


7. Staafnummers traverses

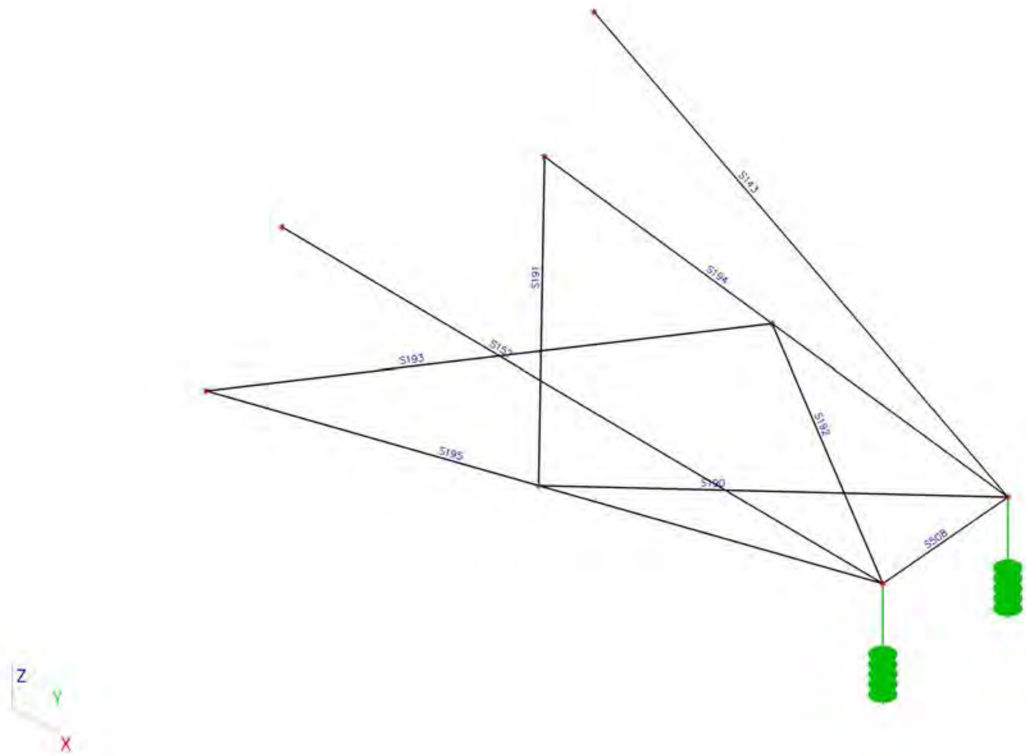
7.1. CrossArm1



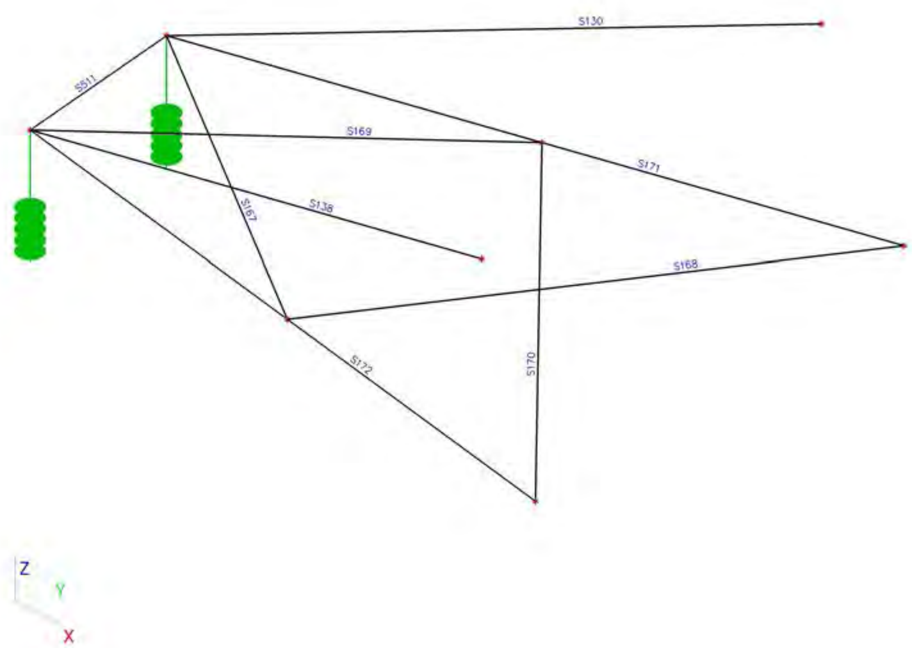
7.2. CrossArm2



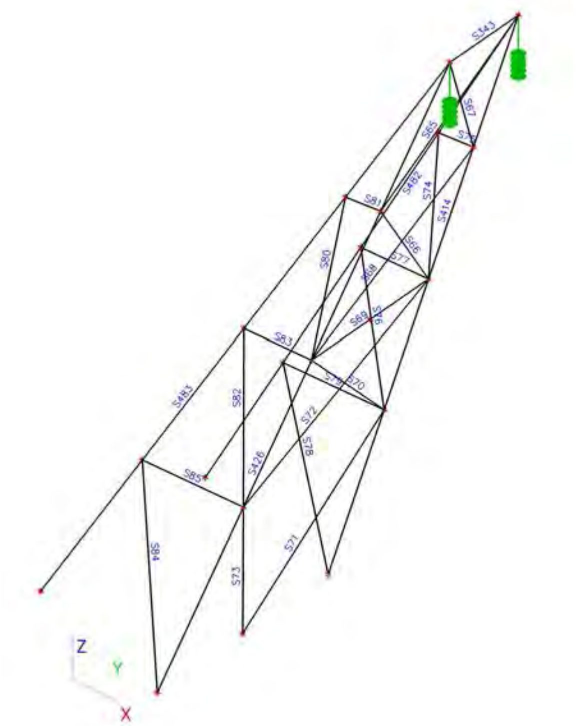
7.3. CrossArm3



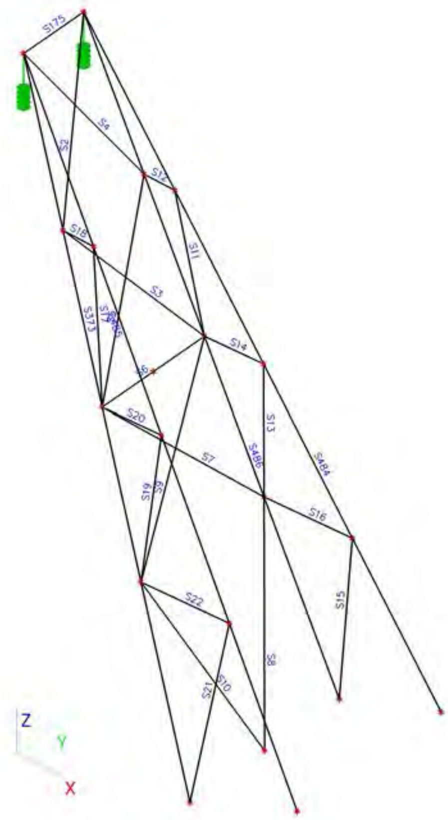
7.4. CrossArm4



7.5. CrossArm5

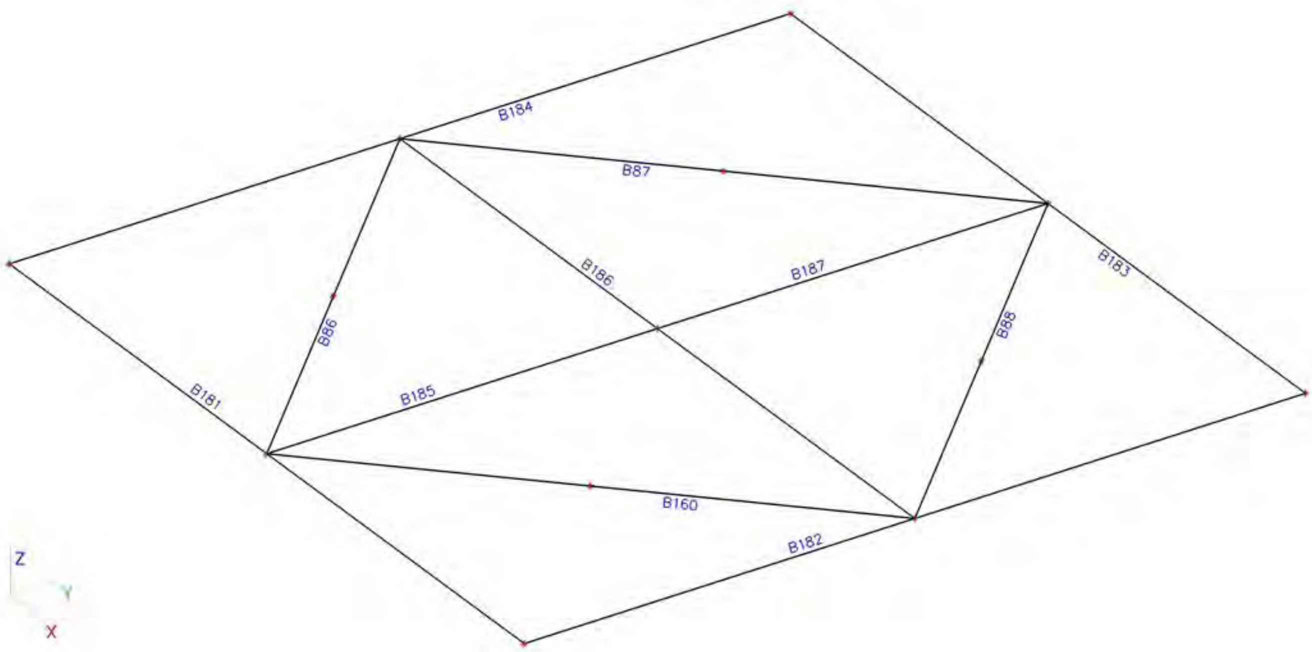


7.6. CrossArm6

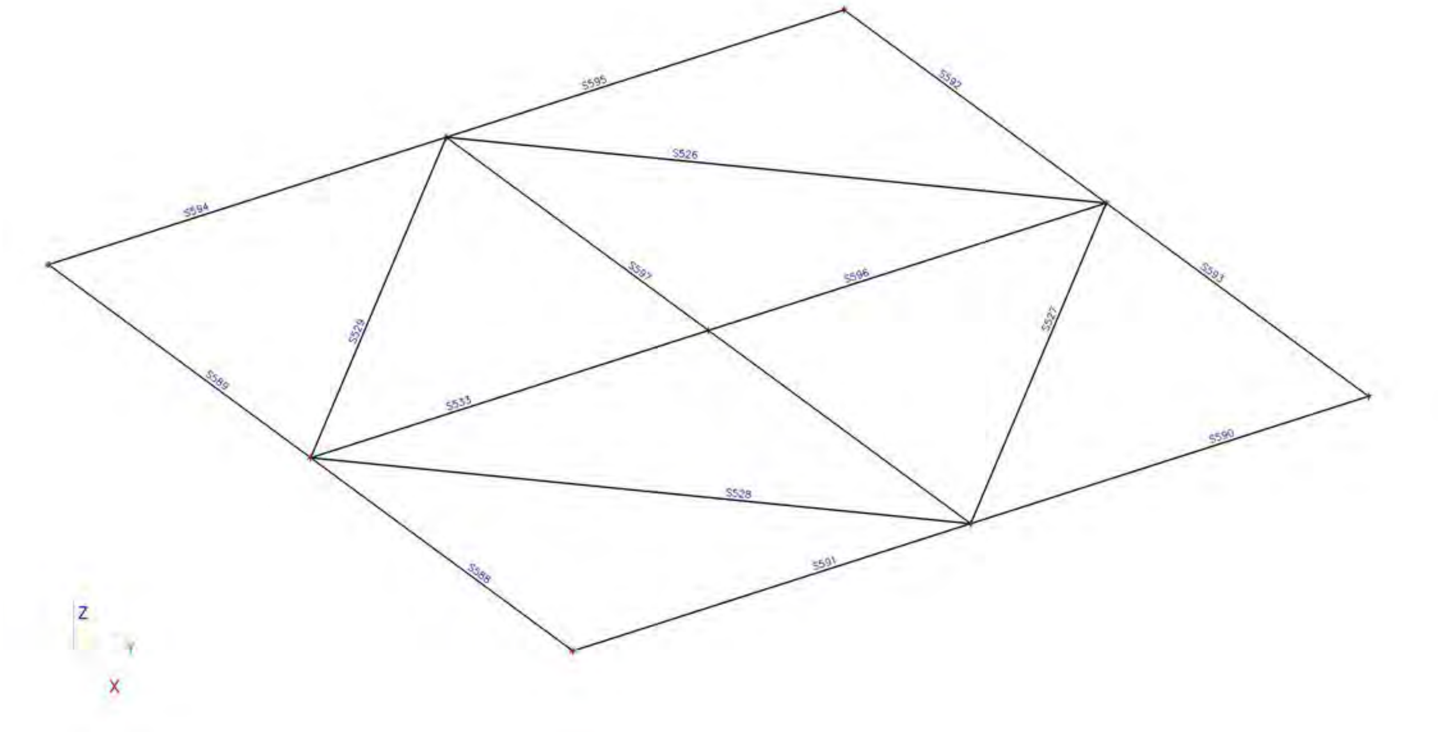


8. Staafnummers horizontale verbanden

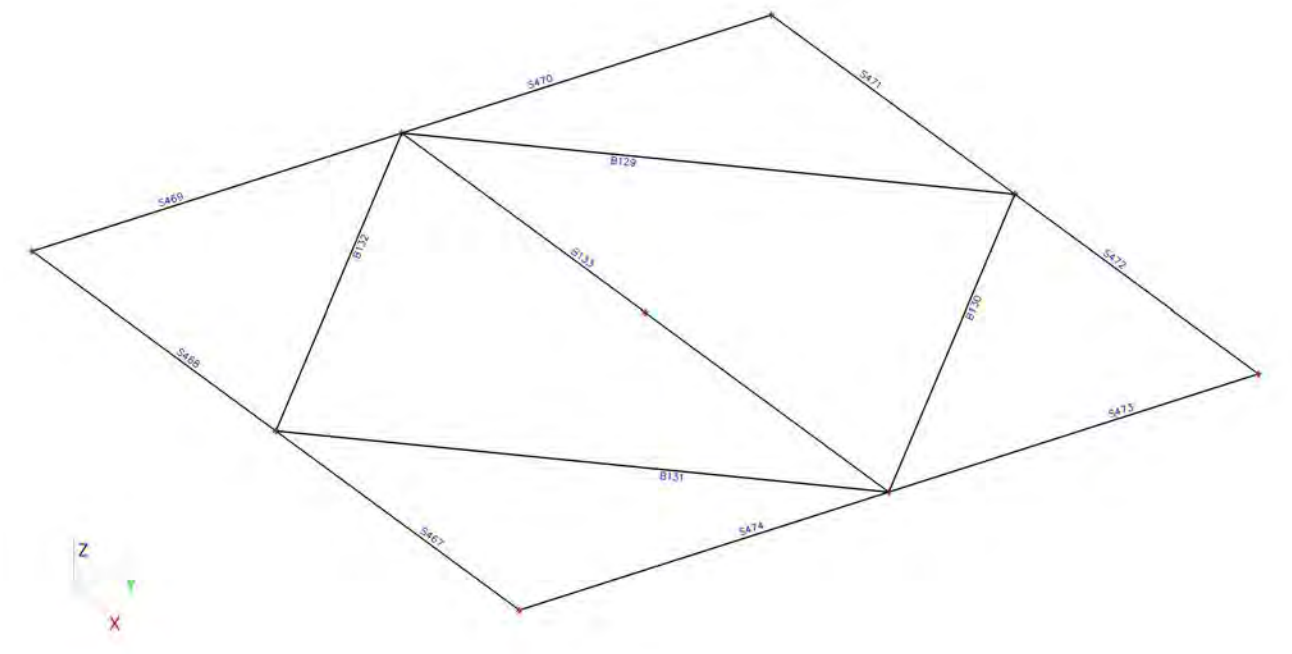
8.1. Horizontaal verband 1



8.2. Horizontaal verband 2



8.3. Horizontaal verband 3



9. Belastingsgevallen

Naam	Omschrijving	Actie type	Lastgroep	Belastingtype	Spec	Richting	Duur	'Master' belastingsgeval
6T	self weight of tower	Permanent	Perm	Eigen gewicht		-Z		
6C	self weight of conductor	Permanent	Perm	Standaard				
W_x-y+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x+y-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x-y-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x+y+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_y-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_y+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
WI_x+	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x+y+	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x+y-	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-y+	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-y-	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_y-	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
Ice	Ice	Variabel	Ice	Statisch	Standaard		Kort	Geen
4M	Maintenance	Variabel	Maint	Statisch	Onderhoudslasten			Geen
4C0	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C1	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C2	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C3	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C4	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C5	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C6	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C7	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C8	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C9	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C10	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C11	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C12	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C13	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
SBS	SBS-load	Variabel	SBS	Statisch	Knikverkorterlasten			Geen
Tuls-1a	Conductor tension	Permanent	CT	Standaard				
Tuls-1b	Conductor tension	Permanent	CT	Standaard				
Tuls-3	Conductor tension	Permanent	CT	Standaard				
Tuls-4	Conductor tension	Permanent	CT	Standaard				
Tuls-6	Conductor tension	Permanent	CT	Standaard				
Tsls-1a-LF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1b-LF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-3-LF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-4-LF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1a-LR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1b-LR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-3-LR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-4-LR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1a-RF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1b-RF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-3-RF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-4-RF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1a-RR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1b-RR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-3-RR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-4-RR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tuls-5a_CI1		Variabel	5a_CI1	Statisch	Standaard		Kort	Geen
Tuls-5a_CI2		Variabel	5a_CI2	Statisch	Standaard		Kort	Geen
Tuls-5a_CI3		Variabel	5a_CI3	Statisch	Standaard		Kort	Geen
Tuls-5a_CI4		Variabel	5a_CI4	Statisch	Standaard		Kort	Geen
Tuls-5a_CI5		Variabel	5a_CI5	Statisch	Standaard		Kort	Geen
Tuls-5a_CI6		Variabel	5a_CI6	Statisch	Standaard		Kort	Geen
Tuls-5a_CI7		Variabel	5a_CI7	Statisch	Standaard		Kort	Geen
Tuls-5a_CI8		Variabel	5a_CI8	Statisch	Standaard		Kort	Geen
Tuls-5a_CI9		Variabel	5a_CI9	Statisch	Standaard		Kort	Geen
Tuls-5a_CI10		Variabel	5a_CI10	Statisch	Standaard		Kort	Geen
Tuls-5a_CI11		Variabel	5a_CI11	Statisch	Standaard		Kort	Geen
Tuls-5a_CI12		Variabel	5a_CI12	Statisch	Standaard		Kort	Geen

Naam	Omschrijving	Actie type	Lastgroep	Belastingtype	Spec	Richting	Duur	'Master' belastingsgeval
Tuls-5a_CI14		Variabel	5a_CI14	Statisch	Standaard		Kort	Geen
Tuls-5a_CI15		Variabel	5a_CI15	Statisch	Standaard		Kort	Geen
Tuls-5a_CI16		Variabel	5a_CI16	Statisch	Standaard		Kort	Geen
Tuls-5a_CI17		Variabel	5a_CI17	Statisch	Standaard		Kort	Geen
Tuls-5a_CI18		Variabel	5a_CI18	Statisch	Standaard		Kort	Geen
Tuls-5a_CI19		Variabel	5a_CI19	Statisch	Standaard		Kort	Geen
Tuls-5a_CI20		Variabel	5a_CI20	Statisch	Standaard		Kort	Geen
Tuls-5a_CI21		Variabel	5a_CI21	Statisch	Standaard		Kort	Geen
Tuls-5a_CI22		Variabel	5a_CI22	Statisch	Standaard		Kort	Geen
WI_y+	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
Tuls-5a_CI13		Variabel	5a_CI13	Statisch	Standaard		Kort	Geen

10. Combinaties

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
1a	wind;10	Omhullende - uiterst	W_x-y+ - Wind	1,50
			W_x+y- - Wind	1,50
			W_x-y- - Wind	1,50
			W_x+y+ - Wind	1,50
			W_y- - Wind	1,50
			W_y+ - Wind	1,50
			W_x- - Wind	1,50
			W_x+ - Wind	1,50
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-1a - Conductor tension	1,00
1b	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-1a - Conductor tension	1,00
3	wind+ice	Omhullende - uiterst	Ice - Ice	1,50
			WI_x+ - WindIce	0,45
			WI_x- - WindIce	0,45
			WI_x+y+ - WindIce	0,45
			WI_x+y- - WindIce	0,45
			WI_x-y+ - WindIce	0,45
			WI_x-y- - WindIce	0,45
			WI_y+ - WindIce	0,45
			WI_y- - WindIce	0,45
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-3 - Conductor tension	1,00
4	Maintenance	Omhullende -	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-4 - Conductor tension	1,00
			4C0 - Construction	1,50
			4C1 - Construction	1,50
			4C2 - Construction	1,50
			4C3 - Construction	1,50
			4C4 - Construction	1,50

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
4	Maintenance	Omhullende - uiterst	4C5 - Construction	1,50
			4C6 - Construction	1,50
			4C7 - Construction	1,50
			4C8 - Construction	1,50
			4C9 - Construction	1,50
			4C10 - Construction	1,50
			4C11 - Construction	1,50
			4C12 - Construction	1,50
			4C13 - Construction	1,50
6	Permanent	Omhullende - uiterst	6T - self weight of tower	1,35
			6C - self weight of conductor	1,35
			Tuls-6 - Conductor tension	1,00
1a-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	1,50
			W_x+y- - Wind	1,50
			W_x-y- - Wind	1,50
			W_x+y+ - Wind	1,50
			W_y- - Wind	1,50
			W_y+ - Wind	1,50
			W_x- - Wind	1,50
			W_x+ - Wind	1,50
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-1a - Conductor tension	1,00
1b-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-1a - Conductor tension	1,00
3-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,50
			WI_x+ - WindIce	0,45
			WI_x- - WindIce	0,45
			WI_x+y+ - WindIce	0,45
			WI_x+y- - WindIce	0,45
			WI_x-y+ - WindIce	0,45
			WI_x-y- - WindIce	0,45
			WI_y+ - WindIce	0,45
			WI_y- - WindIce	0,45
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-3 - Conductor tension	1,00
4-p	Maintenance	Omhullende -	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-4 - Conductor tension	1,00
			4C0 - Construction	1,50
			4C1 - Construction	1,50
			4C2 - Construction	1,50
			4C3 - Construction	1,50
			4C4 - Construction	1,50
			4C5 - Construction	1,50
			4C6 - Construction	1,50
			4C7 - Construction	1,50

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 55
Omschrijving	- ontwerpberekening
Nationale norm	EC - EN
Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
4-p	Maintenance	Omhullende - uiterst	4C8 - Construction	1,50
			4C9 - Construction	1,50
			4C10 - Construction	1,50
			4C11 - Construction	1,50
			4C12 - Construction	1,50
			4C13 - Construction	1,50
sp1aLF	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aLR	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aRF	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aRR	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
sp1aF	wind;10	Omhullende -	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1aF	wind;10	Omhullende -	W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aR	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
sp1aLF-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aLR-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aRF-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aRR-p	wind;10	Omhullende -	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08

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Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1aRR-p	wind;10	Omhullende - uiterst	6C - self weight of conductor	0,90
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
sp1aF-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aR-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
sp1bLF	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bLR	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bRF	wind;-20	Omhullende -	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LF - Conductor tension	1,00

	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 55
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1bRF	wind;-20	Omhullende - uiterst	Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bRR	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
sp1bF	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bR	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
sp1bLF-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bLR-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1bRF-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bRR-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
sp1bF-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bR-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
sp3LF	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3LR	wind+ice	Omhullende -	Ice - Ice	1,00

	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 55
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp3LR	wind+ice	Omhullende - Uiterst	WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3RF	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3RR	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
sp3F	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3R	wind+ice	Omhullende -	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp3R	wind+ice	Omhullende - uiterst	Tsls-3-LF - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
sp3LF-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3LR-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3RF-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3RR-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
sp3F-p	wind+ice	Omhullende -	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp3F-p	wind+ice	Omhullende - uiterst	WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3R-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
sp4LF	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4LR	maintenance	Omhullende -	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20

	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 55
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4LR	maintenance	Omhullende - uiterst	4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4RF	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4RR	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4F	maintenance	Omhullende -	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4F	maintenance	Omhullende - uiterst	W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4R	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4LF-p	maintenance	Omhullende -	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20

	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 55
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4LF-p	maintenance	Omhullende - uiterst	4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4LR-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4RF-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4RR-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4F-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4R-p	maintenance	Omhullende -	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4R-p	maintenance	Uiterst Ontsullende -	4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20

11. Resultaten

11.1. Interne krachten in staaf

Lineaire berekening, Extreem : Staaf, Systeem : Hoofd
Selectie : Alle
Klasse : All UGT

Staaf	BG	Geval beschrijving	N [kN]
B8	sp3RF-p/79	wind+ice	148,91
B8	sp3RR/78	wind+ice	-151,20
B10	sp3RF-p/130	wind+ice	130,73
B10	sp3RR/126	wind+ice	-140,83
B12	sp3RR-p/36	wind+ice	149,92
B12	sp3RF/35	wind+ice	-144,28
B22	sp3LF/74	wind+ice	197,44
B22	sp3LR-p/75	wind+ice	-176,30
B26	sp3LR/32	wind+ice	-167,18
B26	sp3LF-p/33	wind+ice	165,38
B31	sp3RF/46	wind+ice	-137,86
B31	sp3RR-p/48	wind+ice	135,68
B32	sp3LR-p/75	wind+ice	147,72
B32	sp3LF/74	wind+ice	-167,32
B33	sp3LF/134	wind+ice	-147,83
B33	sp3LR-p/135	wind+ice	146,59
B34	sp3LF-p/77	wind+ice	145,35
B34	sp3LR/76	wind+ice	-159,76
B36	sp3RF-p/79	wind+ice	-259,69
B36	sp3RR/78	wind+ice	255,84
B37	sp3RR-p/52	wind+ice	-262,06
B37	sp3RF/51	wind+ice	241,55
B38	sp3RF/123	wind+ice	-201,04
B38	sp3RR-p/141	wind+ice	201,85
B39	sp3LR-p/142	wind+ice	219,42
B39	sp3LF/31	wind+ice	-226,23
B73	sp3RF-p/89	wind+ice	151,32
B73	sp3RR/88	wind+ice	-155,02
B74	sp3RF/35	wind+ice	171,86
B74	sp3RR-p/36	wind+ice	-181,18
B75	sp3LR-p/103	wind+ice	164,54
B75	sp3LF/137	wind+ice	-170,12
B76	sp3LF-p/77	wind+ice	-173,88
B76	sp3LR/76	wind+ice	187,94
B84	sp3RF/173	wind+ice	0,00
B84	sp1aRR/172	wind;10	0,00
B85	sp1bF/174	wind;-20	0,00
B85	sp3RF/175	wind+ice	0,00
B86	sp3RR/127	wind+ice	-9,68
B86	sp3RF-p/97	wind+ice	7,79
B87	sp3RF/99	wind+ice	-8,85
B87	sp3RR-p/98	wind+ice	8,18
B88	sp3LF/86	wind+ice	-10,41
B88	sp3LR-p/157	wind+ice	8,57
B93	sp3LF-p/133	wind+ice	150,52
B93	sp3LR/3	wind+ice	-147,84
B94	sp3RF-p/79	wind+ice	-179,27
B94	sp3RR/78	wind+ice	180,64
B95	sp3RF/123	wind+ice	-150,97
B95	sp3RR-p/136	wind+ice	155,28
B98	sp3LF-p/77	wind+ice	214,97
B98	sp3LR/76	wind+ice	-232,40
B99	sp3RR-p/139	wind+ice	166,56
B99	sp3RF/138	wind+ice	-166,25
B100	sp3RR-p/36	wind+ice	223,63
B100	sp3RF/35	wind+ice	-212,49
B101	sp3LF-p/33	wind+ice	184,16
B101	sp3LR/140	wind+ice	-182,64
B102	sp3R/64	wind+ice	4,70
B102	sp3F-p/2	wind+ice	-4,43

Staaf	BG	Geval beschrijving	N [kN]
B103	1a/71	wind;10	3,13
B103	1a-p/70	wind;10	-1,79
B104	sp3F/26	wind+ice	4,80
B104	sp3R-p/27	wind+ice	-4,30
B105	1a/43	wind;10	2,29
B105	1a-p/44	wind;10	-2,62
B106	sp3RF-p/147	wind+ice	162,58
B106	sp3RR/154	wind+ice	-170,24
B107	sp3LR-p/75	wind+ice	216,56
B107	sp3LF/74	wind+ice	-242,51
B108	sp3LR/32	wind+ice	182,06
B108	sp3LF/153	wind+ice	-183,95
B109	sp3RF-p/79	wind+ice	220,14
B109	sp3RR/78	wind+ice	-221,69
B110	1a/71	wind;10	0,00
B110	1a/19	wind;10	0,00
B111	sp3F/41	wind+ice	0,00
B111	1a/15	wind;10	0,00
B112	1a/43	wind;10	0,00
B112	1a/56	wind;10	0,00
B113	sp3R/39	wind+ice	0,00
B113	1a/59	wind;10	0,00
B114	sp3LR/76	wind+ice	264,46
B114	sp3LF-p/77	wind+ice	-248,87
B115	sp3RF-p/89	wind+ice	196,95
B115	sp3RR/88	wind+ice	-206,84
B116	sp3LF/132	wind+ice	279,54
B116	sp3LR-p/155	wind+ice	-253,44
B117	sp3LF-p/33	wind+ice	221,03
B117	sp3LR/32	wind+ice	-223,27
B129	sp3RR-p/159	wind+ice	49,16
B129	sp3RF/158	wind+ice	-47,98
B130	sp3LR-p/142	wind+ice	48,17
B130	sp3LF/31	wind+ice	-50,62
B131	sp3LF-p/133	wind+ice	49,64
B131	sp3LR/32	wind+ice	-49,57
B132	sp3RF-p/161	wind+ice	47,17
B132	sp3RR/160	wind+ice	-49,85
B133	sp1aLR/163	wind;10	0,60
B133	3-p/162	wind+ice	-0,09
B154	sp3RF-p/38	wind+ice	173,31
B154	sp3RR/37	wind+ice	-220,60
B159	sp3RR-p/98	wind+ice	239,61
B159	sp3RF/123	wind+ice	-247,44
B160	sp3LF-p/85	wind+ice	8,09
B160	sp3LR/121	wind+ice	-10,60
B177	sp3F/41	wind+ice	0,00
B177	1a/19	wind;10	-0,09
B178	1a/71	wind;10	0,00
B178	1a/56	wind;10	-0,09
B179	sp3F/14	wind+ice	0,00
B179	1a/19	wind;10	-0,12
B180	sp3RR/37	wind+ice	0,00
B180	1a/56	wind;10	-0,12
B181	sp3F-p/34	wind+ice	179,17
B181	sp3R/17	wind+ice	-209,74
B182	sp3R-p/55	wind+ice	174,27
B182	sp3F/61	wind+ice	-227,23
B183	sp3F/61	wind+ice	-221,41
B183	sp3R-p/55	wind+ice	167,64

Staaf	BG	Geval beschrijving	N [kN]
B184	sp3R/17	wind+ice	-216,17
B184	sp3F-p/34	wind+ice	185,17
B185	3/84	wind+ice	-1,17
B185	1a-p/70	wind;10	-0,80
B186	1a/43	wind;10	-1,02
B186	sp3LR-p/176	wind+ice	-0,74
B187	1a-p/70	wind;10	-1,28
B187	3/84	wind+ice	-1,81
B188	sp3RR-p/36	wind+ice	0,00
B188	sp3RF/173	wind+ice	0,00
B189	sp3RR-p/47	wind+ice	0,00
B189	1a/71	wind;10	-0,09
B190	sp3LF/74	wind+ice	0,00
B190	1a/68	wind;10	-0,09
B191	sp3RF/175	wind+ice	0,00
B191	sp3RR-p/36	wind+ice	0,00
B192	sp3RR/37	wind+ice	0,00
B192	1a/56	wind;10	-0,09
B193	sp3F/4	wind+ice	0,00
B193	1a/19	wind;10	-0,09
B194	sp3RR/150	wind+ice	0,00
B194	sp3RR-p/36	wind+ice	0,00
B195	sp3F/14	wind+ice	0,00
B195	1a/19	wind;10	-0,12
B196	sp3RR/37	wind+ice	0,00
B196	1a/56	wind;10	-0,12
B197	sp3LF-p/18	wind+ice	218,33
B197	sp3LR/1	wind+ice	-207,37
B198	sp3LF/31	wind+ice	-274,75
B198	sp3LR-p/142	wind+ice	252,50
B199	sp3LF/179	wind+ice	0,00
B199	sp1bRF/178	wind;-20	0,00
B200	sp3F/61	wind+ice	0,00
B200	1a/59	wind;10	-0,12
B201	1a/15	wind;10	-0,12
B201	sp3LR/1	wind+ice	0,00
B202	sp3LF/179	wind+ice	0,00
B202	sp1aF/180	wind;10	0,00
B203	sp3F/61	wind+ice	0,00
B203	1a/59	wind;10	-0,12
B204	sp3LR/1	wind+ice	0,00
B204	1a/15	wind;10	-0,12
B205	sp3F/41	wind+ice	0,00
B205	1a/59	wind;10	-0,09
B206	1a/43	wind;10	0,00
B206	1a/15	wind;10	-0,09
B207	sp3LF/179	wind+ice	0,00
B207	sp1bLR/183	wind;-20	0,00
B208	sp3LR/1	wind+ice	0,00
B208	1a/15	wind;10	-0,09
B209	sp3F/26	wind+ice	0,00
B209	1a/59	wind;10	-0,09
B210	sp3LF/137	wind+ice	0,00
B210	sp4LR/184	maintenance	0,00
B211	sp3LF/137	wind+ice	0,00
B211	sp3LR-p/75	wind+ice	0,00
B212	sp3LF/12	wind+ice	0,00
B212	1a/15	wind;10	-0,09
B213	sp3RR-p/36	wind+ice	0,00
B213	1a/68	wind;10	-0,09

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 55
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- SMA

Staaf	BG	Geval beschrijving	N [kN]	Staaf	BG	Geval beschrijving	N [kN]	Staaf	BG	Geval beschrijving	N [kN]
B214	sp3RF/65	wind+ice	**-224,24**	B247	1a/56	wind;10	**-0,12**	S15	1a-p/16	wind;10	**0,30**
B214	sp3RR-p/47	wind+ice	**187,66**	C5	sp3R/17	wind+ice	**-1488,58**	S15	1a/15	wind;10	**-1,78**
B215	sp3RF-p/89	wind+ice	**237,40**	C5	sp3F-p/34	wind+ice	**1291,38**	S16	1a/15	wind;10	**1,10**
B215	sp3RR/127	wind+ice	**-250,50**	C6	sp3R/45	wind+ice	**-1460,44**	S16	1a-p/16	wind;10	**-0,21**
B216	sp4LF/188	maintenance	**0,00**	C6	sp3F-p/60	wind+ice	**1097,35**	S17	1a-p/16	wind;10	**0,57**
B216	sp3RF-p/187	wind+ice	**0,00**	C7	sp3R-p/5	wind+ice	**1184,77**	S17	sp3R/17	wind+ice	**-2,25**
B217	sp3R/17	wind+ice	**0,00**	C7	sp3F/14	wind+ice	**-1374,10**	S18	sp3R/17	wind+ice	**0,59**
B217	1a/15	wind;10	**-0,12**	C8	sp3F/61	wind+ice	**-1568,46**	S18	sp3LF-p/18	wind+ice	**-0,16**
B218	sp3RF/65	wind+ice	**0,00**	C8	sp3R-p/55	wind+ice	**1212,95**	S19	1a-p/20	wind;10	**0,18**
B218	1a/59	wind;10	**-0,12**	C9	sp3R/17	wind+ice	**-1400,50**	S19	1a/19	wind;10	**-1,42**
B219	sp3RF-p/187	wind+ice	**0,00**	C9	sp3F-p/34	wind+ice	**1210,73**	S20	1a/15	wind;10	**0,64**
B219	sp3F/61	wind+ice	**0,00**	C10	sp3F-p/60	wind+ice	**1031,67**	S20	1a-p/16	wind;10	**-0,16**
B220	sp3R/17	wind+ice	**0,00**	C10	sp3R/45	wind+ice	**-1374,75**	S21	1a-p/20	wind;10	**0,37**
B220	1a/15	wind;10	**-0,12**	C11	sp3F/14	wind+ice	**-1296,07**	S21	1a/19	wind;10	**-2,08**
B221	sp3RF/65	wind+ice	**0,00**	C11	sp3R-p/5	wind+ice	**1111,92**	S22	1a/19	wind;10	**1,06**
B221	1a/59	wind;10	**-0,12**	C12	sp3R-p/55	wind+ice	**1137,80**	S22	1a-p/20	wind;10	**-0,19**
B222	sp3R/39	wind+ice	**0,00**	C12	sp3F/61	wind+ice	**-1473,98**	S23	sp3LR-p/21	wind+ice	**9,06**
B222	1a/15	wind;10	**-0,09**	C13	sp3F-p/34	wind+ice	**952,01**	S23	sp3LF/12	wind+ice	**-10,11**
B223	1a/71	wind;10	**0,00**	C13	sp3R/17	wind+ice	**-1123,28**	S24	sp3F/9	wind+ice	**11,11**
B223	1a/59	wind;10	**-0,09**	C14	sp3R/45	wind+ice	**-1102,35**	S24	sp3R-p/7	wind+ice	**-9,27**
B224	sp1aLF/190	wind;10	**0,00**	C14	sp3F-p/60	wind+ice	**800,64**	S25	sp1aF-p/23	wind;10	**-4,77**
B224	sp3RF-p/187	wind+ice	**0,00**	C15	sp3F/14	wind+ice	**-1040,76**	S25	3/22	wind+ice	**-13,78**
B225	1a/59	wind;10	**-0,09**	C15	sp3R-p/5	wind+ice	**865,90**	S26	sp3F-p/25	wind+ice	**115,16**
B225	sp3RF/65	wind+ice	**0,00**	C16	sp3R-p/55	wind+ice	**887,28**	S26	sp3R/24	wind+ice	**-119,86**
B226	sp3R/17	wind+ice	**0,00**	C16	sp3F/61	wind+ice	**-1185,13**	S27	sp3R-p/27	wind+ice	**98,77**
B226	1a/15	wind;10	**-0,09**	C17	sp3F-p/34	wind+ice	**769,91**	S27	sp3F/26	wind+ice	**-110,19**
B227	sp1aLF/191	wind;10	**0,00**	C17	sp3R/17	wind+ice	**-935,99**	S28	sp3F/26	wind+ice	**-128,02**
B227	sp3RF-p/187	wind+ice	**0,00**	C18	sp3R/45	wind+ice	**-921,15**	S28	sp3R-p/27	wind+ice	**117,51**
B228	sp3RR/192	wind+ice	**0,00**	C18	sp3F-p/60	wind+ice	**649,70**	S29	sp3R/24	wind+ice	**-102,66**
B228	sp3RF-p/187	wind+ice	**0,00**	C19	sp3R-p/5	wind+ice	**699,72**	S29	sp3F-p/25	wind+ice	**95,58**
B229	sp3RR/37	wind+ice	**0,00**	C19	sp3F/14	wind+ice	**-876,05**	S30	sp3LF-p/18	wind+ice	**-0,63**
B229	1a/71	wind;10	**-0,09**	C20	sp3R-p/55	wind+ice	**716,07**	S30	sp3LR/1	wind+ice	**2,00**
B230	1a/66	wind;10	**-0,09**	C20	sp3F/61	wind+ice	**-981,56**	S31	sp3R-p/27	wind+ice	**-69,41**
B230	sp3LR/76	wind+ice	**0,00**	C29	sp3R/17	wind+ice	**-1574,09**	S31	sp3F/26	wind+ice	**76,54**
B231	sp3LR-p/21	wind+ice	**201,78**	C29	sp3F-p/34	wind+ice	**1344,49**	S34	sp3R/28	wind+ice	**-66,54**
B231	sp3LF/12	wind+ice	**-199,00**	C30	sp3R/45	wind+ice	**-1544,62**	S34	sp3F-p/29	wind+ice	**67,76**
B232	sp3LF-p/33	wind+ice	**256,83**	C30	sp3F-p/60	wind+ice	**1141,59**	S35	3/30	wind+ice	**-23,73**
B232	sp3LR/32	wind+ice	**-267,30**	C31	sp3R-p/5	wind+ice	**1233,00**	S35	sp3LR-p/21	wind+ice	**-7,13**
B233	sp3LR/169	wind+ice	**0,00**	C31	sp3F/14	wind+ice	**-1454,24**	S36	sp3F-p/25	wind+ice	**-67,00**
B233	sp1aLR-p/193	wind;10	**0,00**	C32	sp3F/61	wind+ice	**-1657,72**	S36	sp3R/24	wind+ice	**70,91**
B234	sp3R/45	wind+ice	**0,00**	C32	sp3R-p/55	wind+ice	**1262,46**	S37	sp3LR/32	wind+ice	**271,23**
B234	1a/56	wind;10	**-0,12**	S2	sp3F-p/2	wind+ice	**19,63**	S37	sp3LF/31	wind+ice	**-283,32**
B235	sp3LR/169	wind+ice	**0,00**	S2	sp3LR/1	wind+ice	**-19,86**	S38	sp3F/14	wind+ice	**8,96**
B235	sp3R/24	wind+ice	**0,00**	S3	sp3LR/3	wind+ice	**12,08**	S38	sp3R-p/5	wind+ice	**-2,19**
B236	sp3R/39	wind+ice	**0,00**	S3	sp3F-p/2	wind+ice	**-12,35**	S40	sp3LF-p/33	wind+ice	**272,61**
B236	1a/56	wind;10	**-0,09**	S4	sp3R-p/5	wind+ice	**18,58**	S40	sp3LR/32	wind+ice	**-281,52**
B237	1a/19	wind;10	**-0,09**	S4	sp3F/4	wind+ice	**-20,30**	S41	sp3R/17	wind+ice	**8,93**
B237	sp3R/17	wind+ice	**0,00**	S5	sp3F/4	wind+ice	**12,57**	S41	sp3F-p/34	wind+ice	**-3,15**
B238	sp1aF/194	wind;10	**0,00**	S5	sp3R-p/6	wind+ice	**-11,68**	S42	sp3F-p/34	wind+ice	**4,49**
B238	sp3LF-p/11	wind+ice	**0,00**	S6	3/8	wind+ice	**1,72**	S42	sp3R/17	wind+ice	**-10,76**
B239	sp3LF/12	wind+ice	**0,00**	S6	sp3R-p/7	wind+ice	**-0,91**	S43	sp3RR-p/36	wind+ice	**0,61**
B239	1a/19	wind;10	**-0,09**	S7	sp3R-p/7	wind+ice	**9,16**	S43	sp3RF/35	wind+ice	**-0,57**
B240	sp3R/24	wind+ice	**0,00**	S7	sp3F/9	wind+ice	**-10,10**	S44	sp3RR/37	wind+ice	**-17,19**
B240	1a/56	wind;10	**-0,09**	S8	sp3F/9	wind+ice	**13,63**	S44	sp3RF-p/38	wind+ice	**11,61**
B241	sp3LR/196	wind+ice	**0,00**	S8	sp3R-p/7	wind+ice	**-12,70**	S47	sp3R/39	wind+ice	**-109,26**
B241	sp4LF/195	maintenance	**0,00**	S9	sp3LF-p/11	wind+ice	**9,12**	S47	sp3F-p/40	wind+ice	**74,64**
B242	sp3LF-p/11	wind+ice	**0,00**	S9	sp3LR/10	wind+ice	**-9,46**	S48	sp3R-p/42	wind+ice	**72,08**
B242	sp3LR/196	wind+ice	**0,00**	S10	sp3LR/10	wind+ice	**12,66**	S48	sp3F/41	wind+ice	**-114,55**
B243	1a/19	wind;10	**-0,09**	S10	sp3LF-p/11	wind+ice	**-12,59**	S49	sp3R-p/42	wind+ice	**62,53**
B243	sp3LR/1	wind+ice	**0,00**	S11	3-p/13	wind+ice	**0,92**	S49	sp3F/41	wind+ice	**-104,71**
B244	1a/66	wind;10	**-0,09**	S11	sp3LF/12	wind+ice	**-2,09**	S51	sp3R-p/5	wind+ice	**8,08**
B244	sp3R/17	wind+ice	**0,00**	S12	sp3F/14	wind+ice	**0,49**	S51	sp3F/14	wind+ice	**-10,80**
B245	sp3LF/12	wind+ice	**0,00**	S12	3-p/13	wind+ice	**-0,29**	S52	sp3F/14	wind+ice	**9,44**
B245	1a/19	wind;10	**-0,12**	S13	1a-p/16	wind;10	**0,16**	S52	sp3R-p/5	wind+ice	**-7,87**
B246	1a/19	wind;10	**-0,12**	S13	1a/15	wind;10	**-1,60**	S54	1a-p/44	wind;10	**5,08**
B246	sp3LF/12	wind+ice	**0,00**	S14	1a/15	wind;10	**0,66**	S54	1a/43	wind;10	**-4,41**
B247	sp3R/45	wind+ice	**0,00**	S14	1a-p/16	wind;10	**-0,15**	S55	sp3F-p/34	wind+ice	**10,53**

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 55
Omschrijving	- ontwerpberekening
Nationale norm	EC - EN
Auteur	- SMA

Staaf	BG	Geval beschrijving	N [kN]
S55	sp3R/17	wind+ice	-13,56
S56	sp3R/17	wind+ice	11,09
S56	sp3F-p/34	wind+ice	-9,79
S61	sp3R-p/42	wind+ice	63,91
S61	sp3F/41	wind+ice	-106,32
S65	sp3F-p/25	wind+ice	18,89
S65	sp3R/45	wind+ice	-19,75
S66	sp3R/24	wind+ice	12,06
S66	sp3F-p/25	wind+ice	-11,99
S67	sp3RR-p/47	wind+ice	18,77
S67	sp3RF/46	wind+ice	-20,99
S68	sp3RF/46	wind+ice	12,78
S68	sp3RR-p/48	wind+ice	-11,77
S69	sp3R/50	wind+ice	1,05
S69	3-p/49	wind+ice	-1,54
S70	sp3RF/51	wind+ice	-9,36
S70	sp3RR-p/52	wind+ice	9,11
S71	sp3RR-p/52	wind+ice	-12,63
S71	sp3RF/51	wind+ice	12,46
S72	sp3R/50	wind+ice	-9,53
S72	sp3F-p/53	wind+ice	9,83
S73	sp3F-p/53	wind+ice	-13,65
S73	sp3R/50	wind+ice	12,78
S74	3/54	wind+ice	-2,94
S74	sp3R-p/55	wind+ice	0,45
S75	3/54	wind+ice	0,74
S75	sp3R-p/55	wind+ice	-0,19
S76	1a/56	wind;10	-1,43
S76	1a-p/57	wind;10	0,18
S77	1a/59	wind;10	0,67
S77	1a-p/58	wind;10	-0,15
S78	1a/56	wind;10	-2,12
S78	1a-p/57	wind;10	0,37
S79	1a/56	wind;10	1,09
S79	1a-p/57	wind;10	-0,19
S80	sp3RR/37	wind+ice	-2,38
S80	sp3RF-p/38	wind+ice	0,38
S81	sp3F-p/60	wind+ice	-0,12
S81	3/54	wind+ice	0,57
S82	1a-p/58	wind;10	0,22
S82	1a/59	wind;10	-1,57
S83	1a-p/58	wind;10	-0,15
S83	1a/59	wind;10	0,66
S84	1a-p/58	wind;10	0,29
S84	1a/59	wind;10	-1,81
S85	1a/59	wind;10	1,14
S85	1a-p/58	wind;10	-0,19
S86	sp3R-p/55	wind+ice	9,13
S86	sp3F/61	wind+ice	-11,68
S87	sp3RF/51	wind+ice	9,51
S87	sp3RR-p/52	wind+ice	-9,27
S88	3/62	wind+ice	-14,00
S88	sp1aRF-p/63	wind;10	-4,99
S89	sp3F-p/2	wind+ice	118,97
S89	sp3R/64	wind+ice	-119,23
S90	sp3R-p/5	wind+ice	96,56
S90	sp3F/14	wind+ice	-97,97
S91	sp3R-p/6	wind+ice	115,25
S91	sp3F/4	wind+ice	-114,98
S92	sp3F-p/2	wind+ice	100,90
S92	sp3R/17	wind+ice	-102,30
S93	sp3RR-p/47	wind+ice	-0,48
S93	sp3RF/65	wind+ice	2,22
S94	1a/66	wind;10	-7,68
S94	1a-p/67	wind;10	7,03
S95	1a/66	wind;10	7,52
S95	1a/68	wind;10	-7,15
S96	1a/66	wind;10	-3,82
S96	1a-p/67	wind;10	3,40
S97	1a/68	wind;10	-3,63
S97	1a-p/69	wind;10	3,61
S98	1a-p/69	wind;10	4,17
S98	1a/66	wind;10	-4,70
S99	1a/68	wind;10	-2,29
S99	1a-p/69	wind;10	2,20
S100	sp3R/17	wind+ice	-62,04
S100	1a-p/44	wind;10	18,06
S101	1a-p/44	wind;10	-24,28
S101	sp3R/17	wind+ice	56,94
S102	1a/43	wind;10	-37,32
S102	1a-p/44	wind;10	50,97
S103	1a/68	wind;10	-2,48
S103	1a-p/69	wind;10	2,29
S104	1a/59	wind;10	3,04
S104	1a-p/58	wind;10	-0,31
S105	1a-p/67	wind;10	2,28
S105	1a/66	wind;10	-2,47
S107	1a-p/44	wind;10	13,01
S107	sp3R/17	wind+ice	-63,42
S108	1a-p/57	wind;10	-0,38
S108	1a/56	wind;10	3,25
S109	sp3R/17	wind+ice	60,01
S109	1a-p/44	wind;10	-19,55
S110	1a-p/44	wind;10	47,33
S110	1a/43	wind;10	-39,20
S111	3/54	wind+ice	-82,64
S111	1a-p/70	wind;10	2,23
S112	1a-p/70	wind;10	-7,46
S112	3/54	wind+ice	78,90
S113	1a/71	wind;10	-57,36
S113	1a-p/70	wind;10	31,03
S114	1a-p/69	wind;10	2,50
S114	1a/68	wind;10	-2,81
S115	sp3R/17	wind+ice	2,64
S115	1a-p/20	wind;10	-0,88
S116	1a-p/67	wind;10	2,62
S116	1a/66	wind;10	-2,68
S118	1a-p/70	wind;10	1,41
S118	3/54	wind+ice	-80,11
S119	1a/15	wind;10	2,81
S119	1a-p/16	wind;10	-1,06
S120	3/54	wind+ice	76,79
S120	1a-p/70	wind;10	-7,05
S121	sp1aR/72	wind;10	3,35
S121	1a-p/69	wind;10	-0,81
S122	1a-p/69	wind;10	3,07
S122	1a/68	wind;10	-3,15
S123	1a-p/67	wind;10	2,96
S123	1a/66	wind;10	-3,28
S125	1a/66	wind;10	3,53
S125	sp1aR-p/73	wind;10	-0,64
S126	1a-p/70	wind;10	32,54
S126	1a/71	wind;10	-54,18
S129	3/30	wind+ice	53,65
S129	1a-p/16	wind;10	25,31
S130	3/30	wind+ice	54,19
S130	sp3LF-p/18	wind+ice	27,01
S131	1a-p/70	wind;10	56,67
S131	1a/71	wind;10	-131,66
S132	1a-p/70	wind;10	60,48
S132	1a/71	wind;10	-123,36
S133	sp3LR-p/75	wind+ice	0,10
S133	sp3LF/74	wind+ice	-0,27
S134	sp3LF-p/77	wind+ice	0,09
S134	sp3LR/76	wind+ice	-0,17
S135	1a-p/44	wind;10	93,04
S135	1a/43	wind;10	-83,25
S136	sp3F/9	wind+ice	3,53
S136	sp3R-p/7	wind+ice	-2,22
S137	3/30	wind+ice	59,71
S137	1a-p/20	wind;10	28,19
S138	3/30	wind+ice	60,31
S138	sp3LR-p/21	wind+ice	30,15
S139	1a/71	wind;10	92,22
S139	1a-p/70	wind;10	-56,01
S140	1a-p/44	wind;10	91,10
S140	1a/43	wind;10	-83,70
S141	1a/71	wind;10	97,66
S141	1a-p/70	wind;10	-52,92
S142	3/54	wind+ice	55,15
S142	1a-p/58	wind;10	26,20
S143	sp3RF-p/38	wind+ice	27,56
S143	3/54	wind+ice	54,96
S144	1a-p/44	wind;10	99,80
S144	sp3R/17	wind+ice	-90,68
S145	1a-p/44	wind;10	92,02
S145	1a/43	wind;10	-91,06
S146	sp3RR-p/36	wind+ice	0,41
S146	sp3F/14	wind+ice	-0,84
S147	sp3RR/78	wind+ice	-0,25
S147	sp3RF-p/79	wind+ice	0,14
S148	1a-p/70	wind;10	56,01
S148	1a/71	wind;10	-119,40
S149	sp3R/50	wind+ice	3,55
S149	sp3F-p/53	wind+ice	-3,40
S150	sp3F/80	wind+ice	2,92
S150	sp3RR-p/52	wind+ice	-2,34
S151	3/54	wind+ice	60,86
S151	sp3RR-p/47	wind+ice	29,02
S152	3/54	wind+ice	61,01
S152	sp3RR-p/47	wind+ice	30,33
S153	1a/43	wind;10	68,10
S153	1a-p/44	wind;10	-78,99
S154	1a-p/70	wind;10	59,95
S154	1a/71	wind;10	-113,77
S155	1a/43	wind;10	63,60
S155	1a-p/44	wind;10	-86,31
S156	sp3F/4	wind+ice	67,78
S156	sp3R-p/6	wind+ice	-67,68
S159	3/22	wind+ice	152,44
S159	sp1aLF-p/81	wind;10	78,04
S160	3/62	wind+ice	153,53
S160	sp1aRF-p/82	wind;10	78,72
S162	1a-p/44	wind;10	208,69
S162	sp3RF/35	wind+ice	-194,65
S164	1a-p/70	wind;10	141,60
S164	1a/71	wind;10	-255,64
S166	3/84	wind+ice	111,91
S166	sp1aLR-p/83	wind;10	58,93
S167	sp3F-p/25	wind+ice	30,78
S167	sp3LR/76	wind+ice	-39,24
S168	sp3LR/76	wind+ice	18,41
S168	sp3LF-p/85	wind+ice	-14,26
S169	sp3R-p/27	wind+ice	31,47
S169	sp3F/26	wind+ice	-38,81
S170	sp3LF/86	wind+ice	18,18
S170	sp3R-p/27	wind+ice	-14,60
S171	sp3R-p/55	wind+ice	41,17
S171	sp3F/61	wind+ice	-120,79
S172	sp3F-p/60	wind+ice	36,49
S172	sp3R/45	wind+ice	-120,95

	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 55
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- SMA

Staaf	BG	Geval beschrijving	N [kN]
S175	3/30	wind+ice	**41,12**
S175	sp3LF-p/87	wind+ice	**-0,77**
S176	sp3R-p/5	wind+ice	**692,03**
S176	sp3F/14	wind+ice	**-830,29**
S177	sp3F-p/34	wind+ice	**762,49**
S177	sp3R/17	wind+ice	**-895,05**
S178	sp3RF-p/89	wind+ice	**8,86**
S178	sp3RR/88	wind+ice	**-6,70**
S179	sp3RR/91	wind+ice	**7,21**
S179	sp3LR-p/90	wind+ice	**-8,41**
S180	sp1aR/93	wind;10	**37,36**
S180	sp1aF-p/92	wind;10	**-36,95**
S181	sp3F/41	wind+ice	**38,86**
S181	sp1aR-p/94	wind;10	**-36,52**
S182	sp3R-p/27	wind+ice	**37,22**
S182	sp3F/26	wind+ice	**-40,40**
S183	sp3F/61	wind+ice	**39,75**
S183	sp3R-p/55	wind+ice	**-36,79**
S184	sp3F-p/40	wind+ice	**37,89**
S184	sp3R/39	wind+ice	**-38,05**
S185	sp3R/45	wind+ice	**37,06**
S185	sp3F-p/25	wind+ice	**-36,89**
S189	3-p/96	wind+ice	**71,28**
S189	sp3LF/95	wind+ice	**-3,06**
S190	sp3F-p/2	wind+ice	**32,97**
S190	sp3R/17	wind+ice	**-39,10**
S191	sp3R/17	wind+ice	**18,29**
S191	sp3RF-p/97	wind+ice	**-15,37**
S192	sp3RR-p/98	wind+ice	**31,29**
S192	sp3F/4	wind+ice	**-39,42**
S193	sp3RF/99	wind+ice	**18,40**
S193	sp3RR-p/98	wind+ice	**-14,57**
S194	sp3R-p/5	wind+ice	**40,84**
S194	sp3F/14	wind+ice	**-113,63**
S195	sp3F-p/34	wind+ice	**39,08**
S195	sp3R/17	wind+ice	**-121,81**
S198	sp3R/39	wind+ice	**36,15**
S198	sp3F-p/40	wind+ice	**-35,12**
S199	sp3F/41	wind+ice	**34,95**
S199	sp3R-p/6	wind+ice	**-35,19**
S200	sp3R-p/6	wind+ice	**37,46**
S200	sp3F/41	wind+ice	**-37,70**
S201	sp3R-p/5	wind+ice	**-36,80**
S201	sp3F/14	wind+ice	**36,80**
S202	sp3F-p/40	wind+ice	**37,49**
S202	sp3R/39	wind+ice	**-38,76**
S203	sp3R/64	wind+ice	**37,55**
S203	sp3F-p/2	wind+ice	**-36,22**
S206	sp3RF/100	wind+ice	**-9,06**
S206	sp1aLF-p/101	wind;10	**7,11**
S207	sp3LR-p/103	wind+ice	**8,75**
S207	sp1aRR/102	wind;10	**-7,48**
S209	3-p/13	wind+ice	**72,33**
S209	sp3LF/104	wind+ice	**-3,10**
S211	1a-p/44	wind;10	**-2,80**
S211	3/30	wind+ice	**11,86**
S212	3/54	wind+ice	**15,03**
S212	1a-p/70	wind;10	**-0,41**
S214	1a-p/69	wind;10	**3,02**
S214	1a/68	wind;10	**-2,82**
S215	1a/68	wind;10	**-2,26**
S215	1a-p/69	wind;10	**1,62**
S216	1a-p/69	wind;10	**0,33**
S216	1a/66	wind;10	**-1,89**
S217	1a/66	wind;10	**-1,69**
S217	1a-p/67	wind;10	**1,19**
S218	1a/66	wind;10	**1,48**

Staaf	BG	Geval beschrijving	N [kN]
S218	1a-p/67	wind;10	**-1,37**
S219	1a/66	wind;10	**-3,34**
S219	1a-p/67	wind;10	**2,50**
S220	1a-p/67	wind;10	**1,93**
S220	1a/66	wind;10	**-1,92**
S223	1a-p/69	wind;10	**0,36**
S223	1a/66	wind;10	**-1,86**
S224	sp3LR/1	wind+ice	**135,05**
S224	1a-p/44	wind;10	**-161,93**
S225	1a-p/44	wind;10	**153,18**
S225	sp3LR/1	wind+ice	**-137,51**
S226	1a/71	wind;10	**185,01**
S226	1a-p/70	wind;10	**-108,60**
S227	sp3LR-p/75	wind+ice	**101,51**
S227	1a/71	wind;10	**-187,24**
S228	3/105	wind+ice	**82,81**
S228	sp3F-p/25	wind+ice	**42,93**
S229	3/105	wind+ice	**-13,53**
S229	sp3F-p/25	wind+ice	**-7,19**
S230	sp3F-p/2	wind+ice	**44,26**
S230	3/84	wind+ice	**85,47**
S231	sp3F-p/2	wind+ice	**42,93**
S231	3/84	wind+ice	**82,87**
S232	sp1aRF-p/82	wind;10	**34,06**
S232	3/62	wind+ice	**65,85**
S233	sp3F-p/2	wind+ice	**-7,19**
S233	3/84	wind+ice	**-13,55**
S234	3/105	wind+ice	**85,65**
S234	sp3F-p/25	wind+ice	**44,39**
S235	3/62	wind+ice	**59,81**
S235	sp4R-p/106	maintenance	**31,82**
S236	3/84	wind+ice	**48,44**
S236	sp1aLR-p/83	wind;10	**25,85**
S237	sp4R-p/106	maintenance	**-5,52**
S237	3/62	wind+ice	**-10,05**
S238	3/22	wind+ice	**61,97**
S238	sp4R-p/107	maintenance	**33,01**
S239	1a/43	wind;10	**130,48**
S239	1a-p/44	wind;10	**-163,23**
S240	1a-p/44	wind;10	**152,88**
S240	sp3RR/78	wind+ice	**-134,11**
S241	1a/71	wind;10	**180,60**
S241	1a-p/70	wind;10	**-113,08**
S242	1a-p/70	wind;10	**104,27**
S242	1a/71	wind;10	**-182,12**
S243	sp3F-p/2	wind+ice	**-63,14**
S243	sp3R/17	wind+ice	**69,15**
S245	sp3F-p/109	wind+ice	**58,36**
S245	sp3R/108	wind+ice	**-64,91**
S247	sp3F/61	wind+ice	**10,06**
S247	sp3R-p/55	wind+ice	**-2,24**
S248	sp3R-p/55	wind+ice	**3,36**
S248	sp3F/61	wind+ice	**-12,17**
S249	sp3R-p/55	wind+ice	**9,59**
S249	sp3F/61	wind+ice	**-14,25**
S250	sp3F/61	wind+ice	**11,72**
S250	sp3R-p/55	wind+ice	**-8,95**
S252	sp3F-p/40	wind+ice	**237,52**
S252	sp3RR/88	wind+ice	**-254,59**
S253	3/22	wind+ice	**59,68**
S253	sp4R-p/110	maintenance	**31,81**
S254	3/105	wind+ice	**48,94**
S254	sp1aRR-p/111	wind;10	**25,87**
S255	sp3R-p/6	wind+ice	**-5,49**
S255	3/22	wind+ice	**-10,00**
S256	3/62	wind+ice	**61,73**
S256	sp4R-p/112	maintenance	**32,90**

Staaf	BG	Geval beschrijving	N [kN]
S257	sp1aRR-p/113	wind;10	**-7,43**
S257	3/54	wind+ice	**-24,72**
S258	3/105	wind+ice	**112,40**
S258	sp1aRR-p/111	wind;10	**58,62**
S260	sp3R/45	wind+ice	**8,82**
S260	sp3F-p/60	wind+ice	**-2,05**
S263	sp4LF-p/114	maintenance	**43,42**
S263	sp3LR/32	wind+ice	**-46,32**
S264	sp3LR/1	wind+ice	**45,68**
S264	sp4LF-p/115	maintenance	**-43,42**
S265	sp3LR/32	wind+ice	**-45,68**
S265	sp4LF-p/114	maintenance	**42,97**
S266	sp4LF/116	maintenance	**-47,70**
S266	sp4LR-p/117	maintenance	**41,60**
S267	sp4LR-p/118	maintenance	**-41,38**
S267	sp4LF/119	maintenance	**47,51**
S268	1a-p/69	wind;10	**1,75**
S268	1a-p/69	wind;10	**-1,80**
S273	sp3LF/31	wind+ice	**-43,99**
S273	sp4LR-p/120	maintenance	**37,22**
S274	sp3LF-p/33	wind+ice	**-16,99**
S274	sp3LR/32	wind+ice	**21,36**
S275	sp3LF/31	wind+ice	**-12,86**
S275	sp4LR-p/120	maintenance	**11,31**
S278	sp3LF-p/33	wind+ice	**35,02**
S278	sp3LR/121	wind+ice	**-45,09**
S279	sp4LR-p/120	maintenance	**-18,03**
S279	sp3LF/31	wind+ice	**20,82**
S280	sp3LR/32	wind+ice	**-13,19**
S280	sp3LF-p/33	wind+ice	**10,69**
S283	sp3LF-p/122	wind+ice	**6,49**
S283	3/54	wind+ice	**84,97**
S287	sp3F-p/60	wind+ice	**-0,31**
S287	sp3F/61	wind+ice	**0,72**
S288	sp3LF-p/85	wind+ice	**33,15**
S288	sp3LR/76	wind+ice	**-58,76**
S289	sp3LF-p/85	wind+ice	**82,94**
S289	sp3R/45	wind+ice	**-224,53**
S290	sp3RF-p/89	wind+ice	**22,29**
S290	sp3RR/88	wind+ice	**-28,89**
S291	sp4RR-p/124	maintenance	**24,63**
S291	sp3RF/123	wind+ice	**-26,72**
S292	sp3RF/99	wind+ice	**25,93**
S292	sp4RR-p/125	maintenance	**-24,75**
S295	sp3RF-p/97	wind+ice	**85,53**
S295	sp3RR/78	wind+ice	**-226,14**
S296	1a-p/67	wind;10	**1,16**
S296	1a/66	wind;10	**-1,72**
S297	1a/66	wind;10	**1,46**
S297	1a-p/67	wind;10	**-1,37**
S298	sp3RR/126	wind+ice	**135,92**
S298	sp3R-p/27	wind+ice	**-95,15**
S300	sp3R/64	wind+ice	**70,85**
S300	sp3F-p/2	wind+ice	**-70,81**
S301	sp3F-p/60	wind+ice	**3,25**
S301	sp3R/45	wind+ice	**-10,90**
S302	sp3RF-p/89	wind+ice	**36,70**
S302	sp3RR/127	wind+ice	**-44,95**
S303	sp3RF/123	wind+ice	**21,21**
S303	sp4RR-p/128	maintenance	**-17,91**
S304	sp3RF-p/89	wind+ice	**11,18**
S304	sp3RR/88	wind+ice	**-13,15**
S307	sp4RR-p/128	maintenance	**36,98**
S307	sp3RF/123	wind+ice	**-44,77**
S308	sp3RR/88	wind+ice	**21,29**
S308	sp3RF-p/89	wind+ice	**-17,78**
S309	sp4RR-p/128	maintenance	**11,24**

Staaf	BG	Geval beschrijving	N [kN]
S309	sp3RF/123	wind+ice	-13,11
S312	3/30	wind+ice	83,94
S312	sp3LF-p/87	wind+ice	6,66
S318	sp4RR-p/124	maintenance	24,79
S318	sp3RF/123	wind+ice	-26,77
S319	sp3RF-p/89	wind+ice	21,74
S319	sp4RR/129	maintenance	-29,26
S320	sp4RR/129	maintenance	29,10
S320	sp3RF-p/130	wind+ice	-21,42
S321	1a-p/58	wind;10	1,03
S321	1a/59	wind;10	-1,20
S324	3-p/131	wind+ice	71,44
S324	sp3R/64	wind+ice	-2,15
S328	sp3RF-p/79	wind+ice	212,07
S328	sp3RR/78	wind+ice	-207,82
S330	sp3RF-p/79	wind+ice	0,51
S330	sp3RR/78	wind+ice	-0,51
S331	sp3RR-p/47	wind+ice	13,37
S331	sp3RF/65	wind+ice	-17,49
S332	sp3RR/78	wind+ice	226,59
S332	sp3RF-p/79	wind+ice	-249,08
S333	sp3F-p/60	wind+ice	7,45
S333	sp3R/45	wind+ice	-11,30
S334	sp3R/45	wind+ice	9,91
S334	sp3F-p/60	wind+ice	-7,29
S336	sp3F-p/40	wind+ice	64,81
S336	sp3R/39	wind+ice	-99,93
S340	sp3R-p/5	wind+ice	68,93
S340	sp3F/4	wind+ice	-248,72
S341	sp3R-p/55	wind+ice	707,08
S341	sp3F/61	wind+ice	-939,90
S342	sp3F-p/60	wind+ice	636,57
S342	sp3R/45	wind+ice	-883,03
S343	3/54	wind+ice	41,86
S343	sp3LF-p/122	wind+ice	-0,77
S345	sp3LF/74	wind+ice	-322,86
S345	sp3LR-p/75	wind+ice	219,84
S347	sp3RF/35	wind+ice	-231,63
S347	sp3LF/132	wind+ice	301,42
S349	sp3RF-p/79	wind+ice	281,97
S349	sp3RR/78	wind+ice	-252,40
S351	sp3RR/78	wind+ice	232,17
S351	1a/71	wind;10	-288,14
S355	sp3F/14	wind+ice	-828,41
S355	sp3R-p/5	wind+ice	693,43
S356	sp3LF/86	wind+ice	-624,57
S356	sp3LR-p/157	wind+ice	338,51
S359	sp3LF/74	wind+ice	-244,67
S359	sp3R-p/55	wind+ice	167,14
S360	sp3R-p/55	wind+ice	169,45
S360	sp3LF/74	wind+ice	-246,26
S361	sp3R-p/5	wind+ice	80,49
S361	sp3F/14	wind+ice	-98,23
S365	sp3F-p/34	wind+ice	764,96
S365	sp3R/17	wind+ice	-894,18
S366	sp3LR/121	wind+ice	-584,16
S366	sp3LF-p/85	wind+ice	340,04
S367	sp3LF-p/85	wind+ice	349,23
S367	sp3LR/121	wind+ice	-592,64
S368	sp3F-p/2	wind+ice	297,67
S368	sp3R/64	wind+ice	-441,27
S369	sp3F-p/2	wind+ice	317,23
S369	sp3R/64	wind+ice	-413,66
S370	sp3LR/76	wind+ice	-240,21
S370	sp3LF-p/77	wind+ice	160,65
S371	sp3LF-p/77	wind+ice	162,53
S371	sp3LR/76	wind+ice	-241,32

Staaf	BG	Geval beschrijving	N [kN]
S372	sp3LF-p/18	wind+ice	76,82
S372	sp3LR/1	wind+ice	-106,52
S373	sp3F-p/34	wind+ice	77,71
S373	sp3LR/1	wind+ice	-104,88
S377	sp3LR/76	wind+ice	246,39
S377	sp3LF-p/77	wind+ice	-132,18
S379	sp3LF/74	wind+ice	284,93
S379	sp3LR-p/75	wind+ice	-146,72
S381	sp3RR/78	wind+ice	227,06
S381	sp3RF-p/79	wind+ice	-197,64
S383	sp3RF/35	wind+ice	217,42
S383	sp3RR-p/36	wind+ice	-177,19
S386	sp3F/61	wind+ice	-185,85
S386	sp3RR-p/36	wind+ice	136,48
S395	sp3LR-p/75	wind+ice	69,69
S395	sp3LF/86	wind+ice	-262,41
S397	sp3R-p/5	wind+ice	3,15
S397	sp3F/14	wind+ice	-11,39
S398	sp3LR-p/157	wind+ice	348,52
S398	sp3LF/86	wind+ice	-633,51
S400	sp3LR-p/142	wind+ice	41,46
S400	sp3LF/31	wind+ice	-46,74
S401	sp3R/24	wind+ice	69,02
S401	sp3F-p/25	wind+ice	-58,48
S402	sp3R-p/6	wind+ice	266,16
S402	sp3F/4	wind+ice	-432,88
S405	sp3RF-p/89	wind+ice	169,09
S405	sp3RR/88	wind+ice	-174,49
S408	sp3RR-p/36	wind+ice	372,26
S408	sp3RF/35	wind+ice	-579,31
S409	sp3R-p/55	wind+ice	268,64
S409	sp3F/26	wind+ice	-458,36
S411	sp3RR-p/36	wind+ice	175,31
S411	sp3RF/35	wind+ice	-224,26
S412	sp3RR-p/36	wind+ice	177,71
S412	sp3RF/35	wind+ice	-225,85
S413	sp3RR-p/47	wind+ice	80,86
S413	sp3RF/65	wind+ice	-116,94
S414	sp3RR-p/47	wind+ice	81,75
S414	sp3RF/65	wind+ice	-115,31
S418	sp3F-p/60	wind+ice	637,78
S418	sp3R/45	wind+ice	-881,31
S419	sp3RR/78	wind+ice	-571,42
S419	sp3RF-p/79	wind+ice	372,67
S420	sp3RR/78	wind+ice	-579,49
S420	sp3RF-p/79	wind+ice	385,56
S421	sp3F-p/60	wind+ice	254,14
S421	sp3R/45	wind+ice	-435,02
S422	sp3F-p/60	wind+ice	273,64
S422	sp3R/45	wind+ice	-407,15
S424	sp3RF-p/79	wind+ice	187,29
S424	sp3R/17	wind+ice	-233,97
S425	sp3F-p/60	wind+ice	77,33
S425	sp3R/45	wind+ice	-104,18
S426	sp3F-p/60	wind+ice	78,16
S426	sp3R/45	wind+ice	-102,75
S430	1a-p/70	wind;10	4,18
S430	1a/71	wind;10	-5,24
S431	sp3R-p/55	wind+ice	709,25
S431	sp3F/61	wind+ice	-939,35
S432	sp3RR-p/36	wind+ice	359,73
S432	sp3RF/35	wind+ice	-572,54
S433	1a-p/44	wind;10	-239,93
S433	sp3RF/35	wind+ice	207,26
S435	sp3F/41	wind+ice	-249,96
S435	sp3RR/88	wind+ice	242,75
S445	1a/71	wind;10	106,73

Staaf	BG	Geval beschrijving	N [kN]
S445	1a-p/70	wind;10	-50,48
S447	sp3LR-p/21	wind+ice	89,73
S447	sp3F/14	wind+ice	-113,19
S448	3/22	wind+ice	65,14
S448	sp1aLF-p/81	wind;10	33,72
S450	sp3LF-p/77	wind+ice	0,49
S450	sp3LR/76	wind+ice	-0,63
S451	1a/71	wind;10	267,11
S451	sp3LF-p/77	wind+ice	-166,09
S453	sp3LR-p/75	wind+ice	0,26
S453	sp3LF/74	wind+ice	-0,40
S454	sp3LF/74	wind+ice	292,59
S454	sp3LR-p/75	wind+ice	-188,76
S456	1a/71	wind;10	2,85
S456	sp3F-p/109	wind+ice	-1,86
S457	sp3LF/74	wind+ice	-269,47
S457	sp3LR-p/75	wind+ice	149,96
S458	sp3LR-p/21	wind+ice	15,54
S458	sp3LF/12	wind+ice	-13,75
S459	sp3LF-p/18	wind+ice	16,60
S459	sp3LR/1	wind+ice	-15,31
S460	sp3R/39	wind+ice	-102,28
S460	sp3F-p/40	wind+ice	66,20
S461	sp3RF/35	wind+ice	5,69
S461	sp3RR-p/36	wind+ice	-3,30
S462	sp3RR/78	wind+ice	6,14
S462	sp3RF-p/79	wind+ice	-4,38
S463	sp3LF/74	wind+ice	6,12
S463	sp3R-p/55	wind+ice	-2,59
S464	sp3LF-p/77	wind+ice	-2,42
S464	sp3LR/76	wind+ice	6,07
S465	sp3R-p/55	wind+ice	35,74
S465	sp3F/26	wind+ice	-56,45
S467	sp3F-p/60	wind+ice	241,61
S467	sp3R/45	wind+ice	-334,99
S468	sp3F-p/34	wind+ice	292,00
S468	sp3R/17	wind+ice	-339,06
S469	sp3R/17	wind+ice	29,44
S469	sp3F-p/2	wind+ice	-24,51
S470	sp3F/14	wind+ice	26,39
S470	sp1aR-p/164	wind;10	-21,82
S471	sp3R-p/5	wind+ice	264,46
S471	sp3F/14	wind+ice	-312,50
S472	sp3F/61	wind+ice	-356,69
S472	sp3R-p/55	wind+ice	269,94
S473	sp3F/61	wind+ice	31,52
S473	sp3R-p/55	wind+ice	-22,44
S474	sp3R/45	wind+ice	28,12
S474	sp1aF-p/165	wind;10	-19,40
S479	sp3RR/91	wind+ice	173,35
S479	sp3RF/123	wind+ice	-169,60
S480	sp3LR/140	wind+ice	194,45
S480	sp3LF/31	wind+ice	-195,42
S481	sp3LF-p/33	wind+ice	194,53
S481	sp3LR/32	wind+ice	-194,60
S482	3/54	wind+ice	59,45
S482	sp3LF-p/122	wind+ice	-17,23
S483	3/54	wind+ice	35,58
S483	3-p/96	wind+ice	-16,94
S484	sp3LR/1	wind+ice	31,25
S484	3-p/13	wind+ice	-42,19
S485	3/30	wind+ice	40,09
S485	3-p/13	wind+ice	-12,79
S486	sp3R-p/5	wind+ice	81,36
S486	sp3F/14	wind+ice	-96,74
S487	sp3R-p/6	wind+ice	291,00
S487	sp3F/4	wind+ice	-396,69

Staaf	BG	Geval beschrijving	N [kN]
S488	sp3LR/1	wind+ice	**297,25**
S488	1a-p/44	wind;10	**-198,65**
S491	sp3LF/12	wind+ice	**246,80**
S491	1a-p/44	wind;10	**-214,88**
S497	sp3F-p/34	wind+ice	**100,67**
S497	sp3R/17	wind+ice	**-137,02**
S501	1a-p/44	wind;10	**-102,18**
S501	1a/43	wind;10	**101,51**
S503	sp3R/17	wind+ice	**111,22**
S503	1a-p/44	wind;10	**-90,34**
S508	3/54	wind+ice	**76,93**
S508	sp3LF-p/122	wind+ice	**1,62**
S511	3/30	wind+ice	**76,24**
S511	sp3LF-p/87	wind+ice	**1,62**
S526	sp3LF-p/148	wind+ice	**17,59**
S526	sp3LR/140	wind+ice	**-17,72**
S527	sp3RR/166	wind+ice	**-18,02**
S527	sp3RF-p/167	wind+ice	**17,02**
S528	sp3LR/140	wind+ice	**-17,28**
S528	sp3RR-p/168	wind+ice	**17,77**
S529	sp3LR-p/103	wind+ice	**17,51**
S529	sp3LF/137	wind+ice	**-17,91**
S533	sp3LR/169	wind+ice	**-0,27**
S533	sp3RR-p/52	wind+ice	**-0,19**
S547	sp3RF-p/79	wind+ice	**153,82**
S547	sp3RR/78	wind+ice	**-172,62**
S548	3/30	wind+ice	**75,47**
S548	sp3LF-p/87	wind+ice	**1,89**
S551	3/54	wind+ice	**76,08**
S551	sp3LF-p/122	wind+ice	**1,89**
S588	sp3LR/76	wind+ice	**0,00**
S588	1a/68	wind;10	**0,00**
S589	1a/15	wind;10	**0,00**
S589	sp3RR/78	wind+ice	**0,00**
S590	sp3RF/46	wind+ice	**0,00**
S590	1a/43	wind;10	**0,00**
S591	1a/56	wind;10	**0,00**
S591	sp3RR-p/141	wind+ice	**0,00**
S592	sp3RF/35	wind+ice	**0,00**
S592	1a/66	wind;10	**0,00**
S593	1a/59	wind;10	**0,00**
S593	sp3LF/74	wind+ice	**0,00**
S594	sp3LR/3	wind+ice	**0,00**
S594	1a/71	wind;10	**0,00**
S595	1a/19	wind;10	**0,00**
S595	sp3LF/31	wind+ice	**0,00**
S596	sp3LF/74	wind+ice	**0,08**
S596	sp3LR-p/157	wind+ice	**0,05**
S597	sp3LF-p/197	wind+ice	**-0,07**
S597	sp3RF/158	wind+ice	**-0,11**
S598	sp3LF/134	wind+ice	**145,49**
S598	sp3LF-p/133	wind+ice	**-110,32**
S599	sp3LR/76	wind+ice	**-57,89**
S599	sp3LF-p/77	wind+ice	**32,53**
S600	sp3R-p/55	wind+ice	**36,16**
S600	sp3F/26	wind+ice	**-57,50**
S601	sp3RF-p/79	wind+ice	**-0,37**
S601	sp3RF/35	wind+ice	**0,67**
S602	sp3RF-p/97	wind+ice	**36,61**
S602	sp3R/17	wind+ice	**-58,42**
S603	sp3RR-p/36	wind+ice	**35,32**
S603	sp3RF/35	wind+ice	**-56,08**
S604	sp3F-p/34	wind+ice	**35,58**
S604	sp3R/17	wind+ice	**-58,09**
S605	sp3RR-p/36	wind+ice	**36,17**
S605	sp3RF/99	wind+ice	**-56,60**
S606	sp3F/61	wind+ice	**-422,37**

Staaf	BG	Geval beschrijving	N [kN]
S606	sp3R-p/55	wind+ice	**293,65**
S607	sp3R/17	wind+ice	**-232,06**
S607	sp3RF-p/79	wind+ice	**184,38**
S608	1a/71	wind;10	**102,04**
S608	sp3R-p/7	wind+ice	**-64,16**
S609	sp3F-p/60	wind+ice	**72,51**
S609	sp3R/45	wind+ice	**-132,81**
S610	sp3R-p/55	wind+ice	**93,34**
S610	sp3F/61	wind+ice	**-150,05**
S612	sp3F-p/34	wind+ice	**155,49**
S612	sp3R/17	wind+ice	**-247,23**
S615	sp3R/45	wind+ice	**-241,24**
S615	sp3F-p/60	wind+ice	**106,72**
S616	1a-p/69	wind;10	**2,54**
S616	1a/68	wind;10	**-2,71**
S617	sp4F-p/198	maintenance	**1,65**
S617	sp3R/24	wind+ice	**108,74**
S618	1a/71	wind;10	**346,36**
S618	1a-p/70	wind;10	**-117,59**
S619	sp3F/4	wind+ice	**91,32**
S619	sp4R-p/199	maintenance	**-9,66**
S620	sp3RF/65	wind+ice	**335,74**
S620	sp3RR-p/47	wind+ice	**-154,13**
S621	1a-p/67	wind;10	**1,68**
S621	1a/66	wind;10	**-2,04**
S624	sp3R-p/55	wind+ice	**129,92**
S624	sp3F/61	wind+ice	**-282,52**
S625	sp3R-p/5	wind+ice	**122,97**
S625	sp3F/14	wind+ice	**-245,71**
S626	1a/43	wind;10	**73,54**
S626	1a-p/44	wind;10	**-86,17**
S628	sp3R/39	wind+ice	**98,87**
S628	1a-p/70	wind;10	**-53,74**
S629	sp3R/39	wind+ice	**98,54**
S629	1a-p/44	wind;10	**-82,88**
S631	1a-p/69	wind;10	**1,39**
S631	1a/68	wind;10	**-1,65**
S632	sp3R-p/55	wind+ice	**15,00**
S632	1a/71	wind;10	**-69,48**
S633	1a-p/44	wind;10	**25,53**
S633	1a/43	wind;10	**-54,39**
S634	3/54	wind+ice	**143,90**
S634	1a-p/70	wind;10	**-55,20**
S635	1a-p/70	wind;10	**12,04**
S635	1a/71	wind;10	**-73,23**
S636	1a-p/44	wind;10	**27,95**
S636	sp3R/17	wind+ice	**-60,22**
S637	3/54	wind+ice	**152,02**
S637	1a-p/70	wind;10	**-55,21**
S638	1a-p/69	wind;10	**1,87**
S638	1a/66	wind;10	**-2,18**
S639	1a-p/67	wind;10	**1,59**
S639	1a/68	wind;10	**-1,86**
S640	1a/71	wind;10	**105,37**
S640	sp3R-p/55	wind+ice	**-64,65**
S641	sp3R/17	wind+ice	**86,58**
S641	1a-p/44	wind;10	**-87,37**
S642	sp3F/41	wind+ice	**100,02**
S642	1a-p/44	wind;10	**-85,01**
SB49	sp3F-p/2	wind+ice	**-14,61**
SB49	sp3R/64	wind+ice	**17,42**
SB50	sp3R/64	wind+ice	**-12,97**
SB50	sp3F-p/2	wind+ice	**9,78**
SB51	sp3R/24	wind+ice	**17,29**
SB51	sp3F-p/25	wind+ice	**-14,13**
SB52	sp3F-p/25	wind+ice	**9,37**
SB52	sp3R/24	wind+ice	**-12,91**

Staaf	BG	Geval beschrijving	N [kN]
SB53	1a/56	wind;10	**11,28**
SB53	sp3RF-p/38	wind+ice	**-5,59**
SB54	sp3RF-p/38	wind+ice	**3,52**
SB54	sp3RR/37	wind+ice	**-8,73**
SB55	sp3R-p/55	wind+ice	**-6,58**
SB55	sp3RF/65	wind+ice	**11,77**
SB56	sp3R-p/55	wind+ice	**4,26**
SB56	sp3RF/65	wind+ice	**-9,11**
SB57	sp3F/26	wind+ice	**17,90**
SB57	sp3R-p/27	wind+ice	**-14,42**
SB58	sp3R-p/27	wind+ice	**9,64**
SB58	sp3F/26	wind+ice	**-13,32**
SB59	sp3F/4	wind+ice	**16,99**
SB59	sp3R-p/6	wind+ice	**-14,28**
SB60	sp3R-p/6	wind+ice	**9,49**
SB60	sp3F/4	wind+ice	**-12,69**
SB61	sp3LF/12	wind+ice	**9,68**
SB61	1a-p/20	wind;10	**-8,02**
SB62	sp3LF/12	wind+ice	**-7,64**
SB62	1a-p/20	wind;10	**5,19**
SB63	sp3LR/1	wind+ice	**10,48**
SB63	sp3LF-p/18	wind+ice	**-8,86**
SB64	sp3LF-p/18	wind+ice	**5,78**
SB64	sp3LR/1	wind+ice	**-8,23**
SB65	sp3R/39	wind+ice	**28,43**
SB65	sp3F-p/40	wind+ice	**-24,72**
SB66	1a/71	wind;10	**17,01**
SB66	1a-p/70	wind;10	**-9,56**
SB67	1a/71	wind;10	**17,22**
SB67	1a-p/70	wind;10	**-9,30**
SB68	sp3F/41	wind+ice	**28,41**
SB68	sp3R-p/42	wind+ice	**-24,69**
SB69	sp3F/41	wind+ice	**28,81**
SB69	sp3R-p/42	wind+ice	**-24,71**
SB70	1a/43	wind;10	**13,27**
SB70	1a-p/44	wind;10	**-13,35**
SB71	1a/43	wind;10	**13,25**
SB71	1a-p/44	wind;10	**-13,20**
SB72	sp3R/39	wind+ice	**28,61**
SB72	sp3F-p/40	wind+ice	**-24,77**
SB73	sp3F-p/40	wind+ice	**17,59**
SB73	sp3R/39	wind+ice	**-18,89**
SB74	1a-p/70	wind;10	**7,18**
SB74	1a/71	wind;10	**-10,94**
SB75	1a-p/70	wind;10	**6,95**
SB75	1a/71	wind;10	**-11,11**
SB76	sp3R-p/42	wind+ice	**17,64**
SB76	sp3F/41	wind+ice	**-18,87**
SB77	sp3R-p/42	wind+ice	**17,60**
SB77	sp3F/41	wind+ice	**-19,15**
SB78	1a-p/44	wind;10	**9,78**
SB78	1a/43	wind;10	**-8,38**
SB79	1a-p/44	wind;10	**9,62**
SB79	1a/43	wind;10	**-8,40**
SB80	sp3F-p/40	wind+ice	**17,71**
SB80	sp3R/39	wind+ice	**-19,00**
SB81	sp3F-p/25	wind+ice	**6,72**
SB81	sp3R/24	wind+ice	**-9,13**
SB82	sp3R/24	wind+ice	**11,60**
SB82	sp3F-p/25	wind+ice	**-10,05**
SB83	sp3RF-p/38	wind+ice	**3,94**
SB83	sp3RR/37	wind+ice	**-7,00**
SB84	sp3RR/37	wind+ice	**8,56**
SB84	sp3RF-p/38	wind+ice	**-6,04**
SB85	sp3RR-p/47	wind+ice	**4,27**
SB85	sp3RF/65	wind+ice	**-7,21**
SB86	sp3RF/65	wind+ice	**8,82**

	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 55
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- SMA

Staaf	BG	Geval beschrijving	N [kN]
SB86	sp3RR-p/47	wind+ice	-6,54
SB87	sp3R-p/27	wind+ice	7,13
SB87	sp3F/26	wind+ice	-9,58
SB88	sp3F/26	wind+ice	12,22
SB88	sp3R-p/27	wind+ice	-10,55
SB89	sp3R-p/6	wind+ice	6,91
SB89	sp3F/4	wind+ice	-8,79
SB90	sp3F/4	wind+ice	11,13
SB90	sp3R-p/6	wind+ice	-10,29
SB91	sp3LR-p/21	wind+ice	5,10
SB91	sp3LF/12	wind+ice	-6,46
SB92	sp3LF/12	wind+ice	7,79
SB92	sp3LR-p/21	wind+ice	-7,62
SB93	sp3LF-p/18	wind+ice	5,45
SB93	sp3LR/1	wind+ice	-6,81
SB94	sp3LR/1	wind+ice	8,25
SB94	sp3LF-p/18	wind+ice	-8,16
SB95	sp3F-p/2	wind+ice	7,30
SB95	sp3R/64	wind+ice	-9,18
SB96	sp3R/64	wind+ice	11,69
SB96	sp3F-p/2	wind+ice	-10,77
SB97	sp3RR/88	wind+ice	8,75
SB97	sp3RF-p/89	wind+ice	-7,59
SB98	sp3LR/76	wind+ice	4,46
SB98	sp3LF-p/77	wind+ice	-3,24
SB99	sp3LF/74	wind+ice	6,63
SB99	sp3LR-p/75	wind+ice	-4,22
SB100	sp3RF/123	wind+ice	6,11
SB100	sp3RR-p/141	wind+ice	-5,52
SB101	sp3LF/31	wind+ice	9,42
SB101	sp3LR-p/142	wind+ice	-8,36
SB102	sp3RF/35	wind+ice	3,95
SB102	sp3RR-p/36	wind+ice	-3,76
SB103	sp3RR/78	wind+ice	5,52
SB103	sp3RF-p/79	wind+ice	-5,15
SB104	sp3LR/32	wind+ice	6,52
SB104	sp3LF-p/33	wind+ice	-6,04
SB105	sp3RF/138	wind+ice	6,47
SB105	sp3RR-p/136	wind+ice	-6,33
SB106	sp3LF/144	wind+ice	3,36
SB106	sp3LR-p/143	wind+ice	-3,26
SB107	sp3LR/146	wind+ice	3,99
SB107	sp3LF-p/145	wind+ice	-4,77
SB108	sp3RR/91	wind+ice	5,28
SB108	sp3RF-p/147	wind+ice	-4,60
SB109	sp3LR/140	wind+ice	7,11
SB109	sp3LF-p/148	wind+ice	-6,77
SB110	sp3RR/150	wind+ice	3,85
SB110	sp3RF-p/149	wind+ice	-2,75
SB111	sp3RF/152	wind+ice	4,71
SB111	sp3RR-p/151	wind+ice	-3,86
SB112	sp3LF/153	wind+ice	5,77
SB112	sp3LR-p/103	wind+ice	-4,91
SB113	sp3F-p/25	wind+ice	10,47
SB113	sp3R/24	wind+ice	-14,21
SB114	sp3R/24	wind+ice	18,91
SB114	sp3F-p/25	wind+ice	-15,39
SB115	sp3RR/37	wind+ice	-9,01
SB115	sp3RF-p/38	wind+ice	3,50
SB116	1a-p/70	wind;10	-4,73
SB116	1a/71	wind;10	11,24
SB117	sp3R-p/55	wind+ice	5,00
SB117	sp3F/61	wind+ice	-10,04
SB118	sp3F/61	wind+ice	12,26
SB118	sp3R-p/55	wind+ice	-6,71
SB119	sp3F/26	wind+ice	-13,96
SB119	sp3R-p/27	wind+ice	10,19

Staaf	BG	Geval beschrijving	N [kN]
SB120	sp3F/26	wind+ice	17,70
SB120	sp3R-p/27	wind+ice	-14,05
SB121	sp3R-p/6	wind+ice	10,66
SB121	sp3F/4	wind+ice	-14,06
SB122	sp3R-p/6	wind+ice	-15,57
SB122	sp3F/4	wind+ice	18,81
SB123	sp3LR-p/21	wind+ice	5,24
SB123	sp3LF/12	wind+ice	-7,75
SB124	sp3LF/12	wind+ice	9,05
SB124	1a-p/44	wind;10	-7,51
SB125	sp3LF-p/18	wind+ice	6,22
SB125	sp3R/17	wind+ice	-9,10
SB126	sp3R/17	wind+ice	10,91
SB126	sp3LF-p/18	wind+ice	-8,57
SB127	sp3F-p/2	wind+ice	10,48
SB127	sp3R/64	wind+ice	-13,57
SB128	sp3F-p/2	wind+ice	-14,39
SB128	sp3R/64	wind+ice	17,24
SB129	sp3LF-p/33	wind+ice	-16,45
SB129	sp3LR/32	wind+ice	19,45
SB130	sp3LF-p/33	wind+ice	14,40
SB130	sp3LR/32	wind+ice	-15,81
SB131	sp3RR/88	wind+ice	16,66
SB131	sp3RF-p/89	wind+ice	-13,71
SB132	sp3RF-p/89	wind+ice	12,06
SB132	sp3RR/88	wind+ice	-13,58
SB133	sp3RF/65	wind+ice	11,43
SB133	sp3RR-p/47	wind+ice	-6,10
SB134	sp3RR-p/47	wind+ice	5,48
SB134	sp3RF/65	wind+ice	-8,81
SB135	sp3RR/37	wind+ice	10,18
SB135	sp1aRF-p/156	wind;10	-5,08
SB136	sp1aRF-p/156	wind;10	4,62
SB136	sp3RR/37	wind+ice	-7,83
SB137	sp3F/41	wind+ice	18,40
SB137	sp3R-p/42	wind+ice	-15,25
SB138	sp3R-p/42	wind+ice	13,30
SB138	sp3F/41	wind+ice	-14,87
SB139	sp3LF/31	wind+ice	18,27
SB139	sp3LR-p/142	wind+ice	-14,86
SB140	sp3LR-p/142	wind+ice	13,06
SB140	sp3LF/31	wind+ice	-14,90
SB141	sp3LR/1	wind+ice	9,89
SB141	sp3LF-p/18	wind+ice	-8,40
SB142	sp3LF-p/18	wind+ice	7,38
SB142	sp3LR/1	wind+ice	-7,53
SB143	sp3LF/12	wind+ice	8,60
SB143	sp3LR-p/21	wind+ice	-7,05
SB144	sp3LR-p/21	wind+ice	6,23
SB144	sp3LF/12	wind+ice	-6,51
SB241	sp3LR/1	wind+ice	0,00
SB241	sp3R-p/170	wind+ice	0,00
SB249	sp3F/171	wind+ice	0,00
SB249	sp3RR/88	wind+ice	0,00
SB250	sp3F/171	wind+ice	0,00
SB250	sp3RR/88	wind+ice	0,00
SB252	sp3LR/1	wind+ice	0,00
SB252	sp3R-p/170	wind+ice	0,00
SB259	sp3RR/127	wind+ice	0,00
SB259	1a/15	wind;10	-0,13
SB260	1a/15	wind;10	-0,17
SB260	sp3RR/91	wind+ice	0,00
SB261	sp3LR/1	wind+ice	0,00
SB261	1a/15	wind;10	-0,17
SB272	sp3LR/1	wind+ice	0,00
SB272	1a/15	wind;10	-0,13
SB273	sp3F/171	wind+ice	0,00

Staaf	BG	Geval beschrijving	N [kN]
SB273	sp3RR/88	wind+ice	0,00
SB274	sp3LR/1	wind+ice	0,00
SB274	sp3R-p/170	wind+ice	0,00
SB275	1a/15	wind;10	-0,13
SB275	sp3LR/1	wind+ice	0,00
SB276	sp3RR/78	wind+ice	0,00
SB276	1a/15	wind;10	-0,13
SB277	sp3F/9	wind+ice	0,00
SB277	sp3RR/88	wind+ice	0,00
SB278	sp3LR/1	wind+ice	0,00
SB278	sp3R-p/7	wind+ice	0,00
SB279	sp3LR/1	wind+ice	0,00
SB279	1a/15	wind;10	-0,13
SB280	sp3RR/91	wind+ice	0,00
SB280	1a/15	wind;10	-0,13
SB281	sp3RR/88	wind+ice	0,00
SB281	sp3F/9	wind+ice	0,00
SB282	sp3LF-p/145	wind+ice	0,00
SB282	sp3LR/146	wind+ice	0,00
SB283	1a/15	wind;10	-0,17
SB283	sp3LR/1	wind+ice	0,00
SB284	sp3RR/91	wind+ice	0,00
SB284	1a/15	wind;10	-0,17
SB285	sp3F/177	wind+ice	0,00
SB285	sp3LR/32	wind+ice	0,00
SB286	sp3F/177	wind+ice	0,00
SB286	sp3LR-p/155	wind+ice	0,00
SB287	sp3LR-p/155	wind+ice	0,00
SB287	sp3LF/132	wind+ice	0,00
SB288	1a/56	wind;10	-0,17
SB288	sp3RR/37	wind+ice	0,00
SB289	sp3F/177	wind+ice	0,00
SB289	sp3LR/32	wind+ice	0,00
SB290	sp3LF/132	wind+ice	0,00
SB290	sp3LR-p/155	wind+ice	0,00
SB291	sp3LR/32	wind+ice	0,00
SB291	1a/56	wind;10	-0,13
SB292	sp3RR/37	wind+ice	0,00
SB292	1a/56	wind;10	-0,17
SB293	1a/56	wind;10	-0,13
SB293	sp3RR/37	wind+ice	0,00
SB294	sp3LR/32	wind+ice	0,00
SB294	sp1aF/181	wind;10	0,00
SB295	sp3R-p/182	wind+ice	0,00
SB295	sp3LF/132	wind+ice	0,00
SB296	1a/56	wind;10	-0,13
SB296	sp3RR/37	wind+ice	0,00
SB297	1a/56	wind;10	-0,13
SB297	sp3LR/140	wind+ice	0,00
SB298	sp3F/177	wind+ice	0,00
SB298	sp3LR-p/155	wind+ice	0,00
SB299	sp3LR/32	wind+ice	0,00
SB299	sp3F/177	wind+ice	0,00
SB300	sp3RR/37	wind+ice	0,00
SB300	1a/56	wind;10	-0,13
SB301	1a/56	wind;10	-0,13
SB301	sp3LR/121	wind+ice	0,00
SB302	sp3LR/32	wind+ice	0,00
SB302	sp3F/80	wind+ice	0,00
SB303	1a/56	wind;10	-0,17
SB303	sp3LR/140	wind+ice	0,00
SB304	sp3LR/140	wind+ice	0,00
SB304	1a/56	wind;10	-0,17
SB305	sp3RF/123	wind+ice	0,00
SB305	sp3R/108	wind+ice	0,00
SB306	sp3F-p/185	wind+ice	0,00
SB306	sp3RR/186	wind+ice	0,00

	Project	- 150 kV lijn Leiden - Zoetermeer
D&C ENGINEERING	Onderdeel	- berekening Mast 55
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- SMA

Staaf	BG	Geval beschrijving	N [kN]
SB307	sp3RF-p/187	wind+ice	**0,00**
SB307	sp3RR/186	wind+ice	**0,00**
SB308	1a/19	wind;10	**-0,17**
SB308	sp3LF/12	wind+ice	**0,00**
SB309	sp3RF/123	wind+ice	**0,00**
SB309	sp3R/108	wind+ice	**0,00**
SB310	sp3RR/186	wind+ice	**0,00**
SB310	sp3F-p/185	wind+ice	**0,00**
SB311	1a/19	wind;10	**-0,13**
SB311	sp3RF/99	wind+ice	**0,00**
SB312	1a/19	wind;10	**-0,17**
SB312	sp3LF/12	wind+ice	**0,00**
SB313	1a/19	wind;10	**-0,13**
SB313	sp3LF/12	wind+ice	**0,00**
SB314	sp3RF/123	wind+ice	**0,00**
SB314	sp1aR/189	wind;10	**0,00**
SB315	sp3F-p/109	wind+ice	**0,00**
SB315	sp3RR/186	wind+ice	**0,00**
SB316	sp3LF/12	wind+ice	**0,00**
SB316	1a/19	wind;10	**-0,13**
SB317	sp3RF/123	wind+ice	**0,00**
SB317	1a/19	wind;10	**-0,13**
SB318	sp3RR/186	wind+ice	**0,00**
SB318	sp3F-p/185	wind+ice	**0,00**
SB319	sp3R/108	wind+ice	**0,00**
SB319	sp3RF/123	wind+ice	**0,00**
SB320	sp3LF/12	wind+ice	**0,00**

Staaf	BG	Geval beschrijving	N [kN]
SB320	1a/19	wind;10	**-0,13**
SB321	sp3RF/35	wind+ice	**0,00**
SB321	1a/19	wind;10	**-0,13**
SB322	sp3R/108	wind+ice	**0,00**
SB322	sp3RF/123	wind+ice	**0,00**
SB323	sp3RF/123	wind+ice	**0,00**
SB323	1a/19	wind;10	**-0,17**
SB324	sp3RF/123	wind+ice	**0,00**
SB324	1a/19	wind;10	**-0,17**
SB325	sp3R/50	wind+ice	**0,00**
SB325	sp3LF/31	wind+ice	**0,00**
SB326	sp3RF/65	wind+ice	**0,00**
SB326	sp3F-p/29	wind+ice	**0,00**
SB327	sp3RF/65	wind+ice	**0,00**
SB327	sp3F-p/29	wind+ice	**0,00**
SB328	sp3R/50	wind+ice	**0,00**
SB328	sp3LF/31	wind+ice	**0,00**
SB329	sp3RF/65	wind+ice	**0,00**
SB329	sp3F-p/29	wind+ice	**0,00**
SB330	sp3LF/86	wind+ice	**0,00**
SB330	1a/59	wind;10	**-0,13**
SB331	sp3RF/65	wind+ice	**0,00**
SB331	1a/59	wind;10	**-0,17**
SB332	sp3RF/65	wind+ice	**0,00**
SB332	1a/59	wind;10	**-0,13**
SB333	sp3R/50	wind+ice	**0,00**
SB333	sp3LF/31	wind+ice	**0,00**

Staaf	BG	Geval beschrijving	N [kN]
SB334	sp3RF/65	wind+ice	**0,00**
SB334	sp3F-p/53	wind+ice	**0,00**
SB335	sp3RF/65	wind+ice	**0,00**
SB335	1a/59	wind;10	**-0,13**
SB336	sp3LF/31	wind+ice	**0,00**
SB336	1a/59	wind;10	**-0,13**
SB337	sp3RF/65	wind+ice	**0,00**
SB337	sp3F-p/29	wind+ice	**0,00**
SB338	sp3R/50	wind+ice	**0,00**
SB338	sp3LF/31	wind+ice	**0,00**
SB339	sp3RF/65	wind+ice	**0,00**
SB339	1a/59	wind;10	**-0,13**
SB340	sp3LF/86	wind+ice	**0,00**
SB340	1a/59	wind;10	**-0,13**
SB341	sp3R/50	wind+ice	**0,00**
SB341	sp3LF/31	wind+ice	**0,00**
SB342	sp3LF/31	wind+ice	**0,00**
SB342	1a/59	wind;10	**-0,17**
SB343	sp3RF/65	wind+ice	**0,00**
SB343	1a/59	wind;10	**-0,17**
SB344	sp3LF/31	wind+ice	**0,00**
SB344	1a/59	wind;10	**-0,17**

11.2. Reacties

Lineaire berekening, Extreem : Globaal
Selectie : Alle
Klasse : All UGT

Steunpunt	BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Sn3/N306	sp3F/26	**-302,70**	-235,69	**1430,16**	0,00	0,00	0,00
Sn1/N248	sp3R/64	**290,70**	222,11	1357,34	0,00	0,00	0,00
Sn3/N306	sp1aF/180	-298,87	**-240,62**	1406,93	0,00	0,00	0,00
Sn1/N248	sp1aR/200	289,03	**230,80**	1352,01	0,00	0,00	0,00
Sn1/N248	sp3F-p/2	-226,89	-166,25	**-1083,93**	0,00	0,00	0,00
Sn1/N248	1a/201	34,57	24,49	131,50	**0,00**	**0,00**	**0,00**

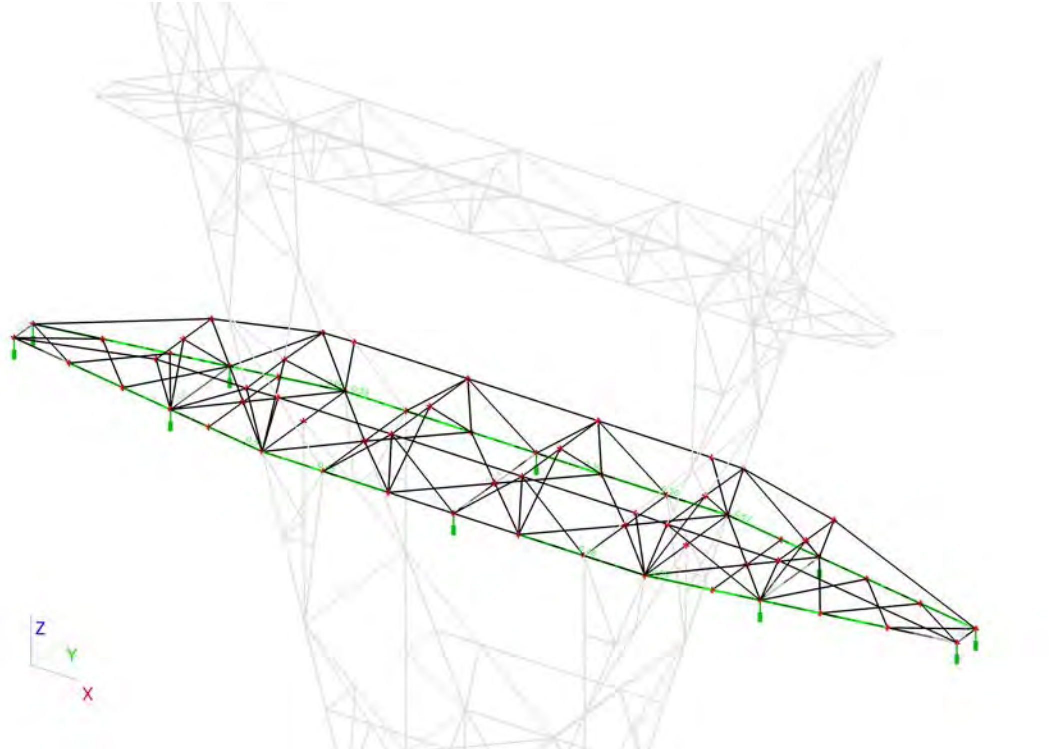
11.3. Resultante op Fundering

Lineaire berekening, Extreem : Globaal
Selectie : Alle
Klasse : All UGT

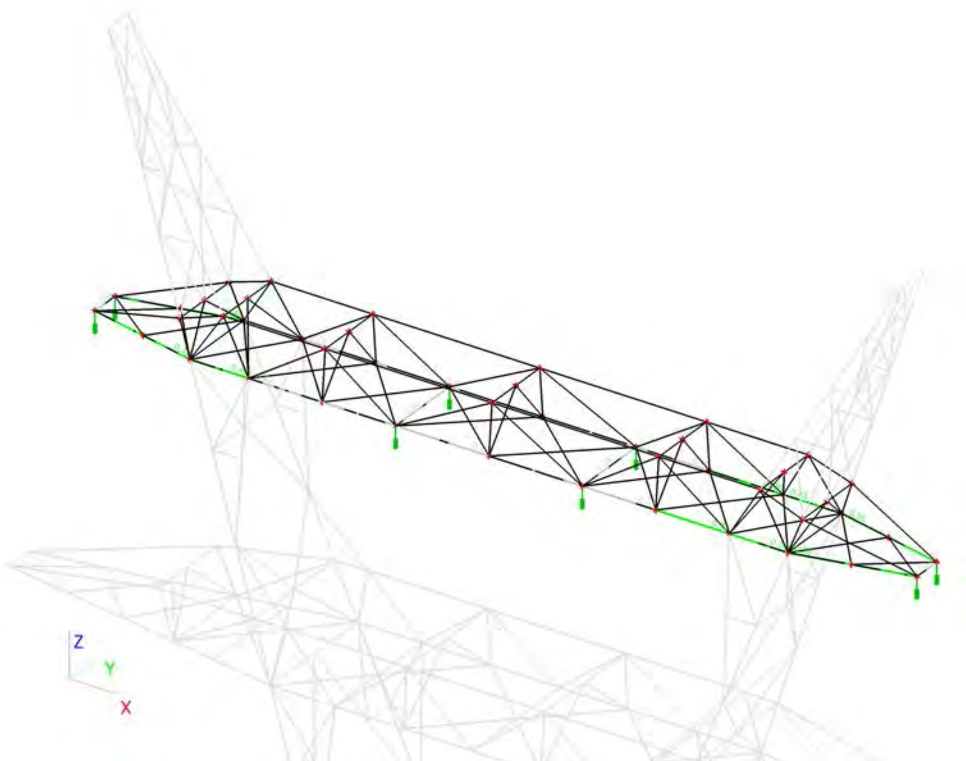
BG	Steunpunt	Extreem	horiz. component [kN]	resultante [kN]	Hoek [deg]	helling(afschot) [-]	Rx [kN]	Ry [kN]	Rz [kN]
sp3F/206	Sn3/N306	Rz	**10,54**	1430,20	30,15	135,64	2,70	10,19	1430,16
sp3F/26	Sn3/N306	Rx	**384,41**	386,53	173,05	-0,11	-302,70	-236,95	-40,45
sp1aF/203	Sn2/N298	Ry	214,95	**283,06**	125,93	-0,86	-33,87	-212,27	-184,17
sp3F/206	Sn3/N306	Rz	10,54	**1430,20**	30,15	135,64	2,70	10,19	1430,16
sp1aR-p/205	Sn3/N306	Rz	148,16	1036,96	**-179,63**	-6,93	-104,09	-105,43	-1026,33
sp1aF/180	Sn3/N306	Ry	383,69	425,81	**173,84**	-0,48	-298,87	-240,62	-184,65
sp1aR-p/205	Sn3/N306	Rz	148,16	1036,96	-179,63	**-6,93**	-104,09	-105,43	-1026,33
sp3F/206	Sn3/N306	Rz	10,54	1430,20	30,15	**135,64**	2,70	10,19	1430,16
sp3F/26	Sn3/N306	Rx	384,41	386,53	173,05	-0,11	**-302,70**	-236,95	-40,45
sp3R/64	Sn1/N248	Rx	366,69	1409,20	172,55	3,71	**290,70**	223,50	1360,66
sp1aF/180	Sn3/N306	Ry	383,69	425,81	173,84	-0,48	-298,87	**-240,62**	-184,65
sp1aR/200	Sn1/N248	Ry	369,88	1401,69	173,61	3,66	289,03	**230,80**	1352,01
sp3F-p/2	Sn1/N248	Rx	281,65	1119,92	-8,67	-3,85	-226,89	-166,87	**-1083,93**
sp3F/206	Sn3/N306	Rz	10,54	1430,20	30,15	135,64	2,70	10,19	**1430,16**

11.4. Controle UNP en HEB profilen

11.4.1. Staalcontrole; Algehele toetsing Vak 9+13+14+ CrossArm1+2



11.4.2. Staalcontrole; Algehele toetsing Vak 15 t/m 21 + CrossArm3+4



Bijlage C Controle staven mastlichaam

Check section: *Vak 1 Randen L200x200x26* *M01*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1657,72*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*1344,49*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/26* (*1)

h	=	*200*	mm	I_y	=	*35603980*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f	=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s	=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}	=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1825*	mm	No. bolts / end / flange	=	*5*	(Per flange !)
$L_{v;cr}$	=	*1825*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*16*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,64**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**47**	**< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,82**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,77**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,53**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **$U.C_{max}$ = 0,82 = 82%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 Diagonalen L130x13x12* *M02*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-271,75*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*256,83*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* [*1]

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2048*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2048*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,58** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **81** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,56** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,00** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,48** **< 1**

Remarks:

The maximum increase of stress or totalstress is [*2] : **$U.C_{max}$ = 1,00 = 100%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 Horizontale En verticale Knikverkorters L50x50x5* *M03*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	*-2,13*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*2,13*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* [(*1)]

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2409*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2409*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*1791*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,05** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,94** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **251** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,15** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,19** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,07** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,08** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,94 = 94%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[(*2)] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 Horizontale en Verticale Knikverkorters L60x60x6* *M04*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-13,95*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*13,95*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* (*1)

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2533*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2533*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*2533*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,25** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,76** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **219** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,54** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,69** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,46** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,41** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,76 = 76%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	Dossier :	13.039 Berekening :
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 Horizontale en Verticale Knikverkorters L55x55x6* *M05*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-3,02*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*3,02*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :			*H55/55/6*	(*1)				
h		=	*55*	mm	I_y	=	*172872*	mm^4
b		=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s		=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}		=	*631*	mm^2	i_v	=	*10,5*	mm
Material :								
Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:								
$L_{y;cr}$		=	*4478*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$		=	*4478*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)		=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)		=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular force}$		=	*2240*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?		=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate		=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,05** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,81** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **425** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,45** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,49** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,10** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,09** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,81 = 81%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 Horizontale en Verticale Knikverkorters L65x65x7* *M06*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-23,73*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*23,73*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H65/65/7* [(*1)]

h	=	*65*	mm	I_y	=	*334319*	mm^4
b	=	*65*	mm	$W_{y;el;eff.1}$	=	*7185*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*18103*	mm^3
y_s	=	*18,5*	mm	i_y	=	*19,6*	mm
A_{bruto}	=	*870*	mm^2	i_v	=	*12,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3322*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3322*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*3322*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,28** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,74** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **266** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,05** **> 1 !!**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,24** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,79** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,53** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] **:** **$U.C_{max}$ = 1,24 = 124%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[(*2)] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	Dossier : 13.039	Berekening :
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 Randen L200x200x26* *M07*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1568,46*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*1291,38*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/26* (*1)

h	=	*200*	mm	I_y	=	*35603980*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f	=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s	=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}	=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1690*	mm	No. bolts / end / flange	=	*5*	(Per flange !)
$L_{v;cr}$	=	*1690*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,62** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **44** < 120

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,76** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,73** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,54** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,76 = 76%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 Horizontale Knikverkorters L55x55x6* *M08*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-20,89	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	20,89	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H55/55/6 (*1)

h	=	55	mm	I_y	=	172872	mm^4
b	=	55	mm	$W_{y;el;eff.1}$	=	4391	mm^3
t_f	=	6	mm	$W_{y;el;eff.2}$	=	11060	mm^3
y_s	=	15,6	mm	i_y	=	16,6	mm
A_{bruto}	=	631	mm^2	i_v	=	10,5	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1900 mm	No. bolts / end / flange		=	1
$L_{v;cr}$	=	1900 mm	Type of bolts	M / "	=	16
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt	e1	=	30 mm
a^*L_{tot} (with comb. buckling)	=	0 mm	Centre-centre spacing bolt	s1	=	50 mm
$L_{perpendicular\ force}$	=	1900 mm	Edge distance bolt	e2	=	25 mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	4,6
Column profile?	=	1 no=1, yes=2	Rolled screw threads		=	1
Thickness tie plate	=	6 mm	Dubble strap joint no=1, yes=2		=	1

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = 0,38 < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = 0,69 < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = 180 < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = n.v.t. < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = 0,63 < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = 0,85 < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = n.v.t. < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = n.v.t. < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = 0,69 < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = 0,62 < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 Schuine Knikverkorters L55x55x6* *M09*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-28,83*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*28,83*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H55/55/6* [(*1)]

h	=	*55*	mm	I_y	=	*172872*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s	=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}	=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2620*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2620*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,52**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**249**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,55**	**> 1 !!**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**1,82**	**> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,96**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,86**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 1,82 = 182%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[(*2)] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 Verticale verbanden L150x100x10* *M10*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-167,32*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*150,52*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/10* (*1)

h	=	*150*	mm	I_y	=	*5516683*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*43563*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*236120*	mm^3
y_s	=	*23,4*	mm	i_y	=	*47,8*	mm
A_{bruto}	=	*2418*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4916*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2458*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,42** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **114** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,62** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,82** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,45** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,82 = 82%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3 Randen L200x200x26* *M11*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1473,98*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*1210,73*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :			*H200/200/26*	(*1)				
h		=	*200*	mm	I_y	=	*35603980*	mm^4
b		=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f		=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s		=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}		=	*9759*	mm^2	i_v	=	*38,8*	mm
Material :								
Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:								
$L_{y;cr}$		=	*1786*	mm	No. bolts / end / flange	=	*5*	(Per flange !)
$L_{v;cr}$		=	*1786*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)		=	*0*	mm	End distance bolt e1	=	*60*	mm
$a*L_{tot}$ (with comb. buckling)		=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$		=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force		=	*1*	(⅂=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?		=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate		=	*12*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,58** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **46** **< 120**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,72** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,68** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,51** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,72 = 72%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5
(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3 Horizontale Knikverkorters L55x55x6* *M12*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-8,74	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	8,74	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H55/55/6 (*1)

h	=	55	mm	I_y	=	172872	mm^4
b	=	55	mm	$W_{y;el;eff.1}$	=	4391	mm^3
t_f	=	6	mm	$W_{y;el;eff.2}$	=	11060	mm^3
y_s	=	15,6	mm	i_y	=	16,6	mm
A_{bruto}	=	631	mm^2	i_v	=	10,5	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1676	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	1676	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	30	mm
a*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	1676	mm	Edge distance bolt e2	=	25	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	6	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,16** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,61** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **159** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,21** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,31** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,26** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,61 = 61%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3 Verticale Knikverkorters L55x55x6* *M13*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-10,16*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*10,16*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile :		*H55/55/6*	(*1)				
h	=	*55*	mm	I_y	=	*172872*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s	=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}	=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2360*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2360*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a{*}L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,18**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**224**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,45**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,57**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,34**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,30**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,57 = 57%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3 Verticale verbanden L150x100x12* M14

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-181,18*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*197,44*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/12* (*1)

h	=	*150*	mm	I_y	=	*6496055*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*51628*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*268690*	mm^3
y_s	=	*24,2*	mm	i_y	=	*47,5*	mm
A_{bruto}	=	*2874*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5028*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2514*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,46** < **1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < **1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **117** < **200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** < **1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < **1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < **1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < **1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < **1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,73** < **1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,45** < **1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,73 = 73%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5
(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4 Randen L200x200x20* *M15*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-1185,13*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*952,01*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/20* (*1)

h	=	*200*	mm	I_y	=	*35603980*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f	=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s	=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}	=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1784*	mm	No. bolts / end / flange	=	*5*	(Per flange !)
$L_{v;cr}$	=	*1784*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,46** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **46** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,55** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,41** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **$U.C_{max}$ = 0,58 = 58%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4 Horizontale Knikverkorters L50x50x5* *M16*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-9,47*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*9,47*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1460*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1460*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*1560*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,21** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,82** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **152** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,28** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,41** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,31** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,34** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,82 = 82%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4 Horizontale staven L60x60x6* *M16a*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-4,4*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*4,79*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* (*1)

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2920*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2920*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*2920*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,09** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,88** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **253** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,22** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,27** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,16** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,17** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,88 = 88%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Checked :	J Boogert						

Order :	14509	**Dossier** : 13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part :	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 4 Verticale Knikverkorters L50x50x5* *M17*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-7,32* kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*7,32* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0* kN	
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0* kN	

Angle profile : *H50/50/5* [*1]

h	=	*50* mm	I_y	=	*109643* mm^4
b	=	*50* mm	$W_{y;el;eff.1}$	=	*3049* mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*7811* mm^3
y_s	=	*14,0* mm	i_y	=	*15,1* mm
A_{bruto}	=	*480* mm^2	i_v	=	*9,6* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2080* mm	No. bolts / end / flange	=	*1*
$L_{v;cr}$	=	*2080* mm	Type of bolts M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*30* mm
a*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*25* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*5* mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,16**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**217**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,40**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,51**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,24**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,26**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] **:** **$U.C_{max}$ = 0,51 = 51%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

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Checked :	J Boogert						

Order :	14509	**Dossier** : 13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part :	Mast 55		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 4 Verticale verbanden L150x100x14* *M18*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-242,51*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*223,83*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/14* (*1)

h	=	*150*	mm	I_y	=	*7434686*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*59460*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*297816*	mm^3
y_s	=	*25,0*	mm	i_y	=	*47,3*	mm
A_{bruto}	=	*3322*	mm^2	i_v	=	*21,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4755*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2377*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,46** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **111** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,63** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,89** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,42** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,89 = 89%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Checked :	J Boogert						

Order : 14509	**Dossier** : 13.039	**Berekening** :	D&C ENGINEERING
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part : Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5 Randen L200x200x20* *M19*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-981,56* kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*769,91* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/20* (*1)

h	=	*200* mm	I_y	=	*35603980*	mm^4
b	=	*200* mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f	=	*26* mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s	=	*59,1* mm	i_y	=	*60,4*	mm
A_{bruto}	=	*9759* mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1784* mm	No. bolts / end / flange	=	*6*	**(Per flange !)**
$L_{v;cr}$	=	*1784* mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*110*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*16* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,37** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **46** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,48** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,76** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,43** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,76 = 76%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Checked :	J Boogert						

Order : 14509	Dossier : 13.039	Berekening :	D&C ENGINEERING
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part : Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5 Horizontale Knikverkorters L50x50x5* *M20*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-16,33* kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*16,33* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50* mm	I_y	=	*109643*	mm^4
b	=	*50* mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0* mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480* mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1250* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1250* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*1250* mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,35** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,65** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **130** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,37** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,59** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,54** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,58** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,65 = 65%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 5 Verticale Knikverkorters L50x50x5* *M21*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-29,39* kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*29,39* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50* mm	I_y	=	*109643*	mm^4
b	=	*50* mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0* mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480* mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1720* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1720* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,64** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **179** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,14** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,52** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,97** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,05** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,52 = 152%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier** : 13.039	**Berekening** :
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5 Verticale verbanden L150x100x12* *M21a*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-262,06*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*279,54*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/12* [(*1)]

h	=	*150*	mm	I_y	=	*6496055*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*51628*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*268690*	mm^3
y_s	=	*24,2*	mm	i_y	=	*47,5*	mm
A_{bruto}	=	*2874*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4360*	mm	No. bolts / end / flange	=	*5*	
$L_{v;cr}$	=	*2180*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,66**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**102**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,71**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,82**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,42**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] **:** **$U.C_{max}$ = 0,82 = 82%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[(*2)] The total stress or increase of stress has been related to the permissible stress

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Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** : 13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part :	Mast 55		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 Randen L200x200x16* *M22*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-939,9*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*764,96*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/16* [*1]

h	=	*200*	mm	I_y	=	*35603980*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f	=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s	=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}	=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1784*	mm	No. bolts / end / flange	=	*6*	**(Per flange !)**
$L_{v;cr}$	=	*1784*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*110*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*16*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,37**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**46**	**< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,46**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,73**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,43**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] **:** **$U.C_{max}$ = 0,73 = 73%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 Verticale verbanden L150x100x12* *M23*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-195,42*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*194,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/12* (*1)

h	=	*150*	mm	I_y	=	*6496055*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*51628*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*268690*	mm^3
y_s	=	*24,2*	mm	i_y	=	*47,5*	mm
A_{bruto}	=	*2874*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4765*	mm	No. bolts / end / flange	=	*5*	
$L_{v;cr}$	=	*2382*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,46** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **111** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,59** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,58** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,29** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,59 = 59%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 Horizontale Knikverkorters L50x50x5* *M24*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-9,75*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*11,67*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1250*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1250*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*1250*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,25**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,65**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**130**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,22**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,35**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,39**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,42**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,65 = 65%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** : 13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part :	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 Horizontale vrband L130x130x12* *M25*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-114,52*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*74,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* [(*1)]

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3950*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*3950*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*130*	mm
$L_{perpendicular\ force}$	=	*3950*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,14** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,12** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **157** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,48** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,84** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,71** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,84 = 84%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[(*2)] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 Vertical Knikverkorters L90x90x9* *M26*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-106,31*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*66,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H90/90/9* [*1]

h	=	*90*	mm	I_y	=	*1158332*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*17927*	mm^3
t_f	=	*9*	mm	$W_{y;el;eff.2}$	=	*45626*	mm^3
y_s	=	*25,4*	mm	i_y	=	*27,3*	mm
A_{bruto}	=	*1552*	mm^2	i_v	=	*17,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2076*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2076*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,34**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**119**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,64**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,78**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,38**	**< 1**

Remarks:

The maximum increase of stress or totalstress is [*2] **:** **$U.C_{max}$ = 0,78 = 78%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 Vertical Knikverkorters L50x50x5* *M27*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-14,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*10,49*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* [*1]

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2571*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2571*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,20** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **268** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,80** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,10** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,09** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] **:** **$U.C_{max}$ = 0,80 = 80%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 6 Verticale verbanden L180x180x16* M28

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-322,86	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	301,42	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H180/180/16 (*1)

h	=	180	mm	I_y	=	16824296	mm^4
b	=	180	mm	$W_{y;el;eff.1}$	=	129653	mm^3
t_f	=	16	mm	$W_{y;el;eff.2}$	=	334903	mm^3
y_s	=	50,2	mm	i_y	=	55,1	mm
A_{bruto}	=	5539	mm^2	i_v	=	35,0	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	5642	mm	No. bolts / end / flange	=	5	
$L_{v;cr}$	=	2825	mm	Type of bolts M / "	=	30	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	65	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	100	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	50	mm
Position perpendicular force	=	1	(⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	14	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,39** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **102** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,46** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,60** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,30** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,60 = 60%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Randen L200x200x16* *M29*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-633,51*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*385,56*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/16* (*1)

h	=	*200*	mm	I_y	=	*35603980*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f	=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s	=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}	=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4261*	mm	No. bolts / end / flange	=	*3*	(Per flange !)
$L_{v;cr}$	=	*2141*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*110*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*16*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,18** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **71** **< 120**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,37** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,98** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,42** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,98 = 98%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5
(*2) The total stress or increase of stress has been related to the permissible stress

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Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Horizontale Knikverkorters L50x50x5* *M30*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-10,02*	kN	***Combined forces diagonal:***		
Tension: N_{Sd}	=	*10,02*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0* kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0* kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643* mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049* mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811* mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1* mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*880*	mm	No. bolts / end / flange	=	*1*
$L_{v;cr}$	=	*880*	mm	Type of bolts M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30* mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50* mm
$L_{perpendicular\ force}$	=	*880*	mm	Edge distance bolt e2	=	*25* mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,22**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,46**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**92**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,14**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,27**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,33**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,36**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **U.C_{max} = 0,46 = 46%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Verticale Knikverkorters L50x50x5* *M31*

Memberforces :		**(Attention! pressure = "-" and tension ="+")**					
Compression: N_{Sd}	=	*-17,33*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*16,47*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H50/50/5* [*1]					
h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*2050*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2050*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,36**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**213**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,92**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**1,16**	**> 1 !!**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,57**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,59**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] **:** **$U.C_{max}$ = 1,16 = 116%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Verticale verbanden L150x100x12* *M32*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-249,08*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*292,52*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/12* (*1)

h	=	*150*	mm	I_y	=	*6496055*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*51628*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*268690*	mm^3
y_s	=	*24,2*	mm	i_y	=	*47,5*	mm
A_{bruto}	=	*2874*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4017*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2019*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,79**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**94**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,62**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,68**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,55**	**< 1**

Remarks:

The maximum increase of stress or totalstress is (*2) **:** **$U.C_{max}$ = 0,79 = 79%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Verticale verbanden L200x100x14* *M33*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-283,32*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*272,81*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/100/14* [*1]

h	=	*200*	mm	I_y	=	*16541310*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*92814*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*759497*	mm^3
y_s	=	*21,8*	mm	i_y	=	*64,1*	mm
A_{bruto}	=	*4028*	mm^2	i_v	=	*21,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4747*	mm	No. bolts / end / flange	=	*5*	
$L_{v;cr}$	=	*2380*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,45** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **112** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,62** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,84** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,35** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,84 = 84%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Verticale verbanden L130x130x12* *M34*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-197,64*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*284,93*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* [(*1)]

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4236*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2206*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,73** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **107** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,55** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,88** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,86** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,88 = 88%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[(*2)] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	Dossier : 13.039	Berekening :
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Verticale verbanden L90x90x9* *M35*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-70,81*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*76,54*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H90/90/9* (*1)

h	=	*90*	mm	I_y	=	*1158332*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*17927*	mm^3
t_f	=	*9*	mm	$W_{y;el;eff.2}$	=	*45626*	mm^3
y_s	=	*25,4*	mm	i_y	=	*27,3*	mm
A_{bruto}	=	*1552*	mm^2	i_v	=	*17,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4621*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2366*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,33** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **169** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,74** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,81** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,81 = 81%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier** : 13.039	**Berekening** :
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Boven randen L160x160x15* *M36*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-214,88* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*346,36* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H160/160/15* (*1)

h	=	*160* mm	I_y	=	*10988350*	mm^4
b	=	*160* mm	$W_{y;el;eff.1}$	=	*95470*	mm^3
t_f	=	*15* mm	$W_{y;el;eff.2}$	=	*244713*	mm^3
y_s	=	*44,9* mm	i_y	=	*48,8*	mm
A_{bruto}	=	*4606* mm^2	i_v	=	*31,1*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3680* mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*3680* mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*50*	mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1* (⅂=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,59** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **119** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,43** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,80** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,98** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **$U.C_{max}$ = 0,98** = **98%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Horizontale verbanden L60x60x6* *M37*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-24,72*	kN	***Combined forces diagonal:***		
Tension: N_{Sd}	=	*24,72*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0* kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0* kN

Angle profile : *H60/60/6* (*1)

h	=	*60*	mm	I_y	=	*227925* mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285* mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507* mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2* mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3232*	mm	No. bolts / end / flange	=	*1*
$L_{v;cr}$	=	*1616*	mm	Type of bolts M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30* mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50* mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*30* mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,34** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **178** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,66** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,00** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,82** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,64** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,00 = 100%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Checked :	J Boogert						

Order :	14509	**Dossier** : 13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part :	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Horizontale verbanden L100x10x10* *M38*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-110,32*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*145,43*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100* mm	I_y	=	*1766764*	mm^4
b	=	*100* mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10* mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2* mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915* mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3507* mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*3507* mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*60*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,75** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **181** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,88** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,68** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,66** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,88 = 88%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Horizontale en verticale Knikverkorters L50x50x5* — *M39*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-3,4*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*3,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3227*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3227*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,07**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**336**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,42**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,48**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,11**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,12**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,48 = 48%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Checked :	J Boogert						

Order :	14509	**Dossier** : 13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part :	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Verticale Knikverkorters L65x50x5* *M40*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-4,34* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*6,15* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H65/50/5* (*1)

h	=	*65* mm	I_y	=	*230454*	mm^4
b	=	*50* mm	$W_{y;el;eff.1}$	=	*4389*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*18449*	mm^3
y_s	=	*12,5* mm	i_y	=	*20,4*	mm
A_{bruto}	=	*554* mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1503* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1503* mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*60*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,15** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **143** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,10** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,13** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,13** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,16** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,16 = 16%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

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Order	:	14509	**Dossier** : 13.039	**Berekening** :
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Schuine verbanden L130x130x12* *M41*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-187,24*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*185,01*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* [*1]

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2376*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2376*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,44** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **94** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,45** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,69** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,35** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] **:** **$U.C_{max}$ = 0,69 = 69%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

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Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Horizontale kruizen L90x90x9* *M42*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-47,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*47,51*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H90/90/9* (*1)

h	=	*90*	mm	I_y	=	*1158332*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*17927*	mm^3
t_f	=	*9*	mm	$W_{y;el;eff.2}$	=	*45626*	mm^3
y_s	=	*25,4*	mm	i_y	=	*27,3*	mm
A_{bruto}	=	*1552*	mm^2	i_v	=	*17,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2540*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2540*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,50** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **146** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,41** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,61** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,44** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,79** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,79 = 79%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Randen L140x140x13* *M43*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-422,37*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*317,23*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H140/140/13* [*1]

h	=	*200*	mm	I_y	=	*35603980*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f	=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s	=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}	=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4356*	mm	No. bolts / end / flange	=	*4*	**(Per flange !)**
$L_{v;cr}$	=	*2220*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*55*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,15**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**72**	**< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,25**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,78**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,33**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,78 = 78%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Horizontale Knikverkorters L50x50x5* *M44*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-2,21* kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*2,21* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50* mm	I_y	=	*109643*	mm^4
b	=	*50* mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0* mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480* mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2536* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1268* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular force}$	=	*0* mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,05** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **168** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,08** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,11** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,07** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,08** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,11 = 11%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Verticale Knikverkorters L50x50x5* *M45*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-3,37*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*3,56*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2179*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2179*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,08** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **227** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,20** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,25** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,12** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,13** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,25 = 25%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039 **Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part :	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Verticale verbanden L150x100x10* *M46*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-119,4*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*93,04*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/10* (*1)

h	=	*150*	mm	I_y	=	*5516683*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*43563*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*236120*	mm^3
y_s	=	*23,4*	mm	i_y	=	*47,8*	mm
A_{bruto}	=	*2418*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4099*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2089*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,29**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**97**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,36**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,88**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,42**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **$U.C_{max}$ = 0,88 = 88%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** : 13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part :	Mast 55		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Verticale verbanden L110x110x10* *M47*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-128,02*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*118,97*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H110/110/10* (*1)

h	=	*110*	mm	I_y	=	*2386992*	mm^4
b	=	*110*	mm	$W_{y;el;eff.1}$	=	*30108*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*77703*	mm^3
y_s	=	*30,7*	mm	i_y	=	*33,6*	mm
A_{bruto}	=	*2115*	mm^2	i_v	=	*21,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5030*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2651*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = 0,35 < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = n.v.t. < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = 150 < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = 0,83 < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = n.v.t. < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = n.v.t. < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = n.v.t. < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = n.v.t. < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = 0,91 < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = 0,30 < 1

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,91 = 91%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Boven randen L120x120x11* *M48*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-102,18*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*152,02*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/120/11* (*1)

h	=	*120*	mm	I_y	=	*3406399*	mm^4
b	=	*120*	mm	$W_{y;el;eff.1}$	=	*39406*	mm^3
t_f	=	*11*	mm	$W_{y;el;eff.2}$	=	*101512*	mm^3
y_s	=	*33,6*	mm	i_y	=	*36,6*	mm
A_{bruto}	=	*2537*	mm^2	i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4465*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*4465*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,41** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **192** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,67** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,75** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,42** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,75 = 75%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5
(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order : 14509	**Dossier** : 13.039	**Berekening** :	D&C ENGINEERING
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part : Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Boven randen L60x60x6* *M49*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*60,86*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* [*1]

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1213*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*1213*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,68** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **105** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,43** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,46** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] **:** **$U.C_{max}$ = 0,68 = 68%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Horiz.-vert. en schuine Knikverkort. L50x50x5*

Memberforces : **(Attention! pressure = "-" and tension ="+")** ***M50***

Compression:	N_{Sd}	=	*-13,75*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*11,11*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :			*H50/50/5*	(*1)				
h		=	*50*	mm	I_y	=	*109643*	mm^4
b		=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s		=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}		=	*480*	mm^2	i_v	=	*9,6*	mm
Material :								
Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:								
$L_{y;cr}$		=	*1993*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$		=	*1993*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)		=	*0*	mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)		=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$		=	*1268*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?		=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate		=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,24**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,66**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**208**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,70**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,89**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,46**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,40**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,89 = 89%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	Dossier : 13.039	Berekening :
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Schuine verbanden L90x90x9* — *M51*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-86,31*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*97,66*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H90/90/9*	(*1)				
h	=	*90*	mm	I_y	=	*1158332*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*17927*	mm^3
t_f	=	*9*	mm	$W_{y;el;eff.2}$	=	*45626*	mm^3
y_s	=	*25,4*	mm	i_y	=	*27,3*	mm
A_{bruto}	=	*1552*	mm^2	i_v	=	*17,4*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*1506*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*1506*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a{*}L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,42** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **87** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,37** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,48** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,33** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,48 = 48%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order : 14509	Dossier : 13.039	Berekening :
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part : Mast 55		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Schuine verbanden L100x100x10* M52

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	-82,64	kN	*Combined forces diagonal:*			
Tension:	N_{Sd} =	50,97	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$ =	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H100/100/10 (*1)

h	=	100	mm	I_y	=	1766764	mm^4
b	=	100	mm	$W_{y;el;eff.1}$	=	24615	mm^3
t_f	=	10	mm	$W_{y;el;eff.2}$	=	62597	mm^3
y_s	=	28,2	mm	i_y	=	30,4	mm
A_{bruto}	=	1915	mm^2	i_v	=	19,3	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2819	mm	No. bolts / end / flange	=	3	
$L_{v;cr}$	=	2819	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	50	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	100	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	45	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	10	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,18** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **146** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,50** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,41** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,16** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,50 = 50%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Schuine verbanden L75x75x8* *M53*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-24,28*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*78,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H75/75/8* (*1)

h	=	*75*	mm	I_y	=	*588737*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*10964*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*27635*	mm^3
y_s	=	*21,3*	mm	i_y	=	*22,7*	mm
A_{bruto}	=	*1147*	mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2819*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2819*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,52**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**195**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,36**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,58**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,45**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,58 = 58%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Horizontale kruizen L60x60x6* *M54*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-40,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*39,76*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :			*H60/60/6*	(*1)				
h		=	*60*	mm	I_y	=	*227925*	mm^4
b		=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s		=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}		=	*691*	mm^2	i_v	=	*11,5*	mm
Material :								
Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:								
$L_{y;cr}$		=	*3100*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$		=	*1652*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)		=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)		=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$		=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?		=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate		=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,47** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **171** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,96** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,67** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,59** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,96 = 96%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb1 Staven L150x150x14* *M55*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-227,23*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*185,17*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/150/14* [*1]

h	=	*150*	mm	I_y	=	*8453963*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*78326*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*200966*	mm^3
y_s	=	*42,1*	mm	i_y	=	*45,8*	mm
A_{bruto}	=	*4031*	mm^2	i_v	=	*29,1*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3800*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*3800*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*3800*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,30**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,08**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**131**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,58**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,84**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,35**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] **:** **$U.C_{max}$ = 0,84 = 84%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

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Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** : 13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part :	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb1 Staven L70x70x7* *M56*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-10,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*8,57*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/7* (*1)

h	=	*70*	mm	I_y	=	*422977*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*8411*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*21457*	mm^3
y_s	=	*19,7*	mm	i_y	=	*21,2*	mm
A_{bruto}	=	*940*	mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5374*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*5374*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*5374*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,08**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**1,02**	**> 1 !!**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**398**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,58**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,11**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,08**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,02 = 102%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb1 Staven L75x75x8* *M57*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-1,81	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	1,81	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H75/75/8 (*1)

h	=	75	mm	I_y	=	588737	mm^4
b	=	75	mm	$W_{y;el;eff.1}$	=	10964	mm^3
t_f	=	8	mm	$W_{y;el;eff.2}$	=	27635	mm^3
y_s	=	21,3	mm	i_y	=	22,7	mm
A_{bruto}	=	1147	mm^2	i_v	=	14,4	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	3800	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	3800	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	30	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	7600	mm	Edge distance bolt e2	=	40	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	8	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,01**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**1,11**	**> 1 !!**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**263**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,06**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,07**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,06**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,04**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 1,11 = 111%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
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Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *HorVerb2 Staven L65x65x7* *M58*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H65/65/7* [*1]

h	=	*65*	mm	I_y	=	*334319*	mm^4
b	=	*65*	mm	$W_{y;el;eff.1}$	=	*7185*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*18103*	mm^3
y_s	=	*18,5*	mm	i_y	=	*19,6*	mm
A_{bruto}	=	*870*	mm^2	i_v	=	*12,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3353*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3353*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular force}$	=	*3353*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,74** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **269** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,00** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,00** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,00** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,74 = 74%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb2 Staven L70x70x7* *M59*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-18,02*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*17,77*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/7* (*1)

h	=	*70*	mm	I_y	=	*422977*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*8411*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*21457*	mm^3
y_s	=	*19,7*	mm	i_y	=	*21,2*	mm
A_{bruto}	=	*940*	mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4741*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*4741*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*4741*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,16**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,90**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**351**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,80**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,19**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,17**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,90 = 90%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *HorVerb2 Staven L60x60x6* *M60*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-0,27*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*0,08*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* (*1)

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3353*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*3353*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*6707*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **2,03** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **290** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,01** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,00** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,00** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 2,03 = 203%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *HorVerb3 Staven L150x150x14* *M61*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-355,69*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*292*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/150/14* (*1)

h	=	*150*	mm	I_y	=	*8453963*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*78326*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*200966*	mm^3
y_s	=	*42,1*	mm	i_y	=	*45,8*	mm
A_{bruto}	=	*4031*	mm^2	i_v	=	*29,1*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2500*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2500*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*110*	mm
$L_{perpendicular\ force}$	=	*2500*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*16*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,50** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,05** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **86** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,83** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,59** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,83 = 83%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb3 Staven L90x90x9* *M62*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-50,62*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*49,64*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H90/90/9* (*1)

h	=	*90*	mm	I_y	=	*1158332*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*17927*	mm^3
t_f	=	*9*	mm	$W_{y;el;eff.2}$	=	*45626*	mm^3
y_s	=	*25,4*	mm	i_y	=	*27,3*	mm
A_{bruto}	=	*1552*	mm^2	i_v	=	*17,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3536*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3536*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*3536*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,40** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,31** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **203** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,76** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,99** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,08** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,72** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,08 = 108%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: HorVerb3 Staven L75x75x8 — M63

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-0,09	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	0,59	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H75/75/8 (*1)

h	=	75	mm	I_y	=	588737	mm^4
b	=	75	mm	$W_{y;el;eff.1}$	=	10964	mm^3
t_f	=	8	mm	$W_{y;el;eff.2}$	=	27635	mm^3
y_s	=	21,3	mm	i_y	=	22,7	mm
A_{bruto}	=	1147	mm^2	i_v	=	14,4	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	5000	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	5000	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	30	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	5000	mm	Edge distance bolt e2	=	40	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	8	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,73** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **347** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,01** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,02** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,01** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,73 = 73%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *CrossArm 1-2 Bovern Randen* *M64*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*85,65*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100*	mm	I_y	=	*1766764*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2*	mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4732*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*4732*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = 0,30 < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = n.v.t. < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = 245 < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = 0,00 < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = n.v.t. < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = n.v.t. < 1

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = n.v.t. < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = n.v.t. < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = 0,42 < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = 0,26 < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,42 = 42%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :**	13.039 **Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 1-2 Horiz.-vert. en schuine Knikverkort. L50x50x5* *M65*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-13,56*	kN	***Combined forces diagonal:***				
Tension: N_{Sd}	=	*2,05*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)		=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)		=	*0*	kN
Angle profile :		*H50/50/5*	(*1)					
h	=	*50*	mm	I_y		=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$		=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$		=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y		=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v		=	*9,6*	mm
Material :								
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:								
$L_{y;cr}$	=	*1888*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*1888*	mm	Type of bolts	M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*50*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt	e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,04**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**197**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,62**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,82**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,45**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,27**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,82 = 82%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** : 13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part :	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 1-2 Horizontale kruizen L65x65x7* *M66*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-45,09*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*37,23*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H65/65/7* (*1)					
h	=	*65*	mm	I_y	=	*334319*	mm^4
b	=	*65*	mm	$W_{y;el;eff.1}$	=	*7185*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*18103*	mm^3
y_s	=	*18,5*	mm	i_y	=	*19,6*	mm
A_{bruto}	=	*870*	mm^2	i_v	=	*12,5*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*2073*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1600*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,37**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**128**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,52**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,48**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,51**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,52 = 52%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 1-2 Horizontale kruizen L55x55x6* *M67*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-18,04*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*21,49*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H55/55/6* (*1)

h	=	*55*	mm	I_y	=	*172872*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s	=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}	=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2713*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1600*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,29**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**164**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,45**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,36**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,32**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,45 = 45%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** : 13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part :	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 1-2 Horizontale kruizen L80x80x8* *M68*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-58,73*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*36,86*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* (*1)

h	=	*80*	mm	I_y	=	*722469*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6*	mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4190*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2445*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,24**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**173**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,80**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,97**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,42**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,97 = 97%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 1-2 Schuine verbanden L60x60x6* *M69*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*0*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*65,96*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* (*1)

h	=	*80*	mm	I_y	=	*722469*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6*	mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4190*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2445*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,42**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**173**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,00**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**1,09**	**> 1 !!**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,74**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 1,09 = 109%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 3-4 Boven renden L80x80x8* *M70*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*0*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*61,01*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* (*1)

h	=	*80*	mm	I_y	=	*722469*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6*	mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2880*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2880*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,36** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **187** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,43** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,29** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,43 = 43%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 3-4 Horizontale kruizen L60x60x6* *M71*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-39,39*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*32,96*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H65/65/7* (*1)

h	=	*65*	mm	I_y	=	*334319*	mm^4
b	=	*65*	mm	$W_{y;el;eff.1}$	=	*7185*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*18103*	mm^3
y_s	=	*18,5*	mm	i_y	=	*19,6*	mm
A_{bruto}	=	*870*	mm^2	i_v	=	*12,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2347*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2347*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,31** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **188** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,73** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,65** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,42** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **U.C$_{max}$ = 0,73 = 73%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5
(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 5-6 Randen L80x80x8* *M72*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-115,31*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*81,75*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* (*1)

h	=	*80*	mm	I_y	=	*722469*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6*	mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3350*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2008*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*73*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,54** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **138** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,13** **> 1 !!**

5 - Check stress in member due to compression with excentricity:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,23** **> 1 !!**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,99** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** $U.C_{max}$ = **1,23** = **123%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5
(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check section: *CrossArm 5-6 Schuine randen L100x75x7* *M73*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-42,19*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*59,45*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/75/7* (*1)

h	=	*100*	mm	I_y	=	*1179878*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s	=	*18,3*	mm	i_y	=	*31,5*	mm
A_{bruto}	=	*1187*	mm^2	i_v	=	*15,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*6950*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1726*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,41** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **220** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,82** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,63** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,49** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,82 = 82%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 5-6 Horizontale en schuine knikverkorters L50x50x5* *M74*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-2,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*2,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h =	*50*	mm	I_y	=	*109643*	mm^4
b =	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f =	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s =	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto} =	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510 = *Fe360* — Permissible stress $f_{y;d}$ = *235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$ =	*1910*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$ =	*1910*	mm	Type of bolts	M / "	=	*16*
L_{tot} (with comb. buckling) =	*0*	mm	End distance bolt	e1	=	*30* mm
a^*L_{tot} (with comb. buckling) =	*0*	mm	Centre-centre spacing bolt	s1	=	*60* mm
$L_{perpendicular\ force}$ =	*969*	mm	Edge distance bolt	e2	=	*25* mm
Position perpendicular force =	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
Column profile? =	*1*	no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate =	*8*	mm	Dubble strap joint no=1, yes=2		=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,06** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,51** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **199** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,14** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,18** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,10** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,10** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,51 = 51%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039 **Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part :	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 5-6 Verticale verbanden1 L50x50x5* *M75*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-13,65*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*13,63*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2162*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2162*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a{*}L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*969*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,30** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **225** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,80** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,00** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,45** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,49** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **U.C$_{max}$ = 1,00 = 100%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Check section: *CrossArm 5-6 Verticale verbanden2 L50x50x5* *M76*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-20,99*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*19,63*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2184*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1155*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,43**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**145**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,57**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,95**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,70**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,70**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,95 = 95%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 Horizontale en Verticale Knikverkorters L70x70x7* V06

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-23,73	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	23,73	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H70/70/7 [(*1)]

h	=	70	mm	I_y	=	422977	mm^4
b	=	70	mm	$W_{y;el;eff.1}$	=	8411	mm^3
t_f	=	7	mm	$W_{y;el;eff.2}$	=	21457	mm^3
y_s	=	19,7	mm	i_y	=	21,2	mm
A_{bruto}	=	940	mm^2	i_v	=	13,5	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe510		Permissible stress $f_{y;d}$	=	355,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	3322	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	3322	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	30	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	3322	mm	Edge distance bolt e2	=	30	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	7	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,20** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,42** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **246** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,82** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,96** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,39** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,37** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,96 = 96%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[(*2)] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 Schuine Knikverkorters L70x70x7* *V09*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-28,83*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*28,83*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/7* [*1]

h	=	*70*	mm	I_y	=	*422977*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*8411*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*21457*	mm^3
y_s	=	*19,7*	mm	i_y	=	*21,2*	mm
A_{bruto}	=	*940*	mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2620*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2620*	mm	Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,32**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**194**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,64**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,80**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,48**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,61**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] **:** **$U.C_{max}$ = 0,80 = 80%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5 Verticale Knikverkorters L55x55x6* *V21*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-29,39*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*29,39*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H55/55/6* (*1)

h	=	*55*	mm	I_y	=	*172872*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s	=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}	=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1720*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1720*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,38**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**163**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,70**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,93**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,49**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,62**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,93 = 93%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier** : 13.039	**Berekening** :
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8-9-10-13-14 Verticale Knikverkorters L55x55x6* *V31*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-17,33*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*16,47*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :			*H55/55/6*	(*1)				
h		=	*55*	mm	I_y	=	*172872*	mm^4
b		=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s		=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}		=	*631*	mm^2	i_v	=	*10,5*	mm
Material :								
Mat. qual. Fe360 / Fe510		=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2
Geometry section and bolts:								
$L_{y;cr}$		=	*2050*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$		=	*2050*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)		=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)		=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$		=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force		=	*1*	(⅂=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?		=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate		=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,21** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **194** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,57** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,72** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,41** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,72 = 72%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb1 Staven L150x150x10* *V56*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-10,6*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*8,57*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/150/10* (*1)

h	=	*150*	mm	I_y	=	*3031455*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*35598*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*92730*	mm^3
y_s	=	*32,7*	mm	i_y	=	*36,2*	mm
A_{bruto}	=	*2312*	mm^2	i_v	=	*23,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5374*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*5374*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular force}$	=	*5374*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,02** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,16** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **232** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,09** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,06** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,05** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,16 = 16%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *HorVerb1 Staven L75x75x8* *V57*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-1,81*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*1,81*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H75/75/8* (*1)

h	=	*75*	mm	I_y	=	*588737*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*10964*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*27635*	mm^3
y_s	=	*21,3*	mm	i_y	=	*22,7*	mm
A_{bruto}	=	*1147*	mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3800*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3800*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*7600*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,01**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,73**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**263**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,06**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,07**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,03**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,02**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,73 = 73%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Name :	J Goddijn						
Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb2 Staven L75x75x8* *V60*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-0,27*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*0,08*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H75/75/8* (*1)

h	=	*75*	mm	I_y	=	*588737*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*10964*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*27635*	mm^3
y_s	=	*21,3*	mm	i_y	=	*22,7*	mm
A_{bruto}	=	*1147*	mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3353*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*3353*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*6707*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,65** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **232** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,00** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,00** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,65 = 65%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

Order	:	14509	**Dossier :** 13.039	**Berekening :**
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 55		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb3 Staven L90x90x9* *V62*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-50,62*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*49,64*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H90/90/9* (*1)

h	=	*90*	mm	I_y	=	*1158332*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*17927*	mm^3
t_f	=	*9*	mm	$W_{y;el;eff.2}$	=	*45626*	mm^3
y_s	=	*25,4*	mm	i_y	=	*27,3*	mm
A_{bruto}	=	*1552*	mm^2	i_v	=	*17,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3536*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3536*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*3536*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,40**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,31**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**203**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,76**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,99**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,54**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,72**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,99 = 99%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *CrossArm 1-2 Schuine verbanden L60x60x6* *V69*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*0*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*65,96*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* (*1)

h	=	*80*	mm	I_y	=	*722469*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6*	mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4190*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2445*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⅂=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,42** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **173** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,55** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,74** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,74 = 74%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5
(*2) The total stress or increase of stress has been related to the permissible stress

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Checked :	J Boogert						

Order :	14509	**Dossier** :	13.039	**Berekening** :
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 55			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *CrossArm 5-6 Randen L80x80x8* *V72*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-115,31*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*81,75*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* (*1)

h	=	*80*	mm	I_y	=	*722469*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6*	mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2008*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2008*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a{*}L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*73*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,54** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **130** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,96** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,61** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,99** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,99 = 99%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	13-mrt-2012						
Name :	J Goddijn						
Checked :	J Boogert						

4. CONTROLE BEREKENING FUNDERINGEN

1 Overzicht palen fundatie

mast nummer	**52**	paal-aantal per poot	Paalcapaciteit per paal	Paalcapaciteit totaal per poot	UC.	Extra voorziening
paalbelasting druk per poot	823	2	1090	2180	0,38	
paalbelasting druk per poot	606	2	134	268	2,26	groutanker met capaciteit van 300 kN

mast nummer		paal-aantal per poot	Paalcapaciteit per paal	Paalcapaciteit totaal per poot	UC.	Extra voorziening
paalbelasting druk per poot	1430	4	1387	5548	0,26	
paalbelasting druk per poot	1084	4	174	697	1,56	groutanker met capaciteit van 400 kN

Resultaten van de optie Trekpalen (NEN-EN model)
TER INDICATIE: Resultaten bij gebruik Ksi3

Overzicht bij paaltype : prefab 400
Paalgroep 1
Aantal palen in deze paalgroep :4
Paalnamen in deze paalgroep
1 2 3 4

PPN [m R.N.]	Sondering	Rt;d [kN]	Rt;kluit;d [kN]	Paal gewicht [kN]	Aandeel van klei in de trekkracht [%]
-10,85	52	114,56	1231,20	21,63	0,00
-14,20	55	148,99	2544,14	28,07	0,00

Sondering	Alpha t gem. totaal	Alpha t gem. zand/grind/leem	Alpha t gem. klei/veen
52	0,0071	0,0070	0,0100
55	0,0070	0,0070	0,0000

Rapport voor D-Foundations 8.2

Ontwerp en Verificatie volgens Eurocode 7 van Strook- en Paalfunderingen
Ontwikkeld door Deltares

Bedrijfsnaam:	van Dijk geo- en milieutechniek
Datum van rapport:	31-3-2014
Tijd van rapport:	14:13:37
Datum van berekening:	31-3-2014
Tijd van berekening:	14:12:36
Bestandsnaam:	C:\..\Koppellijn Krimpen Leiden\Koppellijn krimpen leiden
Projectbeschrijving:	Koppellijn Krimpen - Leiden
	D-Foundations Koppellijn krimpen leiden

1 Bearing Piles (EC7-NL): Resultaten van de optie Voorontwerp-Draagkracht bij vaste PPN's

1.1 Rekenparameters

1.1.1 Factoren Paal

gamma;b (NEN-EN 1997-1:2005, bijlage A.6 A.7 A.8, Grenstoestand EQU/GEO) :	1,20
gamma;b (NEN-EN 1997-1:2005, bijlage A.6 A.7 A.8, de Bruikbaarheidsgrenstoestand) :	1,00
gamma;s (NEN-EN 1997-1:2005, bijlage A.6 A.7 A.8, Grenstoestand EQU/GEO) :	1,20
gamma;s (NEN-EN 1997-1:2005, bijlage A.6 A.7 A.8, de Bruikbaarheidsgrenstoestand) :	1,00
ksi3 (naar eigen opgave) :	1,39
ksi4 (naar eigen opgave) :	1,39

1.1.2 Paaltype : prefab 400

Paaltype :	Prefab betonpaal
Materiaaltype paal :	Beton
Gladheidsbehandeling voor paal :	Geen gladheidsbehandeling
Paalvorm :	Rechthoekige paal
beta (Paalvoetvormfactor; figuur 7i, NEN-EN 1997 1:2005 par. 7.6.2.3(g): NEN 9097-1) :	1,00
s (NEN-EN 1997 1:2005 par. 7.6.2.3(h), NEN 9097-1 : factor voor invloed vorm dwarsdoorsnede paalvoet) :	1,00

Paalafmetingen :

Kleinste zijde paalpunt [m] :	0,400
Grootste zijde paalpunt [m] :	0,400

Sondering	Alpha_s Zand/ Grind	Alpha_s Klei/Leem Veen	Alpha_p
52	0,0100	--	1,0000
55	0,0100	--	1,0000

1.2 Overzicht bij paaltype : prefab 400

Sondering	PPN [m R.N.]	Maaiveld [m R.N.]	Rb;cal;max [kN]	Rs;cal;max [kN]	Rc;cal;max [kN]	Rc;d [kN]	F;nk;rep [kN]	Fnk;d [kN]
52	-10.85	0,00	1461	551	2012	1206	116	116
55	-14.20	0,00	1850	714	2564	1537	150	150

1.3 Samenvatting Rekenwaarde Draagkracht in kN

Sondering	Maaiveld [m R.N.]	PPN [m R.N.]	prefab 400 Rc;net;d [kN]
52	0,00	-10,85	1090,00
55	0,00	-14,20	1387,00

Einde Rapport

Controle berekeningen M73 en M75

Project:
Randstad 380 kV Noordring

Opdrachtgever:
TenneT TSO

Revisie	Datum	Wijzigingen ten opzichte van vorige revisie
00	04-04-2014	Eerste versie

Documentnummer: R3N-OWR-0055

Opsteller	*Controleur*	*Vrijgever*
Koen Pieters Project Leider	Pieter de Jager Ontwerp Manager	Erik Duwel Project Manager

Distributie

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Eric van Rooijen	BAM
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Erwin ten Cate	BAM
Michaël Desmet	Cofely Fabricom
Koen Pieters	Cofely Fabricom
Hein Pijnappel	Mott McDonald

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Neem bij twijfel over de geldende versie contact op met de documentbeheerder.

Inhoudsopgave

1. INLEIDING

De komende jaren werken het ministerie van Economische Zaken en TenneT aan de aanleg van een nieuwe 380 kV hoogspanningsverbinding in de Randstad. De nieuwe verbinding stelt de voorziening van elektriciteit in de Randstad veilig.

Het ontwerptracé van de nieuwe Randstad 380 kV verbinding is sinds eind 2008 bekend. De plannen gaan uit van twee ringen, tussen Wateringen en Zoetermeer (de Zuidring) en tussen Zoetermeer en Beverwijk (de Noordring). Eind 2012 heeft Tennet de aanbesteding opgestart voor het gedeelte van de Noordring tussen station Vijfhuizen en Bleiswijk. Het contract is opgedeeld in twee percelen, waarbij de grens ligt bij Zuidelijke Ringvaart. Dit document heeft betrekking op perceel 2 (het zuidelijke gedeelte).

Het voorliggende document is onderdeel van het definitief ontwerp ten behoeve van de vergunningsaanvragen en behandelt:

- De controle berekeningen van M52 en M55 ten behoeven van de omleiding rond M54 en M53

.

2. CONTROLE BEREKENING MAST 73

Postbus 1
2950 AA Alblasserdam
Nieuwland Parc 301-302
2952 DD Alblasserdam
T +31 (0) 78 - 691 9222
E info@dcengineering.nl
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D&C ENGINEERING
design and construct

Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer

Onderwerp	:	Controleberekening mast 73, 150 kV-lijn Zoetermeer -Leiden
Opdrachtgever	:	Cofely Fabricom Koen Pieters
Referentienr	:	1303914509
Opgesteld	:	S. Al Mashta
Gecontroleerd	:	J.Hollaar
Goedgekeurd	:	J.Hollaar
Revisie	:	0
Datum	:	27-Mar-2014
D&C documentnr.	:	B.14014

SGS
Quality Masters
GECERTIFICEERD ISO 9001:2008

Rev.	Datum	Omschrijving	Opgesteld	Gecontr.	Goedgek.
0	27-Mar-14	Controleberekening mast 73, 150 kV-lijn Zoetermeer -Leiden	S. Al Mashta	J.Hollaar	J.Hollaar
A					

Inhoudsopgave

1 Algemeen

1.1 Inleiding

Door Cofely Fabricom is aan D&C engineering te Alblasserdam opdracht verstrekt voor o.a. het uitvoeren van een controleberekening voor mast nr.73 in de 150 kV-lijn Zoetermeer -Leiden. Mast 73 moet gecontroleerd worden, omdat rond de nieuwe 380kv-lijn een omleiding nodig is. Voor mast 74 komt een portaal waardoor de belasting op mast 73 wijzigd.
De berekeningen worden uitgevoerd conform de vigerende norm NEN-EN-50341-1 en 3.
Voor de geleiderbelasting vanuit de bliksemdraden wordt ijsgebied A aangehouden, conform afspraak (aanvullende eis van TenneT), zoals vermeld in: "Lijnen; Standaard programma van eisen; PVE.05.000;25 november 2010; versie 1.0".

1.2 Normen en tekeningen en documenten en andere uitgangspunten

Tekeningen :

Mast nr.55 in de 150 kV-lijn Zoetermeer -Leiden.	
tek.nr.	omschrijving
6775-5-E	Onderstuk HU
6775-6-D	Onderste tussenstuk HU
6775-7-E	Tweede tussenstuk HU
6775-8-E	Eerste bovenstuk HU
6775-9-D	Tweede bovenstuk HU
6775-10-E	Ondertraverse HU
6775-11-E	Bovenste traverse HU

Normen:

NEN-EN 50341-1 : 2001
NEN-EN 50341-3 : 2001

Andere uitgangspunten:

Fundatiehoogte 0,50 m boven maaiveld.

1.3 Nadere bepalingen

De geleiderbelastingen en de benodigde verzwaringen van de mastconstructies worden berekend volgens NEN-EN 50341-1 en 3 met spanningscontroles volgens EC-3.

De mastconstructie wordt 3D doorgerekend.

De gestelde slankheidsrestricties in NEN-EN 50341-1 en 3 worden geacht niet van toepassing te zijn, omdat in sommige gevallen in het verleden grotere slankheden zijn toegestaan.

Voor de mastconstructie zal een maximum totaalspanning van 100% worden gehanteerd.

Er is gerekend dat er geen antenne-opstellingen in de te controleren mastconstructie aanwezig zijn.

De berekening is uitgevoerd met het rekenpakket Scia LTA programma 2013

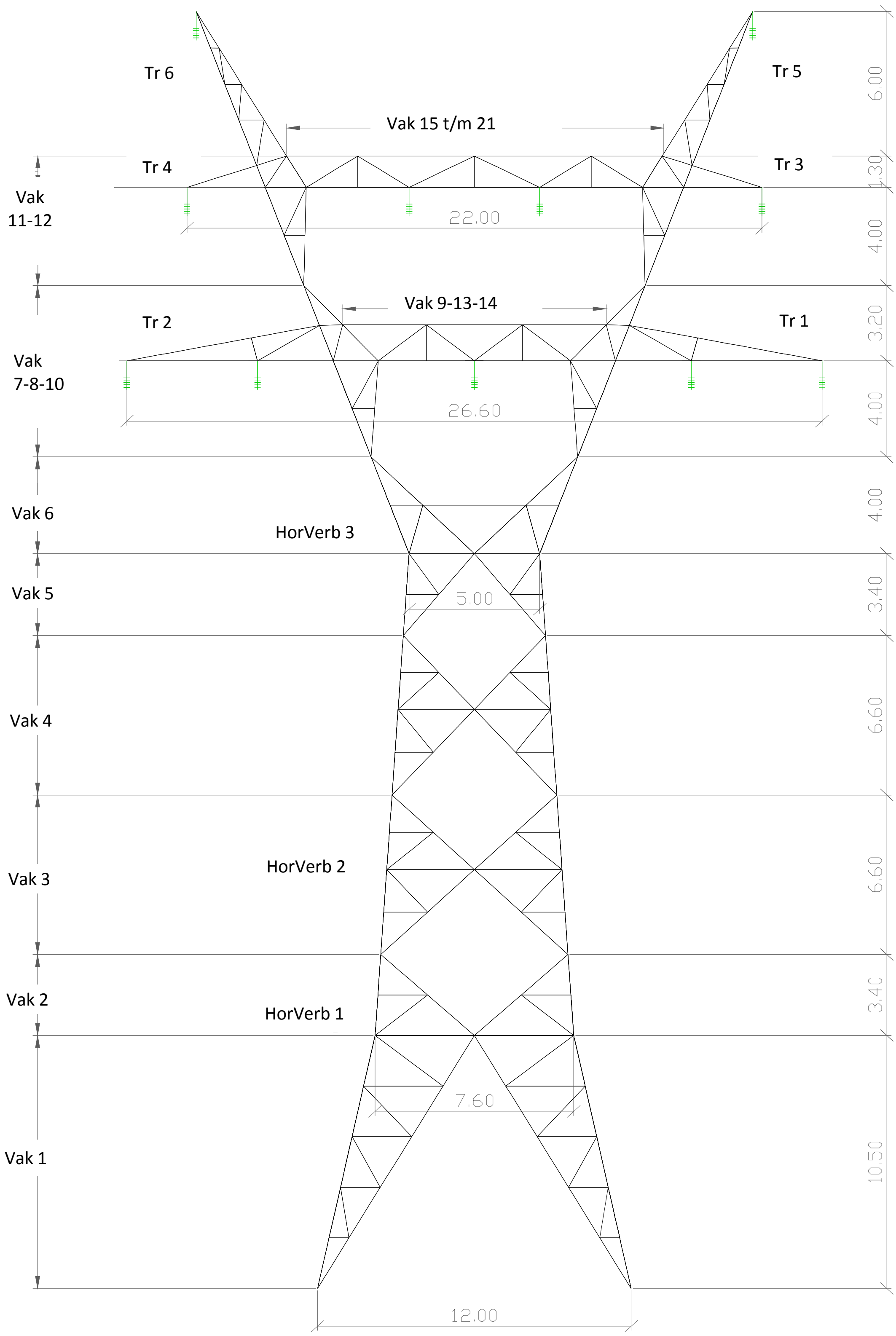
Voor de geleiderbelasting vanuit de bliksemdraden wordt gerekend met ijsgebied A.
Zie richtlijn van Tennet: "Lijnen; standaard programma van eisen; PVE.05.000;
25 november 2010; versie 1.0; artikel 5.3".

1.4 Materialen

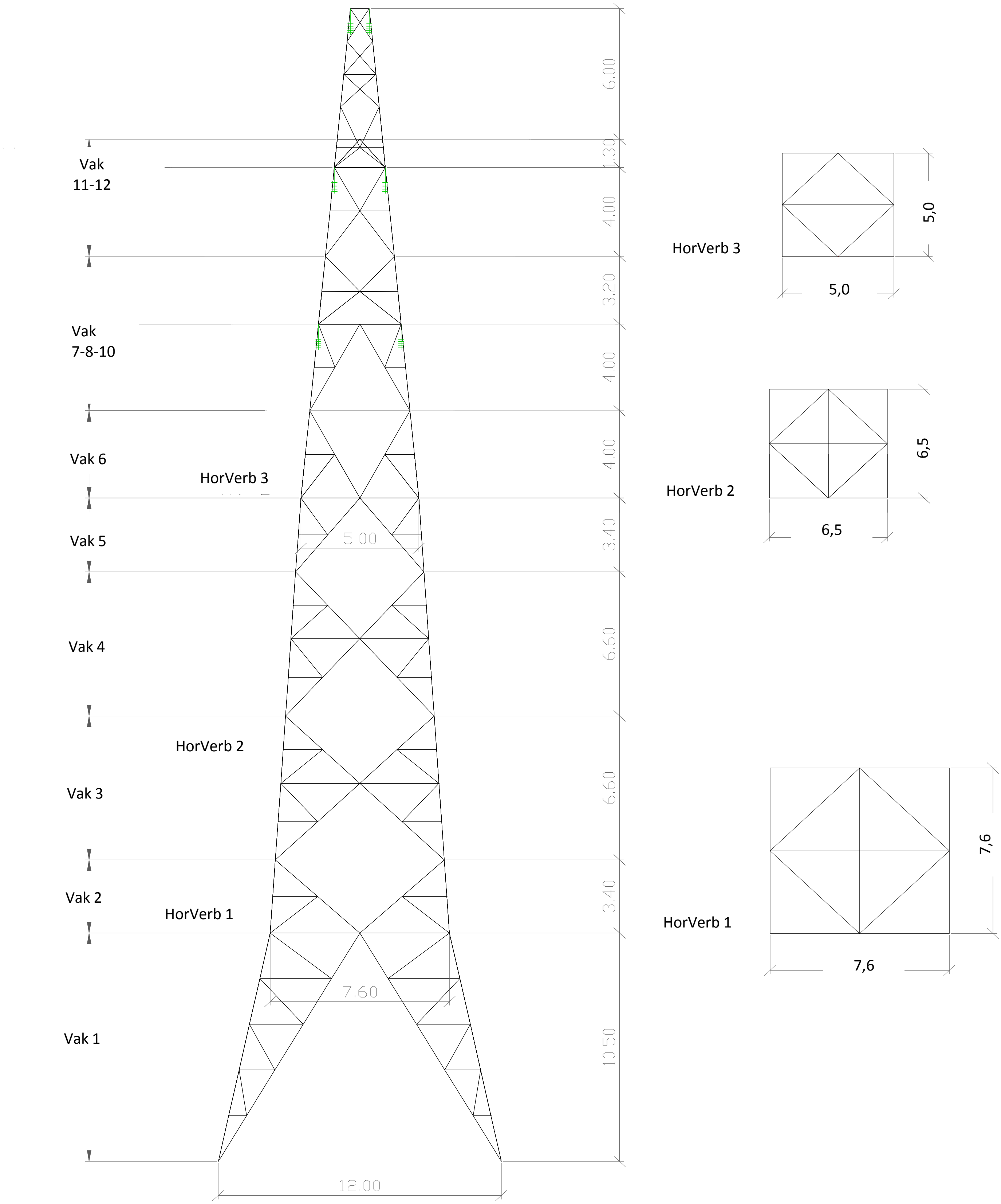
Materiaal randen	:	Fe360	(Fe510 nieuw)
Materiaal diagonalen	:	Fe360	(Fe510 nieuw)
Materiaal bouten	:	4.6	(8.8 nieuw)

1.5 Overzicht mast

1.5.1 Overzicht voorvlak mastlichaam



1.5.2 Overzicht zijvlak mastlichaam



2 Ontwerpgegevens mast

2.1 Ontwerpcode

De berekening is gebaseerd op NEN-en 50341-1 en -3-15
Bovengrondse hoogspanningslijnen.

2.2 Ontwerpgegevens

Lijnhoek	-	180° -172°	
Windgebied	-	II	
Bebouwing	-	onbebouwd	
IJsgebied bliksemdraden	-	**A**	
IJsgebied fasedraden	-	B	
Toeslag eigengewicht	-	20%	
Totale hoogte van de mast	-	53,0 m	*)
Hoogte traverse 1	-	38,5 m	*)
Hoogte traverse 2	-	45,7 m	*)

Hoogte voet boven maaiveld	-	0,5 m	
Veldlengten	-	325 - 405 m	
Bliksemdraden	-	Br 50	(2x)
Factor β bliksemdraad	-	1,0	
Fasedraden	-	CU 185	(9 x 2-bundel)
Factor β fasedraad	-	0,8	
Boutklasse	-	8.8	
Materiaal mastranden	-	S235	
Materiaal overige mast	-	S235	
	-		

*) t.o.v. bovenzijde fundatiepoer

2.3 Geleidergegevens

		Br 50	CU 185
		Bliksemdraad	fasedraad
Eigen gewicht	N/m	4,43	16,62
Doorsnede	mm2	48,36	181,6
Diameter	mm	9	17,5
Elasticiteitsmod.	N/mm2	130000	130000
Lin. Uitzettingsc.	1/°C	0,000017	0,000017
Breeksterkte	N	28390,7	72760,5

2.4 Gegevens isolatoren

Dubbele afspanning

lengte isolatorketting	2	m	
totale gewicht afspanning per zijde	2,5	kN	
diameter isolator schaal	255	mm	(voor wind 2/3*255mm =170mm)

2.5 Mastbelastingen uit geleiders

Voor belastingen uit de geleiders wordt verwezen naar bijlage A van dit rapport.

3 Berekening mast

3.1 Uitgangspunten berekening

Ontwerp-norm	NEN-EN 50341-3
Boutkwaliteit	4.6
Staalkwaliteit	S235
Toeslag eigengewicht	20%
Referentie periode	50 jaar

Voor verdere gegevens wordt verwezen naar hoofstuk 2.0

3.2 Berekening met behulp van computerprogramma

SCIA - ESA-Engineer - LTA

Voor de berekening van de mastconstructie wordt verwezen naar bijlage B van dit rapport.

4 Fundatie

4.1 Algemeen

Voor fundatiebelastingen zie Bijlage B:(maximale belastingen per knoop en Resultante op fundatie).
Deze belastingen zijn opgesteld en weergegeven conform NEN-EN 50341-1 en 3 november 2001; Bovengrondse hoogspanningslijnen.

Per fundatie-belastingweergave is dit opgegeven inclusief combinatie- en belastingfactoren.

Aan de hand van de bovengenoemde belastinggegevens en de sonderinggegevens kan de fundatie berekend worden.

4.2 Fundatie belastingen

11.2. Reacties

Lineaire berekening, Extreem : Globaal
Selectie : Alle
Klasse : All UGT

Steunpunt	BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Sn4/N290	sp1aR/205	**-286,39**	227,28	1343,11	0,00	0,00	0,00
Sn2/N298	sp3F/4	**302,43**	-242,69	**1459,70**	0,00	0,00	0,00
Sn2/N298	sp1aF/215	297,48	**-247,51**	1431,70	0,00	0,00	0,00
Sn1/N248	1a/14	209,13	**229,46**	1094,45	0,00	0,00	0,00
Sn4/N290	sp3F-p/24	230,09	-175,01	**-1123,83**	0,00	0,00	0,00
Sn1/N248	1a/216	63,50	72,70	350,60	**0,00**	**0,00**	**0,00**

11.3. Resultante op Fundering

Lineaire berekening, Extreem : Globaal
Selectie : Alle
Klasse : All UGT

BG	Steunpunt	Extreem	horiz. component [kN]	resultante [kN]	Hoek [deg]	helling(afschot) [-]	Rx [kN]	Ry [kN]	Rz [kN]
sp1aF/217	Sn3/N306	Rz	**57,68**	1219,38	1,63	21,12	39,61	41,93	1218,01
sp1aR/218	Sn1/N248	Rx	**365,14**	1391,19	173,85	3,68	284,37	229,05	1342,42
sp1aF/219	Sn2/N298	Ry	250,35	**322,84**	126,36	-0,81	-37,60	-247,51	-203,83
sp3F/4	Sn2/N298	Rx	302,65	**1490,74**	-132,80	4,82	302,43	11,64	1459,70
sp1aR-p/220	Sn3/N306	Rz	148,46	1035,33	**-179,72**	-6,90	-104,46	-105,49	-1024,63
sp1aR/218	Sn1/N248	Rx	365,14	1391,19	**173,85**	3,68	284,37	229,05	1342,42
sp1aR-p/220	Sn3/N306	Rz	148,46	1035,33	-179,72	**-6,90**	-104,46	-105,49	-1024,63
sp1aF/217	Sn3/N306	Rz	57,68	1219,38	1,63	**21,12**	39,61	41,93	1218,01
sp1aR/205	Sn4/N290	Rx	289,09	346,86	-127,16	-0,66	**-286,39**	-39,45	-191,68
sp3F/4	Sn2/N298	Rx	302,65	1490,74	-132,80	4,82	**302,43**	11,64	1459,70
sp1aF/219	Sn2/N298	Ry	250,35	322,84	126,36	-0,81	-37,60	**-247,51**	-203,83
1a/14	Sn1/N248	Ry	310,46	1137,63	-177,35	3,53	209,13	**229,46**	1094,45
sp3F-p/221	Sn4/N290	Rz	190,61	1139,88	-68,34	-5,90	-75,52	-175,01	**-1123,83**
sp3F/4	Sn2/N298	Rx	302,65	1490,74	-132,80	4,82	302,43	11,64	**1459,70**

4.3 Berekening Fundatie

De berekening van de fundatie, met de gegevens zoals de sonderingen, is een op zichzelf staande berekening, welke niet valt onder de scope van deze opdracht.

5 Resultaten

Uit de controleberekening van de mast volgen de volgende resultaten:

(Opmerking: De verschillende berekeningen zijn te vinden in de bijlagen B en C)

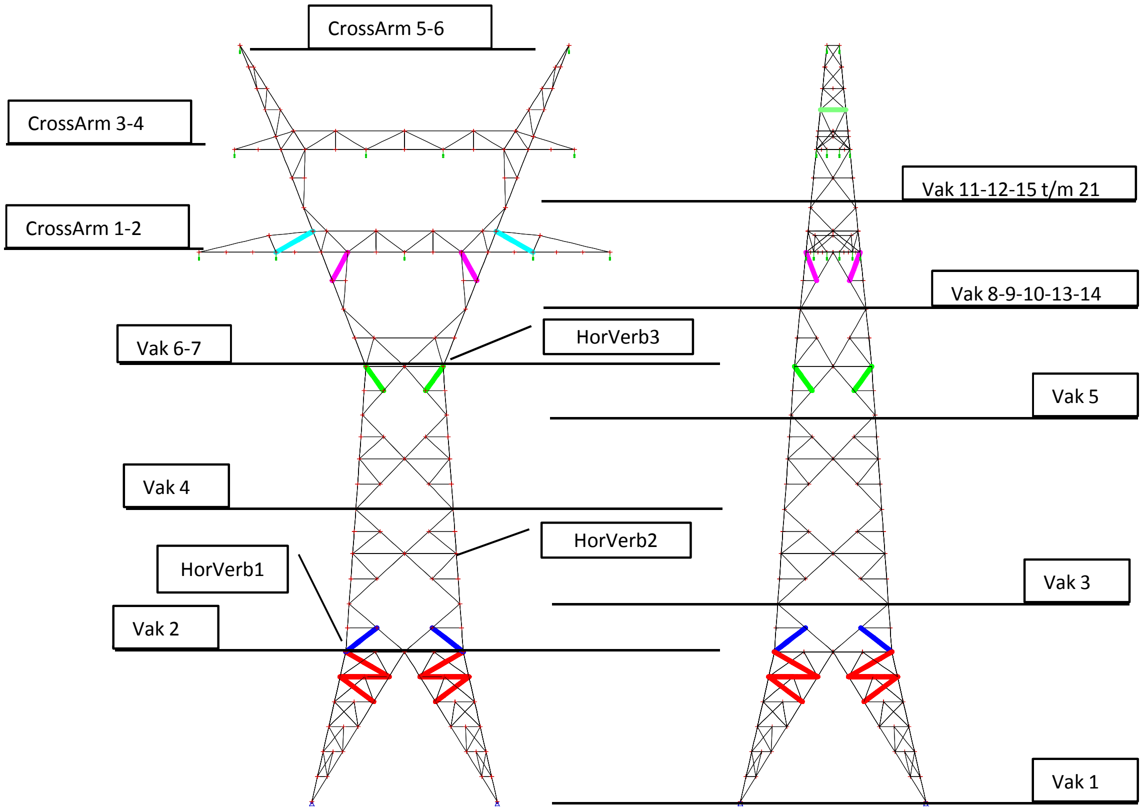
5.1 Overzicht spanningniveau's

Sheet nr.	Vak	Staaf type	Doorsnede	Staalkwal. N/mm^2	Lengte (m) $L_{y;cr}$	Lengte (m) $L_{v;cr}$	Bout type	Kwalit.	Aantal bouten	Max. U.C. verbinding	Max. druk N_{Ed} (kN)	U.C	Max. trek N_{Ed} (kN)	U.C	Punt last $F_{per.;sd}$ (kN)	U.C	Opmerkingen
M01	Vak 1	Randen L200x200x26	H200/200/26	235	1825	1825	M 30	4,6	10	0,79	-1698,53	0,84	1393,46	0,67	0,00	n.v.t.	
M02	Vak 1	Diagonalen L130x13x12	H130/130/12	235	2048	2048	M 24	4,6	4	1,00	-271,75	0,56	256,83	0,58	0,00	n.v.t.	
M03	Vak 1	Horizontale En verticale Knikverkorters L50x50x5	H50/50/5	235	2409	2409	M 16	4,6	1	0,08	-2,13	0,19	2,13	0,05	1,50	0,94	
M04	Vak 1	Horizontale en Verticale Knikverkorters L60x60x6	H60/60/6	235	2533	2533	M 16	4,6	1	0,46	-13,95	0,69	13,95	0,25	1,50	0,76	
M05	Vak 1	Horizontale en Verticale Knikverkorters L55x55x6	H55/55/6	235	4478	4478	M 16	4,6	1	0,10	-3,02	0,49	3,02	0,05	1,50	0,81	
M06	Vak 1	Horizontale en Verticale Knikverkorters L65x65x7	H65/65/7	235	3322	3322	M 16	4,6	1	0,79	-23,73	1,24	23,73	0,28	1,50	0,74	Staven uitwisselen in L70x70x7, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V06
M07	Vak 2	Randen L200x200x26	H200/200/26	235	1690	1690	M 30	4,6	10	0,73	-1568,46	0,76	1291,38	0,62	0,00	n.v.t.	
M08	Vak 2	Horizontale Knikverkorters L55x55x6	H55/55/6	235	1900	1900	M 16	4,6	1	0,69	-20,89	0,85	20,89	0,38	1,50	0,69	
M09	Vak 2	Schuine Knikverkorters L55x55x6	H55/55/6	235	2620	2620	M 16	4,6	1	0,96	-28,83	1,82	28,83	0,52	0,00	n.v.t.	Staven uitwisselen in L70x70x7, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V09
M10	Vak 2	Verticale verbanden L150x100x10	H150/100/10	235	4916	2458	M 24	4,6	3	0,82	-167,32	0,62	150,52	0,42	0,00	n.v.t.	
M11	Vak 3	Randen L200x200x26	H200/200/26	235	1786	1786	M 30	4,6	10	0,68	-1473,98	0,72	1210,73	0,58	0,00	n.v.t.	
M12	Vak 3	Horizontale Knikverkorters L55x55x6	H55/55/6	235	1676	1676	M 16	4,6	1	0,29	-8,74	0,31	8,74	0,16	1,50	0,61	
M13	Vak 3	Verticale Knikverkorters L55x55x6	H55/55/6	235	2360	2360	M 16	4,6	1	0,34	-10,16	0,57	10,16	0,18	0,00	n.v.t.	
M14	Vak 3	Verticale verbanden L150x100x12	H150/100/12	235	5028	2514	M 24	4,6	4	0,73	-181,18	0,58	197,44	0,46	0,00	n.v.t.	
M15	Vak 4	Randen L200x200x20	H200/200/20	235	1784	1784	M 30	4,6	10	0,55	-1185,13	0,58	952,01	0,46	0,00	n.v.t.	
M16	Vak 4	Horizontale Knikverkorters L50x50x5	H50/50/5	235	1460	1460	M 16	4,6	1	0,34	-9,47	0,41	9,47	0,21	1,50	0,82	
M16a	Vak 4	Horizontale staven L60x60x6	H60/60/6	235	2920	2920	M 16	4,6	1	0,17	-4,40	0,27	4,79	0,09	1,50	0,88	
M17	Vak 4	Verticale Knikverkorters L50x50x5	H50/50/5	235	2080	2080	M 16	4,6	1	0,26	-7,32	0,51	7,32	0,16	0,00	n.v.t.	
M18	Vak 4	Verticale verbanden L150x100x14	H150/100/14	235	4755	2377	M 24	4,6	4	0,89	-242,51	0,63	223,83	0,46	0,00	n.v.t.	
M19	Vak 5	Randen L200x200x20	H200/200/20	235	1784	1784	M 30	4,6	12	0,76	-981,56	0,48	769,91	0,37	0,00	n.v.t.	
M20	Vak 5	Horizontale Knikverkorters L50x50x5	H50/50/5	235	1250	1250	M 16	4,6	1	0,58	-16,33	0,59	16,33	0,35	1,50	0,65	
M21	Vak 5	Verticale Knikverkorters L50x50x5	H50/50/5	235	1720	1720	M 16	4,6	1	1,05	-29,39	1,52	29,39	0,64	0,00	n.v.t.	Staven uitwisselen in L55x55x6, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V21
M21a	Vak 5	Verticale verbanden L150x100x12	H150/100/12	235	4360	2180	M 24	4,6	5	0,82	-262,06	0,71	279,54	0,66	0,00	n.v.t.	
M22	Vak 6	Randen L200x200x16	H200/200/16	235	1784	1784	M 30	4,6	12	0,73	-939,90	0,46	764,96	0,37	0,00	n.v.t.	
M23	Vak 6	Verticale verbanden L150x100x12	H150/100/12	235	4765	2382	M 24	4,6	5	0,58	-195,42	0,59	194,50	0,46	0,00	n.v.t.	
M24	Vak 6	Horizontale Knikverkorters L50x50x5	H50/50/5	235	1250	1250	M 16	4,6	1	0,42	-9,75	0,35	11,67	0,25	1,50	0,65	
M25	Vak 6	Horizontale vrband L130x130x12	H130/130/12	235	3950	3950	M 24	4,6	2	0,84	-114,52	0,48	74,60	0,14	1,50	0,12	
M26	Vak 6	Vertical Knikverkorters L90x90x9	H90/90/9	235	2076	2076	M 24	4,6	2	0,78	-106,31	0,64	66,20	0,34	0,00	n.v.t.	
M27	Vak 6	Vertical Knikverkorters L50x50x5	H50/50/5	235	2571	2571	M 24	4,6	2	0,10	-14,20	0,80	10,49	0,20	0,00	n.v.t.	
M28	Vak 6	Verticale verbanden L180x180x16	H180/180/16	235	5642	2825	M 30	4,6	5	0,60	-322,86	0,46	301,42	0,39	0,00	n.v.t.	
M29	Vak 7-8-9-10-13-14	Randen L200x200x16	H200/200/16	235	4261	2141	M 30	4,6	6	0,98	-633,51	0,37	385,56	0,18	0,00	n.v.t.	
M30	Vak 7-8-9-10-13-14	Horizontale Knikverkorters L50x50x5	H50/50/5	235	880	880	M 16	4,6	1	0,36	-10,02	0,27	10,02	0,22	1,50	0,46	
M31	Vak 7-8-9-10-13-14	Verticale Knikverkorters L50x50x5	H50/50/5	235	2050	2050	M 16	4,6	1	0,59	-17,33	1,16	16,47	0,36	0,00	n.v.t.	Staven uitwisselen in L55x55x6, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V31
M32	Vak 7-8-9-10-13-14	Verticale verbanden L150x100x12	H150/100/12	235	4017	2019	M 30	4,6	4	0,68	-249,08	0,62	292,52	0,79	0,00	n.v.t.	
M33	Vak 7-8-9-10-13-14	Verticale verbanden L200x100x14	H200/100/14	235	4747	2380	M 24	4,6	5	0,84	-283,32	0,62	272,81	0,45	0,00	n.v.t.	
M34	Vak 7-8-9-10-13-14	Verticale verbanden L130x130x12	H130/130/12	235	4236	2206	M 30	4,6	3	0,88	-197,64	0,55	284,93	0,73	0,00	n.v.t.	
M35	Vak 7-8-9-10-13-14	Verticale verbanden L90x90x9	H90/90/9	235	4621	2366	M 20	4,6	2	0,81	-70,81	0,74	76,54	0,33	0,00	n.v.t.	
M36	Vak 7-8-9-10-13-14	Boven randen L160x160x15	H160/160/15	235	3680	3680	M 30	4,6	4	0,98	-214,88	0,43	346,36	0,59	0,00	n.v.t.	
M37	Vak 7-8-9-10-13-14	Horizontale verbanden L60x60x6	H60/60/6	235	3232	1616	M 16	4,6	1	0,82	-24,72	1,00	24,72	0,34	0,00	n.v.t.	
M38	Vak 7-8-9-10-13-14	Horizontale verbanden L100x10x10	H100/100/10	235	3507	3507	M 30	4,6	2	0,68	-110,32	0,88	145,43	0,75	0,00	n.v.t.	
M39	Vak 7-8-9-10-13-14	Horizontale en verticale Knikverkorters L50x50x5	H50/50/5	235	3227	3227	M 16	4,6	1	0,12	-3,40	0,48	3,40	0,07	0,00	n.v.t.	
M40	Vak 7-8-9-10-13-14	Verticale Knikverkorters L65x50x5	H65/50/5	235	1503	1503	M 20	4,6	1	0,16	-4,34	0,13	6,15	0,15	0,00	n.v.t.	
M41	Vak 7-8-9-10-13-14	Schuine verbanden L130x130x12	H130/130/12	235	2376	2376	M 24	4,6	4	0,69	-187,24	0,45	185,01	0,44	0,00	n.v.t.	
M42	Vak 7-8-9-10-13-14	Horizontale kruizen L90x90x9	H90/90/9	235	2540	2540	M 30	4,6	1	0,79	-47,70	0,61	47,51	0,50	0,00	n.v.t.	

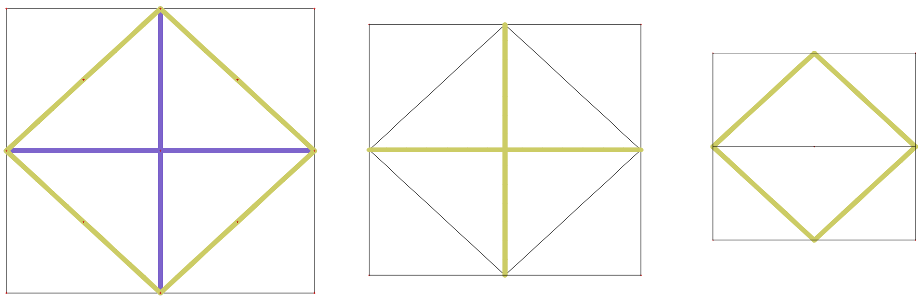
Sheet nr.	Vak	Staaf type	Doorsnede	Staalkwal. N/mm²	Lengte (m) $L_{y;cr}$	Lengte (m) $L_{v;cr}$	Bout type	Kwalit.	Aantal bouten	Max. U.C. verbinding	Max. druk N_{Ed} (kN)	U.C	Max. trek N_{Ed} (kN)	U.C	Punt last $F_{per;sd}$ (kN)	U.C	Opmerkingen
M43	Vak 10-11-12-15-t_m 21	Randen L140x140x13	H140/140/13	235	4356	2220	M 24	4,6	8	**0,78**	-422,37	**0,25**	317,23	**0,15**	0,00	**n.v.t.**	
M44	Vak 10-11-12-15-t_m 21	Horizontale Knikverkorters L50x50x5	H50/50/5	235	2536	1268	M 16	4,6	1	**0,08**	-2,21	**0,11**	2,21	**0,05**	0,00	**n.v.t.**	
M45	Vak 10-11-12-15-t_m 21	Verticale Knikverkorters L50x50x5	H50/50/5	235	2179	2179	M 16	4,6	1	**0,13**	-3,37	**0,25**	3,56	**0,08**	0,00	**n.v.t.**	
M46	Vak 10-11-12-15-t_m 21	Verticale verbanden L150x100x10	H150/100/10	235	4099	2089	M 24	4,6	2	**0,88**	-119,40	**0,36**	93,04	**0,29**	0,00	**n.v.t.**	
M47	Vak 10-11-12-15-t_m 21	Verticale verbanden L110x110x10	H110/110/10	235	5030	2651	M 20	4,6	3	**0,91**	-128,02	**0,83**	118,97	**0,35**	0,00	**n.v.t.**	
M48	Vak 10-11-12-15-t_m 21	Boven randen L120x120x11	H120/120/11	235	4465	4465	M 24	4,6	3	**0,75**	-102,18	**0,67**	152,02	**0,41**	0,00	**n.v.t.**	
M49	Vak 10-11-12-15-t_m 21	Boven randen L60x60x6	H60/60/6	235	1213	1213	M 20	4,6	3	**0,46**	0,00	**0,00**	60,86	**0,68**	0,00	**n.v.t.**	
M50	Vak 10-11-12-15-t_m 21	Horiz.-vert. en schuine Knikverkort. L50x50x5	H50/50/5	235	1993	1993	M 16	4,6	1	**0,46**	-13,75	**0,89**	11,11	**0,24**	1,50	**0,66**	
M51	Vak 10-11-12-15-t_m 21	Schuine verbanden L90x90x9	H90/90/9	235	1506	1506	M 24	4,6	3	**0,48**	-86,31	**0,37**	97,66	**0,42**	0,00	**n.v.t.**	
M52	Vak 10-11-12-15-t_m 21	Schuine verbanden L100x100x10	H100/100/10	235	2819	2819	M 24	4,6	3	**0,41**	-82,64	**0,50**	50,97	**0,18**	0,00	**n.v.t.**	
M53	Vak 10-11-12-15-t_m 21	Schuine verbanden L75x75x8	H75/75/8	235	2819	2819	M 24	4,6	2	**0,58**	-24,28	**0,36**	78,90	**0,52**	0,00	**n.v.t.**	
M54	Vak 10-11-12-15-t_m 21	Horizontale kruizen L60x60x6	H60/60/6	235	3100	1652	M 16	4,6	2	**0,67**	-40,40	**0,96**	39,76	**0,47**	0,00	**n.v.t.**	
M55	HorVerb1	Staven L150x150x14	H150/150/14	235	3800	3800	M 24	4,6	4	**0,84**	-227,23	**0,58**	185,17	**0,30**	1,50	**0,08**	
M56	HorVerb1	Staven L70x70x7	H70/70/7	235	5374	5374	M 20	4,6	2	**0,10**	-9,23	**0,51**	7,91	**0,07**	1,50	**1,02**	**Staven uitwisselen in L150x150x10, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V56**
M57	HorVerb1	Staven L75x75x8	H75/75/8	235	3800	3800	M 16	4,6	1	**0,06**	-1,81	**0,07**	1,81	**0,01**	1,50	**1,11**	**Staven uitwisselen in L75x75x8, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V57**
M58	HorVerb2	Staven L65x65x7	H65/65/7	235	3353	3353	M 16	4,6	1	**0,00**	0,00	**0,00**	0,00	**0,00**	1,50	**0,74**	
M59	HorVerb2	Staven L70x70x7	H70/70/7	235	4741	4741	M 20	4,6	2	**0,19**	-18,02	**0,80**	17,77	**0,16**	1,50	**0,90**	
M60	HorVerb2	Staven L60x60x6	H60/60/6	235	3353	3353	M 24	4,6	4	**0,00**	-0,27	**0,01**	0,08	**0,00**	1,50	**2,03**	**Staven uitwisselen in L75x75x8, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V60**
M61	HorVerb3	Staven L150x150x14	H150/150/14	235	2500	2500	M 30	4,6	4	**0,83**	-355,69	**0,58**	292,00	**0,50**	1,50	**0,05**	
M62	HorVerb3	Staven L90x90x9	H90/90/9	235	3536	3536	M 20	4,6	1	**1,08**	-50,62	**0,99**	49,64	**0,40**	1,50	**0,31**	**Bouten uitwisselen in kwaliteit 8.8, zie berekening sheet V62**
M63	HorVerb3	Staven L75x75x8	H75/75/8	235	5000	5000	M 16	4,6	1	**0,02**	-0,09	**0,01**	0,59	**0,00**	1,50	**0,73**	
M64	CrossArm 1-2	Bovern Randen	H100/100/10	235	4732	4732	M 24	4,6	3	**0,42**	0,00	**0,00**	85,65	**0,30**	0,00	**n.v.t.**	
M65	CrossArm 1-2	Horiz.-vert. en schuine Knikverkort. L50x50x5	H50/50/5	235	1888	1888	M 16	4,6	1	**0,45**	-13,56	**0,82**	2,05	**0,04**	0,00	**n.v.t.**	
M66	CrossArm 1-2	Horizontale kruizen L65x65x7	H65/65/7	235	2073	1600	M 20	4,6	2	**0,51**	-45,09	**0,52**	37,23	**0,37**	0,00	**n.v.t.**	
M67	CrossArm 1-2	Horizontale kruizen L55x55x6	H55/55/6	235	2713	1600	M 16	4,6	2	**0,36**	-18,04	**0,45**	21,49	**0,29**	0,00	**n.v.t.**	
M68	CrossArm 1-2	Horizontale kruizen L80x80x8	H80/80/8	235	4190	2445	M 16	4,6	2	**0,97**	-58,73	**0,80**	36,86	**0,24**	0,00	**n.v.t.**	
M69	CrossArm 1-2	Schuine verbanden L60x60x6	H80/80/8	235	4190	2445	M 16	4,6	2	**1,09**	0,00	**0,00**	65,96	**0,42**	0,00	**n.v.t.**	**Bouten uitwisselen in kwaliteit 8.8, zie berekening sheet V69**
M70	CrossArm 3-4	Boven renden L80x80x8	H80/80/8	235	2880	2880	M 20	4,6	3	**0,43**	0,00	**0,00**	61,01	**0,36**	0,00	**n.v.t.**	
M71	CrossArm 3-4	Horizontale kruizen L60x60x6	H65/65/7	235	2347	2347	M 16	4,6	2	**0,65**	-39,39	**0,73**	32,96	**0,31**	0,00	**n.v.t.**	
M72	CrossArm 5-6	Randen L80x80x8	H80/80/8	235	3350	2008	M 20	4,6	2	**1,23**	-115,31	**1,13**	81,75	**0,54**	0,00	**n.v.t.**	**Knikverkorters aanbrengen L50x50x5, en bouten uitwisselen in kwaliteit 8.8, zie berekening sheet V72**
M73	CrossArm 5-6	Schuine randen L100x75x7	H100/75/7	235	6950	1726	M 20	4,6	2	**0,63**	-42,19	**0,82**	59,45	**0,41**	0,00	**n.v.t.**	
M74	CrossArm 5-6	Horizontale en schuine knikverkorters L50x50x5	H50/50/5	235	1910	1910	M 16	4,6	1	**0,10**	-2,90	**0,18**	2,90	**0,06**	1,50	**0,51**	
M75	CrossArm 5-6	Verticale verbanden1 L50x50x5	H50/50/5	235	2162	2162	M 16	4,6	1	**0,49**	-13,65	**1,00**	13,63	**0,30**	0,00	**n.v.t.**	
M76	CrossArm 5-6	Verticale verbanden2 L50x50x5	H50/50/5	235	2184	1155	M 16	4,6	1	**0,70**	-20,99	**0,95**	19,63	**0,43**	0,00	**n.v.t.**	
	Vak 9-13-14 + CrossArm1-2	Ondre randen UNP200	UNP200	Zie uitvoer computerberekening SCIA						**0,66**							
		Dwars liggers HEB200	HEB200	Zie uitvoer computerberekening SCIA						**0,11**							
	Vak 15 t_m 21 + CrossArm3-4	Ondre randen UNP180	UNP180	Zie uitvoer computerberekening SCIA						**0,44**							
		Dwars liggers HEB180	HEB180	Zie uitvoer computerberekening SCIA						**0,05**							
V06	Vak 1	Horizontale en Verticale Knikverkorters L70x70x7	H70/70/7	355	3322	3322	M 16	8,8	1	**0,39**	-23,73	**0,96**	23,73	**0,20**	1,50	**0,42**	
V09	Vak 2	Schuine Knikverkorters L70x70x7	H70/70/7	355	2620	2620	M 16	8,8	1	**0,61**	-28,83	**0,80**	28,83	**0,32**	0,00	**n.v.t.**	
V21	Vak 5	Verticale Knikverkorters L55x55x6	H55/55/6	355	1720	1720	M 16	8,8	1	**0,62**	-29,39	**0,93**	29,39	**0,38**	0,00	**n.v.t.**	
V31	Vak 7-8-9-10-13-14	Verticale Knikverkorters L55x55x6	H55/55/6	355	2050	2050	M 16	8,8	1	**0,45**	-19,39	**0,80**	17,86	**0,23**	0,00	**n.v.t.**	
V56	HorVerb1	Staven L70x70x7	H70/70/7	355	5374	5374	M 20	8,8	2	**0,12**	-17,87	**0,93**	17,61	**0,11**	1,50	**0,67**	
V57	HorVerb1	Staven L75x75x8	H75/75/8	355	3800	3800	M 16	8,8	1	**0,03**	-1,81	**0,07**	1,81	**0,01**	1,50	**0,73**	
V60	HorVerb2	Staven L75x75x8	H75/75/8	355	3353	3353	M 24	8,8	4	**0,00**	-0,27	**0,00**	0,08	**0,00**	1,50	**0,65**	
V62	HorVerb3	Staven L90x90x9	H90/90/9	235	3536	3536	M 20	8,8	1	**0,72**	-50,62	**0,99**	49,64	**0,40**	1,50	**0,31**	
V69	CrossArm 1-2	Schuine verbanden L60x60x6	H80/80/8	235	4190	2445	M 16	8,8	2	**0,74**	0,00	**0,00**	65,96	**0,42**	0,00	**n.v.t.**	
V72	CrossArm 5-6	Randen L80x80x8	H80/80/8	235	2008	2008	M 20	8,8	2	**0,99**	-115,31	**0,96**	81,75	**0,54**	0,00	**n.v.t.**	

5.2 Overzicht Verzwaring

5.2.1 Overzicht van de Mast



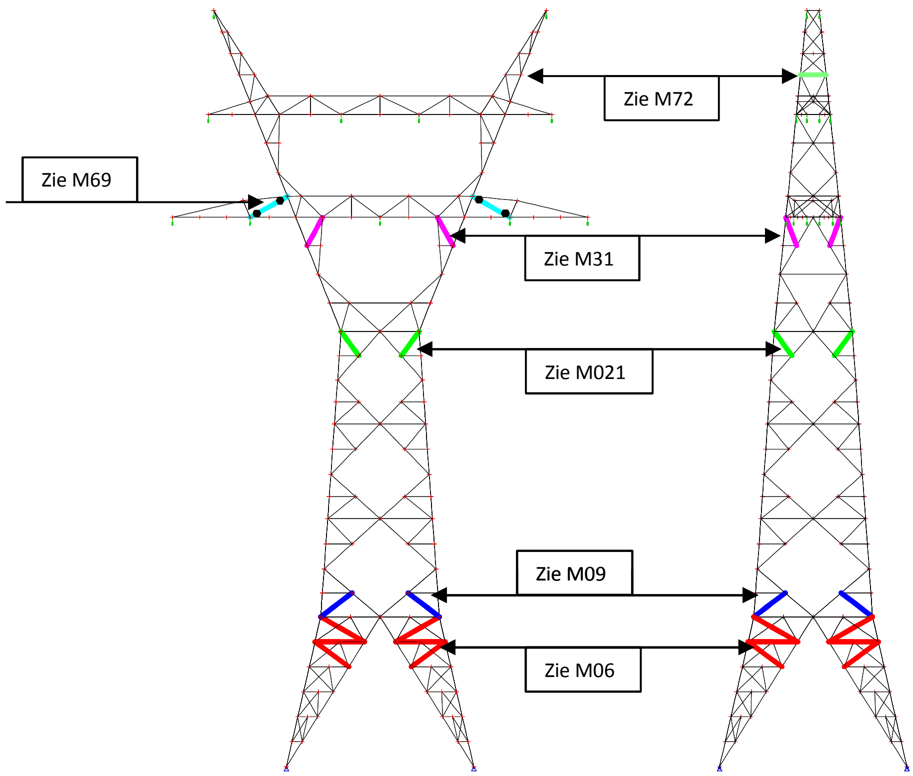
Voor / Achter **Zwart / Wit**



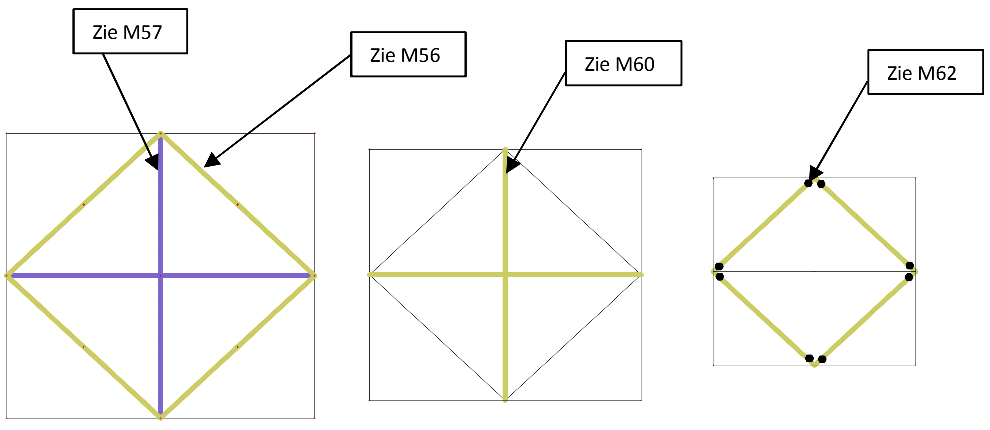
Bovenaanzicht Horizontale windverbanden

HorVerb1 **HorVerb2** **HorVerb3**

5.2.2 Uit te wisselen onderdelen van de mast



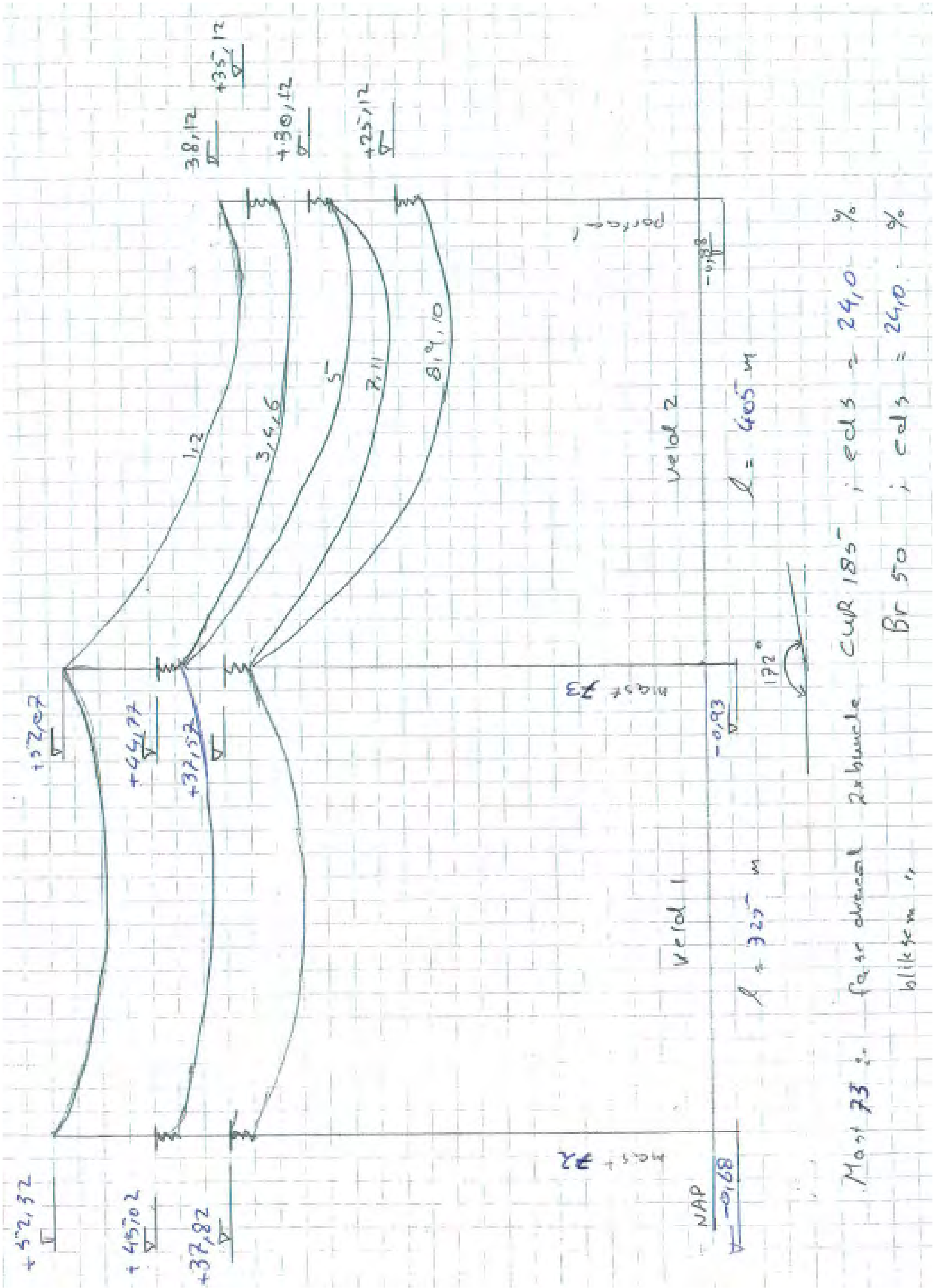
Voor / Achter **Zwart / Wit**



Bovenaanzicht Horizontale windverbanden

HorVerb1 **HorVerb2** **HorVerb3**

Bijlage A Geleiderbelastingen


mast 72
mast 73
portaal
NAP
veld 1
veld 2
l = 325 m
l = 405 m
172°
Mast 73 : fase draad 2x bundel CUR 185 ; eds = 24,0 %
bliksem " Br 50 ; eds = 24,0 %

KARAKTERISTIEKE GEGEVENS

Naam hoogspanningslijn	: 150 kv-Lijn Leiden-Zoetermeer			
Masttype	: hoekmast			
Mastnaam	: Mast 73 type HU			
Mastnummer	: 73			
Windgebied	: II			
Bebouwing	: Onbebouwd			
IJsgebied	: A			
Referentie periode	: 50			
			VELD 1	VELD 2
Minimum lijnhoek		[graden]	180	164
Maximum lijnhoek		[graden]	180	180
Veldlengte		[m]	325	405
Vaklengte		[m]	730	

* Belastingcombinaties en -factoren: NEN-EN 50341 -1 t/m -3, nov. 2001

* Berekend worden de "Ultimate Limit State" belastingcombinaties, (table 4.2.11/NL.1)

(1a) Permanente belasting met extreme windbelasting
(1b) Permanente belasting met extreme koude
(3) Permanente belasting met extreme ijsbelasting
(4) Permanente belasting met onderhoudsbelasting
(5a) Permanente belasting met torsie
(6) Permanente belasting

* Berekend worden de "Special Limit State" belastingcombinaties, (table 4.2.11/NL.3)

(1a) Permanente belasting met extreme windbelasting
(1b) Permanente belasting met extreme koude
(3) Permanente belasting met extreme ijsbelasting
(4) Permanente belasting met onderhoudsbelasting

* Alle belastingscomponenten zijn exclusief belastingsfactoren, uitgezonderd draadtrekkrachten jTrep

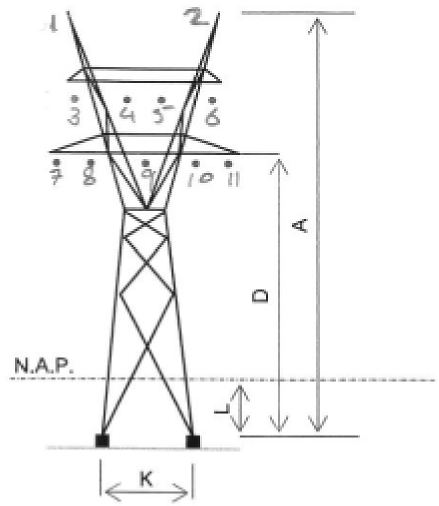
```
* Assenstelsel:     y    ^          Veld 2
                         |
y = lijnrichting         L---> x
                                    Veld 1
```

INVOERGEGEVENS VOOR DRAAD No.:1

Geleidersoort	:	bliksemdraad		
Geleidersoort + plaats	:	bliksemdr. boventrav		
Geleiders veld 1 en 2	:	Br 50		
Eigen gewicht draad	[N/m] :	4.43		
Draaddoorsnede	[mm2] :	48.36		
Draaddiameter	[mm] :	9		
Elasticiteitsmodulus	[N/mm2] :	130000		
Uitzettingscoëfficiënt	[1/°C] :	0.000017		
Breekbelasting draad	[N] :	28390.2		
Maximum percentage breekbelasting	[%] :	100		
EDS percentage breekbelasting	[%] :	24		
Hoogte draadbevestiging	[m] :	53.5		
Eigen gewicht isolator	[kN] :		0	0
Lengte isolator	[m] :		0	0
Diameter isolatorschaal	[mm] :		0	0
Hoogte isolator boven maaiveld	[m] :		0	0
Hoogte verschil draadbevestiging	[m] :		0.25	-13.95

(aangrenzende minus beschouwende mast)

(hoger = positief)



Mastnummer	:	73
Draadnummer	:	1,2
Geleidersoort + plaats	:	bliksemdr. boventrav
Geleiders veld 1 en 2	:	Br 50
Veldlengte voor gewicht [m]	:	416.79

BELASTING COMPONENTEN [kN]		GELEIDER		ISOLATOR	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 0.72	- 1.14	0.00	0.00
Qijs;rep		- 2.42	- 3.85	0.00	0.00
Qonderhoud;rep		0.00	0.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	1.32	1.50	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	-0.21	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	-0.03	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	0.66	0.56	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.08	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	0.66	0.98	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.14	0.00	0.00
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	1.32	1.55	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	0.66	0.77	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	0.66	0.77	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	0.00	0.00
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	7.69	8.64	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	-1.21	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	-0.17	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	3.84	3.19	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.45	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	3.84	5.62	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.79	0.00	0.00
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	7.69	8.89	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	3.84	4.45	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	3.84	4.45	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	0.00	0.00

Mastnummer	:	73
Draadnummer	:	1,2
Geleidersoort + plaats	:	bliksemdr. boventrav
Geleiders veld 1 en 2	:	Br 50

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

	Hoek t.o.v.lijnrichting	VELD 1 Min.lijnhoek	VELD 1 Max.lijnhoek	VELD 2 Min.lijnhoek	VELD 2 Max.lijnhoek
jTrep bij combinatie (1a)	90°	17.17	17.17	17.34	17.45
	0°	8.22	8.22	8.62	8.29
	45°	13.91	13.91	12.79	14.00
	-45°	13.91	13.91	15.07	14.00
jTrep bij combinatie (1b)	90°	9.94	9.94	9.64	9.65
	0°	9.20	9.20	8.97	8.95
	45°	9.58	9.58	9.21	9.31
	-45°	9.58	9.58	9.41	9.31
jTrep bij combinatie (3)	90°	35.64	35.64	38.31	38.41
	0°	30.15	30.15	32.97	32.84
	45°	33.11	33.11	35.04	35.81
	-45°	33.11	33.11	36.56	35.81
jTrep bij combinatie (4)	90°	9.07	9.07	9.04	9.05
	0°	8.37	8.37	8.38	8.37
	45°	8.73	8.73	8.62	8.72
	-45°	8.73	8.73	8.81	8.72
jTrep bij combinatie (5a)	90°	6.85		6.91	
jTrep bij combinatie (6)	90°	9.25		9.33	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

	Hoek t.o.v.lijnrichting	VELD 1 Min.lijnhoek	VELD 1 Max.lijnhoek	VELD 2 Min.lijnhoek	VELD 2 Max.lijnhoek
jTrep bij combinatie (1a)	90°	10.70	10.70	10.98	11.03
	0°	8.22	8.22	8.35	8.29
	45°	9.56	9.56	9.41	9.79
	-45°	9.56	9.56	10.16	9.79
jTrep bij combinatie (1b)	90°	9.62	9.62	9.36	9.37
	0°	9.20	9.20	8.96	8.95
	45°	9.42	9.42	9.11	9.17
	-45°	9.42	9.42	9.22	9.17
jTrep bij combinatie (3)	90°	18.78	18.78	19.37	19.51
	0°	7.71	7.71	8.78	8.40
	45°	14.64	14.64	13.76	15.24
	-45°	14.64	14.64	16.57	15.24
jTrep bij combinatie (4)	90°	8.78	8.78	8.78	8.79
	0°	8.37	8.37	8.38	8.37
	45°	8.58	8.58	8.52	8.58
	-45°	8.58	8.58	8.64	8.58

Geleidersoort + plaats	:	bliksemdr. boventrav	aantal draden in bundel:	1
Geleiders veld 1 en 2	:	Br 50	Draadnummer	1,2
Veldlengte voor gewicht	[m] :	416,79		

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-0,72	-1,14	0	0	**-0,72**	**-1,14**
Qijs;rep		-2,42	-3,85	0	0	**-2,42**	**-3,85**
Qonderhoud;rep		0	0			**0,00**	**0,00**
BIJ MINIMUM LIJNHOEKEN -						**0,00**	**0,00**
Qw;rep loodrecht lijn,	x	1,32	1,5	0	0	**1,32**	**1,50**
Qw;rep loodrecht lijn,	y	0	-0,21	0	0	**0,00**	**-0,21**
Qw;rep in lijnrichting,	x	0	-0,03	0	0	**0,00**	**-0,03**
Qw;rep in lijnrichting,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (+y, +x),	x	0,66	0,56	0	0	**0,66**	**0,56**
Qw;rep 45 graden (+y, +x),	y	0	-0,08	0	0	**0,00**	**-0,08**
Qw;rep 45 graden (-y, +x),	x	0,66	0,98	0	0	**0,66**	**0,98**
Qw;rep 45 graden (-y, +x),	y	0	-0,14	0	0	**0,00**	**-0,14**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	1,32	1,55	0	0	**1,32**	**1,55**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (+y, +x),	x	0,66	0,77	0	0	**0,66**	**0,77**
Qw;rep 45 graden (+y, +x),	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (-y, +x),	x	0,66	0,77	0	0	**0,66**	**0,77**
Qw;rep 45 graden (-y, +x),	y	0	0	0	0	**0,00**	**0,00**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	7,69	8,64	0	0	**7,69**	**8,64**
Qw;rep loodrecht lijn,	y	0	-1,21	0	0	**0,00**	**-1,21**
Qw;rep in lijnrichting,	x	0	-0,17	0	0	**0,00**	**-0,17**
Qw;rep in lijnrichting,	y	0	0,02	0	0	**0,00**	**0,02**
Qw;rep 45 graden (+y, +x),	x	3,84	3,19	0	0	**3,84**	**3,19**
Qw;rep 45 graden (+y, +x),	y	0	-0,45	0	0	**0,00**	**-0,45**
Qw;rep 45 graden (-y, +x),	x	3,84	5,62	0	0	**3,84**	**5,62**
Qw;rep 45 graden (-y, +x),	y	0	-0,79	0	0	**0,00**	**-0,79**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	7,69	8,89	0	0	**7,69**	**8,89**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (+y, +x),	x	3,84	4,45	0	0	**3,84**	**4,45**
Qw;rep 45 graden (+y, +x),	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (-y, +x),	x	3,84	4,45	0	0	**3,84**	**4,45**
Qw;rep 45 graden (-y, +x),	y	0	0	0	0	**0,00**	**0,00**

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		**VELD 2**		**VELD 1**		**VELD 2**	
	Hoek t,o,v,lijnrichting	**Min,lijnh**	**Max,lijnh**	**Min,lijnh**	**Max,lijnhoek**				
jTrep bij combinatie (1a)	90°	17,17	17,17	17,34	17,45	**17,17**	**17,17**	**17,34**	**17,45**
	0°	8,22	8,22	8,62	8,29				
	45°	13,91	13,91	12,79	14				
	-45°	13,91	13,91	15,07	14				
jTrep bij combinatie (1b)	90°	9,94	9,94	9,64	9,65	**9,94**	**9,94**	**9,64**	**9,65**
	0°	9,2	9,2	8,97	8,95				
	45°	9,58	9,58	9,21	9,31				
	-45°	9,58	9,58	9,41	9,31				
jTrep bij combinatie (3)	90°	35,64	35,64	38,31	38,41	**35,64**	**35,64**	**38,31**	**38,41**
	0°	30,15	30,15	32,97	32,84				
	45°	33,11	33,11	35,04	35,81				
	-45°	33,11	33,11	36,56	35,81				
jTrep bij combinatie (4)	90°	9,07	9,07	9,04	9,05	**9,07**	**9,07**	**9,04**	**9,05**
	0°	8,37	8,37	8,38	8,37				
	45°	8,73	8,73	8,62	8,72				
	-45°	8,73	8,73	8,81	8,72				
jTrep bij combinatie (5a)	90°	6,85		6,91		**6,85**		**6,91**	
jTrep bij combinatie (6)	90°	9,25		9,33		**9,25**		**9,33**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	10,7	10,7	10,98	11,03	**10,7**	**10,7**	**10,98**	**11,03**
	0°	8,22	8,22	8,35	8,29				
	45°	9,56	9,56	9,41	9,79				
	-45°	9,56	9,56	10,16	9,79				
jTrep bij combinatie (1b)	90°	9,62	9,62	9,36	9,37	**9,62**	**9,62**	**9,36**	**9,37**
	0°	9,2	9,2	8,96	8,95				
	45°	9,42	9,42	9,11	9,17				
	-45°	9,42	9,42	9,22	9,17				
jTrep bij combinatie (3)	90°	18,78	18,78	19,37	19,51	**18,78**	**18,78**	**19,37**	**19,51**
	0°	7,71	7,71	8,78	8,4				
	45°	14,64	14,64	13,76	15,24				
	-45°	14,64	14,64	16,57	15,24				
jTrep bij combinatie (4)	90°	8,78	8,78	8,78	8,79	**8,78**	**8,78**	**8,78**	**8,79**
	0°	8,37	8,37	8,38	8,37				
	45°	8,58	8,58	8,52	8,58				
	-45°	8,58	8,58	8,64	8,58				

KARAKTERISTIEKE GEGEVENS

Naam hoogspanningslijn	: 150 kv-Lijn Leiden-Zoetermeer		
Masttype	: hoekmast		
Mastnaam	: Mast 73 type HU		
Mastnummer	: 73		
Windgebied	: II		
Bebouwing	: Onbebouwd		
IJsgebied	: B		
Referentie periode	: 50		

		VELD 1	VELD 2
Minimum lijnhoek	[graden]	180	164
Maximum lijnhoek	[graden]	180	180
Veldlengte	[m]	325	405
Vaklengte	[m]	730	

* Belastingcombinaties en -factoren: NEN-EN 50341 -1 t/m -3, nov. 2001

* Berekend worden de "Ultimate Limit State" belastingcombinaties, (table 4.2.11/NL.1)

(1a) Permanente belasting met extreme windbelasting
(1b) Permanente belasting met extreme koude
(3) Permanente belasting met extreme ijsbelasting
(4) Permanente belasting met onderhoudsbelasting
(5a) Permanente belasting met torsie
(6) Permanente belasting

* Berekend worden de "Special Limit State" belastingcombinaties, (table 4.2.11/NL.3)

(1a) Permanente belasting met extreme windbelasting
(1b) Permanente belasting met extreme koude
(3) Permanente belasting met extreme ijsbelasting
(4) Permanente belasting met onderhoudsbelasting

* Alle belastingscomponenten zijn exclusief belastingsfactoren, uitgezonderd draadtrekkrachten jTrep
* Assenstelsel: y ^ Veld 2
|
y = lijnrichting L---> x
Veld 1

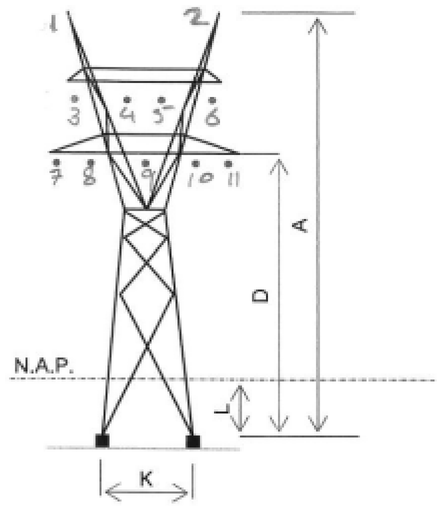
INVOERGEGEVENS VOOR DRAAD No.:1

Geleidersoort	:	fasedraad	
Geleidersoort + plaats	:	fasedr. boventravers	
Geleiders veld 1 en 2	:	CU185	
Eigen gewicht draad	[N/m] :	16.62	
Draaddoorsnede	[mm2] :	181.6	
Draaddiameter	[mm] :	17.5	
Elasticiteitsmodulus	[N/mm2] :	130000	
Uitzettingscoëfficiënt	[1/°C] :	.000017	
Breekbelasting draad	[N] :	72760.5	
Maximum percentage breekbelasting	[%] :	100	
EDS percentage breekbelasting	[%] :	24	
Hoogte draadbevestiging	[m] :	44.7	

Eigen gewicht isolator	[kN] :	2.5	2.5
Lengte isolator	[m] :	2	2
Diameter isolatorschaal	[mm] :	170	170
Hoogte isolator boven maaiveld	[m] :	46.2	46.2
Hoogte verschil draadbevestiging	[m] :	0.25	-9.65

(aangrenzende minus beschouwende mast)

(hoger = positief)



INVOERGEGEVENS VOOR DRAAD No.:2

Geleidersoort	:	fasedraad
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185
Eigen gewicht draad	[N/m] :	16.62
Draaddoorsnede	[mm2] :	181.6
Draaddiameter	[mm] :	17.5
Elasticiteitsmodulus	[N/mm2] :	130000
Uitzettingscoëfficiënt	[1/°C] :	.000017
Breekbelasting draad	[N] :	72760.5
Maximum percentage breekbelasting	[%] :	100
EDS percentage breekbelasting	[%] :	24
Hoogte draadbevestiging	[m] :	44.7

Eigen gewicht isolator	[kN] :	2.5	2.5
Lengte isolator	[m] :	2	2
Diameter isolatorschaal	[mm] :	170	170
Hoogte isolator boven maaiveld	[m] :	46.2	46.2
Hoogte verschil draadbevestiging	[m] :	0.25	-14.65

(aangrenzende minus beschouwende mast)

(hoger = positief)

INVOERGEGEVENS VOOR DRAAD No.:3

Geleidersoort	:	fasedraad		
Geleidersoort + plaats	:	fasedr. ondertravers		
Geleiders veld 1 en 2	:	CU185		
Eigen gewicht draad	[N/m] :	16.62		
Draaddoorsnede	[mm2] :	181.6		
Draaddiameter	[mm] :	17.5		
Elasticiteitsmodulus	[N/mm2] :	130000		
Uitzettingscoëfficiënt	[1/°C] :	.000017		
Breekbelasting draad	[N] :	72760.5		
Maximum percentage breekbelasting	[%] :	100		
EDS percentage breekbelasting	[%] :	24		
Hoogte draadbevestiging	[m] :	37.5		
Eigen gewicht isolator	[kN] :		2.5	2.5
Lengte isolator	[m] :		2	2
Diameter isolatorschaal	[mm] :		170	170
Hoogte isolator boven maaiveld	[m] :		39	39
Hoogte verschil draadbevestiging	[m] :		0.25	-7.45

(aangrenzende minus beschouwende mast)

(hoger = positief)

INVOERGEGEVENS VOOR DRAAD No.:4

Geleidersoort	:	Geleidersoort + plaats:fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185
Eigen gewicht draad	[N/m] :	16.62
Draaddoorsnede	[mm2] :	181.6
Draaddiameter	[mm] :	17.5
Elasticiteitsmodulus	[N/mm2] :	130000
Uitzettingscoëfficiënt	[1/°C] :	.000017
Breekbelasting draad	[N] :	72760.5
Maximum percentage breekbelasting	[%] :	100
EDS percentage breekbelasting	[%] :	24
Hoogte draadbevestiging	[m] :	37.5

Eigen gewicht isolator	[kN] :	2.5	2.5
Lengte isolator	[m] :	2	2
Diameter isolatorschaal	[mm] :	170	170
Hoogte isolator boven maaiveld	[m] :	39	39
Hoogte verschil draadbevestiging	[m] :	0.25	-12.45

(aangrenzende minus beschouwende mast)

(hoger = positief)

Mastnummer	:	73
Draadnummer	:	3,4,6
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	389.23

BELASTING COMPONENTEN [kN]		GELEIDER		ISOLATOR	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 2.70	- 3.81	- 2.50	- 2.50
Qijs;rep		- 1.22	- 1.73	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.17	2.39	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.34	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.05	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.09	0.88	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.12	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.09	1.55	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.22	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.17	2.46	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.09	1.23	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.09	1.23	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.56	6.11	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.86	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.12	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	2.78	2.26	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.32	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	2.78	3.98	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.56	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.56	6.30	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	2.78	3.15	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	2.78	3.15	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40

Mastnummer	:	73
Draadnummer	:	3,4,6
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2	
	Hoek t.o.v.lijnrichting	**Min.lijnhoek**	**Max.lijnhoek**	**Min.lijnhoek**	**Max.lijnhoek**
jTrep bij combinatie (1a)	90°	29.41	29.41	28.57	28.69
	0°	21.21	21.21	21.61	21.45
	45°	25.71	25.71	24.36	25.37
	-45°	25.71	25.71	26.33	25.37
jTrep bij combinatie (1b)	90°	22.95	22.95	22.64	22.65
	0°	22.53	22.53	22.30	22.29
	45°	22.74	22.74	22.42	22.47
	-45°	22.74	22.74	22.52	22.47
jTrep bij combinatie (3)	90°	36.37	36.37	36.35	36.40
	0°	32.94	32.94	33.46	33.40
	45°	34.71	34.71	34.53	34.94
	-45°	34.71	34.71	35.35	34.94
jTrep bij combinatie (4)	90°	28.37	28.37	26.69	26.70
	0°	27.92	27.92	26.32	26.31
	45°	28.15	28.15	26.45	26.51
	-45°	28.15	28.15	26.56	26.51
jTrep bij combinatie (5a)	90°	17.67		17.87	
jTrep bij combinatie (6)	90°	23.86		24.13	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

		VELD 1		VELD 2	
	Hoek t.o.v.lijnrichting	**Min.lijnhoek**	**Max.lijnhoek**	**Min.lijnhoek**	**Max.lijnhoek**
jTrep bij combinatie (1a)	90°	23.40	23.40	23.41	23.45
	0°	21.21	21.21	21.49	21.45
	45°	22.34	22.34	22.20	22.47
	-45°	22.34	22.34	22.75	22.47
jTrep bij combinatie (1b)	90°	22.79	22.79	22.51	22.52
	0°	22.53	22.53	22.30	22.29
	45°	22.66	22.66	22.37	22.40
	-45°	22.66	22.66	22.44	22.40
jTrep bij combinatie (3)	90°	26.76	26.76	26.65	26.70
	0°	23.69	23.69	24.09	24.03
	45°	25.29	25.29	25.04	25.41
	-45°	25.29	25.29	25.77	25.41
jTrep bij combinatie (4)	90°	27.15	27.15	25.89	25.90
	0°	26.86	26.86	25.65	25.65
	45°	27.01	27.01	25.74	25.77
	-45°	27.01	27.01	25.81	25.77

Mastnummer	:	73
Draadnummer	:	5
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	402.20

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 2.70	- 4.03	- 2.50	- 2.50
Qijs;rep		- 1.22	- 1.83	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.17	2.31	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.33	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.05	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.09	0.85	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.12	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.09	1.50	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.21	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.17	2.38	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.09	1.19	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.09	1.19	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.56	5.92	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.83	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.12	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	2.78	2.19	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.31	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	2.78	3.85	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.54	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.56	6.09	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	2.78	3.05	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	2.78	3.05	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40

Mastnummer	:	73
Draadnummer	:	5
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2	
	Hoek t.o.v.lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	29.41	29.41	28.26	28.37
	0°	21.21	21.21	21.66	21.50
	45°	25.71	25.71	24.25	25.21
	-45°	25.71	25.71	26.12	25.21
jTrep bij combinatie (1b)	90°	22.95	22.95	22.68	22.68
	0°	22.53	22.53	22.36	22.35
	45°	22.74	22.74	22.47	22.52
	-45°	22.74	22.74	22.56	22.52
jTrep bij combinatie (3)	90°	36.37	36.37	36.27	36.32
	0°	32.94	32.94	33.55	33.49
	45°	34.71	34.71	34.55	34.94
	-45°	34.71	34.71	35.33	34.94
jTrep bij combinatie (4)	90°	28.37	28.37	26.43	26.44
	0°	27.92	27.92	26.08	26.07
	45°	28.15	28.15	26.21	26.26
	-45°	28.15	28.15	26.31	26.26
jTrep bij combinatie (5a)	90°	17.67		17.92	
jTrep bij combinatie (6)	90°	23.86		24.19	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

		VELD 1		VELD 2	
	Hoek t.o.v.lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	23.40	23.40	23.36	23.39
	0°	21.21	21.21	21.54	21.50
	45°	22.34	22.34	22.21	22.47
	-45°	22.34	22.34	22.73	22.47
jTrep bij combinatie (1b)	90°	22.79	22.79	22.56	22.56
	0°	22.53	22.53	22.36	22.35
	45°	22.66	22.66	22.43	22.46
	-45°	22.66	22.66	22.48	22.46
jTrep bij combinatie (3)	90°	26.76	26.76	26.57	26.61
	0°	23.69	23.69	24.15	24.10
	45°	25.29	25.29	25.04	25.39
	-45°	25.29	25.29	25.73	25.39
jTrep bij combinatie (4)	90°	27.15	27.15	25.72	25.72
	0°	26.86	26.86	25.49	25.49
	45°	27.01	27.01	25.57	25.61
	-45°	27.01	27.01	25.64	25.61

Mastnummer	:	73
Draadnummer	:	7,11
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	383.52

BELASTING COMPONENTEN [kN]		GELEIDER		ISOLATOR	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 2.70	- 3.71	- 2.50	- 2.50
Qijs;rep		- 1.22	- 1.68	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.02	2.19	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.31	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.04	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.01	0.81	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.11	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.01	1.42	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.20	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.02	2.26	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.01	1.13	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.01	1.13	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.17	5.60	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.79	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.11	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	2.59	2.07	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.29	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	2.59	3.65	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.51	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.17	5.77	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	2.59	2.89	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	2.59	2.89	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39

Mastnummer	:	73
Draadnummer	:	7,11
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2	
	Hoek t.o.v.lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	28.47	28.47	27.54	27.65
	0°	21.21	21.21	21.56	21.42
	45°	25.16	25.16	23.89	24.76
	-45°	25.16	25.16	25.59	24.76
jTrep bij combinatie (1b)	90°	22.89	22.89	22.56	22.57
	0°	22.53	22.53	22.27	22.27
	45°	22.71	22.71	22.38	22.42
	-45°	22.71	22.71	22.46	22.42
jTrep bij combinatie (3)	90°	35.93	35.93	35.86	35.90
	0°	32.94	32.94	33.42	33.36
	45°	34.47	34.47	34.31	34.66
	-45°	34.47	34.47	35.01	34.66
jTrep bij combinatie (4)	90°	28.31	28.31	26.75	26.75
	0°	27.92	27.92	26.43	26.43
	45°	28.12	28.12	26.54	26.59
	-45°	28.12	28.12	26.63	26.59
jTrep bij combinatie (5a)	90°	17.67		17.85	
jTrep bij combinatie (6)	90°	23.86		24.10	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

		VELD 1		VELD 2	
	Hoek t.o.v.lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	23.12	23.12	23.08	23.12
	0°	21.21	21.21	21.46	21.42
	45°	22.19	22.19	22.05	22.29
	-45°	22.19	22.19	22.52	22.29
jTrep bij combinatie (1b)	90°	22.75	22.75	22.45	22.46
	0°	22.53	22.53	22.27	22.27
	45°	22.64	22.64	22.34	22.36
	-45°	22.64	22.64	22.39	22.36
jTrep bij combinatie (3)	90°	26.37	26.37	26.22	26.27
	0°	23.69	23.69	24.05	24.00
	45°	25.08	25.08	24.85	25.16
	-45°	25.08	25.08	25.47	25.16
jTrep bij combinatie (4)	90°	27.11	27.11	25.93	25.93
	0°	26.86	26.86	25.73	25.72
	45°	26.99	26.99	25.80	25.83
	-45°	26.99	26.99	25.86	25.83

Mastnummer	:	73
Draadnummer	:	8,9,10
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	396.49

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 2.70	- 3.93	- 2.50	- 2.50
Qijs;rep		- 1.22	- 1.78	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.02	2.10	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.29	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.04	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.01	0.77	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.11	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.01	1.36	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.19	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.02	2.16	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.01	1.08	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.01	1.08	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.17	5.36	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.75	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.11	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	2.59	1.98	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.28	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	2.59	3.49	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.49	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.17	5.52	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	2.59	2.76	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	2.59	2.76	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39

Mastnummer	:	73
Draadnummer	:	8,9,10
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

	Hoek t.o.v.lijnrichting	VELD 1 Min.lijnhoek	VELD 1 Max.lijnhoek	VELD 2 Min.lijnhoek	VELD 2 Max.lijnhoek
jTrep bij combinatie (1a)	90°	28.47	28.47	27.15	27.25
	0°	21.21	21.21	21.61	21.48
	45°	25.16	25.16	23.75	24.56
	-45°	25.16	25.16	25.33	24.56
jTrep bij combinatie (1b)	90°	22.89	22.89	22.59	22.60
	0°	22.53	22.53	22.33	22.33
	45°	22.71	22.71	22.42	22.46
	-45°	22.71	22.71	22.50	22.46
jTrep bij combinatie (3)	90°	35.93	35.93	35.75	35.79
	0°	32.94	32.94	33.50	33.45
	45°	34.47	34.47	34.32	34.64
	-45°	34.47	34.47	34.96	34.64
jTrep bij combinatie (4)	90°	28.31	28.31	26.47	26.47
	0°	27.92	27.92	26.18	26.18
	45°	28.12	28.12	26.28	26.33
	-45°	28.12	28.12	26.37	26.33
jTrep bij combinatie (5a)	90°	17.67		17.90	
jTrep bij combinatie (6)	90°	23.86		24.16	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

	Hoek t.o.v.lijnrichting	VELD 1 Min.lijnhoek	VELD 1 Max.lijnhoek	VELD 2 Min.lijnhoek	VELD 2 Max.lijnhoek
jTrep bij combinatie (1a)	90°	23.12	23.12	23.01	23.04
	0°	21.21	21.21	21.51	21.48
	45°	22.19	22.19	22.06	22.27
	-45°	22.19	22.19	22.49	22.27
jTrep bij combinatie (1b)	90°	22.75	22.75	22.49	22.50
	0°	22.53	22.53	22.33	22.33
	45°	22.64	22.64	22.39	22.41
	-45°	22.64	22.64	22.43	22.41
jTrep bij combinatie (3)	90°	26.37	26.37	26.11	26.15
	0°	23.69	23.69	24.11	24.07
	45°	25.08	25.08	24.84	25.13
	-45°	25.08	25.08	25.42	25.13
jTrep bij combinatie (4)	90°	27.11	27.11	25.74	25.75
	0°	26.86	26.86	25.56	25.55
	45°	26.99	26.99	25.62	25.65
	-45°	26.99	26.99	25.68	25.65

Geleidersoort + plaats	:	fasedr. boventravers	aantal draden in bundel: 2
Geleiders veld 1 en 2	:	CU185	Draadnummer 3,4,6
Veldlengte voor gewicht [m]	:	389,23	

BELASTING COMPONENTEN [kN]		GELEIDER		ISOLATOR			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-2,7	-3,81	-2,5	-2,5	**-7,90**	**-10,12**
Qijs;rep		-1,22	-1,73	0	0	**-2,44**	**-3,46**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,17	2,39	0,57	0,57	**4,91**	**5,35**
Qw;rep loodrecht lijn,	y	0	-0,34	0	0	**0,00**	**-0,68**
Qw;rep in lijnrichting,	x	0	-0,05	0	0	**0,00**	**-0,10**
Qw;rep in lijnrichting,	y	0	0,01	0,57	0,57	**0,57**	**0,59**
Qw;rep 45 graden (+y, +x),	x	1,09	0,88	0,4	0,4	**2,58**	**2,16**
Qw;rep 45 graden (+y, +x),	y	0	-0,12	0,4	0,4	**0,40**	**0,16**
Qw;rep 45 graden (-y, +x),	x	1,09	1,55	0,4	0,4	**2,58**	**3,50**
Qw;rep 45 graden (-y, +x),	y	0	-0,22	-0,4	-0,4	**-0,40**	**-0,84**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,17	2,46	0,57	0,57	**4,91**	**5,49**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,09	1,23	0,4	0,4	**2,58**	**2,86**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	1,09	1,23	0,4	0,4	**2,58**	**2,86**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,56	6,11	0,57	0,57	**11,69**	**12,79**
Qw;rep loodrecht lijn,	y	0	-0,86	0	0	**0,00**	**-1,72**
Qw;rep in lijnrichting,	x	0	-0,12	0	0	**0,00**	**-0,24**
Qw;rep in lijnrichting,	y	0	0,02	0,57	0,57	**0,57**	**0,61**
Qw;rep 45 graden (+y, +x),	x	2,78	2,26	0,4	0,4	**5,96**	**4,92**
Qw;rep 45 graden (+y, +x),	y	0	-0,32	0,4	0,4	**0,40**	**-0,24**
Qw;rep 45 graden (-y, +x),	x	2,78	3,98	0,4	0,4	**5,96**	**8,36**
Qw;rep 45 graden (-y, +x),	y	0	-0,56	-0,4	-0,4	**-0,40**	**-1,52**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,56	6,3	0,57	0,57	**11,69**	**13,17**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	2,78	3,15	0,4	0,4	**5,96**	**6,70**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	2,78	3,15	0,4	0,4	**5,96**	**6,70**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	29,41	29,41	28,57	28,69	**58,82**	**58,82**	**57,14**	**57,38**
	0°	21,21	21,21	21,61	21,45				
	45°	25,71	25,71	24,36	25,37				
	-45°	25,71	25,71	26,33	25,37				
jTrep bij combinatie (1b)	90°	22,95	22,95	22,64	22,65	**45,9**	**45,9**	**45,28**	**45,3**
	0°	22,53	22,53	22,3	22,29				
	45°	22,74	22,74	22,42	22,47				
	-45°	22,74	22,74	22,52	22,47				
jTrep bij combinatie (3)	90°	36,37	36,37	36,35	36,4	**72,74**	**72,74**	**72,7**	**72,8**
	0°	32,94	32,94	33,46	33,4				
	45°	34,71	34,71	34,53	34,94				
	-45°	34,71	34,71	35,35	34,94				
jTrep bij combinatie (4)	90°	28,37	28,37	26,69	26,7	**56,74**	**56,74**	**53,38**	**53,4**
	0°	27,92	27,92	26,32	26,31				
	45°	28,15	28,15	26,45	26,51				
	-45°	28,15	28,15	26,56	26,51				
jTrep bij combinatie (5a)	90°	17,67		17,87		**35,34**		**35,74**	
jTrep bij combinatie (6)	90°	23,86		24,13		**47,72**		**48,26**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4,2,11/NL,3)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	23,4	23,4	23,41	23,45	**46,8**	**46,8**	**46,82**	**46,9**
	0°	21,21	21,21	21,49	21,45				
	45°	22,34	22,34	22,2	22,47				
	-45°	22,34	22,34	22,75	22,47				
jTrep bij combinatie (1b)	90°	22,79	22,79	22,51	22,52	**45,58**	**45,58**	**45,02**	**45,04**
	0°	22,53	22,53	22,3	22,29				
	45°	22,66	22,66	22,37	22,4				
	-45°	22,66	22,66	22,44	22,4				
jTrep bij combinatie (3)	90°	26,76	26,76	26,65	26,7	**53,52**	**53,52**	**53,3**	**53,4**
	0°	23,69	23,69	24,09	24,03				
	45°	25,29	25,29	25,04	25,41				
	-45°	25,29	25,29	25,77	25,41				
jTrep bij combinatie (4)	90°	27,15	27,15	25,89	25,9	**54,3**	**54,3**	**51,78**	**51,8**
	0°	26,86	26,86	25,65	25,65				
	45°	27,01	27,01	25,74	25,77				
	-45°	27,01	27,01	25,81	25,77				

Geleidersoort + plaats	:	fasedr. boventravers	aantal draden in bundel:	2
Geleiders veld 1 en 2	:	CU185	Draadnummer	5
Veldlengte voor gewicht [m]	:	402,2		

BELASTING COMPONENTEN [kN]		GELEIDER		ISOLATOR			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-2,7	-4,03	-2,5	-2,5	**-7,90**	**-10,56**
Qijs;rep		-1,22	-1,83	0	0	**-2,44**	**-3,66**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,17	2,31	0,57	0,57	**4,91**	**5,19**
Qw;rep loodrecht lijn,	y	0	-0,33	0	0	**0,00**	**-0,66**
Qw;rep in lijnrichting,	x	0	-0,05	0	0	**0,00**	**-0,10**
Qw;rep in lijnrichting,	y	0	0,01	0,57	0,57	**0,57**	**0,59**
Qw;rep 45 graden (+y, +x),	x	1,09	0,85	0,4	0,4	**2,58**	**2,10**
Qw;rep 45 graden (+y, +x),	y	0	-0,12	0,4	0,4	**0,40**	**0,16**
Qw;rep 45 graden (-y, +x),	x	1,09	1,5	0,4	0,4	**2,58**	**3,40**
Qw;rep 45 graden (-y, +x),	y	0	-0,21	-0,4	-0,4	**-0,40**	**-0,82**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,17	2,38	0,57	0,57	**4,91**	**5,33**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,09	1,19	0,4	0,4	**2,58**	**2,78**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	1,09	1,19	0,4	0,4	**2,58**	**2,78**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,56	5,92	0,57	0,57	**11,69**	**12,41**
Qw;rep loodrecht lijn,	y	0	-0,83	0	0	**0,00**	**-1,66**
Qw;rep in lijnrichting,	x	0	-0,12	0	0	**0,00**	**-0,24**
Qw;rep in lijnrichting,	y	0	0,02	0,57	0,57	**0,57**	**0,61**
Qw;rep 45 graden (+y, +x),	x	2,78	2,19	0,4	0,4	**5,96**	**4,78**
Qw;rep 45 graden (+y, +x),	y	0	-0,31	0,4	0,4	**0,40**	**-0,22**
Qw;rep 45 graden (-y, +x),	x	2,78	3,85	0,4	0,4	**5,96**	**8,10**
Qw;rep 45 graden (-y, +x),	y	0	-0,54	-0,4	-0,4	**-0,40**	**-1,48**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,56	6,09	0,57	0,57	**11,69**	**12,75**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	2,78	3,05	0,4	0,4	**5,96**	**6,50**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	2,78	3,05	0,4	0,4	**5,96**	**6,50**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

	VEL	VELD 2				VELD 1		VELD 2	
	Hoe	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	29,41	29,41	28,26	28,37	**58,82**	**58,82**	**56,52**	**56,74**
	0°	21,21	21,21	21,66	21,5				
	45°	25,71	25,71	24,25	25,21				
	-45°	25,71	25,71	26,12	25,21				
jTrep bij combinatie (1b)	90°	22,95	22,95	22,68	22,68	**45,9**	**45,9**	**45,36**	**45,36**
	0°	22,53	22,53	22,36	22,35				
	45°	22,74	22,74	22,47	22,52				
	-45°	22,74	22,74	22,56	22,52				
jTrep bij combinatie (3)	90°	36,37	36,37	36,27	36,32	**72,74**	**72,74**	**72,54**	**72,64**
	0°	32,94	32,94	33,55	33,49				
	45°	34,71	34,71	34,55	34,94				
	-45°	34,71	34,71	35,33	34,94				
jTrep bij combinatie (4)	90°	28,37	28,37	26,43	26,44	**56,74**	**56,74**	**52,86**	**52,88**
	0°	27,92	27,92	26,08	26,07				
	45°	28,15	28,15	26,21	26,26				
	-45°	28,15	28,15	26,31	26,26				
jTrep bij combinatie (5a)	90°	17,67		17,92		**35,34**		**35,84**	
jTrep bij combinatie (6)	90°	23,86		24,19		**47,72**		**48,38**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	23,4	23,4	23,36	23,39	**46,8**	**46,8**	**46,72**	**46,78**
	0°	21,21	21,21	21,54	21,5				
	45°	22,34	22,34	22,21	22,47				
	-45°	22,34	22,34	22,73	22,47				
jTrep bij combinatie (1b)	90°	22,79	22,79	22,56	22,56	**45,58**	**45,58**	**45,12**	**45,12**
	0°	22,53	22,53	22,36	22,35				
	45°	22,66	22,66	22,43	22,46				
	-45°	22,66	22,66	22,48	22,46				
jTrep bij combinatie (3)	90°	26,76	26,76	26,57	26,61	**53,52**	**53,52**	**53,14**	**53,22**
	0°	23,69	23,69	24,15	24,1				
	45°	25,29	25,29	25,04	25,39				
	-45°	25,29	25,29	25,73	25,39				
jTrep bij combinatie (4)	90°	27,15	27,15	25,72	25,72	**54,3**	**54,3**	**51,44**	**51,44**
	0°	26,86	26,86	25,49	25,49				
	45°	27,01	27,01	25,57	25,61				
	-45°	27,01	27,01	25,64	25,61				

Geleidersoort + plaats	:	fasedr. ondertravers	aantal draden in bundel:	2
Geleiders veld 1 en 2	:	CU185	Draadnummer	7,11
Veldlengte voor gewicht [m]	:	383,52		

BELASTING COMPONENTEN [kN]		GELEIDER		ISOLATOR			
		VELD 1	VELD 2	VELD 1	VELD 2	VELD 1	VELD 2
Grep		-2,7	-3,71	-2,5	-2,5	**-7,90**	**-9,92**
Qijs;rep		-1,22	-1,68	0	0	**-2,44**	**-3,36**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,02	2,19	0,55	0,55	**4,59**	**4,93**
Qw;rep loodrecht lijn,	y	0	-0,31	0	0	**0,00**	**-0,62**
Qw;rep in lijnrichting,	x	0	-0,04	0	0	**0,00**	**-0,08**
Qw;rep in lijnrichting,	y	0	0,01	0,55	0,55	**0,55**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,01	0,81	0,39	0,39	**2,41**	**2,01**
Qw;rep 45 graden (+y, +x),	y	0	-0,11	0,39	0,39	**0,39**	**0,17**
Qw;rep 45 graden (-y, +x),	x	1,01	1,42	0,39	0,39	**2,41**	**3,23**
Qw;rep 45 graden (-y, +x),	y	0	-0,2	-0,39	-0,39	**-0,39**	**-0,79**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,02	2,26	0,55	0,55	**4,59**	**5,07**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	**0,55**	**0,55**
Qw;rep 45 graden (+y, +x),	x	1,01	1,13	0,39	0,39	**2,41**	**2,65**
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	**0,39**	**0,39**
Qw;rep 45 graden (-y, +x),	x	1,01	1,13	0,39	0,39	**2,41**	**2,65**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	**-0,39**	**-0,39**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,17	5,6	0,55	0,55	**10,89**	**11,75**
Qw;rep loodrecht lijn,	y	0	-0,79	0	0	**0,00**	**-1,58**
Qw;rep in lijnrichting,	x	0	-0,11	0	0	**0,00**	**-0,22**
Qw;rep in lijnrichting,	y	0	0,02	0,55	0,55	**0,55**	**0,59**
Qw;rep 45 graden (+y, +x),	x	2,59	2,07	0,39	0,39	**5,57**	**4,53**
Qw;rep 45 graden (+y, +x),	y	0	-0,29	0,39	0,39	**0,39**	**-0,19**
Qw;rep 45 graden (-y, +x),	x	2,59	3,65	0,39	0,39	**5,57**	**7,69**
Qw;rep 45 graden (-y, +x),	y	0	-0,51	-0,39	-0,39	**-0,39**	**-1,41**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,17	5,77	0,55	0,55	**10,89**	**12,09**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	**0,55**	**0,55**
Qw;rep 45 graden (+y, +x),	x	2,59	2,89	0,39	0,39	**5,57**	**6,17**
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	**0,39**	**0,39**
Qw;rep 45 graden (-y, +x),	x	2,59	2,89	0,39	0,39	**5,57**	**6,17**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	**-0,39**	**-0,39**

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	28,47	28,47	27,54	27,65	**56,94**	**56,94**	**55,08**	**55,3**
	0°	21,21	21,21	21,56	21,42				
	45°	25,16	25,16	23,89	24,76				
	-45°	25,16	25,16	25,59	24,76				
jTrep bij combinatie (1b)	90°	22,89	22,89	22,56	22,57	**45,78**	**45,78**	**45,12**	**45,14**
	0°	22,53	22,53	22,27	22,27				
	45°	22,71	22,71	22,38	22,42				
	-45°	22,71	22,71	22,46	22,42				
jTrep bij combinatie (3)	90°	35,93	35,93	35,86	35,9	**71,86**	**71,86**	**71,72**	**71,8**
	0°	32,94	32,94	33,42	33,36				
	45°	34,47	34,47	34,31	34,66				
	-45°	34,47	34,47	35,01	34,66				
jTrep bij combinatie (4)	90°	28,31	28,31	26,75	26,75	**56,62**	**56,62**	**53,5**	**53,5**
	0°	27,92	27,92	26,43	26,43				
	45°	28,12	28,12	26,54	26,59				
	-45°	28,12	28,12	26,63	26,59				
jTrep bij combinatie (5a)	90°	17,67		17,85		**35,34**		**35,7**	
jTrep bij combinatie (6)	90°	23,86		24,1		**47,72**		**48,2**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4,2,11/NL,3)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	23,12	23,12	23,08	23,12	**46,24**	**46,24**	**46,16**	**46,24**
	0°	21,21	21,21	21,46	21,42				
	45°	22,19	22,19	22,05	22,29				
	-45°	22,19	22,19	22,52	22,29				
jTrep bij combinatie (1b)	90°	22,75	22,75	22,45	22,46	**45,5**	**45,5**	**44,9**	**44,92**
	0°	22,53	22,53	22,27	22,27				
	45°	22,64	22,64	22,34	22,36				
	-45°	22,64	22,64	22,39	22,36				
jTrep bij combinatie (3)	90°	26,37	26,37	26,22	26,27	**52,74**	**52,74**	**52,44**	**52,54**
	0°	23,69	23,69	24,05	24				
	45°	25,08	25,08	24,85	25,16				
	-45°	25,08	25,08	25,47	25,16				
jTrep bij combinatie (4)	90°	27,11	27,11	25,93	25,93	**54,22**	**54,22**	**51,86**	**51,86**
	0°	26,86	26,86	25,73	25,72				
	45°	26,99	26,99	25,8	25,83				
	-45°	26,99	26,99	25,86	25,83				

Geleidersoort + plaats	:	fasedr. ondertravers	aantal draden in bundel:	2
Geleiders veld 1 en 2	:	CU185	Draadnummer	8,9,10
Veldlengte voor gewicht [m]	:	396,49		

BELASTING COMPONENTEN [kN]		GELEIDER		ISOLATOR			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-2,7	-3,93	-2,5	-2,5	**-7,90**	**-10,36**
Qijs;rep		-1,22	-1,78	0	0	**-2,44**	**-3,56**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,02	2,1	0,55	0,55	**4,59**	**4,75**
Qw;rep loodrecht lijn,	y	0	-0,29	0	0	**0,00**	**-0,58**
Qw;rep in lijnrichting,	x	0	-0,04	0	0	**0,00**	**-0,08**
Qw;rep in lijnrichting,	y	0	0,01	0,55	0,55	**0,55**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,01	0,77	0,39	0,39	**2,41**	**1,93**
Qw;rep 45 graden (+y, +x),	y	0	-0,11	0,39	0,39	**0,39**	**0,17**
Qw;rep 45 graden (-y, +x),	x	1,01	1,36	0,39	0,39	**2,41**	**3,11**
Qw;rep 45 graden (-y, +x),	y	0	-0,19	-0,39	-0,39	**-0,39**	**-0,77**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,02	2,16	0,55	0,55	**4,59**	**4,87**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	**0,55**	**0,55**
Qw;rep 45 graden (+y, +x),	x	1,01	1,08	0,39	0,39	**2,41**	**2,55**
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	**0,39**	**0,39**
Qw;rep 45 graden (-y, +x),	x	1,01	1,08	0,39	0,39	**2,41**	**2,55**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	**-0,39**	**-0,39**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,17	5,36	0,55	0,55	**10,89**	**11,27**
Qw;rep loodrecht lijn,	y	0	-0,75	0	0	**0,00**	**-1,50**
Qw;rep in lijnrichting,	x	0	-0,11	0	0	**0,00**	**-0,22**
Qw;rep in lijnrichting,	y	0	0,01	0,55	0,55	**0,55**	**0,57**
Qw;rep 45 graden (+y, +x),	x	2,59	1,98	0,39	0,39	**5,57**	**4,35**
Qw;rep 45 graden (+y, +x),	y	0	-0,28	0,39	0,39	**0,39**	**-0,17**
Qw;rep 45 graden (-y, +x),	x	2,59	3,49	0,39	0,39	**5,57**	**7,37**
Qw;rep 45 graden (-y, +x),	y	0	-0,49	-0,39	-0,39	**-0,39**	**-1,37**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,17	5,52	0,55	0,55	**10,89**	**11,59**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	**0,55**	**0,55**
Qw;rep 45 graden (+y, +x),	x	2,59	2,76	0,39	0,39	**5,57**	**5,91**
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	**0,39**	**0,39**
Qw;rep 45 graden (-y, +x),	x	2,59	2,76	0,39	0,39	**5,57**	**5,91**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	**-0,39**	**-0,39**

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		**VELD 2**		**VELD 1**		**VELD 2**	
	Hoek t,o,v,lijnrichting	**Min,lijnh**	**Max,lijnh**	**Min,lijnh**	**Max,lijnhoek**				
jTrep bij combinatie (1a)	90°	28,47	28,47	27,15	27,25	**56,94**	**56,94**	**54,3**	**54,5**
	0°	21,21	21,21	21,61	21,48				
	45°	25,16	25,16	23,75	24,56				
	-45°	25,16	25,16	25,33	24,56				
jTrep bij combinatie (1b)	90°	22,89	22,89	22,59	22,6	**45,78**	**45,78**	**45,18**	**45,2**
	0°	22,53	22,53	22,33	22,33				
	45°	22,71	22,71	22,42	22,46				
	-45°	22,71	22,71	22,5	22,46				
jTrep bij combinatie (3)	90°	35,93	35,93	35,75	35,79	**71,86**	**71,86**	**71,5**	**71,58**
	0°	32,94	32,94	33,5	33,45				
	45°	34,47	34,47	34,32	34,64				
	-45°	34,47	34,47	34,96	34,64				
jTrep bij combinatie (4)	90°	28,31	28,31	26,47	26,47	**56,62**	**56,62**	**52,94**	**52,94**
	0°	27,92	27,92	26,18	26,18				
	45°	28,12	28,12	26,28	26,33				
	-45°	28,12	28,12	26,37	26,33				
jTrep bij combinatie (5a)	90°	17,67		17,9		**35,34**		**35,8**	
jTrep bij combinatie (6)	90°	23,86		24,16		**47,72**		**48,32**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4,2,11/NL,3)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	23,12	23,12	23,01	23,04	**46,24**	**46,24**	**46,02**	**46,08**
	0°	21,21	21,21	21,51	21,48				
	45°	22,19	22,19	22,06	22,27				
	-45°	22,19	22,19	22,49	22,27				
jTrep bij combinatie (1b)	90°	22,75	22,75	22,49	22,5	**45,5**	**45,5**	**44,98**	**45**
	0°	22,53	22,53	22,33	22,33				
	45°	22,64	22,64	22,39	22,41				
	-45°	22,64	22,64	22,43	22,41				
jTrep bij combinatie (3)	90°	26,37	26,37	26,11	26,15	**52,74**	**52,74**	**52,22**	**52,3**
	0°	23,69	23,69	24,11	24,07				
	45°	25,08	25,08	24,84	25,13				
	-45°	25,08	25,08	25,42	25,13				
jTrep bij combinatie (4)	90°	27,11	27,11	25,74	25,75	**54,22**	**54,22**	**51,48**	**51,5**
	0°	26,86	26,86	25,56	25,55				
	45°	26,99	26,99	25,62	25,65				
	-45°	26,99	26,99	25,68	25,65				

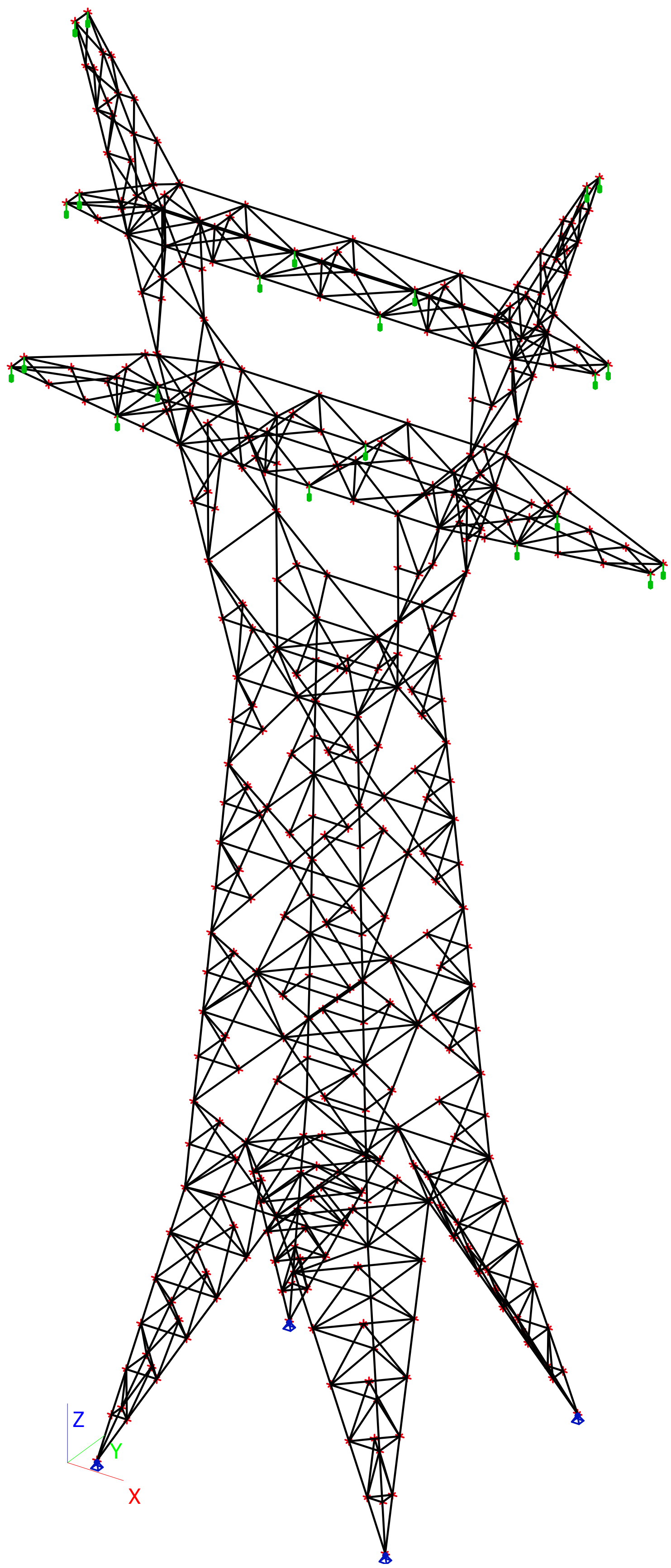
Bijlage B Berekening Mast 73; Scia Engineer

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Auteur	- SMA
Datum	28.03.2014
Constructie	Algemeen XYZ
Nationale norm	EC - ENV

Stalenprofielen op niveau 39+ en 46.2+ zijn
gecontroleerd volgens EC - EN, Zie 11.4

1. Inhoudsopgave

2. Overzicht rekenmodel



3. Knoop

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K1	-8,904	-0,682	49,980
K2	-9,553	0,000	49,980
K3	-10,100	-0,541	51,489
K5	-9,553	0,682	49,980
K7	-10,100	0,541	51,489
K9	-9,553	-0,682	49,980
K13	-9,014	0,821	48,490
K15	-8,333	0,000	46,609
K17	-9,014	-0,821	48,490
K21	-9,764	0,543	51,470
K24	-8,905	0,682	49,980
K28	-8,045	0,821	48,490
K29	-8,333	0,996	46,609
K31	-9,764	-0,543	51,470
K38	-8,045	-0,821	48,490
K39	-8,333	-0,996	46,609
K43	-8,004	-1,081	45,700
K47	-7,279	0,000	43,700
K55	-7,279	-1,268	43,700
K56	-7,279	1,268	43,700
K61	-5,929	1,616	39,971
K63	-5,397	-1,753	38,500
K65	-5,929	-1,616	39,971
K67	-5,938	0,000	39,994
K69	-3,952	2,126	34,509
K70	-5,397	0,000	38,500
K71	-4,678	1,939	36,515
K72	-4,676	1,060	36,510
K75	-3,952	-2,126	34,509
K77	-4,678	-1,939	36,515
K78	-4,676	-1,060	36,510
K81	4,678	1,939	36,515
K82	3,814	1,939	36,514
K83	3,677	1,753	38,500
K86	-1,974	2,323	32,501
K87	1,974	2,323	32,501
K88	-1,974	-2,323	32,501
K89	1,974	-2,323	32,501
K90	-3,226	2,313	32,505
K91	-2,500	2,500	30,500
K93	0,000	2,500	30,500
K95	-3,226	1,063	32,505
K99	-2,500	0,000	30,500
K102	-2,500	-2,500	30,500
K103	-3,226	-1,063	32,505
K104	-3,226	-2,313	32,505
K109	0,000	-2,500	30,500
K111	3,226	2,313	32,505
K112	2,500	2,500	30,500
K115	8,904	0,682	49,980
K116	9,553	0,000	49,980
K117	8,904	-0,682	49,980
K118	10,100	-0,541	51,489
K120	9,553	0,682	49,980
K122	10,100	0,541	51,489
K124	9,553	-0,682	49,980
K128	9,014	0,821	48,490
K130	8,333	0,000	46,609
K132	9,014	-0,821	48,490
K136	9,764	0,543	51,470
K143	8,045	0,821	48,490
K144	8,333	0,996	46,609
K146	9,764	-0,543	51,470
K153	8,045	-0,821	48,490
K154	8,333	-0,997	46,609
K156	8,004	1,081	45,700

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K158	8,004	-1,081	45,700
K162	7,279	0,000	43,700
K170	7,279	-1,268	43,700
K171	7,279	1,268	43,700
K173	-7,185	0,001	47,000
K177	7,185	0,001	47,000
K186	-2,498	1,081	45,700
K191	-4,465	0,000	47,000
K194	-4,465	-1,081	45,700
K198	-6,435	-1,081	45,700
K201	-2,498	-1,081	45,700
K205	4,465	0,960	47,000
K206	6,435	1,081	45,700
K207	2,498	1,081	45,700
K211	4,465	1,081	45,700
K212	4,465	0,000	47,000
K215	4,465	-1,081	45,700
K217	4,465	-0,960	47,000
K219	6,435	-1,081	45,700
K222	2,498	-1,081	45,700
K224	0,000	1,081	45,700
K226	0,000	0,000	47,000
K227	0,000	-1,081	45,700
K233	-7,185	0,960	47,000
K235	-7,185	-0,960	47,000
K243	-6,480	1,268	43,700
K245	-6,480	-1,268	43,700
K254	-11,000	-0,400	45,700
K256	-10,647	0,400	53,000
K261	7,185	0,960	47,000
K264	11,000	0,400	45,700
K267	7,185	-0,960	47,000
K269	6,480	1,268	43,700
K271	6,480	-1,268	43,700
K282	11,000	-0,400	45,700
K284	10,647	0,400	53,000
K291	-3,677	1,753	38,500
K294	-5,042	1,614	39,996
K298	5,929	1,616	39,971
K301	5,397	1,753	38,500
K302	5,042	1,614	39,996
K306	-5,042	-1,614	39,996
K307	-3,677	-1,753	38,500
K311	-9,475	-0,747	45,700
K314	-9,475	0,747	45,700
K325	-10,647	-0,400	53,000
K335	-6,435	1,081	45,700
K388	-8,004	1,081	45,700
K394	-1,837	1,753	38,500
K395	-1,840	0,000	39,996
K396	1,837	1,753	38,500
K397	1,840	0,000	39,996
K400	-8,778	-0,008	39,672
K401	-8,316	-1,253	38,500
K404	-1,837	-1,753	38,500
K406	1,837	-1,753	38,500
K408	-1,840	-1,614	39,996
K409	-1,840	1,614	39,996
K410	1,840	-1,614	39,996
K411	1,840	1,614	39,996
K414	0,000	1,753	38,500
K420	-13,297	0,400	38,500
K423	-8,778	1,174	39,672
K424	13,297	0,400	38,500
K426	8,316	1,253	38,500
K428	8,778	1,174	39,672

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K429	-13,297	-0,400	38,500
K433	-8,778	-1,174	39,672
K434	0,000	-1,753	38,500
K438	3,677	-1,753	38,500
K444	5,397	-1,753	38,500
K447	5,397	0,000	38,500
K448	4,676	1,060	36,510
K451	3,226	1,063	32,505
K456	3,952	-2,126	34,509
K458	13,297	-0,400	38,500
K459	5,929	-1,616	39,971
K460	8,316	-1,253	38,500
K462	8,778	-1,174	39,672
K469	4,678	-1,939	36,515
K470	4,676	-1,060	36,510
K473	-3,677	0,000	38,500
K493	-11,540	0,701	38,500
K496	-11,540	-0,701	38,500
K521	-7,103	-1,461	38,500
K522	-7,103	1,461	38,500
K527	3,677	0,000	38,500
K531	0,000	0,000	38,500
K538	8,778	-0,008	39,672
K546	5,938	0,000	39,994
K550	11,540	-0,701	38,500
K552	9,833	-0,993	38,500
K553	11,540	0,701	38,500
K555	9,833	0,993	38,500
K598	5,042	-1,614	39,996
K601	3,813	-1,939	36,514
K605	3,226	-1,063	32,505
K606	3,226	-2,313	32,505
K618	10,647	-0,400	53,000
K619	-6,526	-1,462	41,620
K620	-6,526	1,462	41,620
K621	6,526	1,462	41,620
K622	6,527	-1,462	41,621
K623	-4,465	0,960	47,000
N2	-3,800	-3,800	10,500
N4	3,800	-3,800	10,500
N5	-3,800	3,800	10,500
N8	3,800	3,800	10,500
N59	-3,582	-3,582	13,860
N61	3,582	-3,582	13,860
N62	-3,582	3,582	13,860
N65	3,582	3,582	13,860
N9	0,000	-3,800	10,500
N66	3,800	0,000	10,500
N67	0,000	3,800	10,500
N68	-3,800	0,000	10,500
N69	-3,691	-3,691	12,180
N14	-1,791	-3,691	12,180
N15	3,691	-3,691	12,180
N16	1,791	-3,691	12,180
N17	3,691	-1,791	12,180
N18	3,691	1,791	12,180
N19	3,691	3,691	12,180
N70	1,791	3,691	12,180
N71	-1,791	3,691	12,180
N72	-3,691	3,691	12,180
N73	-3,691	1,791	12,180
N74	-3,691	-1,791	12,180
N76	-3,151	-3,151	20,480
N78	3,151	-3,151	20,480
N79	-3,151	3,151	20,480
N82	3,151	3,151	20,480

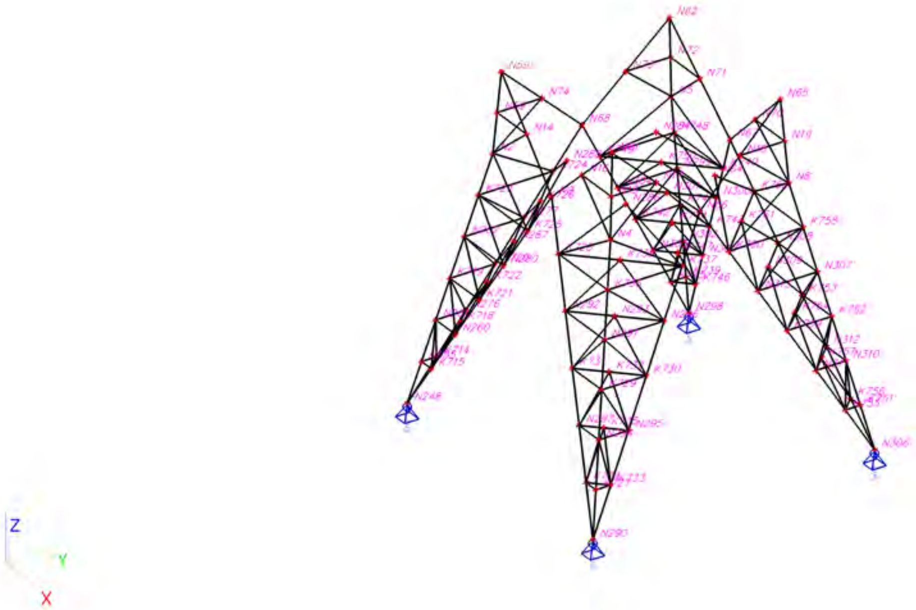
Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
N87	1,791	-3,467	15,621
N88	3,467	-3,467	15,621
N89	3,467	-1,791	15,621
N90	3,467	1,791	15,621
N91	3,467	3,467	15,621
N92	1,791	3,467	15,621
N93	-1,791	3,467	15,621
N94	-3,467	3,467	15,621
N95	-3,467	1,791	15,621
N96	-3,467	-1,791	15,621
N97	-3,467	-3,467	15,621
N98	-1,791	-3,467	15,621
N99	1,576	-3,252	18,931
N100	3,252	-3,252	18,931
N101	3,252	-1,576	18,931
N102	3,252	1,575	18,931
N33	3,252	3,252	18,931
N103	1,576	3,252	18,931
N104	-1,576	3,252	18,931
N105	-3,252	3,252	18,931
N106	-3,252	1,575	18,931
N38	-3,252	-1,576	18,931
N107	-3,252	-3,252	18,931
N108	-1,576	-3,252	18,931
N114	-2,720	-2,721	27,100
N116	2,721	-2,721	27,100
N117	-2,720	2,720	27,100
N120	2,721	2,720	27,100
N121	-2,920	-2,920	24,033
N122	2,920	-2,920	24,033
N123	2,920	2,920	24,033
N124	-2,920	2,920	24,033
N125	1,576	-3,036	22,256
N126	3,036	-3,036	22,256
N127	3,036	-1,576	22,256
N128	3,036	1,575	22,256
N129	3,036	3,035	22,256
N130	1,576	3,035	22,256
N131	-1,576	3,035	22,256
N132	-3,036	3,035	22,256
N133	-3,036	1,575	22,256
N134	-3,036	-1,576	22,256
N135	-3,036	-3,036	22,256
N136	-1,576	-3,036	22,256
N137	1,361	-2,821	25,566
N138	2,821	-2,821	25,566
N139	2,821	-1,361	25,566
N140	2,821	1,360	25,566
N141	2,821	2,820	25,566
N142	1,361	2,820	25,566
N143	-1,360	2,820	25,566
N144	-2,820	2,820	25,566
N145	-2,820	1,360	25,566
N146	-2,820	-1,361	25,566
N147	-2,820	-2,821	25,566
N148	-1,360	-2,821	25,566
N149	2,920	0,000	24,033
N150	0,000	2,920	24,033
N151	-2,920	0,000	24,033
N152	0,000	-2,920	24,033
N156	2,500	-2,500	30,500
N165	-2,610	-2,611	28,800
N166	-1,360	-2,611	28,800
N167	1,360	-2,611	28,800

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
N168	2,610	-2,611	28,800
N169	2,610	-1,361	28,800
N170	2,610	1,360	28,800
N171	2,610	2,610	28,800
N172	1,361	2,610	28,800
N173	-1,360	2,610	28,800
N174	-2,610	2,610	28,800
N175	-2,610	1,360	28,800
N176	-2,610	-1,361	28,800
K625	2,500	-0,001	30,500
K626	-5,397	1,753	38,500
K627	-4,465	-0,960	47,000
K628	3,952	2,126	34,509
K629	-3,814	-1,939	36,515
K630	-3,814	1,939	36,515
N183	0,000	0,000	30,500
N191	0,000	0,960	47,000
N192	0,000	-0,960	47,000
K631	-11,000	0,400	45,700
N247	0,000	-3,353	17,382
K705	3,353	3,353	17,382
K706	3,353	0,000	17,382
K707	3,353	-3,353	17,382
K708	-3,353	3,353	17,382
K709	0,000	3,353	17,382
K711	-3,353	-3,353	17,382
K712	-3,353	0,000	17,382
N248	-6,000	-6,000	0,000
N260	-4,000	-5,267	3,500
N261	-5,267	-5,267	3,500
N262	-4,533	-4,533	7,000
N276	-5,267	-4,000	3,500
N277	-4,533	-2,000	7,000
N280	-2,000	-4,533	7,000
N64	1,900	1,900	10,500
N284	-1,900	1,900	10,500
N286	1,900	-1,900	10,500
N287	-3,267	-3,267	7,000
N288	-1,900	-1,900	10,500
N289	0,000	0,000	10,500
K655	-5,633	-5,633	1,750
K714	-5,633	-5,000	1,750
K715	-5,000	-5,633	1,750
K718	-4,633	-4,633	3,500
K719	-4,900	-4,900	5,250
K720	-4,900	-3,000	5,250
K721	-3,000	-4,900	5,250
K722	-3,950	-3,950	5,250
K723	-4,167	-4,167	8,750
K724	-4,167	-1,000	8,750
K725	-1,000	-4,167	8,750
K726	-2,583	-2,583	8,750
N290	6,000	-6,000	0,000
K727	5,633	-5,633	1,750
K728	1,000	-4,167	8,750
N291	4,533	-4,533	7,000
N292	2,000	-4,533	7,000
N293	3,267	-3,267	7,000
K729	4,900	-4,900	5,250
K730	4,900	-3,000	5,250
K731	3,000	-4,900	5,250
K732	3,950	-3,950	5,250
N294	5,267	-5,267	3,500
N295	5,267	-4,000	3,500

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K733	5,633	-5,000	1,750
K734	5,000	-5,633	1,750
K735	4,633	-4,633	3,500
N296	4,533	-2,000	7,000
K736	4,167	-4,167	8,750
K737	4,167	-1,000	8,750
K738	2,583	-2,583	8,750
N297	4,000	-5,267	3,500
N298	-6,000	6,000	0,000
K739	-5,633	5,633	1,750
K740	-1,000	4,167	8,750
N299	-4,533	4,533	7,000
N300	-2,000	4,533	7,000
N301	-3,267	3,267	7,000
K741	-4,900	4,900	5,250
K742	-4,900	3,000	5,250
K743	-3,000	4,900	5,250
K744	-3,950	3,950	5,250
N302	-5,267	5,267	3,500
N303	-5,267	4,000	3,500
K745	-5,633	5,000	1,750
K746	-5,000	5,633	1,750
K747	-4,633	4,633	3,500
N304	-4,533	2,000	7,000
K748	-4,167	4,167	8,750
K749	-4,167	1,000	8,750
K750	-2,583	2,583	8,750
N305	-4,000	5,267	3,500
N306	6,000	6,000	0,000
K751	5,633	5,633	1,750
N307	4,533	4,533	7,000
N308	2,000	4,533	7,000
N309	3,267	3,267	7,000
K752	4,900	4,900	5,250
K753	3,000	4,900	5,250
K754	3,950	3,950	5,250
N310	5,267	5,267	3,500
N311	5,267	4,000	3,500
K755	5,633	5,000	1,750
K756	5,000	5,633	1,750
K757	4,633	4,633	3,500
K758	4,167	4,167	8,750
N312	4,000	5,267	3,500
K759	4,900	3,000	5,250
N313	4,533	2,000	7,000
K760	4,167	1,000	8,750
K761	2,583	2,583	8,750
K762	1,000	4,167	8,750
K763	0,000	0,000	17,382
K765	-7,103	0,001	38,500
K767	-9,833	-0,993	38,500
K768	-9,833	0,993	38,500
K774	7,103	0,002	38,500
K775	7,103	-1,461	38,500
K776	7,103	1,461	38,500
K780	9,475	-0,747	45,700
K781	9,475	0,747	45,700
K783	6,527	1,462	41,621
K785	6,526	-1,462	41,620
K786	-8,316	1,253	38,500
K787	-4,465	1,081	45,700

4. Knoopnummers

4.1. Knoopnummers steunpunten



5. 1D-staaf

Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
S2	CS12 - L50X5	1,862	Lijn	K3	K256	Kolom (100)	standaard	CrossArm6
S3	CS12 - L50X5	2,018	Lijn	K5	K3	Kolom (100)	standaard	CrossArm6
S4	CS12 - L50X5	1,862	Lijn	K7	K325	Kolom (100)	standaard	CrossArm6
S5	CS12 - L50X5	2,018	Lijn	K9	K7	Kolom (100)	standaard	CrossArm6
S6	CS12 - L50X5	1,364	Lijn	K9	K5	Balk (80)	standaard	CrossArm6
S7	CS12 - L50X5	2,184	Lijn	K13	K9	Kolom (100)	standaard	CrossArm6
S8	CS130 - L50X5	2,162	Lijn	K15	K13	Kolom (100)	standaard	CrossArm6
S9	CS12 - L50X5	2,184	Lijn	K17	K5	Kolom (100)	standaard	CrossArm6
S10	CS130 - L50X5	2,162	Lijn	K15	K17	Kolom (100)	standaard	CrossArm6
S11	CS7 - L50X5	1,511	Lijn	K21	K5	Kolom (100)	standaard	CrossArm6
S12	CS7 - L50X5	0,336	Lijn	K21	K7	Balk (80)	standaard	CrossArm6
S13	CS7 - L50X5	1,501	Lijn	K24	K13	Kolom (100)	standaard	CrossArm6
S14	CS7 - L50X5	0,649	Lijn	K24	K5	Balk (80)	standaard	CrossArm6
S15	CS7 - L50X5	1,911	Lijn	K28	K29	Kolom (100)	standaard	CrossArm6
S16	CS7 - L50X5	0,969	Lijn	K28	K13	Balk (80)	standaard	CrossArm6
S17	CS7 - L50X5	1,511	Lijn	K31	K9	Kolom (100)	standaard	CrossArm6
S18	CS7 - L50X5	0,336	Lijn	K31	K3	Balk (80)	standaard	CrossArm6
S19	CS7 - L50X5	1,501	Lijn	K1	K17	Kolom (100)	standaard	CrossArm6
S20	CS7 - L50X5	0,649	Lijn	K1	K9	Balk (80)	standaard	CrossArm6
S21	CS7 - L50X5	1,911	Lijn	K38	K39	Kolom (100)	standaard	CrossArm6
S22	CS7 - L50X5	0,969	Lijn	K38	K17	Balk (80)	standaard	CrossArm6
S23	CS151 - L50X5	1,450	Lijn	K388	K15	Kolom (100)	standaard	Vak20
S24	CS151 - L50X5	1,451	Lijn	K43	K15	Kolom (100)	standaard	Vak20
S25	CS151 - L50X5	1,993	Lijn	K39	K29	Balk (80)	standaard	Vak20
S26	CS96 - L110X10	2,386	Lijn	K47	K388	Kolom (100)	standaard	Vak11
S27	CS96 - L110X10	2,652	Lijn	K620	K47	Kolom (100)	standaard	Vak11
S28	CS96 - L110X10	2,386	Lijn	K47	K43	Kolom (100)	standaard	Vak11
S29	CS96 - L110X10	2,651	Lijn	K619	K47	Kolom (100)	standaard	Vak11
S30	CS129 - L50X5	2,536	Lijn	K55	K56	Balk (80)	standaard	Vak11
S31	CS93 - L90X9	2,265	Lijn	K67	K620	Kolom (100)	standaard	Vak10
S34	CS93 - L90X9	2,366	Lijn	K63	K67	Kolom (100)	standaard	Vak10
S35	CS125 - L60X6	3,232	Polylijn	K65	K61	Balk (80)	standaard	Vak10
S36	CS93 - L90X9	2,265	Lijn	K67	K619	Kolom (100)	standaard	Vak10
S37	CS91 - L150X15	4,747	Lijn	K69	K70	Kolom (100)	standaard	Vak7
S38	CS4 - L50X5	0,879	Lijn	K71	K72	Balk (80)	standaard	Vak7
S40	CS91 - L150X15	4,747	Lijn	K75	K70	Kolom (100)	standaard	Vak7
S41	CS4 - L50X5	0,879	Lijn	K77	K78	Balk (80)	standaard	Vak7
S42	CS92 - L50X5	2,227	Lijn	K78	K63	Kolom (100)	standaard	Vak7
S43	CS4 - L50X5	0,864	Lijn	K81	K82	Balk (80)	standaard	Vak8
S44	CS92 - L50X5	2,231	Lijn	K81	K83	Kolom (100)	standaard	Vak8
S47	CS86 - L130X12	6,452	Polylijn	K104	K606	Balk (80)	standaard	Vak6
S48	CS86 - L130X12	6,452	Polylijn	K111	K90	Balk (80)	standaard	Vak6
S49	CS84 - L90X9	2,076	Lijn	K91	K86	Kolom (100)	standaard	Vak6
S51	CS85 - L50X5	2,571	Lijn	K91	K95	Kolom (100)	standaard	Vak6
S52	CS130 - L50X5	1,250	Lijn	K90	K95	Balk (80)	standaard	Vak6
S54	CS37 - L75X8	4,252	Lijn	K75	K69	Balk (80)	standaard	Vak7
S55	CS85 - L50X5	2,571	Lijn	K102	K103	Kolom (100)	standaard	Vak6
S56	CS130 - L50X5	1,250	Lijn	K104	K103	Balk (80)	standaard	Vak6
S61	CS84 - L90X9	2,076	Lijn	K112	K87	Kolom (100)	standaard	Vak6
S65	CS12 - L50X5	1,862	Lijn	K118	K284	Kolom (100)	standaard	CrossArm5
S66	CS12 - L50X5	2,018	Lijn	K120	K118	Kolom (100)	standaard	CrossArm5
S67	CS12 - L50X5	1,862	Lijn	K122	K618	Kolom (100)	standaard	CrossArm5
S68	CS12 - L50X5	2,018	Lijn	K124	K122	Kolom (100)	standaard	CrossArm5
S69	CS12 - L50X5	1,364	Lijn	K124	K120	Balk (80)	standaard	CrossArm5
S70	CS12 - L50X5	2,184	Lijn	K128	K124	Kolom (100)	standaard	CrossArm5
S71	CS130 - L50X5	2,162	Lijn	K130	K128	Kolom (100)	standaard	CrossArm5
S72	CS12 - L50X5	2,184	Lijn	K132	K120	Kolom (100)	standaard	CrossArm5
S73	CS130 - L50X5	2,162	Lijn	K130	K132	Kolom (100)	standaard	CrossArm5
S74	CS7 - L50X5	1,511	Lijn	K136	K120	Kolom (100)	standaard	CrossArm5
S75	CS7 - L50X5	0,336	Lijn	K136	K122	Balk (80)	standaard	CrossArm5
S76	CS7 - L50X5	1,501	Lijn	K115	K128	Kolom (100)	standaard	CrossArm5
S77	CS7 - L50X5	0,649	Lijn	K115	K120	Balk (80)	standaard	CrossArm5
S78	CS7 - L50X5	1,911	Lijn	K143	K144	Kolom (100)	standaard	CrossArm5
S79	CS7 - L50X5	0,969	Lijn	K143	K128	Balk (80)	standaard	CrossArm5
S80	CS7 - L50X5	1,511	Lijn	K146	K124	Kolom (100)	standaard	CrossArm5
S81	CS7 - L50X5	0,336	Lijn	K146	K118	Balk (80)	standaard	CrossArm5
S82	CS7 - L50X5	1,501	Lijn	K117	K132	Kolom (100)	standaard	CrossArm5

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
S83	CS7 - L50X5	0,649	Lijn	K117	K124	Balk (80)	standaard	CrossArm5
S84	CS7 - L50X5	1,911	Lijn	K153	K154	Kolom (100)	standaard	CrossArm5
S85	CS7 - L50X5	0,969	Lijn	K153	K132	Balk (80)	standaard	CrossArm5
S86	CS151 - L50X5	1,450	Lijn	K156	K130	Kolom (100)	standaard	Vak15
S87	CS151 - L50X5	1,451	Lijn	K158	K130	Kolom (100)	standaard	Vak15
S88	CS151 - L50X5	1,993	Lijn	K154	K144	Balk (80)	standaard	Vak15
S89	CS96 - L110X10	2,386	Lijn	K162	K156	Kolom (100)	standaard	Vak12
S90	CS96 - L110X10	2,652	Lijn	K621	K162	Kolom (100)	standaard	Vak12
S91	CS96 - L110X10	2,386	Lijn	K162	K158	Kolom (100)	standaard	Vak12
S92	CS96 - L110X10	2,651	Lijn	K622	K162	Kolom (100)	standaard	Vak12
S93	CS129 - L50X5	2,536	Lijn	K170	K171	Balk (80)	standaard	Vak12
S94	CS152 - L50X5	1,851	Lijn	K198	K173	Kolom (100)	standaard	Vak20
S95	CS152 - L50X5	1,849	Lijn	K335	K173	Kolom (100)	standaard	Vak20
S96	CS152 - L50X5	1,851	Lijn	K219	K177	Kolom (100)	standaard	Vak15
S97	CS152 - L50X5	1,849	Lijn	K206	K177	Kolom (100)	standaard	Vak15
S98	CS152 - L50X5	1,920	Lijn	K235	K233	Balk (80)	standaard	Vak20
S99	CS152 - L50X5	1,920	Lijn	K267	K261	Balk (80)	standaard	Vak15
S100	CS154 - L100X10	2,364	Lijn	K623	K335	Kolom (100)	standaard	Vak19
S101	CS155 - L75X8	2,361	Lijn	K186	K623	Kolom (100)	standaard	Vak18
S102	CS154 - L100X10	2,818	Lijn	N191	K186	Balk (80)	standaard	Vak18
S103	CS153 - L50X5	1,691	Lijn	K787	K191	Kolom (100)	standaard	Vak19
S104	CS153 - L50X5	1,306	Lijn	K787	K623	Kolom (100)	standaard	Vak19
S105	CS153 - L50X5	1,691	Lijn	K194	K191	Kolom (100)	standaard	Vak19
S107	CS154 - L100X10	2,364	Lijn	K627	K198	Kolom (100)	standaard	Vak19
S108	CS153 - L50X5	1,306	Lijn	K194	K627	Kolom (100)	standaard	Vak19
S109	CS155 - L75X8	2,361	Lijn	K201	K627	Kolom (100)	standaard	Vak18
S110	CS154 - L100X10	2,819	Lijn	N192	K201	Balk (80)	standaard	Vak18
S111	CS154 - L100X10	2,363	Lijn	K205	K206	Kolom (100)	standaard	Vak16
S112	CS155 - L75X8	2,361	Lijn	K207	K205	Kolom (100)	standaard	Vak17
S113	CS154 - L100X10	2,819	Lijn	N191	K207	Balk (80)	standaard	Vak17
S114	CS153 - L50X5	1,691	Lijn	K211	K212	Kolom (100)	standaard	Vak16
S115	CS153 - L50X5	1,306	Lijn	K211	K205	Kolom (100)	standaard	Vak16
S116	CS153 - L50X5	1,691	Lijn	K215	K212	Kolom (100)	standaard	Vak16
S118	CS154 - L100X10	2,363	Lijn	K217	K219	Kolom (100)	standaard	Vak16
S119	CS153 - L50X5	1,306	Lijn	K215	K217	Kolom (100)	standaard	Vak16
S120	CS155 - L75X8	2,361	Lijn	K222	K217	Kolom (100)	standaard	Vak17
S121	CS153 - L50X5	1,306	Lijn	N191	K224	Kolom (100)	standaard	Vak18
S122	CS153 - L50X5	1,691	Lijn	K224	K226	Kolom (100)	standaard	Vak18
S123	CS153 - L50X5	1,691	Lijn	K227	K226	Kolom (100)	standaard	Vak18
S125	CS153 - L50X5	1,306	Lijn	N192	K227	Kolom (100)	standaard	Vak18
S126	CS154 - L100X10	2,819	Lijn	N192	K222	Balk (80)	standaard	Vak17
S129	CS156 - L60X6	1,213	Lijn	K233	K29	Balk (80)	standaard	Vak20
S130	CS147 - L80X8	2,880	Lijn	K29	K631	Balk (80)	standaard	CrossArm4
S131	CS150 - L100X10	1,541	Lijn	K233	K388	Kolom (100)	standaard	Vak20
S132	CS150 - L100X10	1,541	Lijn	K235	K43	Kolom (100)	standaard	Vak20
S133	CS129 - L50X5	0,799	Lijn	K243	K56	Balk (80)	standaard	Vak11
S134	CS129 - L50X5	0,800	Lijn	K245	K55	Balk (80)	standaard	Vak11
S135	CS128 - L150X100X10	4,098	Lijn	K619	K198	Kolom (100)	standaard	Vak11
S136	CS129 - L50X5	2,179	Lijn	K335	K56	Kolom (100)	standaard	Vak11
S137	CS156 - L60X6	1,213	Lijn	K235	K39	Balk (80)	standaard	Vak20
S138	CS147 - L80X8	2,880	Lijn	K39	K254	Balk (80)	standaard	CrossArm4
S139	CS158 - L90X9	1,506	Lijn	K335	K233	Kolom (100)	standaard	Vak20
S140	CS128 - L150X100X10	4,099	Lijn	K620	K335	Kolom (100)	standaard	Vak11
S141	CS158 - L90X9	1,506	Lijn	K198	K235	Kolom (100)	standaard	Vak20
S142	CS156 - L60X6	1,213	Lijn	K261	K144	Balk (80)	standaard	Vak15
S143	CS147 - L80X8	2,880	Lijn	K144	K264	Balk (80)	standaard	CrossArm3
S144	CS150 - L100X10	1,541	Lijn	K261	K156	Kolom (100)	standaard	Vak15
S145	CS150 - L100X10	1,541	Lijn	K267	K158	Kolom (100)	standaard	Vak15
S146	CS129 - L50X5	0,800	Lijn	K269	K171	Balk (80)	standaard	Vak12
S147	CS129 - L50X5	0,800	Lijn	K271	K170	Balk (80)	standaard	Vak12
S148	CS128 - L150X100X10	4,098	Lijn	K622	K219	Kolom (100)	standaard	Vak12
S149	CS129 - L50X5	2,179	Lijn	K219	K170	Kolom (100)	standaard	Vak12
S150	CS129 - L50X5	2,179	Lijn	K206	K171	Kolom (100)	standaard	Vak12
S151	CS156 - L60X6	1,213	Lijn	K267	K154	Balk (80)	standaard	Vak15
S152	CS147 - L80X8	2,880	Lijn	K154	K282	Balk (80)	standaard	CrossArm3
S153	CS158 - L90X9	1,506	Lijn	K206	K261	Kolom (100)	standaard	Vak15
S154	CS128 - L150X100X10	4,099	Lijn	K621	K206	Kolom (100)	standaard	Vak12
S155	CS158 - L90X9	1,506	Lijn	K219	K267	Kolom (100)	standaard	Vak15
S156	CS93 - L90X9	2,264	Lijn	K546	K621	Kolom (100)	standaard	Vak10

Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
S159	CS126 - L160X15	0,888	Lijn	K294	K61	Balk (80)	standaard	Vak10
S160	CS126 - L160X15	0,888	Lijn	K302	K298	Balk (80)	standaard	Vak10
S162	CS124 - UNP200	1,544	Lijn	K302	K301	Kolom (100)	standaard	Vak10
S164	CS124 - UNP200	1,544	Lijn	K306	K63	Kolom (100)	standaard	Vak10
S166	CS126 - L160X15	0,888	Lijn	K306	K65	Balk (80)	standaard	Vak10
S167	CS148 - L60X6	1,908	Lijn	K311	K631	Balk (80)	standaard	CrossArm4
S168	CS148 - L60X6	2,347	Lijn	K388	K311	Balk (80)	standaard	CrossArm4
S169	CS148 - L60X6	1,908	Lijn	K314	K254	Balk (80)	standaard	CrossArm4
S170	CS148 - L60X6	2,347	Lijn	K43	K314	Balk (80)	standaard	CrossArm4
S171	CS149 - UNP180	3,073	Lijn	K388	K631	Balk (80)	standaard	CrossArm4
S172	CS149 - UNP180	3,073	Lijn	K43	K254	Balk (80)	standaard	CrossArm4
S175	CS160 - HEB120	0,800	Lijn	K325	K256	Balk (80)	standaard	CrossArm6
S176	CS82 - L200X16	2,140	Lijn	K91	K90	Kolom (100)	standaard	Vak6
S177	CS82 - L200X16	2,140	Lijn	K102	K104	Kolom (100)	standaard	Vak6
S178	CS148 - L60X6	3,304	Lijn	K201	K224	Balk (80)	standaard	Vak18
S179	CS148 - L60X6	3,304	Lijn	K227	K186	Balk (80)	standaard	Vak18
S180	CS148 - L60X6	2,672	Lijn	K198	K388	Balk (80)	standaard	Vak20
S181	CS148 - L60X6	2,671	Lijn	K335	K43	Balk (80)	standaard	Vak20
S182	CS148 - L60X6	2,926	Lijn	K194	K335	Balk (80)	standaard	Vak19
S183	CS148 - L60X6	2,923	Lijn	K186	K194	Balk (80)	standaard	Vak18
S184	CS148 - L60X6	2,925	Lijn	K787	K198	Balk (80)	standaard	Vak19
S185	CS148 - L60X6	2,923	Lijn	K201	K787	Balk (80)	standaard	Vak18
S189	CS146 - HEB180	2,163	Lijn	K201	K186	Balk (80)	standaard	Vak18
S190	CS148 - L60X6	1,908	Lijn	K780	K264	Balk (80)	standaard	CrossArm3
S191	CS148 - L60X6	2,347	Lijn	K156	K780	Balk (80)	standaard	CrossArm3
S192	CS148 - L60X6	1,908	Lijn	K781	K282	Balk (80)	standaard	CrossArm3
S193	CS148 - L60X6	2,347	Lijn	K158	K781	Balk (80)	standaard	CrossArm3
S194	CS149 - UNP180	3,073	Lijn	K156	K264	Balk (80)	standaard	CrossArm3
S195	CS149 - UNP180	3,073	Lijn	K158	K282	Balk (80)	standaard	CrossArm3
S198	CS148 - L60X6	2,672	Lijn	K219	K156	Balk (80)	standaard	Vak15
S199	CS148 - L60X6	2,672	Lijn	K206	K158	Balk (80)	standaard	Vak15
S200	CS148 - L60X6	2,925	Lijn	K215	K206	Balk (80)	standaard	Vak16
S201	CS148 - L60X6	2,923	Lijn	K207	K215	Balk (80)	standaard	Vak17
S202	CS148 - L60X6	2,925	Lijn	K211	K219	Balk (80)	standaard	Vak16
S203	CS148 - L60X6	2,923	Lijn	K222	K211	Balk (80)	standaard	Vak17
S206	CS148 - L60X6	3,304	Lijn	K222	K224	Balk (80)	standaard	Vak17
S207	CS148 - L60X6	3,304	Lijn	K227	K207	Balk (80)	standaard	Vak17
S209	CS146 - HEB180	2,163	Lijn	K222	K207	Balk (80)	standaard	Vak17
S211	CS4 - L50X5	2,163	Lijn	K158	K156	Balk (80)	standaard	Vak15
S212	CS4 - L50X5	2,163	Lijn	K43	K388	Balk (80)	standaard	Vak20
S214	CS140 - L50X5	2,305	Lijn	K394	K395	Kolom (100)	standaard	Vak14
S215	CS140 - L50X5	2,305	Lijn	K396	K397	Kolom (100)	standaard	Vak14
S216	CS139 - L50X5	2,348	Lijn	K433	K423	Balk (80)	standaard	CrossArm2
S217	CS139 - L50X5	1,771	Lijn	K400	K401	Kolom (100)	standaard	CrossArm2
S218	CS139 - L50X5	1,782	Lijn	K400	K786	Kolom (100)	standaard	CrossArm2
S219	CS140 - L50X5	2,305	Lijn	K404	K395	Kolom (100)	standaard	Vak14
S220	CS140 - L50X5	2,305	Lijn	K406	K397	Kolom (100)	standaard	Vak14
S223	CS139 - L50X5	2,348	Lijn	K462	K428	Balk (80)	standaard	CrossArm1
S224	CS142 - L130X12	2,376	Lijn	K409	K414	Kolom (100)	standaard	Vak14
S225	CS142 - L130X12	2,373	Lijn	K291	K409	Kolom (100)	standaard	Vak9
S226	CS142 - L130X12	2,376	Lijn	K411	K414	Kolom (100)	standaard	Vak14
S227	CS142 - L130X12	2,373	Lijn	K83	K411	Kolom (100)	standaard	Vak13
S228	CS137 - L100X10	4,732	Lijn	K423	K420	Balk (80)	standaard	CrossArm2
S229	CS139 - L50X5	1,262	Lijn	K423	K786	Kolom (100)	standaard	CrossArm2
S230	CS137 - L100X10	2,898	Lijn	K61	K423	Balk (80)	standaard	CrossArm2
S231	CS137 - L100X10	4,732	Lijn	K428	K424	Balk (80)	standaard	CrossArm1
S232	CS138 - L60X6	2,827	Lijn	K298	K426	Kolom (100)	standaard	CrossArm1
S233	CS139 - L50X5	1,262	Lijn	K428	K426	Kolom (100)	standaard	CrossArm1
S234	CS137 - L100X10	2,898	Lijn	K298	K428	Balk (80)	standaard	CrossArm1
S235	CS137 - L100X10	4,732	Lijn	K433	K429	Balk (80)	standaard	CrossArm2
S236	CS138 - L60X6	2,827	Lijn	K65	K401	Kolom (100)	standaard	CrossArm2
S237	CS139 - L50X5	1,262	Lijn	K433	K401	Kolom (100)	standaard	CrossArm2
S238	CS137 - L100X10	2,898	Lijn	K65	K433	Balk (80)	standaard	CrossArm2
S239	CS142 - L130X12	2,376	Lijn	K408	K434	Kolom (100)	standaard	Vak14
S240	CS142 - L130X12	2,373	Lijn	K307	K408	Kolom (100)	standaard	Vak9
S241	CS142 - L130X12	2,376	Lijn	K410	K434	Kolom (100)	standaard	Vak14
S242	CS142 - L130X12	2,373	Lijn	K438	K410	Kolom (100)	standaard	Vak13
S243	CS93 - L90X9	2,366	Lijn	K301	K546	Kolom (100)	standaard	Vak10
S245	CS93 - L90X9	2,366	Lijn	K444	K546	Kolom (100)	standaard	Vak10

Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
S247	CS4 - L50X5	0,878	Lijn	K81	K448	Balk (80)	standaard	Vak8
S248	CS92 - L50X5	2,227	Lijn	K448	K301	Kolom (100)	standaard	Vak8
S249	CS85 - L50X5	2,571	Lijn	K112	K451	Kolom (100)	standaard	Vak6
S250	CS130 - L50X5	1,250	Lijn	K111	K451	Balk (80)	standaard	Vak6
S252	CS91 - L150X15	4,747	Lijn	K456	K447	Kolom (100)	standaard	Vak8
S253	CS137 - L100X10	4,732	Lijn	K462	K458	Balk (80)	standaard	CrossArm1
S254	CS138 - L60X6	2,827	Lijn	K459	K460	Kolom (100)	standaard	CrossArm1
S255	CS139 - L50X5	1,262	Lijn	K462	K460	Kolom (100)	standaard	CrossArm1
S256	CS137 - L100X10	2,898	Lijn	K459	K462	Balk (80)	standaard	CrossArm1
S257	CS125 - L60X6	3,232	Polylijn	K298	K459	Balk (80)	standaard	Vak10
S258	CS126 - L160X15	0,888	Lijn	K598	K459	Balk (80)	standaard	Vak10
S260	CS4 - L50X5	0,879	Lijn	K469	K470	Balk (80)	standaard	Vak8
S263	CS143 - L90X9	2,542	Lijn	K394	K473	Balk (80)	standaard	Vak9
S264	CS143 - L90X9	2,539	Lijn	K531	K394	Balk (80)	standaard	Vak14
S265	CS143 - L90X9	2,456	Lijn	K473	K63	Balk (80)	standaard	Vak9
S266	CS143 - L90X9	2,542	Lijn	K404	K473	Balk (80)	standaard	Vak9
S267	CS143 - L90X9	2,539	Lijn	K531	K404	Balk (80)	standaard	Vak14
S268	CS145 - L50X5	3,507	Lijn	K307	K291	Balk (80)	standaard	Vak9
S273	CS136 - L65X7	2,073	Lijn	K493	K429	Balk (80)	standaard	CrossArm2
S274	CS135 - L55X6	2,405	Lijn	K768	K496	Balk (80)	standaard	CrossArm2
S275	CS135 - L55X6	2,710	Lijn	K786	K767	Balk (80)	standaard	CrossArm2
S278	CS136 - L65X7	2,073	Lijn	K496	K420	Balk (80)	standaard	CrossArm2
S279	CS135 - L55X6	2,405	Lijn	K767	K493	Balk (80)	standaard	CrossArm2
S280	CS135 - L55X6	2,711	Lijn	K401	K768	Balk (80)	standaard	CrossArm2
S283	CS132 - HEB200	2,506	Lijn	K401	K786	Balk (80)	standaard	CrossArm2
S287	CS133 - L50X5	2,922	Lijn	K521	K522	Balk (80)	standaard	CrossArm2
S288	CS134 - L80X8	2,447	Lijn	K63	K765	Balk (80)	standaard	CrossArm2
S289	CS44 - UNP200	8,015	Lijn	K63	K429	Balk (80)	standaard	CrossArm2
S290	CS143 - L90X9	2,456	Lijn	K527	K444	Balk (80)	standaard	Vak13
S291	CS143 - L90X9	2,542	Lijn	K406	K527	Balk (80)	standaard	Vak13
S292	CS143 - L90X9	2,539	Lijn	K531	K406	Balk (80)	standaard	Vak14
S295	CS44 - UNP200	8,015	Lijn	K444	K458	Balk (80)	standaard	CrossArm1
S296	CS139 - L50X5	1,771	Lijn	K538	K460	Kolom (100)	standaard	CrossArm1
S297	CS139 - L50X5	1,782	Lijn	K538	K426	Kolom (100)	standaard	CrossArm1
S298	CS36 - L100X10	3,507	Lijn	K301	K444	Balk (80)	standaard	Vak10
S300	CS93 - L90X9	2,265	Lijn	K546	K622	Kolom (100)	standaard	Vak10
S301	CS92 - L50X5	2,227	Lijn	K470	K444	Kolom (100)	standaard	Vak8
S302	CS136 - L65X7	2,073	Lijn	K550	K424	Balk (80)	standaard	CrossArm1
S303	CS135 - L55X6	2,405	Lijn	K552	K553	Balk (80)	standaard	CrossArm1
S304	CS135 - L55X6	2,711	Lijn	K460	K555	Balk (80)	standaard	CrossArm1
S307	CS136 - L65X7	2,073	Lijn	K553	K458	Balk (80)	standaard	CrossArm1
S308	CS135 - L55X6	2,405	Lijn	K555	K550	Balk (80)	standaard	CrossArm1
S309	CS135 - L55X6	2,711	Lijn	K426	K552	Balk (80)	standaard	CrossArm1
S312	CS132 - HEB200	2,506	Lijn	K426	K460	Balk (80)	standaard	CrossArm1
S318	CS143 - L90X9	2,456	Lijn	K527	K301	Balk (80)	standaard	Vak13
S319	CS143 - L90X9	2,542	Lijn	K396	K527	Balk (80)	standaard	Vak13
S320	CS143 - L90X9	2,539	Lijn	K531	K396	Balk (80)	standaard	Vak14
S321	CS145 - L50X5	3,507	Lijn	K83	K438	Balk (80)	standaard	Vak13
S324	CS144 - HEB200	3,507	Lijn	K414	K434	Balk (80)	standaard	Vak14
S328	CS124 - UNP200	1,544	Lijn	K444	K598	Kolom (100)	standaard	Vak10
S330	CS4 - L50X5	0,864	Lijn	K469	K601	Balk (80)	standaard	Vak8
S331	CS92 - L50X5	2,231	Lijn	K469	K438	Kolom (100)	standaard	Vak8
S332	CS90 - L150X100X12	4,017	Lijn	K456	K438	Kolom (100)	standaard	Vak8
S333	CS85 - L50X5	2,571	Lijn	N156	K605	Kolom (100)	standaard	Vak6
S334	CS130 - L50X5	1,250	Lijn	K606	K605	Balk (80)	standaard	Vak6
S336	CS84 - L90X9	2,076	Lijn	N156	K89	Kolom (100)	standaard	Vak6
S340	CS44 - UNP200	8,015	Lijn	K301	K424	Balk (80)	standaard	CrossArm1
S341	CS82 - L200X16	2,140	Lijn	K112	K111	Kolom (100)	standaard	Vak6
S342	CS82 - L200X16	2,140	Lijn	N156	K606	Kolom (100)	standaard	Vak6
S343	CS160 - HEB120	0,800	Lijn	K618	K284	Balk (80)	standaard	CrossArm5
S345	CS35 - L180X16	5,642	Polylijn	K93	K69	Balk (80)	standaard	Vak6
S347	CS35 - L180X16	5,642	Polylijn	K93	K628	Balk (80)	standaard	Vak6
S349	CS35 - L180X16	5,642	Polylijn	K109	K456	Balk (80)	standaard	Vak6
S351	CS35 - L180X16	5,642	Polylijn	K109	K75	Balk (80)	standaard	Vak6
C5	CS113 - L200X26	3,374	Lijn	N2	N59	Kolom (100)	standaard	Vak2
C6	CS113 - L200X26	3,374	Lijn	N4	N61	Kolom (100)	standaard	Vak2
C7	CS113 - L200X26	3,374	Lijn	N5	N62	Kolom (100)	standaard	Vak2
C8	CS113 - L200X26	3,374	Lijn	N8	N65	Kolom (100)	standaard	Vak2
B8	CS100 - L150X100X10	4,916	Lijn	N9	N61	vakwerkdiagonaal (90)	standaard	Vak2

Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
B10	CS100 - L150X100X10	4,916	Lijn	N66	N65	vakwerkdiagonaal (90)	standaard	Vak2
B12	CS100 - L150X100X10	4,916	Lijn	N67	N65	vakwerkdiagonaal (90)	standaard	Vak2
B93	CS100 - L150X100X10	4,916	Lijn	N68	N62	vakwerkdiagonaal (90)	standaard	Vak2
SB49	CS63 - L55X6	1,900	Lijn	N14	N69	vertikaal windverband (0)	standaard	Vak2
SB50	CS65 - L55X6	2,621	Lijn	N2	N14	vertikaal windverband (0)	standaard	Vak2
SB51	CS63 - L55X6	1,900	Lijn	N15	N16	vertikaal windverband (0)	standaard	Vak2
SB52	CS65 - L55X6	2,621	Lijn	N4	N16	vertikaal windverband (0)	standaard	Vak2
SB53	CS63 - L55X6	1,900	Lijn	N17	N15	vertikaal windverband (0)	standaard	Vak2
SB54	CS65 - L55X6	2,621	Lijn	N4	N17	vertikaal windverband (0)	standaard	Vak2
SB55	CS63 - L55X6	1,900	Lijn	N19	N18	vertikaal windverband (0)	standaard	Vak2
SB56	CS65 - L55X6	2,621	Lijn	N8	N18	vertikaal windverband (0)	standaard	Vak2
SB57	CS63 - L55X6	1,900	Lijn	N70	N19	vertikaal windverband (0)	standaard	Vak2
SB58	CS65 - L55X6	2,621	Lijn	N8	N70	vertikaal windverband (0)	standaard	Vak2
SB59	CS63 - L55X6	1,900	Lijn	N72	N71	vertikaal windverband (0)	standaard	Vak2
SB60	CS65 - L55X6	2,621	Lijn	N5	N71	vertikaal windverband (0)	standaard	Vak2
SB61	CS63 - L55X6	1,900	Lijn	N73	N72	vertikaal windverband (0)	standaard	Vak2
SB62	CS65 - L55X6	2,621	Lijn	N5	N73	vertikaal windverband (0)	standaard	Vak2
SB63	CS63 - L55X6	1,900	Lijn	N69	N74	vertikaal windverband (0)	standaard	Vak2
SB64	CS65 - L55X6	2,621	Lijn	N2	N74	vertikaal windverband (0)	standaard	Vak2
B31	CS100 - L150X100X10	4,916	Lijn	N66	N61	vakwerkdiagonaal (90)	standaard	Vak2
B32	CS100 - L150X100X10	4,916	Lijn	N67	N62	vakwerkdiagonaal (90)	standaard	Vak2
B33	CS100 - L150X100X10	4,916	Lijn	N68	N59	vakwerkdiagonaal (90)	standaard	Vak2
B34	CS100 - L150X100X10	4,916	Lijn	N9	N59	vakwerkdiagonaal (90)	standaard	Vak2
C9	CS113 - L200X26	6,648	Lijn	N59	N76	Kolom (100)	standaard	Vak3
C10	CS113 - L200X26	6,648	Lijn	N61	N78	Kolom (100)	standaard	Vak3
C11	CS113 - L200X26	6,648	Lijn	N62	N79	Kolom (100)	standaard	Vak3
C12	CS113 - L200X26	6,648	Lijn	N65	N82	Kolom (100)	standaard	Vak3
B94	CS68 - L150X100X12	9,452	Lijn	N61	N76	vakwerkdiagonaal (90)	standaard	Vak3
B95	CS68 - L150X100X12	9,452	Lijn	N65	N78	vakwerkdiagonaal (90)	standaard	Vak3
B22	CS68 - L150X100X12	9,452	Lijn	N62	N82	vakwerkdiagonaal (90)	standaard	Vak3
B26	CS68 - L150X100X12	9,452	Lijn	N59	N79	vakwerkdiagonaal (90)	standaard	Vak3
SB65	CS67 - L55X6	1,676	Lijn	N88	N87	vertikaal windverband (0)	standaard	Vak3
SB66	CS67 - L55X6	1,676	Lijn	N89	N88	vertikaal windverband (0)	standaard	Vak3
SB67	CS67 - L55X6	1,676	Lijn	N91	N90	vertikaal windverband (0)	standaard	Vak3
SB68	CS67 - L55X6	1,676	Lijn	N92	N91	vertikaal windverband (0)	standaard	Vak3
SB69	CS67 - L55X6	1,676	Lijn	N94	N93	vertikaal windverband (0)	standaard	Vak3
SB70	CS67 - L55X6	1,676	Lijn	N95	N94	vertikaal windverband (0)	standaard	Vak3
SB71	CS67 - L55X6	1,676	Lijn	N97	N96	vertikaal windverband (0)	standaard	Vak3
SB72	CS67 - L55X6	1,676	Lijn	N98	N97	vertikaal windverband (0)	standaard	Vak3
SB73	CS66 - L55X6	2,356	Lijn	N87	K707	vertikaal windverband (0)	standaard	Vak3
SB74	CS66 - L55X6	2,356	Lijn	N89	K707	vertikaal windverband (0)	standaard	Vak3
SB75	CS66 - L55X6	2,356	Lijn	N90	K705	vertikaal windverband (0)	standaard	Vak3
SB76	CS66 - L55X6	2,356	Lijn	N92	K705	vertikaal windverband (0)	standaard	Vak3
SB77	CS66 - L55X6	2,356	Lijn	N93	K708	vertikaal windverband (0)	standaard	Vak3
SB78	CS66 - L55X6	2,356	Lijn	N95	K708	vertikaal windverband (0)	standaard	Vak3
SB79	CS66 - L55X6	2,356	Lijn	N96	K711	vertikaal windverband (0)	standaard	Vak3
SB80	CS66 - L55X6	2,356	Lijn	N98	K711	vertikaal windverband (0)	standaard	Vak3
SB81	CS66 - L55X6	2,360	Lijn	K707	N99	vertikaal windverband (0)	standaard	Vak3
SB82	CS67 - L55X6	1,676	Lijn	N100	N99	vertikaal windverband (0)	standaard	Vak3
SB83	CS66 - L55X6	2,360	Lijn	K707	N101	vertikaal windverband (0)	standaard	Vak3
SB84	CS67 - L55X6	1,676	Lijn	N101	N100	vertikaal windverband (0)	standaard	Vak3
SB85	CS66 - L55X6	2,360	Lijn	K705	N102	vertikaal windverband (0)	standaard	Vak3
SB86	CS67 - L55X6	1,676	Lijn	N33	N102	vertikaal windverband (0)	standaard	Vak3
SB87	CS66 - L55X6	2,360	Lijn	K705	N103	vertikaal windverband (0)	standaard	Vak3
SB88	CS67 - L55X6	1,676	Lijn	N103	N33	vertikaal windverband (0)	standaard	Vak3
SB89	CS66 - L55X6	2,360	Lijn	K708	N104	vertikaal windverband (0)	standaard	Vak3
SB90	CS67 - L55X6	1,676	Lijn	N105	N104	vertikaal windverband (0)	standaard	Vak3
SB91	CS66 - L55X6	2,360	Lijn	K708	N106	vertikaal windverband (0)	standaard	Vak3
SB92	CS67 - L55X6	1,676	Lijn	N106	N105	vertikaal windverband (0)	standaard	Vak3
SB93	CS66 - L55X6	2,360	Lijn	K711	N38	vertikaal windverband (0)	standaard	Vak3
SB94	CS67 - L55X6	1,676	Lijn	N107	N38	vertikaal windverband (0)	standaard	Vak3
SB95	CS66 - L55X6	2,360	Lijn	K711	N108	vertikaal windverband (0)	standaard	Vak3
SB96	CS67 - L55X6	1,676	Lijn	N108	N107	vertikaal windverband (0)	standaard	Vak3
B73	CS68 - L150X100X12	9,452	Lijn	N61	N82	vakwerkdiagonaal (90)	standaard	Vak3
B74	CS68 - L150X100X12	9,452	Lijn	N65	N79	vakwerkdiagonaal (90)	standaard	Vak3
B75	CS68 - L150X100X12	9,452	Lijn	N62	N76	vakwerkdiagonaal (90)	standaard	Vak3
B76	CS68 - L150X100X12	9,452	Lijn	N59	N78	vakwerkdiagonaal (90)	standaard	Vak3
C13	CS13 - L200X20	6,648	Lijn	N76	N114	Kolom (100)	standaard	Vak4
C14	CS13 - L200X20	6,648	Lijn	N78	N116	Kolom (100)	standaard	Vak4

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	Auteur	- SMA

Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
C15	CS13 - L200X20	6,648	Lijn	N79	N117	Kolom (100)	standaard	Vak4
C16	CS13 - L200X20	6,648	Lijn	N82	N120	Kolom (100)	standaard	Vak4
B98	CS70 - L150X100X14	8,859	Lijn	N78	N114	vakwerkdiagonaal (90)	standaard	Vak4
B99	CS70 - L150X100X14	8,860	Lijn	N82	N116	vakwerkdiagonaal (90)	standaard	Vak4
B100	CS70 - L150X100X14	8,860	Lijn	N79	N120	vakwerkdiagonaal (90)	standaard	Vak4
B101	CS70 - L150X100X14	8,859	Lijn	N76	N117	vakwerkdiagonaal (90)	standaard	Vak4
B102	CS81 - L60X6	2,920	Lijn	N152	N121	vertikaal windverband (0)	standaard	Vak4
B103	CS81 - L60X6	2,920	Lijn	N149	N122	vertikaal windverband (0)	standaard	Vak4
B104	CS81 - L60X6	2,920	Lijn	N150	N123	vertikaal windverband (0)	standaard	Vak4
B105	CS81 - L60X6	2,920	Lijn	N151	N124	vertikaal windverband (0)	standaard	Vak4
SB97	CS69 - L50X5	1,460	Lijn	N126	N125	vertikaal windverband (0)	standaard	Vak4
SB98	CS69 - L50X5	1,460	Lijn	N127	N126	vertikaal windverband (0)	standaard	Vak4
SB99	CS69 - L50X5	1,460	Lijn	N129	N128	vertikaal windverband (0)	standaard	Vak4
SB100	CS69 - L50X5	1,460	Lijn	N130	N129	vertikaal windverband (0)	standaard	Vak4
SB101	CS69 - L50X5	1,460	Lijn	N132	N131	vertikaal windverband (0)	standaard	Vak4
SB102	CS69 - L50X5	1,460	Lijn	N133	N132	vertikaal windverband (0)	standaard	Vak4
SB103	CS69 - L50X5	1,460	Lijn	N135	N134	vertikaal windverband (0)	standaard	Vak4
SB104	CS69 - L50X5	1,460	Lijn	N136	N135	vertikaal windverband (0)	standaard	Vak4
SB105	CS71 - L50X5	2,231	Lijn	N125	N122	vertikaal windverband (0)	standaard	Vak4
SB106	CS71 - L50X5	2,231	Lijn	N127	N122	vertikaal windverband (0)	standaard	Vak4
SB107	CS71 - L50X5	2,231	Lijn	N128	N123	vertikaal windverband (0)	standaard	Vak4
SB108	CS71 - L50X5	2,231	Lijn	N130	N123	vertikaal windverband (0)	standaard	Vak4
SB109	CS71 - L50X5	2,231	Lijn	N131	N124	vertikaal windverband (0)	standaard	Vak4
SB110	CS71 - L50X5	2,231	Lijn	N133	N124	vertikaal windverband (0)	standaard	Vak4
SB111	CS71 - L50X5	2,231	Lijn	N134	N121	vertikaal windverband (0)	standaard	Vak4
SB112	CS71 - L50X5	2,231	Lijn	N136	N121	vertikaal windverband (0)	standaard	Vak4
SB113	CS71 - L50X5	2,190	Lijn	N122	N137	vertikaal windverband (0)	standaard	Vak4
SB114	CS69 - L50X5	1,460	Lijn	N138	N137	vertikaal windverband (0)	standaard	Vak4
SB115	CS71 - L50X5	2,190	Lijn	N122	N139	vertikaal windverband (0)	standaard	Vak4
SB116	CS69 - L50X5	1,460	Lijn	N139	N138	vertikaal windverband (0)	standaard	Vak4
SB117	CS71 - L50X5	2,190	Lijn	N123	N140	vertikaal windverband (0)	standaard	Vak4
SB118	CS69 - L50X5	1,460	Lijn	N141	N140	vertikaal windverband (0)	standaard	Vak4
SB119	CS71 - L50X5	2,190	Lijn	N123	N142	vertikaal windverband (0)	standaard	Vak4
SB120	CS69 - L50X5	1,460	Lijn	N142	N141	vertikaal windverband (0)	standaard	Vak4
SB121	CS71 - L50X5	2,190	Lijn	N124	N143	vertikaal windverband (0)	standaard	Vak4
SB122	CS69 - L50X5	1,460	Lijn	N144	N143	vertikaal windverband (0)	standaard	Vak4
SB123	CS71 - L50X5	2,190	Lijn	N124	N145	vertikaal windverband (0)	standaard	Vak4
SB124	CS69 - L50X5	1,460	Lijn	N145	N144	vertikaal windverband (0)	standaard	Vak4
SB125	CS71 - L50X5	2,190	Lijn	N121	N146	vertikaal windverband (0)	standaard	Vak4
SB126	CS69 - L50X5	1,460	Lijn	N147	N146	vertikaal windverband (0)	standaard	Vak4
SB127	CS71 - L50X5	2,190	Lijn	N121	N148	vertikaal windverband (0)	standaard	Vak4
SB128	CS69 - L50X5	1,460	Lijn	N148	N147	vertikaal windverband (0)	standaard	Vak4
B106	CS70 - L150X100X14	8,859	Lijn	N78	N120	vakwerkdiagonaal (90)	standaard	Vak4
B107	CS70 - L150X100X14	8,859	Lijn	N82	N117	vakwerkdiagonaal (90)	standaard	Vak4
B108	CS70 - L150X100X14	8,860	Lijn	N79	N114	vakwerkdiagonaal (90)	standaard	Vak4
B109	CS70 - L150X100X14	8,860	Lijn	N76	N116	vakwerkdiagonaal (90)	standaard	Vak4
B110	CS81 - L60X6	2,920	Lijn	N122	N152	vertikaal windverband (0)	standaard	Vak4
B111	CS81 - L60X6	2,920	Lijn	N123	N149	vertikaal windverband (0)	standaard	Vak4
B112	CS81 - L60X6	2,920	Lijn	N124	N150	vertikaal windverband (0)	standaard	Vak4
B113	CS81 - L60X6	2,920	Lijn	N121	N151	vertikaal windverband (0)	standaard	Vak4
C17	CS112 - L200X20	3,414	Lijn	N114	K102	Kolom (100)	standaard	Vak5
C18	CS112 - L200X20	3,414	Lijn	N116	N156	Kolom (100)	standaard	Vak5
C19	CS112 - L200X20	3,414	Lijn	N117	K91	Kolom (100)	standaard	Vak5
C20	CS112 - L200X20	3,414	Lijn	N120	K112	Kolom (100)	standaard	Vak5
B114	CS73 - L150X100X12	4,360	Lijn	N114	K109	vakwerkdiagonaal (90)	standaard	Vak5
B115	CS73 - L150X100X12	4,360	Lijn	N116	K625	vakwerkdiagonaal (90)	standaard	Vak5
B116	CS73 - L150X100X12	4,360	Lijn	N117	K93	vakwerkdiagonaal (90)	standaard	Vak5
B117	CS73 - L150X100X12	4,360	Lijn	N114	K99	vakwerkdiagonaal (90)	standaard	Vak5
SB129	CS20 - L50X5	1,250	Lijn	N166	N165	vertikaal windverband (0)	standaard	Vak5
SB130	CS72 - L50X5	2,050	Lijn	N166	K102	vertikaal windverband (0)	standaard	Vak5
SB131	CS20 - L50X5	1,250	Lijn	N168	N167	vertikaal windverband (0)	standaard	Vak5
SB132	CS72 - L50X5	2,050	Lijn	N167	N156	vertikaal windverband (0)	standaard	Vak5
SB133	CS20 - L50X5	1,250	Lijn	N169	N168	vertikaal windverband (0)	standaard	Vak5
SB134	CS72 - L50X5	2,049	Lijn	N169	N156	vertikaal windverband (0)	standaard	Vak5
SB135	CS20 - L50X5	1,250	Lijn	N171	N170	vertikaal windverband (0)	standaard	Vak5
SB136	CS72 - L50X5	2,050	Lijn	N170	K112	vertikaal windverband (0)	standaard	Vak5
SB137	CS20 - L50X5	1,250	Lijn	N172	N171	vertikaal windverband (0)	standaard	Vak5
SB138	CS72 - L50X5	2,050	Lijn	N172	K112	vertikaal windverband (0)	standaard	Vak5
SB139	CS20 - L50X5	1,250	Lijn	N174	N173	vertikaal windverband (0)	standaard	Vak5

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	Nationale norm	EC - ENV
	Auteur	- SMA

Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
SB140	CS72 - L50X5	2,050	Lijn	N173	K91	vertikaal windverband (0)	standaard	Vak5
SB141	CS20 - L50X5	1,250	Lijn	N175	N174	vertikaal windverband (0)	standaard	Vak5
SB142	CS72 - L50X5	2,050	Lijn	N175	K91	vertikaal windverband (0)	standaard	Vak5
SB143	CS20 - L50X5	1,250	Lijn	N165	N176	vertikaal windverband (0)	standaard	Vak5
SB144	CS72 - L50X5	2,050	Lijn	N176	K102	vertikaal windverband (0)	standaard	Vak5
B36	CS73 - L150X100X12	4,360	Lijn	N116	K109	vakwerkdiagonaal (90)	standaard	Vak5
B37	CS73 - L150X100X12	4,360	Lijn	N120	K93	vakwerkdiagonaal (90)	standaard	Vak5
B38	CS73 - L150X100X12	4,360	Lijn	N120	K625	vakwerkdiagonaal (90)	standaard	Vak5
B39	CS73 - L150X100X12	4,360	Lijn	N117	K99	vakwerkdiagonaal (90)	standaard	Vak5
S355	CS82 - L200X16	2,140	Lijn	K90	K69	Kolom (100)	standaard	Vak6
S356	CS82 - L200X16	2,141	Lijn	K69	K71	Kolom (100)	standaard	Vak7
S359	CS89 - L140X13	2,220	Lijn	K620	K56	Kolom (100)	standaard	Vak11
S360	CS89 - L140X13	2,135	Lijn	K56	K388	Kolom (100)	standaard	Vak11
S361	CS89 - L140X13	0,970	Lijn	K388	K29	Kolom (100)	standaard	Vak20
S365	CS82 - L200X16	2,140	Lijn	K104	K75	Kolom (100)	standaard	Vak6
S366	CS82 - L200X16	2,141	Lijn	K75	K77	Kolom (100)	standaard	Vak7
S367	CS82 - L200X16	2,119	Lijn	K77	K63	Kolom (100)	standaard	Vak7
S368	CS82 - L200X16	1,570	Lijn	K63	K65	Kolom (100)	standaard	Vak10
S369	CS89 - L140X13	1,761	Lijn	K65	K619	Kolom (100)	standaard	Vak10
S370	CS89 - L140X13	2,220	Lijn	K55	K619	Kolom (100)	standaard	Vak11
S371	CS89 - L140X13	2,135	Lijn	K43	K55	Kolom (100)	standaard	Vak11
S372	CS89 - L140X13	0,970	Lijn	K39	K43	Kolom (100)	standaard	Vak20
S373	CS131 - L80X8	6,823	Lijn	K325	K39	Kolom (100)	standaard	CrossArm6
S377	CS122 - L130X12	4,236	Polylijn	K307	K619	Balk (80)	standaard	Vak10
S379	CS122 - L130X12	4,235	Polylijn	K291	K620	Balk (80)	standaard	Vak10
S381	CS122 - L130X12	4,236	Polylijn	K438	K622	Balk (80)	standaard	Vak10
S383	CS122 - L130X12	4,235	Polylijn	K83	K621	Balk (80)	standaard	Vak10
S386	CS44 - UNP200	3,674	Lijn	K394	K396	Balk (80)	standaard	Vak14
S395	CS44 - UNP200	8,015	Lijn	K626	K420	Balk (80)	standaard	CrossArm2
S397	CS92 - L50X5	2,227	Lijn	K626	K72	Balk (80)	standaard	Vak7
S398	CS82 - L200X16	2,119	Lijn	K626	K71	Balk (80)	standaard	Vak7
S400	CS143 - L90X9	2,456	Lijn	K626	K473	Balk (80)	standaard	Vak9
S401	CS93 - L90X9	2,366	Lijn	K626	K67	Balk (80)	standaard	Vak10
S402	CS82 - L200X16	1,570	Lijn	K626	K61	Balk (80)	standaard	Vak10
S405	CS83 - L150X100X12	4,765	Lijn	K628	K625	Kolom (100)	standaard	Vak6
S408	CS82 - L200X16	2,119	Lijn	K81	K301	Kolom (100)	standaard	Vak8
S409	CS82 - L200X16	1,571	Lijn	K301	K298	Kolom (100)	standaard	Vak10
S411	CS89 - L140X13	2,221	Lijn	K171	K621	Kolom (100)	standaard	Vak12
S412	CS89 - L140X13	2,135	Lijn	K156	K171	Kolom (100)	standaard	Vak12
S413	CS89 - L140X13	0,970	Lijn	K144	K156	Kolom (100)	standaard	Vak15
S414	CS131 - L80X8	6,823	Lijn	K284	K144	Kolom (100)	standaard	CrossArm5
S418	CS82 - L200X16	2,140	Lijn	K606	K456	Kolom (100)	standaard	Vak6
S419	CS82 - L200X16	2,141	Lijn	K456	K469	Kolom (100)	standaard	Vak8
S420	CS82 - L200X16	2,119	Lijn	K469	K444	Kolom (100)	standaard	Vak8
S421	CS82 - L200X16	1,571	Lijn	K444	K459	Kolom (100)	standaard	Vak10
S422	CS89 - L140X13	1,761	Lijn	K459	K622	Kolom (100)	standaard	Vak10
S424	CS89 - L140X13	2,135	Lijn	K170	K158	Kolom (100)	standaard	Vak12
S425	CS89 - L140X13	0,970	Lijn	K158	K154	Kolom (100)	standaard	Vak15
S426	CS131 - L80X8	6,823	Lijn	K154	K618	Kolom (100)	standaard	CrossArm5
S430	CS37 - L75X8	4,252	Lijn	K456	K628	Balk (80)	standaard	Vak8
S431	CS82 - L200X16	2,140	Lijn	K111	K628	Balk (80)	standaard	Vak6
S432	CS82 - L200X16	2,141	Lijn	K628	K81	Balk (80)	standaard	Vak8
S433	CS90 - L150X100X12	4,017	Polylijn	K628	K83	Balk (80)	standaard	Vak8
S435	CS91 - L150X15	4,747	Lijn	K628	K447	Balk (80)	standaard	Vak8
S445	CS149 - UNP180	1,970	Lijn	K787	K335	Balk (80)	standaard	Vak19
S447	CS149 - UNP180	1,568	Lijn	K335	K388	Balk (80)	standaard	Vak20
S448	CS138 - L60X6	2,827	Lijn	K61	K786	Balk (80)	standaard	CrossArm2
S450	CS4 - L50X5	0,864	Lijn	K77	K629	Balk (80)	standaard	Vak7
S451	CS90 - L150X100X12	4,017	Lijn	K75	K307	Balk (80)	standaard	Vak7
S453	CS4 - L50X5	0,864	Lijn	K71	K630	Balk (80)	standaard	Vak7
S454	CS90 - L150X100X12	4,017	Polylijn	K69	K291	Balk (80)	standaard	Vak7
S456	CS129 - L50X5	2,179	Lijn	K55	K198	Balk (80)	standaard	Vak11
S457	CS124 - UNP200	1,544	Lijn	K626	K294	Balk (80)	standaard	Vak10
S458	CS92 - L50X5	2,231	Lijn	K307	K77	Balk (80)	standaard	Vak7
S459	CS92 - L50X5	2,231	Lijn	K291	K71	Balk (80)	standaard	Vak7
S460	CS84 - L90X9	2,076	Lijn	K88	K102	Balk (80)	standaard	Vak6
S461	CS141 - L65X50X5	1,503	Lijn	K396	K411	Balk (80)	standaard	Vak14
S462	CS141 - L65X50X5	1,503	Lijn	K410	K406	Balk (80)	standaard	Vak14
S463	CS141 - L65X50X5	1,503	Lijn	K409	K394	Balk (80)	standaard	Vak14

Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
S464	CS141 - L65X50X5	1,503	Lijn	K404	K408	Balk (80)	standaard	Vak14
S465	CS134 - L80X8	1,745	Lijn	K401	K765	Balk (80)	standaard	CrossArm2
B129	CS79 - L90X9	3,536	Lijn	K99	K93	vakwerkdiagonaal (90)	standaard	HorVerb3
B130	CS79 - L90X9	3,536	Lijn	K93	K625	vakwerkdiagonaal (90)	standaard	HorVerb3
B131	CS79 - L90X9	3,535	Lijn	K625	K109	vakwerkdiagonaal (90)	standaard	HorVerb3
B132	CS79 - L90X9	3,536	Lijn	K99	K109	vakwerkdiagonaal (90)	standaard	HorVerb3
B133	CS77 - L75X8	5,000	Polylijn	K99	K625	vakwerkdiagonaal (90)	standaard	HorVerb3
S467	CS78 - L150X14	2,500	Lijn	N156	K109	Balk (80)	standaard	HorVerb3
S468	CS78 - L150X14	2,500	Lijn	K109	K102	Balk (80)	standaard	HorVerb3
S469	CS78 - L150X14	2,500	Lijn	K102	K99	Balk (80)	standaard	HorVerb3
S470	CS78 - L150X14	2,500	Lijn	K99	K91	Balk (80)	standaard	HorVerb3
S471	CS78 - L150X14	2,500	Lijn	K91	K93	Balk (80)	standaard	HorVerb3
S472	CS78 - L150X14	2,500	Lijn	K93	K112	Balk (80)	standaard	HorVerb3
S473	CS78 - L150X14	2,501	Lijn	K112	K625	Balk (80)	standaard	HorVerb3
S474	CS78 - L150X14	2,499	Lijn	K625	N156	Balk (80)	standaard	HorVerb3
S479	CS83 - L150X100X12	4,764	Lijn	K456	K625	Kolom (100)	standaard	Vak6
S480	CS83 - L150X100X12	4,765	Lijn	K75	K99	Kolom (100)	standaard	Vak6
S481	CS83 - L150X100X12	4,765	Lijn	K69	K99	Kolom (100)	standaard	Vak6
S482	CS21 - L100X75X7	6,950	Polylijn	K284	K261	Kolom (100)	standaard	CrossArm5
S483	CS21 - L100X75X7	6,950	Lijn	K267	K618	Kolom (100)	standaard	CrossArm5
S484	CS21 - L100X75X7	6,950	Lijn	K233	K256	Kolom (100)	standaard	CrossArm6
S485	CS21 - L100X75X7	6,950	Polylijn	K325	K235	Kolom (100)	standaard	CrossArm6
S486	CS131 - L80X8	6,823	Lijn	K29	K256	Kolom (100)	standaard	CrossArm6
S487	CS89 - L140X13	1,761	Lijn	K61	K620	Balk (80)	standaard	Vak10
S488	CS127 - L160X15	3,202	Lijn	K294	K409	Balk (80)	standaard	Vak9
S491	CS127 - L160X15	3,201	Lijn	K306	K408	Balk (80)	standaard	Vak9
S497	CS149 - UNP180	1,568	Lijn	K43	K198	Balk (80)	standaard	Vak20
S501	CS157 - L120X11	2,721	Lijn	K233	K623	Balk (80)	standaard	Vak19
S503	CS157 - L120X11	2,720	Lijn	K235	K627	Balk (80)	standaard	Vak19
S508	CS146 - HEB180	0,800	Lijn	K282	K264	Balk (80)	standaard	CrossArm3
S511	CS146 - HEB180	0,800	Lijn	K254	K631	Balk (80)	standaard	CrossArm4
S526	CS59 - L70/7	4,741	Lijn	K712	K709	Balk (80)	standaard	HorVerb2
S527	CS59 - L70/7	4,741	Lijn	K709	K706	Balk (80)	standaard	HorVerb2
S528	CS59 - L70/7	4,741	Lijn	K706	N247	Balk (80)	standaard	HorVerb2
S529	CS59 - L70/7	4,741	Lijn	N247	K712	Balk (80)	standaard	HorVerb2
S533	CS121 - L60X6	3,353	Lijn	N247	K763	Balk (80)	standaard	HorVerb2
S547	CS44 - UNP200	3,674	Lijn	K406	K404	Balk (80)	standaard	Vak14
S548	CS132 - HEB200	0,799	Lijn	K429	K420	Balk (80)	standaard	CrossArm2
S551	CS132 - HEB200	0,799	Lijn	K424	K458	Balk (80)	standaard	CrossArm1
S588	CS104 - L65X7	3,353	Lijn	K707	N247	Balk (80)	standaard	HorVerb2
S589	CS104 - L65X7	3,353	Lijn	N247	K711	Balk (80)	standaard	HorVerb2
S590	CS104 - L65X7	3,353	Lijn	K705	K706	Balk (80)	standaard	HorVerb2
S591	CS104 - L65X7	3,353	Lijn	K706	K707	Balk (80)	standaard	HorVerb2
S592	CS104 - L65X7	3,353	Lijn	K708	K709	Balk (80)	standaard	HorVerb2
S593	CS104 - L65X7	3,353	Lijn	K709	K705	Balk (80)	standaard	HorVerb2
S594	CS104 - L65X7	3,353	Lijn	K711	K712	Balk (80)	standaard	HorVerb2
S595	CS104 - L65X7	3,353	Lijn	K712	K708	Balk (80)	standaard	HorVerb2
C29	CS113 - L200X26	10,951	Lijn	N248	N2	Kolom (100)	standaard	Vak1
B154	CS114 - L130X12	12,292	Lijn	N248	N9	vakwerkdiagonaal (90)	standaard	Vak1
B159	CS114 - L130X12	12,292	Lijn	N248	N68	vakwerkdiagonaal (90)	standaard	Vak1
SB241	CS115 - L60X6	1,267	Lijn	N260	N261	vertikaal windverband (0)	standaard	Vak1
SB249	CS115 - L60X6	1,267	Lijn	N261	N276	vertikaal windverband (0)	standaard	Vak1
SB250	CS115 - L60X6	2,533	Lijn	N262	N277	vertikaal windverband (0)	standaard	Vak1
SB252	CS115 - L60X6	2,533	Lijn	N280	N262	vertikaal windverband (0)	standaard	Vak1
SB259	CS115 - L60X6	2,002	Lijn	N276	K719	vertikaal windverband (0)	standaard	Vak1
SB260	CS119 - L65X7	2,809	Lijn	N277	K723	vertikaal windverband (0)	standaard	Vak1
SB261	CS119 - L65X7	2,809	Lijn	N280	K723	vertikaal windverband (0)	standaard	Vak1
SB272	CS115 - L60X6	2,002	Lijn	N260	K719	vertikaal windverband (0)	standaard	Vak1
B84	CS8 - L50X5	1,791	Lijn	N260	N276	vertikaal windverband (0)	standaard	Vak1
B85	CS120 - L55X6	3,583	Lijn	N280	N277	vertikaal windverband (0)	standaard	Vak1
B86	CS118 - L70X7	5,374	Lijn	N9	N68	vakwerkdiagonaal (90)	standaard	HorVerb1
B87	CS118 - L70X7	5,374	Lijn	N68	N67	vakwerkdiagonaal (90)	standaard	HorVerb1
B88	CS118 - L70X7	5,374	Lijn	N67	N66	vakwerkdiagonaal (90)	standaard	HorVerb1
B160	CS118 - L70X7	5,374	Lijn	N66	N9	vakwerkdiagonaal (90)	standaard	HorVerb1
B177	CS8 - L50X5	2,191	Lijn	N260	K722	vertikaal windverband (0)	standaard	Vak1
B178	CS8 - L50X5	2,191	Lijn	N276	K722	vertikaal windverband (0)	standaard	Vak1
B179	CS120 - L55X6	2,684	Lijn	N280	K726	vertikaal windverband (0)	standaard	Vak1
B180	CS120 - L55X6	2,684	Lijn	N277	K726	vertikaal windverband (0)	standaard	Vak1
B181	CS6 - L150X14	7,600	Lijn	N2	N4	Balk (80)	standaard	HorVerb1

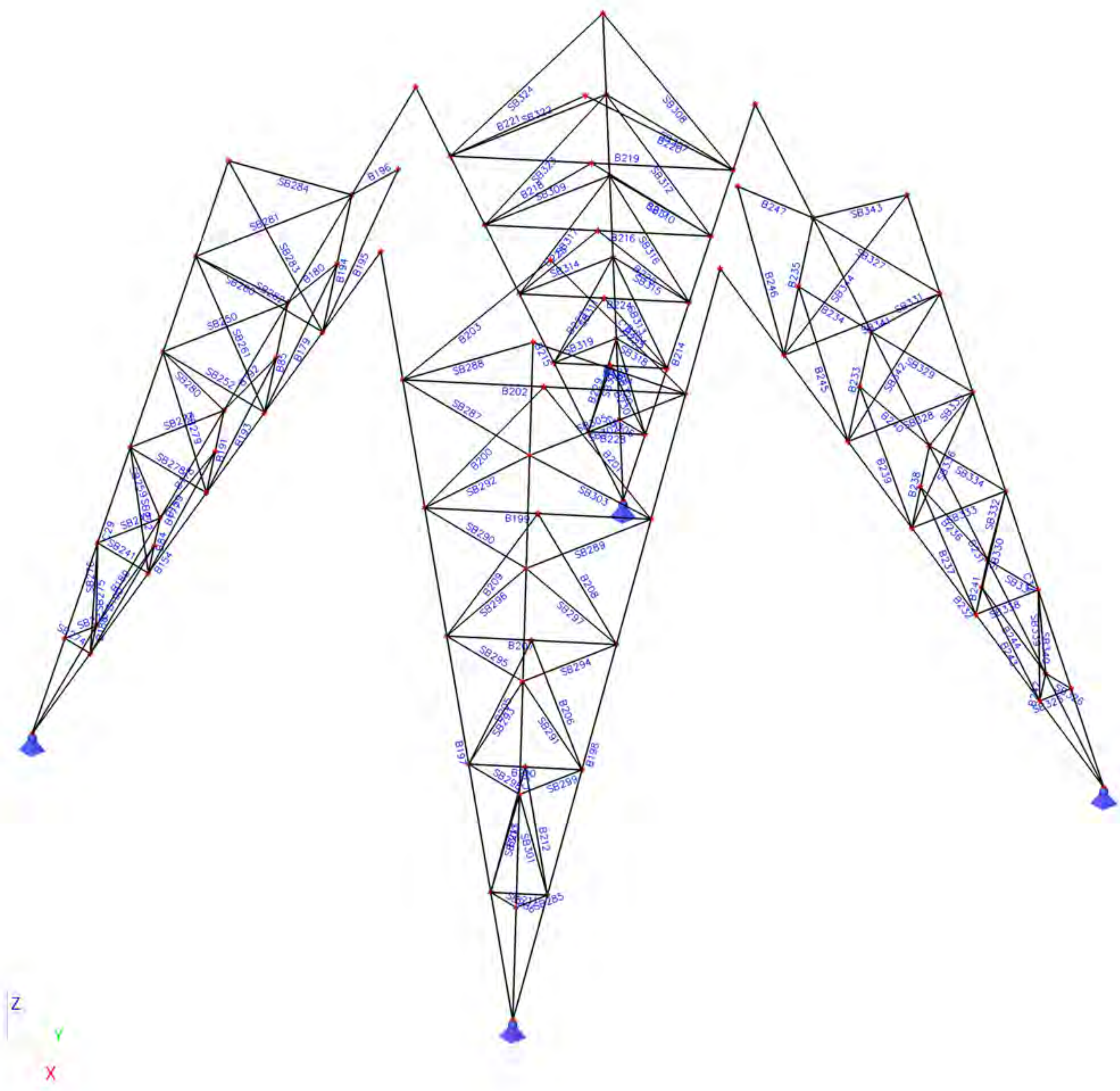
Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
B182	CS6 - L150X14	7,600	Lijn	N4	N8	Balk (80)	standaard	HorVerb1
B183	CS6 - L150X14	7,600	Lijn	N8	N5	Balk (80)	standaard	HorVerb1
B184	CS6 - L150X14	7,600	Lijn	N5	N2	Balk (80)	standaard	HorVerb1
B185	CS117 - L75X8	3,800	Lijn	N9	N289	vakwerkdiagonaal (90)	standaard	HorVerb1
B186	CS117 - L75X8	7,600	Polylijn	N68	N66	vakwerkdiagonaal (90)	standaard	HorVerb1
B187	CS117 - L75X8	3,800	Lijn	N289	N67	vakwerkdiagonaal (90)	standaard	HorVerb1
SB273	CS115 - L60X6	0,633	Lijn	K655	K714	vertikaal windverband (0)	standaard	Vak1
SB274	CS115 - L60X6	0,633	Lijn	K715	K655	vertikaal windverband (0)	standaard	Vak1
B188	CS8 - L50X5	0,896	Lijn	K715	K714	vertikaal windverband (0)	standaard	Vak1
B189	CS8 - L50X5	2,049	Lijn	K714	K718	vertikaal windverband (0)	standaard	Vak1
B190	CS8 - L50X5	2,049	Lijn	K715	K718	vertikaal windverband (0)	standaard	Vak1
SB275	CS115 - L60X6	1,808	Lijn	K715	N261	vertikaal windverband (0)	standaard	Vak1
SB276	CS115 - L60X6	1,808	Lijn	K714	N261	vertikaal windverband (0)	standaard	Vak1
SB277	CS115 - L60X6	1,900	Lijn	K719	K720	vertikaal windverband (0)	standaard	Vak1
SB278	CS115 - L60X6	1,900	Lijn	K721	K719	vertikaal windverband (0)	standaard	Vak1
B191	CS8 - L50X5	2,687	Lijn	K721	K720	vertikaal windverband (0)	standaard	Vak1
SB279	CS115 - L60X6	2,355	Lijn	K721	N262	vertikaal windverband (0)	standaard	Vak1
SB280	CS115 - L60X6	2,355	Lijn	K720	N262	vertikaal windverband (0)	standaard	Vak1
B192	CS8 - L50X5	2,409	Lijn	K720	N287	vertikaal windverband (0)	standaard	Vak1
B193	CS8 - L50X5	2,409	Lijn	K721	N287	vertikaal windverband (0)	standaard	Vak1
B194	CS120 - L55X6	4,478	Lijn	K725	K724	vertikaal windverband (0)	standaard	Vak1
SB281	CS119 - L65X7	3,167	Lijn	K723	K724	vertikaal windverband (0)	standaard	Vak1
SB282	CS119 - L65X7	3,167	Lijn	K725	K723	vertikaal windverband (0)	standaard	Vak1
B195	CS120 - L55X6	3,002	Lijn	K725	N288	vertikaal windverband (0)	standaard	Vak1
B196	CS120 - L55X6	3,002	Lijn	K724	N288	vertikaal windverband (0)	standaard	Vak1
SB283	CS119 - L65X7	3,322	Lijn	K725	N2	vertikaal windverband (0)	standaard	Vak1
SB284	CS119 - L65X7	3,322	Lijn	K724	N2	vertikaal windverband (0)	standaard	Vak1
C30	CS113 - L200X26	10,951	Lijn	N290	N4	Kolom (100)	standaard	Vak1
B197	CS114 - L130X12	12,292	Lijn	N290	N9	vakwerkdiagonaal (90)	standaard	Vak1
B198	CS114 - L130X12	12,292	Lijn	N290	N66	vakwerkdiagonaal (90)	standaard	Vak1
SB285	CS115 - L60X6	0,633	Lijn	K727	K733	vertikaal windverband (0)	standaard	Vak1
SB286	CS115 - L60X6	0,633	Lijn	K734	K727	vertikaal windverband (0)	standaard	Vak1
B199	CS120 - L55X6	3,583	Lijn	N292	N296	vertikaal windverband (0)	standaard	Vak1
B200	CS120 - L55X6	2,684	Lijn	N292	K738	vertikaal windverband (0)	standaard	Vak1
B201	CS120 - L55X6	2,684	Lijn	N296	K738	vertikaal windverband (0)	standaard	Vak1
B202	CS120 - L55X6	4,478	Lijn	K728	K737	vertikaal windverband (0)	standaard	Vak1
SB287	CS119 - L65X7	3,167	Lijn	K728	K736	vertikaal windverband (0)	standaard	Vak1
B203	CS120 - L55X6	3,002	Lijn	K728	N286	vertikaal windverband (0)	standaard	Vak1
SB288	CS119 - L65X7	3,322	Lijn	K728	N4	vertikaal windverband (0)	standaard	Vak1
B204	CS120 - L55X6	3,002	Lijn	K737	N286	vertikaal windverband (0)	standaard	Vak1
SB289	CS115 - L60X6	2,533	Lijn	N291	N296	vertikaal windverband (0)	standaard	Vak1
SB290	CS115 - L60X6	2,533	Lijn	N292	N291	vertikaal windverband (0)	standaard	Vak1
SB291	CS115 - L60X6	2,002	Lijn	N295	K729	vertikaal windverband (0)	standaard	Vak1
SB292	CS119 - L65X7	2,809	Lijn	N292	K736	vertikaal windverband (0)	standaard	Vak1
SB293	CS115 - L60X6	2,002	Lijn	N297	K729	vertikaal windverband (0)	standaard	Vak1
B205	CS8 - L50X5	2,191	Lijn	N297	K732	vertikaal windverband (0)	standaard	Vak1
B206	CS8 - L50X5	2,191	Lijn	N295	K732	vertikaal windverband (0)	standaard	Vak1
SB294	CS115 - L60X6	1,900	Lijn	K729	K730	vertikaal windverband (0)	standaard	Vak1
SB295	CS115 - L60X6	1,900	Lijn	K731	K729	vertikaal windverband (0)	standaard	Vak1
B207	CS8 - L50X5	2,687	Lijn	K731	K730	vertikaal windverband (0)	standaard	Vak1
SB296	CS115 - L60X6	2,355	Lijn	K731	N291	vertikaal windverband (0)	standaard	Vak1
SB297	CS115 - L60X6	2,355	Lijn	K730	N291	vertikaal windverband (0)	standaard	Vak1
B208	CS8 - L50X5	2,409	Lijn	K730	N293	vertikaal windverband (0)	standaard	Vak1
B209	CS8 - L50X5	2,409	Lijn	K731	N293	vertikaal windverband (0)	standaard	Vak1
SB298	CS115 - L60X6	1,267	Lijn	N297	N294	vertikaal windverband (0)	standaard	Vak1
SB299	CS115 - L60X6	1,267	Lijn	N294	N295	vertikaal windverband (0)	standaard	Vak1
B210	CS8 - L50X5	1,791	Lijn	N297	N295	vertikaal windverband (0)	standaard	Vak1
B211	CS8 - L50X5	0,896	Lijn	K734	K733	vertikaal windverband (0)	standaard	Vak1
B212	CS8 - L50X5	2,049	Lijn	K733	K735	vertikaal windverband (0)	standaard	Vak1
B213	CS8 - L50X5	2,049	Lijn	K734	K735	vertikaal windverband (0)	standaard	Vak1
SB300	CS115 - L60X6	1,808	Lijn	K734	N294	vertikaal windverband (0)	standaard	Vak1
SB301	CS115 - L60X6	1,808	Lijn	K733	N294	vertikaal windverband (0)	standaard	Vak1
SB302	CS119 - L65X7	3,167	Lijn	K736	K737	vertikaal windverband (0)	standaard	Vak1
SB303	CS119 - L65X7	2,809	Lijn	N296	K736	vertikaal windverband (0)	standaard	Vak1
SB304	CS119 - L65X7	3,322	Lijn	K737	N4	vertikaal windverband (0)	standaard	Vak1
C31	CS113 - L200X26	10,951	Lijn	N298	N5	Kolom (100)	standaard	Vak1
B214	CS114 - L130X12	12,292	Lijn	N298	N67	vakwerkdiagonaal (90)	standaard	Vak1
B215	CS114 - L130X12	12,292	Lijn	N298	N68	vakwerkdiagonaal (90)	standaard	Vak1
SB305	CS115 - L60X6	0,633	Lijn	K739	K745	vertikaal windverband (0)	standaard	Vak1

Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
SB306	CS115 - L60X6	0,633	Lijn	K746	K739	vertikaal windverband (0)	standaard	Vak1
B216	CS120 - L55X6	3,583	Lijn	N300	N304	vertikaal windverband (0)	standaard	Vak1
B217	CS120 - L55X6	2,684	Lijn	N300	K750	vertikaal windverband (0)	standaard	Vak1
B218	CS120 - L55X6	2,684	Lijn	N304	K750	vertikaal windverband (0)	standaard	Vak1
B219	CS120 - L55X6	4,478	Lijn	K740	K749	vertikaal windverband (0)	standaard	Vak1
SB307	CS119 - L65X7	3,167	Lijn	K740	K748	vertikaal windverband (0)	standaard	Vak1
B220	CS120 - L55X6	3,002	Lijn	K740	N284	vertikaal windverband (0)	standaard	Vak1
SB308	CS119 - L65X7	3,322	Lijn	K740	N5	vertikaal windverband (0)	standaard	Vak1
B221	CS120 - L55X6	3,002	Lijn	K749	N284	vertikaal windverband (0)	standaard	Vak1
SB309	CS115 - L60X6	2,533	Lijn	N299	N304	vertikaal windverband (0)	standaard	Vak1
SB310	CS115 - L60X6	2,533	Lijn	N300	N299	vertikaal windverband (0)	standaard	Vak1
SB311	CS115 - L60X6	2,002	Lijn	N303	K741	vertikaal windverband (0)	standaard	Vak1
SB312	CS119 - L65X7	2,809	Lijn	N300	K748	vertikaal windverband (0)	standaard	Vak1
SB313	CS115 - L60X6	2,002	Lijn	N305	K741	vertikaal windverband (0)	standaard	Vak1
B222	CS8 - L50X5	2,191	Lijn	N305	K744	vertikaal windverband (0)	standaard	Vak1
B223	CS8 - L50X5	2,191	Lijn	N303	K744	vertikaal windverband (0)	standaard	Vak1
SB314	CS115 - L60X6	1,900	Lijn	K741	K742	vertikaal windverband (0)	standaard	Vak1
SB315	CS115 - L60X6	1,900	Lijn	K743	K741	vertikaal windverband (0)	standaard	Vak1
B224	CS8 - L50X5	2,687	Lijn	K743	K742	vertikaal windverband (0)	standaard	Vak1
SB316	CS115 - L60X6	2,355	Lijn	K743	N299	vertikaal windverband (0)	standaard	Vak1
SB317	CS115 - L60X6	2,355	Lijn	K742	N299	vertikaal windverband (0)	standaard	Vak1
B225	CS8 - L50X5	2,409	Lijn	K742	N301	vertikaal windverband (0)	standaard	Vak1
B226	CS8 - L50X5	2,409	Lijn	K743	N301	vertikaal windverband (0)	standaard	Vak1
SB318	CS115 - L60X6	1,267	Lijn	N305	N302	vertikaal windverband (0)	standaard	Vak1
SB319	CS115 - L60X6	1,267	Lijn	N302	N303	vertikaal windverband (0)	standaard	Vak1
B227	CS8 - L50X5	1,791	Lijn	N305	N303	vertikaal windverband (0)	standaard	Vak1
B228	CS8 - L50X5	0,896	Lijn	K746	K745	vertikaal windverband (0)	standaard	Vak1
B229	CS8 - L50X5	2,049	Lijn	K745	K747	vertikaal windverband (0)	standaard	Vak1
B230	CS8 - L50X5	2,049	Lijn	K746	K747	vertikaal windverband (0)	standaard	Vak1
SB320	CS115 - L60X6	1,808	Lijn	K746	N302	vertikaal windverband (0)	standaard	Vak1
SB321	CS115 - L60X6	1,808	Lijn	K745	N302	vertikaal windverband (0)	standaard	Vak1
SB322	CS119 - L65X7	3,167	Lijn	K748	K749	vertikaal windverband (0)	standaard	Vak1
SB323	CS119 - L65X7	2,809	Lijn	N304	K748	vertikaal windverband (0)	standaard	Vak1
SB324	CS119 - L65X7	3,322	Lijn	K749	N5	vertikaal windverband (0)	standaard	Vak1
C32	CS113 - L200X26	10,951	Lijn	N306	N8	Kolom (100)	standaard	Vak1
B231	CS114 - L130X12	12,292	Lijn	N306	N67	vakwerkdiagonaal (90)	standaard	Vak1
B232	CS114 - L130X12	12,292	Lijn	N306	N66	vakwerkdiagonaal (90)	standaard	Vak1
SB325	CS115 - L60X6	0,633	Lijn	K751	K755	vertikaal windverband (0)	standaard	Vak1
SB326	CS115 - L60X6	0,633	Lijn	K756	K751	vertikaal windverband (0)	standaard	Vak1
B233	CS120 - L55X6	3,583	Lijn	N308	N313	vertikaal windverband (0)	standaard	Vak1
B234	CS120 - L55X6	2,684	Lijn	N308	K761	vertikaal windverband (0)	standaard	Vak1
B235	CS120 - L55X6	4,478	Lijn	K762	K760	vertikaal windverband (0)	standaard	Vak1
SB327	CS119 - L65X7	3,167	Lijn	K762	K758	vertikaal windverband (0)	standaard	Vak1
SB328	CS115 - L60X6	2,533	Lijn	N307	N313	vertikaal windverband (0)	standaard	Vak1
SB329	CS115 - L60X6	2,533	Lijn	N308	N307	vertikaal windverband (0)	standaard	Vak1
SB330	CS115 - L60X6	2,002	Lijn	N311	K752	vertikaal windverband (0)	standaard	Vak1
SB331	CS119 - L65X7	2,809	Lijn	N308	K758	vertikaal windverband (0)	standaard	Vak1
SB332	CS115 - L60X6	2,002	Lijn	N312	K752	vertikaal windverband (0)	standaard	Vak1
B236	CS8 - L50X5	2,191	Lijn	N312	K754	vertikaal windverband (0)	standaard	Vak1
B237	CS8 - L50X5	2,191	Lijn	N311	K754	vertikaal windverband (0)	standaard	Vak1
SB333	CS115 - L60X6	1,900	Lijn	K752	K759	vertikaal windverband (0)	standaard	Vak1
SB334	CS115 - L60X6	1,900	Lijn	K753	K752	vertikaal windverband (0)	standaard	Vak1
B238	CS8 - L50X5	2,687	Lijn	K753	K759	vertikaal windverband (0)	standaard	Vak1
SB335	CS115 - L60X6	2,355	Lijn	K753	N307	vertikaal windverband (0)	standaard	Vak1
SB336	CS115 - L60X6	2,355	Lijn	K759	N307	vertikaal windverband (0)	standaard	Vak1
B239	CS8 - L50X5	2,409	Lijn	K759	N309	vertikaal windverband (0)	standaard	Vak1
B240	CS8 - L50X5	2,409	Lijn	K753	N309	vertikaal windverband (0)	standaard	Vak1
SB337	CS115 - L60X6	1,267	Lijn	N312	N310	vertikaal windverband (0)	standaard	Vak1
SB338	CS115 - L60X6	1,267	Lijn	N310	N311	vertikaal windverband (0)	standaard	Vak1
B241	CS8 - L50X5	1,791	Lijn	N312	N311	vertikaal windverband (0)	standaard	Vak1
B242	CS8 - L50X5	0,896	Lijn	K756	K755	vertikaal windverband (0)	standaard	Vak1
B243	CS8 - L50X5	2,049	Lijn	K755	K757	vertikaal windverband (0)	standaard	Vak1
B244	CS8 - L50X5	2,049	Lijn	K756	K757	vertikaal windverband (0)	standaard	Vak1
SB339	CS115 - L60X6	1,808	Lijn	K756	N310	vertikaal windverband (0)	standaard	Vak1
SB340	CS115 - L60X6	1,808	Lijn	K755	N310	vertikaal windverband (0)	standaard	Vak1
SB341	CS119 - L65X7	3,167	Lijn	K758	K760	vertikaal windverband (0)	standaard	Vak1
SB342	CS119 - L65X7	2,809	Lijn	N313	K758	vertikaal windverband (0)	standaard	Vak1
B245	CS120 - L55X6	2,684	Lijn	N313	K761	vertikaal windverband (0)	standaard	Vak1
SB343	CS119 - L65X7	3,322	Lijn	K762	N8	vertikaal windverband (0)	standaard	Vak1

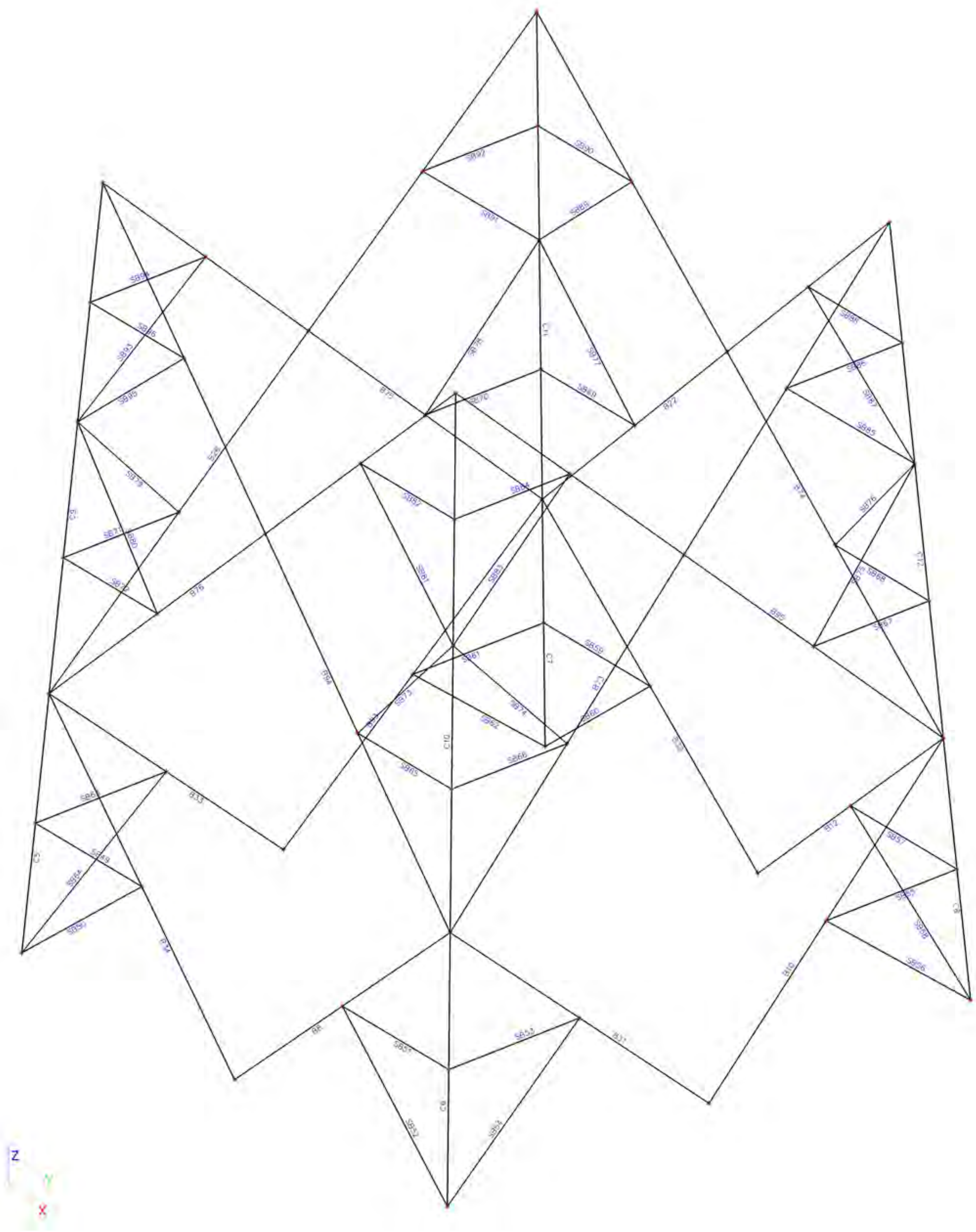
Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
B246	CS120 - L55X6	3,002	Lijn	K760	N64	vertikaal windverband (0)	standaard	Vak1
SB344	CS119 - L65X7	3,322	Lijn	K760	N8	vertikaal windverband (0)	standaard	Vak1
B247	CS120 - L55X6	3,002	Lijn	K762	N64	vertikaal windverband (0)	standaard	Vak1
S596	CS121 - L60X6	3,353	Lijn	K763	K709	Balk (80)	standaard	HorVerb2
S597	CS121 - L60X6	6,705	Lijn	K712	K706	Balk (80)	standaard	HorVerb2
S598	CS36 - L100X10	3,507	Lijn	K626	K63	Balk (80)	standaard	Vak10
S599	CS134 - L80X8	1,743	Lijn	K765	K786	Balk (80)	standaard	CrossArm2
S600	CS134 - L80X8	2,445	Lijn	K765	K626	Balk (80)	standaard	CrossArm2
S601	CS133 - L50X5	2,922	Lijn	K775	K776	Balk (80)	standaard	CrossArm1
S602	CS134 - L80X8	2,448	Lijn	K444	K774	Balk (80)	standaard	CrossArm1
S603	CS134 - L80X8	1,745	Lijn	K460	K774	Balk (80)	standaard	CrossArm1
S604	CS134 - L80X8	1,743	Lijn	K774	K426	Balk (80)	standaard	CrossArm1
S605	CS134 - L80X8	2,445	Lijn	K774	K301	Balk (80)	standaard	CrossArm1
S606	CS89 - L140X13	1,761	Lijn	K298	K783	Kolom (100)	standaard	Vak10
S607	CS89 - L140X13	2,221	Lijn	K170	K785	Kolom (100)	standaard	Vak12
S608	CS149 - UNP180	1,970	Lijn	K198	K194	Balk (80)	standaard	Vak19
S609	CS149 - UNP180	1,569	Lijn	K219	K158	Balk (80)	standaard	Vak15
S610	CS149 - UNP180	1,569	Lijn	K206	K156	Balk (80)	standaard	Vak15
S612	CS44 - UNP200	3,560	Lijn	K404	K63	Balk (80)	standaard	Vak9
S615	CS44 - UNP200	3,560	Lijn	K444	K406	Balk (80)	standaard	Vak13
S616	CS140 - L50X5	3,227	Lijn	K408	K409	Balk (80)	standaard	Vak14
S617	CS127 - L160X15	3,680	Lijn	K409	K411	Balk (80)	standaard	Vak14
S618	CS127 - L160X15	3,202	Lijn	K411	K302	Balk (80)	standaard	Vak13
S619	CS127 - L160X15	3,680	Lijn	K408	K410	Balk (80)	standaard	Vak13
S620	CS127 - L160X15	3,202	Lijn	K410	K598	Balk (80)	standaard	Vak13
S621	CS140 - L50X5	3,227	Lijn	K410	K411	Balk (80)	standaard	Vak14
S624	CS44 - UNP200	3,560	Lijn	K396	K301	Balk (80)	standaard	Vak13
S625	CS44 - UNP200	3,560	Polylijn	K626	K394	Balk (80)	standaard	Vak9
S626	CS149 - UNP180	1,970	Lijn	K215	K219	Balk (80)	standaard	Vak16
S628	CS149 - UNP180	4,465	Lijn	K194	K227	Balk (80)	standaard	Vak18
S629	CS149 - UNP180	4,465	Lijn	K227	K215	Balk (80)	standaard	Vak17
S631	CS153 - L50X5	1,920	Lijn	K627	K623	Balk (80)	standaard	Vak19
S632	CS157 - L120X11	4,465	Lijn	K627	N192	Balk (80)	standaard	Vak18
S633	CS157 - L120X11	4,465	Lijn	N192	K217	Balk (80)	standaard	Vak17
S634	CS157 - L120X11	2,720	Lijn	K217	K267	Balk (80)	standaard	Vak16
S635	CS157 - L120X11	4,464	Lijn	K623	N191	Balk (80)	standaard	Vak18
S636	CS157 - L120X11	4,465	Lijn	N191	K205	Balk (80)	standaard	Vak17
S637	CS157 - L120X11	2,720	Lijn	K205	K261	Balk (80)	standaard	Vak16
S638	CS153 - L50X5	1,920	Lijn	N192	N191	Balk (80)	standaard	Vak18
S639	CS153 - L50X5	1,920	Lijn	K217	K205	Balk (80)	standaard	Vak16
S640	CS149 - UNP180	4,465	Lijn	K224	K787	Balk (80)	standaard	Vak18
S641	CS149 - UNP180	1,970	Lijn	K206	K211	Balk (80)	standaard	Vak16
S642	CS149 - UNP180	4,465	Lijn	K211	K224	Balk (80)	standaard	Vak17

6. Staafnummers mastlichaam

6.1. Vak 1

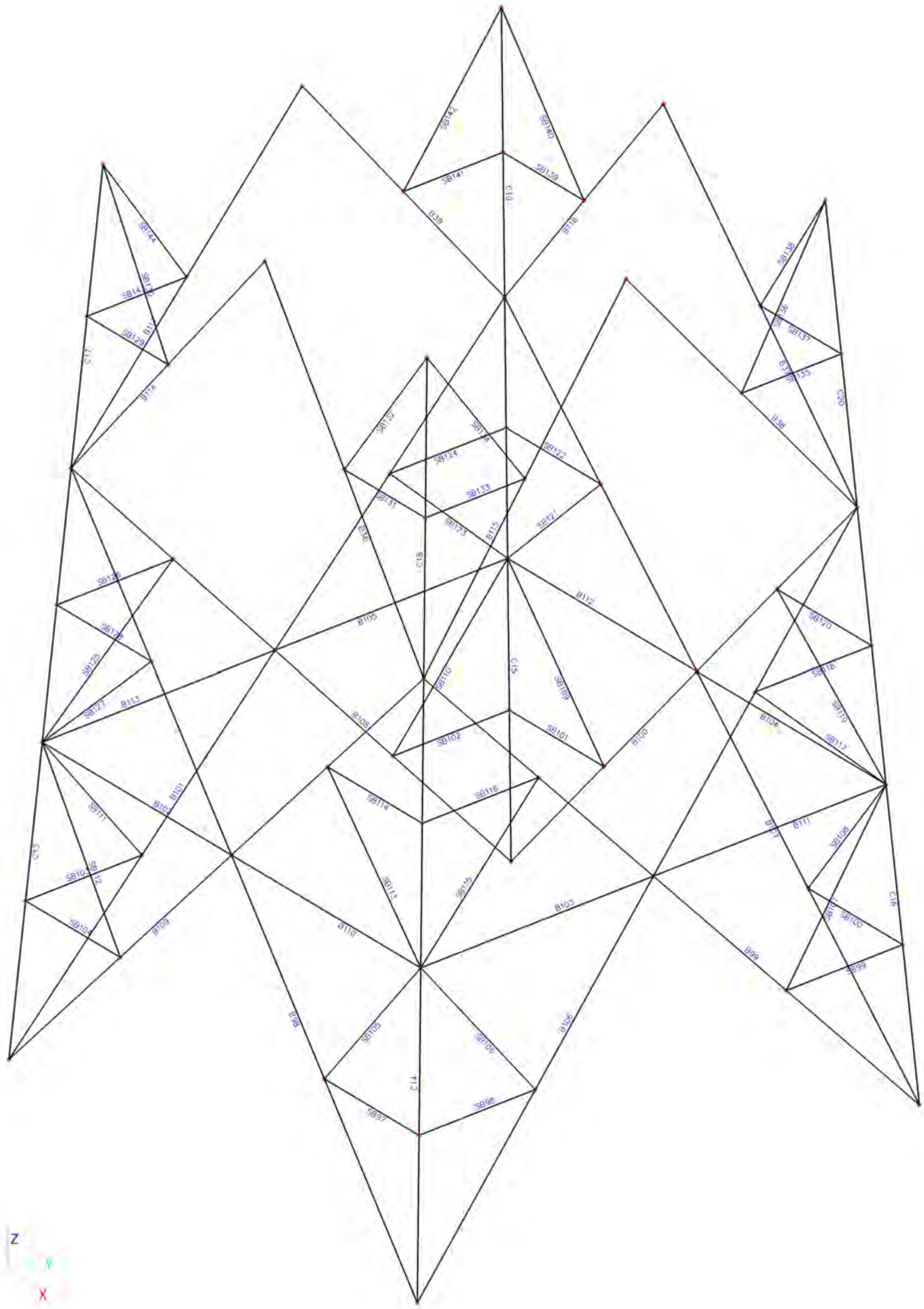


6.2. Vak 2+3

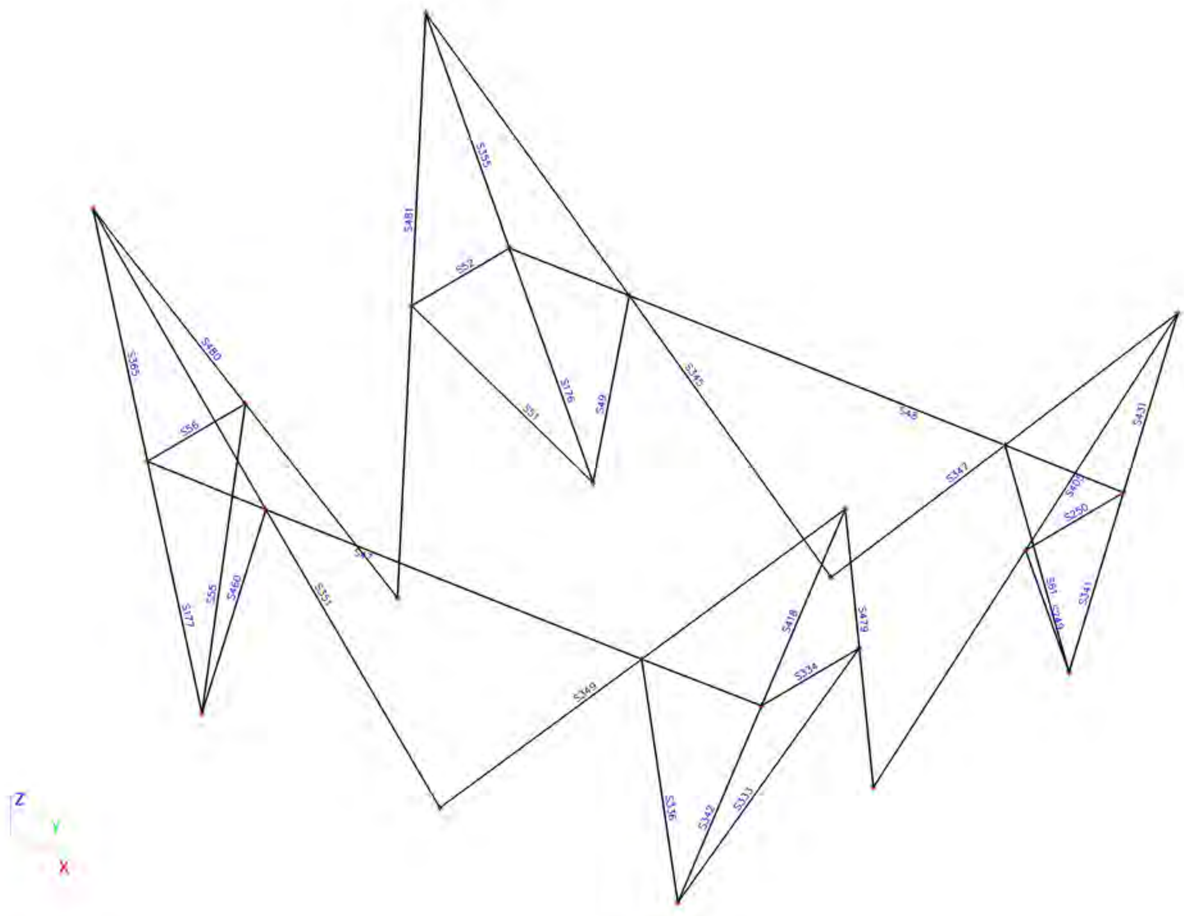


	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

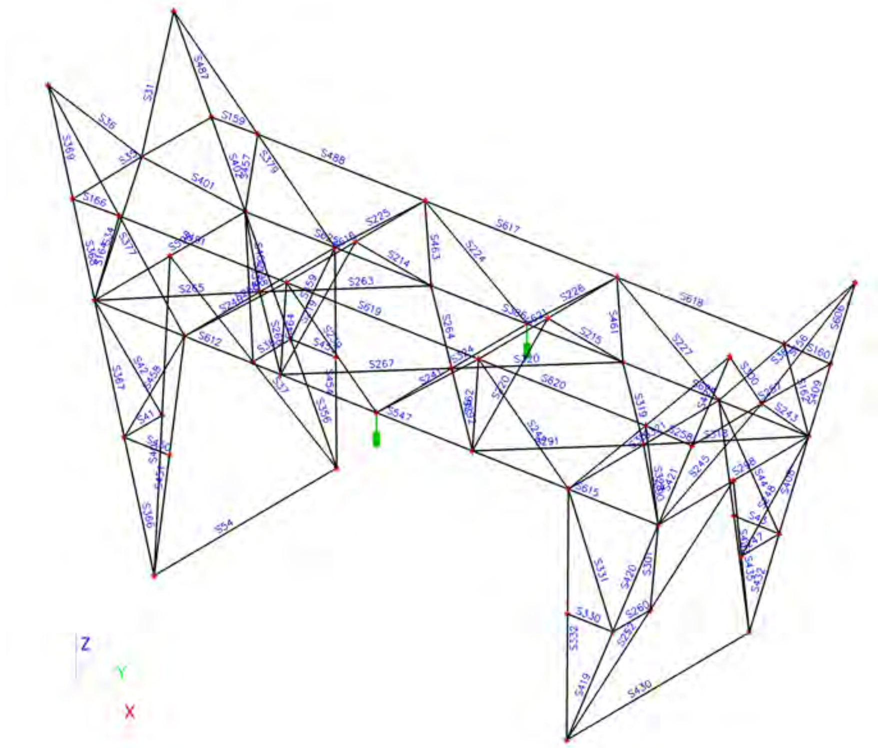
6.3. Vak 4+5



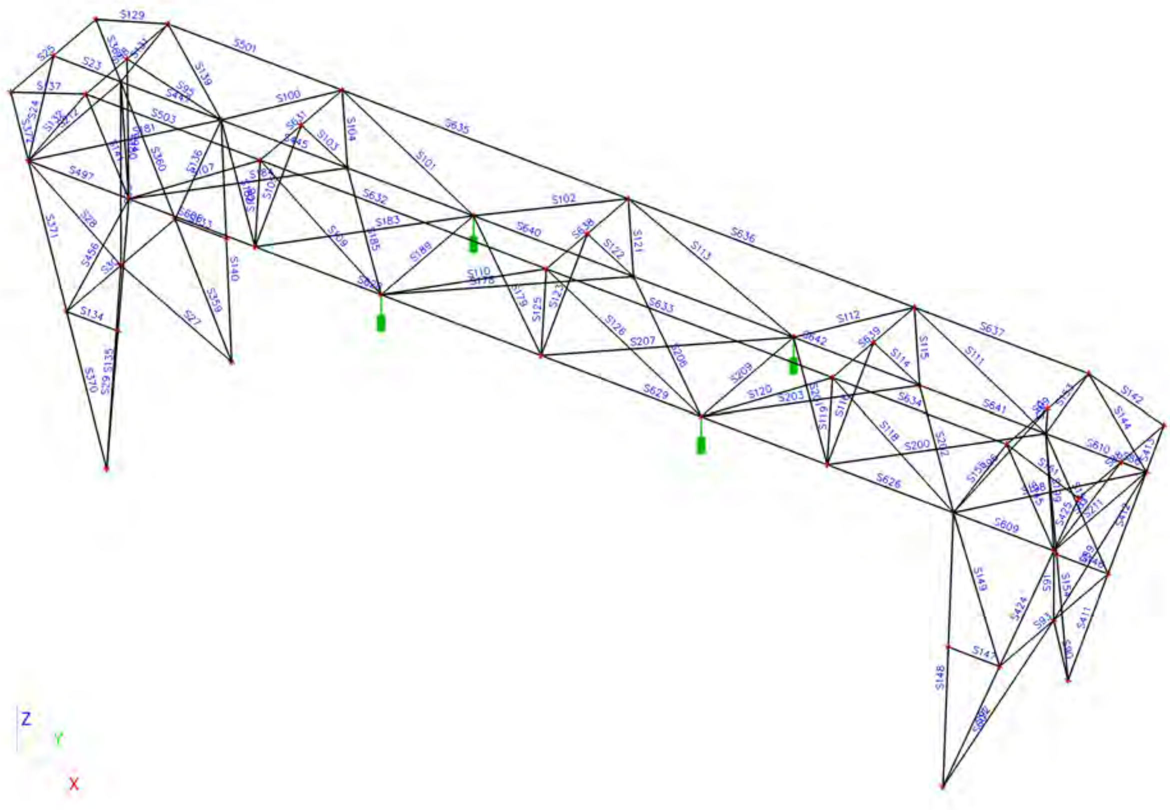
6.4. Vak 6



6.5. Vak 7+8+9+10+13+14



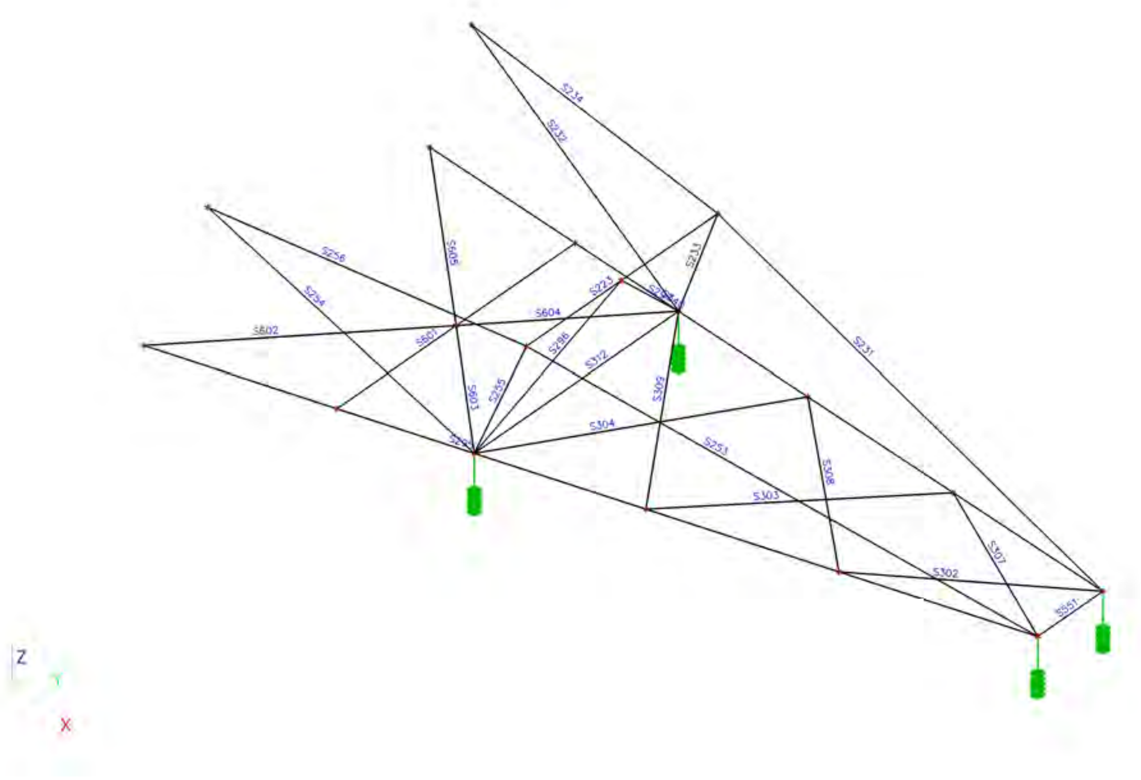
6.6. Vak 11+12+15 t/m 21



	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

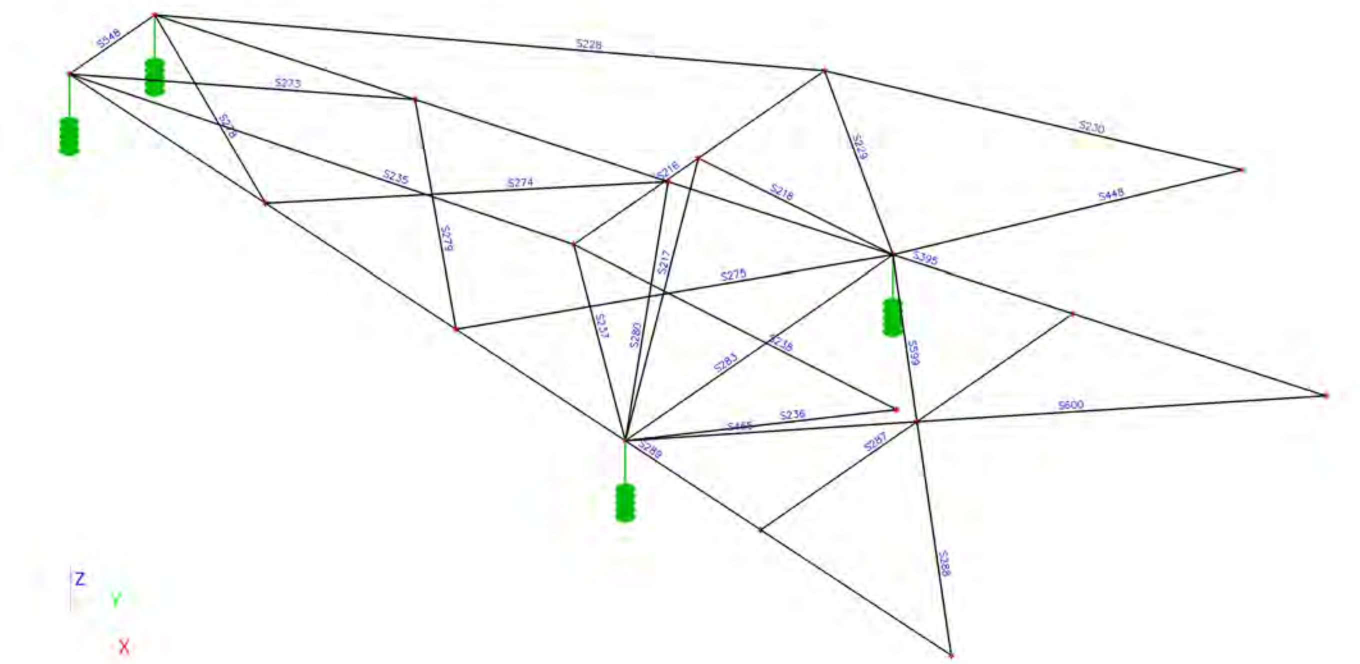
7. Staafnummers traverses

7.1. CrossArm1

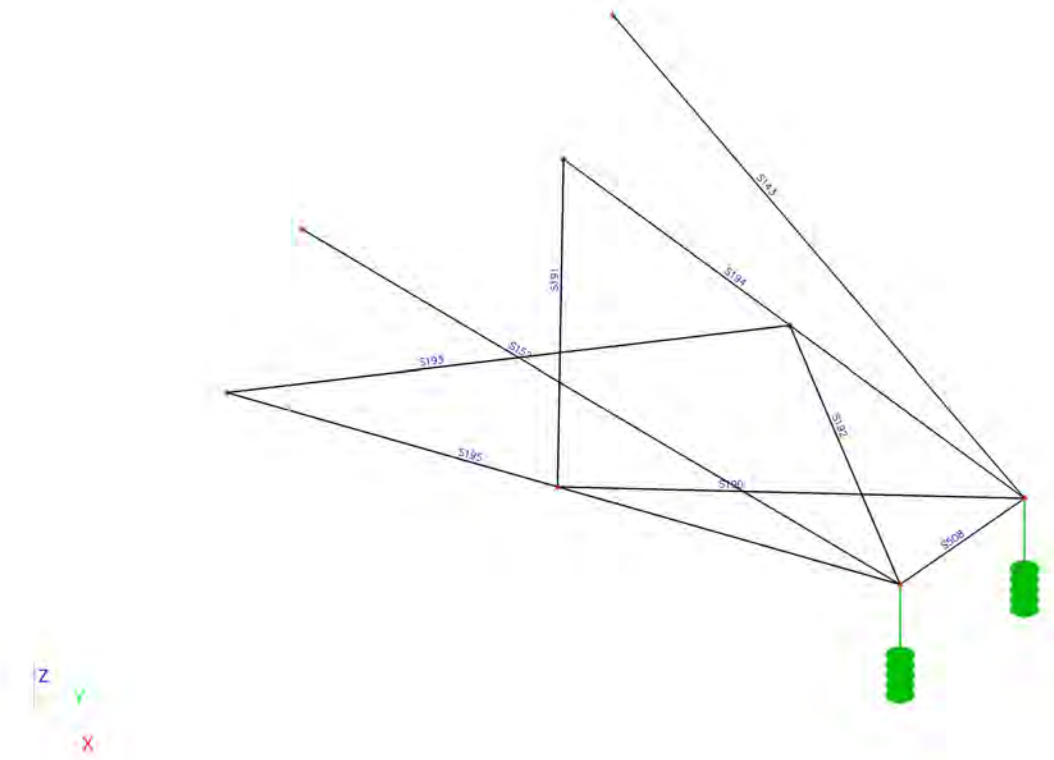


D&C ENGINEERING design and construct	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

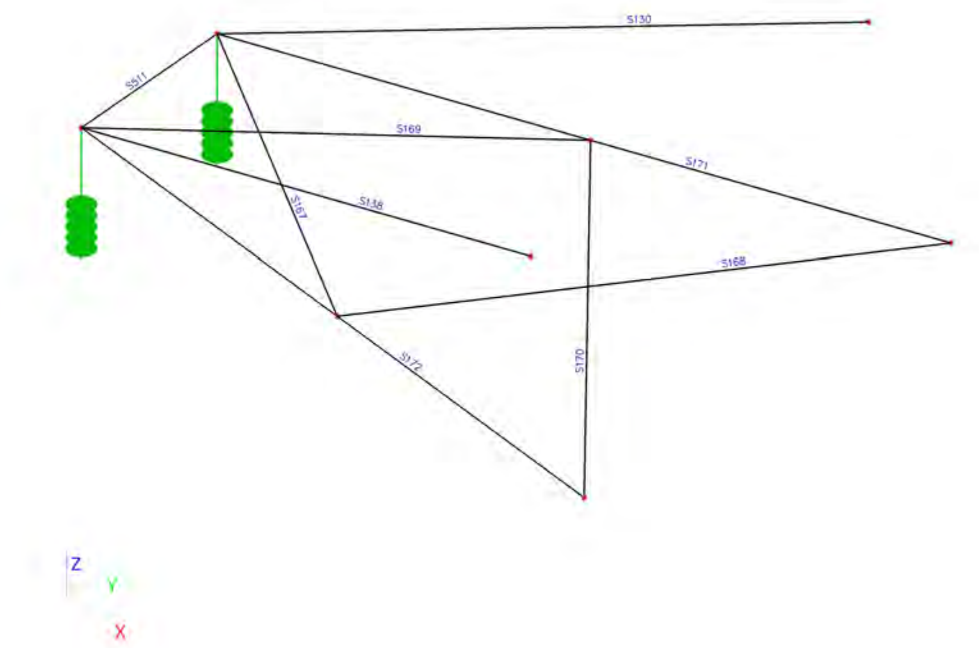
7.2. CrossArm2



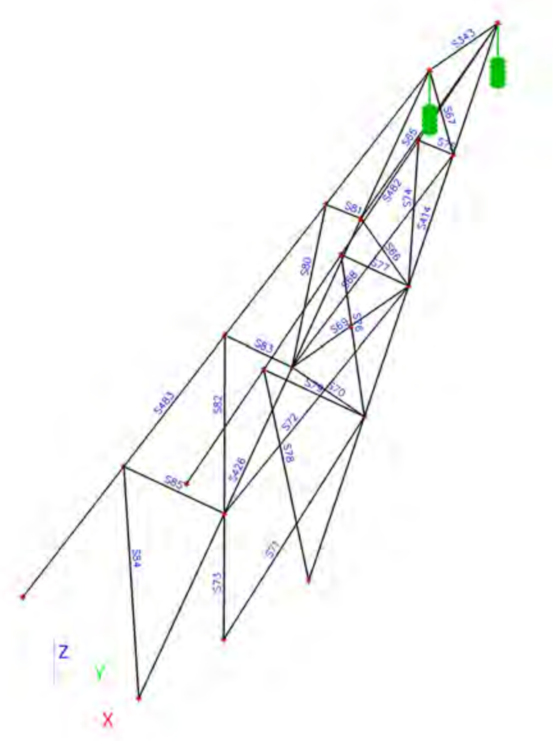
7.3. CrossArm3



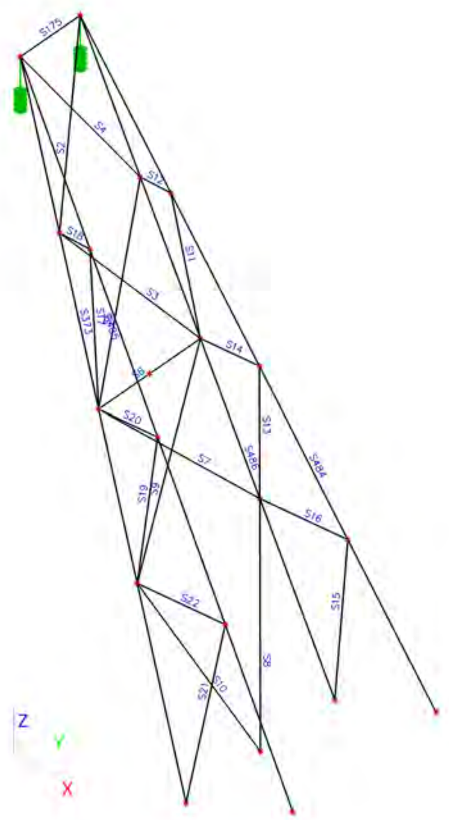
7.4. CrossArm4



7.5. CrossArm5

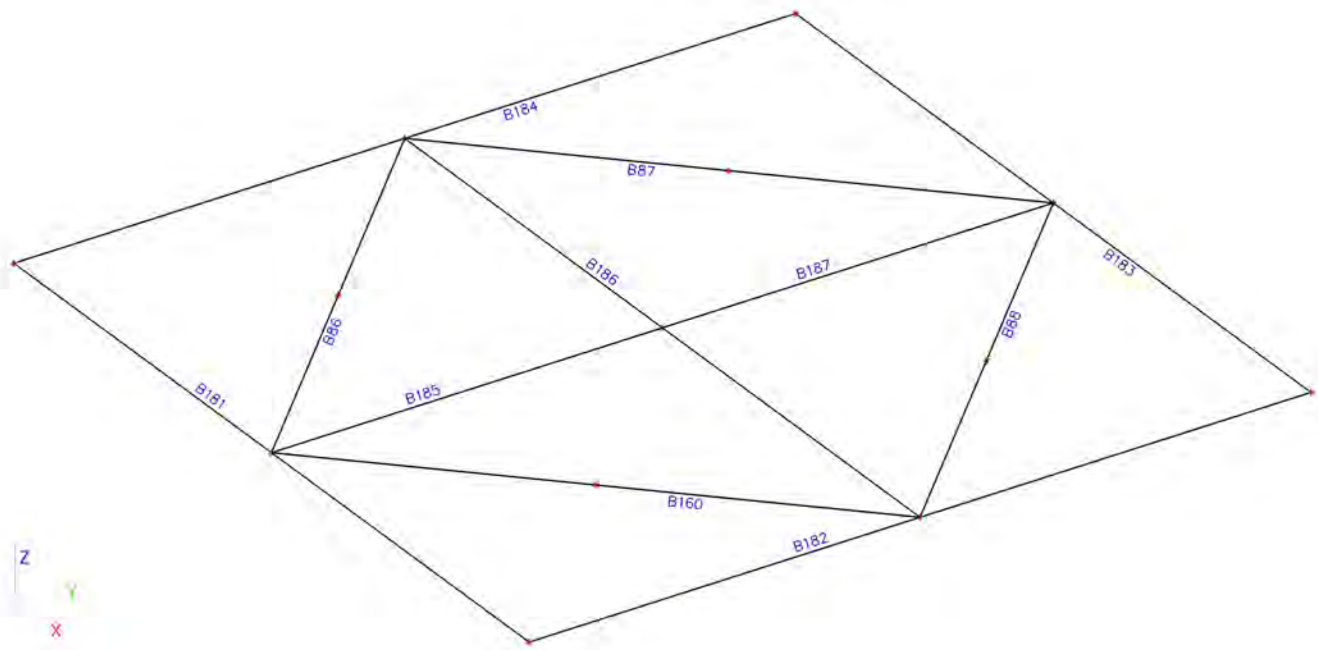


7.6. CrossArm6

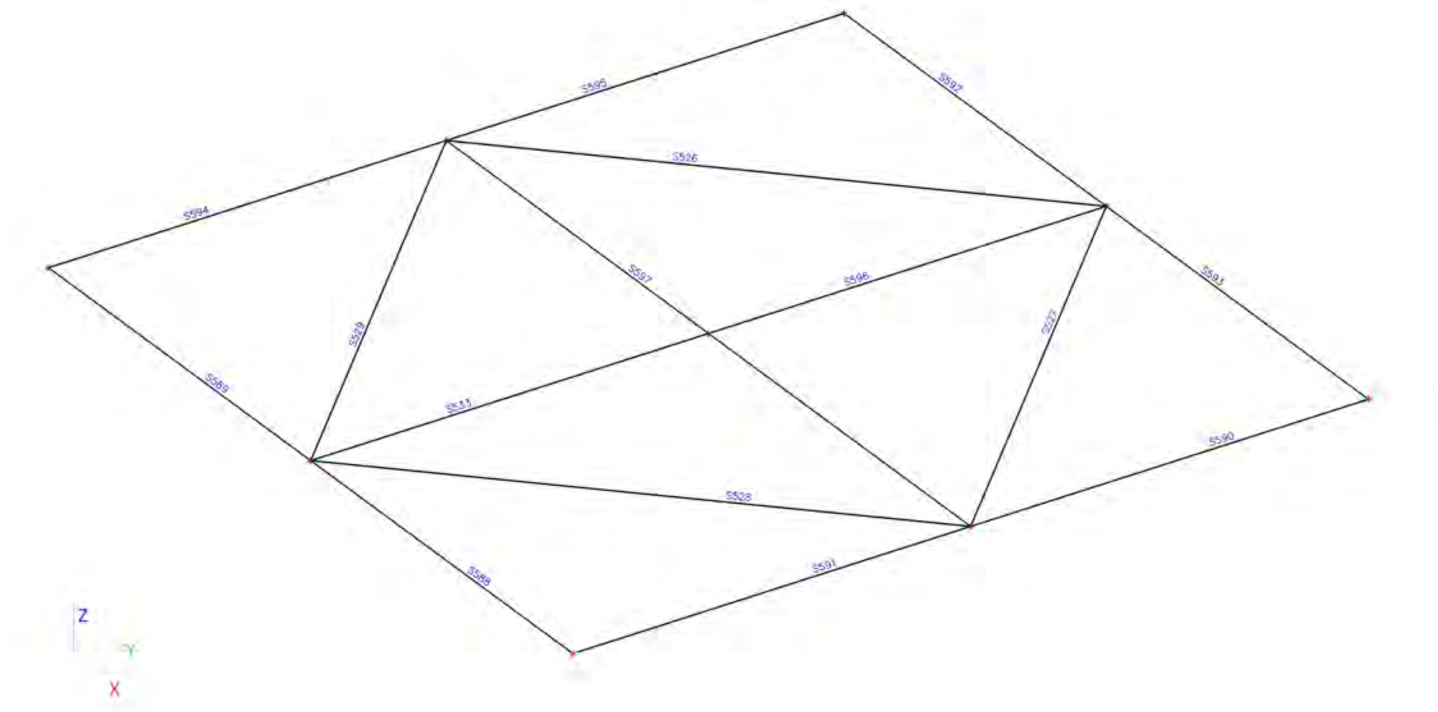


8. Staafnummers horizontale verbanden

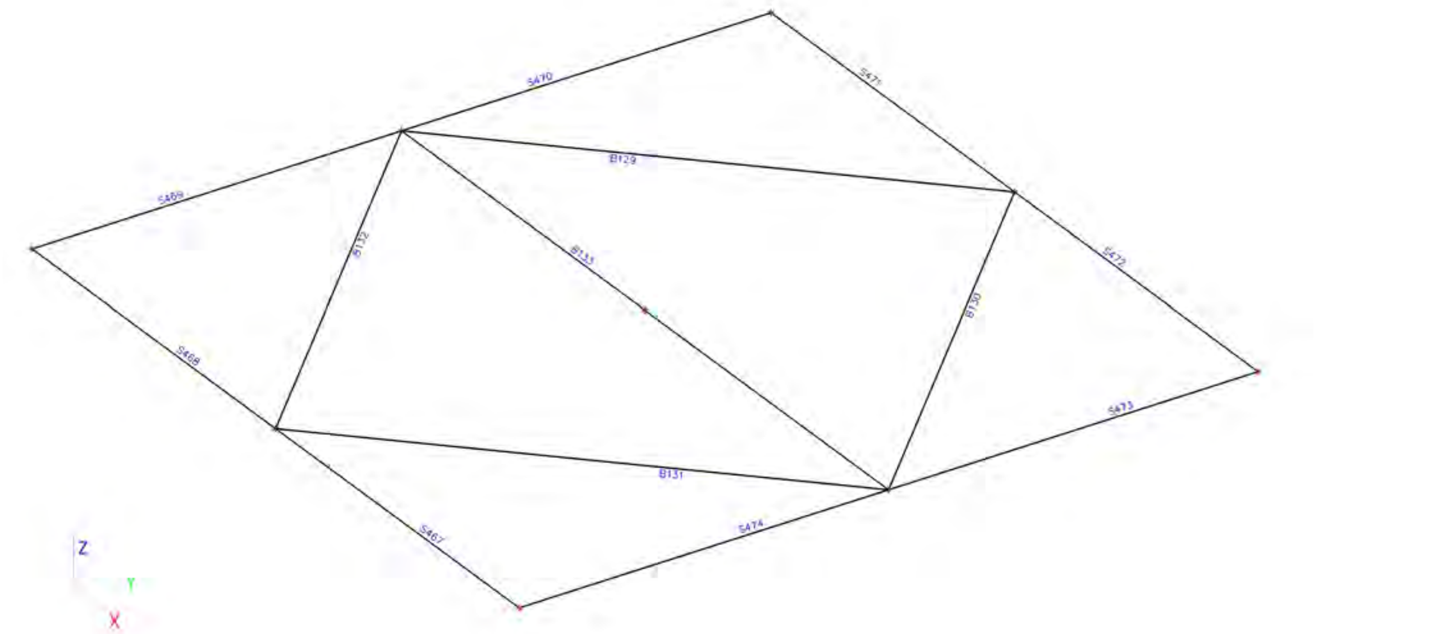
8.1. Horizontaal verband 1



8.2. Horizontaal verband 2



8.3. Horizontaal verband 3



9. Belastingsgevallen

Naam	Omschrijving	Actie type	Lastgroep	Belastingtype	Spec	Richting	Duur	'Master' belastingsgeval
6T	self weight of tower	Permanent	Perm	Eigen gewicht		-Z		
6C	self weight of conductor	Permanent	Perm	Standaard				
W_x-y+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x+y-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x-y-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x+y+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_y-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_y+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
WI_x+	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x+y+	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x+y-	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-y+	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-y-	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_y-	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
Ice	Ice	Variabel	Ice	Statisch	Standaard		Kort	Geen
4M	Maintenance	Variabel	Maint	Statisch	Onderhoudslasten			Geen
4C0	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C1	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C2	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C3	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C4	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C5	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C6	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C7	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C8	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C9	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C10	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C11	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C12	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C13	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
SBS	SBS-load	Variabel	SBS	Statisch	Knikverkorterlasten			Geen
Tuls-1a	Conductor tension	Permanent	CT	Standaard				
Tuls-1b	Conductor tension	Permanent	CT	Standaard				
Tuls-3	Conductor tension	Permanent	CT	Standaard				
Tuls-4	Conductor tension	Permanent	CT	Standaard				
Tuls-6	Conductor tension	Permanent	CT	Standaard				
Tsls-1a-LF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1b-LF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-3-LF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-4-LF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1a-LR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1b-LR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-3-LR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-4-LR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1a-RF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1b-RF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-3-RF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-4-RF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1a-RR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1b-RR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-3-RR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-4-RR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tuls-5a_CI1		Variabel	5a_CI1	Statisch	Standaard		Kort	Geen
Tuls-5a_CI2		Variabel	5a_CI2	Statisch	Standaard		Kort	Geen
Tuls-5a_CI3		Variabel	5a_CI3	Statisch	Standaard		Kort	Geen
Tuls-5a_CI4		Variabel	5a_CI4	Statisch	Standaard		Kort	Geen
Tuls-5a_CI5		Variabel	5a_CI5	Statisch	Standaard		Kort	Geen
Tuls-5a_CI6		Variabel	5a_CI6	Statisch	Standaard		Kort	Geen
Tuls-5a_CI7		Variabel	5a_CI7	Statisch	Standaard		Kort	Geen
Tuls-5a_CI8		Variabel	5a_CI8	Statisch	Standaard		Kort	Geen
Tuls-5a_CI9		Variabel	5a_CI9	Statisch	Standaard		Kort	Geen
Tuls-5a_CI10		Variabel	5a_CI10	Statisch	Standaard		Kort	Geen
Tuls-5a_CI11		Variabel	5a_CI11	Statisch	Standaard		Kort	Geen
Tuls-5a_CI12		Variabel	5a_CI12	Statisch	Standaard		Kort	Geen

Naam	Omschrijving	Actie type	Lastgroep	Belastingtype	Spec	Richting	Duur	'Master' belastingsgeval
Tuls-5a_CI14		Variabel	5a_CI14	Statisch	Standaard		Kort	Geen
Tuls-5a_CI15		Variabel	5a_CI15	Statisch	Standaard		Kort	Geen
Tuls-5a_CI16		Variabel	5a_CI16	Statisch	Standaard		Kort	Geen
Tuls-5a_CI17		Variabel	5a_CI17	Statisch	Standaard		Kort	Geen
Tuls-5a_CI18		Variabel	5a_CI18	Statisch	Standaard		Kort	Geen
Tuls-5a_CI19		Variabel	5a_CI19	Statisch	Standaard		Kort	Geen
Tuls-5a_CI20		Variabel	5a_CI20	Statisch	Standaard		Kort	Geen
Tuls-5a_CI21		Variabel	5a_CI21	Statisch	Standaard		Kort	Geen
Tuls-5a_CI22		Variabel	5a_CI22	Statisch	Standaard		Kort	Geen
WI_y+	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
Tuls-5a_CI13		Variabel	5a_CI13	Statisch	Standaard		Kort	Geen

10. Combinaties

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
1a	wind;10	Omhullende - uiterst	W_x-y+ - Wind	1,50
			W_x+y- - Wind	1,50
			W_x-y- - Wind	1,50
			W_x+y+ - Wind	1,50
			W_y- - Wind	1,50
			W_y+ - Wind	1,50
			W_x- - Wind	1,50
			W_x+ - Wind	1,50
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-1a - Conductor tension	1,00
1b	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-1a - Conductor tension	1,00
3	wind+ice	Omhullende - uiterst	Ice - Ice	1,50
			WI_x+ - WindIce	0,45
			WI_x- - WindIce	0,45
			WI_x+y+ - WindIce	0,45
			WI_x+y- - WindIce	0,45
			WI_x-y+ - WindIce	0,45
			WI_x-y- - WindIce	0,45
			WI_y+ - WindIce	0,45
			WI_y- - WindIce	0,45
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-3 - Conductor tension	1,00
4	Maintenance	Omhullende -	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-4 - Conductor tension	1,00
			4C0 - Construction	1,50
			4C1 - Construction	1,50
			4C2 - Construction	1,50
			4C3 - Construction	1,50

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
4	Maintenance	Omhullende - Uiterst	4C4 - Construction	1,50
			4C5 - Construction	1,50
			4C6 - Construction	1,50
			4C7 - Construction	1,50
			4C8 - Construction	1,50
			4C9 - Construction	1,50
			4C10 - Construction	1,50
			4C11 - Construction	1,50
			4C12 - Construction	1,50
			4C13 - Construction	1,50
6	Permanent	Omhullende - uiterst	6T - self weight of tower	1,35
			6C - self weight of conductor	1,35
			Tuls-6 - Conductor tension	1,00
1a-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	1,50
			W_x+y- - Wind	1,50
			W_x-y- - Wind	1,50
			W_x+y+ - Wind	1,50
			W_y- - Wind	1,50
			W_y+ - Wind	1,50
			W_x- - Wind	1,50
			W_x+ - Wind	1,50
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-1a - Conductor tension	1,00
1b-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-1a - Conductor tension	1,00
3-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,50
			WI_x+ - WindIce	0,45
			WI_x- - WindIce	0,45
			WI_x+y+ - WindIce	0,45
			WI_x+y- - WindIce	0,45
			WI_x-y+ - WindIce	0,45
			WI_x-y- - WindIce	0,45
			WI_y+ - WindIce	0,45
			WI_y- - WindIce	0,45
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-3 - Conductor tension	1,00
4-p	Maintenance	Omhullende -	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-4 - Conductor tension	1,00
			4C0 - Construction	1,50
			4C1 - Construction	1,50
			4C2 - Construction	1,50
			4C3 - Construction	1,50
			4C4 - Construction	1,50
			4C5 - Construction	1,50
			4C6 - Construction	1,50

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
4-p	Maintenance	Omhullende - uiterst	4C7 - Construction	1,50
			4C8 - Construction	1,50
			4C9 - Construction	1,50
			4C10 - Construction	1,50
			4C11 - Construction	1,50
			4C12 - Construction	1,50
			4C13 - Construction	1,50
sp1aLF	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aLR	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aRF	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aRR	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
sp1aF	wind;10	Omhullende -	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1aF	wind;10	Omhullende - Uiterst	W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aR	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
sp1aLF-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aLR-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aRF-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aRR-p	wind;10	Omhullende -	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1aRR-p	wind;10	Omhullende - uiterst	6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
sp1aF-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aR-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
sp1bLF	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bLR	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bRF	wind;-20	Omhullende -	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1bRF	wind;-20	Omhullende - uiterst	Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bRR	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
sp1bF	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bR	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
sp1bLF-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bLR-p	wind;-20	Omhullende -	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1bLR-p	wind;-20	Omhullende - uiterst	Tsls-1b-RR - Conductor tension	1,00
sp1bRF-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bRR-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
sp1bF-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bR-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
sp3LF	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp3LR	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3RF	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3RR	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
sp3F	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3R	wind+ice	Omhullende -	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp3R	wind+ice	Omhullende - uiterst	6C - self weight of conductor	1,20
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
sp3LF-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3LR-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3RF-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3RR-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
sp3F-p	wind+ice	Omhullende -	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp3F-p	wind+ice	Omhullende - uiterst	WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3R-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
sp4LF	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4LR	maintenance	Omhullende -	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20

Project		- 150 kV lijn Leiden - Zoetermeer
Onderdeel		- berekening Mast 73
Omschrijving		- ontwerpberekening
Nationale norm		EC - ENV
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Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4LR	maintenance	Omhullende - uiterst	4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4RF	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4RR	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4F	maintenance	Omhullende -	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4F	maintenance	Omhullende - uiterst	W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4R	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4LF-p	maintenance	Omhullende -	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4LF-p	maintenance	Omhullende - uiterst	4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4LR-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4RF-p	maintenance	Omhullende -	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4RF-p	maintenance	Omhullende - uiterst	4C13 - Construction	1,20
sp4RR-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4F-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4R-p	maintenance	Omhullende -	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20

D&C ENGINEERING design and construct	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4R-p	maintenance	Omhullende - Uiterst	4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20

11. Resultaten

11.1. Interne krachten in staaf

Lineaire berekening, Extreem : Staaf, Systeem : Hoofd
Selectie : Alle
Klasse : All UGT

Staaf	BG	dx [m]	N [kN]
S2	sp3R/1	0,000	**-18,60**
S2	sp3F-p/2	1,862	**17,18**
S3	sp3F-p/2	0,000	**-10,91**
S3	sp3R/3	2,018	**11,36**
S4	sp3F/4	0,000	**-18,92**
S4	sp3LR-p/5	1,862	**17,41**
S5	sp3LR-p/6	0,000	**-10,92**
S5	sp3F/4	2,018	**11,46**
S6	3-p/7	0,000	**-1,77**
S6	sp3R/8	0,000	**0,98**
S7	sp3F/9	0,000	**-8,36**
S7	sp3LR-p/10	2,184	**8,73**
S8	sp3LR-p/10	0,000	**-12,11**
S8	sp3F/9	2,162	**11,12**
S9	sp3R/8	0,000	**-8,83**
S9	sp3F-p/11	2,184	**9,03**
S10	sp3F-p/11	0,000	**-12,59**
S10	sp3R/8	2,162	**11,84**
S11	3/12	1,511	**-3,23**
S11	sp3LR-p/5	0,000	**0,48**
S12	sp3R-p/13	0,000	**-0,16**
S12	3/12	0,336	**0,81**
S13	1a/14	1,501	**-1,57**
S13	1a-p/15	0,000	**0,24**
S14	1a-p/15	0,000	**-0,13**
S14	1a/14	0,649	**0,69**
S15	1a/14	1,911	**-1,82**
S15	1a-p/15	0,000	**0,29**
S16	1a-p/15	0,000	**-0,18**
S16	1a/14	0,969	**1,15**
S17	3/12	1,511	**-2,31**
S17	1a-p/15	0,000	**0,50**
S18	sp3LF-p/16	0,000	**-0,13**
S18	3/12	0,336	**0,52**
S19	1a/17	1,501	**-1,46**
S19	1a-p/18	0,000	**0,17**
S20	1a-p/15	0,000	**-0,15**
S20	1a/14	0,649	**0,67**
S21	1a/17	1,911	**-2,12**
S21	1a-p/18	0,000	**0,37**
S22	1a-p/18	0,000	**-0,19**
S22	1a/17	0,000	**1,09**
S23	sp3LF-p/19	0,000	**-8,95**
S23	sp3R/8	1,450	**10,24**
S24	sp3LR/20	0,000	**-11,24**
S24	sp3LF-p/16	1,451	**6,94**
S25	3/21	0,997	**-13,02**
S25	sp1aR-p/22	0,000	**-3,66**
S26	sp3R/23	0,000	**-121,95**
S26	sp3F-p/24	2,386	**121,01**
S27	sp3F/25	0,000	**-95,04**
S27	sp3R-p/26	2,652	**98,88**
S28	sp3F/25	0,000	**-112,31**
S28	sp3R-p/26	2,386	**118,11**
S29	sp3R/23	0,000	**-104,10**
S29	sp3F-p/24	2,651	**103,14**
S30	sp3LR-p/5	2,536	**-0,48**
S30	sp3LF/27	1,268	**2,14**
S31	sp3R-p/26	0,000	**-69,44**
S31	sp3F/25	2,265	**65,76**

Staaf	BG	dx [m]	N [kN]
S34	sp3R/28	0,000	**-65,53**
S34	sp3F-p/29	2,366	**57,16**
S35	3/12	3,232	**-23,17**
S35	sp1aLR-p/30	1,616	**-7,45**
S36	sp3F-p/24	0,000	**-72,66**
S36	sp3R/23	2,265	**72,05**
S37	sp3LF/31	0,000	**-275,81**
S37	sp3LR/32	4,747	**274,53**
S38	sp3R-p/13	0,878	**-2,41**
S38	sp3F/33	0,000	**10,11**
S40	sp3LR/32	0,000	**-285,33**
S40	sp3LF-p/34	4,747	**264,04**
S41	sp3F-p/35	0,879	**-1,62**
S41	sp3R/1	0,000	**8,70**
S42	sp3R/1	0,000	**-10,46**
S42	sp3F-p/35	2,227	**2,69**
S43	sp3RF/36	0,864	**-0,79**
S43	sp3RR-p/37	0,000	**0,51**
S44	sp3RR/38	0,000	**-13,67**
S44	sp3RF-p/39	2,231	**17,86**
S47	sp3R/40	1,252	**-116,14**
S47	sp3F-p/41	1,252	**80,08**
S48	sp3F/42	1,252	**-118,84**
S48	sp3R-p/43	1,252	**78,79**
S49	sp3F/42	0,000	**-106,84**
S49	sp3R-p/43	2,076	**67,87**
S51	sp3F/33	0,000	**-12,41**
S51	sp3R-p/13	2,571	**8,35**
S52	sp3R-p/13	1,250	**-8,13**
S52	sp3F/33	0,000	**10,96**
S54	1a/44	2,126	**-8,41**
S54	1a-p/45	0,000	**4,42**
S55	sp3R/1	0,000	**-13,53**
S55	sp3F-p/2	2,571	**8,06**
S56	sp3F-p/35	1,250	**-7,57**
S56	sp3R/1	0,000	**11,07**
S61	sp3F/42	0,000	**-109,64**
S61	sp3R-p/43	2,076	**69,23**
S65	sp3RR/38	0,000	**-18,58**
S65	sp3F-p/24	1,862	**18,02**
S66	sp3F-p/24	0,000	**-11,30**
S66	sp3RR/46	2,018	**11,38**
S67	sp3F/25	0,000	**-18,00**
S67	sp3R-p/47	1,862	**17,52**
S68	sp3R/28	0,000	**-10,97**
S68	sp3F/25	2,018	**11,18**
S69	sp3LF-p/48	0,000	**-0,86**
S69	3/49	0,000	**1,95**
S70	sp3RF/50	0,000	**-9,33**
S70	sp3R-p/51	2,184	**8,60**
S71	sp3R-p/51	0,000	**-11,93**
S71	sp3RF/50	2,162	**12,66**
S72	sp3RR/52	0,000	**-8,99**
S72	sp3F-p/29	2,184	**8,01**
S73	sp3F-p/29	0,000	**-11,06**
S73	sp3RR/52	2,162	**12,07**
S74	sp3LF/53	1,511	**-1,94**
S74	3-p/54	0,000	**1,17**
S75	3-p/54	0,000	**-0,34**
S75	sp3LF/53	0,336	**0,46**
S76	1a/55	1,501	**-1,51**
S76	1a-p/56	0,000	**0,14**
S77	1a-p/57	0,000	**-0,17**
S77	1a/58	0,649	**0,66**
S78	1a/55	1,911	**-2,09**
S78	1a-p/56	0,000	**0,45**
S79	1a-p/56	0,485	**-0,22**

Staaf	BG	dx [m]	N [kN]
S79	1a/55	0,969	**1,08**
S80	sp3RR/38	1,511	**-2,17**
S80	sp3RF-p/39	0,000	**0,47**
S81	sp3F-p/59	0,000	**-0,17**
S81	sp3R/60	0,336	**0,51**
S82	1a/58	1,501	**-1,61**
S82	1a-p/57	0,000	**0,22**
S83	1a-p/57	0,000	**-0,14**
S83	1a/58	0,649	**0,69**
S84	1a/58	1,911	**-1,86**
S84	1a-p/57	0,000	**0,28**
S85	1a-p/57	0,969	**-0,23**
S85	1a/58	0,000	**1,12**
S86	sp3F-p/61	0,000	**-6,91**
S86	sp3RR/52	1,450	**10,43**
S87	sp3R/60	0,000	**-11,06**
S87	sp3RF-p/39	1,451	**9,12**
S88	sp3R/23	0,997	**-12,80**
S88	sp1aRR-p/62	0,000	**-3,67**
S89	sp3R/1	0,000	**-120,04**
S89	sp3F-p/2	2,386	**110,70**
S90	sp3F/4	0,001	**-109,41**
S90	sp3R-p/13	2,652	**98,39**
S91	sp3F/4	0,000	**-125,63**
S91	sp3R-p/63	2,386	**117,01**
S92	sp3R/1	0,000	**-103,23**
S92	sp3F-p/2	2,651	**91,87**
S93	sp3RF-p/39	1,268	**-0,93**
S93	sp3RF/64	1,268	**1,91**
S94	1a/65	0,000	**-7,82**
S94	1a-p/66	1,851	**7,18**
S95	1a/67	0,000	**-7,31**
S95	1a/65	1,849	**7,66**
S96	1a/65	0,000	**-3,81**
S96	1a-p/66	1,851	**3,56**
S97	1a/67	0,000	**-3,75**
S97	1a-p/68	1,849	**3,64**
S98	1a/65	1,680	**-4,75**
S98	1a-p/68	0,000	**4,28**
S99	1a/67	0,961	**-2,38**
S99	1a-p/68	0,000	**2,20**
S100	3/12	2,364	**-91,84**
S100	sp3LF-p/69	0,000	**-3,99**
S101	sp3R-p/13	0,000	**-1,39**
S101	3/12	2,361	**88,64**
S102	1a/44	2,818	**-65,51**
S102	sp3LF-p/69	0,000	**23,71**
S103	1a/67	0,000	**-2,62**
S103	1a-p/68	1,691	**2,25**
S104	1a-p/57	0,000	**-0,96**
S104	sp3R/60	1,306	**2,64**
S105	1a/65	0,000	**-2,42**
S105	1a-p/66	1,691	**2,43**
S107	3/12	2,364	**-77,01**
S107	1a-p/45	0,000	**1,93**
S108	1a-p/56	0,000	**-1,30**
S108	1a/55	1,306	**2,37**
S109	1a-p/45	0,000	**-7,04**
S109	3/12	2,361	**74,47**
S110	1a/44	2,819	**-61,32**
S110	1a-p/45	0,000	**26,83**
S111	sp3R/60	2,363	**-62,51**
S111	1a-p/70	0,000	**23,42**
S112	1a-p/70	0,000	**-29,79**
S112	sp3LF/53	2,361	**57,46**
S113	sp3R/8	2,819	**-31,38**
S113	1a-p/70	0,000	**58,85**

Staaf	BG	dx [m]	N [kN]
S114	1a/67	0,000	**-2,77**
S114	1a-p/68	1,691	**2,65**
S115	1a-p/18	0,000	**-0,20**
S115	1a/17	1,306	**3,36**
S116	1a/65	0,000	**-2,83**
S116	1a-p/66	1,691	**2,56**
S118	sp3LF/53	2,363	**-53,78**
S118	1a-p/70	0,000	**24,01**
S119	1a-p/15	0,000	**-0,51**
S119	1a/14	1,306	**3,40**
S120	1a-p/70	0,000	**-30,58**
S120	sp3R/60	2,361	**50,35**
S121	sp1aF-p/71	1,306	**-0,75**
S121	1a/67	0,000	**3,46**
S122	1a/67	0,000	**-3,21**
S122	1a/65	1,691	**3,12**
S123	1a/65	0,000	**-3,34**
S123	1a-p/66	1,691	**3,03**
S125	1a-p/66	1,306	**-0,86**
S125	sp1aF/72	0,000	**3,38**
S126	1a/73	2,819	**-33,22**
S126	1a-p/70	0,000	**55,14**
S129	1a-p/18	1,213	**27,14**
S129	3/12	0,000	**56,70**
S130	sp3LF-p/16	2,880	**28,31**
S130	3/12	0,000	**56,45**
S131	sp3R/60	1,541	**-86,28**
S131	3-p/54	0,000	**117,50**
S132	1a/73	1,541	**-74,62**
S132	1a-p/70	0,000	**111,72**
S133	sp3LF/74	0,799	**-0,23**
S133	sp3LR-p/75	0,000	**0,14**
S134	sp3LR/76	0,800	**-0,12**
S134	sp3LF-p/77	0,000	**0,15**
S135	1a/44	0,000	**-133,73**
S135	1a-p/45	4,098	**44,55**
S136	1a-p/70	2,179	**-2,65**
S136	sp3F/78	0,000	**2,19**
S137	sp1aLR-p/30	1,213	**21,15**
S137	3/12	0,000	**44,86**
S138	sp3LR-p/5	2,880	**22,18**
S138	3/12	0,000	**44,10**
S139	1a-p/70	0,000	**-92,96**
S139	sp3R/60	1,506	**60,10**
S140	1a/44	0,000	**-130,05**
S140	1a-p/45	4,099	**48,06**
S141	1a-p/70	0,000	**-101,75**
S141	1a/73	1,506	**50,32**
S142	1a-p/57	1,213	**25,44**
S142	3/79	0,000	**54,49**
S143	sp3RF-p/39	2,880	**27,44**
S143	3/79	0,000	**55,17**
S144	3/12	1,541	**-150,94**
S144	sp3LF-p/69	0,000	**43,87**
S145	1a/44	1,541	**-134,34**
S145	sp3R-p/13	0,000	**55,30**
S146	sp3F/33	0,000	**-0,96**
S146	sp3R-p/13	0,800	**0,42**
S147	sp3RR/80	0,800	**-0,25**
S147	sp3RF-p/81	0,000	**0,07**
S148	sp3R/8	0,000	**-70,56**
S148	1a-p/70	4,098	**109,24**
S149	sp3F-p/35	2,179	**-1,79**
S149	sp3RR/80	0,000	**3,87**
S150	sp3R-p/51	2,179	**-2,35**
S150	sp3F/82	0,000	**4,07**
S151	1a-p/56	1,213	**19,94**

Staaf	BG	dx [m]	N [kN]
S151	3/79	0,000	**42,58**
S152	sp3RR-p/83	2,880	**21,85**
S152	3/79	0,000	**42,90**
S153	1a-p/45	0,000	**-44,88**
S153	1a/44	1,506	**105,43**
S154	1a/73	0,001	**-71,35**
S154	1a-p/70	4,099	**105,67**
S155	sp3R-p/13	0,000	**-45,03**
S155	1a/44	1,506	**109,12**
S156	sp3R-p/63	0,000	**-68,70**
S156	sp3F/4	2,264	**76,17**
S159	sp1aLF-p/84	0,888	**73,34**
S159	3/85	0,000	**142,21**
S160	sp1aRF-p/86	0,888	**72,22**
S160	3/87	0,000	**140,61**
S162	1a/44	1,544	**-295,25**
S162	sp3RR-p/37	0,000	**135,91**
S164	sp3LR/76	1,544	**-191,09**
S164	1a-p/70	0,000	**244,07**
S166	sp1aLR-p/88	0,888	**60,14**
S166	3/21	0,000	**114,90**
S167	sp3R/60	0,000	**-38,95**
S167	sp3F-p/24	0,000	**33,79**
S168	sp3LF-p/89	0,000	**-15,79**
S168	sp3R/60	0,000	**18,19**
S169	sp3F/25	0,000	**-38,74**
S169	sp3LR-p/75	0,000	**32,55**
S170	sp3LR-p/75	0,000	**-15,20**
S170	sp3LF/90	0,000	**18,07**
S171	sp3F/25	0,000	**-111,51**
S171	sp3R-p/47	0,000	**41,73**
S172	sp3R/60	0,000	**-108,46**
S172	sp3F-p/24	0,000	**46,76**
S175	sp3LF-p/69	0,533	**-0,89**
S175	3/12	0,000	**37,98**
S176	sp3F/33	0,000	**-956,03**
S176	sp3R-p/13	2,140	**705,06**
S177	sp3R/1	0,000	**-883,59**
S177	sp3F-p/35	2,140	**586,13**
S178	sp3LF/91	0,000	**-9,58**
S178	sp1aLR-p/92	2,360	**6,32**
S179	sp3LR-p/93	0,000	**-6,81**
S179	sp3LF/91	0,236	**9,07**
S180	sp1aF-p/94	0,000	**-36,23**
S180	sp1aR/95	0,971	**38,04**
S181	sp1aR-p/96	0,000	**-37,13**
S181	sp1aF/97	0,000	**35,32**
S182	sp3F/25	0,000	**-36,09**
S182	sp3R-p/26	0,000	**37,97**
S183	sp3R-p/47	0,000	**-37,51**
S183	sp3F/25	0,000	**35,28**
S184	sp3R/40	0,000	**-38,97**
S184	sp3F-p/24	0,000	**36,39**
S185	sp3F-p/24	0,000	**-35,48**
S185	sp3R/60	0,000	**38,43**
S189	sp3LF/53	0,000	**-3,01**
S189	3-p/98	1,922	**72,62**
S190	sp3RR/80	0,000	**-39,07**
S190	sp3F-p/2	0,000	**30,53**
S191	sp3RF-p/99	0,000	**-14,14**
S191	sp3RR/80	0,000	**18,33**
S192	sp3F/4	0,000	**-37,78**
S192	sp3R-p/13	0,000	**32,42**
S193	sp3R-p/13	0,000	**-15,04**
S193	sp3RF/100	1,304	**17,74**
S194	sp3F/4	0,000	**-122,16**
S194	sp3R-p/13	0,000	**41,71**

Staaf	BG	dx [m]	N [kN]
S195	sp3R/1	0,000	**-108,48**
S195	sp3F-p/2	0,000	**42,94**
S198	sp3F-p/41	0,000	**-35,14**
S198	sp3R/40	0,000	**36,65**
S199	sp3R/101	0,000	**-35,84**
S199	sp3F-p/102	0,000	**37,78**
S200	sp3F/4	0,000	**-40,43**
S200	sp3R-p/63	2,194	**38,11**
S201	sp3R-p/13	0,000	**-37,44**
S201	sp3F/4	0,000	**39,55**
S202	sp3R/40	0,000	**-39,33**
S202	sp3F-p/41	0,000	**37,73**
S203	sp3F-p/2	0,000	**-36,75**
S203	sp3R/1	0,974	**38,48**
S206	sp1aLR/103	0,000	**-6,93**
S206	sp3LF-p/34	0,000	**9,64**
S207	sp3LF/104	0,000	**-9,12**
S207	sp1aLR-p/105	3,304	**7,37**
S209	sp3LF/106	0,000	**-3,06**
S209	3-p/107	0,481	**70,60**
S211	1a-p/45	0,000	**0,00**
S211	3/12	0,000	**14,74**
S212	1a-p/70	0,000	**-4,63**
S212	sp3LF/53	0,961	**10,43**
S214	1a/67	0,000	**-3,30**
S214	1a-p/68	2,305	**2,66**
S215	1a/67	0,000	**-1,87**
S215	1a-p/68	2,305	**2,09**
S216	1a/65	1,166	**-1,83**
S216	1a-p/68	0,000	**0,34**
S217	1a/65	1,771	**-1,66**
S217	1a-p/66	0,000	**1,27**
S218	1a/67	1,782	**-1,46**
S218	1a/65	0,000	**1,44**
S219	1a/65	0,000	**-2,97**
S219	1a-p/66	2,305	**2,99**
S220	1a/65	0,000	**-2,40**
S220	1a-p/66	2,305	**1,53**
S223	1a/65	1,166	**-1,80**
S223	1a-p/68	0,000	**0,37**
S224	sp3RR-p/37	2,376	**-93,44**
S224	1a/44	0,000	**210,89**
S225	1a/44	0,000	**-212,45**
S225	sp3RR-p/37	2,373	**88,29**
S226	1a-p/70	2,376	**-188,84**
S226	sp3RR/38	0,000	**120,41**
S227	sp3RR/38	0,000	**-121,99**
S227	1a-p/70	2,373	**179,39**
S228	sp3F-p/24	4,732	**39,38**
S228	3/108	0,000	**75,46**
S229	3/108	1,262	**-12,41**
S229	sp3F-p/24	0,000	**-6,65**
S230	sp3F-p/2	2,898	**40,62**
S230	3/21	0,000	**77,94**
S231	sp3F-p/2	4,732	**39,31**
S231	3/21	0,000	**75,40**
S232	sp1aRF-p/86	2,827	**31,63**
S232	3/87	0,000	**61,04**
S233	3/21	1,262	**-12,41**
S233	sp3F-p/2	0,000	**-6,64**
S234	sp3F-p/24	2,898	**40,67**
S234	3/108	0,000	**77,97**
S235	sp4R-p/109	4,732	**32,35**
S235	3/87	0,000	**60,75**
S236	sp1aLR-p/88	2,827	**26,44**
S236	3/21	0,000	**49,98**
S237	3/87	1,262	**-10,20**

Staaf	BG	dx [m]	N [kN]
S237	sp4R-p/109	0,000	**-5,60**
S238	sp4R-p/110	2,898	**33,55**
S238	3/85	0,000	**62,94**
S239	sp3LR-p/5	2,376	**-101,02**
S239	1a/44	0,000	**207,07**
S240	1a/44	0,000	**-207,77**
S240	sp3LR-p/5	2,373	**91,09**
S241	1a-p/70	2,376	**-189,36**
S241	sp3LR/76	0,000	**119,51**
S242	sp3LR/76	0,000	**-123,96**
S242	1a-p/70	2,373	**178,23**
S243	sp3F-p/2	0,000	**-56,27**
S243	sp3R/1	2,366	**68,33**
S245	sp3R/8	0,000	**-65,31**
S245	sp3F-p/11	2,366	**69,00**
S247	sp3R-p/47	0,878	**-2,30**
S247	sp3F/111	0,000	**8,26**
S248	sp3F/111	0,000	**-10,02**
S248	sp3R-p/47	2,227	**3,44**
S249	sp3F/111	0,000	**-12,02**
S249	sp3R-p/47	2,571	**9,65**
S250	sp3R-p/47	1,250	**-9,01**
S250	sp3F/111	0,000	**9,71**
S252	sp3R/40	0,000	**-254,22**
S252	sp3F-p/41	2,380	**243,39**
S253	sp4R-p/112	4,732	**32,34**
S253	3/85	0,000	**60,96**
S254	sp1aRR-p/113	2,827	**26,08**
S254	3/108	0,000	**49,12**
S255	3/85	1,262	**-10,20**
S255	sp3R-p/63	0,000	**-5,57**
S256	sp4R-p/114	2,898	**33,45**
S256	3/87	0,000	**63,04**
S257	sp3RR/38	0,000	**-21,93**
S257	sp1aRR-p/62	1,616	**-7,39**
S258	sp1aRR-p/113	0,888	**59,17**
S258	3/108	0,000	**113,43**
S260	sp3F-p/59	0,879	**-3,52**
S260	sp3R/60	0,000	**8,75**
S263	sp4LR/115	0,000	**-47,24**
S263	sp4LF-p/116	0,000	**40,59**
S264	sp4LF-p/117	0,000	**-40,31**
S264	sp4LR/118	0,000	**46,93**
S265	sp3LR/32	0,000	**-46,49**
S265	sp4LF-p/116	0,000	**40,25**
S266	sp4LF/119	0,000	**-45,06**
S266	sp4LR-p/120	0,000	**42,61**
S267	sp4LR-p/121	0,000	**-42,61**
S267	sp4LF/122	0,000	**44,35**
S268	1a-p/68	2,004	**-1,92**
S268	1a-p/68	0,000	**1,67**
S273	sp3LF/31	0,000	**-44,67**
S273	sp4LR-p/123	0,000	**37,24**
S274	sp3LF-p/34	0,000	**-18,04**
S274	sp3LR/124	0,000	**21,28**
S275	sp3LF/31	0,000	**-13,10**
S275	sp4LR-p/123	0,000	**11,31**
S278	sp3LR/124	0,000	**-44,95**
S278	sp3LF-p/34	0,000	**37,25**
S279	sp4LR-p/123	0,000	**-18,03**
S279	sp3LF/31	0,000	**21,19**
S280	sp3LR/124	0,000	**-13,14**
S280	sp3LF-p/34	0,000	**11,33**
S283	sp3LF-p/125	1,754	**6,06**
S283	3/79	0,000	**82,26**
S287	sp3F-p/59	0,975	**-0,34**
S287	sp3F/111	1,462	**0,63**

Staaf	BG	dx [m]	N [kN]
S288	sp3R/60	0,000	**-58,13**
S288	sp3F-p/24	0,000	**37,57**
S289	sp3LR/76	1,731	**-228,32**
S289	sp3LF-p/89	0,000	**84,97**
S290	sp3RR/126	0,000	**-26,69**
S290	sp4RF-p/127	0,000	**24,95**
S291	sp3RF/128	1,017	**-28,87**
S291	sp4RR-p/129	0,000	**23,03**
S292	sp4RR-p/130	0,000	**-22,83**
S292	sp4RF/131	0,000	**28,76**
S295	sp3R/1	0,000	**-227,54**
S295	sp3RF-p/99	1,731	**81,11**
S296	1a/65	1,771	**-1,68**
S296	1a-p/66	0,000	**1,24**
S297	1a/67	1,782	**-1,46**
S297	1a/65	0,000	**1,42**
S298	sp3RF-p/132	1,753	**-98,21**
S298	sp3R/23	1,753	**133,50**
S300	sp3F-p/2	0,000	**-64,06**
S300	sp3R/1	2,264	**71,00**
S301	sp3R/60	0,000	**-10,67**
S301	sp3F-p/59	2,227	**4,50**
S302	sp3RR/133	0,000	**-44,90**
S302	sp3RF-p/134	0,000	**34,75**
S303	sp4RR-p/135	0,000	**-18,02**
S303	sp3RF/128	0,240	**20,64**
S304	sp3RR/133	0,000	**-13,11**
S304	sp3RF-p/134	0,000	**10,62**
S307	sp3RF/128	0,000	**-43,59**
S307	sp4RR-p/135	0,000	**37,21**
S308	sp3RF-p/134	0,000	**-16,86**
S308	sp3RR/133	0,000	**21,25**
S309	sp3RF/128	0,000	**-12,75**
S309	sp4RR-p/135	1,232	**11,31**
S312	sp3LF-p/69	0,000	**6,22**
S312	3/12	2,005	**84,58**
S318	sp3RF/128	0,982	**-28,80**
S318	sp4RR-p/129	0,000	**23,30**
S319	sp4RR/136	0,000	**-26,95**
S319	sp4RF-p/127	0,000	**24,64**
S320	sp4RF-p/137	0,000	**-24,81**
S320	sp4RR/138	0,000	**26,71**
S321	1a/58	1,753	**-1,12**
S321	1a-p/57	3,507	**1,16**
S324	sp3R/1	0,000	**-2,38**
S324	3-p/139	1,753	**71,23**
S328	1a/44	0,000	**-291,70**
S328	sp3RF-p/81	1,544	**112,66**
S330	sp3RR/80	0,864	**-0,59**
S330	sp3RF-p/81	0,000	**0,34**
S331	sp3RF/64	0,000	**-11,73**
S331	sp3RR-p/83	2,231	**16,15**
S332	sp3LR-p/5	0,000	**-146,90**
S332	1a/44	4,017	**304,12**
S333	sp3R/60	0,000	**-11,47**
S333	sp3F-p/59	2,571	**9,42**
S334	sp3F-p/59	1,250	**-9,15**
S334	sp3R/60	0,000	**10,07**
S336	sp3R/40	0,000	**-105,27**
S336	sp3F-p/41	2,076	**68,27**
S340	sp3RF/100	0,000	**-256,33**
S340	sp3RR-p/140	1,731	**75,18**
S341	sp3F/111	0,000	**-776,92**
S341	sp3R-p/47	2,140	**704,46**
S342	sp3R/60	0,000	**-884,96**
S342	sp3F-p/59	2,140	**786,83**
S343	sp3LF-p/125	0,000	**-0,89**

Staaf	BG	dx [m]	N [kN]
S343	3/79	0,000	**36,81**
S345	sp3RR-p/37	0,000	**-201,67**
S345	sp3RF/36	2,816	**329,02**
S347	sp3RF/36	2,816	**-351,28**
S347	sp3RR-p/37	5,642	**198,66**
S349	1a/44	2,816	**-331,50**
S349	sp3LR/76	2,816	**228,59**
S351	sp3LR/76	2,816	**-236,48**
S351	1a/44	2,816	**317,53**
C5	sp3R/1	0,000	**-1498,28**
C5	sp1aF-p/141	3,374	**1057,95**
C6	sp3R/60	0,000	**-1493,89**
C6	sp3F-p/24	3,374	**1346,79**
C7	sp3F/4	0,000	**-1622,36**
C7	sp3R-p/13	3,374	**1218,88**
C8	sp3F/25	0,000	**-1322,56**
C8	sp3R-p/47	3,374	**1224,13**
B8	sp3RR/80	0,000	**-148,44**
B8	sp3RF-p/81	4,916	**130,30**
B10	sp3RR/46	0,000	**-131,98**
B10	sp3RF/50	4,916	**139,21**
B12	sp3RF/36	0,000	**-157,61**
B12	sp3RR-p/37	4,916	**131,36**
B93	sp3LR/142	0,000	**-148,51**
B93	sp3LF/143	4,916	**141,01**
SB49	sp3RF-p/39	0,000	**0,00**
SB49	sp3RR/38	0,000	**0,00**
SB50	sp3RR/133	0,000	**0,00**
SB50	1a/58	2,621	**0,12**
SB51	sp3LR/142	0,000	**0,00**
SB51	sp3LF-p/144	0,000	**0,00**
SB52	sp3LR/124	0,000	**0,00**
SB52	1a/17	2,621	**0,12**
SB53	sp3LR-p/75	0,000	**0,00**
SB53	sp3LF/74	0,000	**0,00**
SB54	sp3RR/38	0,000	**0,00**
SB54	1a/17	2,621	**0,12**
SB55	sp3LR/76	0,000	**0,00**
SB55	sp3LF-p/77	0,000	**0,00**
SB56	sp3RF/64	0,000	**0,00**
SB56	1a/14	2,621	**0,12**
SB57	sp3LR-p/6	0,000	**0,00**
SB57	sp3LF/145	0,000	**0,00**
SB58	sp3LF/90	0,000	**0,00**
SB58	1a/14	2,621	**0,12**
SB59	sp3RF/146	0,000	**0,00**
SB59	sp3RR-p/83	0,000	**0,00**
SB60	sp3RF/100	0,000	**0,00**
SB60	1a/55	2,621	**0,12**
SB61	sp3RF-p/81	0,000	**0,00**
SB61	sp3RR/80	0,000	**0,00**
SB62	sp3LF/27	0,000	**0,00**
SB62	1a/55	2,621	**0,12**
SB63	sp3RF/36	0,000	**0,00**
SB63	sp3RR-p/37	0,000	**0,00**
SB64	sp3RF/36	0,000	**0,00**
SB64	1a/58	2,621	**0,12**
B31	sp3RF-p/99	0,000	**-133,32**
B31	sp3RR/133	4,916	**135,15**
B32	sp3LF/74	0,000	**-133,35**
B32	sp3LR-p/75	4,916	**151,16**
B33	sp3LF-p/89	0,000	**-144,44**
B33	sp3LR/32	4,916	**146,74**
B34	sp3LR/76	0,000	**-143,48**
B34	sp3LF-p/77	4,916	**151,77**
C9	sp3R/1	0,000	**-1397,89**
C9	sp3F-p/2	6,648	**974,25**

Staaf	BG	dx [m]	N [kN]
C10	sp3R/60	0,000	**-1393,61**
C10	sp3F-p/24	6,648	**1247,43**
C11	sp3F/4	0,000	**-1509,75**
C11	sp3R-p/13	6,648	**1134,08**
C12	sp3F/25	0,000	**-1237,74**
C12	sp3R-p/47	6,648	**1138,42**
B94	sp3RF-p/81	5,028	**-162,11**
B94	sp3RR/80	9,452	**185,19**
B95	sp3RF/147	0,000	**-158,27**
B95	sp3RR-p/148	5,028	**148,32**
B22	sp3LR-p/75	5,028	**-184,76**
B22	sp3LF/74	9,452	**168,09**
B26	sp3LR/32	0,000	**-168,21**
B26	sp3LF-p/34	5,028	**161,83**
SB65	sp3LF-p/77	1,676	**0,00**
SB65	sp3LR/76	1,676	**0,00**
SB66	sp3RR-p/148	1,676	**0,00**
SB66	sp3RF/50	1,676	**0,00**
SB67	sp3RF-p/149	0,000	**0,00**
SB67	sp3RR/150	0,000	**0,00**
SB68	sp3LR-p/75	0,000	**0,00**
SB68	sp3LF/90	0,000	**0,00**
SB69	sp3RF-p/151	0,000	**0,00**
SB69	sp3RR/152	0,000	**0,00**
SB70	sp3LR-p/6	0,000	**0,00**
SB70	sp3LF/145	0,000	**0,00**
SB71	sp1aLF-p/153	1,676	**0,00**
SB71	sp3LR/142	1,676	**0,00**
SB72	sp3RR-p/154	1,676	**0,00**
SB72	sp3RF/155	1,676	**0,00**
SB73	1a/67	0,000	**-0,12**
SB73	sp3RR/133	2,356	**0,00**
SB74	1a/44	0,000	**-0,12**
SB74	sp3LR/76	2,356	**0,00**
SB75	sp3RR/38	0,000	**0,00**
SB75	1a/73	2,356	**0,12**
SB76	sp3RF/100	0,000	**0,00**
SB76	1a/58	2,356	**0,12**
SB77	sp3LF/90	0,000	**0,00**
SB77	1a/17	2,356	**0,12**
SB78	sp3LR/20	0,000	**0,00**
SB78	1a/44	2,356	**0,12**
SB79	1a/73	0,000	**-0,12**
SB79	sp3LF/27	2,356	**0,00**
SB80	1a/67	0,000	**-0,12**
SB80	sp3LR/124	2,356	**0,00**
SB81	1a/17	0,000	**-0,11**
SB81	sp3R/60	2,360	**0,00**
SB82	sp3LF-p/77	1,676	**0,00**
SB82	sp3LR/76	1,676	**0,00**
SB83	1a/17	0,000	**-0,11**
SB83	sp3R/23	2,360	**0,00**
SB84	sp3R/156	1,676	**0,00**
SB84	sp3F-p/102	1,676	**0,00**
SB85	sp3F/25	0,000	**0,00**
SB85	1a/55	2,360	**0,11**
SB86	sp3R/156	1,676	**0,00**
SB86	sp3F-p/102	1,676	**0,00**
SB87	sp1aLF/157	0,000	**0,00**
SB87	1a/17	2,360	**0,11**
SB88	sp1aRR/158	1,676	**0,00**
SB88	sp3RF-p/151	1,676	**0,00**
SB89	sp3RF/36	0,000	**0,00**
SB89	1a/58	2,360	**0,11**
SB90	sp3RF/159	0,000	**0,00**
SB90	sp1aRR-p/160	0,000	**0,00**
SB91	sp3F/4	0,000	**0,00**

Staaf	BG	dx [m]	N [kN]
SB91	1a/14	2,360	**0,11**
SB92	sp3R/156	0,000	**0,00**
SB92	sp3F-p/102	0,000	**0,00**
SB93	1a/58	0,000	**-0,11**
SB93	sp3R/3	2,360	**0,00**
SB94	sp3F/161	1,676	**0,00**
SB94	sp3R-p/162	1,676	**0,00**
SB95	1a/58	0,000	**-0,11**
SB95	sp3RR/80	2,360	**0,00**
SB96	sp3LF/163	1,676	**0,00**
SB96	sp3LR-p/164	1,676	**0,00**
B73	sp3RR/126	0,000	**-153,75**
B73	sp3RF-p/134	5,028	**151,06**
B74	sp3RR-p/37	5,028	**-162,11**
B74	sp3RF/36	9,452	**196,30**
B75	sp3LF/104	0,000	**-161,61**
B75	sp3LR-p/165	5,028	**166,97**
B76	sp3LF-p/77	5,028	**-184,56**
B76	sp3LR/76	9,452	**179,89**
C13	sp3R/1	0,000	**-1112,97**
C13	sp3F-p/2	6,648	**750,59**
C14	sp3R/60	0,000	**-1110,30**
C14	sp3F-p/59	6,648	**983,67**
C15	sp3F/33	0,000	**-1201,40**
C15	sp3R-p/13	6,648	**887,93**
C16	sp3F/111	0,000	**-978,15**
C16	sp3R-p/47	6,648	**890,65**
B98	sp3LR/76	0,000	**-218,56**
B98	sp3LF-p/77	8,859	**226,42**
B99	sp3RF/147	0,000	**-168,65**
B99	sp3RR/126	8,860	**164,62**
B100	sp3RF/36	0,000	**-239,86**
B100	sp3RR-p/37	8,860	**198,61**
B101	sp3LR/32	0,000	**-187,52**
B101	sp3LF-p/144	8,859	**173,52**
B102	sp3F-p/2	2,920	**-3,40**
B102	sp3R/3	0,000	**3,86**
B103	sp3F-p/59	2,920	**-2,63**
B103	sp3R/60	0,000	**2,46**
B104	sp3R-p/26	2,920	**-3,64**
B104	sp3F/25	0,000	**3,70**
B105	sp3R-p/13	2,920	**-2,87**
B105	sp3F/33	0,000	**4,74**
SB97	sp1aLR-p/166	0,000	**0,00**
SB97	1a/44	0,000	**0,00**
SB98	sp3F/42	0,000	**0,00**
SB98	sp3R-p/43	0,000	**0,00**
SB99	sp3F-p/102	0,000	**0,00**
SB99	sp3R/156	0,000	**0,00**
SB100	1a/44	0,000	**0,00**
SB100	sp1aRR-p/160	0,000	**0,00**
SB101	1a-p/70	0,000	**0,00**
SB101	sp1aRR/158	0,000	**0,00**
SB102	sp3R/40	0,000	**0,00**
SB102	sp3F-p/41	0,000	**0,00**
SB103	sp3R-p/43	0,000	**0,00**
SB103	sp3F/42	0,000	**0,00**
SB104	sp1aLR/167	0,000	**0,00**
SB104	1a-p/70	0,000	**0,00**
SB105	sp3RR/80	0,000	**0,00**
SB105	1a/44	2,231	**0,09**
SB106	sp3F/25	0,000	**0,00**
SB106	1a/44	2,231	**0,09**
SB107	sp3R/23	0,000	**0,00**
SB107	1a/14	2,231	**0,09**
SB108	sp3RF/36	0,000	**0,00**
SB108	1a/14	2,231	**0,09**

Staaf	BG	dx [m]	N [kN]
SB109	sp1aLF/157	0,000	**0,00**
SB109	1a/73	2,231	**0,09**
SB110	sp3R/3	0,000	**0,00**
SB110	1a/73	2,231	**0,09**
SB111	sp3F/4	0,000	**0,00**
SB111	1a/58	2,231	**0,09**
SB112	sp3LR/76	0,000	**0,00**
SB112	1a/58	2,231	**0,09**
SB113	sp3R/60	0,000	**0,00**
SB113	1a/14	2,190	**0,08**
SB114	sp1aLR/167	0,000	**0,00**
SB114	1a-p/70	0,000	**0,00**
SB115	sp3R/23	0,000	**0,00**
SB115	1a/55	2,190	**0,08**
SB116	sp3F-p/41	0,000	**0,00**
SB116	sp3R/40	0,000	**0,00**
SB117	sp3F/25	0,000	**0,00**
SB117	1a/73	2,190	**0,08**
SB118	sp3F/42	0,000	**0,00**
SB118	sp3R-p/43	0,000	**0,00**
SB119	sp1aLF/168	0,000	**0,00**
SB119	1a/58	2,190	**0,08**
SB120	1a-p/70	0,000	**0,00**
SB120	1a/73	0,000	**0,00**
SB121	sp3RF/36	0,000	**0,00**
SB121	1a/58	2,190	**0,08**
SB122	1a/44	0,000	**0,00**
SB122	sp1aRR-p/160	0,000	**0,00**
SB123	sp3F/4	0,000	**0,00**
SB123	1a/44	2,190	**0,08**
SB124	sp3R-p/43	0,000	**0,00**
SB124	sp3F/42	0,000	**0,00**
SB125	sp3R/3	0,000	**0,00**
SB125	1a/44	2,190	**0,08**
SB126	sp3R/40	0,000	**0,00**
SB126	sp3F-p/41	0,000	**0,00**
SB127	1a/44	0,000	**0,00**
SB127	1a/14	2,190	**0,08**
SB128	1a-p/45	0,000	**0,00**
SB128	1a/44	0,000	**0,00**
B106	sp3RR/46	0,000	**-166,53**
B106	sp3RF/128	8,859	**168,95**
B107	sp3LF/74	0,000	**-204,54**
B107	sp3LR-p/75	8,859	**224,78**
B108	sp3LF/104	0,000	**-182,80**
B108	sp3LR/32	8,860	**182,86**
B109	sp3RR/80	0,000	**-226,37**
B109	sp3RF-p/81	8,860	**196,88**
B110	1a/17	0,000	**0,00**
B110	sp1aLR-p/166	2,920	**0,00**
B111	1a/14	0,000	**0,00**
B111	sp3F/42	2,920	**0,00**
B112	1a/65	0,000	**0,00**
B112	1a/44	2,920	**0,00**
B113	1a/58	0,000	**0,00**
B113	sp3R/40	2,920	**0,00**
C17	sp3R/1	0,000	**-945,38**
C17	sp3F-p/2	3,414	**621,33**
C18	sp3R/60	0,000	**-942,43**
C18	sp3F-p/59	3,414	**804,18**
C19	sp3F/4	0,000	**-1002,41**
C19	sp3R-p/13	3,414	**720,68**
C20	sp3F/111	0,000	**-844,09**
C20	sp3R-p/47	3,414	**729,79**
B114	sp3LF-p/77	0,000	**-273,68**
B114	sp3LR/76	4,360	**258,81**
B115	sp3RR/126	0,000	**-202,34**

Staaf	BG	dx [m]	N [kN]
B115	sp3RF-p/134	4,360	**201,50**
B116	sp3LR-p/75	2,180	**-271,45**
B116	sp3LF/74	4,360	**239,81**
B117	sp3LR/32	0,000	**-224,32**
B117	sp3LF-p/34	4,360	**214,31**
SB129	1a-p/45	0,000	**0,00**
SB129	1a/44	0,000	**0,00**
SB130	sp3R/60	0,000	**0,00**
SB130	1a/17	2,050	**0,09**
SB131	1a-p/45	0,000	**0,00**
SB131	1a/44	0,000	**0,00**
SB132	sp3RR/80	0,000	**0,00**
SB132	1a/58	2,050	**0,09**
SB133	sp3F-p/41	0,000	**0,00**
SB133	sp3R/40	0,000	**0,00**
SB134	sp3F/25	0,000	**0,00**
SB134	1a/14	2,049	**0,09**
SB135	sp3F-p/102	0,000	**0,00**
SB135	sp3R/156	0,000	**0,00**
SB136	sp3R/23	0,000	**0,00**
SB136	1a/17	2,050	**0,09**
SB137	1a-p/70	0,000	**0,00**
SB137	1a/44	1,250	**0,00**
SB138	sp3F/33	0,000	**0,00**
SB138	1a/55	2,050	**0,09**
SB139	sp3LR-p/169	0,000	**-12,32**
SB139	sp3LF/90	1,250	**13,58**
SB140	sp3LF/90	0,000	**-11,07**
SB140	sp3LR-p/169	2,050	**10,93**
SB141	sp3LF-p/16	0,000	**-5,02**
SB141	sp3LR/20	0,000	**10,70**
SB142	sp3LR/20	0,000	**-8,21**
SB142	sp3LF-p/16	2,050	**4,57**
SB143	sp3R-p/162	0,000	**0,00**
SB143	sp3F/161	0,000	**0,00**
SB144	sp3F/4	0,000	**0,00**
SB144	1a/55	2,050	**0,09**
B36	sp3RF-p/81	0,000	**-240,62**
B36	sp3RR/80	4,360	**268,49**
B37	sp3RR-p/37	0,000	**-239,70**
B37	sp3RF/36	4,360	**285,58**
B38	sp3RF/128	0,000	**-206,49**
B38	sp3RR-p/170	4,360	**196,50**
B39	sp3LF/31	2,180	**-216,23**
B39	sp3LR-p/171	4,360	**222,03**
S355	sp3F/33	0,000	**-954,88**
S355	sp3R-p/13	2,140	**706,55**
S356	sp3LF/90	0,000	**-540,36**
S356	sp3LR-p/169	2,141	**363,31**
S359	sp3LF/90	0,000	**-208,81**
S359	sp3LR-p/75	2,220	**177,79**
S360	sp3LF/90	0,000	**-209,20**
S360	sp3LR-p/75	2,135	**180,24**
S361	sp3F/33	0,000	**-111,55**
S361	sp3LR-p/5	0,970	**73,76**
S365	sp3R/1	0,000	**-882,76**
S365	sp3F-p/35	2,140	**587,86**
S366	sp3LR/124	0,000	**-555,09**
S366	sp3LF-p/89	2,141	**382,12**
S367	sp3LR/124	0,000	**-561,83**
S367	sp3LF-p/89	2,119	**395,22**
S368	sp3R/1	0,000	**-425,42**
S368	sp3F-p/2	1,571	**244,14**
S369	sp3R/1	0,000	**-397,38**
S369	sp3F-p/2	1,761	**263,97**
S370	sp3R/60	2,220	**-218,54**
S370	sp3LF-p/89	0,000	**186,20**

Staaf	BG	dx [m]	N [kN]
S371	sp3R/60	2,135	**-219,79**
S371	sp3LF-p/89	0,000	**188,58**
S372	sp3R/1	0,970	**-93,89**
S372	sp3F-p/35	0,000	**72,14**
S373	sp3R/1	6,823	**-92,25**
S373	sp3F-p/35	4,815	**73,09**
S377	sp3LF-p/77	0,000	**-214,20**
S377	sp3LR/76	2,030	**213,67**
S379	1a-p/70	0,000	**-201,45**
S379	sp3LF/74	2,030	**186,95**
S381	1a-p/70	2,030	**-117,58**
S381	sp3RR/80	2,030	**267,78**
S383	sp3RR-p/37	0,000	**-133,57**
S383	sp3RF/36	2,030	**306,74**
S386	sp3RF/36	0,000	**-226,72**
S386	1a-p/70	1,837	**141,96**
S395	sp3LF/90	1,731	**-236,32**
S395	sp3R-p/26	0,000	**74,94**
S397	sp3F/33	2,227	**-12,11**
S397	sp3R-p/13	0,000	**3,37**
S398	sp3LF/90	2,119	**-545,14**
S398	sp3LR-p/75	0,000	**376,11**
S400	sp3LF/31	0,000	**-44,35**
S400	sp4LR-p/120	0,000	**42,28**
S401	sp3F-p/24	0,000	**-66,03**
S401	sp3R/23	2,366	**68,75**
S402	sp3F/4	0,000	**-456,52**
S402	sp3R-p/63	1,570	**267,11**
S405	sp3RR/126	4,765	**-171,57**
S405	sp3RF/147	2,383	**172,53**
S408	sp3RF/100	0,000	**-630,07**
S408	sp3RR-p/37	2,119	**337,84**
S409	sp3F/25	0,000	**-409,54**
S409	sp3R-p/47	1,571	**266,45**
S411	sp3RF/100	2,220	**-239,09**
S411	sp3R-p/13	0,000	**162,78**
S412	sp3RF/36	2,135	**-241,40**
S412	sp3R-p/13	0,000	**165,17**
S413	sp3F/111	0,970	**-86,41**
S413	sp3R-p/47	0,000	**74,00**
S414	sp3F/111	6,823	**-84,87**
S414	sp3R-p/47	4,815	**74,89**
S418	sp3R/60	0,000	**-883,36**
S418	sp3F-p/59	2,140	**788,74**
S419	sp3RR/80	0,000	**-583,80**
S419	sp3RF-p/99	2,141	**321,55**
S420	sp3RR/80	0,000	**-593,71**
S420	sp3RF-p/99	2,119	**329,41**
S421	sp3R/60	0,000	**-423,99**
S421	sp3F-p/24	1,571	**299,84**
S422	sp3R/60	0,000	**-395,63**
S422	sp3F-p/24	1,760	**319,57**
S424	sp3RR/80	0,000	**-233,70**
S424	sp3RF-p/81	2,135	**147,65**
S425	sp3RR/38	0,000	**-93,90**
S425	sp3RF-p/39	0,970	**70,62**
S426	sp3RR/38	0,000	**-92,43**
S426	sp3F-p/59	2,008	**71,49**
S430	1a/73	0,000	**-5,50**
S430	1a-p/70	0,000	**7,62**
S431	sp3F/111	0,000	**-775,62**
S431	sp3R-p/47	2,140	**706,65**
S432	sp3RF/100	0,000	**-620,19**
S432	sp3RR-p/37	2,141	**327,66**
S433	sp3RR-p/37	0,000	**-170,40**
S433	sp3RF/36	4,017	**320,58**
S435	sp3F/42	0,000	**-251,91**

Staaf	BG	dx [m]	N [kN]
S435	sp3R-p/43	2,380	**242,27**
S445	1a-p/70	0,000	**-98,97**
S445	sp3R/60	0,000	**82,35**
S447	sp3F/33	0,000	**-157,66**
S447	sp3R-p/13	0,000	**90,43**
S448	sp1aLF-p/84	2,827	**32,38**
S448	3/85	0,000	**62,12**
S450	sp3LR/76	0,864	**-0,55**
S450	sp3LF-p/77	0,000	**0,69**
S451	sp3LF-p/77	0,000	**-271,82**
S451	sp3LR/76	4,017	**209,77**
S453	sp3LF/74	0,000	**-0,29**
S453	sp3LR-p/75	0,000	**0,30**
S454	1a-p/70	0,000	**-279,76**
S454	sp3LF/74	4,017	**174,11**
S456	sp3F-p/172	0,000	**-2,84**
S456	sp3R/8	2,179	**2,92**
S457	sp3LF/74	0,000	**-163,40**
S457	1a-p/70	1,544	**245,40**
S458	sp3LF/27	2,231	**-19,39**
S458	sp3LR-p/5	0,000	**12,99**
S459	sp3LR/20	2,231	**-17,85**
S459	sp3LF-p/16	0,000	**10,24**
S460	sp3R/40	2,076	**-107,63**
S460	sp3F-p/41	0,000	**70,14**
S461	sp3RR-p/37	0,000	**-2,85**
S461	sp3RF/36	1,503	**6,96**
S462	sp3RF-p/81	1,503	**-2,62**
S462	sp3RR/80	0,000	**6,97**
S463	sp3LR-p/75	1,503	**-2,95**
S463	sp3LF/74	0,000	**4,68**
S464	sp3LF-p/77	0,000	**-4,15**
S464	sp3R/60	1,503	**5,86**
S465	sp3LF/90	0,000	**-54,95**
S465	sp3LR-p/75	0,000	**36,22**
B129	sp3RF/173	0,000	**-50,30**
B129	sp3RR-p/174	0,000	**47,27**
B130	sp3LF/175	0,000	**-47,88**
B130	sp3LR-p/165	0,000	**48,52**
B131	sp3LR/142	0,000	**-50,39**
B131	sp3LF-p/144	0,000	**47,10**
B132	sp3RR/176	0,000	**-47,81**
B132	sp3RF-p/177	0,000	**49,75**
B133	sp3LF-p/178	2,500	**0,45**
B133	sp3LR/179	2,500	**1,29**
S467	sp3R/60	0,000	**-337,29**
S467	sp3F-p/59	0,000	**304,77**
S468	sp3R/1	0,000	**-335,76**
S468	sp3F-p/35	0,000	**222,47**
S469	sp1aF-p/141	0,000	**-18,73**
S469	sp3R/1	0,000	**28,27**
S470	sp1aR-p/22	0,000	**-22,17**
S470	sp3F/4	0,000	**31,39**
S471	sp3F/33	0,000	**-365,39**
S471	sp3R-p/13	0,000	**270,34**
S472	sp3F/111	0,000	**-292,59**
S472	sp3R-p/47	0,000	**270,31**
S473	sp3R-p/47	0,000	**-21,55**
S473	sp3F/25	0,000	**25,36**
S474	sp3F-p/24	0,000	**-24,37**
S474	sp3R/23	0,000	**27,73**
S479	sp3RF-p/134	4,764	**-172,45**
S479	sp3R/40	2,382	**171,83**
S480	sp3LF-p/180	4,765	**-188,17**
S480	sp3LR/181	2,382	**197,67**
S481	sp3LR/32	4,765	**-195,80**
S481	sp3LF/104	2,382	**189,93**

Staaf	BG	dx [m]	N [kN]
S482	3-p/54	3,498	**-48,43**
S482	sp3RR/38	5,224	**31,26**
S483	3-p/54	3,452	**-17,59**
S483	3/79	1,726	**31,00**
S484	sp3LF-p/69	3,452	**-15,04**
S484	3/12	1,726	**67,48**
S485	3-p/107	3,498	**-17,37**
S485	3/12	5,224	**31,56**
S486	sp3F/33	0,000	**-110,05**
S486	sp3LR-p/5	2,008	**74,61**
S487	sp3F/4	0,000	**-422,75**
S487	sp3R-p/63	1,761	**290,69**
S488	1a-p/45	0,000	**-87,06**
S488	1a/44	0,000	**381,05**
S491	sp3LR-p/5	0,000	**-134,56**
S491	1a/44	0,000	**361,64**
S497	sp3LR/20	0,000	**-130,25**
S497	sp3F-p/35	0,000	**69,32**
S501	sp3R-p/13	0,000	**-48,85**
S501	3/12	0,000	**177,47**
S503	1a-p/45	0,000	**-49,64**
S503	1a/44	0,000	**152,17**
S508	sp3LF-p/125	0,000	**1,15**
S508	3/87	0,800	**75,38**
S511	sp3LF-p/69	0,000	**1,15**
S511	3/85	0,000	**76,52**
S526	sp3RF/182	0,000	**-17,87**
S526	sp3LF-p/178	0,000	**16,68**
S527	sp3RR/183	0,000	**-17,10**
S527	sp3RF-p/184	0,000	**17,58**
S528	sp3RF/182	0,000	**-17,82**
S528	sp3RR-p/185	0,000	**16,81**
S529	sp3LF/143	0,000	**-16,89**
S529	sp3RF-p/184	0,000	**17,61**
S533	sp3RF/155	0,000	**-0,27**
S533	sp3RR-p/154	1,676	**-0,19**
S547	sp3RR/80	1,837	**-198,95**
S547	sp3F-p/59	0,000	**136,94**
S548	sp3LF-p/69	0,799	**1,61**
S548	3/85	0,000	**75,80**
S551	sp3LF-p/125	0,533	**1,61**
S551	3/87	0,000	**74,75**
S588	sp3F/186	0,000	**0,00**
S588	sp3LR/76	3,353	**0,00**
S589	sp3LF-p/77	3,353	**0,00**
S589	sp3R/3	0,000	**0,00**
S590	1a/44	0,000	**0,00**
S590	sp3F/25	3,353	**0,00**
S591	sp3RR-p/170	3,353	**0,00**
S591	1a/55	0,000	**0,00**
S592	sp3R/101	0,000	**0,00**
S592	sp3RF/36	3,353	**0,00**
S593	sp3RR/38	3,353	**0,00**
S593	1a/58	0,000	**0,00**
S594	1a/73	0,000	**0,00**
S594	sp3LR/142	3,353	**0,00**
S595	sp3LF/31	3,353	**0,00**
S595	1a/17	0,000	**0,00**
C29	sp3R/1	0,000	**-1569,93**
C29	sp1aF-p/141	10,951	**1093,61**
B154	sp3RR/38	0,000	**-186,43**
B154	sp3RF-p/39	12,292	**221,94**
B159	sp3RF/128	0,000	**-253,53**
B159	sp3RR-p/140	12,292	**231,80**
SB241	sp3R-p/187	0,000	**0,00**
SB241	sp3RF/159	1,267	**0,00**
SB249	sp3RR/188	1,267	**0,00**

Staaf	BG	dx [m]	N [kN]
SB249	sp3F/9	0,000	**0,00**
SB250	sp3RR/188	2,533	**0,00**
SB250	sp3F/9	0,000	**0,00**
SB252	sp3R-p/187	0,000	**0,00**
SB252	sp3RF/159	2,533	**0,00**
SB259	1a/14	0,000	**-0,13**
SB259	sp3RR/188	2,002	**0,00**
SB260	1a/14	0,000	**-0,17**
SB260	sp3RR/188	2,809	**0,00**
SB261	1a/14	0,000	**-0,17**
SB261	sp3RF/36	2,809	**0,00**
SB272	1a/14	0,000	**-0,13**
SB272	sp3LR/20	2,002	**0,00**
B84	sp1bLF/189	0,000	**0,00**
B84	sp3RF/100	0,896	**0,00**
B85	sp4LF/190	1,791	**0,00**
B85	sp3RF/191	1,791	**0,00**
B86	sp3RR/133	0,000	**-8,71**
B86	sp3RF-p/99	0,000	**6,39**
B87	sp3RF/100	0,000	**-8,60**
B87	sp3RR-p/140	0,000	**6,79**
B88	sp3LF/90	0,000	**-8,41**
B88	sp3LR-p/169	0,000	**7,91**
B160	sp3LR/124	0,000	**-9,23**
B160	sp3LF-p/89	0,000	**7,45**
B177	1a/17	0,000	**-0,09**
B177	sp3F/42	2,191	**0,00**
B178	1a/55	0,000	**-0,09**
B178	sp3LF/53	2,191	**0,00**
B179	1a/17	0,000	**-0,12**
B179	sp3F/4	2,684	**0,00**
B180	1a/55	0,000	**-0,12**
B180	sp3R/8	2,684	**0,00**
B181	sp3R/1	0,000	**-213,71**
B181	sp3F-p/24	3,800	**188,94**
B182	sp3R/60	0,000	**-217,40**
B182	sp3F-p/59	0,000	**191,78**
B183	sp3F/4	3,800	**-231,74**
B183	sp3R-p/47	0,000	**171,09**
B184	sp3F/33	0,000	**-234,44**
B184	sp3R-p/13	0,000	**174,77**
B185	sp3LF/90	0,000	**-1,07**
B185	sp3LR-p/75	0,000	**-0,67**
B186	1a/44	3,800	**-0,96**
B186	sp3RR-p/192	0,000	**-0,62**
B187	sp3LF/90	0,000	**-1,71**
B187	sp3LR-p/75	0,000	**-1,15**
SB273	sp3RR/188	0,633	**0,00**
SB273	sp3F/9	0,000	**0,00**
SB274	sp3R-p/187	0,000	**0,00**
SB274	sp3RF/159	0,633	**0,00**
B188	sp3RR-p/37	0,896	**0,00**
B188	sp3RF/100	0,000	**0,00**
B189	1a/73	0,000	**-0,09**
B189	sp3RR-p/83	2,049	**0,00**
B190	1a/67	0,000	**-0,09**
B190	sp3LF/74	2,049	**0,00**
SB275	1a/14	0,000	**-0,13**
SB275	sp3LR/20	1,808	**0,00**
SB276	1a/14	0,000	**-0,13**
SB276	sp3RR/52	1,808	**0,00**
SB277	sp3RR/188	1,900	**0,00**
SB277	sp1aF/193	0,000	**0,00**
SB278	sp3R-p/194	0,000	**0,00**
SB278	sp3RF/159	1,900	**0,00**
B191	sp3RR-p/37	2,687	**0,00**
B191	sp3R/8	0,000	**0,00**

Staaf	BG	dx [m]	N [kN]
SB279	1a/14	0,000	**-0,13**
SB279	sp3LR/20	2,355	**0,00**
SB280	1a/14	0,000	**-0,13**
SB280	sp3RR/188	2,355	**0,00**
B192	1a/55	0,000	**-0,09**
B192	sp3R/8	2,409	**0,00**
B193	1a/17	0,000	**-0,09**
B193	sp3F/4	2,409	**0,00**
B194	sp3RR-p/37	4,478	**0,00**
B194	sp4R/195	0,000	**0,00**
SB281	sp3RR/188	3,167	**0,00**
SB281	sp3F/9	0,000	**0,00**
SB282	sp3R-p/187	0,000	**0,00**
SB282	sp3RF/159	3,167	**0,00**
B195	1a/17	0,000	**-0,12**
B195	sp3F/4	3,002	**0,00**
B196	1a/55	0,000	**-0,12**
B196	sp3R/8	3,002	**0,00**
SB283	1a/14	0,000	**-0,17**
SB283	sp3RF/36	3,322	**0,00**
SB284	1a/14	0,000	**-0,17**
SB284	sp3RR/188	3,322	**0,00**
C30	sp3R/60	0,000	**-1565,27**
C30	sp3F-p/24	10,951	**1393,46**
B197	sp3LR/20	0,000	**-222,72**
B197	sp3LF-p/16	12,292	**159,81**
B198	sp3LF/31	0,000	**-258,65**
B198	sp3LR-p/171	12,292	**256,20**
SB285	sp3LR/181	0,633	**0,00**
SB285	sp3F/186	0,000	**0,00**
SB286	sp3RF-p/39	0,633	**0,00**
SB286	sp3F/186	0,000	**0,00**
B199	sp4RF/196	0,000	**0,00**
B199	sp3LF/175	1,791	**0,00**
B200	1a/58	0,000	**-0,12**
B200	sp3F/25	2,684	**0,00**
B201	1a/14	0,000	**-0,12**
B201	sp3LR/197	2,684	**0,00**
B202	sp1aF/198	0,000	**0,00**
B202	sp3LF/175	2,239	**0,00**
SB287	sp3RF-p/151	2,923	**0,00**
SB287	sp3RR/152	2,923	**0,00**
B203	1a/58	0,000	**-0,12**
B203	sp3F/25	3,002	**0,00**
SB288	1a/55	0,000	**-0,17**
SB288	sp3RR/38	3,322	**0,00**
B204	1a/14	0,000	**-0,12**
B204	sp3LR/197	3,002	**0,00**
SB289	sp3LR/181	2,533	**0,00**
SB289	sp3F/186	0,000	**0,00**
SB290	sp3RF-p/39	2,533	**0,00**
SB290	sp3RR/152	2,280	**0,00**
SB291	1a/55	0,000	**-0,13**
SB291	sp3LR/181	2,002	**0,00**
SB292	1a/55	0,000	**-0,17**
SB292	sp3RR/38	2,809	**0,00**
SB293	1a/55	0,000	**-0,13**
SB293	sp3RR/38	2,002	**0,00**
B205	1a/58	0,000	**-0,09**
B205	sp3F/42	2,191	**0,00**
B206	1a/14	0,000	**-0,09**
B206	1a/44	2,191	**0,00**
SB294	sp3LR/181	1,900	**0,00**
SB294	sp3F/82	0,000	**0,00**
SB295	sp3R-p/51	0,000	**0,00**
SB295	sp3RR/38	1,900	**0,00**
B207	sp1aLR/199	0,000	**0,00**

Staaf	BG	dx [m]	N [kN]
B207	sp3LF/175	1,344	**0,00**
SB296	1a/55	0,000	**-0,13**
SB296	sp3RR/38	2,355	**0,00**
SB297	1a/55	0,000	**-0,13**
SB297	sp3LR/181	2,355	**0,00**
B208	1a/14	0,000	**-0,09**
B208	sp3LR/197	2,409	**0,00**
B209	1a/58	0,000	**-0,09**
B209	sp3F/25	2,409	**0,00**
SB298	sp3RF-p/151	1,013	**0,00**
SB298	sp3F/186	0,000	**0,00**
SB299	sp3LR/181	1,267	**0,00**
SB299	sp3F/186	0,000	**0,00**
B210	sp1aLR/199	0,000	**0,00**
B210	sp3LF/90	0,896	**0,00**
B211	sp3LR-p/75	0,896	**0,00**
B211	sp3LF/90	0,000	**0,00**
B212	1a/14	0,000	**-0,09**
B212	sp3LF/27	2,049	**0,00**
B213	1a/67	0,000	**-0,09**
B213	sp3F/33	2,049	**0,00**
SB300	1a/55	0,000	**-0,13**
SB300	sp3RR/38	1,808	**0,00**
SB301	1a/55	0,000	**-0,13**
SB301	sp3LR/200	1,808	**0,00**
SB302	sp3LR/181	3,167	**0,00**
SB302	sp3F/186	0,000	**0,00**
SB303	1a/55	0,000	**-0,17**
SB303	sp3LR/181	2,809	**0,00**
SB304	1a/55	0,000	**-0,17**
SB304	sp3LR/181	3,322	**0,00**
C31	sp3F/4	0,000	**-1698,53**
C31	sp3R-p/13	10,951	**1260,75**
B214	sp3RF/64	0,000	**-179,49**
B214	sp3RR-p/83	12,292	**201,54**
B215	sp3RR/188	0,000	**-245,09**
B215	sp3RF-p/201	12,292	**236,67**
SB305	sp3RF/128	0,633	**0,00**
SB305	sp3R/8	0,000	**0,00**
SB306	sp3F-p/11	0,000	**0,00**
SB306	sp3LF/163	0,633	**0,00**
B216	sp3RF-p/202	3,583	**0,00**
B216	sp3LF/203	0,000	**0,00**
B217	1a/14	0,000	**-0,12**
B217	sp3R/204	2,684	**0,00**
B218	1a/58	0,000	**-0,12**
B218	sp3RF/64	2,684	**0,00**
B219	sp3RF-p/202	4,478	**0,00**
B219	sp3F/25	0,000	**0,00**
SB307	sp3F-p/11	0,000	**0,00**
SB307	sp3LF/163	3,167	**0,00**
B220	1a/14	0,000	**-0,12**
B220	sp3R/204	3,002	**0,00**
SB308	1a/17	0,000	**-0,17**
SB308	sp3LF/27	3,322	**0,00**
B221	1a/58	0,000	**-0,12**
B221	sp3RF/64	3,002	**0,00**
SB309	sp3RF/128	2,533	**0,00**
SB309	sp3R/8	0,000	**0,00**
SB310	sp3F-p/11	0,000	**0,00**
SB310	sp3LF/163	2,533	**0,00**
SB311	1a/17	0,000	**-0,13**
SB311	sp3RF/128	2,002	**0,00**
SB312	1a/17	0,000	**-0,17**
SB312	sp3LF/27	2,809	**0,00**
SB313	1a/17	0,000	**-0,13**
SB313	sp3LF/27	2,002	**0,00**

Staaf	BG	dx [m]	N [kN]
B222	1a/14	0,000	**-0,09**
B222	sp3R/156	2,191	**0,00**
B223	1a/73	0,000	**-0,09**
B223	sp3R/60	2,191	**0,00**
SB314	sp3RF/128	1,900	**0,00**
SB314	sp1aR/205	0,000	**0,00**
SB315	sp3F-p/172	0,000	**0,00**
SB315	sp3LF/163	1,900	**0,00**
B224	sp3RF-p/202	2,687	**0,00**
B224	sp4RR/206	0,000	**0,00**
SB316	1a/17	0,000	**-0,13**
SB316	sp3LF/27	2,355	**0,00**
SB317	1a/17	0,000	**-0,13**
SB317	sp3RF/128	2,355	**0,00**
B225	1a/58	0,000	**-0,09**
B225	sp3RF/64	2,409	**0,00**
B226	1a/14	0,000	**-0,09**
B226	sp3R/204	2,409	**0,00**
SB318	sp3F-p/11	0,000	**0,00**
SB318	sp3LF/163	1,267	**0,00**
SB319	sp3RF/128	1,267	**0,00**
SB319	sp3R/8	0,000	**0,00**
B227	sp3RF-p/202	1,791	**0,00**
B227	sp1aLF/207	0,000	**0,00**
B228	sp3RF-p/202	0,896	**0,00**
B228	sp3RR/52	0,000	**0,00**
B229	1a/73	0,000	**-0,09**
B229	sp3RR/152	2,049	**0,00**
B230	1a/65	0,000	**-0,09**
B230	sp3LR/179	2,049	**0,00**
SB320	1a/17	0,000	**-0,13**
SB320	sp3LF/27	1,808	**0,00**
SB321	1a/17	0,000	**-0,13**
SB321	sp3RF/100	1,808	**0,00**
SB322	sp3RF/128	3,167	**0,00**
SB322	sp3R/8	0,000	**0,00**
SB323	1a/17	0,000	**-0,17**
SB323	sp3RF/128	2,809	**0,00**
SB324	1a/17	0,000	**-0,17**
SB324	sp3RF/128	3,322	**0,00**
C32	sp3F/25	0,000	**-1387,43**
C32	sp3R-p/47	10,951	**1266,14**
B231	sp3LF/27	0,000	**-232,20**
B231	sp3LR-p/5	12,292	**180,75**
B232	sp3LR/181	0,000	**-266,25**
B232	sp3LF-p/180	12,292	**250,59**
SB325	sp3LF/31	0,633	**0,00**
SB325	sp3R/204	0,000	**0,00**
SB326	sp3F-p/29	0,000	**0,00**
SB326	sp3LR/76	0,633	**0,00**
B233	sp3LF-p/19	3,583	**0,00**
B233	sp1aLF/207	0,000	**0,00**
B234	1a/55	0,000	**-0,12**
B234	sp3R/8	2,684	**0,00**
B235	sp3LR/179	0,000	**0,00**
B235	sp3LR/208	2,239	**0,00**
SB327	sp3LF-p/19	2,680	**0,00**
SB327	sp3LR/179	2,923	**0,00**
SB328	sp3LF/31	2,533	**0,00**
SB328	sp3R/204	0,000	**0,00**
SB329	sp3F-p/29	0,000	**0,00**
SB329	sp3LR/76	2,533	**0,00**
SB330	1a/58	0,000	**-0,13**
SB330	sp3LF/31	2,002	**0,00**
SB331	1a/58	0,000	**-0,17**
SB331	sp3RF/64	2,809	**0,00**
SB332	1a/58	0,000	**-0,13**

Staaf	BG	dx [m]	N [kN]
SB332	sp3RF/64	2,002	**0,00**
B236	1a/55	0,000	**-0,09**
B236	sp3R/156	2,191	**0,00**
B237	1a/17	0,000	**-0,09**
B237	1a/44	2,191	**0,00**
SB333	sp3LF/31	1,900	**0,00**
SB333	sp3R/204	0,000	**0,00**
SB334	sp3F-p/61	0,000	**0,00**
SB334	sp3LR/76	1,900	**0,00**
B238	sp3LF-p/19	2,687	**0,00**
B238	sp4F/209	0,000	**0,00**
SB335	1a/58	0,000	**-0,13**
SB335	sp3RF/64	2,355	**0,00**
SB336	1a/58	0,000	**-0,13**
SB336	sp3LF/31	2,355	**0,00**
B239	1a/17	0,000	**-0,09**
B239	sp3LF/27	2,409	**0,00**
B240	1a/55	0,000	**-0,09**
B240	sp3R/101	2,409	**0,00**
SB337	sp3F-p/29	0,000	**0,00**
SB337	sp3LR/76	1,267	**0,00**
SB338	sp3LF/31	1,267	**0,00**
SB338	sp3R/204	0,000	**0,00**
B241	sp4LF/210	0,000	**0,00**
B241	sp3LR/200	0,896	**0,00**
B242	sp3LF-p/19	0,896	**0,00**
B242	sp3LR/200	0,000	**0,00**
B243	1a/17	0,000	**-0,09**
B243	sp3LF-p/211	2,049	**0,00**
B244	1a/65	0,000	**-0,09**
B244	sp3RR/52	2,049	**0,00**
SB339	1a/58	0,000	**-0,13**
SB339	sp3RF/64	1,808	**0,00**
SB340	1a/58	0,000	**-0,13**
SB340	sp3LF/90	1,808	**0,00**
SB341	sp3LF/31	3,167	**0,00**
SB341	sp3R/204	0,000	**0,00**
SB342	1a/58	0,000	**-0,17**
SB342	sp3LF/31	2,809	**0,00**
B245	1a/17	0,000	**-0,12**
B245	sp3LF/27	2,684	**0,00**
SB343	1a/58	0,000	**-0,17**
SB343	sp3RF/64	3,322	**0,00**
B246	1a/17	0,000	**-0,12**
B246	sp3LF/27	3,002	**0,00**
SB344	1a/58	0,000	**-0,17**
SB344	sp3LF/31	3,322	**0,00**
B247	1a/55	0,000	**-0,12**
B247	sp3R/8	3,002	**0,00**
S596	sp3RF-p/81	0,000	**0,05**
S596	sp3RR/80	2,634	**0,08**
S597	sp3LR/197	0,000	**-0,11**
S597	sp3LF-p/212	6,466	**-0,07**
S598	sp3LR-p/6	0,000	**-107,54**
S598	sp3LR/142	1,753	**149,60**
S599	sp3R/60	0,000	**-57,23**
S599	sp3LF-p/89	0,000	**36,92**
S600	sp3F/25	0,000	**-55,97**
S600	sp3LR-p/75	0,000	**36,64**
S601	sp3RF-p/81	1,463	**-0,32**
S601	sp3RF/36	1,463	**0,71**
S602	sp3RR/80	0,000	**-58,25**
S602	sp3RF-p/99	0,000	**32,67**
S603	sp3F/4	0,000	**-56,46**
S603	sp3R-p/13	0,000	**35,69**
S604	sp3RR/80	0,000	**-57,84**
S604	sp3F-p/2	0,000	**31,57**

Staaf	BG	dx [m]	N [kN]
S605	sp3RF/100	2,201	**-56,97**
S605	sp3R-p/13	0,000	**36,51**
S606	sp3F/25	0,000	**-375,55**
S606	sp3R-p/47	1,760	**290,19**
S607	sp3RR/80	2,220	**-231,55**
S607	sp3RF-p/99	0,000	**145,93**
S608	1a-p/70	0,000	**-98,81**
S608	1a/73	0,000	**59,05**
S609	sp3R/60	0,000	**-126,09**
S609	sp3F-p/59	0,000	**111,82**
S610	sp3F/111	0,000	**-104,70**
S610	sp3RR-p/83	0,000	**95,63**
S612	sp3R/1	1,840	**-247,26**
S612	sp3F-p/35	1,840	**95,68**
S615	sp3R/60	0,000	**-245,60**
S615	sp3F-p/59	1,720	**168,41**
S616	1a/67	0,000	**-3,22**
S616	1a-p/68	0,000	**2,13**
S617	sp4F-p/213	0,000	**-1,02**
S617	sp3R/23	0,000	**102,87**
S618	1a-p/70	0,000	**-243,73**
S618	sp3RR/38	0,000	**272,61**
S619	sp4R-p/214	0,000	**-9,82**
S619	sp3F/4	0,000	**90,99**
S620	1a-p/70	0,000	**-253,93**
S620	sp3RF/64	0,000	**225,28**
S621	1a/65	1,614	**-2,27**
S621	1a-p/66	1,614	**1,52**
S624	sp3F/111	1,840	**-229,10**
S624	1a-p/70	0,000	**143,61**
S625	sp3F/33	0,000	**-284,81**
S625	sp3R-p/13	1,720	**129,72**
S626	sp3R-p/13	0,000	**-62,24**
S626	1a/44	0,000	**118,08**
S628	1a-p/70	0,000	**-90,11**
S628	sp3R/40	1,967	**94,33**
S629	1a-p/45	2,498	**-41,74**
S629	1a/44	2,498	**113,99**
S631	1a/67	0,960	**-1,75**
S631	1a-p/66	0,960	**1,47**
S632	1a/73	0,000	**-47,65**
S632	1a-p/70	0,000	**36,58**
S633	1a/44	0,000	**-70,72**
S633	sp3R-p/13	0,000	**15,87**
S634	1a-p/70	0,000	**-110,75**
S634	sp3R/60	1,731	**95,78**
S635	sp3R/60	0,470	**-58,97**
S635	1a-p/70	0,000	**36,06**
S636	3/12	0,940	**-81,13**
S636	sp3LF-p/69	0,000	**4,04**
S637	1a-p/70	2,225	**-117,02**
S637	sp3LF/53	0,000	**95,59**
S638	1a/65	1,920	**-2,22**
S638	1a-p/68	0,000	**1,91**
S639	1a/65	1,920	**-1,88**
S639	1a-p/68	0,000	**1,62**
S640	1a-p/70	2,498	**-100,61**
S640	sp3F/42	0,000	**100,19**
S641	1a-p/45	0,000	**-39,25**
S641	1a/44	0,000	**123,53**
S642	sp3R-p/13	0,000	**-64,04**
S642	1a/44	0,000	**116,79**

11.2. Reacties

Lineaire berekening, Extreem : Globaal
Selectie : Alle
Klasse : All UGT

Steunpunt	BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Sn4/N290	sp1aR/205	**-286,39**	227,28	1343,11	0,00	0,00	0,00
Sn2/N298	sp3F/4	**302,43**	-242,69	**1459,70**	0,00	0,00	0,00
Sn2/N298	sp1aF/215	297,48	**-247,51**	1431,70	0,00	0,00	0,00
Sn1/N248	1a/14	209,13	**229,46**	1094,45	0,00	0,00	0,00
Sn4/N290	sp3F-p/24	230,09	-175,01	**-1123,83**	0,00	0,00	0,00
Sn1/N248	1a/216	63,50	72,70	350,60	**0,00**	**0,00**	**0,00**

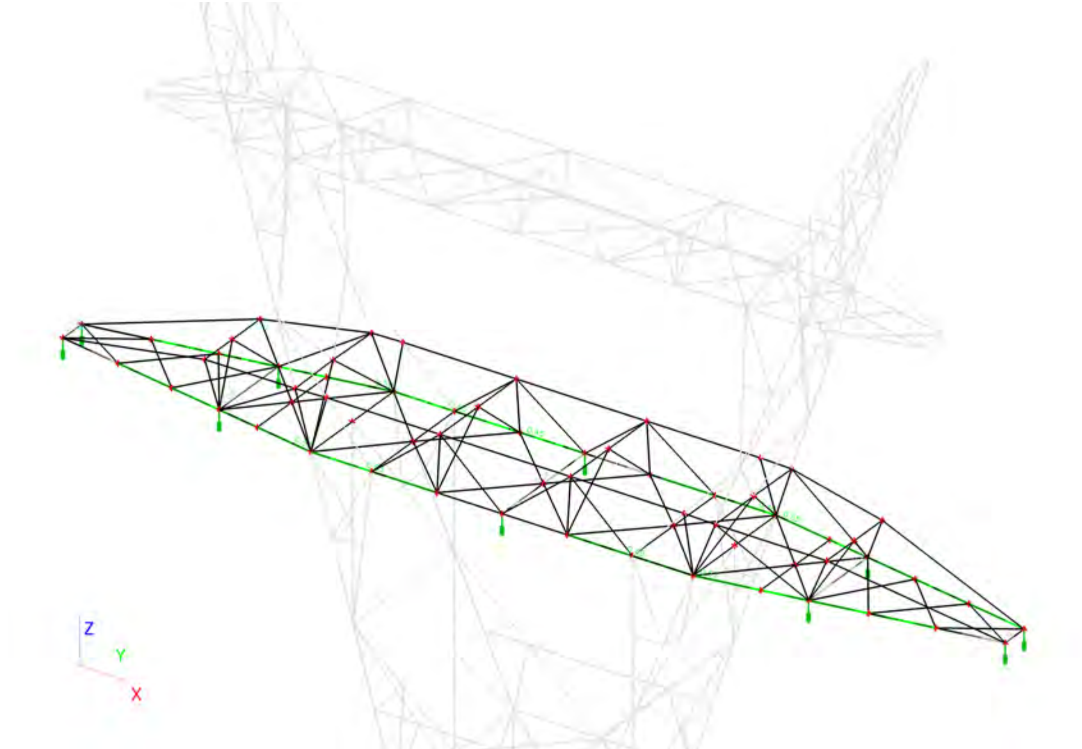
11.3. Resultante op Fundering

Lineaire berekening, Extreem : Globaal
Selectie : Alle
Klasse : All UGT

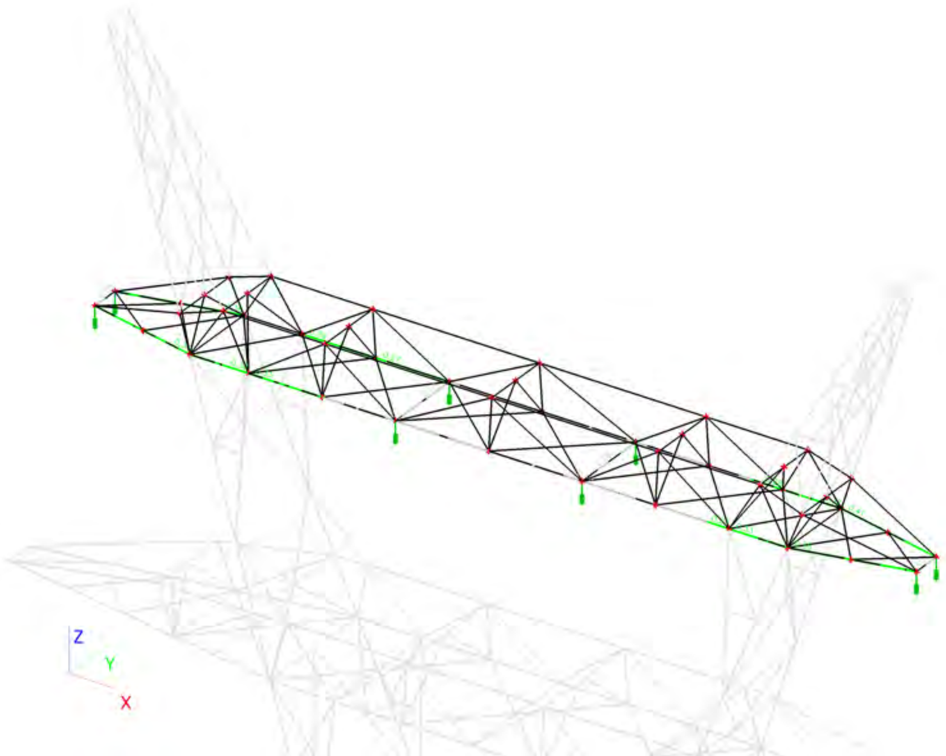
BG	Steunpunt	Extreem	horiz. component [kN]	resultante [kN]	Hoek [deg]	helling(afschot) [-]	Rx [kN]	Ry [kN]	Rz [kN]
sp1aF/217	Sn3/N306	Rz	**57,68**	1219,38	1,63	21,12	39,61	41,93	1218,01
sp1aR/218	Sn1/N248	Rx	**365,14**	1391,19	173,85	3,68	284,37	229,05	1342,42
sp1aF/219	Sn2/N298	Ry	250,35	**322,84**	126,36	-0,81	-37,60	-247,51	-203,83
sp3F/4	Sn2/N298	Rx	302,65	**1490,74**	-132,80	4,82	302,43	11,64	1459,70
sp1aR-p/220	Sn3/N306	Rz	148,46	1035,33	**-179,72**	-6,90	-104,46	-105,49	-1024,63
sp1aR/218	Sn1/N248	Rx	365,14	1391,19	**173,85**	3,68	284,37	229,05	1342,42
sp1aR-p/220	Sn3/N306	Rz	148,46	1035,33	-179,72	**-6,90**	-104,46	-105,49	-1024,63
sp1aF/217	Sn3/N306	Rz	57,68	1219,38	1,63	**21,12**	39,61	41,93	1218,01
sp1aR/205	Sn4/N290	Rx	289,09	346,86	-127,16	-0,66	**-286,39**	-39,45	-191,68
sp3F/4	Sn2/N298	Rx	302,65	1490,74	-132,80	4,82	**302,43**	11,64	1459,70
sp1aF/219	Sn2/N298	Ry	250,35	322,84	126,36	-0,81	-37,60	**-247,51**	-203,83
1a/14	Sn1/N248	Ry	310,46	1137,63	-177,35	3,53	209,13	**229,46**	1094,45
sp3F-p/221	Sn4/N290	Rz	190,61	1139,88	-68,34	-5,90	-75,52	-175,01	**-1123,83**
sp3F/4	Sn2/N298	Rx	302,65	1490,74	-132,80	4,82	302,43	11,64	**1459,70**

11.4. Controle UNP en HEB profilen

11.4.1. Staalcontrole; Algehele toetsing Vak 9+13+14+ CrossArm1+2



11.4.2. Staalcontrole; Algehele toetsing Vak 15 t/m 21 + CrossArm3+4



Bijlage C Controle staven mastlichaam

Order :	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 Randen L200x200x26* *M01*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-1698,53*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*1393,46*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/26* (*1)

h	=	*200*	mm	I_y	=	*35603980*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f	=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s	=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}	=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1825*	mm	No. bolts / end / flange	=	*5*	**(Per flange !)**
$L_{v;cr}$	=	*1825*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*16*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,67** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **47** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,84** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,79** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,54** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,84 = 84%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 Diagonalen L130x13x12* — M02

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-266,25	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	256,2	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H130/130/12 (*1)

h	=	130	mm	I_y	=	4721746	mm^4
b	=	130	mm	$W_{y;el;eff.1}$	=	50442	mm^3
t_f	=	12	mm	$W_{y;el;eff.2}$	=	129742	mm^3
y_s	=	36,4	mm	i_y	=	39,7	mm
A_{bruto}	=	2997	mm^2	i_v	=	25,2	mm

Material :

Mat. qual. Fe360 / Fe510 = Fe360 — Permissible stress $f_{y;d}$ = 235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2048 mm	No. bolts / end / flange		=	4
$L_{v;cr}$	=	2048 mm	Type of bolts	M / "	=	24
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt	e1	=	50 mm
a^*L_{tot} (with comb. buckling)	=	0 mm	Centre-centre spacing bolt	s1	=	90 mm
$L_{perpendicular\ force}$	=	0 mm	Edge distance bolt	e2	=	40 mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	4,6
Column profile?	=	1 no=1, yes=2	Rolled screw threads		=	1
Thickness tie plate	=	12 mm	Dubble strap joint no=1, yes=2		=	1

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,57** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **81** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,55** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,98** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,48** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,98 = 98%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 Horizontale En verticale Knikverkorters L50x50x5* — M03

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	*-2,13*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd} =	*2,13*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : H50/50/5 (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2409*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2409*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*1791*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,05**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,94**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**251**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,15**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,19**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,07**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,08**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,94 = 94%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 Horizontale en Verticale Knikverkorters L60x60x6* *M04*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	*-13,96*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*13,95*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* [(*1)]

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2533*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2533*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*2533*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,25** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,76** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **219** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,54** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,69** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,46** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,41** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **U.C_{max} = 0,76 = 76%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :** 13.039	**Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 Horizontale en Verticale Knikverkorters L55x55x6* *M05*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-3,02*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*3,02*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile :		*H55/55/6* (*1)					
h	=	*55*	mm	I_y	=	*172872*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s	=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}	=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4478*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*4478*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*2240*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,05** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,81** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **425** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,45** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,49** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,10** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,09** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2) : **$U.C_{max}$ = 0,81 = 81%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 Horizontale en Verticale Knikverkorters L65x65x7* *M06*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-23,73*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*23,73*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H65/65/7* (*1)					
h	=	*65*	mm	I_y	=	*334319*	mm^4
b	=	*65*	mm	$W_{y;el;eff.1}$	=	*7185*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*18103*	mm^3
y_s	=	*18,5*	mm	i_y	=	*19,6*	mm
A_{bruto}	=	*870*	mm^2	i_v	=	*12,5*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*3322*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3322*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*3322*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,28** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,74** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **266** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,05** **> 1 !!**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,24** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,79** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,53** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,24 = 124%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 Randen L200x200x26* *M07*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-1622,36*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1346,79*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/26* (*1)

h	=	*200*	mm	I_y	=	*35603980*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f	=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s	=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}	=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1690*	mm	No. bolts / end / flange	=	*5*	**(Per flange !)**
$L_{v;cr}$	=	*1690*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,65** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **44** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,79** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,75** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,56** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,79 = 79%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-13-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order : 14509	**Dossier** : 13.039	**Berekening** : B.14014		D&C ENGINEERING
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part : Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 Horizontale Knikverkorters L55x55x6* *M08*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-20,89*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*20,89*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H55/55/6* (*1)					
h	=	*55*	mm	I_y	=	*172872*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s	=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}	=	*631*	mm^2	i_v	=	*10,5*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*1900*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1900*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*1900*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,38** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,69** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **180** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,63** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,85** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,69** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,62** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2) : **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 Schuine Knikverkorters L55x55x6* *M09*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	*-28,83*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*28,83*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H55/55/6* (*1)

h	=	*55*	mm	I_y	=	*172872*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s	=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}	=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2620*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2620*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,52** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **249** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,55** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,82** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,96** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,86** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,82 = 182%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :** 13.039	**Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 Verticale verbanden L150x100x10* *M10*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-157,61*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*151,77*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/10* (*1)

h	=	*150*	mm	I_y	=	*5516683*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*43563*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*236120*	mm^3
y_s	=	*23,4*	mm	i_y	=	*47,8*	mm
A_{bruto}	=	*2418*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4916*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2458*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,42** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **114** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,78** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,46** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,78 = 78%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3 Randen L200x200x26* *M11*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1509,75*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*1247,43*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/26* (*1)

h	=	*200*	mm	I_y	=	*35603980*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f	=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s	=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}	=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1786*	mm	No. bolts / end / flange	=	*5*	(Per flange !)
$L_{v;cr}$	=	*1786*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,60	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	46	< 120
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,74	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,70	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,52	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) **:** $U.C_{max}$ = **0,74** = **74%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part :	Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3 Horizontale Knikverkorters L55x55x6* *M12*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-8,74*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*8,74*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H55/55/6* (*1)

h	=	*55*	mm	I_y	=	*172872*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s	=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}	=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1676*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1676*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*1676*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,16** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,61** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **159** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,21** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,31** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,26** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,61 = 61%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3 Verticale Knikverkorters L55x55x6* *M13*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	-12,28 kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	12,28 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0 kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H55/55/6 (*1)

h	=	55 mm	I_y	=	172872	mm^4
b	=	55 mm	$W_{y;el;eff.1}$	=	4391	mm^3
t_f	=	6 mm	$W_{y;el;eff.2}$	=	11060	mm^3
y_s	=	15,6 mm	i_y	=	16,6	mm
A_{bruto}	=	631 mm^2	i_v	=	10,5	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2356 mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2356 mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt e1	=	30	mm
a^*L_{tot} (with comb. buckling)	=	0 mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	0 mm	Edge distance bolt e2	=	25	mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1 no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	6 mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,22**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**223**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,54**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,68**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,41**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,37**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,68 = 68%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** : B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part :	Mast 73		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3 Verticale verbanden L150x100x12* *M14*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-184,76*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*196,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/12* (*1)

h	=	*150*	mm	I_y	=	*6496055*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*51628*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*268690*	mm^3
y_s	=	*24,2*	mm	i_y	=	*47,5*	mm
A_{bruto}	=	*2874*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5028*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2514*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,46**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**117**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,59**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,72**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,44**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **U.C$_{max}$ = 0,72 = 72%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order : 14509	**Dossier** : 13.039	**Berekening** : B.14014		D&C ENGINEERING
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part : Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4 Randen L200x200x20* *M15*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-1201,4*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*983,67*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/20* (*1)

h	=	*200*	mm	I_y	=	*35603980*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f	=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s	=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}	=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1784*	mm	No. bolts / end / flange	=	*5*	**(Per flange !)**
$L_{v;cr}$	=	*1784*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,47** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **46** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,59** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,56** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,42** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,59 = 59%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :** 13.039	**Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4 Horizontale Knikverkorters L50x50x5* *M16*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-16,33*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*16,33*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1460*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1460*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*1460*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,35** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,76** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **152** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,48** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,70** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,54** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,58** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **$U.C_{max}$ = 0,76 = 76%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :** 13.039	**Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4 Horizontale staven L60x60x6* *M16a*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-16,33*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*16,33*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* (*1)

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2920*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2920*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*2920*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,30** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,88** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **253** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,83** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,99** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,54** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,58** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,99 = 99%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4 Verticale Knikverkorters L50x50x5* *M17*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-24,96* kN	***Combined forces diagonal:***		
Tension: N_{Sd}	=	*24,96* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0* kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0* kN

Angle profile : *H50/50/5* (*1)

h	=	*50* mm	I_y	=	*109643* mm^4
b	=	*50* mm	$W_{y;el;eff.1}$	=	*3049* mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*7811* mm^3
y_s	=	*14,0* mm	i_y	=	*15,1* mm
A_{bruto}	=	*480* mm^2	i_v	=	*9,6* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2080* mm	No. bolts / end / flange	=	*1*
$L_{v;cr}$	=	*2080* mm	Type of bolts M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*30* mm
a*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*25* mm
Position perpendicular force	=	*1* (⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*5* mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,54** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **217** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,36** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,69** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,83** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,89** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,69 = 169%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4 Verticale verbanden L150x100x14* *M18*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-239,86*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*226,42*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/14* (*1)

h	=	*150*	mm	I_y	=	*7434686*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*59460*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*297816*	mm^3
y_s	=	*25,0*	mm	i_y	=	*47,3*	mm
A_{bruto}	=	*3322*	mm^2	i_v	=	*21,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4755*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2377*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,46**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**111**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,63**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,88**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,43**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,88 = 88%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order : 14509	**Dossier** : 13.039	**Berekening** : B.14014		D&C ENGINEERING
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part : Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5 Randen L200x200x20* *M19*

Memberforces : (**Attention! pressure = "-" and tension ="+"**)

Compression: N_{Sd}	=	*-1002,41*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*804,18*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/20* [*1]

h	=	*200*	mm	I_y	=	*35603980*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f	=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s	=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}	=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1707*	mm	No. bolts / end / flange	=	*6*	**(Per flange !)**
$L_{v;cr}$	=	*1707*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*110*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*16*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,39	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	44	< 120
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,49	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,78	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,45	< 1

Remarks:

The maximum increase of stress or totalstress is[*2] **:** **$U.C_{max}$ = 0,78 = 78%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5 Horizontale Knikverkorters L50x50x5* *M20*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-16,33	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	16,33	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H50/50/5 [*1]

h	=	50	mm	I_y	=	109643	mm^4
b	=	50	mm	$W_{y;el;eff.1}$	=	3049	mm^3
t_f	=	5	mm	$W_{y;el;eff.2}$	=	7811	mm^3
y_s	=	14,0	mm	i_y	=	15,1	mm
A_{bruto}	=	480	mm^2	i_v	=	9,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1250	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	1250	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	30	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	1250	mm	Edge distance bolt e2	=	25	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	5	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,35** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,65** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **130** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,37** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,59** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,54** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,58** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,65 = 65%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5 Verticale Knikverkorters L50x50x5* *M21*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-26,78*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*26,78*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H50/50/5* (*1)					
h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*2050*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2050*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,58**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**213**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,43**	**> 1 !!**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**1,77**	**> 1 !!**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,89**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,96**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,77 = 177%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5 Verticale verbanden L150x100x12* *M21a*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-273,68*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*285,58*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/12* (*1)

h	=	*150*	mm	I_y	=	*6496055*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*51628*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*268690*	mm^3
y_s	=	*24,2*	mm	i_y	=	*47,5*	mm
A_{bruto}	=	*2874*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4360*	mm	No. bolts / end / flange	=	*5*	
$L_{v;cr}$	=	*2180*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,67** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **102** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,74** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,84** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,43** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,84 = 84%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: Vak 6 Randen L200x200x16 M22

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-956,03	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	788,74	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H200/200/16 (*1)

h	=	200	mm	I_y	=	35603980	mm^4
b	=	200	mm	$W_{y;el;eff.1}$	=	252744	mm^3
t_f	=	26	mm	$W_{y;el;eff.2}$	=	602125	mm^3
y_s	=	59,1	mm	i_y	=	60,4	mm
A_{bruto}	=	9759	mm^2	i_v	=	38,8	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2140	mm	No. bolts / end / flange	=	6	(Per flange !)
$L_{v;cr}$	=	2140	mm	Type of bolts M / "	=	30	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	50	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	110	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	45	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	2	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	16	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = 0,38 < 1

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = n.v.t. < 1

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = 55 < 120

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = 0,49 < 1

5 - Check stress in member due to compression with excentricity:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = n.v.t. < 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = n.v.t. < 1

6 - Check stress with combined buckling of two sections:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = n.v.t. < 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = n.v.t. < 1

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = 0,74 < 1

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = 0,44 < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : $U.C_{max}$ = 0,74 = 74%

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5
(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 Verticale verbanden L150x100x12* *M23*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-195,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*197,69*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/12* (*1)

h	=	*150*	mm	I_y	=	*6496055*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*51628*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*268690*	mm^3
y_s	=	*24,2*	mm	i_y	=	*47,5*	mm
A_{bruto}	=	*2874*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4765* mm	No. bolts / end / flange		=	*5*
$L_{v;cr}$	=	*2382* mm	Type of bolts	M / "	=	*24*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	e1	=	*50* mm
a*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt	s1	=	*90* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt	e2	=	*40* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate	=	*12* mm	Dubble strap joint no=1, yes=2		=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,46**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**111**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,59**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,58**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,30**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,59 = 59%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 Horizontale Knikverkorters L50x50x5* *M24*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-9,15	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	11,07	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H50/50/5 (*1)

h	=	50	mm	I_y	=	109643	mm^4
b	=	50	mm	$W_{y;el;eff.1}$	=	3049	mm^3
t_f	=	5	mm	$W_{y;el;eff.2}$	=	7811	mm^3
y_s	=	14,0	mm	i_y	=	15,1	mm
A_{bruto}	=	480	mm^2	i_v	=	9,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1250	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	1250	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	30	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	1250	mm	Edge distance bolt e2	=	25	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	5	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,24** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,65** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **130** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,21** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,33** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,37** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,40** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,65 = 65%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 Horizontale staaf L130x130x12* *M25*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-118,84*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*80,08*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3950*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*3950*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*130*	mm
$L_{perpendicular\ force}$	=	*3950*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,15** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,12** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **157** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,50** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,88** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,91** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,91 = 91%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 Vertical Knikverkorters L90x90x9* *M26*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-109,64*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*70,14*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H90/90/9* (*1)

h	=	*90*	mm	I_y	=	*1158332*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*17927*	mm^3
t_f	=	*9*	mm	$W_{y;el;eff.2}$	=	*45626*	mm^3
y_s	=	*25,4*	mm	i_y	=	*27,3*	mm
A_{bruto}	=	*1552*	mm^2	i_v	=	*17,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2076*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2076*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,36** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **119** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,66** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,81** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,81 = 81%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order : 14509	**Dossier** : 13.039	**Berekening** : B,14014	
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part : Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 Vertical Knikverkorters L50x50x5* M27

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-13,53 kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	9,65 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0 kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H50/50/5 (*1)

h	=	50 mm	I_y	=	109643	mm^4
b	=	50 mm	$W_{y;el;eff.1}$	=	3049	mm^3
t_f	=	5 mm	$W_{y;el;eff.2}$	=	7811	mm^3
y_s	=	14,0 mm	i_y	=	15,1	mm
A_{bruto}	=	480 mm^2	i_v	=	9,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2571 mm	No. bolts / end / flange	=	2	
$L_{v;cr}$	=	2571 mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt e1	=	50	mm
$a*L_{tot}$ (with comb. buckling)	=	0 mm	Centre-centre spacing bolt s1	=	90	mm
$L_{perpendicular force}$	=	0 mm	Edge distance bolt e2	=	40	mm
Position perpendicular force	=	1 (⎤=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1 no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	10 mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,19	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	268	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,76	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,10	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,09	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,76 = 76%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 Verticale verbanden L180x180x16* M28

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-351,28	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	329,02	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN
Angle profile :		H180/180/16 [*1]					
h	=	180	mm	I_y	=	16824296	mm^4
b	=	180	mm	$W_{y;el;eff.1}$	=	129653	mm^3
t_f	=	16	mm	$W_{y;el;eff.2}$	=	334903	mm^3
y_s	=	50,2	mm	i_y	=	55,1	mm
A_{bruto}	=	5539	mm^2	i_v	=	35,0	mm
Material :							
Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	5642	mm	No. bolts / end / flange	=	5	
$L_{v;cr}$	=	2825	mm	Type of bolts M / "	=	30	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	65	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	100	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	50	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	14	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,42	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	102	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,50	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,65	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,33	< 1

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,65 = 65%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5
[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part :	Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Randen L200x200x16* — *M29*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-630,07*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*395,22*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/16* (*1)

h	=	*200*	mm	I_y	=	*35603980*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f	=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s	=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}	=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4261*	mm	No. bolts / end / flange	=	*3*	(Per flange !)
$L_{v;cr}$	=	*2141*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*110*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*16*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,19**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**71**	**< 120**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,36**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,97**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,42**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,97 = 97%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Horizontale Knikverkorters L50x50x5* *M30*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-10,11*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*10,11*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*880*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*880*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*880*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,22** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,46** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **92** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,15** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,27** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,34** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,36** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **U.C**$_{max}$ = **0,46** = **46%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :** 13.039	**Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003   File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Verticale Knikverkorters L50x50x5* *M31*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-19,39*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*17,86*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2050*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2050*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,39**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**213**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,03**	**> 1 !!**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**1,30**	**> 1 !!**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,64**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,64**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 1,30 = 130%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Verticale verbanden L150x100x12* *M32*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-279,78*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*320,58*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/12* [*1]

h	=	*150*	mm	I_y	=	*6496055*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*51628*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*268690*	mm^3
y_s	=	*24,2*	mm	i_y	=	*47,5*	mm
A_{bruto}	=	*2874*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4017*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2019*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,87** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **94** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,70** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,74** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,60** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,87 = 87%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Verticale verbanden L200x100x14* — *M33*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-285,33*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*274,53*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile :		*H200/100/14* (*1)					
h	=	*200*	mm	I_y	=	*16541310*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*92814*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*759497*	mm^3
y_s	=	*21,8*	mm	i_y	=	*64,1*	mm
A_{bruto}	=	*4028*	mm^2	i_v	=	*21,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4747*	mm	No. bolts / end / flange	=	*5*	
$L_{v;cr}$	=	*2380*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,45** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **112** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,62** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,84** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,35** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,84 = 84%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** : B,14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Verticale verbanden L130x130x12* *M34*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-214,2*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*306,74*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4236*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2206*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,79	< 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	107	< 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,59	< 1

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,95	< 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,92	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,95 = 95%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Verticale verbanden L90x90x9* M35

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-72,68	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	76,17	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H90/90/9 [*1]

h	=	90	mm	I_y	=	1158332	mm^4
b	=	90	mm	$W_{y;el;eff.1}$	=	17927	mm^3
t_f	=	9	mm	$W_{y;el;eff.2}$	=	45626	mm^3
y_s	=	25,4	mm	i_y	=	27,3	mm
A_{bruto}	=	1552	mm^2	i_v	=	17,4	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	4621	mm	No. bolts / end / flange	=	2	
$L_{v;cr}$	=	2366	mm	Type of bolts M / "	=	20	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	50	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	90	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	40	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	10	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,33** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **169** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,76** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,81** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,81 = 81%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Boven randen L160x160x15* *M36*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-253,93*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*381,05*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H160/160/15* (*1)					
h	=	*160*	mm	I_y	=	*10988350*	mm^4
b	=	*160*	mm	$W_{y;el;eff.1}$	=	*95470*	mm^3
t_f	=	*15*	mm	$W_{y;el;eff.2}$	=	*244713*	mm^3
y_s	=	*44,9*	mm	i_y	=	*48,8*	mm
A_{bruto}	=	*4606*	mm^2	i_v	=	*31,1*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*3680*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*3680*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*55*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,64**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**119**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,51**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,88**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,98**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,98 = 98%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** : B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part :	Mast 73		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Horizontale verbanden L60x60x6* — M37

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-23,17	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	23,17	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H60/60/6 [*1]

h	=	60	mm	I_y	=	227925	mm^4
b	=	60	mm	$W_{y;el;eff.1}$	=	5285	mm^3
t_f	=	6	mm	$W_{y;el;eff.2}$	=	13507	mm^3
y_s	=	16,9	mm	i_y	=	18,2	mm
A_{bruto}	=	691	mm^2	i_v	=	11,5	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	3232	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	1616	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	30	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	30	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	10	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,32**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**178**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,62**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,93**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,77**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,60**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,93 = 93%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check section: *Vak 7-8-9-10-13-14 Horizontale verbanden L100x10x10* *M38*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-107,54*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*149,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100*	mm	I_y	=	*1766764*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2*	mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3507*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*3507*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,77**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**181**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,86**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,69**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,67**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **U.C$_{max}$ = 0,86 = 86%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Horizontale en verticale Knikverkorters L50x50x5* M39

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	-3,3	kN	*Combined forces diagonal:*			
Tension:	N_{Sd} =	3,3	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$ =	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H50/50/5 [*1]

h	=	50	mm	I_y	=	109643	mm^4
b	=	50	mm	$W_{y;el;eff.1}$	=	3049	mm^3
t_f	=	5	mm	$W_{y;el;eff.2}$	=	7811	mm^3
y_s	=	14,0	mm	i_y	=	15,1	mm
A_{bruto}	=	480	mm^2	i_v	=	9,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	3227	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	3227	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	30	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	25	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	5	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,07** < 1

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **336** < 200 or 240

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,41** < 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,47** < 1

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,11** < 1

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,12** < 1

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,47 = 47%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5
[*2] The total stress or increase of stress has been related to the permissible stress

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Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 7-8-9-10-13-14 Verticale Knikverkorters L65x50x5* *M40*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-6,97*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*6,97*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H65/50/5* (*1)

h	=	*65*	mm	I_y	=	*230454*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*4389*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*18449*	mm^3
y_s	=	*12,5*	mm	i_y	=	*20,4*	mm
A_{bruto}	=	*554*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1503*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1503*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
$a{*}L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,17**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**143**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,16**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,21**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,15**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,18**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **U.C$_{max}$ = 0,21 = 21%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Schuine verbanden L130x130x12* *M41*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-212,45*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*210,89*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile :		*H130/130/12* (*1)					
h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*2376*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2376*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,50**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**94**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,51**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,78**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,40**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **U.C$_{max}$ = 0,78 = 78%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Horizontale kruizen L90x90x9* *M42*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-47,24*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*46,93*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H90/90/9*	(*1)				
h	=	*90*	mm	I_y	=	*1158332*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*17927*	mm^3
t_f	=	*9*	mm	$W_{y;el;eff.2}$	=	*45626*	mm^3
y_s	=	*25,4*	mm	i_y	=	*27,3*	mm
A_{bruto}	=	*1552*	mm^2	i_v	=	*17,4*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*2540*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2540*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,49** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **146** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,40** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,60** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,44** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,78** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,78 = 78%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Randen L140x140x13* *M43*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd} = *-422,75* kN

Tension: N_{Sd} = *319,57* kN

$F_{perpend.;s;d}$ = *0* kN

Combined forces diagonal:

$N_{comb1;c;s;d}$ (min. Compr. or tension) = *0* kN

$N_{comb2;c;s;d}$ (max. compression) = *0* kN

Angle profile : *H140/140/13* (*1)

h	=	*200* mm		I_y	=	*35603980* mm^4
b	=	*200* mm		$W_{y;el;eff.1}$	=	*252744* mm^3
t_f	=	*26* mm		$W_{y;el;eff.2}$	=	*602125* mm^3
y_s	=	*59,1* mm		i_y	=	*60,4* mm
A_{bruto}	=	*9759* mm^2		i_v	=	*38,8* mm

Material :

Mat. qual. Fe360 / Fe510 = *Fe360* Permissible stress $f_{y;d}$ = *235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4356* mm	No. bolts / end / flange	=	*4* **(Per flange !)**
$L_{v;cr}$	=	*2220* mm	Type of bolts M / "	=	*24*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*55* mm
a*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*80* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*45* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*2* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*12* mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,15**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**72**	**< 120**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,25**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,78**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,33**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,78 = 78%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
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Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Horizontale Knikverkorters L50x50x5* *M44*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-4,07* kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*4,07* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50* mm	I_y	=	*109643*	mm^4
b	=	*50* mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0* mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480* mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2536* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1268* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular force}$	=	*0* mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,09** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **168** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,14** **< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,20** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,14** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,15** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,20 = 20%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5
(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order : 14509	**Dossier** : 13.039	**Berekening** : B.14014		D&C ENGINEERING
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part : Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Verticale Knikverkorters L50x50x5* *M45*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-4,07*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*4,07*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2179*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2179*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,09** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **227** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,24** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,31** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,14** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,15** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,31 = 31%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Verticale verbanden L150x100x10* *M46*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-133,73*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*109,24*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/10* (*1)

h	=	*150*	mm	I_y	=	*5516683*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*43563*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*236120*	mm^3
y_s	=	*23,4*	mm	i_y	=	*47,8*	mm
A_{bruto}	=	*2418*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4099*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2089*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,34** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **97** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,41** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,99** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,49** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,99 = 99%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Verticale verbanden L110x110x10* *M47*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-125,63*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*121,01*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H110/110/10* (*1)

h	=	*110*	mm	I_y	=	*2386992*	mm^4
b	=	*110*	mm	$W_{y;el;eff.1}$	=	*30108*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*77703*	mm^3
y_s	=	*30,7*	mm	i_y	=	*33,6*	mm
A_{bruto}	=	*2115*	mm^2	i_v	=	*21,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5030*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2651*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*60*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,35** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **150** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,82** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,89** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,31** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,89 = 89%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Boven randen L120x120x11* — *M48*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-117,02*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*177,47*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/120/11* [*1]

h	=	*120*	mm	I_y	=	*3406399*	mm^4
b	=	*120*	mm	$W_{y;el;eff.1}$	=	*39406*	mm^3
t_f	=	*11*	mm	$W_{y;el;eff.2}$	=	*101512*	mm^3
y_s	=	*33,6*	mm	i_y	=	*36,6*	mm
A_{bruto}	=	*2537*	mm^2	i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4465*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*4465*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,47**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**192**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,76**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,87**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,49**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] **:** **$U.C_{max}$ = 0,87 = 87%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Boven randen L60x60x6* *M49*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*0*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*56,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* (*1)

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1213*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*1213*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,64	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	105	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,00	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,40	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,43	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,64 = 64%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part :	Mast 73				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Horiz.-vert. en schuine Knikverkort. L50x50x5*

Memberforces : **(Attention! pressure = "-" and tension ="+")** *M50*

Compression: N_{Sd}	=	*-13,02* kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*10,43* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50* mm	I_y	=	*109643*	mm^4
b	=	*50* mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0* mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480* mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1933* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1933* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*1268* mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,23** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,66** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **201** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,62** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,81** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,43** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,37** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **$U.C_{max}$ = 0,81 = 81%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order : 14509	**Dossier** : 13.039	**Berekening** : B.14014		D&C ENGINEERING
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part : Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Schuine verbanden L90x90x9* *M51*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-101,75*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*109,12*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H90/90/9* (*1)

h	=	*90*	mm	I_y	=	*1158332*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*17927*	mm^3
t_f	=	*9*	mm	$W_{y;el;eff.2}$	=	*45626*	mm^3
y_s	=	*25,4*	mm	i_y	=	*27,3*	mm
A_{bruto}	=	*1552*	mm^2	i_v	=	*17,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1506*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*1506*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,47**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**87**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,43**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,54**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,36**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,54 = 54%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part :	Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003   File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Schuine verbanden L100x100x10* *M52*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-150,94*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*117,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100*	mm	I_y	=	*1766764*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2*	mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2819*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2819*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,41**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**146**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,92**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,74**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,35**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,92 = 92%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mahta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part :	Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Schuine verbanden L75x75x8* *M53*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-30,58*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*88,64*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H75/75/8* (*1)

h	=	*75*	mm	I_y	=	*588737*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*10964*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*27635*	mm^3
y_s	=	*21,3*	mm	i_y	=	*22,7*	mm
A_{bruto}	=	*1147*	mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2819*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2819*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,58** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **195** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,45** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,65** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,50** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,65 = 65%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier :** 13.039	**Berekening :**	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10-11-12-15-t_m 21 Horizontale kruizen L60x60x6* *M54*

Memberforces : (**Attention! pressure = "-" and tension ="+"**)

Compression: N_{Sd}	=	*-40,43*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*39,55*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* [(*1)]

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3100*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1652*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,47** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **171** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,96** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,67** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,59** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] **:** **U.C$_{max}$ = 0,96 = 96%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[(*2)] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order : 14509	**Dossier** : 13.039	**Berekening** : B.14014		D&C ENGINEERING
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part : Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb1 Staven L150x150x14* *M55*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-234,44*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*181,78*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/150/14* (*1)

h	=	*150*	mm	I_y	=	*8453963*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*78326*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*200966*	mm^3
y_s	=	*42,1*	mm	i_y	=	*45,8*	mm
A_{bruto}	=	*4031*	mm^2	i_v	=	*29,1*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3800*	mm	No. bolts / end / flange		=	*4*	
$L_{v;cr}$	=	*3800*	mm	Type of bolts	M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*50*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*3800*	mm	Edge distance bolt	e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,30** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,08** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **131** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,59** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,86** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,34** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,86 = 86%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order : 14509	**Dossier** : 13.039	**Berekening** : B.14014	
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part : Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb1 Staven L70x70x7* *M56*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-9,23* kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*7,91* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/7* (*1)

h	=	*70* mm	I_y	=	*422977*	mm^4
b	=	*70* mm	$W_{y;el;eff.1}$	=	*8411*	mm^3
t_f	=	*7* mm	$W_{y;el;eff.2}$	=	*21457*	mm^3
y_s	=	*19,7* mm	i_y	=	*21,2*	mm
A_{bruto}	=	*940* mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5374* mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*5374* mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*5374* mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,07** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **1,02** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **398** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,51** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,10** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,07** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,02** = **102%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier :** 13.039	**Berekening :**	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb1 Staven L75x75x8* *M57*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-1,71*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,71*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :			*H75/75/8* [*1]					
h		=	*75*	mm	I_y	=	*588737*	mm^4
b		=	*75*	mm	$W_{y;el;eff.1}$	=	*10964*	mm^3
t_f		=	*8*	mm	$W_{y;el;eff.2}$	=	*27635*	mm^3
y_s		=	*21,3*	mm	i_y	=	*22,7*	mm
A_{bruto}		=	*1147*	mm^2	i_v	=	*14,4*	mm
Material :								
Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:								
$L_{y;cr}$		=	*3800*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$		=	*3800*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)		=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)		=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$		=	*7600*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?		=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate		=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,01**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**1,11**	**> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**263**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,06**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,07**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,06**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,03**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 1,11 = 111%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kV-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb2 Staven L65x65x7* *M58*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H65/65/7* (*1)

h	=	*65*	mm	I_y	=	*334319*	mm^4
b	=	*65*	mm	$W_{y;el;eff.1}$	=	*7185*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*18103*	mm^3
y_s	=	*18,5*	mm	i_y	=	*19,6*	mm
A_{bruto}	=	*870*	mm^2	i_v	=	*12,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3353*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3353*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*3353*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,00**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,74**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**269**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,00**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,00**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,00**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,00**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,74 = 74%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	j. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb2 Staven L70x70x7* *M59*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	*-17,87*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*17,61*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/7* [*1]

h	=	*70*	mm	I_y	=	*422977*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*8411*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*21457*	mm^3
y_s	=	*19,7*	mm	i_y	=	*21,2*	mm
A_{bruto}	=	*940*	mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4741*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*4741*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*4741*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,16**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,90**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**351**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,80**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,19**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,16**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,90 = 90%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :** 13.039	**Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb2 Staven L60x60x6* *M60*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-0,27*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*0,08*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* (*1)

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3353*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*3353*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*6707*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **2,03** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **290** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,01** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,00** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,00** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 2,03 = 203%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check section: *HorVerb3 Staven L150x150x14* *M61*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-365,39*	kN	***Combined forces diagonal:***				
Tension: N_{Sd}	=	*304,77*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H150/150/14*	(*1)				
h	=	*150*	mm	I_y	=	*8453963*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*78326*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*200966*	mm^3
y_s	=	*42,1*	mm	i_y	=	*45,8*	mm
A_{bruto}	=	*4031*	mm^2	i_v	=	*29,1*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*2500*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2500*	mm	Type of bolts M / "	=	*30*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*60*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*110*	mm
$L_{perpendicular\ force}$	=	*2500*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*16*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,52** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,05** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **86** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,59** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,85** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,61** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order : 14509	**Dossier** : 13.039	**Berekening** : B.14014	D&C ENGINEERING
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part : Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb3 Staven L90x90x9* *M62*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-50,39	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	49,75	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN
Angle profile :		H90/90/9 [*1]					
h	=	90	mm	I_y	=	1158332	mm^4
b	=	90	mm	$W_{y;el;eff.1}$	=	17927	mm^3
t_f	=	9	mm	$W_{y;el;eff.2}$	=	45626	mm^3
y_s	=	25,4	mm	i_y	=	27,3	mm
A_{bruto}	=	1552	mm^2	i_v	=	17,4	mm
Material :							
Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	3536	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	3536	mm	Type of bolts M / "	=	20	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	3536	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	10	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,40** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,31** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **203** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,76** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,98** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,07** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,72** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 1,07 = 107%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part :	Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb3 Staven L75x75x8* *M63*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1,29*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,29*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H75/75/8* [*1]

h	=	*75*	mm	I_y	=	*588737*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*10964*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*27635*	mm^3
y_s	=	*21,3*	mm	i_y	=	*22,7*	mm
A_{bruto}	=	*1147*	mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5000*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*5000*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*5000*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,01**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,73**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**347**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,07**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,08**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,04**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,03**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] **:** **$U.C_{max}$ = 0,73 = 73%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[*2] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :** 13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 73		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 1-2 Bovern Randen* *M64*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*0*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd} =	*77,97*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100* mm	I_y	=	*1766764*	mm^4
b	=	*100* mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10* mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2* mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915* mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4732* mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*4732* mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*50*	mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,27** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **245** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,38** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,23** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,38 = 38%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 1-2 Horiz.-vert. en schuine Knikverkort. L50x50x5* *M65*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-12,41*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,44*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510 = *Fe360* Permissible stress $f_{y;d}$ = *235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1888*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1888*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,03** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **197** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,57** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,75** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,41** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,25** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,75 = 75%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 1-2 Horizontale kruizen L65x65x7* M66

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-44,95	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	37,25	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H65/65/7 (*1)

h	=	65	mm	I_y	=	334319	mm^4
b	=	65	mm	$W_{y;el;eff.1}$	=	7185	mm^3
t_f	=	7	mm	$W_{y;el;eff.2}$	=	18103	mm^3
y_s	=	18,5	mm	i_y	=	19,6	mm
A_{bruto}	=	870	mm^2	i_v	=	12,5	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2073	mm	No. bolts / end / flange	=	2	
$L_{v;cr}$	=	1600	mm	Type of bolts M / "	=	20	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	40	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	25	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	8	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,38** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **128** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,52** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,48** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,51** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,52 = 52%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 1-2 Horizontale kruizen L55x55x6* *M67*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-18,04*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*21,28*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H55/55/6* (*1)

h	=	*55*	mm	I_y	=	*172872*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s	=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}	=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2713*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1600*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,28** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **164** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,45** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,35** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,32** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,45 = 45%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 1-2 Horizontale kruizen L80x80x8* *M68*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-58,25*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*37,57*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* (*1)

h	=	*80*	mm	I_y	=	*722469*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6*	mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4190*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2445*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,24** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **173** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,79** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,97** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,42** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,97 = 97%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 1-2 Schuine verbanden L60x60x6* *M69*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*62,12*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* (*1)

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4190*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2445*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,74**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**231**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,00**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**1,03**	**> 1 !!**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,92**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 1,03 = 103%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 3-4 Boven renden L80x80x8* *M70*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*56,45*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* (*1)

h	=	*80*	mm	I_y	=	*722469*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6*	mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2880*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2880*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,34	< 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	187	< 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,00	< 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,40	< 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,27	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,40 = 40%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

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Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :** 13.039	**Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 3-4 Horizontale kruizen L60x60x6* *M71*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd} = *-39,07* kN

Tension: N_{Sd} = *33,79* kN

$F_{perpend.;s;d}$ = *0* kN

Combined forces diagonal:

$N_{comb1;c;s;d}$ (min. Compr. or tension) = *0* kN

$N_{comb2;c;s;d}$ (max. compression) = *0* kN

Angle profile : *H65/65/7* (*1)

h	=	*65*	mm	I_y	=	*334319*	mm^4
b	=	*65*	mm	$W_{y;el;eff.1}$	=	*7185*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*18103*	mm^3
y_s	=	*18,5*	mm	i_y	=	*19,6*	mm
A_{bruto}	=	*870*	mm^2	i_v	=	*12,5*	mm

Material :

Mat. qual. Fe360 / Fe510 = *Fe360*

Permissible stress $f_{y;d}$ = *235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2347*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2347*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⅂=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,32** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **188** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,72** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,65** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,43** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,72 = 72%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 5-6 Randen L80x80x8* *M72*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-110,05*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*74,89*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* [(*1)]

h	=	*80*	mm	I_y	=	*722469*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6*	mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3350*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2008*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*73*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,50** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **138** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,08** **> 1 !!**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,17** **> 1 !!**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,94** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 1,17 = 117%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5
[(*2)] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Masgta						
Checked :	J. Hollaar						

Order : 14509	**Dossier** : 13.039	**Berekening** : B.14014		
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part : Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 5-6 Schuine randen L100x75x7* *M73*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-48,43*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*67,48*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/75/7* (*1)

h	=	*100*	mm	I_y	=	*1179878*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s	=	*18,3*	mm	i_y	=	*31,5*	mm
A_{bruto}	=	*1187*	mm^2	i_v	=	*15,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*6950*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1726*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,47**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**220**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,94**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,72**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,55**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,94 = 94%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order : 14509	**Dossier** : 13.039	**Berekening** : B.14014		
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part : Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 5-6 Horizontale en schuine knikverkorters L50x50x5* *M74*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-3,23*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*1,17*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1910*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1910*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*969*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,03**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,51**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**199**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,15**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,20**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,11**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,06**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** $U.C_{max}$ = **0,51** = **51%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	Dossier :	13.039	Berekening : B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 5-6 Verticale verbanden1 L50x50x5* *M75*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-12,59*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*12,66*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2162*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2162*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*969*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,27** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **225** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,74** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,92** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,42** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,45** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,92 = 92%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Masha						
Checked :	J. Hollaar						

Check section: *CrossArm 5-6 Verticale verbanden2 L50x50x5* *M76*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-18,92*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*18,02*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2184*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1155*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,39** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **145** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,51** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,84** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,63** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,64** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,84 = 84%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :** 13.039	**Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 Horizontale en Verticale Knikverkorters L70x70x7* V06

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-23,73*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*23,73*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/7* (*1)

h	=	*70*	mm	I_y	=	*422977*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*8411*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*21457*	mm^3
y_s	=	*19,7*	mm	i_y	=	*21,2*	mm
A_{bruto}	=	*940*	mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3322*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3322*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*3322*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,20**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,42**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**246**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,82**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,96**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,39**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,37**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,96 = 96%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :** 13.039	**Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 Schuine Knikverkorters L70x70x7* *V09*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-28,83* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*28,83* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/7* [(*1)]

h	=	*70* mm	I_y	=	*422977*	mm^4
b	=	*70* mm	$W_{y;el;eff.1}$	=	*8411*	mm^3
t_f	=	*7* mm	$W_{y;el;eff.2}$	=	*21457*	mm^3
y_s	=	*19,7* mm	i_y	=	*21,2*	mm
A_{bruto}	=	*940* mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2620* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2620* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1* (⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,32** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **194** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,64** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,80** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,48** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,61** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,80 = 80%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

[(*2)] The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5 Verticale Knikverkorters L55x55x6* *V21*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-26,78*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*26,78*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H55/55/6* (*1)

h	=	*55*	mm	I_y	=	*172872*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s	=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}	=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1720*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1720*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⅂=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,34** < **1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < **1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **163** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < **1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,64** < **1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,85** < **1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < **1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < **1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,44** < **1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,56** < **1**

Remarks:

The maximum increase of stress or totalstress is (*2) **:** **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7-8-9-10-13-14 Verticale Knikverkorters L55x55x6* *V31*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-19,39*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*17,86*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H55/55/6* (*1)

h	=	*55*	mm	I_y	=	*172872*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s	=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}	=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2050*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2050*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a{*}L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,23**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**194**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,64**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,80**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,32**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,45**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,80 = 80%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 7-8-9-10-13-14 Boven randen L160x160x15* *V36*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-253,93*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*381,05*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H160/160/15* (*1)

h	=	*160*	mm	I_y	=	*10988350*	mm^4
b	=	*160*	mm	$W_{y;el;eff.1}$	=	*95470*	mm^3
t_f	=	*15*	mm	$W_{y;el;eff.2}$	=	*244713*	mm^3
y_s	=	*44,9*	mm	i_y	=	*48,8*	mm
A_{bruto}	=	*4606*	mm^2	i_v	=	*31,1*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3680*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*3680*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,64** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **119** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,51** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,88** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,07** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,07 = 107%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *HorVerb1 Staven L70x70x7* *V56*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-17,87*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*17,61*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/7* (*1)

h	=	*70*	mm	I_y	=	*422977*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*8411*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*21457*	mm^3
y_s	=	*19,7*	mm	i_y	=	*21,2*	mm
A_{bruto}	=	*940*	mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5374*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*5374*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular force}$	=	*5374*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,11** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,67** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **398** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,93** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,09** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,12** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,93 = 93%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order : 14509	**Dossier** : 13.039	**Berekening** : B.14014		D&C ENGINEERING
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part : Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb1 Staven L75x75x8* *V57*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-1,71*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,71*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H75/75/8* (*1)

h	=	*75*	mm	I_y	=	*588737*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*10964*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*27635*	mm^3
y_s	=	*21,3*	mm	i_y	=	*22,7*	mm
A_{bruto}	=	*1147*	mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3800*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3800*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*7600*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,01** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,73** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **263** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,05** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,07** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,03** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,02** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,73 = 73%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :** 13.039	**Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: ***HorVerb2 Staven L75x75x8*** ***V60***

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-0,27*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*0,08*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H75/75/8* (*1)

h	=	*75*	mm	I_y	=	*588737*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*10964*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*27635*	mm^3
y_s	=	*21,3*	mm	i_y	=	*22,7*	mm
A_{bruto}	=	*1147*	mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3353*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*3353*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	mm
$L_{perpendicular\ force}$	=	*6707*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,65** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **232** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,00** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,00** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,65 = 65%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :** 13.039	**Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HorVerb3 Staven L90x90x9* *V62*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-50,39* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*49,75* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H90/90/9* (*1)

h	=	*90*	mm	I_y	=	*1158332*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*17927*	mm^3
t_f	=	*9*	mm	$W_{y;el;eff.2}$	=	*45626*	mm^3
y_s	=	*25,4*	mm	i_y	=	*27,3*	mm
A_{bruto}	=	*1552*	mm^2	i_v	=	*17,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3536*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3536*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*3536*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,40** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,31** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **203** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,76** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,98** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,54** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,72** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2) : **$U.C_{max}$ = 0,98 = 98%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order : 14509	**Dossier** : 13.039	**Berekening** : B.14014		
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer				
Part : Mast 73				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 1-2 Schuine verbanden L60x60x6* — *V69*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*0*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*62,12*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H60/60/6*	(*1)				
h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*4190*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2445*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⅂=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,74**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**231**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,00**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,52**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,92**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,92 = 92%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** : 13.039	**Berekening** :	B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *CrossArm 5-6 Randen L80x80x8* *V72*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-110,05*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*74,89*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* (*1)

h	=	*80*	mm	I_y	=	*722469*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6*	mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2008*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2008*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*73*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,50** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **130** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,91** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,58** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,94** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,94 = 94%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5

(*2) The total stress or increase of stress has been related to the permissible stress

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

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W www.dcengineering.nl

Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer

Onderwerp	:	Controleberekening mast 75, 150 kV-lijn Zoetermeer -Leiden
Opdrachtgever	:	Cofely Fabricom Koen Pieters
Referentienr	:	1303914509
Opgesteld	:	M. Glegola
Gecontroleerd	:	J.Hollaar
Goedgekeurd	:	J.Hollaar
Revisie	:	0
Datum	:	7-Apr-2014
D&C documentnr.	:	B.14013

Rev.	Datum	Omschrijving	Opgesteld	Gecontr.	Goedgek.
0	7-Apr-14	Ontwerpberekening	M.Glegola	J.Hollaar	J.Hollaar
A					

Inhoudsopgave

1 Algemeen

1.1 Inleiding

Door Cofely Fabricom is aan D&C engineering te Alblasserdam opdracht verstrekt voor o.a. het uitvoeren van een controleberekening voor mast nr.75 in de 150 kV-lijn Zoetermeer -Leiden. Mast 75 moet gecontroleerd worden, omdat rond de nieuwe 380kv-lijn een omleiding nodig is. Voor mast 73 komt een portaal waardoor de belasting op mast 75 wijzigd.
De berekeningen worden uitgevoerd conform de vigerende norm NEN-EN-50341-1 en 3.
Voor de geleiderbelasting vanuit de bliksemdraden wordt ijsgebied A aangehouden, conform afspraak (aanvullende eis van TenneT), zoals vermeld in: "Lijnen; Standaard programma van eisen; PVE.05.000;25 november 2010; versie 1.0".

1.2 Normen en tekeningen en documenten en andere uitgangspunten

Tekeningen :

Mast nr.75 in de 150 kV-lijn Zoetermeer -Leiden.	
tek.nr.	omschrijving
5703-21-E	Ondergedeelte mastlichaam masttype D-D
5703-20-D	Tussengedeelte mastlichaam masttype D-D
5703-19-E	Bovengedeelte mastlichaam masttype D-D
5703-17-C	Ondertraverse masttype D-D
5703-16-D	Ondertraverse masttype D-D
5703-14-A	Boventraverse masttype D-D
5703-13-G	Boventraverse masttype D-D

Normen:

NEN-EN 50341-1 : 2001
NEN-EN 50341-3 : 2001

Andere uitgangspunten:

Fundatiehoogte 0,50 m boven maaiveld.

1.3 Nadere bepalingen

De geleiderbelastingen en de benodigde verzwaringen van de mastconstructies worden berekend volgens NEN-EN 50341-1 en 3 met spanningscontroles volgens EC-3.

De mastconstructie wordt 3D doorgerekend.

De gestelde slankheidsrestricties in NEN-EN 50341-1 en 3 worden geacht niet van toepassing te zijn, omdat in sommige gevallen in het verleden grotere slankheden zijn toegestaan.

Voor de mastconstructie zal een maximum totaalspanning van 100% worden gehanteerd.

Er is gerekend dat er geen antenne-opstellingen in de te controleren mastconstructie aanwezig zijn.

De berekening is uitgevoerd met het rekenpakket Scia LTA programma 2013

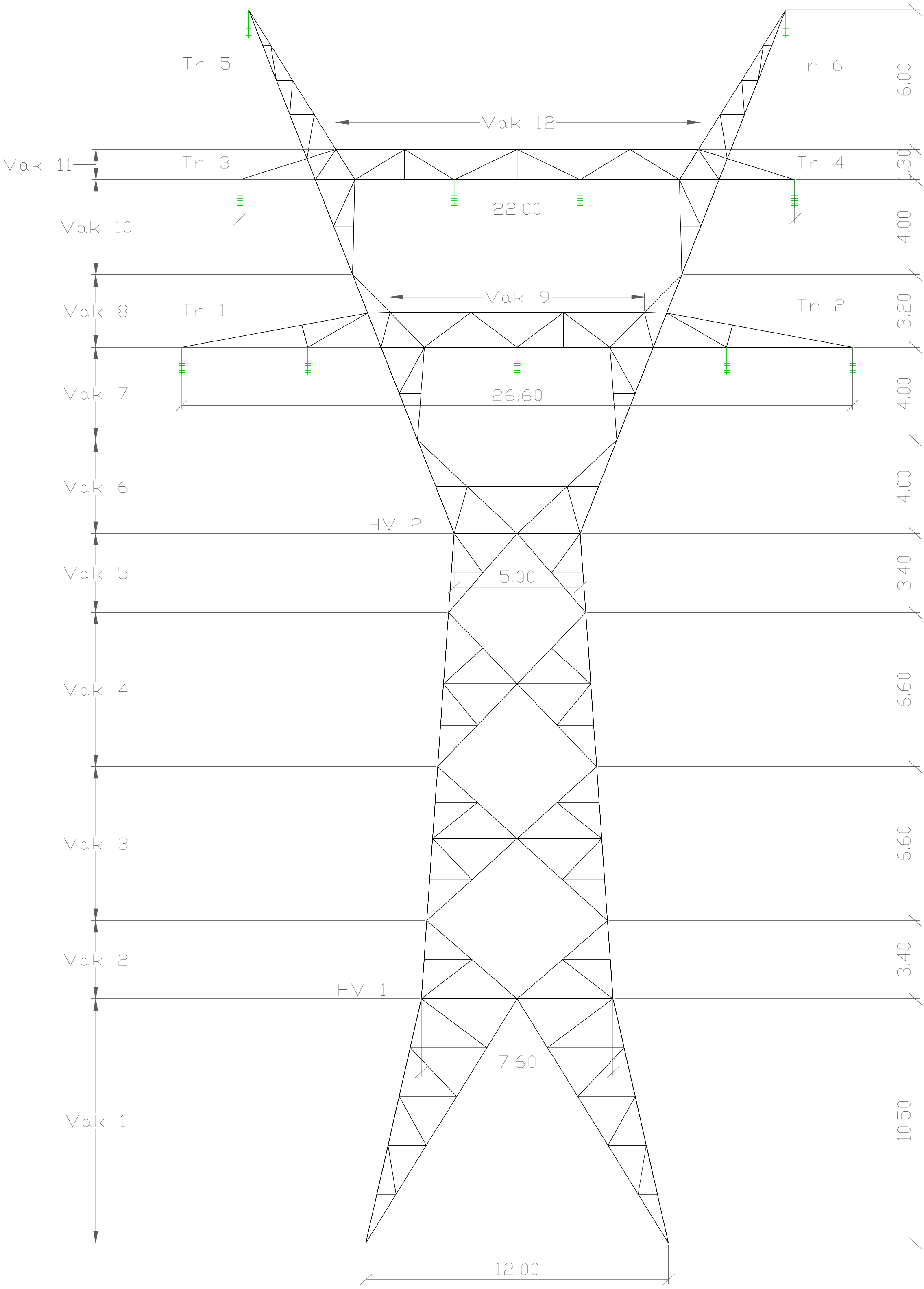
Voor de geleiderbelasting vanuit de bliksemdraden wordt gerekend met ijsgebied A.
Zie richtlijn van Tennet: "Lijnen; standaard programma van eisen; PVE.05.000;
25 november 2010; versie 1.0; artikel 5.3".

1.4 Materialen

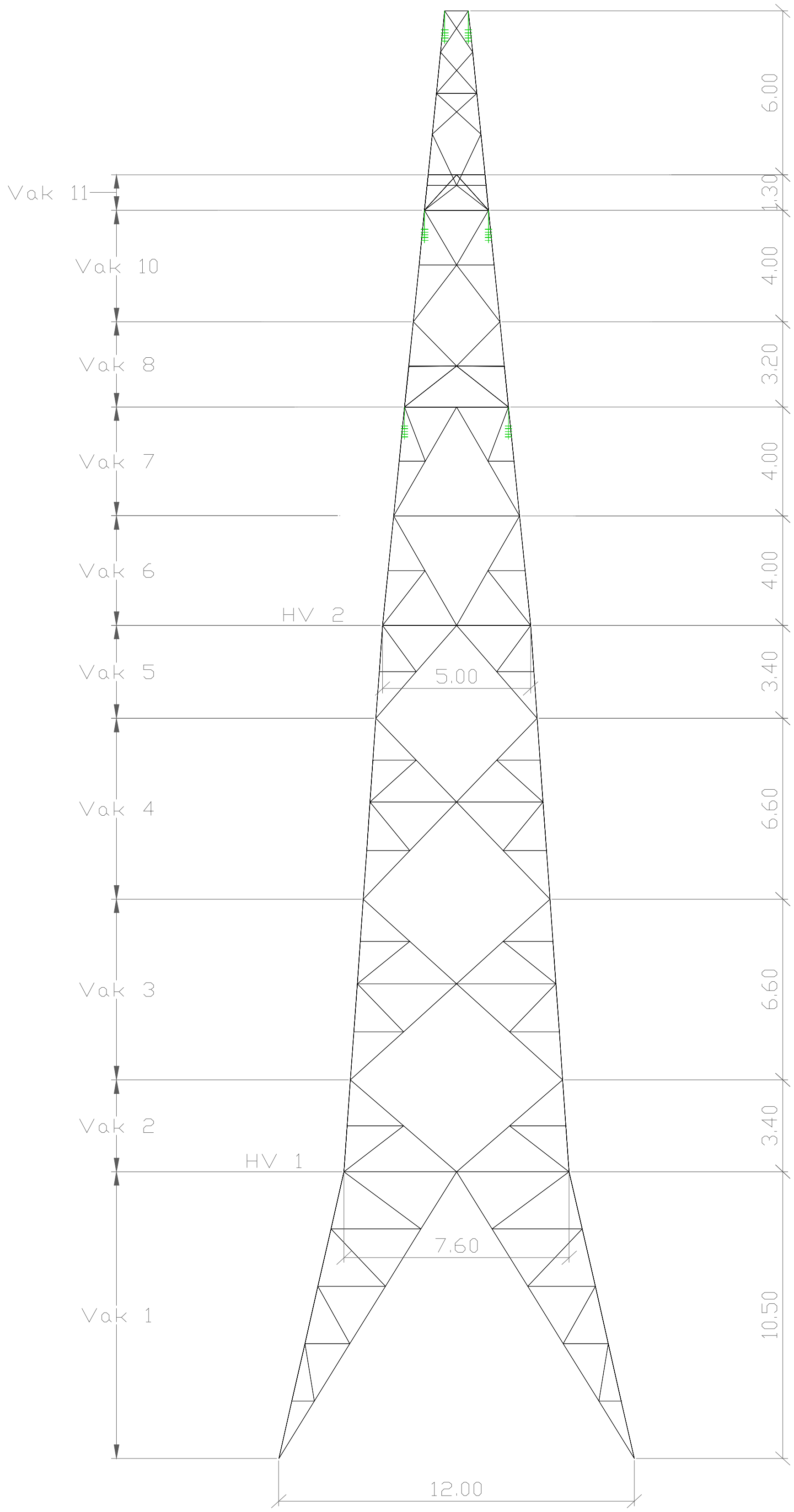
Materiaal randen	:	Fe360
Materiaal diagonalen	:	Fe360
Materiaal bouten	:	4.6 (8.8 nieuw)

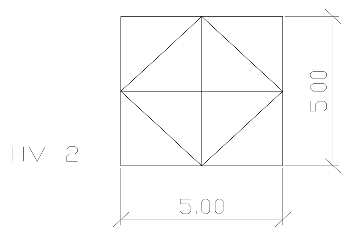
1.5 Overzicht mast

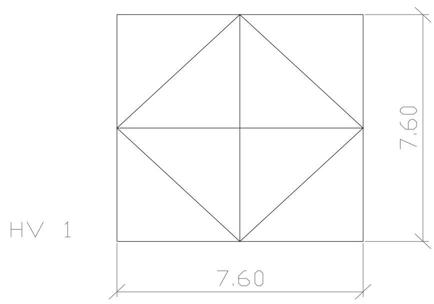
1.5.1 Overzicht voorvlak mastlichaam



1.5.2 Overzicht zijvlak mastlichaam







2 Ontwerpgegevens mast

2.1 Ontwerpcode

De berekening is gebaseerd op NEN-en 50341-1 en -3-15
Bovengrondse hoogspanningslijnen.

2.2 Ontwerpgegevens

Lijnhoek	-	8°	
Windgebied	-	II	
Bebouwing	-	onbebouwd	
IJsgebied bliksemdraden	-	**A**	
IJsgebied fasedraden	-	B	
Toeslag eigengewicht	-	20%	
Totale hoogte van de mast	-	53,0 m	*)
Hoogte traverse 1	-	38,5 m	*)
Hoogte traverse 2	-	45,7 m	*)
Hoogte voet boven maaiveld	-	0,5 m	
Veldlengten	-	421/418 m	
Bliksemdraden	-	Br 50	(2x)
Factor β bliksemdraad	-	1,0	
Fasedraden	-	CU 185	(9 x 2-bundel)
Factor β fasedraad	-	0,8	
Boutklasse	-	8.8	
Materiaal mastranden	-	S235	
Materiaal overige mast	-	S235	
	-		

*) t.o.v. bovenzijde fundatiepoer

2.3 Geleidergegevens

		Br 50	CU 185
		Bliksemdraad	fasedraad
Eigen gewicht	N/m	4,43	16,62
Doorsnede	mm2	48,36	181,6
Diameter	mm	9	17,5
Elasticiteitsmod.	N/mm2	130000	130000
Lin. Uitzettingsc.	1/°C	0,000017	0,000017
Breeksterkte	N	28390,7	72760,5

2.4 Gegevens isolatoren

Dubbele afspanning

lengte isolatorketting	2	m	
totale gewicht afspanning per zijde	2,5	kN	
diameter isolator schaal	255	mm	(voor wind 2/3*255mm =170mm)

2.5 Mastbelastingen uit geleiders

Voor belastingen uit de geleiders wordt verwezen naar bijlage A van dit rapport.

3 Berekening mast

3.1 Uitgangspunten berekening

Ontwerp-norm	NEN-EN 50341-3
Boutkwaliteit	4,6
Staalkwaliteit	S235
Toeslag eigengewicht	20%
Referentie periode	50 jaar

Voor verdere gegevens wordt verwezen naar hoofstuk 2.0

3.2 Berekening met behulp van computerprogramma

SCIA - ESA-Engineer - LTA

Voor de berekening van de mastconstructie wordt verwezen naar bijlage B van dit rapport.

4 Fundatie

4.1 Algemeen

Voor fundatiebelastingen zie Bijlage B:(maximale belastingen per knoop en Resultante op fundatie).
Deze belastingen zijn opgesteld en weergegeven conform NEN-EN 50341-1 en 3 november 2001; Bovengrondse hoogspanningslijnen.

Per fundatie-belastingweergave is dit opgegeven inclusief combinatie- en belastingfactoren.

Aan de hand van de bovengenoemde belastinggegevens en de sonderinggegevens kan de fundatie berekend worden.

4.2 Fundatie belastingen

Reacties

Lineaire berekening, Extreem : Globaal
Selectie : Alle
Klasse : All UGT

Steunpunt	BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Sn2/N3	1a/3	**-162,62**	155,08	763,04	0,00	0,00	0,00
Sn1/N1	1a/2	**194,94**	**212,20**	**1021,68**	0,00	0,00	0,00
Sn4/N6	1a/1	179,11	**-195,03**	927,69	0,00	0,00	0,00
Sn3/N7	1a-p/4	150,15	161,16	**-783,97**	0,00	0,00	0,00
Sn1/N1	1a/5	52,05	60,34	300,61	**0,00**	**0,00**	**0,00**

Resultante

Lineaire berekening, Extreem : Globaal
Selectie : Alle
Klasse : All UGT

BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
1a/6	467,30	28,34	545,09	-1192,90	15690,86	-56,23
1a/7	-325,97	28,34	545,09	-1192,90	-9675,22	-67,66
1a-p/8	75,50	328,37	408,82	-9776,25	3208,66	-67,05
1a/9	75,32	-292,54	545,09	8269,15	3198,81	-70,61
3/10	294,07	19,61	657,68	-834,45	11397,70	-80,03
3-p/11	-94,27	19,61	408,82	-843,14	-2819,43	-88,57
1a-p/12	467,30	28,34	408,82	-1195,23	15691,17	-56,23
5a13/13	108,91	-24,58	455,24	939,74	4608,10	283,72
5a21/14	108,91	-24,58	455,24	938,94	4605,45	-475,83

Centraalpunt:

X [m]	Y [m]	Z [m]
0,000	0,000	0,000

Resultante op Fundering

Lineaire berekening, Extreem : Nee
Selectie : Alle
Klasse : All UGT

BG	Steunpunt	Extreem	horiz. component [kN]	resultante [kN]	Hoek [deg]	helling(afschot) [-]	Rx [kN]	Ry [kN]	Rz [kN]
1a-p/15	Sn1/N1	Rx	133,26	452,08	-0,23	-3,24	-94,61	-93,85	-432,00
1a/2	Sn1/N1	Rx	288,15	1061,53	-177,57	3,55	194,94	212,20	1021,68
1a-p/15	Sn1/N1	Ry	133,26	452,08	-0,23	-3,24	-94,61	-93,85	-432,00
1a/2	Sn1/N1	Ry	288,15	1061,53	-177,57	3,55	194,94	212,20	1021,68
1a-p/15	Sn1/N1	Rz	133,26	452,08	-0,23	-3,24	-94,61	-93,85	-432,00
1a/2	Sn1/N1	Rz	288,15	1061,53	-177,57	3,55	194,94	212,20	1021,68
1a/3	Sn2/N3	Rx	215,85	689,43	-93,89	-3,03	-162,62	-141,93	-654,77
1a-p/16	Sn2/N3	Rx	196,33	755,03	94,04	3,71	128,70	148,26	729,05
1a-p/17	Sn2/N3	Ry	215,33	721,63	-91,31	-3,20	-155,69	-148,75	-688,76
1a/1	Sn2/N3	Ry	197,17	788,10	96,86	3,87	121,77	155,08	763,04
1a-p/17	Sn2/N3	Rz	215,33	721,63	-91,31	-3,20	-155,69	-148,75	-688,76
1a/1	Sn2/N3	Rz	197,17	788,10	96,86	3,87	121,77	155,08	763,04
1a/18	Sn3/N7	Rx	201,21	776,32	-179,62	-3,73	-141,34	-143,20	-749,80
1a-p/4	Sn3/N7	Rx	220,27	673,06	2,02	2,89	150,15	161,16	636,00
1a/18	Sn3/N7	Ry	201,21	776,32	-179,62	-3,73	-141,34	-143,20	-749,80
1a-p/4	Sn3/N7	Ry	220,27	673,06	2,02	2,89	150,15	161,16	636,00
1a-p/15	Sn3/N7	Rz	191,46	807,01	-179,57	-4,09	-134,37	-136,39	-783,97
1a/2	Sn3/N7	Rz	210,53	702,46	2,15	3,18	143,18	154,34	670,17
1a-p/17	Sn4/N6	Rx	218,23	567,68	104,59	-2,40	-110,46	-188,21	-524,06
1a/1	Sn4/N6	Rx	206,91	950,48	-104,96	4,48	179,11	103,60	927,69
1a/3	Sn4/N6	Ry	220,78	537,36	107,05	-2,22	-103,49	-195,03	-489,91
1a-p/16	Sn4/N6	Ry	204,50	916,64	-102,32	4,37	172,14	110,41	893,54
1a-p/17	Sn4/N6	Rz	218,23	567,68	104,59	-2,40	-110,46	-188,21	-524,06
1a/1	Sn4/N6	Rz	206,91	950,48	-104,96	4,48	179,11	103,60	927,69

4.3 Berekening Fundatie

De berekening van de fundatie, met de gegevens zoals de sonderingen, is een op zichzelf staande berekening, welke niet valt onder de scope van deze opdracht.

5 Resultaten

Uit de controleberekening van de mast volgen de volgende resultaten:
(Opmerking: De verschillende berekeningen zijn te vinden in de bijlagen B en C)

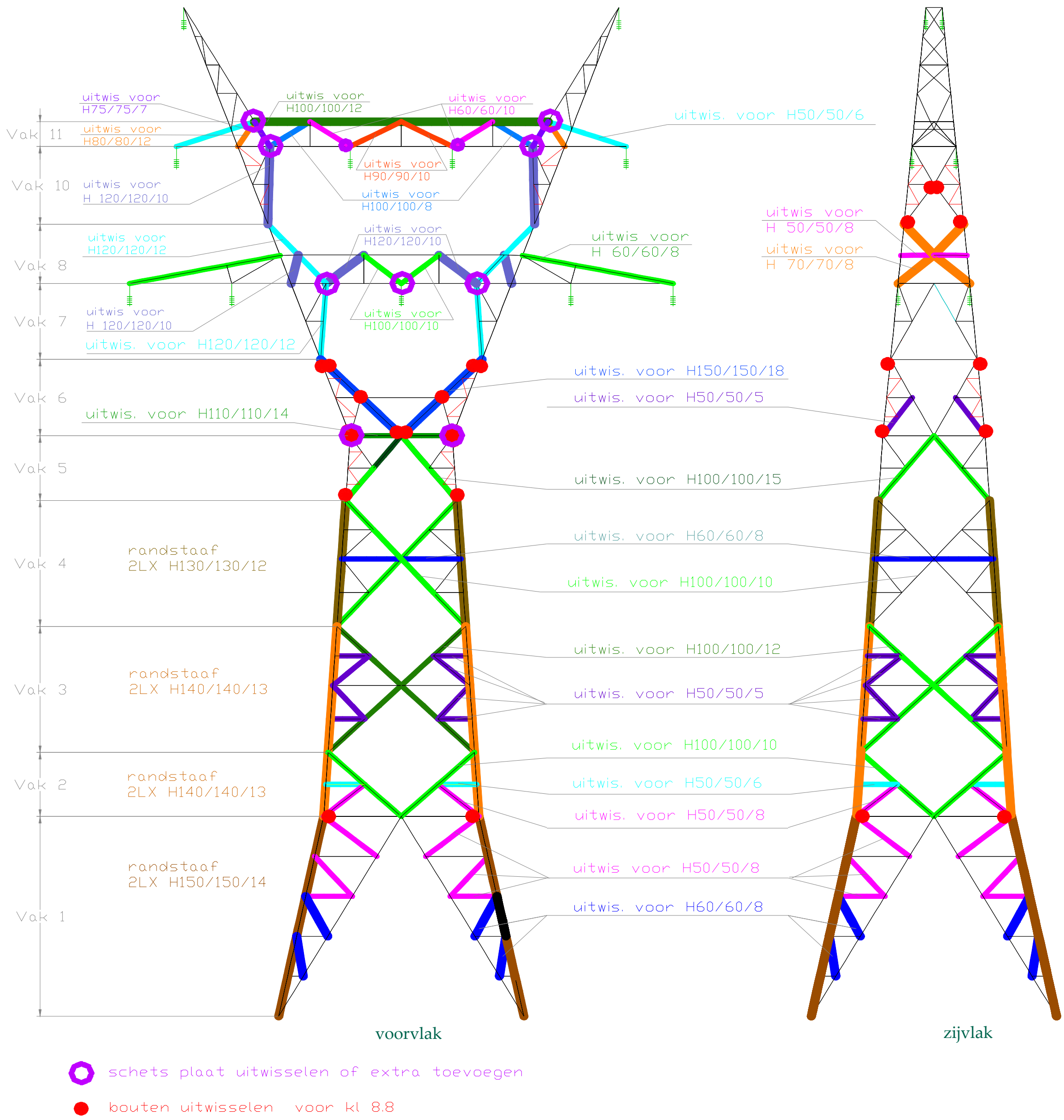
5.1 Overzicht spanningniveau's

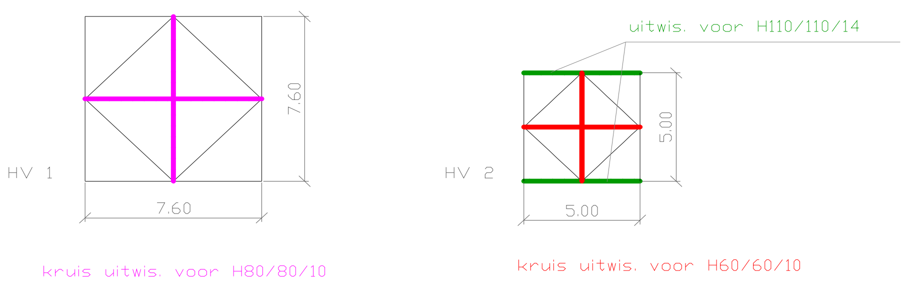
Plaats		$UC_{tot,1}$	Verzwaring:			$UC_{tot,2}$
Vak 1 - randen	H150/150/14	161%	vlindersprofiel bouten visselen voor	2x H150/150/14 kl 8,8		87%
Vak 1 - diagonalen	H180/90/10	89%				
Vak 1 - 1e en 2e hor knikverkorters	H50/40/5	92%				
Vak 1 - 3e hor. knikverkorters	H50/50/5	119%	uitwisselen voor	H50/50/8	kl8,8	78%
Vak 1 - 4e hor. knikverkorters	H60/60/6	92%				
Vak 1 1e en 2e schuine knikverkorters	H50/40/5	235%	uitwisselen voor	H60/60/8	kl8,8	85%
Vak 1 - 3e schuine knikverkorters	H50/40/5	164%	knikverkorters			61%
Vak 1 4e schuine knikverkorters	H50/50/5	145%	knikverkorters			74%
Vak 2 - randen	H140/140/13	158%	vlindersprofiel	2x H140/140/13	kl8,8	98%
Vak 2 - diagonalen	H100/100/10	96%				
Vak 2 - hor. kikverkorters	H50/40/5	115%	uitwisselen voor	H50/50/6	kl8,8	84%
Vak 2 schuin kikverkorter	H50/40/5	180%	uitwisselen voor	H50/50/8	kl8,8	90%
Vak3 randen	H140/140/13	144%	vlindersprofiel	2 x H140/140/13	kl 8,8	96%
Vak 3 diagonalen	H100/75/7	154%	uitwisselen voor	H100/100/12	kl 8,8	95%
Vak 3 horizontaal	H70/70/6	74%				
Vak 3 hor. knikverkorters	H50/40/5	101%	uitwisselen voor	H50/50/5	kl 8,8	88%
Vak 3 - schuine knikverkorters	H50/40/5	117%	knikverkorters			47%
Vak 4 randen	H130/130/12	136%	vlindersprofiel	2x H130/130/12	kl 8,8	61%
Vak 4 diagonalen	H100/75/7	105%	uitwisselen voor	H100/100/10	kl8,8	69%
Vak 4 horizontaal	H60/60/5	105%	uitwisselen voor	H60/60/8	kl8,8	68%
Vak 4 hor. knikverkorters	H50/40/5	88%				
Vak 4 schuine knikverkorters	H50/40/5	70%				
Vak 5 randen	H130/130/12	147%	extra knikverkoters	H50/50/5	kl8,8	84%
Vak 5 diagonalen	H100/75/7	176%	uitwisselen voor	H100/100/15	kl8,8	90%
Vak 5 hor. knikverkorters	H50/40/5	76%				
Vak 5 schuine knikverkorters	H50/40/5	67%				
Vak 6 randen	H130/130/12	144%	extra knikverkoters	H50/50/5	kl 8,8	93%
Vak 6 diagonalen voor- en achtervlak	H150/150/14	154%	uitwisselen voor extra schetsplaat t=14mm	H150/150/18	kl 8,8	88%
Vak 6 diagonalen zijvlak	H100/75/7	97%				
Vak 6 horizontaal	H130/130/12	68%				
Vak 6 hor. knikverkorters	H50/40/5	76%				
Vak 6 schuine knikverkorters voorvlak	H100/100/6	19%				
Vak 6 schuine knikverkorters zijvlak	H50/40/5	112%	uitwisselen voor	H50/50/5	kl 8,8	83%
Vak 7 randen	H130/130/12	77%				
Vak 7 diagonalen voor- en achtervlak	H120/80/8	174%	uitwisselen voor	H120/120/12	kl 8,8	**102%**
Vak 7 diagonalen zijvlak	H120/80/8	71%				
Vak 7 horizontaal zijvlak	H75/75/8	62%				
Vak 7 hor. knikverkorters	H50/40/5	52%				
Vak 7 schuine knikverkorters	H50/40/5	73%				

Plaats			$UC_{tot,1}$	Verzwaring:			$UC_{tot,2}$
Vak 8	randen	H130/130/12	44%				
Vak 8	diagonalen voor en achter vlak	H120/80/8	139%	uitwisselen voor	H120/120/12	kl 8,8	90%
Vak 8	diagonalen zijvlak	H70/70/5	138%	uitwisselen voor	H70/70/8	kl 8,8	98%
Vak 8	hor. knikverkorters voorvlak	H130/130/10	79%				
Vak 8	hor. knikverkorters zijvlak	H50/40/5	147%	uitwisselen voor	H50/50/8	kl 8,8	82%
Vak 8	schuine knikverkorters voorvlak	H120/80/8	127%	uitwisselen voor	H120/120/10	kl 8,8	81%
Vak 9	bovenrand	H130/130/12	81%				
Vak 9	onderrand	UNP160	96%				
Vak 9	diagonalen voor-en achtervlak	H100/100/8	118%	uitwisselen voor	H100/100/10		**118%**
Vak 9	diagonalen voor-en achtervlak	H120/120/8	117%	uitwisselen voor	H120/120/10		**117%**
Vak 9	verticalen	H50/50/5	17%				
Vak 9	diagonalen ondervlak	H75/75/6	76%				
Vak 10	randen	H100/100/6	127%	extra knikverkoters	H50/50/5		61%
Vak 10	diagonalen voor- en achtervlak	H120/80/8	105%	uitwisselen voor extra schets plaat t=8	H120/120/10		84%
Vak 10	diagonalen zijvlak	H80/80/6	79%				
Vak 10	diagonalen zijvlak	H80/80/10	106%	bouten wisselen		kl 8,8	88%
Vak 10	hor. knikverkorters voorvlak	H45/30/5	68%				
Vak 10	hor. knikverkorters zijvlak	H45/45/5	83%				
Vak 10	schuine knikverkorters voorvlak	H50/40/5	29%				
Vak 11	randen	H80/80/6	36%				
Vak 11	diagonalen voor- en achtervlak	H75/75/6	143%	uitwisselen voor	H75/75/7	kl 8,8	90%
Vak 11	schuine diagonalen zijvlak	H45/30/5	85%				
Vak 11	horizontaal zijvlak	H65/65/6	87%				
Vak 11	hor. voor en achtervlak	H50/40/5	114%	uitwisselen voor	H50/50/6	kl 8,8	82%
Vak 11	schuine diagonaal v.v en a.v	H80/80/6	162%	uitwisselen voor	H80/80/12	kl 8,8	81%
Vak 11	hor. knikverkorters zijvlak	H45/45/5	65%				
Vak 12	bovenrand	H100/100/10	120%	uitwisselen voor nieuwe schets plaat t=12	H100/100/12		80%
Vak 12	onderrand	UNP120	91%				
Vak 12	diagonalen ondervlak	H55/55/5	58%				
Vak 12	diagonalen v.v en a.v	H100/100/6	103%	uitwisselen voor	H100/100/8		62%
Vak 12	diagonalenv.v en a.v	H90/90/6	167%	uitwisselen voor extra bout M16	H90/90/10	kl 8,8	81%
Vak 12	diagonalen v.v en a.v	H50/40/5	217%	uitwisselen voor	H60/60/10	kl 8,8	98%
HV 1	rand	H120/120/11	108%	bouten wisselen		kl 8,8	77%
HV 1	diagonalen	H80/80/6	92%				
HV 1	kruis	H70/70/5	216%	uitwisselen voor	H80/80/10	kl 8,8	79%
HV 2	randen voor- en achtervlak	H110/110/10	166%	uitwisselen voor	H110/110/14	kl 8,8	**110%**
HV 2	randen zijvlak	H80/80/6	52%				
HV 2	diagonalen	H100/100/8	35%				
HV 2	kruis	H60/60/5	179%	uitwisselen voor	H60/60/10		95%

Plaats			$UC_{tot,1}$	Verzwaring:			$UC_{tot,2}$
Tr. 1 en 2	bovenrand	H65/50/5	137%	uitwisselen voor	H65/65/8	kl 8,8	84%
Tr. 1 en 2	onderrand	UNP160	97%				
Tr. 1 en 2	diagonalen v.v en a.v	H50/40/5	89%				
Tr. 1 en 2	diagonalen ondervlak	H75/75/6	84%				
Tr. 1 en 2	diagonalen ondervlak	H55/55/5	90%				
Tr. 3 en 4	bovenrand	H50/40/5	114%	uitwisselen voor	H50/50/6	kl 8,8	83%
Tr. 3 en 4	onderrand	UNP120	34%				
Tr. 3 en 4	diagonalen ondervlak	H50/50/5	69%				
Tr. 5 en 6	bovenrand	H75/75/12	78%	uitwisselen voor nieuwe schets plaat t=12	H75/75/12		78%
Tr. 5 en 6	onderrand	H80/80/6	79%				
Tr. 5 en 6	diagonalen ondervlak	H45/45/5	66%				
Tr. 5 en 6	diagonalen ondervlak	H45/30/5	30%				
Tr. 5 en 6	diagonalen v.v en a.v.	H45/30/5	40%				

5.2 Overzicht verzwaring

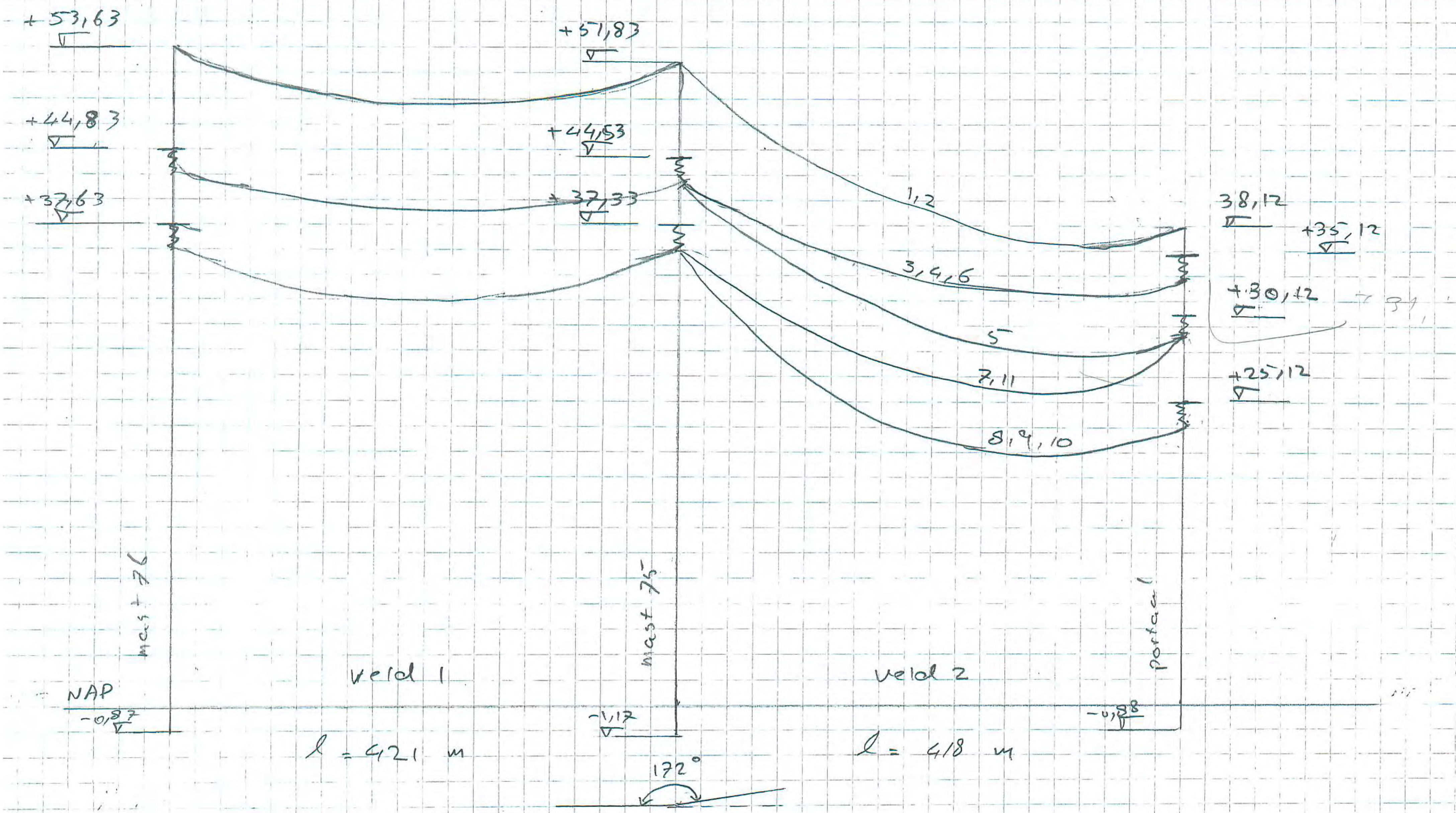




Verzwaring :

Extra knikveroters	L50/50/5	bij randstaven	**Vaknr. 5; 6 en 10**	voor- en achtervlak
Bouten wisselen voor	kl 8.8	bij randstaven	**Vaknr. 1 t/m 6**	voor- en achtervlak
		bij randstaven	**HV 1**	voor- en achtervlak
		bij diagonalen	**Vaknr. 6 en 10**	voorvlak
Bouten	kl 8.8	bij alle nieuwe staven		

Bijlage A Geleiderbelastingen



Mast 75 : fase draad 2x bundel CUR 185 ; eds = 24 %

bliksem " Br 50 ; eds = 24 %

KARAKTERISTIEKE GEGEVENS

Naam hoogspanningslijn	:	150 kv-Lijn Leiden-Zoetermeer
Masttype	:	steunmast
Mastnaam	:	Mast 75 type DD
Mastnummer	:	75
Windgebied	:	II
Bebouwing	:	Onbebouwd
IJsgebied	:	A
Referentie periode	:	50

		VELD 1	VELD 2
Minimum lijnhoek	[graden]	180	164
Maximum lijnhoek	[graden]	180	180
Veldlengte	[m]	421	418
Vaklengte	[m]	839	

* Belastingcombinaties en -factoren: NEN-EN 50341 -1 t/m -3, nov. 2001

* Berekend worden de "Ultimate Limit State" belastingcombinaties, (table 4.2.11/NL.1)

(1a)	Permanente belasting met extreme windbelasting
(1b)	Permanente belasting met extreme koude
(3)	Permanente belasting met extreme ijsbelasting
(4)	Permanente belasting met onderhoudsbelasting
(5a)	Permanente belasting met torsie
(6)	Permanente belasting

* Alle belastingscomponenten zijn exclusief belastingsfactoren, uitgezonderd draadtrekkrachten jTrep

```
* Assenstelsel:   y   ^        Veld 2
                      |
y = lijnrichting      L---> x
                               Veld 1
```

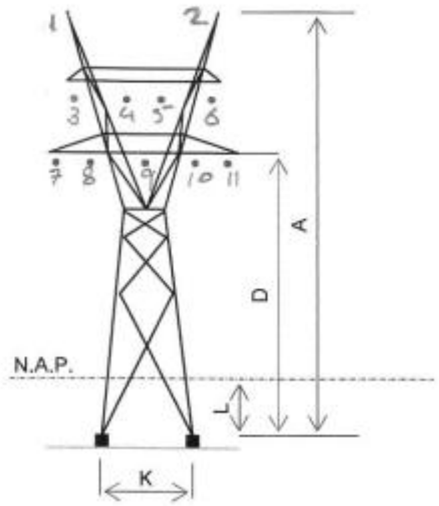
INVOERGEGEVENS VOOR DRAAD No.:1

Geleidersoort	:	bliksemdraad
Geleidersoort + plaats	:	bliksemdr. boventrav
Geleiders veld 1 en 2	:	Br 50
Eigen gewicht draad	[N/m] :	4.43
Draaddoorsnede	[mm2] :	48.36
Draaddiameter	[mm] :	9
Elasticiteitsmodulus	[N/mm2] :	130000
Uitzettingscoëfficiënt	[1/°C] :	0.000017
Breekbelasting draad	[N] :	28390.2
Maximum percentage breekbelasting	[%] :	100
EDS percentage breekbelasting	[%] :	24
Hoogte draadbevestiging	[m] :	53.5

Eigen gewicht isolator	[kN] :	0	0
Lengte isolator	[m] :	0	0
Diameter isolatorschaal	[mm] :	0	0
Hoogte isolator boven maaiveld	[m] :	0	0
Hoogte verschil draadbevestiging	[m] :	1.5	-14.5

(aangrenzende minus beschouwende mast)

(hoger = positief)



Mastnummer	:	75
Draadnummer	:	1,2
Geleidersoort + plaats	:	bliksemdr. boventrav
Geleiders veld 1 en 2	:	Br 50
Veldlengte voor gewicht [m]	:	467.37

BELASTING COMPONENTEN [kN]		GELEIDER		ISOLATOR	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 0.91	- 1.17	0.00	0.00
Qijs;rep		- 3.08	- 3.95	0.00	0.00
Qonderhoud;rep		0.00	0.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	1.65	1.52	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	-0.21	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	-0.03	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	0.83	0.56	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.08	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	0.83	0.99	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.14	0.00	0.00
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	1.65	1.57	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	0.83	0.78	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	0.83	0.78	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	0.00	0.00
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	9.62	8.72	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	-1.23	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	-0.17	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	4.81	3.22	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.45	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	4.81	5.67	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.80	0.00	0.00
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	9.62	8.98	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	4.81	4.49	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	4.81	4.49	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	0.00	0.00

Mastnummer	:	75
Draadnummer	:	1,2
Geleidersoort + plaats	:	bliksemdr. boventrav
Geleiders veld 1 en 2	:	Br 50

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2	
	Hoek t.o.v.lijnrichting	**Min.lijnhoek**	**Max.lijnhoek**	**Min.lijnhoek**	**Max.lijnhoek**
jTrep bij combinatie (1a)	90°	17.81	17.81	17.20	17.32
	0°	8.26	8.26	8.61	8.30
	45°	14.23	14.23	12.69	13.89
	-45°	14.23	14.23	14.96	13.89
jTrep bij combinatie (1b)	90°	9.61	9.61	9.58	9.60
	0°	8.88	8.88	8.94	8.92
	45°	9.25	9.25	9.17	9.27
	-45°	9.25	9.25	9.36	9.27
jTrep bij combinatie (3)	90°	39.15	39.15	38.56	38.66
	0°	33.08	33.08	33.32	33.20
	45°	36.33	36.33	35.35	36.11
	-45°	36.33	36.33	36.84	36.11
jTrep bij combinatie (4)	90°	9.05	9.05	9.02	9.03
	0°	8.35	8.35	8.38	8.37
	45°	8.71	8.71	8.62	8.71
	-45°	8.71	8.71	8.80	8.71
jTrep bij combinatie (5a)	90°	6.88		6.91	
jTrep bij combinatie (6)	90°	9.29		9.33	

Geleidersoort + plaats	:	bliksemdr	aantal draden in bundel:	1
Geleiders veld 1 en 2	:	Br 50		
Veldlengte voor gewicht [m]	:	467,37		

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-0,91	-1,17	0	0	**-0,91**	**-1,17**
Qijs;rep		-3,08	-3,95	0	0	**-3,08**	**-3,95**
Qonderhoud;rep		0	0			**0,00**	**0,00**
BIJ MINIMUM LIJNHOEKEN -						**0,00**	**0,00**
Qw;rep loodrecht lijn,	x	1,65	1,52	0	0	**1,65**	**1,52**
Qw;rep loodrecht lijn,	y	0	-0,21	0	0	**0,00**	**-0,21**
Qw;rep in lijnrichting,	x	0	-0,03	0	0	**0,00**	**-0,03**
Qw;rep in lijnrichting,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (+y, +x),	x	0,83	0,56	0	0	**0,83**	**0,56**
Qw;rep 45 graden (+y, +x),	y	0	-0,08	0	0	**0,00**	**-0,08**
Qw;rep 45 graden (-y, +x),	x	0,83	0,99	0	0	**0,83**	**0,99**
Qw;rep 45 graden (-y, +x),	y	0	-0,14	0	0	**0,00**	**-0,14**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	1,65	1,57	0	0	**1,65**	**1,57**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (+y, +x),	x	0,83	0,78	0	0	**0,83**	**0,78**
Qw;rep 45 graden (+y, +x),	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (-y, +x),	x	0,83	0,78	0	0	**0,83**	**0,78**
Qw;rep 45 graden (-y, +x),	y	0	0	0	0	**0,00**	**0,00**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	9,62	8,72	0	0	**9,62**	**8,72**
Qw;rep loodrecht lijn,	y	0	-1,23	0	0	**0,00**	**-1,23**
Qw;rep in lijnrichting,	x	0	-0,17	0	0	**0,00**	**-0,17**
Qw;rep in lijnrichting,	y	0	0,02	0	0	**0,00**	**0,02**
Qw;rep 45 graden (+y, +x),	x	4,81	3,22	0	0	**4,81**	**3,22**
Qw;rep 45 graden (+y, +x),	y	0	-0,45	0	0	**0,00**	**-0,45**
Qw;rep 45 graden (-y, +x),	x	4,81	5,67	0	0	**4,81**	**5,67**
Qw;rep 45 graden (-y, +x),	y	0	-0,8	0	0	**0,00**	**-0,80**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	9,62	8,98	0	0	**9,62**	**8,98**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (+y, +x),	x	4,81	4,49	0	0	**4,81**	**4,49**
Qw;rep 45 graden (+y, +x),	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (-y, +x),	x	4,81	4,49	0	0	**4,81**	**4,49**
Qw;rep 45 graden (-y, +x),	y	0	0	0	0	**0,00**	**0,00**

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2		**VELD 1**		**VELD 2**	
	Hoek t,o,v,lijnrichting	**Min,lijnh**	**Max,lijnh**	**Min,lijnh**	**Max,lijnhoek**				
jTrep bij combinatie (1a)	90°	17,81	17,81	17,2	17,32	**17,81**	**17,81**	**17,2**	**17,32**
	0°	8,26	8,26	8,61	8,3				
	45°	14,23	14,23	12,69	13,89				
	-45°	14,23	14,23	14,96	13,89				
jTrep bij combinatie (1b)	90°	9,61	9,61	9,58	9,6	**9,61**	**9,61**	**9,58**	**9,6**
	0°	8,88	8,88	8,94	8,92				
	45°	9,25	9,25	9,17	9,27				
	-45°	9,25	9,25	9,36	9,27				
jTrep bij combinatie (3)	90°	39,15	39,15	38,56	38,66	**39,15**	**39,15**	**38,56**	**38,66**
	0°	33,08	33,08	33,32	33,2				
	45°	36,33	36,33	35,35	36,11				
	-45°	36,33	36,33	36,84	36,11				
jTrep bij combinatie (4)	90°	9,05	9,05	9,02	9,03	**9,05**	**9,05**	**9,02**	**9,03**
	0°	8,35	8,35	8,38	8,37				
	45°	8,71	8,71	8,62	8,71				
	-45°	8,71	8,71	8,8	8,71				
jTrep bij combinatie (5a)	90°	6,88		6,91		**6,88**		**6,91**	
jTrep bij combinatie (6)	90°	9,29		9,33		**9,29**		**9,33**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								
jTrep bij combinatie (1b)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								
jTrep bij combinatie (3)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								
jTrep bij combinatie (4)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								

KARAKTERISTIEKE GEGEVENS

Naam hoogspanningslijn	: 150 kv-Lijn Leiden-Zoetermeer
Masttype	: steunmast
Mastnaam	: Mast 75 type DD
Mastnummer	: 75
Windgebied	: II
Bebouwing	: Onbebouwd
IJsgebied	: B
Referentie periode	: 50

		VELD 1	VELD 2
Minimum lijnhoek	[graden]	180	164
Maximum lijnhoek	[graden]	180	180
Veldlengte	[m]	421	418
Vaklengte	[m]	839	

* Belastingcombinaties en -factoren: NEN-EN 50341 -1 t/m -3, nov. 2001

* Berekend worden de "Ultimate Limit State" belastingcombinaties, (table 4.2.11/NL.1)

(1a)	Permanente belasting met extreme windbelasting
(1b)	Permanente belasting met extreme koude
(3)	Permanente belasting met extreme ijsbelasting
(4)	Permanente belasting met onderhoudsbelasting
(5a)	Permanente belasting met torsie
(6)	Permanente belasting

* Alle belastingscomponenten zijn exclusief belastingsfactoren, uitgezonderd draadtrekkrachten jTrep
* Assenstelsel: y ^ Veld 2
|
y = lijnrichting L---> x
Veld 1

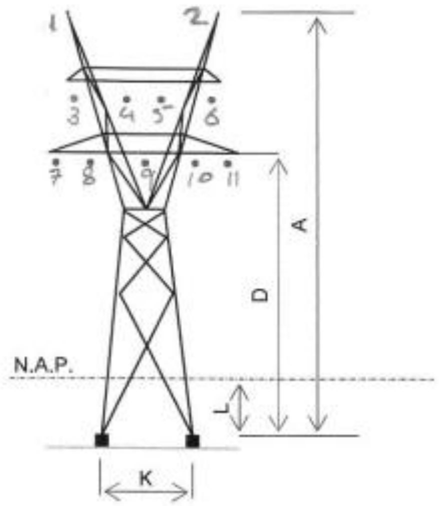
INVOERGEGEVENS VOOR DRAAD No.:1

Geleidersoort	:	fasedraad		
Geleidersoort + plaats	:	fasedr. boventravers		
Geleiders veld 1 en 2	:	CU185		
Eigen gewicht draad	[N/m] :	16.62		
Draaddoorsnede	[mm2] :	181.6		
Draaddiameter	[mm] :	17.5		
Elasticiteitsmodulus	[N/mm2] :	130000		
Uitzettingscoëfficiënt	[1/°C] :	.000017		
Breekbelasting draad	[N] :	72760.5		
Maximum percentage breekbelasting	[%] :	100		
EDS percentage breekbelasting	[%] :	24		
Hoogte draadbevestiging	[m] :	44.7		

Eigen gewicht isolator	[kN] :	2.5	2.5
Lengte isolator	[m] :	2	2
Diameter isolatorschaal	[mm] :	170	170
Hoogte isolator boven maaiveld	[m] :	46.2	46.2
Hoogte verschil draadbevestiging	[m] :	0.3	-9.41

(aangrenzende minus beschouwende mast)

(hoger = positief)



INVOERGEGEVENS VOOR DRAAD No.:2

Geleidersoort	:	fasedraad		
Geleidersoort + plaats	:	fasedr. boventravers		
Geleiders veld 1 en 2	:	CU185		
Eigen gewicht draad	[N/m] :	16.62		
Draaddoorsnede	[mm2] :	181.6		
Draaddiameter	[mm] :	17.5		
Elasticiteitsmodulus	[N/mm2] :	130000		
Uitzettingscoëfficiënt	[1/°C] :	.000017		
Breekbelasting draad	[N] :	72760.5		
Maximum percentage breekbelasting	[%] :	100		
EDS percentage breekbelasting	[%] :	24		
Hoogte draadbevestiging	[m] :	44.7		
Eigen gewicht isolator	[kN] :		2.5	2.5
Lengte isolator	[m] :		2	2
Diameter isolatorschaal	[mm] :		170	170
Hoogte isolator boven maaiveld	[m] :		46.2	46.2
Hoogte verschil draadbevestiging	[m] :		0.3	-14.41

(aangrenzende minus beschouwende mast)

(hoger = positief)

INVOERGEGEVENS VOOR DRAAD No.:3

Geleidersoort	:	fasedraad	
Geleidersoort + plaats	:	fasedr. ondertravers	
Geleiders veld 1 en 2	:	CU185	
Eigen gewicht draad	[N/m] :	16.62	
Draaddoorsnede	[mm2] :	181.6	
Draaddiameter	[mm] :	17.5	
Elasticiteitsmodulus	[N/mm2] :	130000	
Uitzettingscoëfficiënt	[1/°C] :	.000017	
Breekbelasting draad	[N] :	72760.5	
Maximum percentage breekbelasting	[%] :	100	
EDS percentage breekbelasting	[%] :	24	
Hoogte draadbevestiging	[m] :	37.5	

Eigen gewicht isolator	[kN] :	2.5	2.5
Lengte isolator	[m] :	2	2
Diameter isolatorschaal	[mm] :	170	170
Hoogte isolator boven maaiveld	[m] :	39	39
Hoogte verschil draadbevestiging	[m] :	0.3	-7.21

(aangrenzende minus beschouwende mast)

(hoger = positief)

INVOERGEGEVENS VOOR DRAAD No.:4

Geleidersoort	:	fasedraad		
Geleidersoort + plaats	:	fasedr. ondertravers		
Geleiders veld 1 en 2	:	CU185		
Eigen gewicht draad	[N/m] :	16.62		
Draaddoorsnede	[mm2] :	181.6		
Draaddiameter	[mm] :	17.5		
Elasticiteitsmodulus	[N/mm2] :	130000		
Uitzettingscoëfficiënt	[1/°C] :	.000017		
Breekbelasting draad	[N] :	72760.5		
Maximum percentage breekbelasting	[%] :	100		
EDS percentage breekbelasting	[%] :	24		
Hoogte draadbevestiging	[m] :	37.5		
Eigen gewicht isolator	[kN] :		2.5	2.5
Lengte isolator	[m] :		2	2
Diameter isolatorschaal	[mm] :		170	170
Hoogte isolator boven maaiveld	[m] :		39	39
Hoogte verschil draadbevestiging	[m] :		0.3	-12.21

(aangrenzende minus beschouwende mast)

(hoger = positief)

Mastnummer	:	75
Draadnummer	:	3,4,6
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	442.40

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 3.51	- 3.90	- 2.50	- 2.50
Qijs;rep		- 1.59	- 1.77	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.64	2.41	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.34	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.05	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.32	0.89	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.13	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.32	1.57	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.22	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.64	2.48	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.32	1.24	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.32	1.24	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.75	6.16	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.87	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.12	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	3.37	2.28	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.32	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	3.37	4.01	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.56	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.75	6.35	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	3.37	3.17	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	3.37	3.17	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40

Mastnummer	:	75
Draadnummer	:	3,4,6
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

	Hoek t.o.v.lijnrichting	VELD 1 Min.lijnhoek	VELD 1 Max.lijnhoek	VELD 2 Min.lijnhoek	VELD 2 Max.lijnhoek
jTrep bij combinatie (1a)	90°	29.02	29.02	28.33	28.45
	0°	21.38	21.38	21.63	21.47
	45°	25.52	25.52	24.26	25.23
	-45°	25.52	25.52	26.17	25.23
jTrep bij combinatie (1b)	90°	22.54	22.54	22.60	22.60
	0°	22.16	22.16	22.27	22.26
	45°	22.35	22.35	22.39	22.43
	-45°	22.35	22.35	22.48	22.43
jTrep bij combinatie (3)	90°	36.50	36.50	36.28	36.33
	0°	33.31	33.31	33.51	33.45
	45°	34.95	34.95	34.52	34.92
	-45°	34.95	34.95	35.32	34.92
jTrep bij combinatie (4)	90°	27.10	27.10	26.60	26.61
	0°	26.69	26.69	26.25	26.24
	45°	26.89	26.89	26.37	26.42
	-45°	26.89	26.89	26.48	26.42
jTrep bij combinatie (5a)	90°	17.82		17.89	
jTrep bij combinatie (6)	90°	24.05		24.15	

Mastnummer	:	75
Draadnummer	:	5
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	454.97

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 3.51	- 4.11	- 2.50	- 2.50
Qijs;rep		- 1.59	- 1.86	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.64	2.33	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.33	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.05	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.32	0.86	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.12	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.32	1.51	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.21	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.64	2.40	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.32	1.20	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.32	1.20	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.75	5.96	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.84	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.12	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	3.37	2.20	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.31	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	3.37	3.87	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.54	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.75	6.13	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	3.37	3.07	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	3.37	3.07	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40

Mastnummer	:	75
Draadnummer	:	5
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		**VELD 2**	
	Hoek t.o.v.lijnrichting	**Min.lijnhoek**	**Max.lijnhoek**	**Min.lijnhoek**	**Max.lijnhoek**
jTrep bij combinatie (1a)	90°	29.02	29.02	28.02	28.13
	0°	21.38	21.38	21.68	21.53
	45°	25.52	25.52	24.15	25.07
	-45°	25.52	25.52	25.95	25.07
jTrep bij combinatie (1b)	90°	22.54	22.54	22.63	22.64
	0°	22.16	22.16	22.33	22.32
	45°	22.35	22.35	22.44	22.48
	-45°	22.35	22.35	22.52	22.48
jTrep bij combinatie (3)	90°	36.50	36.50	36.20	36.25
	0°	33.31	33.31	33.59	33.54
	45°	34.95	34.95	34.55	34.92
	-45°	34.95	34.95	35.29	34.92
jTrep bij combinatie (4)	90°	27.10	27.10	26.36	26.37
	0°	26.69	26.69	26.03	26.02
	45°	26.89	26.89	26.15	26.20
	-45°	26.89	26.89	26.24	26.20
jTrep bij combinatie (5a)	90°	17.82		17.94	
jTrep bij combinatie (6)	90°	24.05		24.22	

Mastnummer	:	75
Draadnummer	:	7,11
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	436.87

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 3.51	- 3.80	- 2.50	- 2.50
Qijs;rep		- 1.59	- 1.72	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.41	2.20	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.31	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.04	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.21	0.81	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.11	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.21	1.43	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.20	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.41	2.27	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.21	1.13	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.21	1.13	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.18	5.63	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.79	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.11	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	3.09	2.08	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.29	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	3.09	3.66	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.51	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.18	5.80	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	3.09	2.90	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	3.09	2.90	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39

Mastnummer	:	75
Draadnummer	:	7,11
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

	Hoek t.o.v.lijnrichting	VELD 1 Min.lijnhoek	VELD 1 Max.lijnhoek	VELD 2 Min.lijnhoek	VELD 2 Max.lijnhoek
jTrep bij combinatie (1a)	90°	27.93	27.93	27.30	27.40
	0°	21.38	21.38	21.58	21.44
	45°	24.90	24.90	23.80	24.63
	-45°	24.90	24.90	25.43	24.63
jTrep bij combinatie (1b)	90°	22.48	22.48	22.52	22.52
	0°	22.16	22.16	22.24	22.24
	45°	22.32	22.32	22.34	22.38
	-45°	22.32	22.32	22.42	22.38
jTrep bij combinatie (3)	90°	36.00	36.00	35.79	35.83
	0°	33.31	33.31	33.46	33.41
	45°	34.69	34.69	34.31	34.65
	-45°	34.69	34.69	34.98	34.65
jTrep bij combinatie (4)	90°	27.03	27.03	26.65	26.65
	0°	26.69	26.69	26.35	26.34
	45°	26.86	26.86	26.46	26.50
	-45°	26.86	26.86	26.54	26.50
jTrep bij combinatie (5a)	90°	17.82		17.87	
jTrep bij combinatie (6)	90°	24.05		24.13	

Mastnummer	:	75
Draadnummer	:	8,9,10
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	449.44

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 3.51	- 4.02	- 2.50	- 2.50
Qijs;rep		- 1.59	- 1.82	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.41	2.10	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.30	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.04	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.21	0.78	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.11	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.21	1.37	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.19	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.41	2.16	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.21	1.08	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.21	1.08	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.18	5.37	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.76	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.11	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	3.09	1.98	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.28	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	3.09	3.49	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.49	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.18	5.53	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	0.00	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	3.09	2.77	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	3.09	2.77	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39

Mastnummer	:	75
Draadnummer	:	8,9,10
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

	Hoek t.o.v.lijnrichting	VELD 1 Min.lijnhoek	VELD 1 Max.lijnhoek	VELD 2 Min.lijnhoek	VELD 2 Max.lijnhoek
jTrep bij combinatie (1a)	90°	27.93	27.93	26.91	27.00
	0°	21.38	21.38	21.62	21.50
	45°	24.90	24.90	23.66	24.43
	-45°	24.90	24.90	25.17	24.43
jTrep bij combinatie (1b)	90°	22.48	22.48	22.55	22.55
	0°	22.16	22.16	22.30	22.29
	45°	22.32	22.32	22.39	22.42
	-45°	22.32	22.32	22.46	22.42
jTrep bij combinatie (3)	90°	36.00	36.00	35.68	35.72
	0°	33.31	33.31	33.54	33.50
	45°	34.69	34.69	34.32	34.63
	-45°	34.69	34.69	34.93	34.63
jTrep bij combinatie (4)	90°	27.03	27.03	26.39	26.40
	0°	26.69	26.69	26.12	26.11
	45°	26.86	26.86	26.22	26.26
	-45°	26.86	26.86	26.29	26.26
jTrep bij combinatie (5a)	90°	17.82		17.92	
jTrep bij combinatie (6)	90°	24.05		24.19	

Geleidersoort + plaats	:	fasedr. boventravers	aantal draden in bundel:	2
Geleiders veld 1 en 2	:	CU185	Draadnummer	3,4,6
Veldlengte voor gewicht [m]	:	442,4		

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-3,51	-3,9	-2,5	-2,5	**-9,52**	**-10,30**
Qijs;rep		-1,59	-1,77	0	0	**-3,18**	**-3,54**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,64	2,41	0,57	0,57	**5,85**	**5,39**
Qw;rep loodrecht lijn,	y	0	-0,34	0	0	**0,00**	**-0,68**
Qw;rep in lijnrichting,	x	0	-0,05	0	0	**0,00**	**-0,10**
Qw;rep in lijnrichting,	y	0	0,01	0,57	0,57	**0,57**	**0,59**
Qw;rep 45 graden (+y, +x),	x	1,32	0,89	0,4	0,4	**3,04**	**2,18**
Qw;rep 45 graden (+y, +x),	y	0	-0,13	0,4	0,4	**0,40**	**0,14**
Qw;rep 45 graden (-y, +x),	x	1,32	1,57	0,4	0,4	**3,04**	**3,54**
Qw;rep 45 graden (-y, +x),	y	0	-0,22	-0,4	-0,4	**-0,40**	**-0,84**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,64	2,48	0,57	0,57	**5,85**	**5,53**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,32	1,24	0,4	0,4	**3,04**	**2,88**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	1,32	1,24	0,4	0,4	**3,04**	**2,88**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,75	6,16	0,57	0,57	**14,07**	**12,89**
Qw;rep loodrecht lijn,	y	0	-0,87	0	0	**0,00**	**-1,74**
Qw;rep in lijnrichting,	x	0	-0,12	0	0	**0,00**	**-0,24**
Qw;rep in lijnrichting,	y	0	0,02	0,57	0,57	**0,57**	**0,61**
Qw;rep 45 graden (+y, +x),	x	3,37	2,28	0,4	0,4	**7,14**	**4,96**
Qw;rep 45 graden (+y, +x),	y	0	-0,32	0,4	0,4	**0,40**	**-0,24**
Qw;rep 45 graden (-y, +x),	x	3,37	4,01	0,4	0,4	**7,14**	**8,42**
Qw;rep 45 graden (-y, +x),	y	0	-0,56	-0,4	-0,4	**-0,40**	**-1,52**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,75	6,35	0,57	0,57	**14,07**	**13,27**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	3,37	3,17	0,4	0,4	**7,14**	**6,74**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	3,37	3,17	0,4	0,4	**7,14**	**6,74**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	29,02	29,02	28,33	28,45	**58,04**	**58,04**	**56,66**	**56,9**
	0°	21,38	21,38	21,63	21,47				
	45°	25,52	25,52	24,26	25,23				
	-45°	25,52	25,52	26,17	25,23				
jTrep bij combinatie (1b)	90°	22,54	22,54	22,6	22,6	**45,08**	**45,08**	**45,2**	**45,2**
	0°	22,16	22,16	22,27	22,26				
	45°	22,35	22,35	22,39	22,43				
	-45°	22,35	22,35	22,48	22,43				
jTrep bij combinatie (3)	90°	36,5	36,5	36,28	36,33	**73**	**73**	**72,56**	**72,66**
	0°	33,31	33,31	33,51	33,45				
	45°	34,95	34,95	34,52	34,92				
	-45°	34,95	34,95	35,32	34,92				
jTrep bij combinatie (4)	90°	27,1	27,1	26,6	26,61	**54,2**	**54,2**	**53,2**	**53,22**
	0°	26,69	26,69	26,25	26,24				
	45°	26,89	26,89	26,37	26,42				
	-45°	26,89	26,89	26,48	26,42				
jTrep bij combinatie (5a)	90°	17,82		17,89		**35,64**		**35,78**	
jTrep bij combinatie (6)	90°	24,05		24,15		**48,1**		**48,3**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4,2,11/NL,3)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)						**0**	**0**	**0**	**0**
jTrep bij combinatie (1b)						**0**	**0**	**0**	**0**
jTrep bij combinatie (3)						**0**	**0**	**0**	**0**
jTrep bij combinatie (4)						**0**	**0**	**0**	**0**

Geleidersoort + plaats	:	fasedr. boventravers	aantal draden in bundel:	2
Geleiders veld 1 en 2	:	CU185	Draadnummer	5
Veldlengte voor gewicht [m]	:	454,97		

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-3,51	-4,11	-2,5	-2,5	**-9,52**	**-10,72**
Qijs;rep		-1,59	-1,86	0	0	**-3,18**	**-3,72**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,64	2,33	0,57	0,57	**5,85**	**5,23**
Qw;rep loodrecht lijn,	y	0	-0,33	0	0	**0,00**	**-0,66**
Qw;rep in lijnrichting,	x	0	-0,05	0	0	**0,00**	**-0,10**
Qw;rep in lijnrichting,	y	0	0,01	0,57	0,57	**0,57**	**0,59**
Qw;rep 45 graden (+y, +x),	x	1,32	0,86	0,4	0,4	**3,04**	**2,12**
Qw;rep 45 graden (+y, +x),	y	0	-0,12	0,4	0,4	**0,40**	**0,16**
Qw;rep 45 graden (-y, +x),	x	1,32	1,51	0,4	0,4	**3,04**	**3,42**
Qw;rep 45 graden (-y, +x),	y	0	-0,21	-0,4	-0,4	**-0,40**	**-0,82**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,64	2,4	0,57	0,57	**5,85**	**5,37**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,32	1,2	0,4	0,4	**3,04**	**2,80**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	1,32	1,2	0,4	0,4	**3,04**	**2,80**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,75	5,96	0,57	0,57	**14,07**	**12,49**
Qw;rep loodrecht lijn,	y	0	-0,84	0	0	**0,00**	**-1,68**
Qw;rep in lijnrichting,	x	0	-0,12	0	0	**0,00**	**-0,24**
Qw;rep in lijnrichting,	y	0	0,02	0,57	0,57	**0,57**	**0,61**
Qw;rep 45 graden (+y, +x),	x	3,37	2,2	0,4	0,4	**7,14**	**4,80**
Qw;rep 45 graden (+y, +x),	y	0	-0,31	0,4	0,4	**0,40**	**-0,22**
Qw;rep 45 graden (-y, +x),	x	3,37	3,87	0,4	0,4	**7,14**	**8,14**
Qw;rep 45 graden (-y, +x),	y	0	-0,54	-0,4	-0,4	**-0,40**	**-1,48**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,75	6,13	0,57	0,57	**14,07**	**12,83**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	3,37	3,07	0,4	0,4	**7,14**	**6,54**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	3,37	3,07	0,4	0,4	**7,14**	**6,54**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

	VEL	VELD 2				VELD 1		VELD 2	
	Hoe	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	29,02	29,02	28,02	28,13	**58,04**	**58,04**	**56,04**	**56,26**
	0°	21,38	21,38	21,68	21,53				
	45°	25,52	25,52	24,15	25,07				
	-45°	25,52	25,52	25,95	25,07				
jTrep bij combinatie (1b)	90°	22,54	22,54	22,63	22,64	**45,08**	**45,08**	**45,26**	**45,28**
	0°	22,16	22,16	22,33	22,32				
	45°	22,35	22,35	22,44	22,48				
	-45°	22,35	22,35	22,52	22,48				
jTrep bij combinatie (3)	90°	36,5	36,5	36,2	36,25	**73**	**73**	**72,4**	**72,5**
	0°	33,31	33,31	33,59	33,54				
	45°	34,95	34,95	34,55	34,92				
	-45°	34,95	34,95	35,29	34,92				
jTrep bij combinatie (4)	90°	27,1	27,1	26,36	26,37	**54,2**	**54,2**	**52,72**	**52,74**
	0°	26,69	26,69	26,03	26,02				
	45°	26,89	26,89	26,15	26,2				
	-45°	26,89	26,89	26,24	26,2				
jTrep bij combinatie (5a)	90°	17,82		17,94		**35,64**		**35,88**	
jTrep bij combinatie (6)	90°	24,05		24,22		**48,1**		**48,44**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								
jTrep bij combinatie (1b)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								
jTrep bij combinatie (3)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								
jTrep bij combinatie (4)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								

Geleidersoort + plaats	:	fasedr. ondertravers	aantal draden in bundel:	2
Geleiders veld 1 en 2	:	CU185	Draadnummer	7,11
Veldlengte voor gewicht [m]	:	436,87		

BELASTING COMPONENTEN [kN]		GELEIDER		ISOLATOR			
		VELD 1	VELD 2	VELD 1	VELD 2	VELD 1	VELD 2
Grep		-3,51	-3,8	-2,5	-2,5	-9,52	-10,10
Qijs;rep		-1,59	-1,72	0	0	-3,18	-3,44
Qonderhoud;rep		-1	-1			-1,00	-1,00
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,41	2,2	0,55	0,55	5,37	4,95
Qw;rep loodrecht lijn,	y	0	-0,31	0	0	0,00	-0,62
Qw;rep in lijnrichting,	x	0	-0,04	0	0	0,00	-0,08
Qw;rep in lijnrichting,	y	0	0,01	0,55	0,55	0,55	0,57
Qw;rep 45 graden (+y, +x),	x	1,21	0,81	0,39	0,39	2,81	2,01
Qw;rep 45 graden (+y, +x),	y	0	-0,11	0,39	0,39	0,39	0,17
Qw;rep 45 graden (-y, +x),	x	1,21	1,43	0,39	0,39	2,81	3,25
Qw;rep 45 graden (-y, +x),	y	0	-0,2	-0,39	-0,39	-0,39	-0,79
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,41	2,27	0,55	0,55	5,37	5,09
Qw;rep loodrecht lijn,	y	0	0	0	0	0,00	0,00
Qw;rep in lijnrichting,	x	0	0	0	0	0,00	0,00
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	0,55	0,55
Qw;rep 45 graden (+y, +x),	x	1,21	1,13	0,39	0,39	2,81	2,65
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	0,39	0,39
Qw;rep 45 graden (-y, +x),	x	1,21	1,13	0,39	0,39	2,81	2,65
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	-0,39	-0,39
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,18	5,63	0,55	0,55	12,91	11,81
Qw;rep loodrecht lijn,	y	0	-0,79	0	0	0,00	-1,58
Qw;rep in lijnrichting,	x	0	-0,11	0	0	0,00	-0,22
Qw;rep in lijnrichting,	y	0	0,02	0,55	0,55	0,55	0,59
Qw;rep 45 graden (+y, +x),	x	3,09	2,08	0,39	0,39	6,57	4,55
Qw;rep 45 graden (+y, +x),	y	0	-0,29	0,39	0,39	0,39	-0,19
Qw;rep 45 graden (-y, +x),	x	3,09	3,66	0,39	0,39	6,57	7,71
Qw;rep 45 graden (-y, +x),	y	0	-0,51	-0,39	-0,39	-0,39	-1,41
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,18	5,8	0,55	0,55	12,91	12,15
Qw;rep loodrecht lijn,	y	0	0	0	0	0,00	0,00
Qw;rep in lijnrichting,	x	0	0	0	0	0,00	0,00
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	0,55	0,55
Qw;rep 45 graden (+y, +x),	x	3,09	2,9	0,39	0,39	6,57	6,19
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	0,39	0,39
Qw;rep 45 graden (-y, +x),	x	3,09	2,9	0,39	0,39	6,57	6,19
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	-0,39	-0,39

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	27,93	27,93	27,3	27,4	55,86	55,86	54,6	54,8
	0°	21,38	21,38	21,58	21,44				
	45°	24,9	24,9	23,8	24,63				
	-45°	24,9	24,9	25,43	24,63				
jTrep bij combinatie (1b)	90°	22,48	22,48	22,52	22,52	44,96	44,96	45,04	45,04
	0°	22,16	22,16	22,24	22,24				
	45°	22,32	22,32	22,34	22,38				
	-45°	22,32	22,32	22,42	22,38				
jTrep bij combinatie (3)	90°	36	36	35,79	35,83	72	72	71,58	71,66
	0°	33,31	33,31	33,46	33,41				
	45°	34,69	34,69	34,31	34,65				
	-45°	34,69	34,69	34,98	34,65				
jTrep bij combinatie (4)	90°	27,03	27,03	26,65	26,65	54,06	54,06	53,3	53,3
	0°	26,69	26,69	26,35	26,34				
	45°	26,86	26,86	26,46	26,5				
	-45°	26,86	26,86	26,54	26,5				
jTrep bij combinatie (5a)	90°	17,82		17,87		35,64		35,74	
jTrep bij combinatie (6)	90°	24,05		24,13		48,1		48,26	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4,2,11/NL,3)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)						**0**	**0**	**0**	**0**
jTrep bij combinatie (1b)						**0**	**0**	**0**	**0**
jTrep bij combinatie (3)						**0**	**0**	**0**	**0**
jTrep bij combinatie (4)						**0**	**0**	**0**	**0**

Geleidersoort + plaats	:	fasedr. ondertravers	aantal draden in bundel:	2	
Geleiders veld 1 en 2	:	CU185	Draadnummer	8,9,10	
Veldlengte voor gewicht [m]	:	449,44			

BELASTING COMPONENTEN [kN]

		GELEIDER		ISOLATOR			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-3,51	-4,02	-2,5	-2,5	**-9,52**	**-10,54**
Qijs;rep		-1,59	-1,82	0	0	**-3,18**	**-3,64**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,41	2,1	0,55	0,55	**5,37**	**4,75**
Qw;rep loodrecht lijn,	y	0	-0,3	0	0	**0,00**	**-0,60**
Qw;rep in lijnrichting,	x	0	-0,04	0	0	**0,00**	**-0,08**
Qw;rep in lijnrichting,	y	0	0,01	0,55	0,55	**0,55**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,21	0,78	0,39	0,39	**2,81**	**1,95**
Qw;rep 45 graden (+y, +x),	y	0	-0,11	0,39	0,39	**0,39**	**0,17**
Qw;rep 45 graden (-y, +x),	x	1,21	1,37	0,39	0,39	**2,81**	**3,13**
Qw;rep 45 graden (-y, +x),	y	0	-0,19	-0,39	-0,39	**-0,39**	**-0,77**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,41	2,16	0,55	0,55	**5,37**	**4,87**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	**0,55**	**0,55**
Qw;rep 45 graden (+y, +x),	x	1,21	1,08	0,39	0,39	**2,81**	**2,55**
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	**0,39**	**0,39**
Qw;rep 45 graden (-y, +x),	x	1,21	1,08	0,39	0,39	**2,81**	**2,55**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	**-0,39**	**-0,39**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,18	5,37	0,55	0,55	**12,91**	**11,29**
Qw;rep loodrecht lijn,	y	0	-0,76	0	0	**0,00**	**-1,52**
Qw;rep in lijnrichting,	x	0	-0,11	0	0	**0,00**	**-0,22**
Qw;rep in lijnrichting,	y	0	0,01	0,55	0,55	**0,55**	**0,57**
Qw;rep 45 graden (+y, +x),	x	3,09	1,98	0,39	0,39	**6,57**	**4,35**
Qw;rep 45 graden (+y, +x),	y	0	-0,28	0,39	0,39	**0,39**	**-0,17**
Qw;rep 45 graden (-y, +x),	x	3,09	3,49	0,39	0,39	**6,57**	**7,37**
Qw;rep 45 graden (-y, +x),	y	0	-0,49	-0,39	-0,39	**-0,39**	**-1,37**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,18	5,53	0,55	0,55	**12,91**	**11,61**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	**0,55**	**0,55**
Qw;rep 45 graden (+y, +x),	x	3,09	2,77	0,39	0,39	**6,57**	**5,93**
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	**0,39**	**0,39**
Qw;rep 45 graden (-y, +x),	x	3,09	2,77	0,39	0,39	**6,57**	**5,93**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	**-0,39**	**-0,39**

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2		**VELD 1**		**VELD 2**	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	27,93	27,93	26,91	27	**55,86**	**55,86**	**53,82**	**54**
	0°	21,38	21,38	21,62	21,5				
	45°	24,9	24,9	23,66	24,43				
	-45°	24,9	24,9	25,17	24,43				
jTrep bij combinatie (1b)	90°	22,48	22,48	22,55	22,55	**44,96**	**44,96**	**45,1**	**45,1**
	0°	22,16	22,16	22,3	22,29				
	45°	22,32	22,32	22,39	22,42				
	-45°	22,32	22,32	22,46	22,42				
jTrep bij combinatie (3)	90°	36	36	35,68	35,72	**72**	**72**	**71,36**	**71,44**
	0°	33,31	33,31	33,54	33,5				
	45°	34,69	34,69	34,32	34,63				
	-45°	34,69	34,69	34,93	34,63				
jTrep bij combinatie (4)	90°	27,03	27,03	26,39	26,4	**54,06**	**54,06**	**52,78**	**52,8**
	0°	26,69	26,69	26,12	26,11				
	45°	26,86	26,86	26,22	26,26				
	-45°	26,86	26,86	26,29	26,26				
jTrep bij combinatie (5a)	90°	17,82		17,92		**35,64**		**35,84**	
jTrep bij combinatie (6)	90°	24,05		24,19		**48,1**		**48,38**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4,2,11/NL,3)

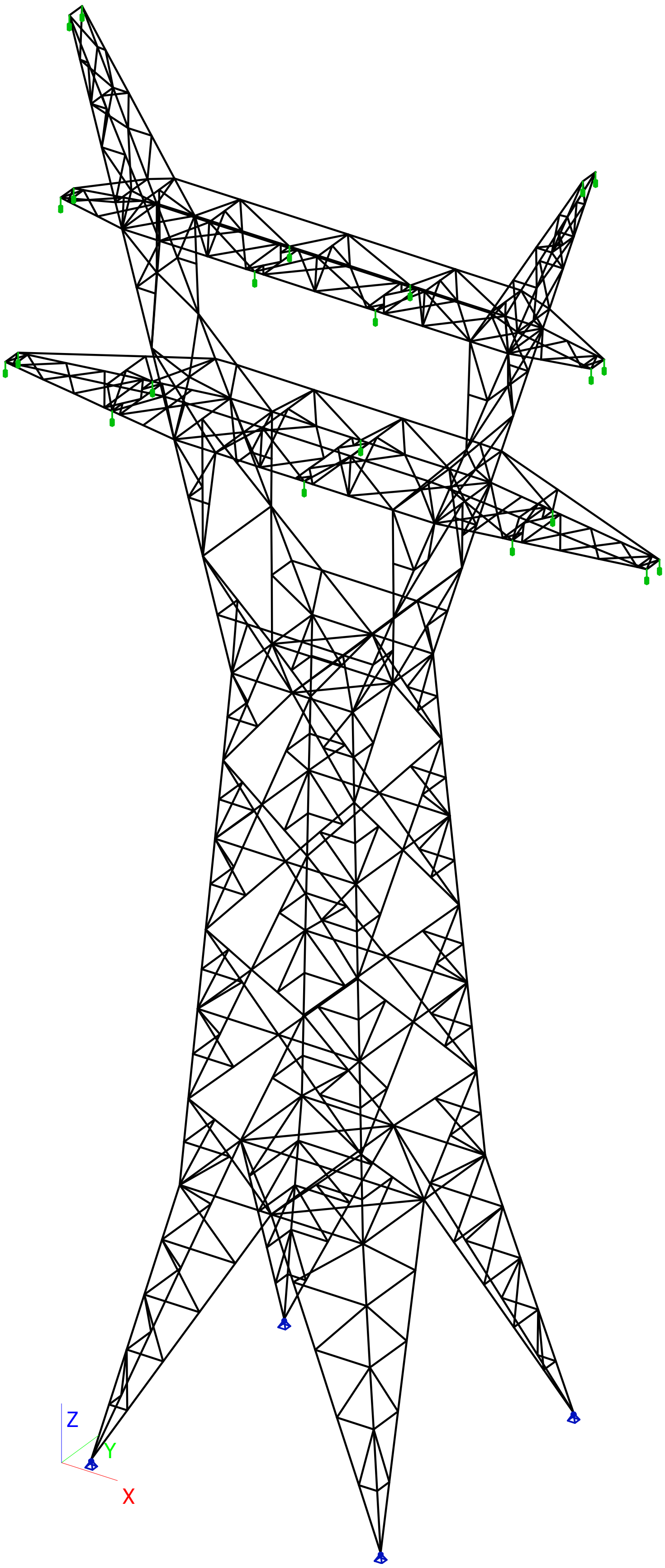
		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)						**0**	**0**	**0**	**0**
jTrep bij combinatie (1b)						**0**	**0**	**0**	**0**
jTrep bij combinatie (3)						**0**	**0**	**0**	**0**
jTrep bij combinatie (4)						**0**	**0**	**0**	**0**

Bijlage B Berekening Mast 75; Scia Engineer

Licentienaam	Onbekend
Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 75
Omschrijving	Controle berekening
Auteur	MG
Datum	27-03-2014
Constructie	Algemeen XYZ
Aantal knopen :	402
Aantal staven :	694
Aantal gebruikte doorsneden :	101
Aantal belastingsgevallen :	60
Aantal gebruikte materialen :	2
Gravitatieversnelling [m/s^2]	9,810
Nationale norm	EC - EN

1. Inhoudsopgave

2. Overzicht rekenmodel



Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 75
Omschrijving	Controle berekening
Nationale norm	EC - EN
Auteur	MG

3. Knoop

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K1	-8,904	-0,682	49,980
K2	-9,553	0,000	49,980
K3	-10,100	-0,541	51,489
K5	-9,553	0,682	49,980
K7	-10,100	0,541	51,489
K9	-9,553	-0,682	49,980
K13	-9,014	0,821	48,490
K15	-8,333	0,000	46,609
K17	-9,014	-0,821	48,490
K21	-9,764	0,543	51,470
K24	-8,905	0,682	49,980
K28	-8,045	0,821	48,490
K29	-8,333	0,996	46,609
K31	-9,764	-0,543	51,470
K38	-8,045	-0,821	48,490
K39	-8,333	-0,996	46,609
K43	-8,004	-1,081	45,700
K47	-7,279	0,000	43,700
K55	-7,279	-1,268	43,700
K56	-7,279	1,268	43,700
K61	-5,929	1,616	39,971
K63	-5,397	-1,753	38,500
K65	-5,929	-1,616	39,971
K67	-5,938	0,000	39,994
K69	-3,952	2,126	34,509
K70	-5,397	0,000	38,500
K72	-4,676	1,060	36,510
K75	-3,952	-2,126	34,509
K77	-4,678	-1,939	36,515
K78	-4,676	-1,060	36,510
K81	4,678	1,939	36,515
K82	3,814	1,939	36,514
K83	3,677	1,753	38,500
K90	-3,226	2,313	32,505
K91	-2,500	2,500	30,500
K93	0,000	2,500	30,500
K95	-3,226	1,063	32,505
K99	-2,500	0,000	30,500
K102	-2,500	-2,500	30,500
K103	-3,226	-1,063	32,505
K104	-3,226	-2,313	32,505
K109	0,000	-2,500	30,500
K111	3,226	2,313	32,505
K112	2,500	2,500	30,500
K115	8,904	0,682	49,980
K116	9,553	0,000	49,980
K117	8,904	-0,682	49,980
K118	10,100	-0,541	51,489
K120	9,553	0,682	49,980
K122	10,100	0,541	51,489
K124	9,553	-0,682	49,980
K128	9,014	0,821	48,490
K130	8,333	0,000	46,609
K132	9,014	-0,821	48,490
K136	9,764	0,543	51,470
K143	8,045	0,821	48,490
K144	8,333	0,996	46,609
K146	9,764	-0,543	51,470
K153	8,045	-0,821	48,490
K154	8,333	-0,997	46,609
K156	8,004	1,081	45,700
K158	8,004	-1,081	45,700
K162	7,279	0,000	43,700
K170	7,279	-1,268	43,700
K171	7,279	1,268	43,700
K173	-7,185	0,001	47,000

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K176	6,434	-1,080	45,700
K177	7,185	0,001	47,000
K186	-2,498	1,081	45,700
K190	-4,465	1,081	45,700
K191	-4,465	0,000	47,000
K194	-4,465	-1,081	45,700
K198	-6,435	-1,081	45,700
K201	-2,498	-1,081	45,700
K205	4,465	0,960	47,000
K206	6,435	1,081	45,700
K207	2,498	1,081	45,700
K211	4,465	1,081	45,700
K212	4,465	0,000	47,000
K215	4,465	-1,081	45,700
K217	4,465	-0,960	47,000
K219	6,435	-1,081	45,700
K222	2,498	-1,081	45,700
K224	0,000	1,081	45,700
K226	0,000	0,000	47,000
K227	0,000	-1,081	45,700
K233	-7,185	0,960	47,000
K235	-7,185	-0,960	47,000
K243	-6,480	1,268	43,700
K245	-6,480	-1,268	43,700
K254	-11,000	-0,400	45,700
K256	-10,647	0,400	53,000
K261	7,185	0,960	47,000
K264	11,000	0,400	45,700
K267	7,185	-0,960	47,000
K269	6,480	1,268	43,700
K271	6,480	-1,268	43,700
K282	11,000	-0,400	45,700
K284	10,647	0,400	53,000
K291	-3,677	1,753	38,500
K294	-5,042	1,614	39,996
K298	5,929	1,616	39,971
K301	5,397	1,753	38,500
K302	5,042	1,614	39,996
K306	-5,042	-1,614	39,996
K307	-3,677	-1,753	38,500
K311	-9,194	-0,811	45,700
K312	-10,645	0,481	45,700
K314	-9,194	0,811	45,700
K315	-10,645	-0,481	45,700
K325	-10,647	-0,400	53,000
K335	-6,435	1,081	45,700
K337	-4,471	-1,081	45,700
K339	-2,861	1,081	45,700
K343	-2,861	-1,081	45,700
K345	-2,145	0,000	45,700
K352	9,194	-0,811	45,700
K353	10,645	0,481	45,700
K355	9,194	0,811	45,700
K356	10,645	-0,481	45,700
K372	2,855	1,081	45,700
K376	2,855	-1,081	45,700
K378	2,145	0,000	45,700
K388	-8,004	1,081	45,700
K394	-1,837	1,753	38,500
K395	-1,840	0,000	39,996
K396	1,837	1,753	38,500
K397	1,840	0,000	39,996
K400	-8,543	-0,008	39,449
K401	-8,297	-1,256	38,500
K403	-8,297	1,256	38,500
K404	-1,837	-1,753	38,500

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K406	1,837	-1,753	38,500
K408	-1,840	-1,614	39,996
K409	-1,840	1,614	39,996
K410	1,840	-1,614	39,996
K411	1,840	1,614	39,996
K414	0,000	1,753	38,500
K420	-13,297	0,400	38,500
K423	-8,543	1,185	39,449
K424	13,297	0,400	38,500
K426	8,297	1,256	38,500
K428	8,543	1,185	39,449
K429	-13,297	-0,400	38,500
K433	-8,543	-1,185	39,449
K434	0,000	-1,753	38,500
K438	3,677	-1,753	38,500
K444	5,397	-1,753	38,500
K447	5,397	0,000	38,500
K448	4,676	1,060	36,510
K451	3,226	1,063	32,505
K456	3,952	-2,126	34,509
K458	13,297	-0,400	38,500
K459	5,929	-1,616	39,971
K460	8,297	-1,256	38,500
K462	8,543	-1,185	39,449
K469	4,678	-1,939	36,515
K470	4,676	-1,060	36,510
K473	-3,677	0,000	38,500
K493	-11,512	0,706	38,500
K494	-12,942	-0,461	38,500
K495	-10,082	0,951	38,500
K496	-11,512	-0,706	38,500
K497	-8,652	1,196	38,500
K498	-10,082	-0,951	38,500
K504	-12,942	0,461	38,500
K507	-8,652	-1,196	38,500
K515	-7,942	0,000	38,500
K519	-7,942	-1,317	38,500
K520	-7,942	1,317	38,500
K521	-6,838	-1,506	38,500
K522	-6,838	1,507	38,500
K527	3,677	0,000	38,500
K531	0,352	0,000	38,500
K532	-0,358	-0,886	38,500
K534	0,352	-1,753	38,500
K538	8,543	-0,008	39,449
K544	-0,358	1,753	38,500
K545	-0,358	-1,753	38,500
K546	5,938	0,000	39,994
K550	11,512	-0,706	38,500
K551	12,942	0,461	38,500
K552	10,082	-0,951	38,500
K553	11,512	0,706	38,500
K554	8,652	-1,196	38,500
K555	10,082	0,951	38,500
K561	12,942	-0,461	38,500
K564	8,652	1,196	38,500
K572	7,942	0,000	38,500
K576	7,942	1,317	38,500
K577	7,942	-1,317	38,500
K578	6,837	1,506	38,500
K579	6,837	-1,506	38,500
K589	-0,358	0,886	38,500
K591	0,352	1,753	38,500
K598	5,042	-1,614	39,996
K601	3,813	-1,939	36,514
K605	3,226	-1,063	32,505

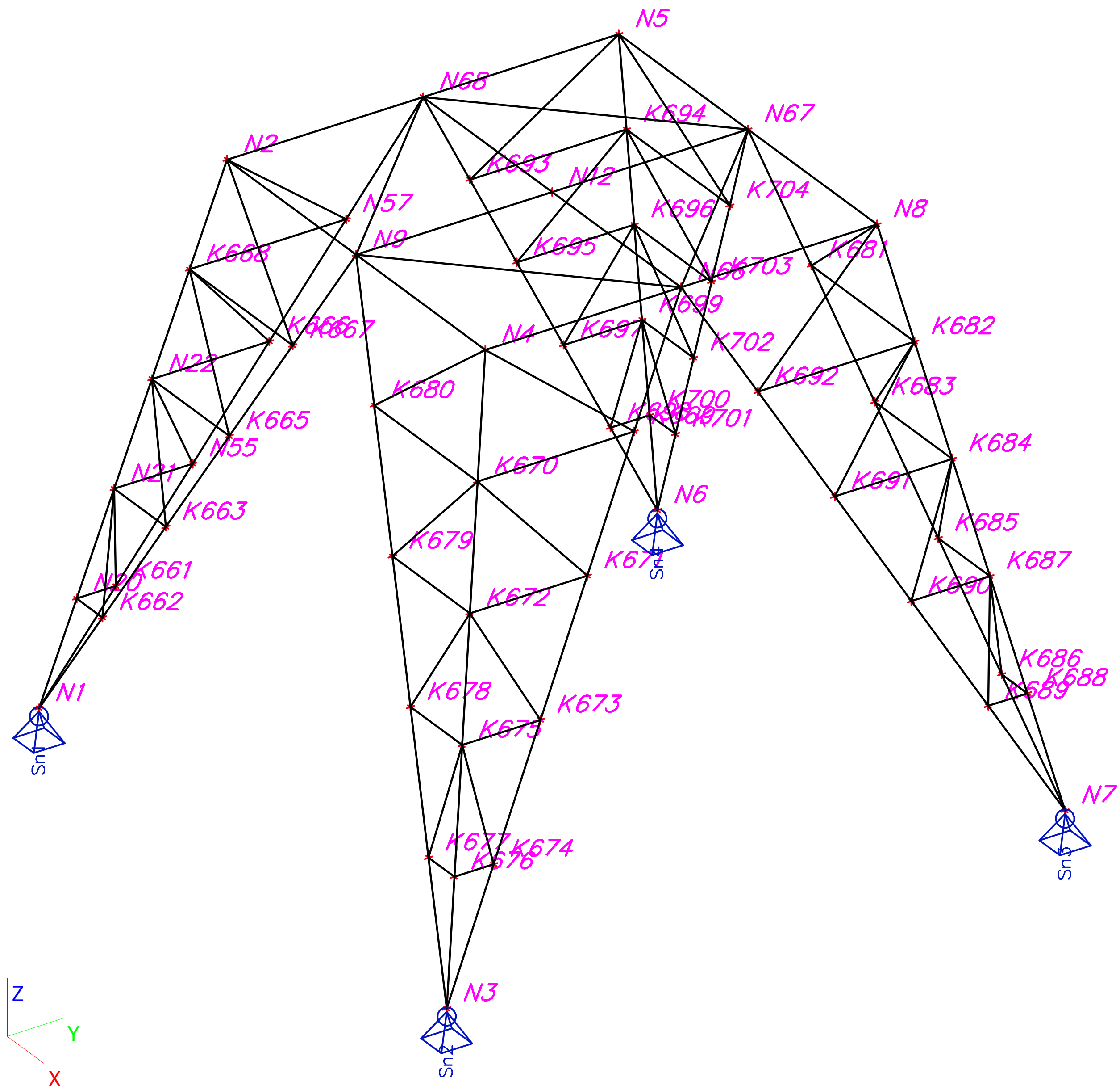
Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K606	3,226	-2,313	32,505
K618	10,647	-0,400	53,000
K619	-6,526	-1,462	41,620
K620	-6,526	1,462	41,620
K621	6,526	1,462	41,620
K622	6,527	-1,462	41,621
K623	-4,465	0,960	47,000
N1	-6,000	-6,000	0,000
N2	-3,800	-3,800	10,500
N3	6,000	-6,000	0,000
N4	3,800	-3,800	10,500
N5	-3,800	3,800	10,500
N6	-6,000	6,000	0,000
N7	6,000	6,000	0,000
N8	3,800	3,800	10,500
N20	-5,560	-5,560	2,100
N21	-5,120	-5,120	4,200
N22	-4,680	-4,680	6,300
N55	-5,120	-3,600	4,200
N57	-4,240	-1,200	8,400
N59	-3,582	-3,582	13,860
N61	3,582	-3,582	13,860
N62	-3,582	3,582	13,860
N65	3,582	3,582	13,860
N9	0,000	-3,800	10,500
N66	3,800	0,000	10,500
N67	0,000	3,800	10,500
N68	-3,800	0,000	10,500
N69	-3,691	-3,691	12,180
N14	-1,791	-3,691	12,180
N15	3,691	-3,691	12,180
N16	1,791	-3,691	12,180
N17	3,691	-1,791	12,180
N18	3,691	1,791	12,180
N19	3,691	3,691	12,180
N70	1,791	3,691	12,180
N71	-1,791	3,691	12,180
N72	-3,691	3,691	12,180
N73	-3,691	1,791	12,180
N74	-3,691	-1,791	12,180
N76	-3,151	-3,151	20,480
N78	3,151	-3,151	20,480
N79	-3,151	3,151	20,480
N82	3,151	3,151	20,480
N83	-3,353	-3,353	17,382
N84	3,353	-3,353	17,382
N85	3,353	3,353	17,382
N86	-3,353	3,353	17,382
N87	1,791	-3,467	15,621
N88	3,467	-3,467	15,621
N89	3,467	-1,791	15,621
N90	3,467	1,791	15,621
N91	3,467	3,467	15,621
N92	1,791	3,467	15,621
N93	-1,791	3,467	15,621
N94	-3,467	3,467	15,621
N95	-3,467	1,791	15,621
N96	-3,467	-1,791	15,621
N97	-3,467	-3,467	15,621
N98	-1,791	-3,467	15,621
N99	1,576	-3,252	18,931
N100	3,252	-3,252	18,931
N101	3,252	-1,576	18,931
N102	3,252	1,575	18,931
N33	3,252	3,252	18,931
N103	1,576	3,252	18,931
N104	-1,576	3,252	18,931
N105	-3,252	3,252	18,931

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
N106	-3,252	1,575	18,931
N38	-3,252	-1,576	18,931
N107	-3,252	-3,252	18,931
N108	-1,576	-3,252	18,931
N114	-2,720	-2,721	27,100
N116	2,721	-2,721	27,100
N117	-2,720	2,720	27,100
N120	2,721	2,720	27,100
N121	-2,920	-2,920	24,033
N122	2,920	-2,920	24,033
N123	2,920	2,920	24,033
N124	-2,920	2,920	24,033
N125	1,576	-3,036	22,256
N126	3,036	-3,036	22,256
N127	3,036	-1,576	22,256
N128	3,036	1,575	22,256
N129	3,036	3,035	22,256
N130	1,576	3,035	22,256
N131	-1,576	3,035	22,256
N132	-3,036	3,035	22,256
N133	-3,036	1,575	22,256
N134	-3,036	-1,576	22,256
N135	-3,036	-3,036	22,256
N136	-1,576	-3,036	22,256
N137	1,361	-2,821	25,566
N138	2,821	-2,821	25,566
N139	2,821	-1,361	25,566
N140	2,821	1,360	25,566
N141	2,821	2,820	25,566
N142	1,361	2,820	25,566
N143	-1,360	2,820	25,566
N144	-2,820	2,820	25,566
N145	-2,820	1,360	25,566
N146	-2,820	-1,361	25,566
N147	-2,820	-2,821	25,566
N148	-1,360	-2,821	25,566
N149	2,920	0,000	24,033
N150	0,000	2,920	24,033
N151	-2,920	0,000	24,033
N152	0,000	-2,920	24,033
N156	2,500	-2,500	30,500
N165	-2,610	-2,611	28,800
N166	-1,360	-2,611	28,800
N167	1,360	-2,611	28,800
N168	2,610	-2,611	28,800
N169	2,610	-1,361	28,800
N170	2,610	1,360	28,800
N171	2,610	2,610	28,800
N172	1,361	2,610	28,800
N173	-1,360	2,610	28,800
N174	-2,610	2,610	28,800
N175	-2,610	1,360	28,800
N176	-2,610	-1,361	28,800
K624	-0,358	0,000	38,500
K625	2,500	-0,001	30,500
K626	-5,397	1,753	38,500
K627	-4,464	-0,960	47,000
K628	3,952	2,126	34,509
K629	-3,814	-1,939	36,515
K630	-3,814	1,939	36,515
N12	0,000	0,000	10,500
N183	0,000	0,000	30,500
N191	0,000	0,960	47,000
N192	0,000	-0,960	47,000
K631	-11,000	0,400	45,700
K661	-5,560	-4,800	2,100
K662	-4,800	-5,560	2,100
K663	-3,600	-5,120	4,200

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K665	-2,400	-4,680	6,300
K666	-4,680	-2,400	6,300
K667	-1,200	-4,240	8,400
K668	-4,240	-4,240	8,400
K669	4,240	-1,200	8,400
K670	4,240	-4,240	8,400
K671	4,680	-2,400	6,300
K672	4,680	-4,680	6,300
K673	5,120	-3,600	4,200
K674	5,560	-4,800	2,100
K675	5,120	-5,120	4,200
K676	5,560	-5,560	2,100
K677	4,800	-5,560	2,100
K678	3,600	-5,120	4,200
K679	2,400	-4,680	6,300
K680	1,200	-4,240	8,400
K681	1,200	4,240	8,400
K682	4,240	4,240	8,400
K683	2,400	4,680	6,300
K684	4,680	4,680	6,300
K685	3,600	5,120	4,200
K686	4,800	5,560	2,100
K687	5,120	5,120	4,200
K688	5,560	5,560	2,100
K689	5,560	4,800	2,100
K690	5,120	3,600	4,200
K691	4,680	2,400	6,300
K692	4,240	1,200	8,400
K693	-4,240	1,200	8,400
K694	-4,240	4,240	8,400
K695	-4,680	2,400	6,300
K696	-4,680	4,680	6,300
K697	-5,120	3,600	4,200
K698	-5,560	4,800	2,100
K699	-5,120	5,120	4,200
K700	-5,560	5,560	2,100
K701	-4,800	5,560	2,100
K702	-3,600	5,120	4,200
K703	-2,400	4,680	6,300
K704	-1,200	4,240	8,400
N247	0,000	-3,353	17,382
K706	3,353	0,000	17,382
K709	0,000	3,353	17,382
K712	-3,353	0,000	17,382
K714	-6,838	0,000	38,500
K715	6,837	0,000	38,500
K716	1,976	2,313	32,505
K717	-1,976	2,313	32,505
K718	-1,976	-2,313	32,505
K719	1,976	-2,313	32,505
K720	-4,678	1,939	36,515
K721	6,526	-1,462	41,620
K728	6,527	1,462	41,621
K729	8,684	0,000	45,700
K731	2,500	0,541	45,700
K732	2,145	1,081	45,700
K733	2,500	-0,541	45,700
K734	2,145	-1,081	45,700
K735	-2,503	-0,541	45,700
K736	-2,145	-1,081	45,700
K737	-2,503	0,541	45,700
K738	-2,145	1,081	45,700
K739	-0,003	1,320	38,500
K740	-0,003	-1,320	38,500
K741	8,297	0,598	38,500
K742	8,297	-0,598	38,500
K743	-8,297	0,598	38,500
K744	-8,297	-0,598	38,500

	Project	150 kV lijn Leiden - Zoetermeer
D&C ENGINEERING	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

4. Knoopnummers steunpunten



5. 1D-staaf

Naam	Doorsnede	Lengte [m]	Type	Laag
S1	CS140 - L45X30X5	0,941	Balk (80)	CrossArm6
S2	CS138 - L45X5	1,862	Kolom (100)	CrossArm6
S3	CS137 - L45X30X5	2,018	Kolom (100)	CrossArm6
S4	CS138 - L45X5	1,862	Kolom (100)	CrossArm6
S5	CS137 - L45X30X5	2,018	Kolom (100)	CrossArm6
S6	CS136 - L45X5	1,364	Balk (80)	CrossArm6
S7	CS135 - L45X30X5	2,184	Kolom (100)	CrossArm6
S8	CS134 - L45X5	2,162	Kolom (100)	CrossArm6
S9	CS135 - L45X30X5	2,184	Kolom (100)	CrossArm6
S10	CS134 - L45X5	2,162	Kolom (100)	CrossArm6
S11	CS140 - L45X30X5	1,511	Kolom (100)	CrossArm6
S12	CS140 - L45X30X5	0,336	Balk (80)	CrossArm6
S13	CS140 - L45X30X5	1,501	Kolom (100)	CrossArm6
S14	CS138 - L45X5	0,649	Balk (80)	CrossArm6
S15	CS139 - L50X40X5	1,911	Kolom (100)	CrossArm6
S16	CS140 - L45X30X5	0,969	Balk (80)	CrossArm6
S17	CS140 - L45X30X5	1,511	Kolom (100)	CrossArm6
S18	CS140 - L45X30X5	0,336	Balk (80)	CrossArm6
S19	CS140 - L45X30X5	1,501	Kolom (100)	CrossArm6
S20	CS138 - L45X5	0,649	Balk (80)	CrossArm6
S21	CS139 - L50X40X5	1,911	Kolom (100)	CrossArm6
S22	CS140 - L45X30X5	0,969	Balk (80)	CrossArm6
S23	CS130 - L45X30X5	1,450	Kolom (100)	Vak11
S24	CS130 - L45X30X5	1,451	Kolom (100)	Vak11
S25	CS131 - L45X5	1,993	Balk (80)	Vak11
S26	CS121 - L80X6	2,386	vertikaal windverband (0)	Vak10
S27	CS121 - L80X6	2,652	vertikaal windverband (0)	Vak10
S28	CS121 - L80X6	2,386	vertikaal windverband (0)	Vak10
S29	CS121 - L80X6	2,651	vertikaal windverband (0)	Vak10
S30	CS123 - L45X5	2,536	horizontaal windverband (0)	Vak10
S31	CS93 - L70x70x5	2,265	Kolom (100)	Vak8
S33	CS4 - L50X40X5	1,616	Balk (80)	Vak8
S34	CS93 - L70x70x5	2,366	Kolom (100)	Vak8
S35	CS4 - L50X40X5	1,616	Balk (80)	Vak8
S36	CS93 - L70x70x5	2,265	Kolom (100)	Vak8
S38	CS4 - L50X40X5	0,879	horizontaal windverband (0)	Vak7
S41	CS4 - L50X40X5	0,879	horizontaal windverband (0)	Vak7
S42	CS92 - L50X40X5	2,227	vertikaal windverband (0)	Vak7
S43	CS4 - L50X40X5	0,864	horizontaal windverband (0)	Vak7l
S44	CS92 - L50X40X5	2,231	vertikaal windverband (0)	Vak7l
S46	CS86 - L130X12	3,952	Balk (80)	Vak6
S47	CS86 - L130X12	3,952	Balk (80)	Vak6
S49	CS84 - L100x100x6	2,080	vertikaal windverband (0)	Vak6
S51	CS88 - L50X40X5	2,571	vertikaal windverband (0)	Vak6
S52	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S54	CS37 - HFLeq75x75x8	4,252	Balk (80)	Vak7
S55	CS88 - L50X40X5	2,571	vertikaal windverband (0)	Vak6
S56	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S61	CS84 - L100x100x6	2,080	vertikaal windverband (0)	Vak6
S63	CS140 - L45X30X5	0,941	Balk (80)	CrossArm5
S64	CS140 - L45X30X5	0,941	Balk (80)	CrossArm5
S65	CS138 - L45X5	1,862	Kolom (100)	CrossArm5
S66	CS137 - L45X30X5	2,018	Kolom (100)	CrossArm5
S67	CS138 - L45X5	1,862	Kolom (100)	CrossArm5
S68	CS137 - L45X30X5	2,018	Kolom (100)	CrossArm5
S69	CS136 - L45X5	1,364	Balk (80)	CrossArm5
S70	CS135 - L45X30X5	2,184	Kolom (100)	CrossArm5
S71	CS134 - L45X5	2,162	Kolom (100)	CrossArm5
S72	CS135 - L45X30X5	2,184	Kolom (100)	CrossArm5
S73	CS134 - L45X5	2,162	Kolom (100)	CrossArm5
S74	CS140 - L45X30X5	1,511	Kolom (100)	CrossArm5
S75	CS140 - L45X30X5	0,336	Balk (80)	CrossArm5
S76	CS140 - L45X30X5	1,501	Kolom (100)	CrossArm5
S77	CS138 - L45X5	0,649	Balk (80)	CrossArm5
S78	CS139 - L50X40X5	1,911	Kolom (100)	CrossArm5
S79	CS140 - L45X30X5	0,969	Balk (80)	CrossArm5
S80	CS140 - L45X30X5	1,511	Kolom (100)	CrossArm5

Naam	Doorsnede	Lengte [m]	Type	Laag
S81	CS140 - L45X30X5	0,336	Balk (80)	CrossArm5
S82	CS140 - L45X30X5	1,501	Kolom (100)	CrossArm5
S83	CS138 - L45X5	0,649	Balk (80)	CrossArm5
S84	CS139 - L50X40X5	1,911	Kolom (100)	CrossArm5
S85	CS140 - L45X30X5	0,969	Balk (80)	CrossArm5
S86	CS130 - L45X30X5	1,450	Kolom (100)	Vak11l
S87	CS130 - L45X30X5	1,451	Kolom (100)	Vak11l
S88	CS131 - L45X5	1,993	Balk (80)	Vak11l
S89	CS121 - L80X6	2,386	vertikaal windverband (0)	Vak10l
S90	CS121 - L80X6	2,652	vertikaal windverband (0)	Vak10l
S91	CS121 - L80X6	2,386	vertikaal windverband (0)	Vak10l
S92	CS121 - L80X6	2,651	vertikaal windverband (0)	Vak10l
S93	CS123 - L45X5	2,536	horizontaal windverband (0)	Vak10l
S94	CS128 - L60X6	1,851	Kolom (100)	Vak11
S95	CS128 - L60X6	1,849	Kolom (100)	Vak11
S96	CS128 - L60X6	1,850	Kolom (100)	Vak11l
S97	CS128 - L60X6	1,849	Kolom (100)	Vak11l
S98	CS127 - L50X5	1,920	Balk (80)	Vak11
S99	CS127 - L50X5	1,920	Balk (80)	Vak11l
S100	CS24 - LS100X6	2,364	Kolom (100)	Vak12d
S101	CS146 - L50X40X5	2,361	Kolom (100)	Vak12c
S102	CS145 - L90x90x6	2,818	Balk (80)	Vak12c
S103	CS149 - L50X40X5	1,691	Kolom (100)	Vak12c
S104	CS148 - L50X5	1,306	Kolom (100)	Vak12c
S105	CS149 - L50X40X5	1,691	Kolom (100)	Vak12c
S106	CS148 - L50X5	1,920	Balk (80)	Vak12c
S107	CS24 - LS100X6	2,364	Kolom (100)	Vak12d
S108	CS148 - L50X5	1,306	Kolom (100)	Vak12c
S109	CS146 - L50X40X5	2,360	Kolom (100)	Vak12c
S110	CS145 - L90x90x6	2,819	Balk (80)	Vak12c
S111	CS24 - LS100X6	2,363	Kolom (100)	Vak12a
S112	CS146 - L50X40X5	2,361	Kolom (100)	Vak12b
S113	CS145 - L90x90x6	2,819	Balk (80)	Vak12b
S114	CS149 - L50X40X5	1,691	Kolom (100)	Vak12b
S115	CS148 - L50X5	1,306	Kolom (100)	Vak12b
S116	CS149 - L50X40X5	1,691	Kolom (100)	Vak12b
S117	CS148 - L50X5	1,920	Balk (80)	Vak12b
S118	CS24 - LS100X6	2,363	Kolom (100)	Vak12a
S119	CS148 - L50X5	1,306	Kolom (100)	Vak12b
S120	CS146 - L50X40X5	2,361	Kolom (100)	Vak12b
S121	CS148 - L50X5	1,306	Kolom (100)	Vak12b
S122	CS149 - L50X40X5	1,691	Kolom (100)	Vak12b
S123	CS149 - L50X40X5	1,691	Kolom (100)	Vak12b
S124	CS148 - L50X5	1,920	Balk (80)	Vak12b
S125	CS148 - L50X5	1,306	Kolom (100)	Vak12b
S126	CS145 - L90x90x6	2,819	Balk (80)	Vak12b
S127	CS97 - L100X8	2,721	Balk (80)	Vak12d
S129	CS132 - L50X40X5	1,213	Balk (80)	Vak11
S130	CS147 - L50X40X5	2,880	Balk (80)	CrossArm4
S131	CS126 - L80x80x6	1,541	Kolom (100)	Vak11
S132	CS126 - L80x80x6	1,541	Kolom (100)	Vak11
S133	CS7 - L45X30X5	0,799	horizontaal windverband (0)	Vak10
S134	CS7 - L45X30X5	0,800	horizontaal windverband (0)	Vak10
S135	CS96 - L120X80X8	4,098	Kolom (100)	Vak10
S136	CS122 - L50X40X5	2,179	vertikaal windverband (0)	Vak10
S137	CS132 - L50X40X5	1,213	Balk (80)	Vak11
S138	CS147 - L50X40X5	2,880	Balk (80)	CrossArm4
S139	CS125 - L75x75x6	1,506	Kolom (100)	Vak11
S140	CS96 - L120X80X8	4,099	Kolom (100)	Vak10
S141	CS125 - L75x75x6	1,506	Kolom (100)	Vak11
S142	CS132 - L50X40X5	1,213	Balk (80)	Vak11l
S143	CS147 - L50X40X5	2,880	Balk (80)	CrossArm3
S144	CS126 - L80x80x6	1,541	Kolom (100)	Vak11l
S145	CS126 - L80x80x6	1,541	Kolom (100)	Vak11l
S146	CS7 - L45X30X5	0,800	horizontaal windverband (0)	Vak10l
S147	CS7 - L45X30X5	0,800	horizontaal windverband (0)	Vak10l
S148	CS96 - L120X80X8	4,098	Kolom (100)	Vak10l
S149	CS122 - L50X40X5	2,179	vertikaal windverband (0)	Vak10l
S150	CS122 - L50X40X5	2,179	vertikaal windverband (0)	Vak10l

Naam	Doorsnede	Lengte [m]	Type	Laag
S151	CS132 - L50X40X5	1,213	Balk (80)	Vak11l
S152	CS147 - L50X40X5	2,880	Balk (80)	CrossArm3
S153	CS125 - L75x75x6	1,506	Kolom (100)	Vak11l
S154	CS96 - L120X80X8	4,099	Kolom (100)	Vak10l
S155	CS125 - L75x75x6	1,506	Kolom (100)	Vak11l
S156	CS93 - L70x70x5	2,264	Kolom (100)	Vak8l
S159	CS120 - ISEA130/130/10	0,888	Balk (80)	Vak8
S160	CS120 - ISEA130/130/10	0,888	Balk (80)	Vak8l
S161	CS151 - HFLeq130x130x12	3,202	Balk (80)	Vak9b
S162	CS155 - HFLue120x80x8	1,544	Kolom (100)	Vak8l
S164	CS155 - HFLue120x80x8	1,544	Kolom (100)	Vak8
S166	CS120 - ISEA130/130/10	0,888	Balk (80)	Vak8
S167	CS150 - L55x55x5	1,943	Balk (80)	CrossArm4
S168	CS148 - L50X5	2,235	Balk (80)	CrossArm4
S169	CS150 - L55x55x5	1,943	Balk (80)	CrossArm4
S170	CS148 - L50X5	2,235	Balk (80)	CrossArm4
S171	CS101 - UNP120	3,073	Balk (80)	CrossArm4
S172	CS101 - UNP120	3,073	Balk (80)	CrossArm4
S173	CS30 - UNP140	0,961	Balk (80)	CrossArm4
S175	CS148 - L50X5	0,800	Balk (80)	CrossArm6
S177	CS82 - L130X12	4,280	Kolom (100)	Vak6
S178	CS15 - HFLeq60x60x5	3,046	Balk (80)	Vak12c
S179	CS15 - HFLeq60x60x5	3,046	Balk (80)	Vak12c
S180	CS150 - L55x55x5	2,672	Balk (80)	Vak12d
S181	CS150 - L55x55x5	2,671	Balk (80)	Vak12d
S182	CS15 - HFLeq60x60x5	2,921	Balk (80)	Vak12d
S183	CS15 - HFLeq60x60x5	2,696	Balk (80)	Vak12c
S184	CS15 - HFLeq60x60x5	2,925	Balk (80)	Vak12d
S185	CS15 - HFLeq60x60x5	2,692	Balk (80)	Vak12c
S186	CS149 - L50X40X5	1,297	Balk (80)	Vak12c
S187	CS149 - L50X40X5	1,297	Balk (80)	Vak12c
S188	CS30 - UNP140	2,163	Balk (80)	Vak12c
S189	CS30 - UNP140	2,163	Balk (80)	Vak12c
S190	CS150 - L55x55x5	1,943	Balk (80)	CrossArm3
S191	CS148 - L50X5	2,235	Balk (80)	CrossArm3
S192	CS150 - L55x55x5	1,943	Balk (80)	CrossArm3
S193	CS148 - L50X5	2,235	Balk (80)	CrossArm3
S194	CS101 - UNP120	3,073	Balk (80)	CrossArm3
S195	CS101 - UNP120	3,073	Balk (80)	CrossArm3
S196	CS30 - UNP140	0,961	Balk (80)	CrossArm3
S198	CS150 - L55x55x5	2,672	Balk (80)	Vak12a
S199	CS150 - L55x55x5	2,672	Balk (80)	Vak12a
S200	CS15 - HFLeq60x60x5	2,925	Balk (80)	Vak12a
S201	CS15 - HFLeq60x60x5	2,696	Balk (80)	Vak12b
S202	CS15 - HFLeq60x60x5	2,925	Balk (80)	Vak12a
S203	CS15 - HFLeq60x60x5	2,696	Balk (80)	Vak12b
S204	CS149 - L50X40X5	1,294	Balk (80)	Vak12b
S205	CS149 - L50X40X5	1,294	Balk (80)	Vak12b
S206	CS15 - HFLeq60x60x5	3,046	Balk (80)	Vak12b
S207	CS15 - HFLeq60x60x5	3,046	Balk (80)	Vak12b
S208	CS30 - UNP140	2,163	Balk (80)	Vak12b
S209	CS30 - UNP140	2,163	Balk (80)	Vak12b
S210	CS101 - UNP120	1,569	Balk (80)	Vak12a
S211	CS129 - L65x65x6	2,163	Balk (80)	Vak11l
S212	CS129 - L65x65x6	2,163	Balk (80)	Vak11
S213	CS101 - UNP120	1,569	Balk (80)	Vak12a
S214	CS156 - L50X5	2,305	Kolom (100)	Vak9c
S215	CS156 - L50X5	2,305	Kolom (100)	Vak9c
S216	CS156 - L50X5	2,369	Balk (80)	CrossArm2
S217	CS158 - L50X40X5	1,587	Kolom (100)	CrossArm2
S218	CS158 - L50X40X5	1,600	Kolom (100)	CrossArm2
S219	CS156 - L50X5	2,305	Kolom (100)	Vak9c
S220	CS156 - L50X5	2,305	Kolom (100)	Vak9c
S221	CS156 - L50X5	3,227	Balk (80)	Vak9c
S222	CS156 - L50X5	3,227	Balk (80)	Vak9c
S223	CS156 - L50X5	2,369	Balk (80)	CrossArm1
S224	CS154 - L100x100x8	2,376	Kolom (100)	Vak9c
S225	CS153 - L120x120x8	2,373	Kolom (100)	Vak9b
S226	CS154 - L100x100x8	2,376	Kolom (100)	Vak9c

Naam	Doorsnede	Lengte [m]	Type	Laag
S227	CS153 - L120x120x8	2,373	Kolom (100)	Vak9a
S228	CS40 - L65X50X5	7,610	Balk (80)	CrossArm2
S229	CS157 - L45X5	0,983	Kolom (100)	CrossArm2
S231	CS40 - L65X50X5	7,611	Balk (80)	CrossArm1
S232	CS158 - L50X40X5	2,810	Kolom (100)	CrossArm1
S233	CS157 - L45X5	0,983	Kolom (100)	CrossArm1
S235	CS40 - L65X50X5	7,611	Balk (80)	CrossArm2
S236	CS158 - L50X40X5	2,811	Kolom (100)	CrossArm2
S237	CS157 - L45X5	0,983	Kolom (100)	CrossArm2
S239	CS154 - L100x100x8	2,376	Kolom (100)	Vak9c
S240	CS153 - L120x120x8	2,373	Kolom (100)	Vak9b
S241	CS154 - L100x100x8	2,376	Kolom (100)	Vak9c
S242	CS153 - L120x120x8	2,373	Kolom (100)	Vak9a
S243	CS93 - L70x70x5	2,366	Kolom (100)	Vak8l
S244	CS4 - L50X40X5	1,616	Balk (80)	Vak8l
S245	CS93 - L70x70x5	2,366	Kolom (100)	Vak8l
S247	CS4 - L50X40X5	0,879	horizontaal windverband (0)	Vak7l
S248	CS92 - L50X40X5	2,227	vertikaal windverband (0)	Vak7l
S249	CS88 - L50X40X5	2,571	vertikaal windverband (0)	Vak6
S250	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S252	CS161 - L120X80X8	4,747	Kolom (100)	Vak7l
S253	CS40 - L65X50X5	7,611	Balk (80)	CrossArm1
S254	CS158 - L50X40X5	2,810	Kolom (100)	CrossArm1
S255	CS157 - L45X5	0,983	Kolom (100)	CrossArm1
S257	CS4 - L50X40X5	1,616	Balk (80)	Vak8l
S258	CS120 - ISEA130/130/10	0,888	Balk (80)	Vak8l
S260	CS4 - L50X40X5	0,879	horizontaal windverband (0)	Vak7l
S263	CS95 - L75x75x6	2,542	Balk (80)	Vak9b
S264	CS95 - L75x75x6	2,294	Balk (80)	Vak9c
S265	CS95 - L75x75x6	2,456	Balk (80)	Vak9b
S266	CS95 - L75x75x6	2,542	Balk (80)	Vak9b
S267	CS95 - L75x75x6	2,294	Balk (80)	Vak9c
S268	CS43 - L75x75x6	3,507	Balk (80)	Vak9b
S270	CS36 - ISEA70/70/5	1,753	Balk (80)	Vak8
S273	CS159 - L55x55x5	1,845	Balk (80)	CrossArm2
S274	CS159 - L55x55x5	2,188	Balk (80)	CrossArm2
S275	CS159 - L55x55x5	2,579	Balk (80)	CrossArm2
S278	CS159 - L55x55x5	1,845	Balk (80)	CrossArm2
S279	CS159 - L55x55x5	2,188	Balk (80)	CrossArm2
S280	CS159 - L55x55x5	2,579	Balk (80)	CrossArm2
S282	CS152 - UNP140	0,921	Balk (80)	CrossArm2
S283	CS152 - UNP140	2,391	Balk (80)	CrossArm2
S284	CS94 - L50X5	1,390	Balk (80)	CrossArm2
S285	CS94 - L50X5	1,391	Balk (80)	CrossArm2
S286	CS152 - UNP140	2,635	Balk (80)	CrossArm2
S287	CS43 - L75x75x6	3,013	Balk (80)	CrossArm2
S288	CS95 - L75x75x6	2,269	Balk (80)	CrossArm2
S289	CS144 - UNP160	8,015	Balk (80)	CrossArm2
S290	CS95 - L75x75x6	2,456	Balk (80)	Vak9a
S291	CS95 - L75x75x6	2,542	Balk (80)	Vak9a
S292	CS95 - L75x75x6	2,298	Balk (80)	Vak9c
S293	CS4 - L50X40X5	1,135	Balk (80)	Vak9c
S294	CS4 - L50X40X5	1,121	Balk (80)	Vak9c
S295	CS144 - UNP160	8,015	Balk (80)	CrossArm1
S296	CS158 - L50X40X5	1,587	Kolom (100)	CrossArm1
S297	CS158 - L50X40X5	1,600	Kolom (100)	CrossArm1
S298	CS36 - ISEA70/70/5	3,507	Balk (80)	Vak8l
S299	CS44 - UNP160	3,507	Balk (80)	Vak9c
S300	CS93 - L70x70x5	2,265	Kolom (100)	Vak8l
S301	CS92 - L50X40X5	2,227	vertikaal windverband (0)	Vak7l
S302	CS159 - L55x55x5	1,845	Balk (80)	CrossArm1
S303	CS159 - L55x55x5	2,188	Balk (80)	CrossArm1
S304	CS159 - L55x55x5	2,579	Balk (80)	CrossArm1
S307	CS159 - L55x55x5	1,845	Balk (80)	CrossArm1
S308	CS159 - L55x55x5	2,188	Balk (80)	CrossArm1
S309	CS159 - L55x55x5	2,579	Balk (80)	CrossArm1
S311	CS152 - UNP140	0,921	Balk (80)	CrossArm1
S312	CS152 - UNP140	2,391	Balk (80)	CrossArm1
S313	CS94 - L50X5	1,390	Balk (80)	CrossArm1

Naam	Doorsnede	Lengte [m]	Type	Laag
S314	CS94 - L50X5	1,391	Balk (80)	CrossArm1
S315	CS152 - UNP140	2,634	Balk (80)	CrossArm1
S316	CS43 - L75x75x6	3,013	Balk (80)	CrossArm1
S317	CS95 - L75x75x6	2,269	Balk (80)	CrossArm1
S318	CS95 - L75x75x6	2,456	Balk (80)	Vak9a
S319	CS95 - L75x75x6	2,542	Balk (80)	Vak9a
S320	CS95 - L75x75x6	2,298	Balk (80)	Vak9c
S321	CS43 - L75x75x6	3,507	Balk (80)	Vak9a
S322	CS4 - L50X40X5	1,135	Balk (80)	Vak9c
S323	CS4 - L50X40X5	1,121	Balk (80)	Vak9c
S324	CS44 - UNP160	3,507	Balk (80)	Vak9c
S328	CS155 - HFLue120x80x8	1,544	Kolom (100)	Vak8l
S330	CS4 - L50X40X5	0,864	horizontaal windverband (0)	Vak7l
S331	CS92 - L50X40X5	2,231	vertikaal windverband (0)	Vak7l
S333	CS88 - L50X40X5	2,571	vertikaal windverband (0)	Vak6
S334	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S336	CS84 - L100x100x6	2,080	vertikaal windverband (0)	Vak6
S340	CS144 - UNP160	8,015	Balk (80)	CrossArm1
S343	CS12 - L50X5	0,800	Balk (80)	CrossArm5
C1	CS172 - 2LX (L150X14; 15)	10,951	Kolom (100)	Vak1
C2	CS172 - 2LX (L150X14; 15)	10,951	Kolom (100)	Vak1
C4	CS172 - 2LX (L150X14; 15)	10,951	Kolom (100)	Vak1
C3	CS172 - 2LX (L150X14; 15)	10,951	Kolom (100)	Vak1
B9	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
B14	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
B16	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
B18	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
SB2	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB18	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB34	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB1	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB17	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB33	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB4	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB20	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB36	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
SB3	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB19	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB35	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
B89	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
B90	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
B91	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
B92	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
C5	CS173 - 2LX (L140X13; 13)	3,374	Kolom (100)	Vak2
C6	CS173 - 2LX (L140X13; 13)	3,374	Kolom (100)	Vak2
C7	CS173 - 2LX (L140X13; 13)	3,374	Kolom (100)	Vak2
C8	CS173 - 2LX (L140X13; 13)	3,374	Kolom (100)	Vak2
B8	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2
B10	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2
B12	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2
B93	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2
SB49	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB50	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
SB51	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB52	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
SB53	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB54	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
SB55	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB56	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
SB57	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB58	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
SB59	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB60	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
SB61	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB62	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
SB63	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB64	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
B31	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2
B32	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2

Naam	Doorsnede	Lengte [m]	Type	Laag
B33	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2
B34	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2
C9	CS174 - 2LX (L140X13; 13)	6,648	Kolom (100)	Vak3
C10	CS174 - 2LX (L140X13; 13)	6,648	Kolom (100)	Vak3
C11	CS174 - 2LX (L140X13; 13)	6,648	Kolom (100)	Vak3
C12	CS174 - 2LX (L140X13; 13)	6,648	Kolom (100)	Vak3
B94	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
B95	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
B22	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
B26	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
SB65	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB66	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB67	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB68	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB69	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB70	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB71	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB72	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB73	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB74	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB75	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB76	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB77	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB78	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB79	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB80	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB81	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB82	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB83	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB84	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB85	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB86	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB87	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB88	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB89	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB90	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB91	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB92	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB93	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB94	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB95	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB96	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
B73	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
B74	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
B75	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
B76	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
C13	CS175 - 2LX (L130X12; 12)	6,648	Kolom (100)	Vak4
C14	CS175 - 2LX (L130X12; 12)	6,648	Kolom (100)	Vak4
C15	CS175 - 2LX (L130X12; 12)	6,648	Kolom (100)	Vak4
C16	CS175 - 2LX (L130X12; 12)	6,648	Kolom (100)	Vak4
B98	CS70 - L100X75X7	8,859	vakwerkdiagonaal (90)	Vak4
B99	CS70 - L100X75X7	8,860	vakwerkdiagonaal (90)	Vak4
B100	CS70 - L100X75X7	8,860	vakwerkdiagonaal (90)	Vak4
B101	CS70 - L100X75X7	8,859	vakwerkdiagonaal (90)	Vak4
B102	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
B103	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
B104	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
B105	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
SB97	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB98	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB99	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB100	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB101	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB102	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB103	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB104	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB105	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4
SB106	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4
SB107	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4

Naam	Doorsnede	Lengte [m]	Type	Laag
SB108	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4
SB109	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4
SB110	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4
SB111	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4
SB112	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4
SB113	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB114	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB115	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB116	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB117	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB118	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB119	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB120	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB121	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB122	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB123	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB124	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB125	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB126	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB127	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB128	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
B106	CS70 - L100X75X7	8,859	vakwerkdiagonaal (90)	Vak4
B107	CS70 - L100X75X7	8,859	vakwerkdiagonaal (90)	Vak4
B108	CS70 - L100X75X7	8,860	vakwerkdiagonaal (90)	Vak4
B109	CS70 - L100X75X7	8,860	vakwerkdiagonaal (90)	Vak4
B110	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
B111	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
B112	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
B113	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
C17	CS112 - HFLeq130x130x12	3,414	Kolom (100)	Vak5
C18	CS112 - HFLeq130x130x12	3,414	Kolom (100)	Vak5
C19	CS112 - HFLeq130x130x12	3,414	Kolom (100)	Vak5
C20	CS112 - HFLeq130x130x12	3,414	Kolom (100)	Vak5
B114	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
B115	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
B116	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
B117	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
SB129	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB130	CS72 - L50X40X5	2,050	vertikaal windverband (0)	Vak5
SB131	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB132	CS72 - L50X40X5	2,050	vertikaal windverband (0)	Vak5
SB133	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB134	CS72 - L50X40X5	2,049	vertikaal windverband (0)	Vak5
SB135	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB136	CS72 - L50X40X5	2,050	vertikaal windverband (0)	Vak5
SB137	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB138	CS72 - L50X40X5	2,050	vertikaal windverband (0)	Vak5
SB139	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB140	CS72 - L50X40X5	2,050	vertikaal windverband (0)	Vak5
SB141	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB142	CS72 - L50X40X5	2,050	vertikaal windverband (0)	Vak5
SB143	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB144	CS72 - L50X40X5	2,050	vertikaal windverband (0)	Vak5
B36	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
B37	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
B38	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
B39	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
S355	CS82 - L130X12	4,280	Kolom (100)	Vak6
S359	CS90 - L100x100x6	4,356	Kolom (100)	Vak10
S361	CS124 - L80X6	0,970	Kolom (100)	Vak11
S368	CS143 - L130X12	3,331	Kolom (100)	Vak8
S370	CS90 - L100x100x6	4,356	Kolom (100)	Vak10
S372	CS124 - L80X6	0,970	Kolom (100)	Vak11
S373	CS133 - L80X6	6,823	Kolom (100)	CrossArm6
S377	CS141 - L120X80X8	2,030	Balk (80)	Vak8
S378	CS141 - L120X80X8	2,206	Balk (80)	Vak8
S379	CS141 - L120X80X8	2,030	Balk (80)	Vak8
S380	CS141 - L120X80X8	2,205	Balk (80)	Vak8
S381	CS141 - L120X80X8	2,030	Balk (80)	Vak8l

	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Doorsnede	Lengte [m]	Type	Laag
S382	CS141 - L120X80X8	2,206	Balk (80)	Vak8l
S383	CS141 - L120X80X8	2,030	Balk (80)	Vak8l
S384	CS141 - L120X80X8	2,205	Balk (80)	Vak8l
S388	CS144 - UNP160	3,674	Balk (80)	Vak9c
S390	CS144 - UNP160	1,840	Balk (80)	Vak9a
S397	CS92 - L50X40X5	2,227	vertikaal windverband (0)	Vak7
S399	CS36 - ISEA70/70/5	1,753	Balk (80)	Vak8
S400	CS95 - L75x75x6	2,456	Balk (80)	Vak9b
S401	CS93 - L70x70x5	2,366	Balk (80)	Vak8
S402	CS143 - L130X12	3,331	Balk (80)	Vak8
S411	CS90 - L100x100x6	4,356	Kolom (100)	Vak10l
S413	CS124 - L80X6	0,970	Kolom (100)	Vak11l
S417	CS133 - L80X6	6,823	Kolom (100)	CrossArm5
S418	CS82 - L130X12	4,280	Kolom (100)	Vak6
S421	CS143 - L130X12	3,332	Kolom (100)	Vak8l
S425	CS124 - L80X6	0,970	Kolom (100)	Vak11l
S426	CS133 - L80X6	6,823	Kolom (100)	CrossArm5
S430	CS37 - HFLeq75x75x8	4,252	Balk (80)	Vak7l
S441	CS101 - UNP120	1,970	Balk (80)	Vak12a
S446	CS101 - UNP120	1,970	Balk (80)	Vak12d
S447	CS101 - UNP120	1,568	Balk (80)	Vak12d
S448	CS158 - L50X40X5	2,810	Balk (80)	CrossArm2
S449	CS140 - L45X30X5	0,941	Balk (80)	CrossArm6
S450	CS4 - L50X40X5	0,864	horizontaal windverband (0)	Vak7
S453	CS4 - L50X40X5	0,864	horizontaal windverband (0)	Vak7
S456	CS122 - L50X40X5	2,179	vertikaal windverband (0)	Vak10
S457	CS155 - HFLue120x80x8	1,544	Balk (80)	Vak8
S458	CS92 - L50X40X5	2,231	vertikaal windverband (0)	Vak7
S459	CS92 - L50X40X5	2,231	vertikaal windverband (0)	Vak7
S460	CS84 - L100x100x6	2,080	vertikaal windverband (0)	Vak6
S461	CS156 - L50X5	1,503	Balk (80)	Vak9c
S462	CS156 - L50X5	1,503	Balk (80)	Vak9c
S463	CS156 - L50X5	1,503	Balk (80)	Vak9c
S464	CS156 - L50X5	1,503	Balk (80)	Vak9c
S465	CS95 - L75x75x6	1,719	Balk (80)	CrossArm2
S466	CS95 - L75x75x6	2,269	Balk (80)	CrossArm1
B7	CS75 - L120X11	7,600	Balk (80)	HorVerb1
B118	CS75 - L120X11	7,600	Balk (80)	HorVerb1
B119	CS75 - L120X11	7,600	Balk (80)	HorVerb1
B120	CS75 - L120X11	7,600	Balk (80)	HorVerb1
B11	CS39 - ISEA80/80/6	5,374	vakwerkdiagonaal (90)	HorVerb1
B121	CS39 - ISEA80/80/6	5,374	vakwerkdiagonaal (90)	HorVerb1
B13	CS39 - ISEA80/80/6	5,374	vakwerkdiagonaal (90)	HorVerb1
B122	CS39 - ISEA80/80/6	5,374	vakwerkdiagonaal (90)	HorVerb1
B123	CS46 - ISEA70/70/5	7,600	vakwerkdiagonaal (90)	HorVerb1
B17	CS46 - ISEA70/70/5	3,800	vakwerkdiagonaal (90)	HorVerb1
B124	CS46 - ISEA70/70/5	3,800	vakwerkdiagonaal (90)	HorVerb1
B129	CS79 - L100X8	3,536	vakwerkdiagonaal (90)	HorVerb2
B130	CS79 - L100X8	3,536	vakwerkdiagonaal (90)	HorVerb2
B131	CS79 - L100X8	3,535	vakwerkdiagonaal (90)	HorVerb2
B132	CS79 - L100X8	3,536	vakwerkdiagonaal (90)	HorVerb2
B133	CS77 - L60X5	5,000	vakwerkdiagonaal (90)	HorVerb2
B134	CS77 - L60X5	2,500	vakwerkdiagonaal (90)	HorVerb2
B135	CS77 - L60X5	2,500	vakwerkdiagonaal (90)	HorVerb2
S467	CS78 - L110X10	5,000	Balk (80)	HorVerb2
S470	CS113 - L80X6	5,000	Balk (80)	HorVerb2
S472	CS78 - L110X10	5,000	Balk (80)	HorVerb2
S474	CS113 - L80X6	5,000	Balk (80)	HorVerb2
S482	CS21 - ISUA65/50/6	6,950	Kolom (100)	CrossArm5
S483	CS21 - ISUA65/50/6	6,950	Kolom (100)	CrossArm5
S484	CS21 - ISUA65/50/6	6,950	Kolom (100)	CrossArm6
S485	CS21 - ISUA65/50/6	6,950	Kolom (100)	CrossArm6
S486	CS133 - L80X6	6,823	Kolom (100)	CrossArm6
S491	CS151 - HFLeq130x130x12	3,201	Balk (80)	Vak9b
S492	CS144 - UNP160	1,720	Balk (80)	Vak9a
S493	CS144 - UNP160	3,674	Balk (80)	Vak9a
S495	CS101 - UNP120	1,970	Balk (80)	Vak12d
S497	CS101 - UNP120	1,568	Balk (80)	Vak12d
S503	CS97 - L100X8	2,721	Balk (80)	Vak12d

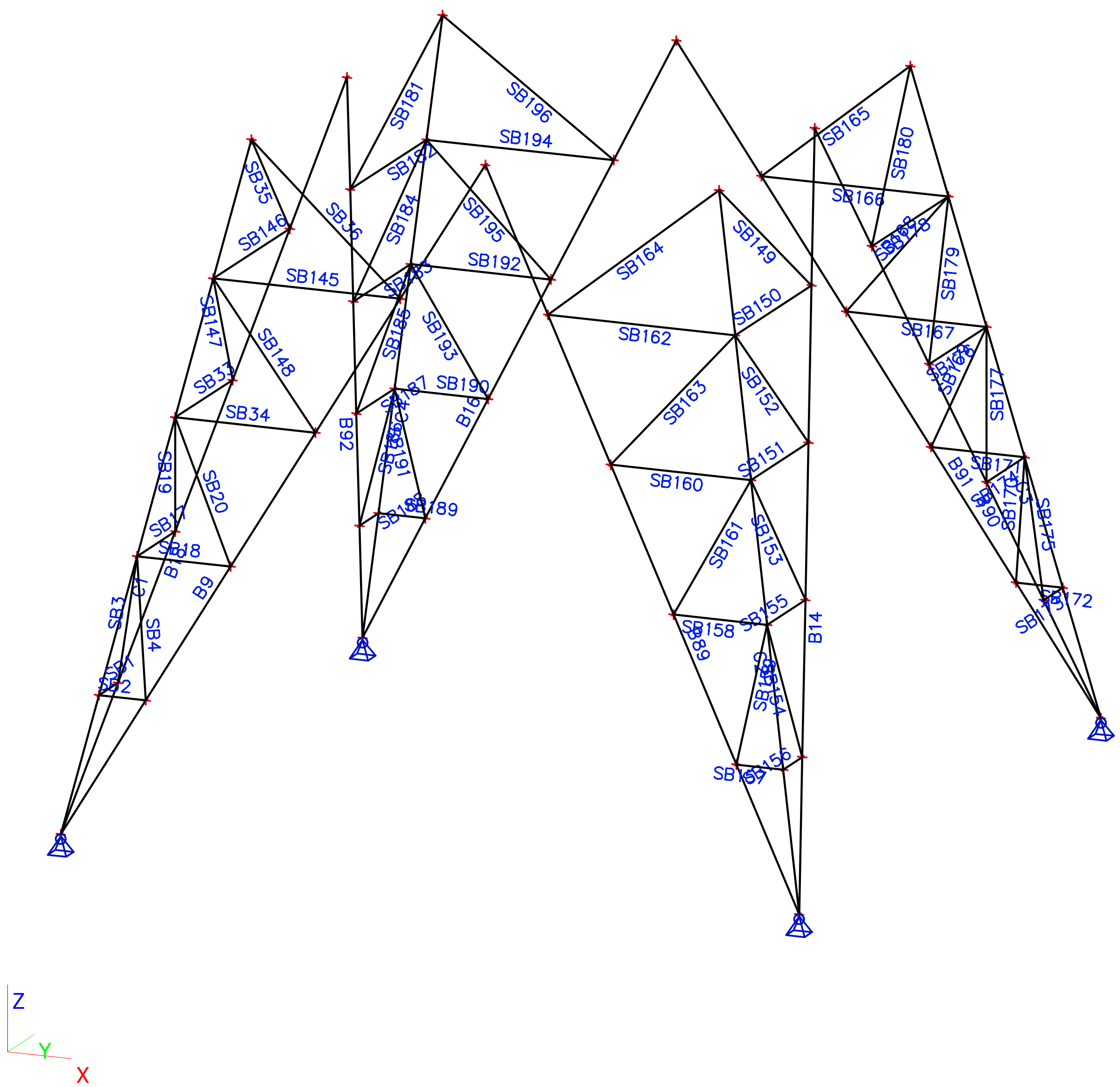
Naam	Doorsnede	Lengte [m]	Type	Laag
S508	CS30 - UNP140	0,800	Balk (80)	CrossArm3
S509	CS36 - ISEA70/70/5	0,950	Balk (80)	CrossArm3
S510	CS36 - ISEA70/70/5	0,950	Balk (80)	CrossArm3
S511	CS30 - UNP140	0,800	Balk (80)	CrossArm4
S513	CS36 - ISEA70/70/5	0,950	Balk (80)	CrossArm4
S514	CS36 - ISEA70/70/5	0,950	Balk (80)	CrossArm4
S547	CS144 - UNP160	1,840	Balk (80)	Vak9b
S548	CS38 - HFLeq80x80x8	0,799	Balk (80)	CrossArm2
S549	CS38 - HFLeq80x80x8	0,931	Balk (80)	CrossArm2
S550	CS38 - HFLeq80x80x8	0,931	Balk (80)	CrossArm2
S551	CS38 - HFLeq80x80x8	0,799	Balk (80)	CrossArm1
S552	CS38 - HFLeq80x80x8	0,931	Balk (80)	CrossArm1
S553	CS38 - HFLeq80x80x8	0,931	Balk (80)	CrossArm1
SB145	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB146	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB147	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB148	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB149	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
SB150	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB151	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB152	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB153	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB154	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB155	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB156	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB157	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB158	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB159	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB160	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB161	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB162	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB163	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB164	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
SB165	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
SB166	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB167	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB168	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB169	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB170	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB171	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB172	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB173	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB174	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB175	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB176	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB177	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB178	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB179	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB180	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
SB181	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
SB182	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB183	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB184	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB185	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB186	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB187	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB188	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB189	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB190	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB191	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB192	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB193	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB194	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB195	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB196	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
S588	CS104 - L70X6	3,353	Balk (80)	Vak3
S589	CS104 - L70X6	3,353	Balk (80)	Vak3
S590	CS104 - L70X6	3,353	Balk (80)	Vak3
S591	CS104 - L70X6	3,353	Balk (80)	Vak3

Naam	Doorsnede	Lengte [m]	Type	Laag
S592	CS104 - L70X6	3,353	Balk (80)	Vak3
S593	CS104 - L70X6	3,353	Balk (80)	Vak3
S594	CS104 - L70X6	3,353	Balk (80)	Vak3
S595	CS104 - L70X6	3,353	Balk (80)	Vak3
S596	CS95 - L75x75x6	1,719	Balk (80)	CrossArm2
S597	CS95 - L75x75x6	2,269	Balk (80)	CrossArm2
S598	CS95 - L75x75x6	1,719	Balk (80)	CrossArm1
S599	CS95 - L75x75x6	1,719	Balk (80)	CrossArm1
S600	CS144 - UNP160	8,015	Balk (80)	CrossArm2
S601	CS144 - UNP160	1,720	Balk (80)	Vak9b
S602	CS160 - L150X14	5,642	vakwerkdiagonaal (90)	Vak6
S603	CS160 - L150X14	5,642	vakwerkdiagonaal (90)	Vak6
S604	CS160 - L150X14	5,642	vakwerkdiagonaal (90)	Vak6
S605	CS160 - L150X14	5,642	vakwerkdiagonaal (90)	Vak6
S606	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S607	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S608	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S609	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S610	CS83 - L100X75X7	4,765	vakwerkdiagonaal (90)	Vak6
S611	CS82 - L130X12	4,280	vakwerkdiagonaal (90)	Vak6
S612	CS83 - L100X75X7	4,764	vakwerkdiagonaal (90)	Vak6
S613	CS83 - L100X75X7	4,765	vakwerkdiagonaal (90)	Vak6
S614	CS83 - L100X75X7	4,765	vakwerkdiagonaal (90)	Vak6
S615	CS89 - L130X12	4,261	vakwerkdiagonaal (90)	Vak7l
S616	CS89 - L130X12	4,261	vakwerkdiagonaal (90)	Vak7l
S617	CS89 - L130X12	4,261	vakwerkdiagonaal (90)	Vak7
S618	CS89 - L130X12	4,261	vakwerkdiagonaal (90)	Vak7
S619	CS142 - L120X80X8	4,017	vakwerkdiagonaal (90)	Vak7
S620	CS142 - L120X80X8	4,017	vakwerkdiagonaal (90)	Vak7l
S621	CS142 - L120X80X8	4,017	vakwerkdiagonaal (90)	Vak7l
S622	CS142 - L120X80X8	4,017	vakwerkdiagonaal (90)	Vak7
S623	CS161 - L120X80X8	4,747	vakwerkdiagonaal (90)	Vak7l
S624	CS161 - L120X80X8	4,747	vakwerkdiagonaal (90)	Vak7
S625	CS161 - L120X80X8	4,747	vakwerkdiagonaal (90)	Vak7
S626	CS90 - L100x100x6	4,356	Kolom (100)	Vak10l
S627	CS97 - L100X8	2,720	Balk (80)	Vak12a
S628	CS97 - L100X8	4,465	Balk (80)	Vak12b
S629	CS97 - L100X8	4,464	Balk (80)	Vak12c
S630	CS101 - UNP120	1,970	Balk (80)	Vak12a
S631	CS101 - UNP120	4,465	Balk (80)	Vak12b
S632	CS101 - UNP120	4,465	Balk (80)	Vak12c
S633	CS101 - UNP120	4,465	Balk (80)	Vak12c
S634	CS101 - UNP120	4,465	Balk (80)	Vak12b
S635	CS97 - L100X8	2,720	Balk (80)	Vak12a
S636	CS97 - L100X8	4,465	Balk (80)	Vak12b
S637	CS97 - L100X8	4,464	Balk (80)	Vak12c
S638	CS151 - HFLeq130x130x12	3,202	Balk (80)	Vak9a
S639	CS151 - HFLeq130x130x12	3,680	Balk (80)	Vak9c
S640	CS151 - HFLeq130x130x12	3,680	Balk (80)	Vak9c
S641	CS151 - HFLeq130x130x12	3,202	Balk (80)	Vak9a
S642	CS144 - UNP160	1,840	Balk (80)	Vak9b
S643	CS144 - UNP160	1,720	Balk (80)	Vak9b
S644	CS144 - UNP160	1,720	Balk (80)	Vak9a
S645	CS144 - UNP160	1,840	Balk (80)	Vak9a
S646	CS143 - L130X12	3,332	Kolom (100)	Vak8l
S648	CS170 - L50X5	0,541	Balk (80)	vers
S649	CS170 - L50X5	0,647	Balk (80)	vers
S650	CS170 - L50X5	0,541	Balk (80)	vers
S651	CS170 - L50X5	0,647	Balk (80)	vers
S652	CS170 - L50X5	0,541	Balk (80)	vers
S653	CS170 - L50X5	0,649	Balk (80)	vers
S654	CS170 - L50X5	0,541	Balk (80)	vers
S655	CS170 - L50X5	0,649	Balk (80)	vers
S656	CS170 - L50X5	0,560	Balk (80)	vers
S657	CS170 - L50X5	0,434	Balk (80)	vers
S658	CS170 - L50X5	0,434	Balk (80)	vers
S659	CS170 - L50X5	0,560	Balk (80)	vers
S660	CS171 - L60X8	0,659	Balk (80)	vers
S661	CS171 - L60X8	0,802	Balk (80)	vers

Naam	Doorsnede	Lengte [m]	Type	Laag
S662	CS171 - L60X8	0,659	Balk (80)	vers
S663	CS171 - L60X8	0,802	Balk (80)	vers
S664	CS171 - L60X8	0,659	Balk (80)	vers
S665	CS171 - L60X8	0,802	Balk (80)	vers
S666	CS171 - L60X8	0,659	Balk (80)	vers
S667	CS171 - L60X8	0,802	Balk (80)	vers

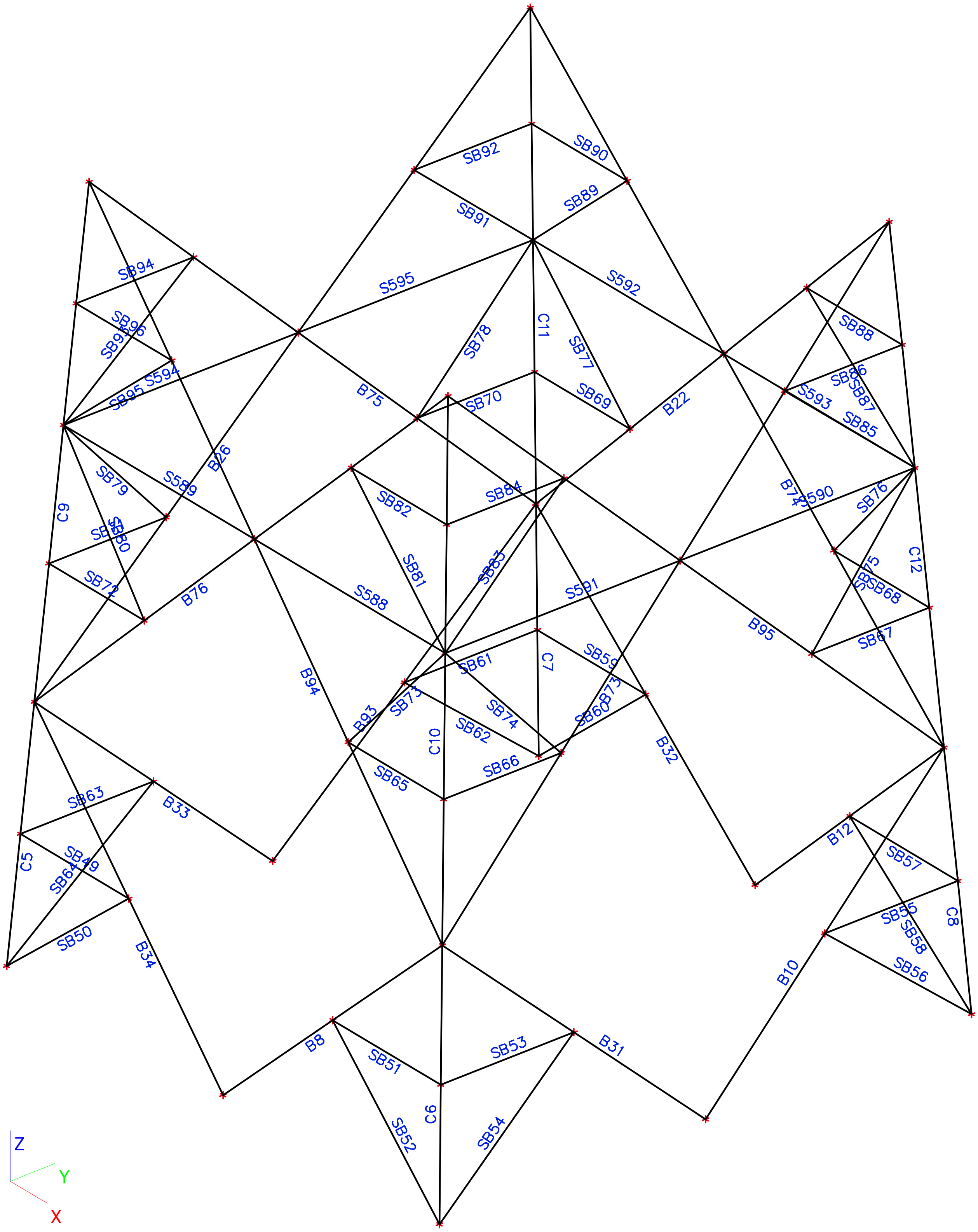
6. Staafnummers mastlichaam

6.1. Vak 1

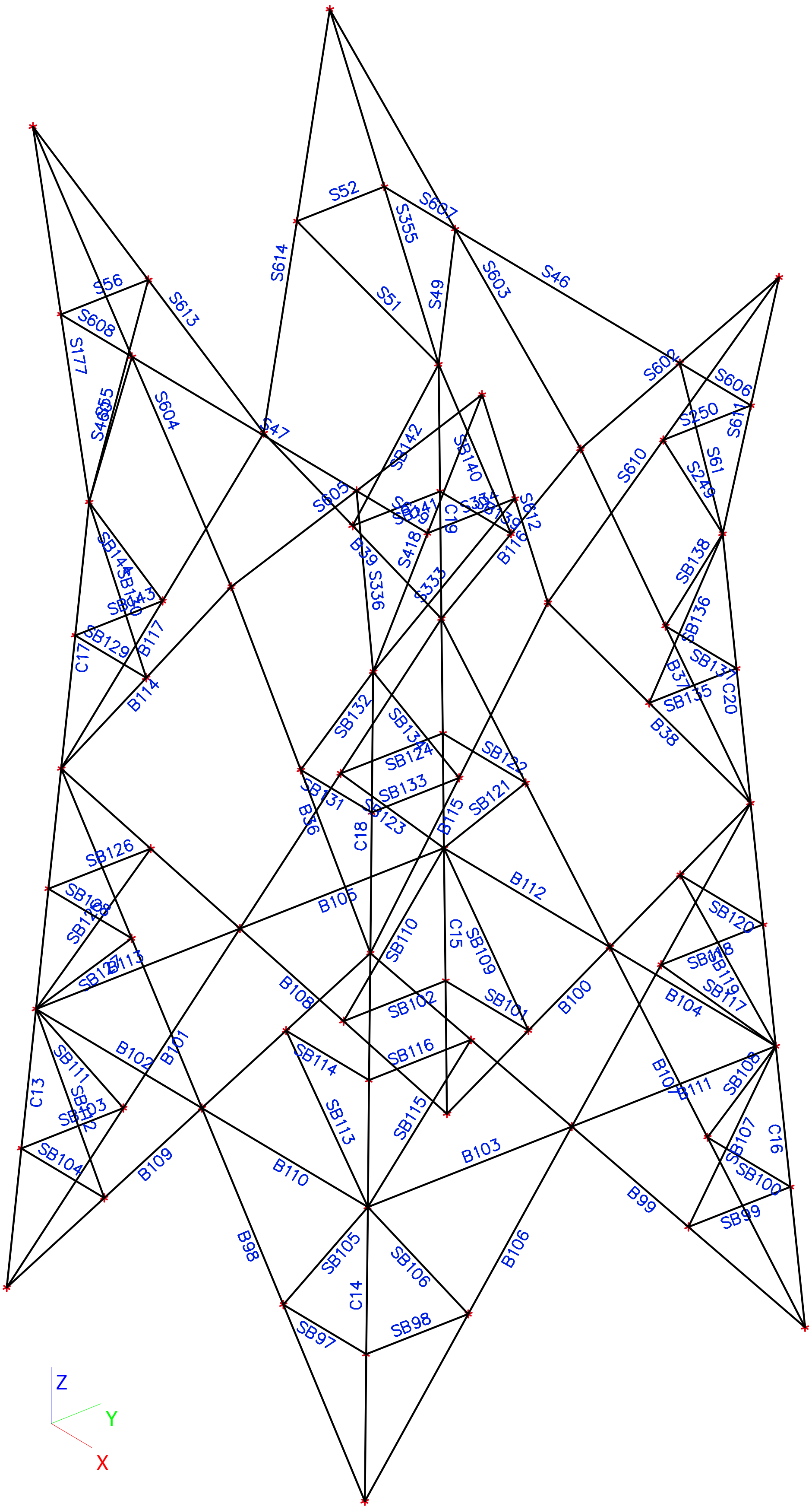


D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

6.2. Vak 2 en 3



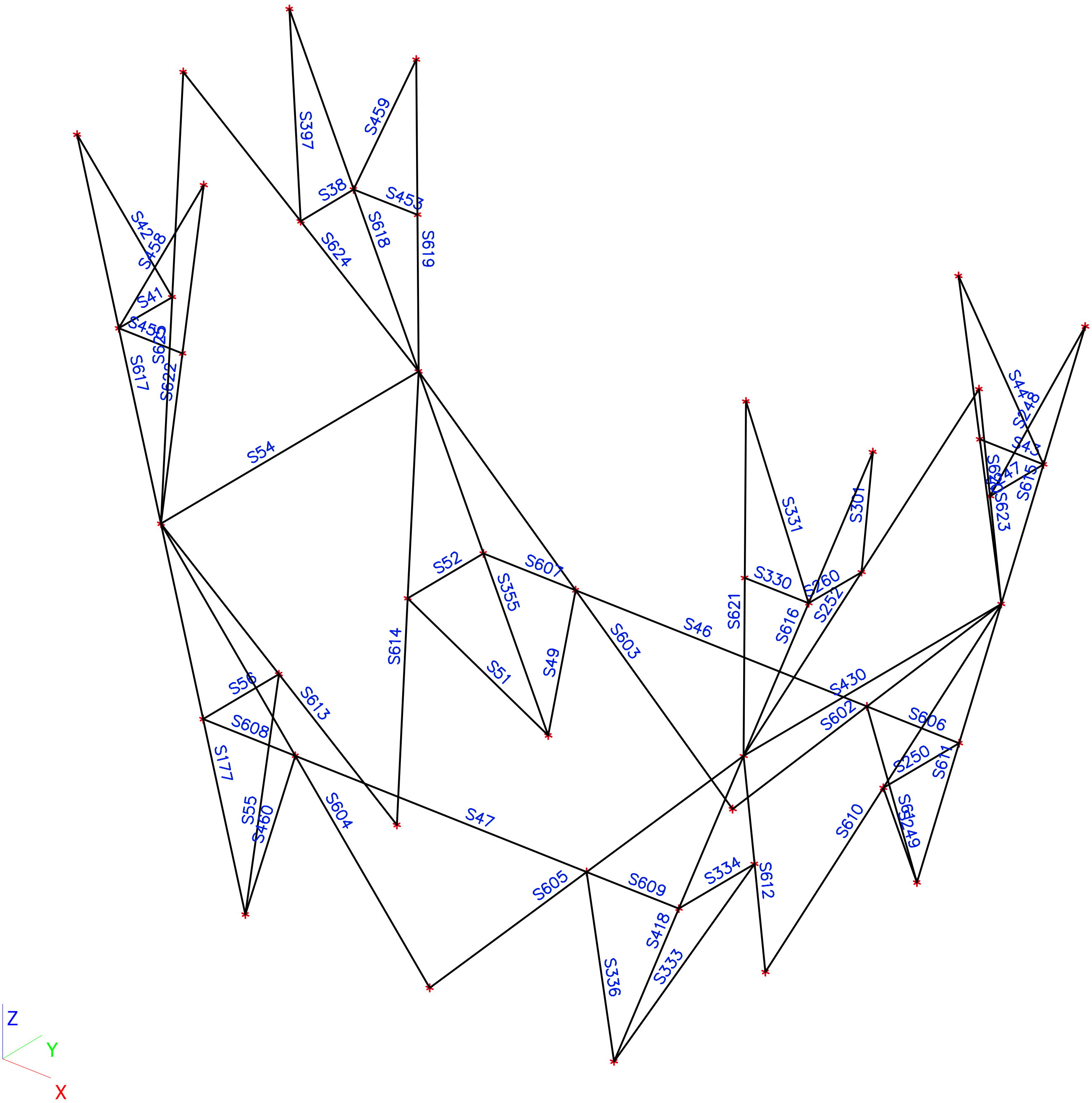
6.3. Vak 4 en 5



S52
S607
S355
S614
S51
S49
S603
S46
S56
S613
S608
S177
S604
S47
S605
SB142
SB140
C19
S612
B116
S418
S333
B39
S336
S609
S606
S250
S61
S610
S249
SB138
SB136
SB137
B37
SB135
C20
B38
SB143
SB129
B117
C17
B114
SB132
SB134
SB124
SB122
SB133
SB121
SB131
B36
C18
SB123
B115
SB126
B105
B112
SB110
C15
SB109
SB120
SB118
SB119
SB117
B113
B104
B108
SB102
SB101
B100
SB116
SB114
B102
B101
SB111
SB103
C13
SB104
B109
SB113
SB115
B110
B103
B107
B111
SB108
C16
SB100
B99
SB99
B98
SB105
SB106
C14
B106
SB97
SB98
Z
Y
X

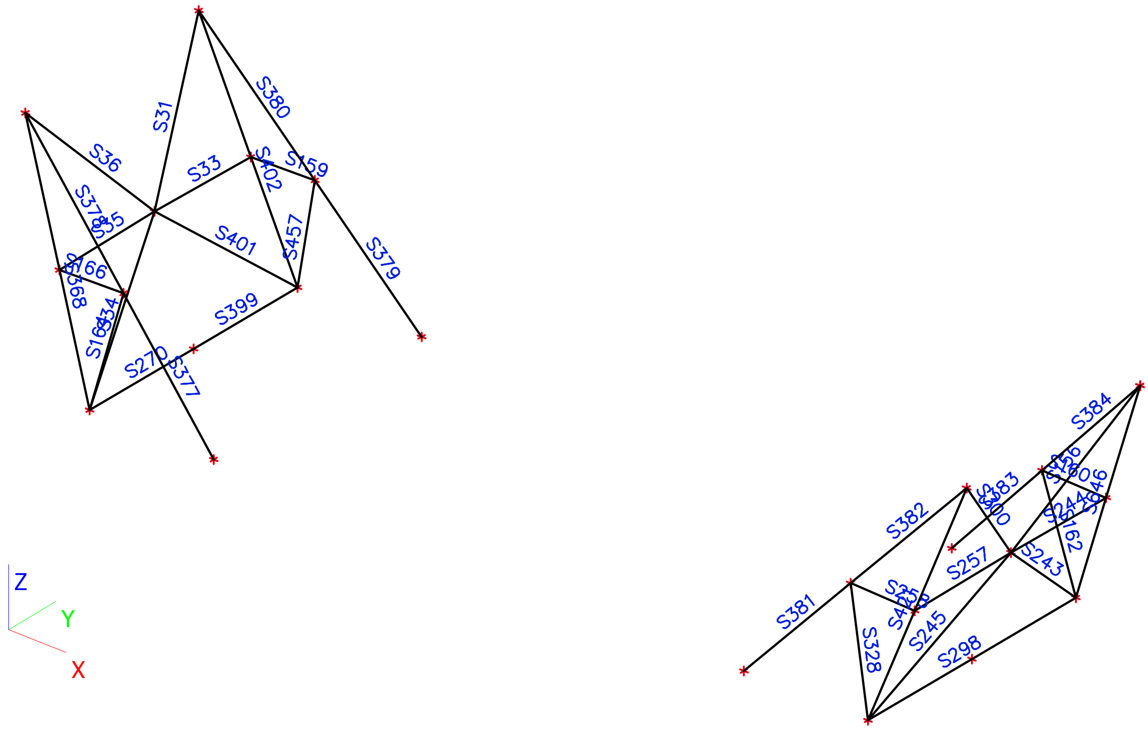
D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

6.4. Vak 6 en 7

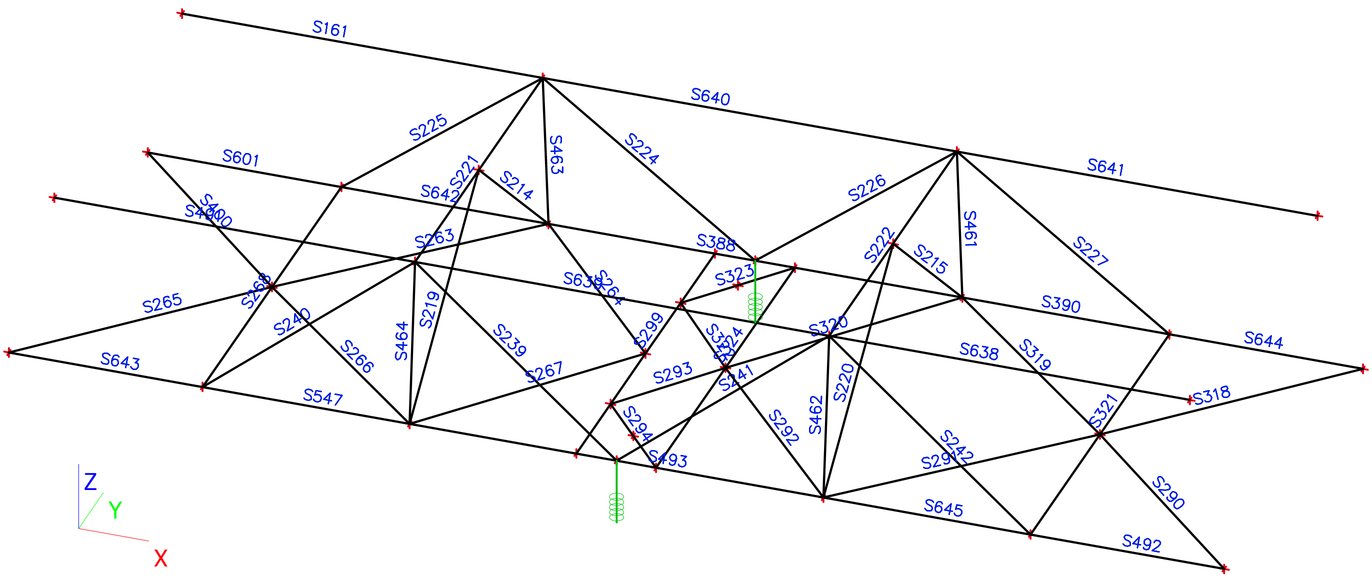


D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

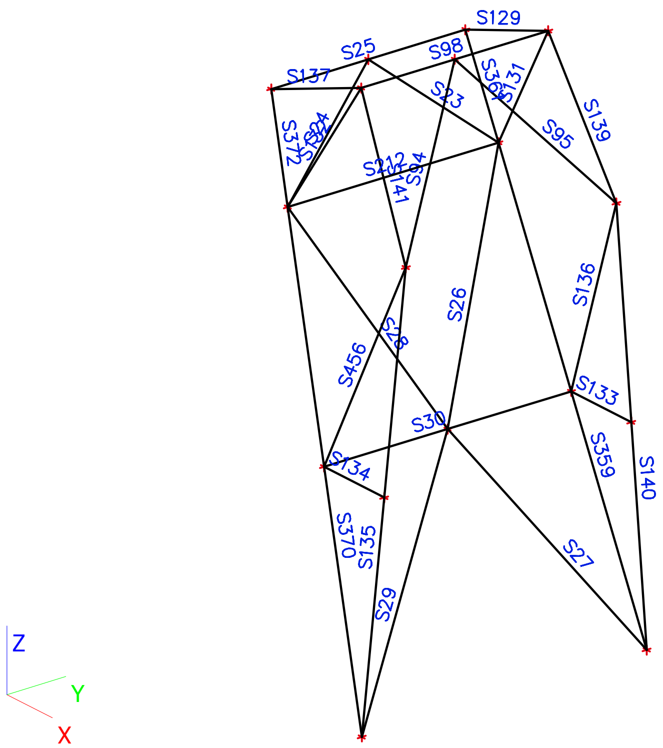
6.5. Vak 8 links en rechts



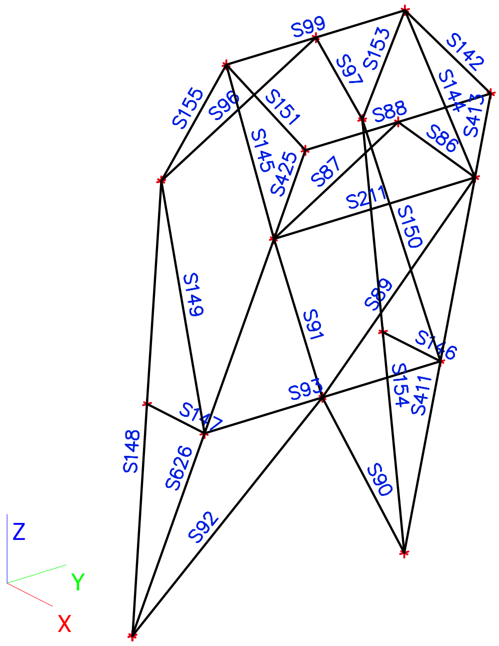
6.6. Vak 9



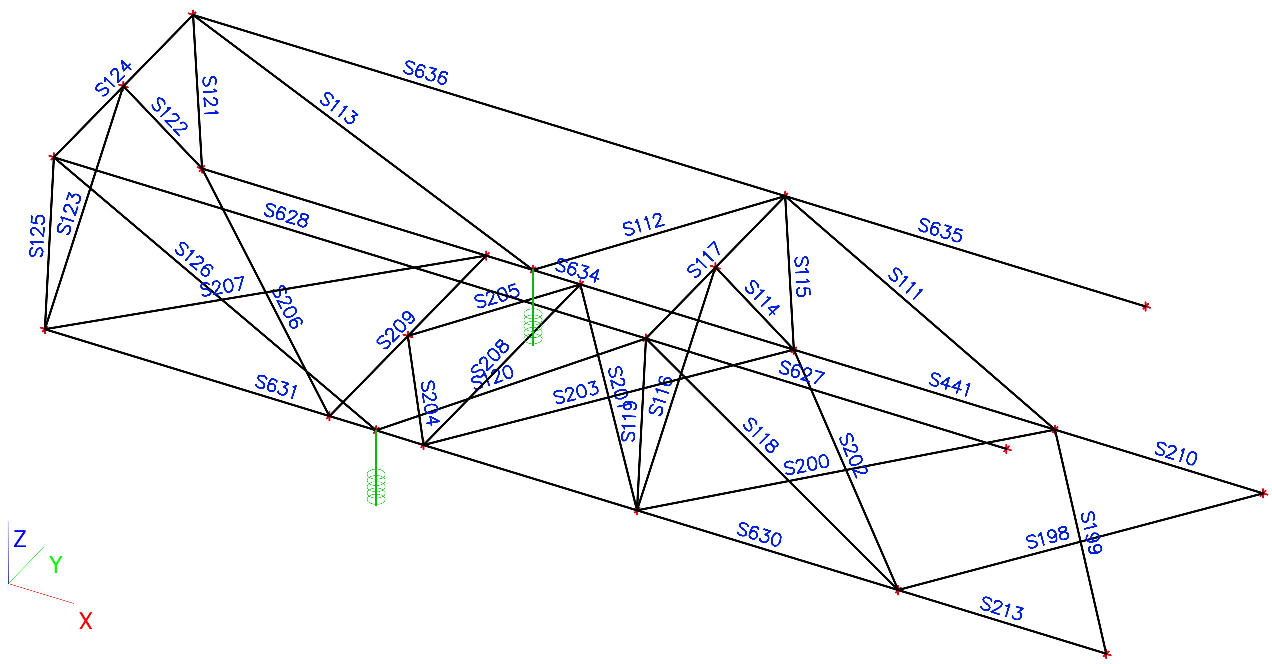
6.7. Vak 10 en 11 - rechts



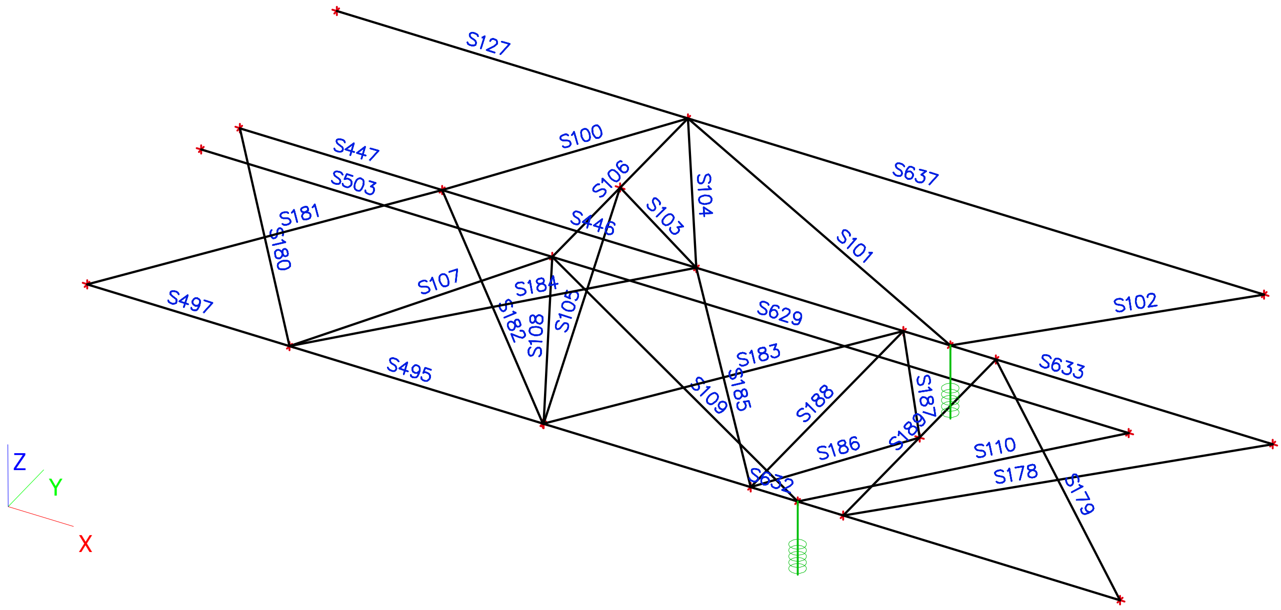
6.8. Vak 10l en 11l - links



6.9. Vak 12 a,12b,

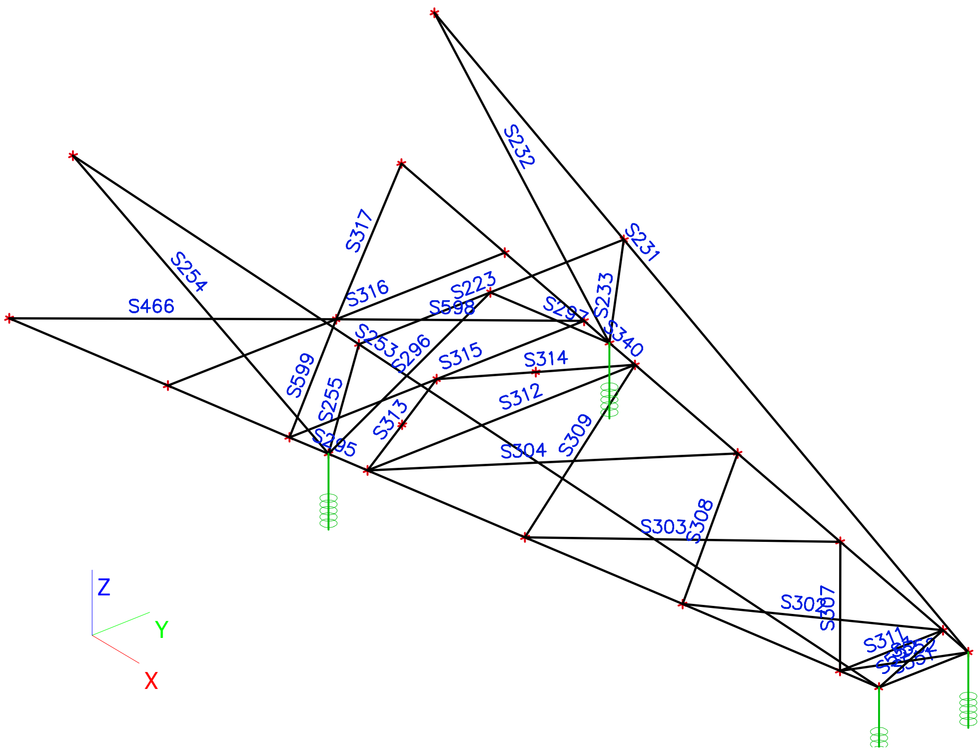


6.10. Vak 12a, 12b,

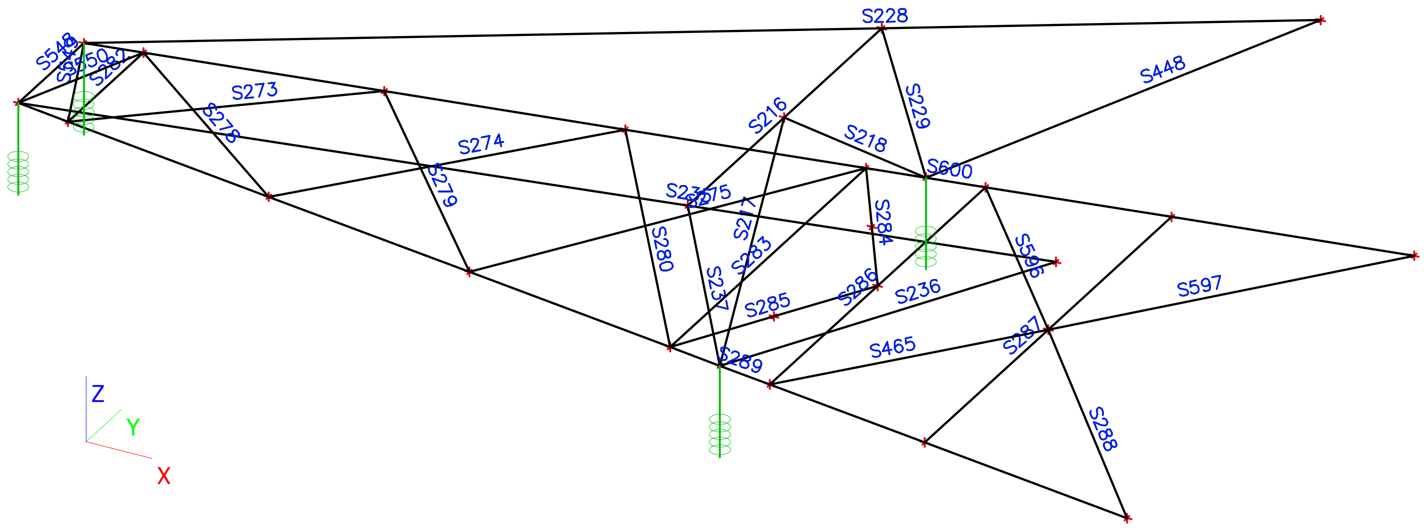


7. Staafnummers traverses

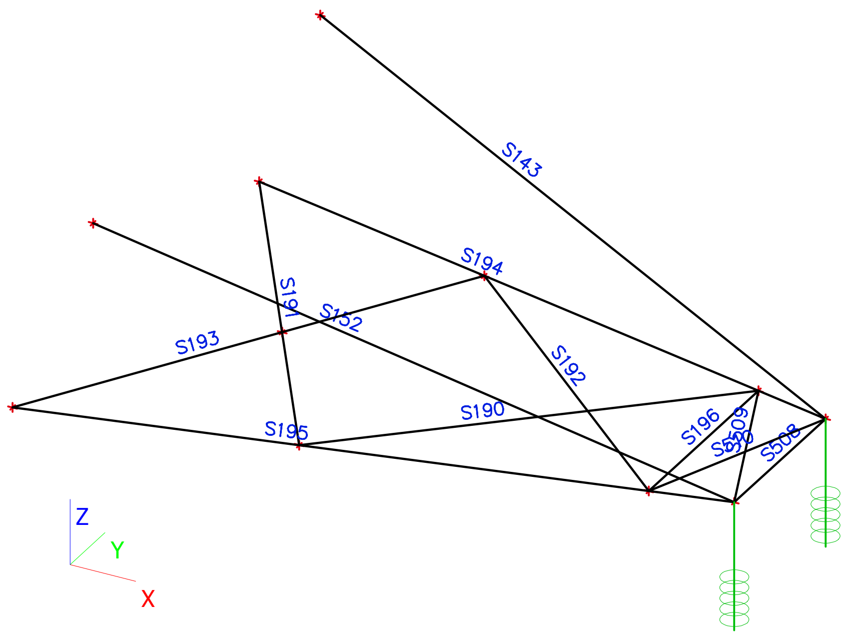
7.1. Traverse 1



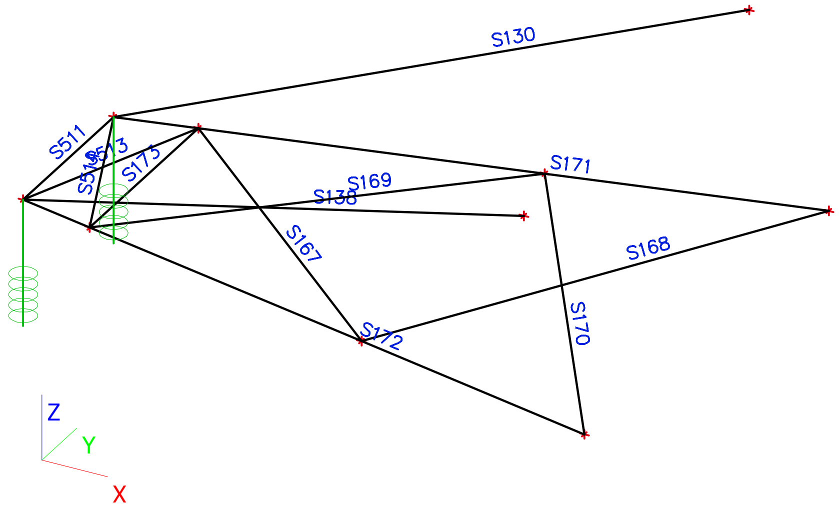
7.2. Traverse 2



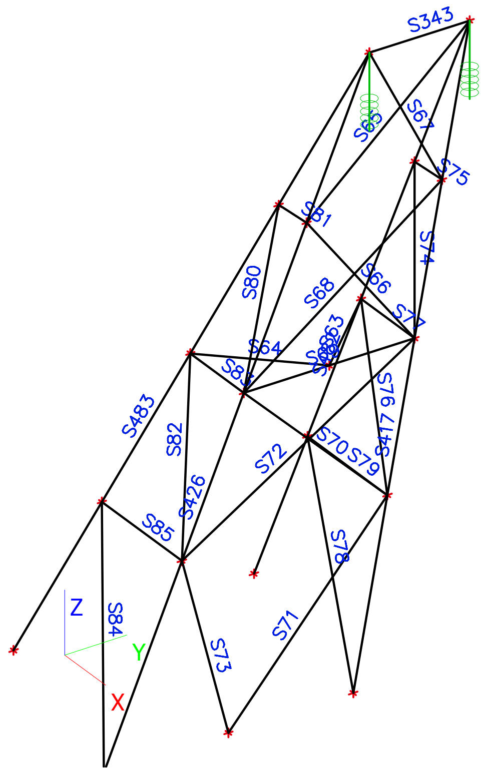
7.3. Traverse 3



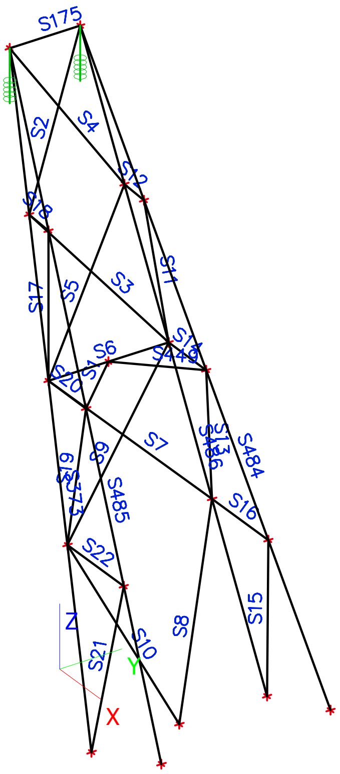
7.4. Traverse 4



7.5. Traverse 5

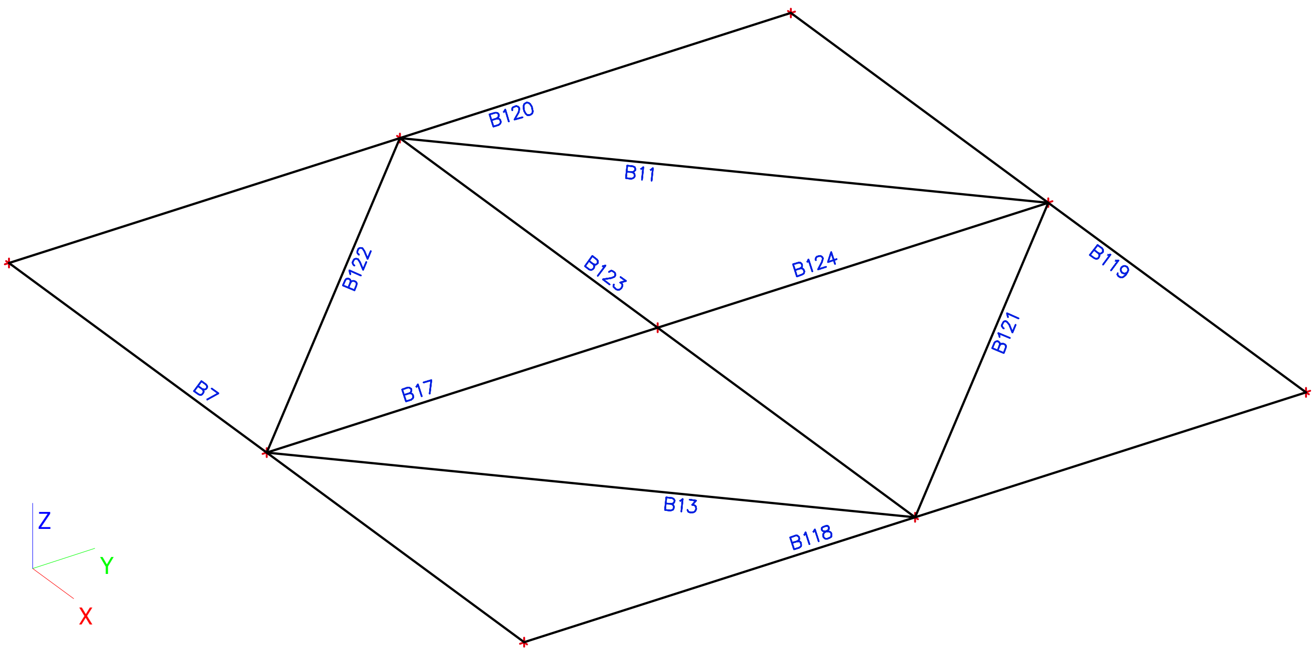


7.6. Traverse 6

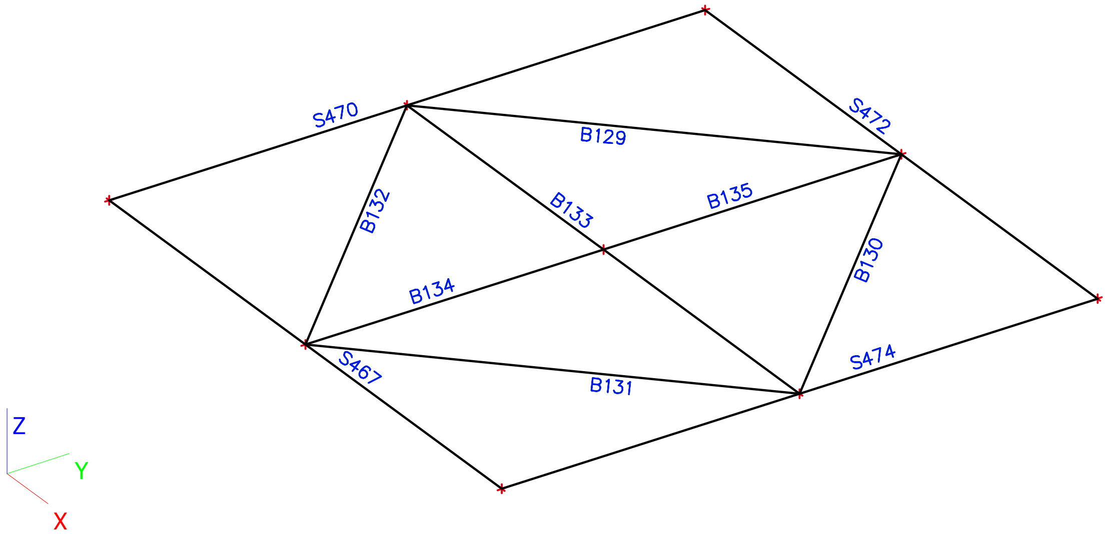


8. Staafnummers horizontale verbanden

8.1. Horizontaal verband 1



8.2. Horizontaal verband 2



9. Belastingsgevallen

Naam	Omschrijving	Actie type	Lastgroep	Belastingtype	Spec	Richting	Duur	'Master' belastingsgeval
6T	self weight of tower	Permanent	Perm	Eigen gewicht		-Z		
6C	self weight of conductor	Permanent	Perm	Standaard				
W_x-y+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x+y-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x-y-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x+y+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_y-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_y+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
WI_x+	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x+y+	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-y+	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x+y-	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-y-	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_y+	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_y-	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
Ice	IJs	Variabel	Ice	Statisch	Standaard		Kort	Geen
4M	Maintenance	Variabel	Maint	Statisch	Onderhoudslasten			Geen
4C0	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C1	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C2	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C3	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C4	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C5	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C6	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C7	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C8	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C9	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C10	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C11	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
SBS	SBS-load	Variabel	SBS	Statisch	Knikverkorterlasten			Geen
Tuls-1a	Conductor tension	Permanent	Perm	Standaard				
Tuls-1b	Conductor tension	Permanent	Perm	Standaard				
Tuls-3	Conductor tension	Permanent	Perm	Standaard				
Tuls-4	Conductor tension	Permanent	Perm	Standaard				
Tuls-6	Conductor tension	Permanent	Perm	Standaard				
Tuls-5a_CI1	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI2	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI3	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI4	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI5	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI6	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI7	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI8	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI9	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI10	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI11	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI12	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI13	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI14	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI15	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI16	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI17	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI18	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI19	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI20	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI21	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI22	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen

10. Combinaties

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
1a	wind;10	Omhullende - uiterst	W_x-y+ - Wind	1,50
			W_x+y- - Wind	1,50
			W_x-y- - Wind	1,50
			W_x+y+ - Wind	1,50
			W_y- - Wind	1,50
			W_y+ - Wind	1,50
			W_x- - Wind	1,50
			W_x+ - Wind	1,50
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-1a - Conductor tension	1,00
1a-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	1,50
			W_x+y- - Wind	1,50
			W_x-y- - Wind	1,50
			W_x+y+ - Wind	1,50
			W_y- - Wind	1,50
			W_y+ - Wind	1,50
			W_x- - Wind	1,50
			W_x+ - Wind	1,50
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-1a - Conductor tension	1,00
1b	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-1b - Conductor tension	1,00
1b-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-1b - Conductor tension	1,00
3	wind+ice	Omhullende - uiterst	Ice - IJs	1,50
			WI_x+ - Wind on tower and iced conductor line	0,45
			WI_x- - Wind on tower and iced conductor line	0,45
			WI_x+y+ - Wind on tower and iced conductor line	0,45
			WI_x+y- - Wind on tower and iced conductor line	0,45
			WI_x-y+ - Wind on tower and iced conductor line	0,45
			WI_x-y- - Wind on tower and iced conductor line	0,45
			WI_y+ - Wind on tower and iced conductor line	0,45
			WI_y- - Wind on tower and iced conductor line	0,45
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-3 - Conductor tension	1,00
3-p	wind+ice	Omhullende - uiterst	Ice - IJs	1,50

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
3-p	wind+ice	Omhullende - uiterst	WI_x+ - Wind on tower and iced conductor line	0,45
			WI_x- - Wind on tower and iced conductor line	0,45
			WI_x+y+ - Wind on tower and iced conductor line	0,45
			WI_x+y- - Wind on tower and iced conductor line	0,45
			WI_x-y+ - Wind on tower and iced conductor line	0,45
			WI_x-y- - Wind on tower and iced conductor line	0,45
			WI_y+ - Wind on tower and iced conductor line	0,45
			WI_y- - Wind on tower and iced conductor line	0,45
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-3 - Conductor tension	1,00
4	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-4 - Conductor tension	1,00
			4C0 - Construction	1,50
			4C1 - Construction	1,50
			4C2 - Construction	1,50
			4C3 - Construction	1,50
			4C4 - Construction	1,50
			4C5 - Construction	1,50
			4C6 - Construction	1,50
			4C7 - Construction	1,50
			4C8 - Construction	1,50
			4C9 - Construction	1,50
			4C10 - Construction	1,50
			4C11 - Construction	1,50
4-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-4 - Conductor tension	1,00
			4C0 - Construction	1,50
			4C1 - Construction	1,50
			4C2 - Construction	1,50
			4C3 - Construction	1,50
			4C4 - Construction	1,50
			4C5 - Construction	1,50
			4C6 - Construction	1,50
			4C7 - Construction	1,50
			4C8 - Construction	1,50
			4C9 - Construction	1,50
			4C10 - Construction	1,50
			4C11 - Construction	1,50
6	permanent	Omhullende - uiterst	6T - self weight of tower	1,35
			6C - self weight of conductor	1,35

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
6	permanent	Omhullende - uiterst	Tuls-6 - Conductor tension	1,00
5a1	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	0,80
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a2	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI1 - Conductor tension	0,80
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a2	safety	Omhullende - uiterst	Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a3	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	0,80
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a4	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	0,80
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a4	safety	Omhullende - uiterst	Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a5	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	0,80
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a6	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a6	safety	Omhullende - uiterst	Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	0,80
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a7	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	0,80
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a8	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a8	safety	Omhullende - uiterst	4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	0,80
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a9	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	0,80
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00

	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a10	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	0,80
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a11	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	0,80
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a11	safety	Omhullende - uiterst	Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a12	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	0,80
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a13	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a13	safety	Omhullende - uiterst	Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	0,80
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a14	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	0,80
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a15	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a15	safety	Omhullende - uiterst	Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	0,80
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a16	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	0,80
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a17	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a17	safety	Omhullende - uiterst	4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	0,80
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a18	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	0,80
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a19	safety	Omhullende - uiterst	6T - self weight of tower	1,20

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a19	safety	Omhullende - uiterst	6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	0,80
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a20	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a20	safety	Omhullende - uiterst	Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	0,80
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a21	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	0,80
			4C11 - Construction	1,00
5a22	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a22	safety	Omhullende - uiterst	Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	0,80
			4C11 - Construction	1,00
5a23	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	0,80
			4C11 - Construction	1,00

11. Resultaten

11.1. Interne krachten in staaf

Interne krachten in staaf
Lineaire berekening, Extreem : Staaf, Systeem : Hoofd
Selectie : Alle
Klasse : All UGT

Staaf	css	BG	dx [m]	N [kN]
S1	CS140 - L45X30X5	1a/9	0,000	**-0,51**
S1	CS140 - L45X30X5	1a-p/8	0,941	**0,42**
S2	CS138 - L45X5	5a2/19	0,000	**-4,76**
S2	CS138 - L45X5	5a1/20	1,862	**4,75**
S3	CS137 - L45X30X5	5a1/20	0,000	**-3,11**
S3	CS137 - L45X30X5	5a2/19	2,018	**3,01**
S4	CS138 - L45X5	5a1/21	0,000	**-4,88**
S4	CS138 - L45X5	5a2/22	1,862	**5,00**
S5	CS137 - L45X30X5	5a2/19	0,000	**-3,32**
S5	CS137 - L45X30X5	5a1/21	2,018	**2,85**
S6	CS136 - L45X5	3/10	0,000	**-2,75**
S6	CS136 - L45X5	3-p/11	0,682	**1,29**
S7	CS135 - L45X30X5	1a/18	0,000	**-1,83**
S7	CS135 - L45X30X5	3-p/23	2,184	**4,29**
S8	CS134 - L45X5	3/10	0,000	**-6,68**
S8	CS134 - L45X5	1a-p/15	2,162	**2,84**
S9	CS135 - L45X30X5	1a/3	0,000	**-2,45**
S9	CS135 - L45X30X5	3-p/23	2,184	**3,18**
S10	CS134 - L45X5	1a/1	0,000	**-4,67**
S10	CS134 - L45X5	1a/3	2,162	**3,71**
S11	CS140 - L45X30X5	3/10	1,511	**-2,63**
S11	CS140 - L45X30X5	1a-p/17	0,000	**0,27**
S12	CS140 - L45X30X5	1a-p/17	0,000	**-0,04**
S12	CS140 - L45X30X5	3/10	0,336	**0,86**
S13	CS140 - L45X30X5	1a/1	1,501	**-1,27**
S13	CS140 - L45X30X5	1a-p/17	0,000	**0,40**
S14	CS138 - L45X5	1a-p/17	0,000	**-0,14**
S14	CS138 - L45X5	1a/1	0,649	**0,58**
S15	CS139 - L50X40X5	1a/1	1,911	**-1,81**
S15	CS139 - L50X40X5	1a-p/17	0,000	**0,60**
S16	CS140 - L45X30X5	1a-p/17	0,000	**-0,28**
S16	CS140 - L45X30X5	1a/1	0,969	**0,98**
S17	CS140 - L45X30X5	3/10	1,511	**-2,07**
S17	CS140 - L45X30X5	3-p/11	0,000	**0,56**
S18	CS140 - L45X30X5	3-p/11	0,000	**-0,22**
S18	CS140 - L45X30X5	3/10	0,336	**0,59**
S19	CS140 - L45X30X5	1a/2	1,501	**-1,66**
S19	CS140 - L45X30X5	1a-p/15	0,000	**0,69**
S20	CS138 - L45X5	1a-p/17	0,000	**-0,15**
S20	CS138 - L45X5	1a/1	0,649	**0,67**
S21	CS139 - L50X40X5	1a/2	1,911	**-1,71**
S21	CS139 - L50X40X5	1a-p/15	0,000	**0,54**
S22	CS140 - L45X30X5	1a-p/15	0,000	**-0,42**
S22	CS140 - L45X30X5	1a/2	0,000	**1,04**
S23	CS130 - L45X30X5	3-p/23	0,000	**-6,83**
S23	CS130 - L45X30X5	1a/3	1,450	**3,91**
S24	CS130 - L45X30X5	3/10	0,000	**-9,14**
S24	CS130 - L45X30X5	1a-p/15	1,451	**2,59**
S25	CS131 - L45X5	3/24	0,997	**-13,98**
S25	CS131 - L45X5	1a-p/8	0,000	**-5,81**
S26	CS121 - L80X6	1a/3	0,000	**-39,34**
S26	CS121 - L80X6	5a5/25	2,386	**34,05**
S27	CS121 - L80X6	1a/18	0,000	**-24,80**
S27	CS121 - L80X6	1a-p/4	2,652	**42,66**
S28	CS121 - L80X6	1a/18	0,000	**-25,87**
S28	CS121 - L80X6	1a-p/4	2,386	**46,24**
S29	CS121 - L80X6	1a/3	0,000	**-36,35**
S29	CS121 - L80X6	1a-p/16	2,651	**31,41**
S30	CS123 - L45X5	1a/1	1,268	**-0,26**
S30	CS123 - L45X5	1a-p/16	1,268	**0,17**
S31	CS93 - L(ARC)70x70x5	1a-p/4	0,000	**-31,44**
S31	CS93 - L(ARC)70x70x5	1a/18	2,265	**18,77**
S33	CS4 - L50X40X5	3/10	1,616	**-24,83**
S33	CS4 - L50X40X5	1a-p/15	0,000	**-11,40**
S34	CS93 - L(ARC)70x70x5	1a-p/4	0,000	**-35,15**
S34	CS93 - L(ARC)70x70x5	1a/18	2,366	**20,28**
S35	CS4 - L50X40X5	3/26	0,000	**-22,05**
S35	CS4 - L50X40X5	1a-p/4	1,616	**-9,37**
S36	CS93 - L(ARC)70x70x5	1a-p/16	0,000	**-25,20**
S36	CS93 - L(ARC)70x70x5	1a/3	2,265	**26,96**
S38	CS4 - L50X40X5	1a/1	0,000	**0,00**
S38	CS4 - L50X40X5	1a/27	0,878	**0,00**
S41	CS4 - L50X40X5	1a/9	0,879	**0,00**
S41	CS4 - L50X40X5	1a/18	0,000	**0,00**
S42	CS92 - L50X40X5	1a/18	0,000	**-0,99**
S42	CS92 - L50X40X5	1a/2	2,227	**0,90**
S43	CS4 - L50X40X5	1a/6	0,000	**0,00**
S43	CS4 - L50X40X5	1a/6	0,864	**0,00**
S44	CS92 - L50X40X5	1a/7	0,000	**-0,55**
S44	CS92 - L50X40X5	1a/6	2,231	**1,02**
S46	CS86 - L130X12	1a/9	0,000	**-28,65**
S46	CS86 - L130X12	1a-p/8	0,000	**6,37**
S47	CS86 - L130X12	1a/27	0,000	**-31,63**
S47	CS86 - L130X12	1a-p/28	0,000	**3,26**
S49	CS84 - L(ARC)100x100x6	1a/9	0,000	**-27,24**
S49	CS84 - L(ARC)100x100x6	1a-p/8	2,080	**3,61**

Staaf	css	BG	dx [m]	N [kN]
S51	CS88 - L50X40X5	1a/1	0,000	**-1,37**
S51	CS88 - L50X40X5	1a-p/17	2,571	**0,88**
S52	CS88 - L50X40X5	1a-p/17	0,000	**-0,88**
S52	CS88 - L50X40X5	1a/1	1,250	**1,01**
S54	CS37 - HFLeq75x75x8	1a-p/29	0,000	**-1,03**
S54	CS37 - HFLeq75x75x8	3/10	0,000	**7,24**
S55	CS88 - L50X40X5	1a/2	0,000	**-3,33**
S55	CS88 - L50X40X5	1a-p/15	2,571	**1,18**
S56	CS88 - L50X40X5	1a-p/15	1,250	**-1,03**
S56	CS88 - L50X40X5	1a/2	0,000	**2,57**
S61	CS84 - L(ARC)100x100x6	1a/9	0,000	**-27,21**
S61	CS84 - L(ARC)100x100x6	1a-p/8	2,080	**6,27**
S63	CS140 - L45X30X5	1a/27	0,000	**-0,55**
S63	CS140 - L45X30X5	1a-p/28	0,941	**0,45**
S64	CS140 - L45X30X5	1a/9	0,000	**-0,49**
S64	CS140 - L45X30X5	1a-p/8	0,941	**0,38**
S65	CS138 - L45X5	5a4/30	0,000	**-4,23**
S65	CS138 - L45X5	5a3/31	1,862	**5,43**
S66	CS137 - L45X30X5	5a3/31	0,000	**-3,44**
S66	CS137 - L45X30X5	5a4/30	2,018	**2,64**
S67	CS138 - L45X5	5a3/32	0,000	**-3,95**
S67	CS138 - L45X5	5a4/33	1,862	**5,40**
S68	CS137 - L45X30X5	3-p/34	0,000	**-3,55**
S68	CS137 - L45X30X5	5a3/32	2,018	**2,47**
S69	CS136 - L45X5	3/35	0,682	**-0,73**
S69	CS136 - L45X5	3-p/34	0,682	**3,30**
S70	CS135 - L45X30X5	1a/1	0,000	**-3,08**
S70	CS135 - L45X30X5	1a-p/17	2,184	**2,55**
S71	CS134 - L45X5	1a/3	0,000	**-4,08**
S71	CS134 - L45X5	1a/1	2,162	**4,66**
S72	CS135 - L45X30X5	1a/2	0,000	**-3,74**
S72	CS135 - L45X30X5	1a-p/15	2,184	**1,91**
S73	CS134 - L45X5	1a/18	0,000	**-3,27**
S73	CS134 - L45X5	1a/2	2,162	**5,64**
S74	CS140 - L45X30X5	1a/3	1,511	**-1,14**
S74	CS140 - L45X30X5	3-p/34	0,000	**1,66**
S75	CS140 - L45X30X5	3-p/34	0,000	**-0,58**
S75	CS140 - L45X30X5	1a/18	0,336	**0,28**
S76	CS140 - L45X30X5	1a/18	1,501	**-1,69**
S76	CS140 - L45X30X5	1a-p/4	0,000	**0,82**
S77	CS138 - L45X5	1a-p/16	0,000	**-0,23**
S77	CS138 - L45X5	1a/3	0,649	**0,64**
S78	CS139 - L50X40X5	1a/18	1,911	**-1,74**
S78	CS139 - L50X40X5	1a-p/4	0,000	**0,67**
S79	CS140 - L45X30X5	1a-p/4	0,969	**-0,50**
S79	CS140 - L45X30X5	1a/18	0,969	**1,07**
S80	CS140 - L45X30X5	3/35	1,511	**-1,71**
S80	CS140 - L45X30X5	1a-p/16	0,000	**0,69**
S81	CS140 - L45X30X5	3-p/34	0,000	**-0,24**
S81	CS140 - L45X30X5	3/35	0,336	**0,53**
S82	CS140 - L45X30X5	1a/3	1,501	**-1,37**
S82	CS140 - L45X30X5	1a-p/16	0,000	**0,42**
S83	CS138 - L45X5	1a-p/16	0,000	**-0,16**
S83	CS138 - L45X5	1a/3	0,649	**0,61**
S84	CS139 - L50X40X5	1a/3	1,911	**-1,85**
S84	CS139 - L50X40X5	1a-p/16	0,000	**0,71**
S85	CS140 - L45X30X5	1a-p/16	0,969	**-0,35**
S85	CS140 - L45X30X5	1a/3	0,000	**1,00**
S86	CS130 - L45X30X5	1a-p/15	0,000	**-3,39**
S86	CS130 - L45X30X5	1a/2	1,450	**6,49**
S87	CS130 - L45X30X5	1a/3	0,000	**-4,79**
S87	CS130 - L45X30X5	1a-p/16	1,451	**5,16**
S88	CS131 - L45X5	3/24	0,997	**-14,11**
S88	CS131 - L45X5	1a-p/8	0,000	**-5,93**
S89	CS121 - L80X6	1a/2	0,000	**-49,75**
S89	CS121 - L80X6	1a-p/15	2,386	**20,95**
S90	CS121 - L80X6	1a/1	0,001	**-42,87**
S90	CS121 - L80X6	1a-p/17	2,652	**23,76**
S91	CS121 - L80X6	5a11/36	0,000	**-46,69**
S91	CS121 - L80X6	1a-p/17	2,386	**27,20**
S92	CS121 - L80X6	1a/2	0,000	**-48,01**
S92	CS121 - L80X6	1a-p/15	2,651	**18,18**
S93	CS123 - L45X5	1a-p/16	1,268	**-0,17**
S93	CS123 - L45X5	1a/1	1,268	**0,35**
S94	CS128 - L60X6	1a/27	0,000	**-2,84**
S94	CS128 - L60X6	1a-p/28	1,851	**2,60**
S95	CS128 - L60X6	1a/9	0,000	**-2,79**
S95	CS128 - L60X6	1a-p/8	1,849	**2,65**
S96	CS128 - L60X6	1a/27	0,000	**-3,17**
S96	CS128 - L60X6	1a-p/28	1,850	**2,64**
S97	CS128 - L60X6	1a/9	0,000	**-2,85**
S97	CS128 - L60X6	1a-p/8	1,849	**2,96**
S98	CS127 - L50X5	1a/9	0,961	**-1,62**
S98	CS127 - L50X5	1a-p/8	0,000	**1,56**
S99	CS127 - L50X5	1a/27	1,920	**-1,84**
S99	CS127 - L50X5	1a-p/8	0,000	**1,68**
S100	CS24 - LS(CH)100X6	3/10	2,364	**-91,97**
S100	CS24 - LS(CH)100X6	1a-p/29	0,000	**-0,25**
S101	CS146 - L50X40X5	1a-p/29	0,000	**-2,58**
S101	CS146 - L50X40X5	3/10	2,361	**88,21**
S102	CS145 - L(ARC)90x90x6	3/10	2,818	**-66,50**
S102	CS145 - L(ARC)90x90x6	1a-p/29	0,000	**25,06**
S103	CS149 - L50X40X5	1a/9	0,000	**-2,28**
S103	CS149 - L50X40X5	1a-p/8	1,691	**2,10**
S104	CS148 - L50X5	1a-p/8	0,000	**-0,69**
S104	CS148 - L50X5	1a/9	1,306	**2,53**
S105	CS149 - L50X40X5	1a/27	0,000	**-2,27**

Staaf	css	BG	dx [m]	N [kN]
S105	CS149 - L50X40X5	1a-p/28	1,691	**2,11**
S106	CS148 - L50X5	1a/9	0,960	**-1,46**
S106	CS148 - L50X5	1a-p/28	0,960	**1,32**
S107	CS24 - LS(CH)100X6	3/10	2,364	**-83,27**
S107	CS24 - LS(CH)100X6	1a-p/29	0,000	**3,99**
S108	CS148 - L50X5	1a-p/28	0,000	**-0,78**
S108	CS148 - L50X5	1a/27	1,306	**2,43**
S109	CS146 - L50X40X5	1a-p/29	0,000	**-6,64**
S109	CS146 - L50X40X5	3/10	2,360	**79,74**
S110	CS145 - L(ARC)90x90x6	1a/6	2,819	**-59,78**
S110	CS145 - L(ARC)90x90x6	1a-p/29	0,000	**28,63**
S111	CS24 - LS(CH)100X6	1a/7	2,363	**-52,85**
S111	CS24 - LS(CH)100X6	3-p/34	0,000	**29,17**
S112	CS146 - L50X40X5	3-p/34	0,000	**-32,00**
S112	CS146 - L50X40X5	1a/7	2,361	**49,31**
S113	CS145 - L(ARC)90x90x6	1a/7	2,819	**-29,55**
S113	CS145 - L(ARC)90x90x6	3-p/34	0,000	**61,63**
S114	CS149 - L50X40X5	1a/9	0,000	**-2,61**
S114	CS149 - L50X40X5	1a-p/8	1,691	**2,44**
S115	CS148 - L50X5	1a-p/8	0,000	**-0,86**
S115	CS148 - L50X5	1a/9	1,306	**2,85**
S116	CS149 - L50X40X5	1a/27	0,000	**-2,63**
S116	CS149 - L50X40X5	1a-p/28	1,691	**2,42**
S117	CS148 - L50X5	1a/27	1,920	**-1,68**
S117	CS148 - L50X5	1a-p/8	0,000	**1,53**
S118	CS24 - LS(CH)100X6	1a/7	2,363	**-53,13**
S118	CS24 - LS(CH)100X6	1a-p/12	0,000	**25,91**
S119	CS148 - L50X5	1a-p/28	0,000	**-0,90**
S119	CS148 - L50X5	1a/27	1,306	**2,80**
S120	CS146 - L50X40X5	1a-p/12	0,000	**-28,74**
S120	CS146 - L50X40X5	1a/7	2,361	**49,73**
S121	CS148 - L50X5	1a-p/8	1,306	**-0,99**
S121	CS148 - L50X5	1a/9	0,000	**3,18**
S122	CS149 - L50X40X5	1a/9	0,000	**-2,83**
S122	CS149 - L50X40X5	1a-p/8	1,691	**2,64**
S123	CS149 - L50X40X5	1a/27	0,000	**-2,83**
S123	CS149 - L50X40X5	1a-p/28	1,691	**2,64**
S124	CS148 - L50X5	1a/27	1,920	**-1,83**
S124	CS148 - L50X5	1a-p/8	0,000	**1,64**
S125	CS148 - L50X5	1a-p/28	1,306	**-1,06**
S125	CS148 - L50X5	1a/27	0,000	**3,10**
S126	CS145 - L(ARC)90x90x6	1a/7	2,819	**-32,99**
S126	CS145 - L(ARC)90x90x6	1a-p/12	0,000	**55,41**
S127	CS97 - L100X8	1a-p/29	0,000	**-40,99**
S127	CS97 - L100X8	3/10	0,000	**185,10**
S129	CS132 - L50X40X5	1a-p/17	1,213	**29,58**

Staaf	css	BG	dx [m]	N [kN]
S129	CS132 - L50X40X5	3/37	0,000	**57,78**
S130	CS147 - L50X40X5	3-p/38	2,880	**30,74**
S130	CS147 - L50X40X5	3/10	0,000	**57,75**
S131	CS126 - L(ARC)80x80x6	1a/7	1,541	**-78,35**
S131	CS126 - L(ARC)80x80x6	3-p/34	0,000	**124,84**
S132	CS126 - L(ARC)80x80x6	1a/7	1,541	**-82,04**
S132	CS126 - L(ARC)80x80x6	1a-p/12	0,000	**113,76**
S133	CS7 - L45X30X5	1a/7	0,799	**-0,14**
S133	CS7 - L45X30X5	1a-p/12	0,000	**0,25**
S134	CS7 - L45X30X5	1a-p/29	0,800	**-0,08**
S134	CS7 - L45X30X5	1a/6	0,000	**0,20**
S135	CS96 - L120X80X8	1a/6	0,000	**-131,28**
S135	CS96 - L120X80X8	1a-p/29	4,098	**44,99**
S136	CS122 - L50X40X5	1a-p/12	2,179	**-0,52**
S136	CS122 - L50X40X5	1a/7	0,000	**0,81**
S137	CS132 - L50X40X5	1a-p/15	1,213	**27,35**
S137	CS132 - L50X40X5	3/39	0,000	**53,30**
S138	CS147 - L50X40X5	1a-p/29	2,880	**28,52**
S138	CS147 - L50X40X5	3/37	0,000	**53,13**
S139	CS125 - L(ARC)75x75x6	1a-p/12	0,000	**-92,99**
S139	CS125 - L(ARC)75x75x6	1a/7	1,506	**61,65**
S140	CS96 - L120X80X8	1a/6	0,000	**-125,95**
S140	CS96 - L120X80X8	1a-p/29	4,099	**51,09**
S141	CS125 - L(ARC)75x75x6	1a-p/12	0,000	**-102,04**
S141	CS125 - L(ARC)75x75x6	1a/7	1,506	**51,89**
S142	CS132 - L50X40X5	1a-p/4	1,213	**29,42**
S142	CS132 - L50X40X5	3/26	0,000	**57,82**
S143	CS147 - L50X40X5	1b-p/40	2,880	**30,71**
S143	CS147 - L50X40X5	3/35	0,000	**57,71**
S144	CS126 - L(ARC)80x80x6	3/10	1,541	**-162,25**
S144	CS126 - L(ARC)80x80x6	1a-p/29	0,000	**43,52**
S145	CS126 - L(ARC)80x80x6	3/10	1,541	**-144,34**
S145	CS126 - L(ARC)80x80x6	1a-p/29	0,000	**53,89**
S146	CS7 - L45X30X5	3/10	0,000	**-0,29**
S146	CS7 - L45X30X5	1a-p/29	0,800	**0,12**
S147	CS7 - L45X30X5	1a/6	0,800	**-0,29**
S147	CS7 - L45X30X5	1a-p/29	0,000	**0,10**
S148	CS96 - L120X80X8	1a/7	0,000	**-68,34**
S148	CS96 - L120X80X8	1a-p/12	4,098	**107,67**
S149	CS122 - L50X40X5	1a-p/29	2,179	**-0,15**
S149	CS122 - L50X40X5	3/10	0,000	**1,43**
S150	CS122 - L50X40X5	1a-p/29	2,179	**-0,34**

Staaf	css	BG	dx [m]	N [kN]
S150	CS122 - L50X40X5	3/10	0,000	**1,98**
S151	CS132 - L50X40X5	1a-p/16	1,213	**27,33**
S151	CS132 - L50X40X5	3/41	0,000	**53,27**
S152	CS147 - L50X40X5	3-p/34	2,880	**28,52**
S152	CS147 - L50X40X5	3/26	0,000	**53,14**
S153	CS125 - L(ARC)75x75x6	1a-p/29	0,000	**-47,07**
S153	CS125 - L(ARC)75x75x6	1a/6	1,506	**107,08**
S154	CS96 - L120X80X8	1a/7	0,001	**-70,82**
S154	CS96 - L120X80X8	1a-p/12	4,099	**105,20**
S155	CS125 - L(ARC)75x75x6	1a-p/29	0,000	**-43,62**
S155	CS125 - L(ARC)75x75x6	1a/6	1,506	**109,74**
S156	CS93 - L(ARC)70x70x5	1a-p/17	0,000	**-19,08**
S156	CS93 - L(ARC)70x70x5	1a/1	2,264	**31,00**
S159	CS120 - ISEA130/130/10	1a-p/17	0,000	**74,22**
S159	CS120 - ISEA130/130/10	3/10	0,888	**141,86**
S160	CS120 - ISEA130/130/10	1a-p/4	0,000	**72,20**
S160	CS120 - ISEA130/130/10	3/35	0,888	**141,27**
S161	CS151 - HFLeq130x130x12	1a-p/29	0,000	**-95,12**
S161	CS151 - HFLeq130x130x12	1a/6	0,000	**377,65**
S162	CS155 - HFLue120x80x8	1a/6	0,000	**-289,16**
S162	CS155 - HFLue120x80x8	1a-p/29	1,544	**117,40**
S164	CS155 - HFLue120x80x8	1a/7	0,000	**-167,21**
S164	CS155 - HFLue120x80x8	1a-p/12	1,544	**239,53**
S166	CS120 - ISEA130/130/10	1a-p/15	0,888	**69,75**
S166	CS120 - ISEA130/130/10	3/10	0,000	**135,01**
S167	CS150 - L(ARC)55x55x5	5a6/42	0,000	**-16,53**
S167	CS150 - L(ARC)55x55x5	5a5/43	0,000	**12,56**
S168	CS148 - L50X5	5a5/43	0,000	**-6,54**
S168	CS148 - L50X5	5a6/42	0,000	**8,44**
S169	CS150 - L(ARC)55x55x5	5a5/25	0,000	**-17,90**
S169	CS150 - L(ARC)55x55x5	5a6/44	0,000	**10,72**
S170	CS148 - L50X5	5a6/44	0,000	**-5,59**
S170	CS148 - L50X5	5a5/25	0,000	**9,14**
S171	CS101 - UNP120	5a5/45	0,000	**-64,11**
S171	CS101 - UNP120	5a6/44	0,000	**8,45**
S172	CS101 - UNP120	5a6/46	0,000	**-68,67**
S172	CS101 - UNP120	5a5/47	0,000	**8,10**
S173	CS30 - UNP140	3-p/34	0,000	**-4,85**
S173	CS30 - UNP140	1a/7	0,641	**0,59**
S175	CS148 - L50X5	4-p/48	0,000	**8,73**
S175	CS148 - L50X5	3/10	0,000	**38,89**
S177	CS82 - L130X12	1a/2	0,000	**-562,61**
S177	CS82 - L130X12	1a-p/15	4,280	**173,68**
S178	CS15 - HFLeq60x60x5	5a7/49	0,000	**-9,44**
S178	CS15 - HFLeq60x60x5	5a9/50	3,046	**5,11**
S179	CS15 - HFLeq60x60x5	5a8/51	0,000	**-5,89**
S179	CS15 - HFLeq60x60x5	5a10/52	0,000	**8,56**
S180	CS150 - L(ARC)55x55x5	5a7/53	0,000	**-9,67**
S180	CS150 - L(ARC)55x55x5	5a8/54	1,781	**13,31**
S181	CS150 - L(ARC)55x55x5	5a8/55	2,078	**-13,25**
S181	CS150 - L(ARC)55x55x5	5a7/56	0,000	**9,63**
S182	CS15 - HFLeq60x60x5	5a7/56	0,000	**-10,62**
S182	CS15 - HFLeq60x60x5	5a8/55	0,584	**14,41**
S183	CS15 - HFLeq60x60x5	5a8/55	0,000	**-13,78**
S183	CS15 - HFLeq60x60x5	5a7/56	0,000	**9,47**
S184	CS15 - HFLeq60x60x5	5a8/54	0,000	**-14,66**
S184	CS15 - HFLeq60x60x5	5a7/53	0,000	**10,51**
S185	CS15 - HFLeq60x60x5	5a7/53	0,000	**-10,14**
S185	CS15 - HFLeq60x60x5	5a8/54	0,598	**13,17**
S186	CS149 - L50X40X5	5a10/52	0,649	**-48,46**
S186	CS149 - L50X40X5	5a9/50	0,000	**4,69**
S187	CS149 - L50X40X5	5a9/50	0,000	**-45,06**
S187	CS149 - L50X40X5	5a10/52	0,649	**7,95**
S188	CS30 - UNP140	1b/57	0,000	**21,47**
S188	CS30 - UNP140	5a9/50	0,000	**40,94**
S189	CS30 - UNP140	1b/58	1,081	**20,99**
S189	CS30 - UNP140	5a10/52	0,360	**47,94**
S190	CS150 - L(ARC)55x55x5	5a12/59	0,000	**-19,18**
S190	CS150 - L(ARC)55x55x5	5a11/60	0,000	**8,37**
S191	CS148 - L50X5	5a11/61	0,958	**-4,39**
S191	CS148 - L50X5	5a12/62	0,000	**9,86**
S192	CS150 - L(ARC)55x55x5	5a11/36	0,000	**-17,12**
S192	CS150 - L(ARC)55x55x5	5a12/63	0,000	**10,95**
S193	CS148 - L50X5	5a12/64	0,000	**-5,69**
S193	CS148 - L50X5	5a11/65	1,277	**8,75**
S194	CS101 - UNP120	5a11/66	0,000	**-77,28**
S194	CS101 - UNP120	5a12/64	0,000	**-1,80**
S195	CS101 - UNP120	5a12/67	0,000	**-69,95**
S195	CS101 - UNP120	5a11/60	0,000	**1,36**
S196	CS30 - UNP140	3-p/11	0,000	**-3,08**
S196	CS30 - UNP140	3/10	0,641	**2,23**
S198	CS150 - L(ARC)55x55x5	5a9/68	0,000	**-11,56**
S198	CS150 - L(ARC)55x55x5	5a10/69	0,000	**11,74**
S199	CS150 - L(ARC)55x55x5	5a10/69	0,000	**-8,98**
S199	CS150 - L(ARC)55x55x5	5a9/68	0,000	**14,41**
S200	CS15 - HFLeq60x60x5	5a9/70	0,000	**-15,74**
S200	CS15 - HFLeq60x60x5	5a10/71	1,463	**9,82**
S201	CS15 - HFLeq60x60x5	5a10/71	0,000	**-9,53**

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
S201	CS15 - HFLeq60x60x5	5a9/70	0,000	**14,19**
S202	CS15 - HFLeq60x60x5	5a10/71	2,924	**-12,78**
S202	CS15 - HFLeq60x60x5	5a9/70	0,000	**12,69**
S203	CS15 - HFLeq60x60x5	5a9/70	0,000	**-12,18**
S203	CS15 - HFLeq60x60x5	5a10/71	0,000	**11,43**
S204	CS149 - L50X40X5	5a8/51	0,647	**-45,62**
S204	CS149 - L50X40X5	5a7/49	0,000	**7,85**
S205	CS149 - L50X40X5	5a7/49	0,000	**-48,09**
S205	CS149 - L50X40X5	5a8/51	0,647	**5,07**
S206	CS15 - HFLeq60x60x5	5a9/50	0,000	**-5,78**
S206	CS15 - HFLeq60x60x5	5a7/49	2,437	**8,77**
S207	CS15 - HFLeq60x60x5	5a10/52	0,000	**-9,22**
S207	CS15 - HFLeq60x60x5	5a8/51	0,000	**5,23**
S208	CS30 - UNP140	1b/72	0,000	**21,04**
S208	CS30 - UNP140	5a8/73	0,000	**40,25**
S209	CS30 - UNP140	1b/74	0,000	**21,11**
S209	CS30 - UNP140	5a7/49	1,081	**47,62**
S210	CS101 - UNP120	1a/7	0,000	**-61,99**
S210	CS101 - UNP120	3-p/34	0,000	**88,53**
S211	CS129 - L(ARC)65x65x6	1a-p/29	0,000	**0,80**
S211	CS129 - L(ARC)65x65x6	3/10	0,000	**23,84**
S212	CS129 - L(ARC)65x65x6	1a-p/12	0,000	**-5,48**
S212	CS129 - L(ARC)65x65x6	3/35	0,309	**16,11**
S213	CS101 - UNP120	1a/7	0,000	**-71,84**
S213	CS101 - UNP120	3-p/34	0,000	**73,11**
S214	CS156 - L50X5	1a/9	0,000	**-2,50**
S214	CS156 - L50X5	1a-p/8	2,305	**2,39**
S215	CS156 - L50X5	1a/9	0,000	**-2,72**
S215	CS156 - L50X5	1a-p/8	2,305	**2,46**
S216	CS156 - L50X5	1a/27	2,369	**-0,10**
S216	CS156 - L50X5	1a/27	0,000	**0,06**
S217	CS158 - L50X40X5	1a/27	1,587	**-0,28**
S217	CS158 - L50X40X5	1a-p/28	0,000	**0,08**
S218	CS158 - L50X40X5	1a/9	1,600	**-0,24**
S218	CS158 - L50X40X5	1a-p/8	0,000	**0,11**
S219	CS156 - L50X5	1a/27	0,000	**-2,71**
S219	CS156 - L50X5	1a-p/28	2,305	**2,20**
S220	CS156 - L50X5	1a/27	0,000	**-2,75**
S220	CS156 - L50X5	1a-p/28	2,305	**2,37**
S221	CS156 - L50X5	1a/27	1,614	**-2,14**
S221	CS156 - L50X5	1a-p/8	0,000	**1,70**
S222	CS156 - L50X5	1a/9	0,000	**-2,11**
S222	CS156 - L50X5	1a-p/8	0,000	**1,87**
S223	CS156 - L50X5	1a/9	0,000	**-0,09**
S223	CS156 - L50X5	1a/9	2,369	**0,07**
S224	CS154 - L(ARC)100x100x8	1a-p/29	2,376	**-92,25**
S224	CS154 - L(ARC)100x100x8	1a/6	0,000	**207,26**
S225	CS153 - L(ARC)120x120x8	1a/6	0,000	**-208,19**
S225	CS153 - L(ARC)120x120x8	1a-p/29	2,373	**87,50**

Staaf	css	BG	dx [m]	N [kN]
S226	CS154 - L(ARC)100x100x8	1a-p/12	2,376	**-186,79**
S226	CS154 - L(ARC)100x100x8	1a/7	0,000	**112,91**
S227	CS153 - L(ARC)120x120x8	1a/7	0,000	**-115,30**
S227	CS153 - L(ARC)120x120x8	1a-p/12	2,373	**180,24**
S228	CS40 - L65X50X5	1a-p/15	2,700	**48,89**
S228	CS40 - L65X50X5	3/10	0,000	**91,05**
S229	CS157 - L45X5	3/37	0,983	**-0,46**
S229	CS157 - L45X5	1a-p/17	0,000	**-0,29**
S231	CS40 - L65X50X5	1a-p/16	7,611	**48,70**
S231	CS40 - L65X50X5	3/35	0,000	**90,97**
S232	CS158 - L50X40X5	1a-p/17	2,810	**24,86**
S232	CS158 - L50X40X5	3/37	0,000	**45,27**
S233	CS157 - L45X5	1a/1	0,983	**-0,45**
S233	CS157 - L45X5	1a-p/17	0,000	**-0,25**
S235	CS40 - L65X50X5	1a-p/17	7,611	**46,26**
S235	CS40 - L65X50X5	3/37	0,000	**85,73**
S236	CS158 - L50X40X5	1a-p/16	2,811	**23,01**
S236	CS158 - L50X40X5	3/41	0,000	**41,41**
S237	CS157 - L45X5	3/39	0,983	**-0,46**
S237	CS157 - L45X5	1a-p/15	0,000	**-0,29**
S239	CS154 - L(ARC)100x100x8	1a-p/29	2,376	**-96,27**
S239	CS154 - L(ARC)100x100x8	1a/6	0,000	**204,77**
S240	CS153 - L(ARC)120x120x8	1a/6	0,000	**-204,59**
S240	CS153 - L(ARC)120x120x8	1a-p/29	2,373	**90,60**
S241	CS154 - L(ARC)100x100x8	1a-p/12	2,376	**-186,15**
S241	CS154 - L(ARC)100x100x8	1a/7	0,000	**115,01**
S242	CS153 - L(ARC)120x120x8	1a/7	0,000	**-116,86**
S242	CS153 - L(ARC)120x120x8	1a-p/12	2,373	**178,13**
S243	CS93 - L(ARC)70x70x5	1a-p/15	0,000	**-15,47**
S243	CS93 - L(ARC)70x70x5	1a/2	2,366	**38,05**
S244	CS4 - L50X40X5	3/39	1,616	**-24,67**
S244	CS4 - L50X40X5	1a-p/28	0,000	**-11,12**
S245	CS93 - L(ARC)70x70x5	1a-p/17	0,000	**-18,97**
S245	CS93 - L(ARC)70x70x5	1a/1	2,366	**30,49**
S247	CS4 - L50X40X5	1a/27	0,879	**0,00**
S247	CS4 - L50X40X5	1a/6	0,000	**0,00**
S248	CS92 - L50X40X5	1a/6	0,000	**-0,83**
S248	CS92 - L50X40X5	1a/18	2,227	**0,54**
S249	CS88 - L50X40X5	1a/18	0,000	**-1,85**
S249	CS88 - L50X40X5	1a-p/4	2,571	**2,59**
S250	CS88 - L50X40X5	1a-p/4	1,250	**-2,19**
S250	CS88 - L50X40X5	1a/18	0,000	**1,35**
S252	CS161 - L120X80X8	1a/27	0,000	**-64,88**
S252	CS161 - L120X80X8	1a-p/28	4,747	**55,35**
S253	CS40 - L65X50X5	1a-p/12	7,611	**46,24**
S253	CS40 - L65X50X5	3/26	0,000	**85,68**
S254	CS158 - L50X40X5	1a-p/15	2,810	**23,04**
S254	CS158 - L50X40X5	3/39	0,000	**41,42**
S255	CS157 - L45X5	1a/2	0,983	**-0,46**

Staaf	css	BG	dx [m]	N [kN]
S255	CS157 - L45X5	1a-p/15	0,000	**-0,26**
S257	CS4 - L50X40X5	3/35	0,000	**-21,65**
S257	CS4 - L50X40X5	1a-p/4	1,616	**-9,14**
S258	CS120 - ISEA130/130/10	1a-p/16	0,888	**68,60**
S258	CS120 - ISEA130/130/10	3/35	0,000	**130,38**
S260	CS4 - L50X40X5	1a/3	0,000	**0,00**
S260	CS4 - L50X40X5	1a/9	0,879	**0,00**
S263	CS95 - L(ARC)75x75x6	5a21/75	0,000	**-16,63**
S263	CS95 - L(ARC)75x75x6	5a17/76	0,000	**5,37**
S264	CS95 - L(ARC)75x75x6	5a13/77	0,000	**-5,63**
S264	CS95 - L(ARC)75x75x6	5a21/75	0,000	**14,18**
S265	CS95 - L(ARC)75x75x6	5a21/75	0,000	**-16,06**
S265	CS95 - L(ARC)75x75x6	5a17/76	0,000	**5,26**
S266	CS95 - L(ARC)75x75x6	5a22/78	0,000	**-11,16**
S266	CS95 - L(ARC)75x75x6	5a21/75	0,000	**10,71**
S267	CS95 - L(ARC)75x75x6	5a21/75	0,000	**-10,87**
S267	CS95 - L(ARC)75x75x6	5a13/77	0,000	**8,94**
S268	CS43 - L(ARC)75x75x6	1a/2	3,214	**-3,10**
S268	CS43 - L(ARC)75x75x6	1a-p/15	1,753	**2,78**
S270	CS36 - ISEA70/70/5	1a-p/28	0,000	**-7,21**
S270	CS36 - ISEA70/70/5	1a/27	0,000	**50,58**
S273	CS159 - L(ARC)55x55x5	5a13/77	0,000	**-18,82**
S273	CS159 - L(ARC)55x55x5	5a14/79	0,000	**13,56**
S274	CS159 - L(ARC)55x55x5	5a13/80	0,000	**-8,81**
S274	CS159 - L(ARC)55x55x5	5a14/81	0,625	**10,16**
S275	CS159 - L(ARC)55x55x5	5a13/77	0,000	**-8,05**
S275	CS159 - L(ARC)55x55x5	5a14/82	0,000	**5,11**
S278	CS159 - L(ARC)55x55x5	5a14/81	0,000	**-17,74**
S278	CS159 - L(ARC)55x55x5	5a13/80	0,000	**14,88**
S279	CS159 - L(ARC)55x55x5	5a14/79	0,000	**-8,03**
S279	CS159 - L(ARC)55x55x5	5a13/77	0,000	**10,80**
S280	CS159 - L(ARC)55x55x5	5a14/81	0,000	**-7,61**
S280	CS159 - L(ARC)55x55x5	5a13/83	0,000	**5,64**
S282	CS152 - UNP140	5a6/84	0,000	**-14,22**
S282	CS152 - UNP140	1b/57	0,000	**-4,52**
S283	CS152 - UNP140	1b-p/85	0,000	**23,25**
S283	CS152 - UNP140	5a14/86	0,000	**43,22**
S284	CS94 - L50X5	5a14/81	0,695	**-40,28**
S284	CS94 - L50X5	5a15/87	0,000	**8,36**
S285	CS94 - L50X5	5a13/77	0,000	**-40,79**
S285	CS94 - L50X5	5a16/88	0,695	**7,22**
S286	CS152 - UNP140	1b-p/40	1,317	**22,79**
S286	CS152 - UNP140	5a13/77	0,000	**46,56**
S287	CS43 - L(ARC)75x75x6	5a14/89	3,013	**-0,78**
S287	CS43 - L(ARC)75x75x6	1b/57	0,000	**-0,26**

Staaf	css	BG	dx [m]	N [kN]
S288	CS95 - L(ARC)75x75x6	5a16/88	0,000	**-14,80**
S288	CS95 - L(ARC)75x75x6	5a15/90	0,000	**16,56**
S289	CS144 - UNP160	5a14/86	1,462	**-137,41**
S289	CS144 - UNP160	5a13/91	2,943	**30,02**
S290	CS95 - L(ARC)75x75x6	1a/3	0,000	**-6,81**
S290	CS95 - L(ARC)75x75x6	5a21/75	1,535	**16,25**
S291	CS95 - L(ARC)75x75x6	5a17/92	2,542	**-10,43**
S291	CS95 - L(ARC)75x75x6	5a13/77	0,000	**11,41**
S292	CS95 - L(ARC)75x75x6	5a22/78	0,000	**-11,19**
S292	CS95 - L(ARC)75x75x6	5a17/92	1,436	**9,01**
S293	CS4 - L50X40X5	5a21/75	0,000	**-9,95**
S293	CS4 - L50X40X5	1a/7	0,000	**0,68**
S294	CS4 - L50X40X5	5a22/78	0,000	**-38,73**
S294	CS4 - L50X40X5	5a21/75	0,560	**12,38**
S295	CS144 - UNP160	5a22/93	1,462	**-136,23**
S295	CS144 - UNP160	5a21/94	2,942	**21,97**
S296	CS158 - L50X40X5	1a/27	1,587	**-0,26**
S296	CS158 - L50X40X5	1a-p/28	0,000	**0,10**
S297	CS158 - L50X40X5	1a/9	1,600	**-0,31**
S297	CS158 - L50X40X5	1a-p/8	0,000	**0,07**
S298	CS36 - ISEA70/70/5	1a-p/4	1,753	**-20,29**
S298	CS36 - ISEA70/70/5	1a/3	0,000	**42,35**
S299	CS44 - UNP160	1b/57	0,000	**21,64**
S299	CS44 - UNP160	5a21/75	1,753	**58,93**
S300	CS93 - L(ARC)70x70x5	1a-p/15	0,000	**-14,97**
S300	CS93 - L(ARC)70x70x5	1a/2	2,264	**32,75**
S301	CS92 - L50X40X5	1a/6	0,000	**-0,83**
S301	CS92 - L50X40X5	1a/3	2,227	**0,54**
S302	CS159 - L(ARC)55x55x5	5a22/95	0,000	**-19,36**
S302	CS159 - L(ARC)55x55x5	5a21/96	0,000	**12,18**
S303	CS159 - L(ARC)55x55x5	5a22/97	0,000	**-8,55**
S303	CS159 - L(ARC)55x55x5	5a21/98	0,000	**9,87**
S304	CS159 - L(ARC)55x55x5	5a22/99	0,000	**-8,22**
S304	CS159 - L(ARC)55x55x5	5a21/100	0,000	**4,58**
S307	CS159 - L(ARC)55x55x5	5a21/98	0,000	**-17,32**
S307	CS159 - L(ARC)55x55x5	5a22/97	0,000	**14,46**
S308	CS159 - L(ARC)55x55x5	5a21/96	0,000	**-7,22**
S308	CS159 - L(ARC)55x55x5	5a22/95	0,313	**11,06**
S309	CS159 - L(ARC)55x55x5	5a21/14	0,000	**-7,40**
S309	CS159 - L(ARC)55x55x5	5a22/101	0,860	**5,49**
S311	CS152 - UNP140	5a14/102	0,000	**-12,95**
S311	CS152 - UNP140	1b/72	0,000	**-3,82**
S312	CS152 - UNP140	1b-p/103	0,000	**22,79**
S312	CS152 - UNP140	5a14/89	0,299	**42,28**
S313	CS94 - L50X5	5a21/104	0,695	**-39,17**

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
S313	CS94 - L50X5	5a20/105	0,000	**8,43**
S314	CS94 - L50X5	5a22/95	0,000	**-40,03**
S314	CS94 - L50X5	5a19/106	0,695	**6,60**
S315	CS152 - UNP140	1b-p/107	1,317	**24,52**
S315	CS152 - UNP140	5a22/108	0,000	**50,47**
S316	CS43 - L(ARC)75x75x6	5a21/14	1,506	**-0,83**
S316	CS43 - L(ARC)75x75x6	1b/72	1,506	**-0,27**
S317	CS95 - L(ARC)75x75x6	5a19/109	0,000	**-19,15**
S317	CS95 - L(ARC)75x75x6	5a20/110	0,000	**11,33**
S318	CS95 - L(ARC)75x75x6	5a21/75	1,842	**-9,82**
S318	CS95 - L(ARC)75x75x6	5a22/78	0,000	**11,49**
S319	CS95 - L(ARC)75x75x6	5a18/111	0,000	**-6,16**
S319	CS95 - L(ARC)75x75x6	5a21/75	0,953	**16,16**
S320	CS95 - L(ARC)75x75x6	5a21/75	0,000	**-16,00**
S320	CS95 - L(ARC)75x75x6	5a18/111	0,000	**4,74**
S321	CS43 - L(ARC)75x75x6	1a/3	0,000	**-2,13**
S321	CS43 - L(ARC)75x75x6	1a-p/16	1,169	**2,34**
S322	CS4 - L50X40X5	5a13/77	0,000	**-7,46**
S322	CS4 - L50X40X5	5a21/75	0,000	**2,41**
S323	CS4 - L50X40X5	5a21/75	0,000	**-40,78**
S323	CS4 - L50X40X5	5a13/77	0,841	**9,83**
S324	CS44 - UNP160	1b/72	1,753	**18,77**
S324	CS44 - UNP160	5a21/75	0,000	**41,99**
S328	CS155 - HFLue120x80x8	1a/6	0,000	**-288,48**
S328	CS155 - HFLue120x80x8	1a-p/29	1,544	**120,53**
S330	CS4 - L50X40X5	1a-p/12	0,864	**0,00**
S330	CS4 - L50X40X5	1a/7	0,000	**0,00**
S331	CS92 - L50X40X5	1a/7	0,000	**-0,55**
S331	CS92 - L50X40X5	1a/6	2,231	**1,02**
S333	CS88 - L50X40X5	1a/3	0,000	**-1,36**
S333	CS88 - L50X40X5	1a-p/16	2,571	**0,83**
S334	CS88 - L50X40X5	1a-p/16	1,250	**-0,82**
S334	CS88 - L50X40X5	1a/3	0,000	**1,02**
S336	CS84 - L(ARC)100x100x6	1a/27	0,000	**-28,66**
S336	CS84 - L(ARC)100x100x6	1a-p/28	2,080	**2,10**
S340	CS144 - UNP160	5a21/104	1,462	**-152,70**
S340	CS144 - UNP160	5a22/112	2,942	**20,53**
S343	CS12 - L50X5	4-p/113	0,000	**8,48**
S343	CS12 - L50X5	3/35	0,000	**37,80**
C1	CS172 - 2LX	1a/2	0,000	**-1139,02**
C1	CS172 - 2LX	1a-p/15	10,951	**477,55**
C2	CS172 - 2LX	1a/3	0,000	**-814,67**
C2	CS172 - 2LX	1a-p/16	10,951	**798,95**
C4	CS172 - 2LX	1a/1	0,000	**-1022,61**
C4	CS172 - 2LX	1a-p/17	10,951	**591,32**
C3	CS172 - 2LX	1a/18	0,000	**-701,23**
C3	CS172 - 2LX	1a-p/4	10,951	**915,65**
B9	CS3 - HFLue180x90x10	1a/7	0,000	**-30,26**
B9	CS3 - HFLue180x90x10	3-p/23	12,292	**93,56**
B14	CS3 - HFLue180x90x10	5a5/114	0,000	**-31,45**
B14	CS3 - HFLue180x90x10	5a6/115	12,292	**39,21**
B16	CS3 - HFLue180x90x10	1a/107	0,000	**-38,50**

Staaf	css	BG	dx [m]	N [kN]
B16	CS3 - HFLue180x90x10	3-p/23	12,292	**83,05**
B18	CS3 - HFLue180x90x10	5a11/116	0,000	**-40,37**
B18	CS3 - HFLue180x90x10	5a12/117	12,292	**30,22**
SB2	CS4 - L50X40X5	1a-p/4	0,000	**0,00**
SB2	CS4 - L50X40X5	3/118	0,760	**0,00**
SB18	CS4 - L50X40X5	1a-p/4	0,000	**0,00**
SB18	CS4 - L50X40X5	3/118	1,520	**0,00**
SB34	CS102 - L50X5	1a-p/4	0,000	**0,00**
SB34	CS102 - L50X5	3/118	2,280	**0,00**
SB1	CS4 - L50X40X5	1a/27	0,760	**0,00**
SB1	CS4 - L50X40X5	1a/18	0,000	**0,00**
SB17	CS4 - L50X40X5	1a/27	1,520	**0,00**
SB17	CS4 - L50X40X5	1a/18	0,000	**0,00**
SB33	CS102 - L50X5	1a/27	2,280	**0,00**
SB33	CS102 - L50X5	1a/18	0,000	**0,00**
SB4	CS4 - L50X40X5	1a/2	0,000	**-0,10**
SB4	CS4 - L50X40X5	3/118	2,169	**0,00**
SB20	CS4 - L50X40X5	1a/2	0,000	**-0,10**
SB20	CS4 - L50X40X5	3/118	2,402	**0,00**
SB36	CS60 - L50X5	1a/2	0,000	**-0,11**
SB36	CS60 - L50X5	3/118	3,371	**0,00**
SB3	CS4 - L50X40X5	1a/2	0,000	**-0,10**
SB3	CS4 - L50X40X5	1a-p/28	2,169	**0,00**
SB19	CS4 - L50X40X5	1a/2	0,000	**-0,10**
SB19	CS4 - L50X40X5	1a/27	2,402	**0,00**
SB35	CS60 - L50X5	1a/2	0,000	**-0,11**
SB35	CS60 - L50X5	1a/27	3,371	**0,00**
B89	CS3 - HFLue180x90x10	3/118	0,000	**-101,41**
B89	CS3 - HFLue180x90x10	1a-p/29	12,292	**21,91**
B90	CS3 - HFLue180x90x10	5a6/119	0,000	**-46,00**
B90	CS3 - HFLue180x90x10	5a5/43	12,292	**24,40**
B91	CS3 - HFLue180x90x10	3/118	0,000	**-89,55**
B91	CS3 - HFLue180x90x10	1a-p/29	12,292	**32,57**
B92	CS3 - HFLue180x90x10	5a12/120	0,000	**-30,43**
B92	CS3 - HFLue180x90x10	5a11/121	12,292	**40,41**
C5	CS173 - 2LX	1a/2	0,000	**-1085,93**
C5	CS173 - 2LX	1a-p/15	3,374	**463,06**
C6	CS173 - 2LX	1a/3	0,000	**-773,55**
C6	CS173 - 2LX	1a-p/16	3,374	**772,61**
C7	CS173 - 2LX	1a/1	0,000	**-973,82**
C7	CS173 - 2LX	1a-p/17	3,374	**572,64**
C8	CS173 - 2LX	1a/18	0,000	**-664,29**
C8	CS173 - 2LX	1a-p/4	3,374	**885,01**
B8	CS100 - L100X75X7	1a-p/12	0,000	**-74,43**
B8	CS100 - L100X75X7	1a/7	4,916	**58,47**
B10	CS100 - L100X75X7	1a-p/8	0,000	**-52,54**
B10	CS100 - L100X75X7	1a/9	4,916	**53,63**
B12	CS100 - L100X75X7	1a-p/12	0,000	**-79,14**
B12	CS100 - L100X75X7	1a/7	4,916	**52,85**
B93	CS100 - L100X75X7	1a-p/8	0,000	**-54,44**
B93	CS100 - L100X75X7	1a/9	4,916	**51,83**
SB49	CS63 - L50X40X5	1a/2	0,000	**0,00**

Staaf	css	BG	dx [m]	N [kN]
SB49	CS63 - L50X40X5	1a-p/15	0,000	**0,00**
SB50	CS65 - L50X40X5	1a/2	0,000	**-0,08**
SB50	CS65 - L50X40X5	1a/2	2,621	**0,00**
SB51	CS63 - L50X40X5	1a/3	0,000	**0,00**
SB51	CS63 - L50X40X5	1a/3	1,900	**0,00**
SB52	CS65 - L50X40X5	1a/3	0,000	**-0,08**
SB52	CS65 - L50X40X5	1a/3	2,621	**0,00**
SB53	CS63 - L50X40X5	1a/3	1,900	**0,00**
SB53	CS63 - L50X40X5	1a-p/16	1,267	**0,00**
SB54	CS65 - L50X40X5	1a/3	0,000	**-0,08**
SB54	CS65 - L50X40X5	1a/3	2,621	**0,00**
SB55	CS63 - L50X40X5	1a/18	0,000	**0,00**
SB55	CS63 - L50X40X5	1a-p/15	1,583	**0,00**
SB56	CS65 - L50X40X5	1a/18	0,000	**-0,08**
SB56	CS65 - L50X40X5	1a/18	2,621	**0,00**
SB57	CS63 - L50X40X5	1a/18	1,583	**0,00**
SB57	CS63 - L50X40X5	1a-p/4	0,000	**0,00**
SB58	CS65 - L50X40X5	1a/18	0,000	**-0,08**
SB58	CS65 - L50X40X5	1a/18	2,621	**0,00**
SB59	CS63 - L50X40X5	1a/1	0,000	**0,00**
SB59	CS63 - L50X40X5	5a21/122	1,583	**0,00**
SB60	CS65 - L50X40X5	1a/1	0,000	**-0,08**
SB60	CS65 - L50X40X5	1a/1	2,621	**0,00**
SB61	CS63 - L50X40X5	1a/1	1,267	**0,00**
SB61	CS63 - L50X40X5	1a-p/17	0,000	**0,00**
SB62	CS65 - L50X40X5	1a/1	0,000	**-0,08**
SB62	CS65 - L50X40X5	1a/1	2,621	**0,00**
SB63	CS63 - L50X40X5	1a/2	0,000	**0,00**
SB63	CS63 - L50X40X5	1a/2	1,900	**0,00**
SB64	CS65 - L50X40X5	1a/2	0,000	**-0,08**
SB64	CS65 - L50X40X5	1a/2	2,621	**0,00**
B31	CS100 - L100X75X7	1a-p/28	0,000	**-52,28**
B31	CS100 - L100X75X7	1a/27	4,916	**54,17**
B32	CS100 - L100X75X7	1a-p/29	0,000	**-50,61**
B32	CS100 - L100X75X7	1a/6	4,916	**81,09**
B33	CS100 - L100X75X7	1a-p/28	0,000	**-43,48**
B33	CS100 - L100X75X7	1a/27	4,916	**62,69**
B34	CS100 - L100X75X7	1a-p/29	0,000	**-59,17**
B34	CS100 - L100X75X7	1a/6	4,916	**74,00**
C9	CS174 - 2LX	1a/2	0,000	**-923,04**
C9	CS174 - 2LX	1a-p/15	6,648	**366,82**
C10	CS174 - 2LX	1a/3	0,000	**-646,27**
C10	CS174 - 2LX	1a-p/16	6,648	**639,35**
C11	CS174 - 2LX	1a/1	0,000	**-819,87**
C11	CS174 - 2LX	1a-p/17	6,648	**467,86**
C12	CS174 - 2LX	1a/18	0,000	**-551,02**
C12	CS174 - 2LX	1a-p/4	6,648	**737,57**
B94	CS68 - L100X75X7	1a/7	0,000	**-58,90**
B94	CS68 - L100X75X7	1a/6	9,452	**77,61**
B95	CS68 - L100X75X7	1a/9	0,000	**-53,25**
B95	CS68 - L100X75X7	1a-p/8	9,452	**52,10**
B22	CS68 - L100X75X7	1a/6	0,000	**-85,07**
B22	CS68 - L100X75X7	1a/7	9,452	**49,97**
B26	CS68 - L100X75X7	1a/27	0,000	**-63,78**
B26	CS68 - L100X75X7	1a-p/28	9,452	**41,52**

Staaf	css	BG	dx [m]	N [kN]
SB65	CS67 - L50X40X5	1a-p/12	1,676	**0,00**
SB65	CS67 - L50X40X5	1a/7	1,676	**0,00**
SB66	CS67 - L50X40X5	1a-p/8	1,341	**0,00**
SB66	CS67 - L50X40X5	1a/9	1,676	**0,00**
SB67	CS67 - L50X40X5	1a-p/4	1,341	**0,00**
SB67	CS67 - L50X40X5	1a/18	1,006	**0,00**
SB68	CS67 - L50X40X5	1a-p/29	1,676	**0,00**
SB68	CS67 - L50X40X5	1a/6	1,676	**0,00**
SB69	CS67 - L50X40X5	1a-p/29	1,341	**0,00**
SB69	CS67 - L50X40X5	1a/6	1,341	**0,00**
SB70	CS67 - L50X40X5	1a-p/16	1,676	**0,00**
SB70	CS67 - L50X40X5	1a/3	1,341	**0,00**
SB71	CS67 - L50X40X5	1a-p/15	1,341	**0,00**
SB71	CS67 - L50X40X5	1a/2	1,341	**0,00**
SB72	CS67 - L50X40X5	1a-p/12	1,676	**0,00**
SB72	CS67 - L50X40X5	1a/7	1,341	**0,00**
SB73	CS66 - L50X40X5	1a/1	0,000	**-0,08**
SB73	CS66 - L50X40X5	1a/2	2,356	**0,00**
SB74	CS66 - L50X40X5	1a/1	0,000	**-0,08**
SB74	CS66 - L50X40X5	1a/18	2,356	**0,00**
SB75	CS66 - L50X40X5	1a/2	0,000	**-0,08**
SB75	CS66 - L50X40X5	1a/3	2,356	**0,00**
SB76	CS66 - L50X40X5	1a/2	0,000	**-0,08**
SB76	CS66 - L50X40X5	1a/1	2,356	**0,00**
SB77	CS66 - L50X40X5	1a/3	0,000	**-0,08**
SB77	CS66 - L50X40X5	1a/18	2,356	**0,00**
SB78	CS66 - L50X40X5	1a/3	0,000	**-0,08**
SB78	CS66 - L50X40X5	1a/2	2,356	**0,00**
SB79	CS66 - L50X40X5	1a/18	0,000	**-0,08**
SB79	CS66 - L50X40X5	1a/1	2,356	**0,00**
SB80	CS66 - L50X40X5	1a/18	0,000	**-0,08**
SB80	CS66 - L50X40X5	1a/3	2,356	**0,00**
SB81	CS66 - L50X40X5	1a/3	0,000	**-0,07**
SB81	CS66 - L50X40X5	1a/7	2,360	**0,00**
SB82	CS67 - L50X40X5	1a/6	1,676	**0,00**
SB82	CS67 - L50X40X5	1a-p/29	1,676	**0,00**
SB83	CS66 - L50X40X5	1a/3	0,000	**-0,07**
SB83	CS66 - L50X40X5	1a/3	2,360	**0,00**
SB84	CS67 - L50X40X5	1a/27	1,676	**0,00**
SB84	CS67 - L50X40X5	1a-p/28	1,676	**0,00**
SB85	CS66 - L50X40X5	1a/18	0,000	**-0,07**
SB85	CS66 - L50X40X5	1a/18	2,360	**0,00**
SB86	CS67 - L50X40X5	1a/27	1,676	**0,00**
SB86	CS67 - L50X40X5	1a-p/28	1,676	**0,00**
SB87	CS66 - L50X40X5	1a/18	0,000	**-0,07**
SB87	CS66 - L50X40X5	1a/7	2,360	**0,00**
SB88	CS67 - L50X40X5	1a/7	1,676	**0,00**
SB88	CS67 - L50X40X5	1a-p/12	1,676	**0,00**
SB89	CS66 - L50X40X5	1a/1	0,000	**-0,07**
SB89	CS66 - L50X40X5	1a/6	2,360	**0,00**
SB90	CS67 - L50X40X5	1a/7	1,676	**0,00**
SB90	CS67 - L50X40X5	1a-p/12	1,676	**0,00**
SB91	CS66 - L50X40X5	1a/1	0,000	**-0,07**
SB91	CS66 - L50X40X5	1a/1	2,360	**0,00**
SB92	CS67 - L50X40X5	1a/9	1,676	**0,00**
SB92	CS67 - L50X40X5	1a-p/8	1,676	**0,00**
SB93	CS66 - L50X40X5	1a/2	0,000	**-0,07**
SB93	CS66 - L50X40X5	1a/2	2,360	**0,00**
SB94	CS67 - L50X40X5	1a/9	1,676	**0,00**
SB94	CS67 - L50X40X5	1a-p/8	1,676	**0,00**
SB95	CS66 - L50X40X5	1a/2	0,000	**-0,07**
SB95	CS66 - L50X40X5	1a/2	2,360	**0,00**
SB96	CS67 - L50X40X5	1a/6	1,676	**0,00**
SB96	CS67 - L50X40X5	1a-p/29	1,676	**0,00**
B73	CS68 - L100X75X7	1a/27	0,000	**-53,93**
B73	CS68 - L100X75X7	1a-p/28	9,452	**51,86**

Staaf	css	BG	dx [m]	N [kN]
B74	CS68 - L100X75X7	1a/7	0,000	**-52,42**
B74	CS68 - L100X75X7	1a/6	9,452	**83,18**
B75	CS68 - L100X75X7	1a/9	0,000	**-51,25**
B75	CS68 - L100X75X7	1a-p/8	9,452	**54,29**
B76	CS68 - L100X75X7	1a/6	0,000	**-76,90**
B76	CS68 - L100X75X7	1a/7	9,452	**59,98**
C13	CS175 - 2LX	1a/2	0,000	**-755,08**
C13	CS175 - 2LX	1a-p/15	6,648	**256,96**
C14	CS175 - 2LX	1a/3	0,000	**-509,79**
C14	CS175 - 2LX	1a-p/16	6,648	**495,88**
C15	CS175 - 2LX	1a/1	0,000	**-665,69**
C15	CS175 - 2LX	1a-p/17	6,648	**343,94**
C16	CS175 - 2LX	1a/18	0,000	**-435,43**
C16	CS175 - 2LX	1a-p/4	6,648	**573,64**
B98	CS70 - L100X75X7	1a/7	0,000	**-60,02**
B98	CS70 - L100X75X7	1a-p/12	8,859	**78,10**
B99	CS70 - L100X75X7	1a-p/28	0,000	**-49,88**
B99	CS70 - L100X75X7	1a/27	8,860	**50,15**
B100	CS70 - L100X75X7	1a/6	0,000	**-88,64**
B100	CS70 - L100X75X7	1a/7	8,860	**48,23**
B101	CS70 - L100X75X7	1a-p/8	0,000	**-52,81**
B101	CS70 - L100X75X7	1a/9	8,859	**46,70**
B102	CS81 - L60X5	1a-p/15	2,920	**-0,44**
B102	CS81 - L60X5	1a/2	0,000	**1,10**
B103	CS81 - L60X5	1a-p/16	2,920	**-1,06**
B103	CS81 - L60X5	1a/3	0,000	**0,87**
B104	CS81 - L60X5	1a-p/4	2,920	**-0,97**
B104	CS81 - L60X5	1a/18	0,000	**0,56**
B105	CS81 - L60X5	1a-p/17	2,920	**-0,67**
B105	CS81 - L60X5	1a/1	0,000	**1,26**
SB97	CS69 - L50X40X5	1a/6	1,460	**0,00**
SB97	CS69 - L50X40X5	1a-p/29	1,460	**0,00**
SB98	CS69 - L50X40X5	1a-p/8	1,460	**0,00**
SB98	CS69 - L50X40X5	1a/9	1,460	**0,00**
SB99	CS69 - L50X40X5	1a/27	1,460	**0,00**
SB99	CS69 - L50X40X5	1a-p/28	1,460	**0,00**
SB100	CS69 - L50X40X5	1a-p/29	1,460	**0,00**
SB100	CS69 - L50X40X5	1a/6	1,460	**0,00**
SB101	CS69 - L50X40X5	1a/7	1,460	**0,00**
SB101	CS69 - L50X40X5	1a-p/12	1,460	**0,00**
SB102	CS69 - L50X40X5	1a-p/28	1,460	**0,00**
SB102	CS69 - L50X40X5	1a/27	1,460	**0,00**
SB103	CS69 - L50X40X5	1a/9	1,460	**0,00**
SB103	CS69 - L50X40X5	1a-p/8	1,460	**0,00**
SB104	CS69 - L50X40X5	1a-p/12	1,460	**0,00**
SB104	CS69 - L50X40X5	1a/7	1,460	**0,00**
SB105	CS71 - L50X40X5	1a/2	0,000	**-0,08**
SB105	CS71 - L50X40X5	1a/2	2,231	**0,00**
SB106	CS71 - L50X40X5	1a/18	0,000	**-0,08**
SB106	CS71 - L50X40X5	1a/18	2,231	**0,00**
SB107	CS71 - L50X40X5	1a/3	0,000	**-0,08**
SB107	CS71 - L50X40X5	1a/3	2,231	**0,00**
SB108	CS71 - L50X40X5	1a/1	0,000	**-0,08**
SB108	CS71 - L50X40X5	1a/1	2,231	**0,00**
SB109	CS71 - L50X40X5	1a/18	0,000	**-0,08**
SB109	CS71 - L50X40X5	1a/18	2,231	**0,00**

Staaf	css	BG	dx [m]	N [kN]
SB110	CS71 - L50X40X5	1a/2	0,000	**-0,08**
SB110	CS71 - L50X40X5	1a/2	2,231	**0,00**
SB111	CS71 - L50X40X5	1a/1	0,000	**-0,08**
SB111	CS71 - L50X40X5	1a/1	2,231	**0,00**
SB112	CS71 - L50X40X5	1a/3	0,000	**-0,08**
SB112	CS71 - L50X40X5	1a/3	2,231	**0,00**
SB113	CS71 - L50X40X5	1a/7	0,000	**-0,07**
SB113	CS71 - L50X40X5	1a/7	2,190	**0,00**
SB114	CS69 - L50X40X5	1a-p/12	1,460	**0,00**
SB114	CS69 - L50X40X5	1a/7	1,460	**0,00**
SB115	CS71 - L50X40X5	1a/27	0,000	**-0,07**
SB115	CS71 - L50X40X5	1a/3	2,190	**0,00**
SB116	CS69 - L50X40X5	1a/27	1,460	**0,00**
SB116	CS69 - L50X40X5	1a-p/28	1,460	**0,00**
SB117	CS71 - L50X40X5	1a/9	0,000	**-0,07**
SB117	CS71 - L50X40X5	1a/18	2,190	**0,00**
SB118	CS69 - L50X40X5	1a-p/8	1,460	**0,00**
SB118	CS69 - L50X40X5	1a/9	1,460	**0,00**
SB119	CS71 - L50X40X5	1a/7	0,000	**-0,07**
SB119	CS71 - L50X40X5	1a/7	2,190	**0,00**
SB120	CS69 - L50X40X5	1a/7	1,460	**0,00**
SB120	CS69 - L50X40X5	1a-p/12	1,460	**0,00**
SB121	CS71 - L50X40X5	1a/6	0,000	**-0,07**
SB121	CS71 - L50X40X5	1a/6	2,190	**0,00**
SB122	CS69 - L50X40X5	1a-p/29	1,460	**0,00**
SB122	CS69 - L50X40X5	1a/6	1,460	**0,00**
SB123	CS71 - L50X40X5	1a/9	0,000	**-0,07**
SB123	CS71 - L50X40X5	1a/1	2,190	**0,00**
SB124	CS69 - L50X40X5	1a/9	1,460	**0,00**
SB124	CS69 - L50X40X5	1a-p/8	1,460	**0,00**
SB125	CS71 - L50X40X5	1a/3	0,000	**-0,07**
SB125	CS71 - L50X40X5	1a/2	2,190	**0,00**
SB126	CS69 - L50X40X5	1a-p/28	1,460	**0,00**
SB126	CS69 - L50X40X5	1a/27	1,460	**0,00**
SB127	CS71 - L50X40X5	1a/6	0,000	**-0,07**
SB127	CS71 - L50X40X5	1a/6	2,190	**0,00**
SB128	CS69 - L50X40X5	1a/6	1,460	**0,00**
SB128	CS69 - L50X40X5	1a-p/29	1,460	**0,00**
B106	CS70 - L100X75X7	1a-p/8	0,000	**-50,53**
B106	CS70 - L100X75X7	1a/9	8,859	**49,64**
B107	CS70 - L100X75X7	1a/7	0,000	**-48,23**
B107	CS70 - L100X75X7	1a/6	8,859	**88,92**
B108	CS70 - L100X75X7	1a-p/28	0,000	**-37,70**
B108	CS70 - L100X75X7	1a/27	8,860	**62,82**
B109	CS70 - L100X75X7	1a/6	0,000	**-82,71**
B109	CS70 - L100X75X7	1a/7	8,860	**56,70**
B110	CS81 - L60X5	1a/6	0,000	**0,00**
B110	CS81 - L60X5	1a/7	2,920	**0,00**
B111	CS81 - L60X5	1a/2	0,000	**0,00**
B111	CS81 - L60X5	1a/9	2,920	**0,00**
B112	CS81 - L60X5	1a/7	0,000	**0,00**
B112	CS81 - L60X5	1a/6	2,920	**0,00**
B113	CS81 - L60X5	1a/18	0,000	**0,00**
B113	CS81 - L60X5	1a/27	2,920	**0,00**
C17	CS112 - HFLeq130x130x12	1a/2	0,000	**-563,06**
C17	CS112 - HFLeq130x130x12	1a-p/15	3,414	**162,32**
C18	CS112 - HFLeq130x130x12	1a/3	0,000	**-376,52**
C18	CS112 - HFLeq130x130x12	1a-p/16	3,414	**340,55**

Staaf	css	BG	dx [m]	N [kN]
C19	CS112 - HFLeq130x130x12	1a/1	0,000	**-488,36**
C19	CS112 - HFLeq130x130x12	1a-p/17	3,414	**235,22**
C20	CS112 - HFLeq130x130x12	1a/18	0,000	**-324,92**
C20	CS112 - HFLeq130x130x12	1a-p/4	3,414	**394,78**
B114	CS73 - L100X75X7	1a/6	0,000	**-87,98**
B114	CS73 - L100X75X7	1a-p/29	4,360	**61,74**
B115	CS73 - L100X75X7	1a/27	0,000	**-52,42**
B115	CS73 - L100X75X7	1a-p/28	4,360	**49,69**
B116	CS73 - L100X75X7	1a/6	0,000	**-100,44**
B116	CS73 - L100X75X7	1a-p/29	4,360	**46,66**
B117	CS73 - L100X75X7	1a/27	0,000	**-67,88**
B117	CS73 - L100X75X7	1a-p/28	4,360	**33,70**
SB129	CS20 - L50X40X5	1a-p/12	1,250	**0,00**
SB129	CS20 - L50X40X5	1a/7	1,250	**0,00**
SB130	CS72 - L50X40X5	1a/2	0,000	**-0,08**
SB130	CS72 - L50X40X5	1a/7	2,050	**0,00**
SB131	CS20 - L50X40X5	1a-p/12	1,250	**0,00**
SB131	CS20 - L50X40X5	1a/7	1,250	**0,00**
SB132	CS72 - L50X40X5	1a/3	0,000	**-0,08**
SB132	CS72 - L50X40X5	1a/6	2,050	**0,00**
SB133	CS20 - L50X40X5	1a-p/8	1,250	**0,00**
SB133	CS20 - L50X40X5	1a/9	1,250	**0,00**
SB134	CS72 - L50X40X5	1a/3	0,000	**-0,08**
SB134	CS72 - L50X40X5	1a/18	2,049	**0,00**
SB135	CS20 - L50X40X5	1a-p/8	1,250	**0,00**
SB135	CS20 - L50X40X5	1a/9	1,250	**0,00**
SB136	CS72 - L50X40X5	1a/18	0,000	**-0,08**
SB136	CS72 - L50X40X5	1a/3	2,050	**0,00**
SB137	CS20 - L50X40X5	1a/7	0,000	**0,00**
SB137	CS20 - L50X40X5	1a/6	1,250	**0,00**
SB138	CS72 - L50X40X5	1a/18	0,000	**-0,08**
SB138	CS72 - L50X40X5	1a/6	2,050	**0,00**
SB139	CS20 - L50X40X5	1a/7	0,000	**0,00**
SB139	CS20 - L50X40X5	1a/6	1,250	**0,00**
SB140	CS72 - L50X40X5	1a/1	0,000	**-0,08**
SB140	CS72 - L50X40X5	1a/7	2,050	**0,00**
SB141	CS20 - L50X40X5	1a-p/28	1,250	**0,00**
SB141	CS20 - L50X40X5	1a/27	1,250	**0,00**
SB142	CS72 - L50X40X5	1a/1	0,000	**-0,08**
SB142	CS72 - L50X40X5	1a/2	2,050	**0,00**
SB143	CS20 - L50X40X5	1a-p/28	1,250	**0,00**
SB143	CS20 - L50X40X5	1a/27	1,250	**0,00**
SB144	CS72 - L50X40X5	1a/2	0,000	**-0,08**
SB144	CS72 - L50X40X5	1a/1	2,050	**0,00**
B36	CS73 - L100X75X7	1a/7	0,000	**-60,26**
B36	CS73 - L100X75X7	1a-p/12	4,360	**88,81**
B37	CS73 - L100X75X7	1a/7	0,000	**-50,20**
B37	CS73 - L100X75X7	1a-p/12	4,360	**97,27**
B38	CS73 - L100X75X7	1a/9	0,000	**-51,55**
B38	CS73 - L100X75X7	1a-p/8	4,360	**50,26**
B39	CS73 - L100X75X7	1a/9	0,000	**-48,78**
B39	CS73 - L100X75X7	1a-p/8	4,360	**53,22**

Staaf	css	BG	dx [m]	N [kN]
S355	CS82 - L130X12	1a/1	0,000	**-490,82**
S355	CS82 - L130X12	1a-p/17	4,280	**248,62**
S359	CS90 - L(ARC)100x100x6	1a/18	2,220	**-61,18**
S359	CS90 - L(ARC)100x100x6	1a-p/4	4,356	**73,20**
S361	CS124 - L80X6	3/10	0,000	**-62,44**
S361	CS124 - L80X6	1a-p/17	0,970	**7,13**
S368	CS143 - L130X12	1a/2	0,000	**-239,54**
S368	CS143 - L130X12	1a-p/15	3,331	**38,20**
S370	CS90 - L(ARC)100x100x6	1a/3	2,220	**-70,88**
S370	CS90 - L(ARC)100x100x6	1a-p/16	4,356	**61,57**
S372	CS124 - L80X6	3/10	0,000	**-43,17**
S372	CS124 - L80X6	1a-p/15	0,970	**14,01**
S373	CS133 - L80X6	3/10	2,008	**-47,43**
S373	CS133 - L80X6	3-p/11	5,210	**16,86**
S377	CS141 - L120X80X8	1a-p/12	0,000	**-201,82**
S377	CS141 - L120X80X8	1a/7	2,030	**169,56**
S378	CS141 - L120X80X8	1a-p/29	0,000	**-47,89**
S378	CS141 - L120X80X8	1a/6	2,206	**122,79**
S379	CS141 - L120X80X8	1a-p/12	0,000	**-212,15**
S379	CS141 - L120X80X8	1a/7	2,030	**155,93**
S380	CS141 - L120X80X8	1a-p/29	0,000	**-53,39**
S380	CS141 - L120X80X8	1a/6	2,205	**121,25**
S381	CS141 - L120X80X8	1a-p/29	0,000	**-97,16**
S381	CS141 - L120X80X8	1a/6	2,030	**272,93**
S382	CS141 - L120X80X8	1a-p/12	0,000	**-105,16**
S382	CS141 - L120X80X8	1a/7	2,205	**69,86**
S383	CS141 - L120X80X8	1a-p/29	0,000	**-93,29**
S383	CS141 - L120X80X8	1a/6	2,030	**276,94**
S384	CS141 - L120X80X8	1a-p/12	0,000	**-102,73**
S384	CS141 - L120X80X8	1a/7	2,205	**70,51**
S388	CS144 - UNP160	1a/6	0,000	**-193,21**
S388	CS144 - UNP160	1a-p/12	1,837	**149,11**
S390	CS144 - UNP160	1a/7	0,000	**-111,86**
S390	CS144 - UNP160	1a-p/12	0,000	**129,88**
S397	CS92 - L50X40X5	1a/3	0,000	**-0,99**
S397	CS92 - L50X40X5	1a/1	2,227	**0,90**
S399	CS36 - ISEA70/70/5	1a-p/8	0,000	**-19,17**
S399	CS36 - ISEA70/70/5	1a/9	0,000	**39,64**
S400	CS95 - L(ARC)75x75x6	5a13/77	0,000	**-10,88**
S400	CS95 - L(ARC)75x75x6	5a21/75	0,000	**10,41**
S401	CS93 - L(ARC)70x70x5	1a-p/16	0,000	**-24,07**
S401	CS93 - L(ARC)70x70x5	1a/3	2,366	**26,80**
S402	CS143 - L130X12	1a/1	0,000	**-211,36**
S402	CS143 - L130X12	1a-p/17	3,331	**73,26**
S411	CS90 - L(ARC)100x100x6	1a/1	2,221	**-95,20**
S411	CS90 - L(ARC)100x100x6	1a-p/17	4,356	**37,45**

	Project	150 kV lijn Leiden - Zoetermeer
D&C ENGINEERING	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
S413	CS124 - L80X6	1a/18	0,000	**-15,45**
S413	CS124 - L80X6	3-p/34	0,970	**43,51**
S417	CS133 - L80X6	3/35	5,210	**-14,99**
S417	CS133 - L80X6	3-p/34	3,599	**49,14**
S418	CS82 - L130X12	1a/3	0,000	**-368,49**
S418	CS82 - L130X12	1a-p/16	4,280	**362,60**
S421	CS143 - L130X12	1a/3	0,000	**-181,75**
S421	CS143 - L130X12	1a-p/16	3,330	**97,86**
S425	CS124 - L80X6	3/35	0,000	**-45,92**
S425	CS124 - L80X6	1a-p/16	0,970	**13,17**
S426	CS133 - L80X6	3/35	2,008	**-45,94**
S426	CS133 - L80X6	3-p/34	5,210	**18,17**
S430	CS37 - HFLeq75x75x8	3-p/34	0,000	**-4,23**
S430	CS37 - HFLeq75x75x8	1a/7	0,000	**3,32**
S441	CS101 - UNP120	1a-p/29	0,000	**-43,76**
S441	CS101 - UNP120	3/118	0,000	**117,55**
S446	CS101 - UNP120	3-p/23	0,000	**-103,73**
S446	CS101 - UNP120	1a/7	0,000	**57,32**
S447	CS101 - UNP120	3/10	0,000	**-136,86**
S447	CS101 - UNP120	1a-p/29	0,000	**28,51**
S448	CS158 - L50X40X5	1a-p/4	2,810	**24,80**
S448	CS158 - L50X40X5	3/26	0,000	**45,17**
S449	CS140 - L45X30X5	1a/27	0,941	**-0,47**
S449	CS140 - L45X30X5	1a-p/28	0,000	**0,34**
S450	CS4 - L50X40X5	1a/7	0,000	**0,00**
S450	CS4 - L50X40X5	1a/7	0,864	**0,00**
S453	CS4 - L50X40X5	1a-p/29	0,864	**0,00**
S453	CS4 - L50X40X5	1a/1	0,000	**0,00**
S456	CS122 - L50X40X5	1a-p/12	0,000	**-0,80**
S456	CS122 - L50X40X5	1a/7	2,179	**0,96**
S457	CS155 - HFLue120x80x8	1a/7	1,544	**-160,84**
S457	CS155 - HFLue120x80x8	1a-p/12	0,000	**247,80**
S458	CS92 - L50X40X5	1a/2	0,000	**-0,84**
S458	CS92 - L50X40X5	1a/7	2,231	**1,08**
S459	CS92 - L50X40X5	1a/1	0,000	**-0,84**
S459	CS92 - L50X40X5	1a/7	2,231	**1,08**
S460	CS84 - L(ARC)100x100x6	1a/27	2,080	**-32,54**
S460	CS84 - L(ARC)100x100x6	1a-p/28	0,000	**0,81**
S461	CS156 - L50X5	1a-p/17	0,000	**-1,03**
S461	CS156 - L50X5	1a/1	1,503	**4,09**
S462	CS156 - L50X5	1a-p/15	0,000	**-1,32**
S462	CS156 - L50X5	1a/2	1,503	**4,91**
S463	CS156 - L50X5	1a-p/4	0,000	**-2,32**
S463	CS156 - L50X5	1a/18	1,503	**2,53**
S464	CS156 - L50X5	1a-p/16	0,000	**-2,78**
S464	CS156 - L50X5	1a/3	1,503	**3,14**
S465	CS95 - L(ARC)75x75x6	5a15/87	0,573	**-16,47**
S465	CS95 - L(ARC)75x75x6	5a16/123	0,000	**15,09**
S466	CS95 - L(ARC)75x75x6	5a20/124	0,000	**-21,77**
S466	CS95 - L(ARC)75x75x6	5a19/125	0,000	**8,40**
B7	CS75 - L120X11	1a/2	0,000	**-151,11**
B7	CS75 - L120X11	1a-p/16	3,800	**103,39**
B118	CS75 - L120X11	1a/3	0,000	**-106,13**
B118	CS75 - L120X11	1a-p/4	3,800	**119,52**
B119	CS75 - L120X11	1a/1	3,800	**-134,98**

Staaf	css	BG	dx [m]	N [kN]
B119	CS75 - L120X11	1a-p/4	0,000	**119,56**
B120	CS75 - L120X11	1a/2	3,800	**-151,07**
B120	CS75 - L120X11	1a-p/17	0,000	**74,60**
B11	CS39 - ISEA80/80/6	5a11/116	0,000	**-3,02**
B11	CS39 - ISEA80/80/6	5a12/126	0,000	**1,93**
B121	CS39 - ISEA80/80/6	5a5/45	0,000	**-2,62**
B121	CS39 - ISEA80/80/6	5a6/44	0,000	**2,36**
B13	CS39 - ISEA80/80/6	5a6/46	0,000	**-3,91**
B13	CS39 - ISEA80/80/6	5a5/47	0,000	**1,02**
B122	CS39 - ISEA80/80/6	5a12/120	0,000	**-2,19**
B122	CS39 - ISEA80/80/6	5a11/127	0,000	**2,82**
B123	CS46 - ISEA70/70/5	1a/7	3,800	**-0,19**
B123	CS46 - ISEA70/70/5	3-p/128	0,000	**-0,04**
B17	CS46 - ISEA70/70/5	3/39	0,000	**-0,45**
B17	CS46 - ISEA70/70/5	1a-p/29	0,000	**-0,30**
B124	CS46 - ISEA70/70/5	3/39	0,000	**-0,84**
B124	CS46 - ISEA70/70/5	1a-p/29	0,000	**-0,59**
B129	CS79 - L100X8	5a11/127	0,000	**-16,93**
B129	CS79 - L100X8	5a12/120	0,000	**6,12**
B130	CS79 - L100X8	5a12/120	0,000	**-7,21**
B130	CS79 - L100X8	5a11/127	0,000	**15,69**
B131	CS79 - L100X8	5a6/44	0,000	**-12,79**
B131	CS79 - L100X8	5a5/114	0,000	**10,15**
B132	CS79 - L100X8	5a5/114	0,000	**-11,51**
B132	CS79 - L100X8	5a11/116	0,000	**11,36**
B133	CS77 - L60X5	3/37	2,500	**-1,76**
B133	CS77 - L60X5	1a-p/12	0,000	**-0,86**
B134	CS77 - L60X5	1a-p/12	0,000	**0,51**
B134	CS77 - L60X5	3/37	0,000	**1,08**
B135	CS77 - L60X5	1a-p/12	0,000	**0,35**
B135	CS77 - L60X5	3/37	0,000	**0,87**
S467	CS78 - L110X10	1a/2	2,500	**-218,80**
S467	CS78 - L110X10	1a-p/16	0,000	**141,94**
S470	CS113 - L80X6	1a-p/17	2,500	**-10,00**
S470	CS113 - L80X6	1a/2	0,000	**19,26**
S472	CS78 - L110X10	1a/1	0,000	**-189,04**
S472	CS78 - L110X10	1a-p/4	2,500	**163,33**
S474	CS113 - L80X6	1a-p/4	0,000	**-14,68**
S474	CS113 - L80X6	1a/3	2,501	**13,83**
S482	CS21 - ISUA65/50/6	3-p/34	1,726	**-49,03**
S482	CS21 - ISUA65/50/6	3/35	1,726	**10,88**
S483	CS21 - ISUA65/50/6	3-p/34	3,452	**-22,37**
S483	CS21 - ISUA65/50/6	3/35	1,726	**37,48**
S484	CS21 - ISUA65/50/6	1a-p/29	0,000	**-0,33**
S484	CS21 - ISUA65/50/6	3/10	1,726	**68,41**
S485	CS21 - ISUA65/50/6	3-p/11	3,452	**-22,09**
S485	CS21 - ISUA65/50/6	3/10	1,726	**37,77**
S486	CS133 - L80X6	3/10	2,008	**-69,65**
S486	CS133 - L80X6	5a2/129	2,008	**7,83**
S491	CS151 - HFLeq130x130x12	1a-p/29	0,000	**-106,86**

Staaf	css	BG	dx [m]	N [kN]
S491	CS151 - HFLeq130x130x12	1a/6	0,000	**367,01**
S492	CS144 - UNP160	1a/7	0,000	**-143,82**
S492	CS144 - UNP160	1a-p/12	0,000	**64,02**
S493	CS144 - UNP160	1a/6	2,195	**-193,48**
S493	CS144 - UNP160	1a-p/12	1,485	**140,46**
S495	CS101 - UNP120	1a-p/12	0,000	**-103,50**
S495	CS101 - UNP120	1a/7	1,964	**58,08**
S497	CS101 - UNP120	3/10	0,000	**-127,75**
S497	CS101 - UNP120	1a-p/29	0,000	**26,92**
S503	CS97 - L100X8	1a-p/29	0,000	**-47,66**
S503	CS97 - L100X8	3/10	0,000	**168,15**
S508	CS30 - UNP140	1b-p/103	0,000	**39,74**
S508	CS30 - UNP140	5a6/84	0,000	**73,87**
S509	CS36 - ISEA70/70/5	5a11/60	0,000	**-6,49**
S509	CS36 - ISEA70/70/5	5a12/59	0,000	**19,63**
S510	CS36 - ISEA70/70/5	5a12/63	0,000	**-8,52**
S510	CS36 - ISEA70/70/5	5a11/36	0,000	**17,34**
S511	CS30 - UNP140	1b-p/85	0,000	**40,78**
S511	CS30 - UNP140	5a2/130	0,000	**75,87**
S513	CS36 - ISEA70/70/5	5a5/25	0,000	**-8,19**
S513	CS36 - ISEA70/70/5	5a6/131	0,000	**18,58**
S514	CS36 - ISEA70/70/5	5a6/42	0,000	**-6,80**
S514	CS36 - ISEA70/70/5	5a5/132	0,000	**20,19**
S547	CS144 - UNP160	1a/6	0,000	**-193,84**
S547	CS144 - UNP160	1a-p/29	1,227	**52,74**
S548	CS38 - HFLeq80x80x8	1b-p/85	0,000	**34,76**
S548	CS38 - HFLeq80x80x8	5a22/133	0,000	**64,13**
S549	CS38 - HFLeq80x80x8	5a14/81	0,000	**0,17**
S549	CS38 - HFLeq80x80x8	5a13/134	0,000	**28,60**
S550	CS38 - HFLeq80x80x8	5a13/77	0,310	**-0,74**
S550	CS38 - HFLeq80x80x8	5a14/135	0,000	**27,41**
S551	CS38 - HFLeq80x80x8	1b-p/103	0,000	**34,24**
S551	CS38 - HFLeq80x80x8	5a14/136	0,000	**63,11**
S552	CS38 - HFLeq80x80x8	5a22/93	0,000	**-1,73**
S552	CS38 - HFLeq80x80x8	5a21/137	0,000	**26,22**
S553	CS38 - HFLeq80x80x8	5a21/104	0,000	**0,04**
S553	CS38 - HFLeq80x80x8	5a22/133	0,000	**28,37**
SB145	CS61 - L60X6	1a-p/4	0,000	**0,00**
SB145	CS61 - L60X6	3/118	3,040	**0,00**
SB146	CS61 - L60X6	1a/27	2,736	**0,00**
SB146	CS61 - L60X6	1a/18	0,000	**0,00**
SB147	CS4 - L50X40X5	1a/2	0,000	**-0,10**
SB147	CS4 - L50X40X5	1a/27	2,827	**0,00**
SB148	CS4 - L50X40X5	1a/2	0,000	**-0,10**
SB148	CS4 - L50X40X5	3/118	2,827	**0,00**
SB149	CS60 - L50X5	1a/3	0,000	**-0,11**
SB149	CS60 - L50X5	1a/27	3,371	**0,00**
SB150	CS61 - L60X6	1a-p/17	0,000	**0,00**
SB150	CS61 - L60X6	1a/27	3,040	**0,00**
SB151	CS102 - L50X5	1a-p/17	0,000	**0,00**
SB151	CS102 - L50X5	1a/27	1,710	**0,00**

Staaf	css	BG	dx [m]	N [kN]
SB152	CS4 - L50X40X5	1a/3	0,000	**-0,10**
SB152	CS4 - L50X40X5	1a/27	2,827	**0,00**
SB153	CS4 - L50X40X5	1a/3	0,000	**-0,10**
SB153	CS4 - L50X40X5	1a/27	2,402	**0,00**
SB154	CS4 - L50X40X5	1a/3	0,000	**-0,10**
SB154	CS4 - L50X40X5	1a/27	2,169	**0,00**
SB155	CS4 - L50X40X5	1a-p/17	0,000	**0,00**
SB155	CS4 - L50X40X5	1a/2	0,912	**0,00**
SB156	CS4 - L50X40X5	1a-p/17	0,000	**0,00**
SB156	CS4 - L50X40X5	1a/27	0,760	**0,00**
SB157	CS4 - L50X40X5	1a/7	0,760	**0,00**
SB157	CS4 - L50X40X5	1a/1	0,000	**0,00**
SB158	CS4 - L50X40X5	1a/7	1,520	**0,00**
SB158	CS4 - L50X40X5	1a/1	0,000	**0,00**
SB159	CS4 - L50X40X5	1a/3	0,000	**-0,10**
SB159	CS4 - L50X40X5	3-p/23	2,169	**0,00**
SB160	CS102 - L50X5	1a/7	2,280	**0,00**
SB160	CS102 - L50X5	1a/1	0,000	**0,00**
SB161	CS4 - L50X40X5	1a/3	0,000	**-0,10**
SB161	CS4 - L50X40X5	1a/7	2,402	**0,00**
SB162	CS61 - L60X6	1a/7	3,040	**0,00**
SB162	CS61 - L60X6	1a/1	0,000	**0,00**
SB163	CS4 - L50X40X5	1a/3	0,000	**-0,10**
SB163	CS4 - L50X40X5	1a/7	2,827	**0,00**
SB164	CS60 - L50X5	1a/3	0,000	**-0,11**
SB164	CS60 - L50X5	1a/7	3,371	**0,00**
SB165	CS60 - L50X5	1a/18	0,000	**-0,11**
SB165	CS60 - L50X5	1a/7	3,371	**0,00**
SB166	CS61 - L60X6	1a/18	0,000	**0,00**
SB166	CS61 - L60X6	1a/7	3,040	**0,00**
SB167	CS102 - L50X5	1a/18	0,000	**0,00**
SB167	CS102 - L50X5	1a/7	2,280	**0,00**
SB168	CS4 - L50X40X5	1a/18	0,000	**-0,10**
SB168	CS4 - L50X40X5	1a/7	2,827	**0,00**
SB169	CS4 - L50X40X5	1a/18	0,000	**-0,10**
SB169	CS4 - L50X40X5	1a/7	2,402	**0,00**
SB170	CS4 - L50X40X5	1a/18	0,000	**-0,10**
SB170	CS4 - L50X40X5	1a/7	2,169	**0,00**
SB171	CS4 - L50X40X5	1a/18	0,000	**0,00**
SB171	CS4 - L50X40X5	1a/7	1,520	**0,00**
SB172	CS4 - L50X40X5	1a/18	0,000	**0,00**
SB172	CS4 - L50X40X5	1a/7	0,760	**0,00**
SB173	CS4 - L50X40X5	1a/9	0,760	**0,00**
SB173	CS4 - L50X40X5	1a/2	0,000	**0,00**
SB174	CS4 - L50X40X5	1a/9	1,520	**0,00**
SB174	CS4 - L50X40X5	1a/2	0,000	**0,00**
SB175	CS4 - L50X40X5	1a/18	0,000	**-0,10**
SB175	CS4 - L50X40X5	1a-p/17	2,169	**0,00**
SB176	CS102 - L50X5	1a/9	2,280	**0,00**
SB176	CS102 - L50X5	1a/2	0,000	**0,00**
SB177	CS4 - L50X40X5	1a/18	0,000	**-0,10**
SB177	CS4 - L50X40X5	1a/9	2,402	**0,00**
SB178	CS61 - L60X6	1a/9	3,040	**0,00**
SB178	CS61 - L60X6	1a/2	0,000	**0,00**
SB179	CS4 - L50X40X5	1a/18	0,000	**-0,10**
SB179	CS4 - L50X40X5	1a/9	2,827	**0,00**
SB180	CS60 - L50X5	1a/18	0,000	**-0,11**
SB180	CS60 - L50X5	1a/9	3,371	**0,00**
SB181	CS60 - L50X5	1a/1	0,000	**-0,11**
SB181	CS60 - L50X5	1a/9	3,371	**0,00**
SB182	CS61 - L60X6	1a/1	0,000	**0,00**
SB182	CS61 - L60X6	1a/9	3,040	**0,00**
SB183	CS102 - L50X5	1a/1	0,000	**0,00**
SB183	CS102 - L50X5	1a/9	2,280	**0,00**
SB184	CS4 - L50X40X5	1a/1	0,000	**-0,10**
SB184	CS4 - L50X40X5	1a/9	2,827	**0,00**
SB185	CS4 - L50X40X5	1a/1	0,000	**-0,10**

Staaf	css	BG	dx [m]	N [kN]
SB185	CS4 - L50X40X5	1a/9	2,402	**0,00**
SB186	CS4 - L50X40X5	1a/1	0,000	**-0,10**
SB186	CS4 - L50X40X5	1a/9	2,169	**0,00**
SB187	CS4 - L50X40X5	1a/1	0,000	**0,00**
SB187	CS4 - L50X40X5	1a/9	1,520	**0,00**
SB188	CS4 - L50X40X5	1a/1	0,000	**0,00**
SB188	CS4 - L50X40X5	1a/9	0,760	**0,00**
SB189	CS4 - L50X40X5	3/10	0,760	**0,00**
SB189	CS4 - L50X40X5	1a/3	0,000	**0,00**
SB190	CS4 - L50X40X5	3/10	1,520	**0,00**
SB190	CS4 - L50X40X5	1a/3	0,000	**0,00**
SB191	CS4 - L50X40X5	1a/1	0,000	**-0,10**
SB191	CS4 - L50X40X5	1a-p/29	2,169	**0,00**
SB192	CS102 - L50X5	3/10	2,280	**0,00**
SB192	CS102 - L50X5	1a/3	0,000	**0,00**
SB193	CS4 - L50X40X5	1a/1	0,000	**-0,10**
SB193	CS4 - L50X40X5	3/118	2,402	**0,00**
SB194	CS61 - L60X6	3/10	3,040	**0,00**
SB194	CS61 - L60X6	1a/3	0,000	**0,00**
SB195	CS4 - L50X40X5	1a/1	0,000	**-0,10**
SB195	CS4 - L50X40X5	3/118	2,827	**0,00**
SB196	CS60 - L50X5	1a/1	0,000	**-0,11**
SB196	CS60 - L50X5	3/118	3,371	**0,00**
S588	CS104 - L70X6	1a/1	0,000	**0,00**
S588	CS104 - L70X6	1a/7	3,353	**0,00**
S589	CS104 - L70X6	1a/6	3,353	**0,00**
S589	CS104 - L70X6	1a/2	0,000	**0,00**
S590	CS104 - L70X6	1a/2	0,000	**0,00**
S590	CS104 - L70X6	1a-p/28	3,353	**0,00**
S591	CS104 - L70X6	1a/27	3,353	**0,00**
S591	CS104 - L70X6	1a/3	0,000	**0,00**
S592	CS104 - L70X6	1a/3	0,000	**0,00**
S592	CS104 - L70X6	1a/6	3,353	**0,00**
S593	CS104 - L70X6	1a/7	3,353	**0,00**
S593	CS104 - L70X6	1a/18	0,000	**0,00**
S594	CS104 - L70X6	1a/18	0,000	**0,00**
S594	CS104 - L70X6	1a-p/8	3,353	**0,00**
S595	CS104 - L70X6	1a/9	3,353	**0,00**
S595	CS104 - L70X6	1a/1	0,000	**0,00**
S596	CS95 - L(ARC)75x75x6	5a16/88	0,000	**-14,80**
S596	CS95 - L(ARC)75x75x6	5a15/90	0,000	**17,04**
S597	CS95 - L(ARC)75x75x6	5a15/87	0,851	**-16,41**
S597	CS95 - L(ARC)75x75x6	5a16/123	0,000	**14,66**
S598	CS95 - L(ARC)75x75x6	5a20/124	0,000	**-21,77**
S598	CS95 - L(ARC)75x75x6	5a19/125	0,000	**8,90**
S599	CS95 - L(ARC)75x75x6	5a19/109	0,000	**-19,09**
S599	CS95 - L(ARC)75x75x6	5a20/110	0,286	**11,89**
S600	CS144 - UNP160	5a13/13	1,461	**-125,50**
S600	CS144 - UNP160	5a14/138	2,942	**29,59**
S601	CS144 - UNP160	3/10	0,000	**-204,63**
S601	CS144 - UNP160	1a-p/29	0,000	**19,25**
S602	CS160 - L150X14	1a/6	2,821	**-312,82**
S602	CS160 - L150X14	1a/7	2,821	**157,57**
S603	CS160 - L150X14	1a/7	2,821	**-170,33**
S603	CS160 - L150X14	1a/6	2,821	**303,84**
S604	CS160 - L150X14	1a/7	2,821	**-181,83**
S604	CS160 - L150X14	1a/6	2,821	**298,64**
S605	CS160 - L150X14	1a/6	2,821	**-311,84**
S605	CS160 - L150X14	1a/7	2,821	**168,62**
S606	CS88 - L50X40X5	1a-p/4	0,000	**-3,41**
S606	CS88 - L50X40X5	1a/18	0,000	**2,60**

Staaf	css	BG	dx [m]	N [kN]
S607	CS88 - L50X40X5	1a-p/29	1,250	**-0,21**
S607	CS88 - L50X40X5	1a/6	0,000	**1,26**
S608	CS88 - L50X40X5	1a-p/15	0,000	**-1,34**
S608	CS88 - L50X40X5	1a/2	1,250	**4,73**
S609	CS88 - L50X40X5	1a-p/12	0,000	**-0,66**
S609	CS88 - L50X40X5	1a/7	1,250	**0,82**
S610	CS83 - L100X75X7	1a/27	0,000	**-51,53**
S610	CS83 - L100X75X7	1a-p/28	2,382	**47,06**
S611	CS82 - L130X12	1a/18	0,000	**-315,19**
S611	CS82 - L130X12	1a-p/4	2,140	**413,39**
S612	CS83 - L100X75X7	1a/9	0,000	**-46,40**
S612	CS83 - L100X75X7	1a-p/8	2,382	**51,90**
S613	CS83 - L100X75X7	1a/9	0,000	**-47,02**
S613	CS83 - L100X75X7	1a-p/8	2,382	**53,47**
S614	CS83 - L100X75X7	1a/27	0,000	**-64,87**
S614	CS83 - L100X75X7	1a-p/28	2,382	**35,36**
S615	CS89 - L130X12	1a/1	0,000	**-298,50**
S615	CS89 - L130X12	1a-p/17	4,261	**54,17**
S616	CS89 - L130X12	1a/2	0,000	**-314,16**
S616	CS89 - L130X12	1a-p/15	4,261	**36,12**
S617	CS89 - L130X12	1a/3	0,000	**-251,47**
S617	CS89 - L130X12	1a-p/16	4,261	**103,92**
S618	CS89 - L130X12	1a/18	0,000	**-207,70**
S618	CS89 - L130X12	1a-p/4	4,261	**148,16**
S619	CS142 - L120X80X8	1a-p/12	0,000	**-295,06**
S619	CS142 - L120X80X8	1a/7	4,017	**169,58**
S620	CS142 - L120X80X8	1a-p/29	0,000	**-144,34**
S620	CS142 - L120X80X8	1a/6	4,017	**321,60**
S621	CS142 - L120X80X8	1a-p/29	0,000	**-148,36**
S621	CS142 - L120X80X8	1a/6	4,017	**317,46**
S622	CS142 - L120X80X8	1a-p/12	0,000	**-284,59**
S622	CS142 - L120X80X8	1a/7	4,017	**182,10**
S623	CS161 - L120X80X8	1a/9	0,000	**-56,51**
S623	CS161 - L120X80X8	1a-p/8	4,747	**63,50**
S624	CS161 - L120X80X8	1a/9	0,000	**-48,63**
S624	CS161 - L120X80X8	1a/27	4,747	**73,30**
S625	CS161 - L120X80X8	1a/27	0,000	**-74,27**
S625	CS161 - L120X80X8	1a-p/28	4,747	**47,78**
S626	CS90 - L(ARC)100x100x6	1a/2	2,221	**-111,98**
S626	CS90 - L(ARC)100x100x6	1a-p/15	4,356	**22,92**
S627	CS97 - L100X8	1a-p/12	0,000	**-107,94**
S627	CS97 - L100X8	1a/7	0,000	**95,09**
S628	CS97 - L100X8	3/10	0,000	**-67,77**
S628	CS97 - L100X8	1a-p/29	0,000	**14,36**
S629	CS97 - L100X8	1a/7	0,000	**-43,72**
S629	CS97 - L100X8	1a-p/12	0,000	**38,40**
S630	CS101 - UNP120	1a-p/29	0,000	**-49,90**
S630	CS101 - UNP120	1a/6	0,000	**108,78**
S631	CS101 - UNP120	1a-p/29	2,855	**-48,23**

Staaf	css	BG	dx [m]	N [kN]
S631	CS101 - UNP120	3/118	2,498	**124,02**
S632	CS101 - UNP120	1a-p/12	0,000	**-97,53**
S632	CS101 - UNP120	5a8/139	1,967	**78,16**
S633	CS101 - UNP120	3-p/23	2,861	**-106,23**
S633	CS101 - UNP120	5a7/140	2,145	**84,17**
S634	CS101 - UNP120	1a-p/29	0,000	**-43,72**
S634	CS101 - UNP120	3/118	1,610	**136,24**
S635	CS97 - L100X8	3-p/34	0,000	**-122,97**
S635	CS97 - L100X8	1a/7	0,000	**87,63**
S636	CS97 - L100X8	3/10	0,000	**-77,79**
S636	CS97 - L100X8	1a-p/29	0,000	**7,94**
S637	CS97 - L100X8	1a/7	0,000	**-44,31**
S637	CS97 - L100X8	3-p/34	0,000	**40,28**
S638	CS151 - HFLeq130x130x12	1a-p/12	0,000	**-244,11**
S638	CS151 - HFLeq130x130x12	1a/7	0,000	**229,49**
S639	CS151 - HFLeq130x130x12	1a-p/17	0,000	**35,41**
S639	CS151 - HFLeq130x130x12	3/37	0,000	**71,38**
S640	CS151 - HFLeq130x130x12	5a13/134	0,000	**38,52**
S640	CS151 - HFLeq130x130x12	3/41	0,000	**76,60**
S641	CS151 - HFLeq130x130x12	1a-p/12	0,000	**-241,06**
S641	CS151 - HFLeq130x130x12	1a/7	0,000	**233,63**
S642	CS144 - UNP160	1a/6	0,000	**-186,45**
S642	CS144 - UNP160	1a-p/29	0,000	**57,41**
S643	CS144 - UNP160	3/10	0,000	**-211,74**
S643	CS144 - UNP160	1a-p/29	0,000	**6,49**
S644	CS144 - UNP160	1a/7	0,000	**-138,01**
S644	CS144 - UNP160	1a-p/12	0,000	**71,15**
S645	CS144 - UNP160	1a/7	0,000	**-119,67**
S645	CS144 - UNP160	1a-p/12	0,000	**121,73**
S646	CS143 - L130X12	1a/18	0,000	**-164,63**
S646	CS143 - L130X12	1a-p/4	3,330	**113,25**
S648	CS170 - L50X5	1b/141	0,000	**36,36**
S648	CS170 - L50X5	5a8/142	0,000	**69,93**

Staaf	css	BG	dx [m]	N [kN]
S649	CS170 - L50X5	5a8/142	0,000	**-41,86**
S649	CS170 - L50X5	1b/141	0,000	**-21,78**
S650	CS170 - L50X5	1b/143	0,000	**36,90**
S650	CS170 - L50X5	5a7/144	0,000	**70,41**
S651	CS170 - L50X5	5a7/144	0,000	**-42,15**
S651	CS170 - L50X5	1b/143	0,000	**-22,10**
S652	CS170 - L50X5	1b/145	0,000	**37,05**
S652	CS170 - L50X5	5a9/146	0,000	**70,69**
S653	CS170 - L50X5	5a9/146	0,000	**-42,74**
S653	CS170 - L50X5	1b/145	0,000	**-22,38**
S654	CS170 - L50X5	1b/147	0,000	**36,72**
S654	CS170 - L50X5	5a10/148	0,000	**70,41**
S655	CS170 - L50X5	5a10/148	0,000	**-42,56**
S655	CS170 - L50X5	1b/147	0,000	**-22,17**
S656	CS170 - L50X5	5a13/13	0,000	**-40,47**
S656	CS170 - L50X5	1b/147	0,000	**-20,97**
S657	CS170 - L50X5	1b/147	0,000	**32,81**
S657	CS170 - L50X5	5a13/13	0,000	**63,36**
S658	CS170 - L50X5	1b/145	0,000	**33,34**
S658	CS170 - L50X5	5a14/86	0,000	**63,95**
S659	CS170 - L50X5	5a14/86	0,000	**-40,80**
S659	CS170 - L50X5	1b/145	0,000	**-21,25**
S660	CS171 - L60X8	1b-p/149	0,000	**35,19**
S660	CS171 - L60X8	5a21/104	0,000	**67,12**
S661	CS171 - L60X8	5a21/104	0,000	**-40,86**
S661	CS171 - L60X8	1b-p/149	0,000	**-21,44**
S662	CS171 - L60X8	1b-p/40	0,000	**36,46**
S662	CS171 - L60X8	5a22/93	0,000	**69,08**
S663	CS171 - L60X8	5a22/93	0,000	**-42,05**
S663	CS171 - L60X8	1b-p/40	0,000	**-22,21**
S664	CS171 - L60X8	1b-p/107	0,000	**36,51**
S664	CS171 - L60X8	5a13/13	0,000	**69,68**
S665	CS171 - L60X8	5a13/13	0,000	**-42,16**
S665	CS171 - L60X8	1b-p/107	0,000	**-22,12**
S666	CS171 - L60X8	1b-p/150	0,000	**36,01**
S666	CS171 - L60X8	5a14/86	0,000	**68,36**
S667	CS171 - L60X8	5a14/86	0,000	**-41,38**
S667	CS171 - L60X8	1b-p/150	0,000	**-21,81**

11.2. Reacties

Lineaire berekening, Extreem : Knoop
Selectie : Alle
Klasse : All UGT

Steunpunt	BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Sn1/N1	1a-p/15	**-94,61**	**-93,85**	**-432,00**	0,00	0,00	0,00
Sn1/N1	1a/2	**194,94**	**212,20**	**1021,68**	0,00	0,00	0,00
Sn1/N1	1a/5	52,05	60,34	300,61	**0,00**	**0,00**	**0,00**
Sn2/N3	1a/3	**-162,62**	**155,08**	**763,04**	0,00	0,00	0,00
Sn2/N3	1a-p/16	**128,70**	**-148,75**	**-688,76**	0,00	0,00	0,00
Sn2/N3	1a/5	-17,73	3,71	38,37	**0,00**	**0,00**	**0,00**
Sn3/N7	1a/18	**-141,34**	**-143,20**	**670,17**	0,00	0,00	0,00
Sn3/N7	1a-p/4	**150,15**	**161,16**	**-783,97**	0,00	0,00	0,00
Sn3/N7	1a/5	-0,80	3,44	-28,58	**0,00**	**0,00**	**0,00**
Sn4/N6	1a-p/17	**-110,46**	**110,41**	**-524,06**	0,00	0,00	0,00
Sn4/N6	1a/1	**179,11**	**-195,03**	**927,69**	0,00	0,00	0,00
Sn4/N6	1a/5	40,68	-48,43	234,69	**0,00**	**0,00**	**0,00**

11.3. Resultante op Fundering

Lineaire berekening, Extreem : Nee
Selectie : Alle
Klasse : All UGT

BG	Steunpunt	Extreem	horiz. component [kN]	resultante [kN]	Hoek [deg]	helling(afschot) [-]	Rx [kN]	Ry [kN]	Rz [kN]
1a-p/15	Sn1/N1	Rx	133,26	452,08	-0,23	-3,24	-94,61	-93,85	-432,00
1a/2	Sn1/N1	Rx	288,15	1061,53	-177,57	3,55	194,94	212,20	1021,68
1a-p/15	Sn1/N1	Ry	133,26	452,08	-0,23	-3,24	-94,61	-93,85	-432,00
1a/2	Sn1/N1	Ry	288,15	1061,53	-177,57	3,55	194,94	212,20	1021,68
1a-p/15	Sn1/N1	Rz	133,26	452,08	-0,23	-3,24	-94,61	-93,85	-432,00
1a/2	Sn1/N1	Rz	288,15	1061,53	-177,57	3,55	194,94	212,20	1021,68
1a/3	Sn2/N3	Rx	215,85	689,43	-93,89	-3,03	-162,62	-141,93	-654,77
1a-p/16	Sn2/N3	Rx	196,33	755,03	94,04	3,71	128,70	148,26	729,05
1a-p/17	Sn2/N3	Ry	215,33	721,63	-91,31	-3,20	-155,69	-148,75	-688,76
1a/1	Sn2/N3	Ry	197,17	788,10	96,86	3,87	121,77	155,08	763,04
1a-p/17	Sn2/N3	Rz	215,33	721,63	-91,31	-3,20	-155,69	-148,75	-688,76
1a/1	Sn2/N3	Rz	197,17	788,10	96,86	3,87	121,77	155,08	763,04
1a/18	Sn3/N7	Rx	201,21	776,32	-179,62	-3,73	-141,34	-143,20	-749,80
1a-p/4	Sn3/N7	Rx	220,27	673,06	2,02	2,89	150,15	161,16	636,00
1a/18	Sn3/N7	Ry	201,21	776,32	-179,62	-3,73	-141,34	-143,20	-749,80
1a-p/4	Sn3/N7	Ry	220,27	673,06	2,02	2,89	150,15	161,16	636,00
1a-p/15	Sn3/N7	Rz	191,46	807,01	-179,57	-4,09	-134,37	-136,39	-783,97
1a/2	Sn3/N7	Rz	210,53	702,46	2,15	3,18	143,18	154,34	670,17
1a-p/17	Sn4/N6	Rx	218,23	567,68	104,59	-2,40	-110,46	-188,21	-524,06
1a/1	Sn4/N6	Rx	206,91	950,48	-104,96	4,48	179,11	103,60	927,69
1a/3	Sn4/N6	Ry	220,78	537,36	107,05	-2,22	-103,49	-195,03	-489,91
1a-p/16	Sn4/N6	Ry	204,50	916,64	-102,32	4,37	172,14	110,41	893,54
1a-p/17	Sn4/N6	Rz	218,23	567,68	104,59	-2,40	-110,46	-188,21	-524,06
1a/1	Sn4/N6	Rz	206,91	950,48	-104,96	4,48	179,11	103,60	927,69

11.4. Controle UNP profilen

11.4.1. Traverse 1 en 2 - onderrand

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

css	BG	Staaf	mat	dx [m]	Algehele toetsing [-]	Doorsnedetoetsing [-]	Stabiliteittoetsing [-]
CS144 - UNP160	5a21/94	S340	S 235	2,942	0,68	0,51	0,68

EC 3

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

EN 1993-1-1 Norm Controle

Nationale bijlage: Nederlandse NEN-EN NA

Staaf S340	**8,015 m**	**UNP160**	**S 235**	**5a21/94**	**0,68 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Classificatie voor doorsnede-ontwerp

Volgens EN 1993-1-1 artikel 5.5.2

Classificatie van interne drukonderdelen

Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	15,73
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	44,82

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen

Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,48
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	18,29

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp

Kritische controle op positie 2.942 m

Interne krachten	Berekende	Eenheid
N,Ed	-97,76	kN
Vy,Ed	6,69	kN
Vz,Ed	1,73	kN
T,Ed	0,01	kNm
My,Ed	-3,59	kNm
Mz,Ed	-1,89	kNm

Drukcontrole

Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	2,4000e-03	m^2
Nc,Rd	564,00	kN
Eenheidscontrole	0,17	-

Torsiecontrole

Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	2,0	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,01	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,3650e-03	m^2

Vpl,y,Rd	185,20	kN
Eenheidscontrole	0,04	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,2240e-03	m^2
Vpl,z,Rd	166,07	kN
Eenheidscontrole	0,01	-

Controle buigend moment voor My
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	1,3760e-04	m^3
Mpl,y,Rd	32,34	kNm
Eenheidscontrole	0,11	-

Controle buigend moment voor Mz
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	3,5200e-05	m^3
Mpl,z,Rd	8,27	kNm
Eenheidscontrole	0,23	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	564,00	kN
Mpl,y,Rd	32,34	kNm
Mpl,z,Rd	8,27	kNm

Eenheidscontrole (6.2) = 0,17 + 0,11 + 0,23 = 0,51 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.
...::STABILITEITSCONTROLE::...
Classificatie voor staafknikontwerp
Beslissende positie voor stabiliteitsclassificatie: 2,942 m
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	15,73
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	44,82

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,48
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	18,29

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp
Buigingsknik Controle
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	geschoord	geschoord	
Systeemlengte L	5.073	0.360	m
lef/lsys k	0.99	0.86	
Kniklengte Lcr	5.039	0.310	m
Kritische Euler belastingen Ncr	755.12	18358.54	kN
Slankheid	81.16	16.46	
Relatieve slankheid Lambda	0.86	0.18	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.62	1.00	
Knikweerstand Nb,Rd	350.78	564.00	kN

Tabel van waarden		
A	2.4000e-03	m^2
Knikweerstand Nb,Rd	350.78	kN
Eenheidscontrole	0.28	-

Torsieknikcontrole
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	0.360	m
Ncr,T	11372.49	kN
Ncr,TF	740.86	kN
Relatieve slankheid Lambda,T	0.87	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	2.4000e-03	m^2
Reductie factor Chi	0.62	
Knikweerstand Nb,Rd	347.88	kN
Eenheidscontrole	0.28	-

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	1.1600e-04	m^3
Elastisch critisch moment Mcr	1037.61	kNm
Relatieve slankheid Lambda,LT	0.16	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	0.360	m
k	1.00	
kw	1.00	
C1	1.09	
C2	0.00	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging
Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)
Interactie Methode 2

Tabel van waarden		
kyy	0.458	
kyz	0.602	
kzy	0.998	
kzz	0.602	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	2.4000e-03	m^2
Wy	1.1600e-04	m^3
Wz	1.8300e-05	m^3
NRk	564.00	kN
My,Rk	27.26	kNm
Mz,Rk	4.30	kNm
My,Ed	-3.59	kNm
Mz,Ed	-1.89	kNm
Interactie Methode 2		
Psi y	-0.009	
Psi z	-0.277	
Cmy	0.400	
Cmz	0.591	
CmLT	0.931	

Eenheidscontrole (6.61) = 0.28 + 0.06 + 0.26 = 0.60
Eenheidscontrole (6.62) = 0.28 + 0.13 + 0.26 = 0.68

Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	18.533

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.
De staaf voldoet aan de stabiliteitscontrole.
EC 3

11.4.2. Traverse 2 en 3 - onderrand

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

css	BG	Staaf	mat	dx [m]	Algehele toetsing [-]	Doorsnedetoetsing [-]	Stabiliteittoetsing [-]
CS101 - UNP120	5a11/65	S194	S 235	0,000	0,32	0,22	0,32

EC 3

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

EN 1993-1-1 Norm Controle

Nationale bijlage: Nederlandse NEN-EN NA

Staaf S194	**3,073 m**	**UNP120**	**S 235**	**5a11/65**	**0,32 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Classificatie voor doorsnede-ontwerp

Volgens EN 1993-1-1 artikel 5.5.2

Classificatie van interne drukonderdelen

Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	12,00
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	44,63

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen

Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,33
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,79

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp

Kritische controle op positie 0.000 m

Interne krachten	Berekende	Eenheid
N,Ed	-77,28	kN
Vy,Ed	0,00	kN
Vz,Ed	0,44	kN
T,Ed	0,01	kNm
My,Ed	-0,38	kNm
Mz,Ed	0,01	kNm

Drukcontrole

Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	1,7000e-03	m^2
Nc,Rd	399,50	kN
Eenheidscontrole	0,19	-

Torsiecontrole

Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	1,2	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,01	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	9,9000e-04	m^2
Vpl,y,Rd	134,32	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	8,5400e-04	m^2
Vpl,z,Rd	115,87	kN
Eenheidscontrole	0,00	-

Controle buigend moment voor My

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	7,2600e-05	m^3

Mpl,y,Rd	17,06	kNm
Eenheidscontrole	0,02	-

Controle buigend moment voor Mz
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	2,1200e-05	m^3
Mpl,z,Rd	4,98	kNm
Eenheidscontrole	0,00	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	399,50	kN
Mpl,y,Rd	17,06	kNm
Mpl,z,Rd	4,98	kNm

Eenheidscontrole (6.2) = 0,19 + 0,02 + 0,00 = 0,22 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.
...::STABILITEITSCONTROLE::...
Classificatie voor staafknikontwerp
Beslissende positie voor stabiliteitsclassificatie: 0,000 m
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	12,00
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	44,63

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,33
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,79

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp
Buigingsknik Controle
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	geschoord	geschoord	
Systeemlengte L	3.073	1.220	m
lef/lsys k	1.00	0.89	
Kniklengte Lcr	3.070	1.090	m
Kritische Euler belastingen Ncr	800.27	753.14	kN
Slankheid	66.35	68.40	
Relatieve slankheid Lambda	0.71	0.73	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.72	0.71	
Knikweerstand Nb,Rd	287.89	282.48	kN

Tabel van waarden		
A	1.7000e-03	m^2
Knikweerstand Nb,Rd	282.48	kN
Eenheidscontrole	0.27	-

Torsieknikcontrole
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	1.220	m
Ncr,T	1349.67	kN
Ncr,TF	624.37	kN
Relatieve slankheid Lambda,T	0.80	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	1.7000e-03	m^2
Reductie factor Chi	0.66	
Knikweerstand Nb,Rd	264.56	kN
Eenheidscontrole	0.29	-

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	6.0700e-05	m^3
Elastisch critisch moment Mcr	113.69	kNm
Relatieve slankheid Lambda,LT	0.35	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.220	m
k	1.00	
kw	1.00	
C1	2.12	
C2	0.06	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging

Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)

Interactie Methode 2

Tabel van waarden		
kyy	0.446	
kyz	0.981	
kzy	0.959	
kzz	0.981	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	1.7000e-03	m^2
Wy	6.0700e-05	m^3
Wz	1.1100e-05	m^3
NRk	399.50	kN
My,Rk	14.26	kNm
Mz,Rk	2.61	kNm
My,Ed	-0.38	kNm
Mz,Ed	0.01	kNm
Interactie Methode 2		
Psi y	-0.051	
Psi z	0.691	
Cmy	0.400	
Cmz	0.876	
CmLT	0.492	

Eenheidscontrole (6.61) = 0.27 + 0.01 + 0.00 = 0.28

Eenheidscontrole (6.62) = 0.29 + 0.03 + 0.00 = 0.32

Plooicontrole

in knikveld 1

Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	14.571

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.

De staaf voldoet aan de stabiliteitscontrole.

EC 3

11.4.3. Vak 9 - onderrand

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

css	BG	Staaf	mat	dx [m]	Algehele toetsing [-]	Doorsnedetoetsing [-]	Stabiliteittoetsing [-]
CS144 - UNP160	3/10	S643	S 235	0,000	0,81	0,57	0,81

EC 3

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

EN 1993-1-1 Norm Controle

Nationale bijlage: Nederlandse NEN-EN NA

Staaf S643	**1,720 m**	**UNP160**	**S 235**	**3/10**	**0,81 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa

Materiaal		
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2

Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	15,73
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	53,81

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,48
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,93

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp

Kritische controle op positie 0.000 m

Interne krachten	Berekende	Eenheid
N,Ed	-211,74	kN
Vy,Ed	-0,12	kN
Vz,Ed	3,33	kN
T,Ed	0,00	kNm
My,Ed	-5,33	kNm
Mz,Ed	0,21	kNm

Drukcontrole
Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	2,4000e-03	m^2
Nc,Rd	564,00	kN
Eenheidscontrole	0,38	-

Torsiecontrole
Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,1	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,3650e-03	m^2
Vpl,y,Rd	185,20	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,2240e-03	m^2
Vpl,z,Rd	166,07	kN
Eenheidscontrole	0,02	-

Controle buigend moment voor My
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	1,3760e-04	m^3
Mpl,y,Rd	32,34	kNm
Eenheidscontrole	0,16	-

Controle buigend moment voor Mz
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	3,5200e-05	m^3
Mpl,z,Rd	8,27	kNm
Eenheidscontrole	0,03	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	564,00	kN
Mpl,y,Rd	32,34	kNm
Mpl,z,Rd	8,27	kNm

Eenheidscontrole (6.2) = 0,38 + 0,16 + 0,03 = 0,57 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.
...::STABILITEITSCONTROLE::...
Classificatie voor staafknikontwerp
Beslissende positie voor stabiliteitsclassificatie: 0,000 m
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	15,73
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	53,81

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,48
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,93

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp
Buigingsknik Controle
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	geschoord	geschoord	
Systeemlengte L	1.720	1.720	m
lef/lsys k	0.94	0.85	
Kniklengte Lcr	1.623	1.463	m
Kritische Euler belastingen Ncr	7281.42	826.53	kN
Slankheid	26.14	77.58	
Relatieve slankheid Lambda	0.28	0.83	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.96	0.65	
Knikweerstand Nb,Rd	541.55	364.23	kN

Tabel van waarden		
A	2.4000e-03	m^2
Knikweerstand Nb,Rd	364.23	kN
Eenheidscontrole	0.58	-

Torsieknikcontrole
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	1.720	m
Ncr,T	1486.54	kN
Ncr,TF	1395.17	kN
Relatieve slankheid Lambda,T	0.64	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	2.4000e-03	m^2
Reductie factor Chi	0.76	
Knikweerstand Nb,Rd	430.87	kN
Eenheidscontrole	0.49	-

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	1.1600e-04	m^3
Elastisch critisch moment Mcr	130.74	kNm
Relatieve slankheid Lambda,LT	0.46	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.720	m
k	1.00	
kw	1.00	
C1	1.82	
C2	0.01	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging
Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)
Interactie Methode 2

Tabel van waarden		
kyy	0.623	
kyz	0.979	
kzy	0.928	
kzz	0.979	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	2.4000e-03	m^2
Wy	1.1600e-04	m^3
Wz	1.8300e-05	m^3
NRk	564.00	kN
My,Rk	27.26	kNm
Mz,Rk	4.30	kNm
My,Ed	-5.33	kNm
Mz,Ed	0.21	kNm
Interactie Methode 2		
Psi y	0.000	
Psi z	0.000	
Cmy	0.585	
Cmz	0.760	
CmLT	0.585	

Eenheidscontrole (6.61) = 0.39 + 0.12 + 0.05 = 0.56
Eenheidscontrole (6.62) = 0.58 + 0.18 + 0.05 = 0.81

Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	18.533

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.
De staaf voldoet aan de stabiliteitscontrole.
EC 3

11.4.4. Vak 12 - onderrand

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

css	BG	Staaf	mat	dx [m]	Algehele toetsing [-]	Doorsnedetoetsing [-]	Stabiliteittoetsing [-]
CS101 - UNP120	3-p/23	S632	S 235	1,604	**3,41**	0,34	**3,41**

EC 3

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT
EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf S632	**4,465 m**	**UNP120**	**S 235**	**3-p/23**	**3,41 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...
Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	12,00
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	42,76

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,33
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	16,86

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp

Kritische controle op positie 1.604 m

Interne krachten	Berekende	Eenheid
N,Ed	-96,75	kN
Vy,Ed	-0,32	kN
Vz,Ed	0,58	kN
T,Ed	0,00	kNm
My,Ed	0,27	kNm
Mz,Ed	-0,41	kNm

Drukcontrole
Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	1,7000e-03	m^2
Nc,Rd	399,50	kN
Eenheidscontrole	0,24	-

Torsiecontrole
Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,1	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	9,9000e-04	m^2
Vpl,y,Rd	134,32	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	8,5400e-04	m^2
Vpl,z,Rd	115,87	kN
Eenheidscontrole	0,01	-

Controle buigend moment voor My
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	7,2600e-05	m^3
Mpl,y,Rd	17,06	kNm
Eenheidscontrole	0,02	-

Controle buigend moment voor Mz
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	2,1200e-05	m^3
Mpl,z,Rd	4,98	kNm
Eenheidscontrole	0,08	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	399,50	kN
Mpl,y,Rd	17,06	kNm
Mpl,z,Rd	4,98	kNm

Eenheidscontrole (6.2) = 0,24 + 0,02 + 0,08 = 0,34 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...
Classificatie voor staafknikontwerp
Beslissende positie voor stabiliteitsclassificatie: 0,000 m
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	12,00
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00

Grenswaarde klasse 3	47,68

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen

Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,33
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,99

=> Uitkragende flenzen klasse 1

=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp

Buigingsknik Controle

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	ongeschoord	geschoord	
Systeemlengte L	1.967	1.604	m
lef/lsys k	7.47	0.71	
Kniklengte Lcr	14.694	1.146	m
Kritische Euler belastingen Ncr	34.94	681.92	kN
Slankheid	317.55	71.88	
Relatieve slankheid Lambda	3.38	0.77	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.08	0.68	
Knikweerstand Nb,Rd	30.45	273.21	kN

Waarschuwing: slankheid 317.55 is groter dan 200.00 !

Tabel van waarden		
A	1.7000e-03	m^2
Knikweerstand Nb,Rd	30.45	kN
Eenheidscontrole	**3.18**	-

Torsieknikcontrole

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	1.604	m
Ncr,T	1177.88	kN
Ncr,TF	34.60	kN
Relatieve slankheid Lambda,T	3.40	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	1.7000e-03	m^2
Reductie factor Chi	0.08	
Knikweerstand Nb,Rd	30.17	kN
Eenheidscontrole	**3.21**	-

Kipcontrole

Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	6.0700e-05	m^3
Elastisch critisch moment Mcr	87.95	kNm
Relatieve slankheid Lambda,LT	0.40	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.604	m
k	1.00	
kw	1.00	
C1	2.30	
C2	0.04	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging

Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)

Interactie Methode 2

Tabel van waarden		
kyy	2.616	
kyz	0.465	
kzy	0.923	
kzz	0.465	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	1.7000e-03	m^2
Wy	6.0700e-05	m^3
Wz	1.1100e-05	m^3

Tabel van waarden		
NRk	399.50	kN
My,Rk	14.26	kNm
Mz,Rk	2.61	kNm
My,Ed	-0.84	kNm
Mz,Ed	-0.41	kNm
Interactie Methode 2		
Psi y	-0.445	
Psi z	-0.224	
Cmy	0.900	
Cmz	0.400	
CmLT	0.427	

Eenheidscontrole (6.61) = 3.18 + 0.15 + 0.07 = 3.41
Eenheidscontrole (6.62) = 3.21 + 0.05 + 0.07 = 3.33

Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	14.571

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.

De staaf voldoet NIET aan de stabiliteitscontrole!

EC 3

11.5. Controle verzwaarde randstaaf van Vak 1 t/m 4

11.5.1. Randen : Vak 1 t/m 4

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - Randen vak 1 t/m 4
Klasse : All UGT

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf C1	10,951 m	2LX (L150X14; 15)	S 235	1a/2	0,87 -

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

Waarschuwing: Sterktereductie gerelateerd aan de dikte wordt niet ondersteund voor dit type doorsnede.

...::DOORSNEDE CONTROLE::...

Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Waarschuwing: Classificatie wordt niet ondersteund voor dit type doorsnede.
De doorsnede wordt gecontroleerd als elastisch, klasse 3.

Kritische controle op positie 10.951 m

As definitie :
- hoofd y- as in deze normcontrole verwijst naar de hoofd z as in Scia Engineer
- hoofd z- as in deze normcontrole verwijst naar de hoofd y as in Scia Engineer

Interne krachten	Berekende	Eenheid
N,Ed	-1129,09	kN
Vy,Ed	-0,03	kN
Vz,Ed	1,46	kN
T,Ed	0,00	kNm
My,Ed	0,00	kNm
Mz,Ed	0,00	kNm

Drukcontrole
Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	8,0640e-03	m^2
Nc,Rd	1895,03	kN
Eenheidscontrole	0,60	-

Afschuivingscontrole voor Vy
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.19)

Tau,Vy,Ed	0,0	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: Er is geen afschuifoppervlak opgegeven voor deze doorsnede/bouwwijze, waardoor de plastische afschuifweerstand niet kan worden bepaald. Het gevolg is dat de elastische afschuifweerstand volgens EN 1993-1-1 artikel 6.2.6(4) wordt getoetst.

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.19)

Tau,Vz,Ed	85,2	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,63	-

Opmerking: Er is geen afschuifoppervlak opgegeven voor deze doorsnede/bouwwijze, waardoor de plastische afschuifweerstand niet kan worden bepaald. Het gevolg is dat de elastische afschuifweerstand volgens EN 1993-1-1 artikel 6.2.6(4) wordt getoetst.

Controle gecombineerde buiging, axiale kracht en afschuifkracht

Volgens EN 1993-1-1 artikel 6.2.1(5) en formule (6.1)

Elastische toetsing		
Vezel	1	
Sigma,N,Ed	140,0	MPa
Sigma,My,Ed	0,0	MPa
Sigma,Mz,Ed	0,0	MPa
Sigma,tot,Ed	140,0	MPa
Tau,Vy,Ed	0,0	MPa
Tau,Vz,Ed	85,2	MPa
Tau,t,Ed	0,0	MPa
Tau,tot,Ed	85,2	MPa
Sigma,von Mises,Ed	203,4	MPa
Eenheidscontrole	0,87	-

De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Buigingsknik Controle

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Slankheidsgegevens (EN 50341-1) voor : Staaf met symmetrische schoren		
L	2.190	m
ivv	57.69	mm
Knikkromme	c	
Kritische slankheid	37.96	
Effectieve slankheid	0.40	
Knikfactor (omega_buc)	0.90	
UC slankheid	0.32	
Limiet slankheid	120.00	

Tabel van waarden		
A	8.0640e-03	m^2
Knikweerstand Nb,Rd	1696.20	kN
Eenheidscontrole	0.67	-

Torsieknikcontrole

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	2.190	m
Ncr,T	17448.30	kN
Ncr,TF	12441.36	kN
Relatieve slankheid Lambda,T	0.39	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	8.0640e-03	m^2
Reductie factor Chi	0.90	
Knikweerstand Nb,Rd	1710.17	kN
Eenheidscontrole	0.66	-

Controle druk en buiging

Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)
Interactie Methode 2

Tabel van waarden		
kyy	0.751	
kyz	0.751	
kzy	0.966	
kzz	0.751	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	8.0640e-03	m^2
Wy	3.7793e-04	m^3
Wz	2.5307e-04	m^3
NRk	1895.03	kN
My,Rk	88.81	kNm
Mz,Rk	59.47	kNm
My,Ed	-2.58	kNm
Mz,Ed	-0.05	kNm
Interactie Methode 2		
Psi y	0.000	
Psi z	0.000	

Tabel van waarden		
Cmy	0.646	
Cmz	0.646	
CmLT	0.646	

Eenheidscontrole (6.61) = 0.67 + 0.02 + 0.00 = 0.69
Eenheidscontrole (6.62) = 0.67 + 0.03 + 0.00 = 0.69
De staaf voldoet aan de stabiliteitscontrole.

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf C5	3,374 m	2LX (L140X13; 13)	S 235	1a/2	0,71 -

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

Waarschuwing: Sterktereductie gerelateerd aan de dikte wordt niet ondersteund voor dit type doorsnede.
...::DOORSNEDE CONTROLE::...
Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Waarschuwing: Classificatie wordt niet ondersteund voor dit type doorsnede.
De doorsnede wordt gecontroleerd als elastisch, klasse 3.
Kritische controle op positie 0.000 m
As definitie :
- hoofd y- as in deze normcontrole verwijst naar de hoofd z as in Scia Engineer
- hoofd z- as in deze normcontrole verwijst naar de hoofd y as in Scia Engineer

Interne krachten	Berekende	Eenheid
N,Ed	-1085,93	kN
Vy,Ed	0,00	kN
Vz,Ed	-0,12	kN
T,Ed	0,00	kNm
My,Ed	0,00	kNm
Mz,Ed	0,00	kNm

Drukcontrole
Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	6,9912e-03	m^2
Nc,Rd	1642,93	kN
Eenheidscontrole	0,66	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.19)

Tau,Vz,Ed	8,4	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,06	-

Opmerking: Er is geen afschuifoppervlak opgegeven voor deze doorsnede/bouwwijze, waardoor de plastische afschuifweerstand niet kan worden bepaald. Het gevolg is dat de elastische afschuifweerstand volgens EN 1993-1-1 artikel 6.2.6(4) wordt getoetst.
Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1(5) en formule (6.1)

Elastische toetsing		
Vezel	13	
Sigma,N,Ed	155,3	MPa
Sigma,My,Ed	0,0	MPa
Sigma,Mz,Ed	0,0	MPa
Sigma,tot,Ed	155,3	MPa
Tau,Vy,Ed	0,0	MPa
Tau,Vz,Ed	8,4	MPa
Tau,t,Ed	0,0	MPa
Tau,tot,Ed	8,4	MPa
Sigma,von Mises,Ed	156,0	MPa
Eenheidscontrole	0,66	-

De staaf voldoet aan de doorsnedecontrole.
...::STABILITEITSCONTROLE::...
Buigingsknik Controle
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Slankheidsgegevens (EN 50341-1) voor : Staaf met symmetrische schoren		
L	1.687	m
ivv	53.85	mm
Knikkromme	c	

Slankheidsgegevens (EN 50341-1) voor : Staaf met symmetrische schoren		
Kritische slankheid	31.33	
Effectieve slankheid	0.33	
Knikfactor (omega_buc)	0.93	
UC slankheid	0.26	
Limiet slankheid	120.00	

Tabel van waarden		
A	6.9912e-03	m^2
Knikweerstand Nb,Rd	1531.10	kN
Eenheidscontrole	0.71	-

Torsieknikcontrole
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	1.687	m
Ncr,T	15393.61	kN
Ncr,TF	14831.65	kN
Relatieve slankheid Lambda,T	0.33	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	6.9912e-03	m^2
Reductie factor Chi	0.93	
Knikweerstand Nb,Rd	1531.75	kN
Eenheidscontrole	0.71	-

Controle druk en buiging
Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)
Interactie Methode 2

Tabel van waarden		
kyy	0.982	
kyz	0.982	
kzy	0.981	
kzz	0.982	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	6.9912e-03	m^2
Wy	3.0188e-04	m^3
Wz	2.0480e-04	m^3
NRk	1642.93	kN
My,Rk	70.94	kNm
Mz,Rk	48.13	kNm
My,Ed	-0.11	kNm
Mz,Ed	0.00	kNm
Interactie Methode 2		
Psi y	0.000	
Psi z	0.000	
Cmy	0.860	
Cmz	0.860	
CmLT	0.860	

Eenheidscontrole (6.61) = 0.71 + 0.00 + 0.00 = 0.71
Eenheidscontrole (6.62) = 0.71 + 0.00 + 0.00 = 0.71
De staaf voldoet aan de stabiliteitscontrole.

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf C9	6,648 m	2LX (L140X13; 13)	S 235	1a/2	0,61 -

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

Waarschuwing: Sterktereductie gerelateerd aan de dikte wordt niet ondersteund voor dit type doorsnede.
...::DOORSNEDE CONTROLE::...
Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Waarschuwing: Classificatie wordt niet ondersteund voor dit type doorsnede.
De doorsnede wordt gecontroleerd als elastisch, klasse 3.
Kritische controle op positie 1.768 m
As definitie :
- hoofd y- as in deze normcontrole verwijst naar de hoofd z as in Scia Engineer
- hoofd z- as in deze normcontrole verwijst naar de hoofd y as in Scia Engineer

Interne krachten	Berekende	Eenheid
N,Ed	-921,59	kN
Vy,Ed	0,00	kN
Vz,Ed	-0,10	kN
T,Ed	0,00	kNm
My,Ed	-0,29	kNm
Mz,Ed	0,00	kNm

Waarschuwing: Torsie wordt niet in rekening genomen voor deze doorsnede!

Drukcontrole

Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	6,9912e-03	m^2
Nc,Rd	1642,93	kN
Eenheidscontrole	0,56	-

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.19)

Tau,Vz,Ed	6,5	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,05	-

Opmerking: Er is geen afschuifoppervlak opgegeven voor deze doorsnede/bouwwijze, waardoor de plastische afschuifweerstand niet kan worden bepaald. Het gevolg is dat de elastische afschuifweerstand volgens EN 1993-1-1 artikel 6.2.6(4) wordt getoetst.

Controle buigend moment voor My

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.14)

Wel,y,min	3,0188e-04	m^3
Mel,y,Rd	70,94	kNm
Eenheidscontrole	0,00	-

Controle buigend moment voor Mz

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.14)

Wel,z,min	2,0480e-04	m^3
Mel,z,Rd	48,13	kNm
Eenheidscontrole	0,00	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht

Volgens EN 1993-1-1 artikel 6.2.1(5) en formule (6.1)

Elastische toetsing		
Vezel	16	
Sigma,N,Ed	131,8	MPa
Sigma,My,Ed	1,0	MPa
Sigma,Mz,Ed	0,0	MPa
Sigma,tot,Ed	132,8	MPa
Tau,Vy,Ed	0,0	MPa
Tau,Vz,Ed	0,0	MPa
Tau,t,Ed	0,0	MPa
Tau,tot,Ed	0,0	MPa
Sigma,von Mises,Ed	132,8	MPa
Eenheidscontrole	0,57	-

De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Buigingsknik Controle

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Slankheidsgegevens (EN 50341-1) voor : Staaf met symmetrische schoren		
L	1.768	m
ivv	53.85	mm
Knikkromme	c	
Kritische slankheid	32.84	
Effectieve slankheid	0.35	
Knikfactor (omega_buc)	0.92	
UC slankheid	0.27	
Limiet slankheid	120.00	

Tabel van waarden		
A	6.9912e-03	m^2
Knikweerstand Nb,Rd	1517.50	kN
Eenheidscontrole	0.61	-

Torsieknikcontrole

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	1.768	m
Ncr,T	15393.61	kN
Ncr,TF	13454.27	kN
Relatieve slankheid Lambda,T	0.35	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	

Tabel van waarden		
Imperfectie Alpha	0.49	
A	6.9912e-03	m^2
Reductie factor Chi	0.92	
Knikweerstand Nb,Rd	1517.66	kN
Eenheidscontrole	0.61	-

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	3.0188e-04	m^3
Elastisch critisch moment Mcr	1328.33	kNm
Relatieve slankheid Lambda,LT	0.23	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.768	m
k	1.00	
kw	1.00	
C1	1.04	
C2	0.03	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)
Controle druk en buiging
Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)
Interactie Methode 2

Tabel van waarden		
kyy	1.123	
kyz	1.127	
kzy	0.986	
kzz	1.127	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	6.9912e-03	m^2
Wy	3.0188e-04	m^3
Wz	2.0480e-04	m^3
NRk	1642.93	kN
My,Rk	70.94	kNm
Mz,Rk	48.13	kNm
My,Ed	-0.36	kNm
Mz,Ed	0.00	kNm
Interactie Methode 2		
Psi y	0.833	
Psi z	0.848	
Cmy	0.996	
Cmz	1.000	
CmLT	0.996	

Eenheidscontrole (6.61) = 0.61 + 0.01 + 0.00 = 0.61
Eenheidscontrole (6.62) = 0.61 + 0.00 + 0.00 = 0.61
De staaf voldoet aan de stabiliteitscontrole.

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf C13	6,648 m	2LX (L130X12; 12)	S 235	1a/2	0,65 -

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

Waarschuwing: Sterktereductie gerelateerd aan de dikte wordt niet ondersteund voor dit type doorsnede.
...::DOORSNEDE CONTROLE::...
Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Waarschuwing: Classificatie wordt niet ondersteund voor dit type doorsnede.
De doorsnede wordt gecontroleerd als elastisch, klasse 3.
Kritische controle op positie 1.784 m
As definitie :
- hoofd y- as in deze normcontrole verwijst naar de hoofd z as in Scia Engineer
- hoofd z- as in deze normcontrole verwijst naar de hoofd y as in Scia Engineer

Interne krachten	Berekende	Eenheid
N,Ed	-753,83	kN

Interne krachten	Berekende	Eenheid
Vy,Ed	0,36	kN
Vz,Ed	-0,44	kN
T,Ed	0,00	kNm
My,Ed	-0,89	kNm
Mz,Ed	-0,65	kNm

Waarschuwing: Torsie wordt niet in rekening genomen voor deze doorsnede!

Drukcontrole

Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	5,9948e-03	m^2
Nc,Rd	1408,79	kN
Eenheidscontrole	0,54	-

Afschuivingscontrole voor Vy

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.19)

Tau,Vy,Ed	0,1	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: Er is geen afschuifoppervlak opgegeven voor deze doorsnede/bouwwijze, waardoor de plastische afschuifweerstand niet kan worden bepaald. Het gevolg is dat de elastische afschuifweerstand volgens EN 1993-1-1 artikel 6.2.6(4) wordt getoetst.

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.19)

Tau,Vz,Ed	34,4	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,25	-

Opmerking: Er is geen afschuifoppervlak opgegeven voor deze doorsnede/bouwwijze, waardoor de plastische afschuifweerstand niet kan worden bepaald. Het gevolg is dat de elastische afschuifweerstand volgens EN 1993-1-1 artikel 6.2.6(4) wordt getoetst.

Controle buigend moment voor My

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.14)

Wel,y,min	2,3996e-04	m^3
Mel,y,Rd	56,39	kNm
Eenheidscontrole	0,02	-

Controle buigend moment voor Mz

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.14)

Wel,z,min	1,6308e-04	m^3
Mel,z,Rd	38,32	kNm
Eenheidscontrole	0,02	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht

Volgens EN 1993-1-1 artikel 6.2.1(5) en formule (6.1)

Elastische toetsing		
Vezel	13	
Sigma,N,Ed	125,7	MPa
Sigma,My,Ed	0,3	MPa
Sigma,Mz,Ed	0,0	MPa
Sigma,tot,Ed	126,0	MPa
Tau,Vy,Ed	0,1	MPa
Tau,Vz,Ed	34,4	MPa
Tau,t,Ed	0,0	MPa
Tau,tot,Ed	34,4	MPa
Sigma,von Mises,Ed	139,4	MPa
Eenheidscontrole	0,59	-

De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Buigingsknik Controle

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Slankheidsgegevens (EN 50341-1) voor : Staaf met symmetrische schoren		
L	1.784	m
ivv	50.01	mm
Knikkromme	c	
Kritische slankheid	35.67	
Effectieve slankheid	0.38	
Knikfactor (omega_buc)	0.91	
UC slankheid	0.30	
Limiet slankheid	120.00	

Tabel van waarden		
A	5.9948e-03	m^2
Knikweerstand Nb,Rd	1279.09	kN
Eenheidscontrole	0.59	-

Torsieknikcontrole

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	1.784	m
Ncr,T	13103.56	kN
Ncr,TF	17869.85	kN
Relatieve slankheid Lambda,T	0.33	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	5.9948e-03	m^2
Reductie factor Chi	0.93	
Knikweerstand Nb,Rd	1317.03	kN
Eenheidscontrole	0.57	-

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	2.3996e-04	m^3
Elastisch critisch moment Mcr	1155.67	kNm
Relatieve slankheid Lambda,LT	0.22	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.784	m
k	1.00	
kw	1.00	
C1	1.24	
C2	0.01	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging
Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)
Interactie Methode 2

Tabel van waarden		
kyy	0.951	
kyz	0.908	
kzy	0.981	
kzz	0.908	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	5.9948e-03	m^2
Wy	2.3996e-04	m^3
Wz	1.6308e-04	m^3
NRk	1408.79	kN
My,Rk	56.39	kNm
Mz,Rk	38.32	kNm
My,Ed	-1.56	kNm
Mz,Ed	-1.29	kNm
Interactie Methode 2		
Psi y	0.566	
Psi z	0.500	
Cmy	0.839	
Cmz	0.800	
CmLT	0.839	

Eenheidscontrole (6.61) = 0.59 + 0.03 + 0.03 = 0.65
Eenheidscontrole (6.62) = 0.59 + 0.03 + 0.03 = 0.65
De staaf voldoet aan de stabiliteitscontrole.
EC 3

Bijlage C Controle staven mastlichaam

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 -* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-1087,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*888,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/150/14* (*1)

h	=	*150*	mm	I_y	=	*8453963*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*78326*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*200966*	mm^3
y_s	=	*42,1*	mm	i_y	=	*45,8*	mm
A_{bruto}	=	*4031*	mm^2	i_v	=	*29,1*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2190*	mm	No. bolts / end / flange	=	*5*	**(Per flange !)**
$L_{v;cr}$	=	*2190*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*75*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**1,04**	**> 1 !!**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**75**	**< 120**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,59**	**> 1 !!**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**1,61**	**> 1 !!**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,77**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,61 = 161%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 1 - diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-107,5	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	93,6	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H180/90/10 (*1)

h	=	180	mm	I_y	=	8803399	mm^4
b	=	90	mm	$W_{y;el;eff.1}$	=	54516	mm^3
t_f	=	10	mm	$W_{y;el;eff.2}$	=	475424	mm^3
y_s	=	18,5	mm	i_y	=	58,0	mm
A_{bruto}	=	2621	mm^2	i_v	=	19,2	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	12292	mm	No. bolts / end / flange		=	2	
$L_{v;cr}$	=	2458	mm	Type of bolts	M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt	e1	=	35	mm
a*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt	s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt	e2	=	40	mm
Position perpendicular force	=	2	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads		=	1	
Thickness tie plate	=	10	mm	Dubble strap joint no=1, yes=2		=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,33** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **212** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,89** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,79** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,73** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,89 = 89%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *1e en 2e schuine knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-25,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*25,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=		kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2169*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2169*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,67**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**258**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**2,14**	**> 1 !!**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**2,35**	**> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,42**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**1,37**	**> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 2,35 = 235%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 1* *1e en 2e schuine knikverkorters* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-25,1*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*25,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=		kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/8* (*1)

h	=	*60*	mm	I_y	=	*291532*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*6890*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*16481*	mm^3
y_s	=	*17,7*	mm	i_y	=	*18,0*	mm
A_{bruto}	=	*903*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510 = *Fe360* Permissible stress $f_{y;d}$ = *235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2169*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2169*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,42** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **188** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,57** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,77** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,21** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,85** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - 3e schuine knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-10,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*10,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2827*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2827*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,29** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **336** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,53** **> 1 !!**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,64** **> 1 !!**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,18** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,59** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,64 = 164%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - 3e schuine knikverkorters* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-10,9*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*10,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : ***H50/50/8*** (*1)

h	=	*50*	mm	I_y	=	*162828*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*4684*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*10685*	mm^3
y_s	=	*15,2*	mm	i_y	=	*14,8*	mm
A_{bruto}	=	*741*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2827*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2827*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,18** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **295** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,69** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,81** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,09** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,37** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,81 = 81%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *4e schuine knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-9,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*9,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* [(*1)]

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3371*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3371*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,26** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **351** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,32** **> 1 !!**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,45** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,16** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,53** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 1,45 = 145%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *4e schuine knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-9,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*9,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : ***H50/50/8*** (*1)

h	=	*50*	mm	I_y	=	*162828*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*4684*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*10685*	mm^3
y_s	=	*15,2*	mm	i_y	=	*14,8*	mm
A_{bruto}	=	*741*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3371*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3371*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,16** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **352** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,86** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,96** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,16** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,33** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,96 = 96%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - 1e en 2e hor knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-8,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*8,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1520*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1520*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1520*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,23** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,92** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **181** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,39** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,49** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,48** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,92 = 92%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14013
Project : 150 kV lijn Leiden - Zoetermeer			
Part : mast 75			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - 3e hor. knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	-8,8	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	8,8	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H50/50/5 (*1)

h	=	50	mm	I_y	=	109643	mm^4
b	=	50	mm	$W_{y;el;eff.1}$	=	3049	mm^3
t_f	=	5	mm	$W_{y;el;eff.2}$	=	7811	mm^3
y_s	=	14,0	mm	i_y	=	15,1	mm
A_{bruto}	=	480	mm^2	i_v	=	9,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2280	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2280	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	25	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	2280	mm	Edge distance bolt e2	=	22	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	5	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,23** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **1,19** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **237** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,57** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,70** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,48** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,19 = 119%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - 3e hor. knikverkorters* — verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-8,8	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	8,8	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H50/50/8 [(*1)]

h	=	50	mm	I_y	=	162828	mm^4
b	=	50	mm	$W_{y;el;eff.1}$	=	4684	mm^3
t_f	=	8	mm	$W_{y;el;eff.2}$	=	10685	mm^3
y_s	=	15,2	mm	i_y	=	14,8	mm
A_{bruto}	=	741	mm^2	i_v	=	9,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2280	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2280	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	25	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	2280	mm	Edge distance bolt e2	=	22	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	5	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,15	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	0,78	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	238	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,37	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	0,47	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,15	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,48	< 1

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,78 = 78%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - 4e hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-8,8*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*8,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* (*1)

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3040*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*3040*	mm	Type of bolts	M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*3040*	mm	Edge distance bolt	e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,20** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,92** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **263** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,48** **< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,58** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,48** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,92 = 92%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 - randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1041,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*857,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile :		*H140/140/13*	(*1)				
h	=	*140*	mm	I_y	=	*6385392*	mm^4
b	=	*140*	mm	$W_{y;el;eff.1}$	=	*63366*	mm^3
t_f	=	*13*	mm	$W_{y;el;eff.2}$	=	*162768*	mm^3
y_s	=	*39,2*	mm	i_y	=	*42,7*	mm
A_{bruto}	=	*3495*	mm^2	i_v	=	*27,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1687*	mm	No. bolts / end / flange	=	*4*	(Per flange !)
$L_{v;cr}$	=	*1687*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*75*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**1,17**	**> 1 !!**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**62**	**< 120**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,58**	**> 1 !!**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**1,92**	**> 1 !!**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**1,00**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,92 = 192%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 - diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	-74,8	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	76,6	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$ =	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H100/75/7 (*1)

h	=	100	mm	I_y	=	1179878	mm^4
b	=	75	mm	$W_{y;el;eff.1}$	=	14444	mm^3
t_f	=	7	mm	$W_{y;el;eff.2}$	=	64418	mm^3
y_s	=	18,3	mm	i_y	=	31,5	mm
A_{bruto}	=	1187	mm^2	i_v	=	15,9	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	4916	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2458	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	45	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	40	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	13	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,70	< 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	156	< 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,93	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	1,33	> 1 !!

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	1,13	> 1 !!

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	1,10	> 1 !!

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,33 = 133%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 - diagonalen* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-74,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*76,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : ***H100/100/10*** (*1)

h	=	*100*	mm	I_y	=	*1766764*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2*	mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4916*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2458*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*45*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*13*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,49**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**162**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,61**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,96**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,56**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,77**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,96 = 96%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2* *schuin kikverkorter*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-13,7 kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	13,7 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0 kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H50/40/5 (*1)

h	=	50 mm	I_y	=	103800	mm^4
b	=	40 mm	$W_{y;el;eff.1}$	=	2638	mm^3
t_f	=	5 mm	$W_{y;el;eff.2}$	=	9746	mm^3
y_s	=	10,7 mm	i_y	=	15,6	mm
A_{bruto}	=	427 mm^2	i_v	=	8,4	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2621 mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2621 mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt e1	=	25	mm
a^*L_{tot} (with comb. buckling)	=	0 mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0 mm	Edge distance bolt e2	=	40	mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1 no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	13 mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,15	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	312	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	1,66	> 1 !!
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	1,80	> 1 !!
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,45	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,51	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,80 = 180%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2* *schuin kikverkorter* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-13,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*13,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/8* (*1)

h	=	*50*	mm	I_y	=	*162828*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*4684*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*10685*	mm^3
y_s	=	*15,2*	mm	i_y	=	*14,8*	mm
A_{bruto}	=	*741*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2621*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2621*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*13*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,10**	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**274**	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,75**	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,90**	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,23**	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,32**	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,90 = 90%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 - hor. kikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-7,5* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*7,5* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)		=	*0* kN
	$F_{perpend.;s;d}$	=	*1,5* kN	$N_{comb2;c;s;d}$ (max. compression)		=	*0* kN

Angle profile : *H50/40/5* (*1)

h	=	*50* mm	I_y	=	*103800* mm^4
b	=	*40* mm	$W_{y;el;eff.1}$	=	*2638* mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*9746* mm^3
y_s	=	*10,7* mm	i_y	=	*15,6* mm
A_{bruto}	=	*427* mm^2	i_v	=	*8,4* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1900* mm	No. bolts / end / flange	=	*1*
$L_{v;cr}$	=	*1900* mm	Type of bolts M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*25* mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*70* mm
$L_{perpendicular\ force}$	=	*1900* mm	Edge distance bolt e2	=	*40* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*13* mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,08** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **1,15** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **226** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,50** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,59** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,25** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,28** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,15 = 115%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2 - hor. kikverkorters* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-7,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*7,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/6* (*1)

h	=	*50*	mm	I_y	=	*128406*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3612*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*8883*	mm^3
y_s	=	*14,5*	mm	i_y	=	*15,0*	mm
A_{bruto}	=	*569*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1900*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1900*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1900*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*13*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,07**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,84**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**198**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,29**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,39**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,12**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,23**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,84 = 84%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak3* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-930,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*745,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H140/140/13* (*1)

h	=	*140*	mm	I_y	=	*6385392*	mm^4
b	=	*140*	mm	$W_{y;el;eff.1}$	=	*63366*	mm^3
t_f	=	*13*	mm	$W_{y;el;eff.2}$	=	*162768*	mm^3
y_s	=	*39,2*	mm	i_y	=	*42,7*	mm
A_{bruto}	=	*3495*	mm^2	i_v	=	*27,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1768*	mm	No. bolts / end / flange	=	*4*	(Per flange !)
$L_{v;cr}$	=	*1768*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*75*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**1,02**	**> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**65**	**< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,44**	**> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**1,72**	**> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,86**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,72 = 172%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-83,0* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*80,7* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/75/7* [(*1)]

h	=	*100*	mm	I_y	=	*1179878*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s	=	*18,3*	mm	i_y	=	*31,5*	mm
A_{bruto}	=	*1187*	mm^2	i_v	=	*15,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5028*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*2514*	mm	Type of bolts	M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*45*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt	e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,91**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**159**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,07**	**> 1 !!**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**1,54**	**> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**1,22**	**> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**1,40**	**> 1 !!**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 1,54 = 154%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3* *diagonalen* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-83,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*80,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : ***H100/100/12*** (*1)

h	=	*100*	mm	I_y	=	*2066880*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*29124*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*71193*	mm^3
y_s	=	*29,0*	mm	i_y	=	*30,2*	mm
A_{bruto}	=	*2271*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5028*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2514*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*45*	mm
$a{*}L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*15*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,53** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **167** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,60** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,95** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,61** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,81** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,95 = 95%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3* *horizontaal*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	-9,2	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	7,4	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$ =	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : *H70/70/6* (*1)

h	=	70	mm	I_y	=	368840	mm^4
b	=	70	mm	$W_{y;el;eff.1}$	=	7272	mm^3
t_f	=	6	mm	$W_{y;el;eff.2}$	=	19129	mm^3
y_s	=	19,3	mm	i_y	=	21,3	mm
A_{bruto}	=	813	mm^2	i_v	=	13,5	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	3353	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	3353	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	25	mm
a*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	3353	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	6	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,08**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,74**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**248**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,38**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,47**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,31**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,23**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **U.C$_{max}$ = 0,74 = 74%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3* *hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-0,9	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	9,2	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN
Angle profile :		H50/40/5	(*1)				
h	=	50	mm	I_y	=	103800	mm^4
b	=	40	mm	$W_{y;el;eff.1}$	=	2638	mm^3
t_f	=	5	mm	$W_{y;el;eff.2}$	=	9746	mm^3
y_s	=	10,7	mm	i_y	=	15,6	mm
A_{bruto}	=	427	mm^2	i_v	=	8,4	mm
Material :							
Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	1676	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	1676	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	25	mm
a*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	1676	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	7	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,12	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	1,01	> 1 !!
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	199	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,05	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	0,06	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,31	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,35	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,01 = 101%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3* *hor. knikverkorters* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-0,9* kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*9,2* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* [*1]

h	=	*50* mm	I_y	=	*109643*	mm^4
b	=	*50* mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0* mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480* mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1676* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1676* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1676* mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,12** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,88** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **174** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,03** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,05** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,15** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,35** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,88 = 88%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3 -* *schuine knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-10,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*10,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2356*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2356*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,14** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **280** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,05** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,17** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,35** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,17 = 117%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3 - schuine knikverkorters* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-10,5*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*10,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2356*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2356*	mm	Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,14	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	245	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,72	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	0,88	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,35	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,39	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,88 = 88%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-723,2* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*554,1* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0* kN	
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0* kN	

Angle profile : *H130/130/12* (*1)

h	=	*130* mm	I_y	=	*4721746* mm^4
b	=	*130* mm	$W_{y;el;eff.1}$	=	*50442* mm^3
t_f	=	*12* mm	$W_{y;el;eff.2}$	=	*129742* mm^3
y_s	=	*36,4* mm	i_y	=	*39,7* mm
A_{bruto}	=	*2997* mm^2	i_v	=	*25,2* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1784* mm	No. bolts / end / flange	=	*4* **(Per flange !)**
$L_{v;cr}$	=	*1784* mm	Type of bolts M / "	=	*24*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*40* mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*75* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*40* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*2* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*14* mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,90** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **71** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,36** **> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,33** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,70** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,36 = 136%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-89,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*91,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/75/7* [*1]

h	=	*100*	mm	I_y	=	*1179878*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s	=	*18,3*	mm	i_y	=	*31,5*	mm
A_{bruto}	=	*1187*	mm^2	i_v	=	*15,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4754*	mm	No. bolts / end / flange		=	*4*	
$L_{v;cr}$	=	*2377*	mm	Type of bolts	M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*45*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt	e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,62**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**151**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,05**	**> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,34**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,40**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 1,05 = 105%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *diagonalen* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-89,6*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*91,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100*	mm	I_y	=	*1766764*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2*	mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4754*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2377*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*45*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,37** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **157** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,69** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,17** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,40** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,69 = 69%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14013
Project : 150 kV lijn Leiden - Zoetermeer			
Part : mast 75			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *horizontaal*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-7,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*5,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/5* (*1)

h	=	*60*	mm	I_y	=	*193708*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*4447*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*11785*	mm^3
y_s	=	*16,4*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*582*	mm^2	i_v	=	*11,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2920*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*2920*	mm	Type of bolts	M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*2920*	mm	Edge distance bolt	e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,07**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**1,05**	**> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**253**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,43**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,53**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,24**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,21**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 1,05 = 105%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *horizontaal* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-7,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*5,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/8* (*1)

h	=	*60*	mm	I_y	=	*291532*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*6890*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*16481*	mm^3
y_s	=	*17,7*	mm	i_y	=	*18,0*	mm
A_{bruto}	=	*903*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2920*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2920*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*2920*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,05** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,68** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **253** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,28** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,35** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,12** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,15** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,68 = 68%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-4,5 kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	4,5 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)		=	0 kN
	$F_{perpend.;s;d}$	=	1,5 kN	$N_{comb2;c;s;d}$ (max. compression)		=	0 kN

Angle profile : H50/40/5 [*1]

h	=	50 mm	I_y	=	103800 mm^4
b	=	40 mm	$W_{y;el;eff.1}$	=	2638 mm^3
t_f	=	5 mm	$W_{y;el;eff.2}$	=	9746 mm^3
y_s	=	10,7 mm	i_y	=	15,6 mm
A_{bruto}	=	427 mm^2	i_v	=	8,4 mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1460 mm	No. bolts / end / flange		=	1
$L_{v;cr}$	=	1460 mm	Type of bolts	M / "	=	16
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt	e1	=	25 mm
$a*L_{tot}$ (with comb. buckling)	=	0 mm	Centre-centre spacing bolt	s1	=	70 mm
$L_{perpendicular\ force}$	=	1460 mm	Edge distance bolt	e2	=	35 mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	4,6
Column profile?	=	1 no=1, yes=2	Rolled screw threads		=	1
Thickness tie plate	=	7 mm	Dubble strap joint no=1, yes=2		=	1

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,06** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,88** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **174** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,19** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,23** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,15** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,17** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,88 = 88%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *schuine knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-6,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*6,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2231*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2231*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,09**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,00**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**265**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,61**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,70**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,23**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,26**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **$U.C_{max}$ = 0,70 = 70%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-598,7*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*419,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1707*	mm	No. bolts / end / flange	=	*3*	(Per flange !)
$L_{v;cr}$	=	*1707*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,68** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **68** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,10** **> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,47** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,90** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,47 = 147%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *randen* *verzwaard*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-598,7* kN		***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*419,5* kN		$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0* kN		$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*854*	mm	No. bolts / end / flange	=	*3*	(Per flange !)
$L_{v;cr}$	=	*854*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,68**	< 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	< 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**34**	< 120

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,90**	< 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	< 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	< 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,74**	< 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,90**	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,90 = 90%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-106,9	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	101,6	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H100/75/7 (*1)

h	=	100	mm	I_y	=	1179878	mm^4
b	=	75	mm	$W_{y;el;eff.1}$	=	14444	mm^3
t_f	=	7	mm	$W_{y;el;eff.2}$	=	64418	mm^3
y_s	=	18,3	mm	i_y	=	31,5	mm
A_{bruto}	=	1187	mm^2	i_v	=	15,9	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	4360	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2180	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	45	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	7	mm	Dubble strap joint no=1, yes=2	=	1	
				Staggered holes no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**1,15**	**> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**138**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,09**	**> 1 !!**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**1,65**	**> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**1,58**	**> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**1,76**	**> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,76 = 176%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *diagonalen* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-106,9* kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*101,6* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)		=	*0* kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)		=	*0* kN

Angle profile : ***H100/100/15*** (*1)

h	=	*100* mm	I_y	=	*2485619* mm^4
b	=	*100* mm	$W_{y;el;eff.1}$	=	*35605* mm^3
t_f	=	*15* mm	$W_{y;el;eff.2}$	=	*82335* mm^3
y_s	=	*30,2* mm	i_y	=	*29,8* mm
A_{bruto}	=	*2790* mm^2	i_v	=	*19,2* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4360* mm	No. bolts / end / flange	=	*1*
$L_{v;cr}$	=	*2180* mm	Type of bolts M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$	=	*0* mm	End distance bolt e1	=	*45* mm
$a{*}L_{tot\ (with\ comb.\ buckling)}$	=	*0* mm	Centre-centre spacing bolt s1	=	*70* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*35* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*14* mm	Dubble strap joint no=1, yes=2	=	*1*
			Staggered holes no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,53**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**146**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,51**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,88**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,79**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,88**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,88 = 88%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *hor. knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-4,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*4,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1250*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*1250*	mm	Type of bolts	M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular force}$	=	*1250*	mm	Edge distance bolt	e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,06**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,76**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**149**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,15**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,19**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,15**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,17**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,76 = 76%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *schuine knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-7,54*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*7,54*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* [(*1)]

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2050*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2050*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,10** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,00** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **244** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,67** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,25** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,28** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,67 = 67%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-586,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*431,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2140*	mm	No. bolts / end / flange	=	*3*	**(Per flange !)**
$L_{v;cr}$	=	*2140*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,70** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **85** < 120

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,26** > 1 !!

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,44** > 1 !!

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,93** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,44 = 144%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *randen* *verzwaard*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-586,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*431,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1070*	mm	No. bolts / end / flange	=	*3*	**(Per flange !)**
$L_{v;cr}$	=	*1070*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,70**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**42**	**< 120**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,92**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,72**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,93**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,93 = 93%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *diagonalen voor- en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	-312,7	kN	*Combined forces diagonal:*			
Tension:	N_{Sd} =	306,6	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$ =	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H150/150/14 (*1)

h	=	150	mm	I_y	=	8453963	mm^4
b	=	150	mm	$W_{y;el;eff.1}$	=	78326	mm^3
t_f	=	14	mm	$W_{y;el;eff.2}$	=	200966	mm^3
y_s	=	42,1	mm	i_y	=	45,8	mm
A_{bruto}	=	4031	mm^2	i_v	=	29,1	mm

Material :

Mat. qual. Fe360 / Fe510 = Fe360 Permissible stress $f_{y;d}$ = 235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2821	mm	No. bolts / end / flange	=	3	
$L_{v;cr}$	=	2821	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
a*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	14	mm	Dubble strap joint no=1, yes=2	=	1	
				Staggered holes no=1, yes=2	=	2	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,41** < 1

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **97** < 200 or 240

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,57** < 1

5 - Check stress in member due to compression with excentricity:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,54** > 1 !!

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,14** > 1 !!

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,54 = 154%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 6* *diagonalen voor- en achtervlak* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-312,7*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*306,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/150/18* (*1)

h	=	*150*	mm	I_y	=	*10499654*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*98735*	mm^3
t_f	=	*18*	mm	$W_{y;el;eff.2}$	=	*240494*	mm^3
y_s	=	*43,7*	mm	i_y	=	*45,4*	mm
A_{bruto}	=	*5103*	mm^2	i_v	=	*29,0*	mm

Material :

Mat. qual. Fe360 / Fe510 = *Fe360* Permissible stress $f_{y;d}$ = *235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2821*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2821*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,45**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**97**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,45**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,38**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,88**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,88 = 88%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *diagonalen zijvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-56,5*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*62,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/75/7* [*1]

h	=	*100*	mm	I_y	=	*1179878*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s	=	*18,3*	mm	i_y	=	*31,5*	mm
A_{bruto}	=	*1187*	mm^2	i_v	=	*15,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2382*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2382*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,70** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **150** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,65** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,83** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,92** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,97** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,97 = 97%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *horizontaal*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-51,5* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*18,5* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130* mm	I_y	=	*4721746*	mm^4
b	=	*130* mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12* mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4* mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997* mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3952* mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*3952* mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*3952* mm	Edge distance bolt e2	=	*20*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,06**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,13**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**157**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,22**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,38**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,68**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,68 = 68%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *hor. knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-4,80*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*4,80*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1250*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1250*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1250*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,06**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,76**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**149**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,15**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,20**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,16**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,18**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,76 = 76%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *schuine knikverkorters voorvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-19,17*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*19,17*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/6* (*1)

h	=	*100*	mm	I_y	=	*680089*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*11071*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*29775*	mm^3
y_s	=	*22,8*	mm	i_y	=	*26,0*	mm
A_{bruto}	=	*1006*	mm^2	i_v	=	*16,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2080*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2080*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,19** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **125** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,19** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,14** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,17** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,19 = 19%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *schuine knikverkorters zijvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-8,64*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*8,64*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2571*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2571*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,12** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **306** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,01** **> 1 !!**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,12** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,16** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,12 = 112%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *schuine knikverkorters zijvlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	-8,64	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	8,64	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : **H50/50/5** (*1)

h	=	50	mm	I_y	=	109643	mm^4
b	=	50	mm	$W_{y;el;eff.1}$	=	3049	mm^3
t_f	=	5	mm	$W_{y;el;eff.2}$	=	7811	mm^3
y_s	=	14,0	mm	i_y	=	15,1	mm
A_{bruto}	=	480	mm^2	i_v	=	9,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2571	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2571	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	50	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	7	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,12	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	268	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,70	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	0,83	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,14	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,16	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **U.C$_{max}$ = 0,83 = 83%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-312,1* kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*147,3* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130* mm	I_y	=	*4721746*	mm^4
b	=	*130* mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12* mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4* mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997* mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2119* mm	No. bolts / end / flange	=	*3*	**(Per flange !)**
$L_{v;cr}$	=	*2119* mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*40*	mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,24** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **84** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,67** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,77** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,32** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,77 = 77%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7* *diagonalen voor- en achtervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-295,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*321,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/80/8* (*1)

h	=	*120*	mm	I_y	=	*2256520*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*22266*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*120944*	mm^3
y_s	=	*18,7*	mm	i_y	=	*38,2*	mm
A_{bruto}	=	*1549*	mm^2	i_v	=	*17,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4017*	mm	No. bolts / end / flange	=	*6*	
$L_{v;cr}$	=	*2009*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**1,62**	**> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**117**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,74**	**> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,79**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**1,04**	**> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **$U.C_{max}$ = 1,74 = 174%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7* *diagonalen voor- en achtervlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	-295,2	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	312,8	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN
Angle profile :		H120/120/12 [*1]					
h	=	120	mm	I_y	=	3676666	mm^4
b	=	120	mm	$W_{y;el;eff.1}$	=	42735	mm^3
t_f	=	12	mm	$W_{y;el;eff.2}$	=	108247	mm^3
y_s	=	34,0	mm	i_y	=	36,5	mm
A_{bruto}	=	2754	mm^2	i_v	=	23,3	mm
Material :							
Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	4017	mm	No. bolts / end / flange	=	6	
$L_{v;cr}$	=	2009	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
a*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	8	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,86	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	110	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,92	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,38	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	1,02	> 1 !!

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 1,02 = 102%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7* *diagonalen zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-74,2*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*73,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H120/80/8*	(*1)				
h	=	*120*	mm	I_y	=	*2256520*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*22266*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*120944*	mm^3
y_s	=	*18,7*	mm	i_y	=	*38,2*	mm
A_{bruto}	=	*1549*	mm^2	i_v	=	*17,2*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*4747*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2009*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,45** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **124** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,49** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,55** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,71** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,71 = 71%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7* *horizontaal zijvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-9,1*	kN	***Combined forces diagonal:***				
Tension:	N_{Sd}	=	*7,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)		=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)		=	*0*	kN

Angle profile : *H75/75/8* (*1)

h	=	*75* mm	I_y	=	*588737*	mm^4
b	=	*75* mm	$W_{y;el;eff.1}$	=	*10964*	mm^3
t_f	=	*8* mm	$W_{y;el;eff.2}$	=	*27635*	mm^3
y_s	=	*21,3* mm	i_y	=	*22,7*	mm
A_{bruto}	=	*1147* mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4252* mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*4252* mm	Type of bolts	M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*4252* mm	Edge distance bolt	e2	=	*35*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,07** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,62** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **295** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,37** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,43** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,19** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,15** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,62 = 62%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7* *hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-2,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*2,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*860*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*860*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*860*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,03	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	0,52	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	102	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,04	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	0,06	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,08	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,09	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,52 = 52%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 7* *schuine knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-7,2*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*7,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2227*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2227*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,10**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**265**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,64**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,73**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,24**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,27**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,73 = 73%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-239,1*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*113,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1570*	mm	No. bolts / end / flange	=	*4*	**(Per flange !)**
$L_{v;cr}$	=	*1570*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*125*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,18** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **62** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,42** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,44** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,18** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,44 = 44%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *diagonalen voor en achter vlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	-212,2	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	277,2	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : *H120/80/8* (*1)

h	=	120	mm	I_y	=	2256520	mm^4
b	=	80	mm	$W_{y;el;eff.1}$	=	22266	mm^3
t_f	=	8	mm	$W_{y;el;eff.2}$	=	120944	mm^3
y_s	=	18,7	mm	i_y	=	38,2	mm
A_{bruto}	=	1549	mm^2	i_v	=	17,2	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2030	mm	No. bolts / end / flange	=	6	
$L_{v;cr}$	=	2030	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	8	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,39** **> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **118** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,26** **> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,68** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,90** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,39 = 139%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		D&C ENGINEERING
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *diagonalen voor en achter vlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-212,2*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*277,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	***0***	kN
$F_{perpend.;s;d}$	=	***0***	kN	$N_{comb2;c;s;d}$ (max. compression)	=	***0***	kN
Angle profile :		***H120/120/12*** (*1)					
h	=	*120*	mm	I_y	=	*3676666*	mm^4
b	=	*120*	mm	$W_{y;el;eff.1}$	=	*42735*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*108247*	mm^3
y_s	=	*34,0*	mm	i_y	=	*36,5*	mm
A_{bruto}	=	*2754*	mm^2	i_v	=	*23,3*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*2030*	mm	No. bolts / end / flange	=	*6*	
$L_{v;cr}$	=	*2030*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a{*}L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,76** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **87** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,51** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,34** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,90** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,90 = 90%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *diagonalen zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-35,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*38,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/5* (*1)

h	=	*70*	mm	I_y	=	*268391*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*5609*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*14898*	mm^3
y_s	=	*18,0*	mm	i_y	=	*20,3*	mm
A_{bruto}	=	*651*	mm^2	i_v	=	*13,0*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2366*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2366*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,55** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **182** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,03** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,38** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,81** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,17** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 1,38 = 138%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *diagonalen zijvlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-35,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*38,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/8* (*1)

h	=	*70*	mm	I_y	=	*474882*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*9522*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*23596*	mm^3
y_s	=	*20,1*	mm	i_y	=	*21,1*	mm
A_{bruto}	=	*1065*	mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2366*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2366*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a{*}L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,35**	< 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	< 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**176**	< 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	< 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,59**	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,82**	< 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	< 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,41**	< 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,98**	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,98 = 98%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *hor. knikverkorters voorvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	*0,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*141,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/10* (*1)

h	=	*130*	mm	I_y	=	*3872340*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*41938*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*109995*	mm^3
y_s	=	*35,2*	mm	i_y	=	*39,4*	mm
A_{bruto}	=	*2493*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*888*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*888*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*888*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,43	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	0,03	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	35	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,00	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,52	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,79	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : $U.C_{max}$ = 0,79 = 79%

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *hor. knikverkorters zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-24,8 kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	0,0 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	1,5 kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H50/40/5 (*1)

h	=	50	mm	I_y	=	103800	mm^4
b	=	40	mm	$W_{y;el;eff.1}$	=	2638	mm^3
t_f	=	5	mm	$W_{y;el;eff.2}$	=	9746	mm^3
y_s	=	10,7	mm	i_y	=	15,6	mm
A_{bruto}	=	427	mm^2	i_v	=	8,4	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1616	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	1616	mm	Type of bolts M / "	=	16	
$L_{tot\ (with\ comb.\ buckling)}$	=	0	mm	End distance bolt e1	=	35	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	1616	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	7	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,00**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,98**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**192**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,23**	**> 1 !!**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**1,47**	**> 1 !!**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,82**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,43**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,47 = 147%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *hor. knikverkorters zijvlak* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-24,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*0,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H50/50/8*	(*1)				
h	=	*50*	mm	I_y	=	*162828*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*4684*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*10685*	mm^3
y_s	=	*15,2*	mm	i_y	=	*14,8*	mm
A_{bruto}	=	*741*	mm^2	i_v	=	*9,6*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*1616*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1616*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1616*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,55** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **169** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,56** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,82** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,41** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,31** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,82 = 82%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *schuine knikverkorters voorvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-289,52*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*247,65*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/80/8* (*1)

h	=	*120*	mm	I_y	=	*2256520*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*22266*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*120944*	mm^3
y_s	=	*18,7*	mm	i_y	=	*38,2*	mm
A_{bruto}	=	*1549*	mm^2	i_v	=	*17,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1544*	mm	No. bolts / end / flange		=	*5*	
$L_{v;cr}$	=	*1544*	mm	Type of bolts	M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt	e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,24** **> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **90** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,27** **> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,85** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,10** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,27 = 127%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *schuine knikverkorters voorvlak* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	-289,52	kN	*Combined forces diagonal:*			
Tension:	N_{Sd} =	247,65	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$ =	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : **H120/120/10** (*1)

h	=	120	mm	I_y	=	3129382	mm^4
b	=	120	mm	$W_{y;el;eff.1}$	=	36027	mm^3
t_f	=	10	mm	$W_{y;el;eff.2}$	=	94438	mm^3
y_s	=	33,1	mm	i_y	=	36,7	mm
A_{bruto}	=	2318	mm^2	i_v	=	23,3	mm

Material :

Mat. qual. Fe360 / Fe510 = *Fe360* Permissible stress $f_{y;d}$ = 235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1544	mm	No. bolts / end / flange	=	5	
$L_{v;cr}$	=	1544	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	10	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,81** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **66** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,68** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,43** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,77** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,81 = 81%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 9* *bovenrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-244,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*377,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3202*	mm	No. bolts / end / flange	=	*0*
$L_{v;cr}$	=	*3202*	mm			
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm			mm
$a*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm			mm
$L_{perpendicular\ force}$	=	*0*	mm			mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)			
Column profile?	=	*1*	no=1, yes=2			

Summary checks :

Only the stresses in the sections has to be checked.

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,54** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **127** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,81** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **n.v.t.** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **n.v.t.** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,81 = 81%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9* *diagonalen voor-en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-186,6* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*207,7* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)		=	*0* kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)		=	*0* kN

Angle profile : *H100/100/8* (*1)

h	=	*100* mm	I_y	=	*1448424* mm^4
b	=	*100* mm	$W_{y;el;eff.1}$	=	*19942* mm^3
t_f	=	*8* mm	$W_{y;el;eff.2}$	=	*52924* mm^3
y_s	=	*27,4* mm	i_y	=	*30,6* mm
A_{bruto}	=	*1551* mm^2	i_v	=	*19,4* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2373* mm	No. bolts / end / flange		=	*3*
$L_{v;cr}$	=	*2373* mm	Type of bolts	M / "	=	*24*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	e1	=	*40* mm
$a{*}L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt	s1	=	*80* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate	=	*10* mm	Dubble strap joint no=1, yes=2		=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,98**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**123**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,15**	**> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**1,02**	**> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**1,18**	**> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** $U.C_{max}$ = **1,18** = **118%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: Vak 9 — diagonalen voor-en achtervlak — verzwaard

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd} =	-186,6 kN	***Combined forces diagonal:***			
Tension: N_{Sd} =	207,7 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$ =	0 kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H100/100/10 (*1)

h =	100 mm	I_y	=	1766764	mm^4
b =	100 mm	$W_{y;el;eff.1}$	=	24615	mm^3
t_f =	10 mm	$W_{y;el;eff.2}$	=	62597	mm^3
y_s =	28,2 mm	i_y	=	30,4	mm
A_{bruto} =	1915 mm^2	i_v	=	19,3	mm

Material :

Mat. qual. Fe360 / Fe510 = Fe360 — Permissible stress $f_{y;d}$ = 235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$ =	2373 mm	No. bolts / end / flange		=	3
$L_{v;cr}$ =	2373 mm	Type of bolts	M / "	=	24
L_{tot} (with comb. buckling) =	0 mm	End distance bolt	e1	=	40 mm
a^*L_{tot} (with comb. buckling) =	0 mm	Centre-centre spacing bolt	s1	=	80 mm
$L_{perpendicular force}$ =	0 mm	Edge distance bolt	e2	=	35 mm
Position perpendicular force =	1 (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	8,8
Column profile? =	1 no=1, yes=2	Rolled screw threads		=	1
Thickness tie plate =	8 mm	Dubble strap joint no=1, yes=2		=	1

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,80** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **123** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,93** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,51** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,18** > 1 !!

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,18 = 118%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9* *diagonalen voor-en achtervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-208,1*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*180,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/120/8* (*1)

h	=	*120*	mm	I_y	=	*1911566*	mm^4
b	=	*120*	mm	$W_{y;el;eff.1}$	=	*24300*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*64520*	mm^3
y_s	=	*29,6*	mm	i_y	=	*33,5*	mm
A_{bruto}	=	*1705*	mm^2	i_v	=	*21,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2373*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2373*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,81** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **111** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,06** **> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,02** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,17** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,17 = 117%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9* *diagonalen voor-en achtervlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-208,1* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*180,6* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)		=	*0* kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)		=	*0* kN

Angle profile : ***H120/120/10*** (*1)

h	= 120 mm		I_y	= 3129382 mm^4
b	= 120 mm		$W_{y;el;eff.1}$	= 36027 mm^3
t_f	= 10 mm		$W_{y;el;eff.2}$	= 94438 mm^3
y_s	= 33,1 mm		i_y	= 36,7 mm
A_{bruto}	= 2318 mm^2		i_v	= 23,3 mm

Material :

Mat. qual. Fe360 / Fe510 = *Fe360* Permissible stress $f_{y;d}$ = 235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2373* mm	No. bolts / end / flange		= *3*
$L_{v;cr}$	=	*2373* mm	Type of bolts	M / "	= *24*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	e1	= 35 mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt	s1	= 70 mm
$L_{perpendicular force}$	=	*0* mm	Edge distance bolt	e2	= 35 mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	= *8,8*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads		= *1*
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2		= *1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,59** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **102** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,70** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,51** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,17** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,17 = 117%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9* *verticalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-3,1	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	4,5	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H50/50/5 [*1]

h	=	50	mm	I_y	=	109643	mm^4
b	=	50	mm	$W_{y;el;eff.1}$	=	3049	mm^3
t_f	=	5	mm	$W_{y;el;eff.2}$	=	7811	mm^3
y_s	=	14,0	mm	i_y	=	15,1	mm
A_{bruto}	=	480	mm^2	i_v	=	9,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1503	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	1503	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	25	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	80	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	8	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,06** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **156** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,10** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,14** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,15** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,17** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,17 = 17%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9* *diagonalen ondervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-28,1*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*27,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H75/75/6* [*1]					
h	=	*75*	mm	I_y	=	*455710*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*8351*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*22305*	mm^3
y_s	=	*20,4*	mm	i_y	=	*22,8*	mm
A_{bruto}	=	*875*	mm^2	i_v	=	*14,5*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*2456*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2456*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,33**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**170**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,55**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,76**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,60**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,70**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,76 = 76%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-112,2*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*73,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/6* (*1)

h	=	*100*	mm	I_y	=	*680089*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*11071*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*29775*	mm^3
y_s	=	*22,8*	mm	i_y	=	*26,0*	mm
A_{bruto}	=	*1006*	mm^2	i_v	=	*16,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2220*	mm	No. bolts / end / flange	=	*2*	**(Per flange !)**
$L_{v;cr}$	=	*2220*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*135*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*55*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,41**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**133**	**< 120**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,27**	**> 1 !!**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,41**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,39**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,27 = 127%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *randen* *verzwaard*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	-112,2	kN	*Combined forces diagonal:*			
Tension:	N_{Sd} =	73,3	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$ =	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H100/100/6 (*1)

h	=	100	mm	I_y	=	680089	mm^4
b	=	100	mm	$W_{y;el;eff.1}$	=	11071	mm^3
t_f	=	6	mm	$W_{y;el;eff.2}$	=	29775	mm^3
y_s	=	22,8	mm	i_y	=	26,0	mm
A_{bruto}	=	1006	mm^2	i_v	=	16,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1110	mm	No. bolts / end / flange	=	2	(Per flange !)
$L_{v;cr}$	=	1110	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	135	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	55	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	2	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	6	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,41** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **67** < 120

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,61** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,41** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : $U.C_{max}$ = **0,61** = **61%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *diagonalen voor- en achtervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-130,9*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*108,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/80/8* [*1]

h	=	*120*	mm	I_y	=	*2256520*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*22266*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*120944*	mm^3
y_s	=	*18,7*	mm	i_y	=	*38,2*	mm
A_{bruto}	=	*1549*	mm^2	i_v	=	*17,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4098*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2090*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,66**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**122**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,80**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,97**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**1,05**	**> 1 !!**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 1,05 = 105%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *diagonalen voor- en achtervlak* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-130,9 kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	108,0 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0 kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H120/120/10 (*1)

h	=	120 mm	I_y	=	3129382	mm^4
b	=	120 mm	$W_{y;el;eff.1}$	=	36027	mm^3
t_f	=	10 mm	$W_{y;el;eff.2}$	=	94438	mm^3
y_s	=	33,1 mm	i_y	=	36,7	mm
A_{bruto}	=	2318 mm^2	i_v	=	23,3	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	4098 mm	No. bolts / end / flange	=	2	
$L_{v;cr}$	=	2090 mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt e1	=	35	mm
a^*L_{tot} (with comb. buckling)	=	0 mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0 mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1 no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	8 mm	Dubble strap joint no=1, yes=2	=	2	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,43** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **112** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,50** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,24** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,84** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,84 = 84%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *diagonalen zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	*-50,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*46,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/6* [(*1)]

h	=	*80*	mm	I_y	=	*521007*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*9280*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*24509*	mm^3
y_s	=	*21,3*	mm	i_y	=	*23,9*	mm
A_{bruto}	=	*914*	mm^2	i_v	=	*15,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2651*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2651*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,48** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **174** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,79** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,53** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,69** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,79 = 79%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *diagonalen zijvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-50,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*46,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/10* (*1)

h	=	*80*	mm	I_y	=	*875033*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*15449*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*37458*	mm^3
y_s	=	*23,4*	mm	i_y	=	*24,1*	mm
A_{bruto}	=	*1511*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2651*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*2651*	mm	Type of bolts	M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt	e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,33** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **172** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,81** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,06** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,88** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,06 = 106%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *diagonalen zijvlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	-50,5	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	46,0	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : *H80/80/10* (*1)

h	=	80	mm	I_y	=	875033	mm^4
b	=	80	mm	$W_{y;el;eff.1}$	=	15449	mm^3
t_f	=	10	mm	$W_{y;el;eff.2}$	=	37458	mm^3
y_s	=	23,4	mm	i_y	=	24,1	mm
A_{bruto}	=	1511	mm^2	i_v	=	15,4	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2651	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2651	mm	Type of bolts M / "	=	20	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	30	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	60	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	8	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,33** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **172** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,82** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,54** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,88** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,88 = 88%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *hor. knikverkorters voorvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-1,12 kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	1,12 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	1,5 kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H45/30/5 (*1)

h	=	45 mm	I_y	=	69843	mm^4
b	=	30 mm	$W_{y;el;eff.1}$	=	1877	mm^3
t_f	=	5 mm	$W_{y;el;eff.2}$	=	8962	mm^3
y_s	=	7,8 mm	i_y	=	14,1	mm
A_{bruto}	=	352 mm^2	i_v	=	6,4	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	799 mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	799 mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt e1	=	25	mm
$a*L_{tot}$ (with comb. buckling)	=	0 mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular force}$	=	799 mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1 (⅂=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1 no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	7 mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,01** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,68** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **125** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,03** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,04** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,04** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,04** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,68 = 68%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *hor. knikverkorters zijvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-1,12*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,12*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H45/45/5* (*1)

h	=	*45*	mm	I_y	=	*78410*	mm^4
b	=	*45*	mm	$W_{y;el;eff.1}$	=	*2435*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*6129*	mm^3
y_s	=	*12,8*	mm	i_y	=	*13,5*	mm
A_{bruto}	=	*430*	mm^2	i_v	=	*8,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1268*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1268*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1268*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,01**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,83**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**147**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,03**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,05**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,04**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,04**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,83 = 83%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *schuine knikverkorters voorvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-2,89*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*2,89*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2179*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$	=	*2179*	mm	Type of bolts	M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*25* mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2		=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,04** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **259** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,25** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,29** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,10** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,11** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,29 = 29%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-62,4	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	43,6	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN
Angle profile :		H80/80/6 [(*1)]					
h	=	80	mm	I_y	=	521007	mm^4
b	=	80	mm	$W_{y;el;eff.1}$	=	9280	mm^3
t_f	=	6	mm	$W_{y;el;eff.2}$	=	24509	mm^3
y_s	=	21,3	mm	i_y	=	23,9	mm
A_{bruto}	=	914	mm^2	i_v	=	15,3	mm
Material :							
Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	970	mm	No. bolts / end / flange	=	2	(Per flange !)
$L_{v;cr}$	=	970	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	75	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	2	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	6	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,28**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**64**	**< 120**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,36**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,23**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,28**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,36 = 36%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *diagonalen voor- en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	*-101,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*110,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H75/75/6* (*1)

h	=	*75*	mm	I_y	=	*455710*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*8351*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*22305*	mm^3
y_s	=	*20,4*	mm	i_y	=	*22,8*	mm
A_{bruto}	=	*875*	mm^2	i_v	=	*14,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1506*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1506*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,26** **> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **104** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,93** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,81** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,43** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 1,43 = 143%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *diagonalen voor- en achtervlak* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-67,9	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	80,8	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN
Angle profile :			H75/75/7	(*1)				
h		=	75	mm	I_y	=	523536	mm^4
b		=	75	mm	$W_{y;el;eff.1}$	=	9673	mm^3
t_f		=	7	mm	$W_{y;el;eff.2}$	=	25075	mm^3
y_s		=	20,9	mm	i_y	=	22,7	mm
A_{bruto}		=	1012	mm^2	i_v	=	14,4	mm
Material :								
Mat. qual. Fe360 / Fe510		=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2
Geometry section and bolts:								
$L_{y;cr}$		=	1506	mm	No. bolts / end / flange	=	2	
$L_{v;cr}$		=	1506	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)		=	0	mm	End distance bolt e1	=	35	mm
a^*L_{tot} (with comb. buckling)		=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$		=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force		=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?		=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate		=	8	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,80	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	104	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,54	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,30	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,90	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,90 = 90%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *schuine diagonalen zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-9,2* kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*6,4* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H45/30/5* (*1)

h	=	*45* mm	I_y	=	*69843*	mm^4
b	=	*30* mm	$W_{y;el;eff.1}$	=	*1877*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*8962*	mm^3
y_s	=	*7,8* mm	i_y	=	*14,1*	mm
A_{bruto}	=	*352* mm^2	i_v	=	*6,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1451* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1451* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular force}$	=	*0* mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,09** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **227** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,75** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,85** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,31** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,17** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-3-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *horizontaal zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-6,2 kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	23,1 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	1,5 kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H65/65/6 (*1)

h	=	65 mm	I_y	=	291871	mm^4
b	=	65 mm	$W_{y;el;eff.1}$	=	6215	mm^3
t_f	=	6 mm	$W_{y;el;eff.2}$	=	16182	mm^3
y_s	=	18,0 mm	i_y	=	19,7	mm
A_{bruto}	=	753 mm^2	i_v	=	12,5	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2163 mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2163 mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt e1	=	25	mm
a^*L_{tot} (with comb. buckling)	=	0 mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	2163 mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1 no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	5 mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,26** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,56** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **173** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,14** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,20** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,77** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,87** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,87 = 87%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *hor. voor en achtervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*57,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1231*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*1231*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**1,14**	**> 1 !!**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**146**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,00**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,48**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,79**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,14 = 114%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *hor. voor en achtervlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	0,0	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	59,4	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$ =	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN
Angle profile :		H50/50/6	(*1)				
h	=	50	mm	I_y	=	128406	mm^4
b	=	50	mm	$W_{y;el;eff.1}$	=	3612	mm^3
t_f	=	6	mm	$W_{y;el;eff.2}$	=	8883	mm^3
y_s	=	14,5	mm	i_y	=	15,0	mm
A_{bruto}	=	569	mm^2	i_v	=	9,6	mm
Material :							
Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	1231	mm	No. bolts / end / flange	=	4	
$L_{v;cr}$	=	1231	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	25	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	22	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	8	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,86** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = 128 < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,25** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,67** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,86 = 86%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *schuine diagonaal v.v en a.v*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-162,7*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*124,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/6* (*1)

h	=	*80*	mm	I_y	=	*521007*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*9280*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*24509*	mm^3
y_s	=	*21,3*	mm	i_y	=	*23,9*	mm
A_{bruto}	=	*914*	mm^2	i_v	=	*15,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1541*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1541*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1541*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**1,35**	**> 1 !!**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**101**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**1,38**	**> 1 !!**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**1,20**	**> 1 !!**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**1,62**	**> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 1,62 = 162%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11* *schuine diagonaal v.v en a.v* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd} = -162,7 kN
Tension: N_{Sd} = 124,5 kN
$F_{perpend.;s;d}$ = 0 kN

Combined forces diagonal:
$N_{comb1;c;s;d}$ (min. Compr. or tension) = 0 kN
$N_{comb2;c;s;d}$ (max. compression) = 0 kN

Angle profile : H80/80/12 (*1)

h	= 80 mm		I_y	= 1016934	mm^4
b	= 80 mm		$W_{y;el;eff.1}$	= 18203	mm^3
t_f	= 12 mm		$W_{y;el;eff.2}$	= 42138	mm^3
y_s	= 24,1 mm		i_y	= 23,9	mm
A_{bruto}	= 1787 mm^2		i_v	= 15,4	mm

Material :
Mat. qual. Fe360 / Fe510 = Fe360
Permissible stress $f_{y;d}$ = 235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	= 1541 mm	No. bolts / end / flange	= 2
$L_{v;cr}$	= 1541 mm	Type of bolts M / "	= 24
L_{tot} (with comb. buckling)	= 0 mm	End distance bolt e1	= 35 mm
$a{*}L_{tot}$ (with comb. buckling)	= 0 mm	Centre-centre spacing bolt s1	= 70 mm
$L_{perpendicular\ force}$	= 1541 mm	Edge distance bolt e2	= 35 mm
Position perpendicular force	= 1 (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	= 8,8
Column profile?	= 1 no=1, yes=2	Rolled screw threads	= 1
Thickness tie plate	= 12 mm	Dubble strap joint no=1, yes=2	= 1

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,69** < 1

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **100** < 200 or 240

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,70** < 1

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,60** < 1

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,81** < 1

Remarks:
The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,81 = 81%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 11* *hor. knikverkorters zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-14,11	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	0,00	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H45/45/5 (*1)

h	=	45	mm	I_y	=	78410	mm^4
b	=	45	mm	$W_{y;el;eff.1}$	=	2435	mm^3
t_f	=	5	mm	$W_{y;el;eff.2}$	=	6129	mm^3
y_s	=	12,8	mm	i_y	=	13,5	mm
A_{bruto}	=	430	mm^2	i_v	=	8,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	996	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	996	mm	Type of bolts M / "	=	16	
$L_{tot\ (with\ comb.\ buckling)}$	=	0	mm	End distance bolt e1	=	25	mm
$a*L_{tot\ (with\ comb.\ buckling)}$	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	996	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	5	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** < 1

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,65** < 1

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **116** < 200 or 240

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,30** < 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,52** < 1

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,47** < 1

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,24** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,65 = 65%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12* *bovenrand*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-123,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*184,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100*	mm	I_y	=	*1766764*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2*	mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2750*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2750*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*55*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,75** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **142** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,73** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,91** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,20** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,20 = 120%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12* *bovenrand* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-123,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*184,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : ***H100/100/12*** (*1)

h	=	*100*	mm	I_y	=	*2066880*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*29124*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*71193*	mm^3
y_s	=	*29,0*	mm	i_y	=	*30,2*	mm
A_{bruto}	=	*2271*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2750*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2750*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*55*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,64** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **143** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,61** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,23** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,80** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,80 = 80%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12* *diagonalen ondervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-16,3*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*13,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H55/55/5* [(*1)]

h	=	*55*	mm	I_y	=	*147150*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*3697*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9685*	mm^3
y_s	=	*15,2*	mm	i_y	=	*16,6*	mm
A_{bruto}	=	*532*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1500*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1500*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,37**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**142**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,39**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,58**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,27**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,47**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,58 = 58%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12* *diagonalen v.v en a.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-91,7	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	29,4	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : *H100/100/6* (*1)

h	=	100	mm	I_y	=	680089	mm^4
b	=	100	mm	$W_{y;el;eff.1}$	=	11071	mm^3
t_f	=	6	mm	$W_{y;el;eff.2}$	=	29775	mm^3
y_s	=	22,8	mm	i_y	=	26,0	mm
A_{bruto}	=	1006	mm^2	i_v	=	16,6	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2363	mm	No. bolts / end / flange	=	2	
$L_{v;cr}$	=	2363	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	10	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,28** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **142** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,03** **> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,68** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,82** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,03 = 103%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12* *diagonalen v.v en a.v* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	-91,7	kN	*Combined forces diagonal:*			
Tension:	N_{Sd} =	29,4	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$ =	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN
Angle profile :		H100/100/8	(*1)				
h	=	100	mm	I_y	=	1448424	mm^4
b	=	100	mm	$W_{y;el;eff.1}$	=	19942	mm^3
t_f	=	8	mm	$W_{y;el;eff.2}$	=	52924	mm^3
y_s	=	27,4	mm	i_y	=	30,6	mm
A_{bruto}	=	1551	mm^2	i_v	=	19,4	mm
Material :							
Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	2363	mm	No. bolts / end / flange	=	2	
$L_{v;cr}$	=	2363	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
a*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	10	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,18**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**122**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,56**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,34**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,62**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,62 = 62%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 12* *diagonalenv.v en a.v*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	-66,1	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	62,1	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H90/90/6 (*1)

h	=	90	mm	I_y	=	605764	mm^4
b	=	90	mm	$W_{y;el;eff.1}$	=	10255	mm^3
t_f	=	6	mm	$W_{y;el;eff.2}$	=	27352	mm^3
y_s	=	22,1	mm	i_y	=	25,1	mm
A_{bruto}	=	965	mm^2	i_v	=	16,0	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2819	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2819	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	40	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	40	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	6	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,67** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **176** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,24** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,67** **> 1 !!**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,97** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,17** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,67 = 167%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12* *diagonalenv.v en a.v* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-66,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*62,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H90/90/10* (*1)

h	=	*90*	mm	I_y	=	*1269150*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*19768*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*49197*	mm^3
y_s	=	*25,8*	mm	i_y	=	*27,2*	mm
A_{bruto}	=	*1713*	mm^2	i_v	=	*17,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$ =	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2819* mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$	=	*2819* mm	Type of bolts	M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	e1	=	*40* mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt	s1	=	*50* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt	e2	=	*40* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*8,8*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate	=	*6* mm	Dubble strap joint no=1, yes=2		=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,32** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **162** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,51** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,55** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,81** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,81 = 81%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12* *diagonalen v.v en a.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-31,7*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*88,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2361*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2361*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,30** **> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **281** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **2,17** **> 1 !!**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,98** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,15** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 2,17 = 217%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 12* *diagonalen v.v en a.v* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-31,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*88,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : ***H60/60/10*** (*1)

h	=	*60*	mm	I_y	=	*349321*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*8408*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*18928*	mm^3
y_s	=	*18,5*	mm	i_y	=	*17,8*	mm
A_{bruto}	=	*1107*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2361*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2361*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,63** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **205** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,52** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,49** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,96** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,96 = 96%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 1* *rand*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-145,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*117,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/120/11* (*1)

h	=	*120*	mm	I_y	=	*3406399*	mm^4
b	=	*120*	mm	$W_{y;el;eff.1}$	=	*39406*	mm^3
t_f	=	*11*	mm	$W_{y;el;eff.2}$	=	*101512*	mm^3
y_s	=	*33,6*	mm	i_y	=	*36,6*	mm
A_{bruto}	=	*2537*	mm^2	i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3800*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*3800*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*3800*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,43** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,15** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **163** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,77** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,08** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,73** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,08 = 108%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 1* *rand* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	-145,8 kN		
Tension: N_{Sd}	=	117,8 kN		
$F_{perpend.;s;d}$	=	1,5 kN		

Combined forces diagonal:

$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0 kN
$N_{comb2;c;s;d}$ (max. compression)	=	0 kN

Angle profile : *H120/120/11* [*1]

h	=	120 mm	I_y	=	3406399 mm^4
b	=	120 mm	$W_{y;el;eff.1}$	=	39406 mm^3
t_f	=	11 mm	$W_{y;el;eff.2}$	=	101512 mm^3
y_s	=	33,6 mm	i_y	=	36,6 mm
A_{bruto}	=	2537 mm^2	i_v	=	23,3 mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	3800 mm	No. bolts / end / flange	=	2
$L_{v;cr}$	=	3800 mm	Type of bolts M / "	=	24
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt e1	=	40 mm
$a*L_{tot}$ (with comb. buckling)	=	0 mm	Centre-centre spacing bolt s1	=	70 mm
$L_{perpendicular\ force}$	=	3800 mm	Edge distance bolt e2	=	40 mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8
Column profile?	=	1 no=1, yes=2	Rolled screw threads	=	1
Thickness tie plate	=	14 mm	Dubble strap joint no=1, yes=2	=	1

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,43** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,15** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **163** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,77** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,54** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,73** < 1

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,77 = 77%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 1* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-3,7 kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	2,7 kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	1,5 kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : *H80/80/6* (*1)

h	=	80 mm	I_y	=	521007	mm^4
b	=	80 mm	$W_{y;el;eff.1}$	=	9280	mm^3
t_f	=	6 mm	$W_{y;el;eff.2}$	=	24509	mm^3
y_s	=	21,3 mm	i_y	=	23,9	mm
A_{bruto}	=	914 mm^2	i_v	=	15,3	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	5374 mm	No. bolts / end / flange		=	1	
$L_{v;cr}$	=	5374 mm	Type of bolts	M / "	=	20	
L_{tot} (with comb. buckling)	=	0 mm	End distance bolt	e1	=	30	mm
$a*L_{tot}$ (with comb. buckling)	=	0 mm	Centre-centre spacing bolt	s1	=	70	mm
$L_{perpendicular\ force}$	=	5374 mm	Edge distance bolt	e2	=	35	mm
Position perpendicular force	=	1 (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1 no=1, yes=2	Rolled screw threads		=	1	
Thickness tie plate	=	6 mm	Dubble strap joint no=1, yes=2		=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,03** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,92** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **352** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,26** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,30** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,08** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,07** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,92 = 92%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 1* *kruis*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1,1* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*0,3* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/5* [(*1)]

h	=	*70*	mm	I_y	=	*268391*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*5609*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*14898*	mm^3
y_s	=	*18,0*	mm	i_y	=	*20,3*	mm
A_{bruto}	=	*651*	mm^2	i_v	=	*13,0*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*7600*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*7600*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*7600*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **2,16** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **585** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,29** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,31** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,02** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,02** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 2,16 = 216%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 1* *kruis* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-1,1* kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*0,3* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/10* (*1)

h	=	*80* mm	I_y	=	*875033*	mm^4
b	=	*80* mm	$W_{y;el;eff.1}$	=	*15449*	mm^3
t_f	=	*10* mm	$W_{y;el;eff.2}$	=	*37458*	mm^3
y_s	=	*23,4* mm	i_y	=	*24,1*	mm
A_{bruto}	=	*1511* mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*7600* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*7600* mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*7600* mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1* (⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,79** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **493** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,09** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,10** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,01** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,01** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,79 = 79%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		D&C ENGINEERING
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 2* *randen voor- en achtervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	-225,6	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	169,4	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : *H110/110/10* (*1)

h	=	110	mm	I_y	=	2386992	mm^4
b	=	110	mm	$W_{y;el;eff.1}$	=	30108	mm^3
t_f	=	10	mm	$W_{y;el;eff.2}$	=	77703	mm^3
y_s	=	30,7	mm	i_y	=	33,6	mm
A_{bruto}	=	2115	mm^2	i_v	=	21,3	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360	Permissible stress $f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2500	mm	No. bolts / end / flange		=	2	
$L_{v;cr}$	=	2500	mm	Type of bolts	M / "	=	24	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt	e1	=	35	mm
$a{*}L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt	s1	=	70	mm
$L_{perpendicular\ force}$	=	2500	mm	Edge distance bolt	e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads		=	1	
Thickness tie plate	=	12	mm	Dubble strap joint no=1, yes=2		=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,75** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,13** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **117** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,97** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,66** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,32** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,66 = 166%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 2* *randen voor- en achtervlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-225,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*169,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H110/110/14* (*1)

h	=	*110*	mm	I_y	=	*3188262*	mm^4
b	=	*110*	mm	$W_{y;el;eff.1}$	=	*41039*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*98672*	mm^3
y_s	=	*32,3*	mm	i_y	=	*33,2*	mm
A_{bruto}	=	*2899*	mm^2	i_v	=	*21,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2500* mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$	=	*2500* mm	Type of bolts	M / "	=	*24*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	e1	=	*35* mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$	=	*2500* mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*8,8*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate	=	*12* mm	Dubble strap joint no=1, yes=2		=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,55** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,10** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **118** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,71** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,83** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,10** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,10 = 110%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 2* *randen zijvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-15,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*20,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/6* (*1)

h =	*80*	mm	I_y =	*521007*	mm^4
b =	*80*	mm	$W_{y;el;eff.1}$ =	*9280*	mm^3
t_f =	*6*	mm	$W_{y;el;eff.2}$ =	*24509*	mm^3
y_s =	*21,3*	mm	i_y =	*23,9*	mm
A_{bruto} =	*914*	mm^2	i_v =	*15,3*	mm

Material :

Mat. qual. Fe360 / Fe510 =	*Fe360*	Permissible stress $f_{y;d}$ =	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$ =	*2500*	mm	No. bolts / end / flange =	*1*	
$L_{v;cr}$ =	*2500*	mm	Type of bolts M / " =	*20*	
L_{tot} (with comb. buckling) =	*0*	mm	End distance bolt =	*30*	mm
$a*L_{tot}$ (with comb. buckling) =	*0*	mm	Centre-centre spacing bolt s1 =	*70*	mm
$L_{perpendicular\ force}$ =	*2500*	mm	Edge distance bolt e2 =	*35*	mm
Position perpendicular force =	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9 =	*4,6*	
Column profile? =	*1*	no=1, yes=2	Rolled screw threads =	*1*	
Thickness tie plate =	*12*	mm	Dubble strap joint no=1, yes=2 =	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,24** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,43** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **164** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,27** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,38** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,43** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,52** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,52 = 52%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 2* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-16,5*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*16,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/8* (*1)

h	=	*100*	mm	I_y	=	*1448424*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*19942*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*52924*	mm^3
y_s	=	*27,4*	mm	i_y	=	*30,6*	mm
A_{bruto}	=	*1551*	mm^2	i_v	=	*19,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3535*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3535*	mm	Type of bolts M / "	=	*20*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*3535*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,15** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,28** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **183** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,20** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,28** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,35** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,31** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,35 = 35%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		D&C ENGINEERING
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 2* *kruis*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-0,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*0,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/5* (*1)

h	=	*60*	mm	I_y	=	*193708*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*4447*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*11785*	mm^3
y_s	=	*16,4*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*582*	mm^2	i_v	=	*11,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5000*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*5000*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	=	*30*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*5000*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,01** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **1,79** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **432** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,12** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,13** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,02** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,02** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,79 = 179%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: HV 2 kruis verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-0,7	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	0,6	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H60/60/10 (*1)

h	=	60	mm	I_y	=	349321	mm^4
b	=	60	mm	$W_{y;el;eff.1}$	=	8408	mm^3
t_f	=	10	mm	$W_{y;el;eff.2}$	=	18928	mm^3
y_s	=	18,5	mm	i_y	=	17,8	mm
A_{bruto}	=	1107	mm^2	i_v	=	11,5	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	5000	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	5000	mm	Type of bolts M / "	=	20	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt	=	30	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	70	mm
$L_{perpendicular\ force}$	=	5000	mm	Edge distance bolt e2	=	35	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	12	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = 0,00 < 1

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = 0,95 < 1

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = 434 < 200 or 240

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = n.v.t. < 1

5 - Check stress in member due to compression with excentricity:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = 0,06 < 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = 0,07 < 1

6 - Check stress with combined buckling of two sections:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = n.v.t. < 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = n.v.t. < 1

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = 0,01 < 1

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = 0,01 < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,95 = 95%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 1 en 2 bovenrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	*0,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*91,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H65/50/5* [*1]

h	=	*65*	mm	I_y	=	*230454*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*4389*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*18449*	mm^3
y_s	=	*12,5*	mm	i_y	=	*20,4*	mm
A_{bruto}	=	*554*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4911*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*4911*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**1,37**	**> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**466**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,00**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,48**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**1,01**	**> 1 !!**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 1,37 = 137%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 1 en 2 bovenrand* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*0,0* kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*91,0* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H65/65/8* [*1]

h	=	*65* mm	I_y	=	*374895*	mm^4
b	=	*65* mm	$W_{y;el;eff.1}$	=	*8128*	mm^3
t_f	=	*8* mm	$W_{y;el;eff.2}$	=	*19858*	mm^3
y_s	=	*18,9* mm	i_y	=	*19,5*	mm
A_{bruto}	=	*985* mm^2	i_v	=	*12,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4911* mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*4911* mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*35*	mm
a*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,75** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **394** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,24** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,84** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,84 = 84%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 1 en 2 diagonalen v.v en a.v*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*0,0* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*45,0* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2810*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2810*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,89**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**334**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,00**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,50**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,82**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,89 = 89%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 1 en 2 diagonalen ondervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	-21,7	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	18,6	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H75/75/6 (*1)

h	=	75	mm	I_y	=	455710	mm^4
b	=	75	mm	$W_{y;el;eff.1}$	=	8351	mm^3
t_f	=	6	mm	$W_{y;el;eff.2}$	=	22305	mm^3
y_s	=	20,4	mm	i_y	=	22,8	mm
A_{bruto}	=	875	mm^2	i_v	=	14,5	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe360		Permissible stress $f_{y;d}$	=	235,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2269	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2269	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	25	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	22	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	4,6	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	6	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,41** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **157** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,37** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,53** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,72** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,84** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,84 = 84%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: ***Traverse 1 en 2 diagonalen ondervlak***

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-17,9* kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*16,5* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H55/55/5* (*1)

h	=	*55* mm	I_y	=	*147150*	mm^4
b	=	*55* mm	$W_{y;el;eff.1}$	=	*3697*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*9685*	mm^3
y_s	=	*15,2* mm	i_y	=	*16,6*	mm
A_{bruto}	=	*532* mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1300* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1300* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,44** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **123** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,34** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,55** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,59** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,90** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,90 = 90%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 3 en 4 bovenrand*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*57,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2880*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2880*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,14** **> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **343** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,48** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,79** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,14 = 114%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 3 en 4 bovenrand* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*57,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :			*H50/50/6*	(*1)				
h		=	*50*	mm	I_y	=	*128406*	mm^4
b		=	*50*	mm	$W_{y;el;eff.1}$	=	*3612*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*8883*	mm^3
y_s		=	*14,5*	mm	i_y	=	*15,0*	mm
A_{bruto}		=	*569*	mm^2	i_v	=	*9,6*	mm
Material :								
Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:								
$L_{y;cr}$		=	*2880*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$		=	*2880*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)		=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)		=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$		=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?		=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate		=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,83**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**300**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,00**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,48**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,65**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,83 = 83%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14008
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 52		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 3 en 4 diagonalen ondervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	*-19,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*12,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1118*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1118*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,34** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **116** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,37** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,62** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,64** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,69** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,69 = 69%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6 bovenrand*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-49,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*68,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H65/50/6*	(*1)				
h	=	*65*	mm	I_y	=	*271004*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*5202*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*21006*	mm^3
y_s	=	*12,9*	mm	i_y	=	*20,3*	mm
A_{bruto}	=	*658*	mm^2	i_v	=	*10,5*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*3452*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1726*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,00** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **170** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,22** > 1 !!

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,13** > 1 !!

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,55** > 1 !!

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,55 = 155%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	23-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	**13039140509**	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6 bovenrand* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-49,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*68,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H75/75/12* (*1)

h	=	*75*	mm	I_y	=	*825669*	mm^4
b	=	*75*	mm	$W_{y;el;eff.1}$	=	*15842*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*36085*	mm^3
y_s	=	*22,9*	mm	i_y	=	*22,3*	mm
A_{bruto}	=	*1667*	mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3452*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1726*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,38**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**155**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,43**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,57**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,78**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,78 = 78%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	23-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6 onderrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-69,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*49,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/6* (*1)

h	=	*80*	mm	I_y	=	*521007*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*9280*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*24509*	mm^3
y_s	=	*21,3*	mm	i_y	=	*23,9*	mm
A_{bruto}	=	*914*	mm^2	i_v	=	*15,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2008*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2008*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*30*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,51** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **132** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,79** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,74** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,74** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,79 = 79%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6 diagonalen ondervlak* *L45/45/5*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-6,7*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*5,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=		kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H45/45/5* (*1)

h	=	*45*	mm	I_y	=	*78410*	mm^4
b	=	*45*	mm	$W_{y;el;eff.1}$	=	*2435*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*6129*	mm^3
y_s	=	*12,8*	mm	i_y	=	*13,5*	mm
A_{bruto}	=	*430*	mm^2	i_v	=	*8,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2162*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2162*	mm	Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,15** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **251** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,54** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,66** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,22** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,30** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,66 = 66%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6 diagonalen ondervlak* *L45/30/5*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-4,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*5,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H45/30/5* [*1]

h	=	*45*	mm	I_y	=	*69843*	mm^4
b	=	*30*	mm	$W_{y;el;eff.1}$	=	*1877*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*8962*	mm^3
y_s	=	*7,8*	mm	i_y	=	*14,1*	mm
A_{bruto}	=	*352*	mm^2	i_v	=	*6,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1092*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1092*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,15** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **171** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,24** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,29** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,18** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,30** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,30 = 30%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6 diagonalen v.v en a.v.*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-2,7* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,7* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0* kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0* kN

Angle profile : *H45/30/5* [*1]

h	=	*45* mm	I_y	=	*69843* mm^4
b	=	*30* mm	$W_{y;el;eff.1}$	=	*1877* mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*8962* mm^3
y_s	=	*7,8* mm	i_y	=	*14,1* mm
A_{bruto}	=	*352* mm^2	i_v	=	*6,4* mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1911* mm	No. bolts / end / flange	=	*1*
$L_{v;cr}$	=	*1911* mm	Type of bolts M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*25* mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*22* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*5* mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,04**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**299**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,37**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,40**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,09**	**< 1**

8 - Check bearing stress boltconnection:

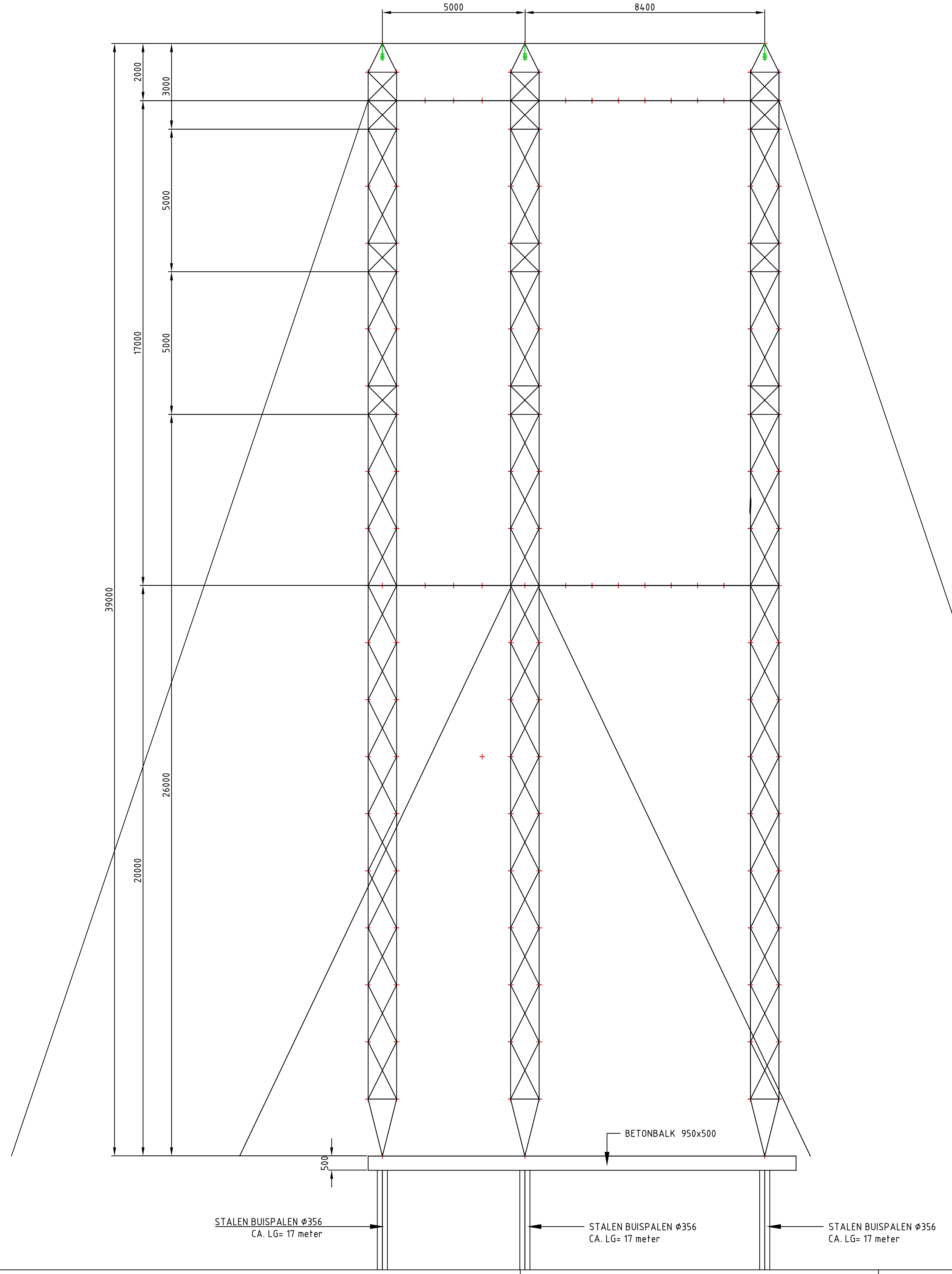
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,09**	**< 1**

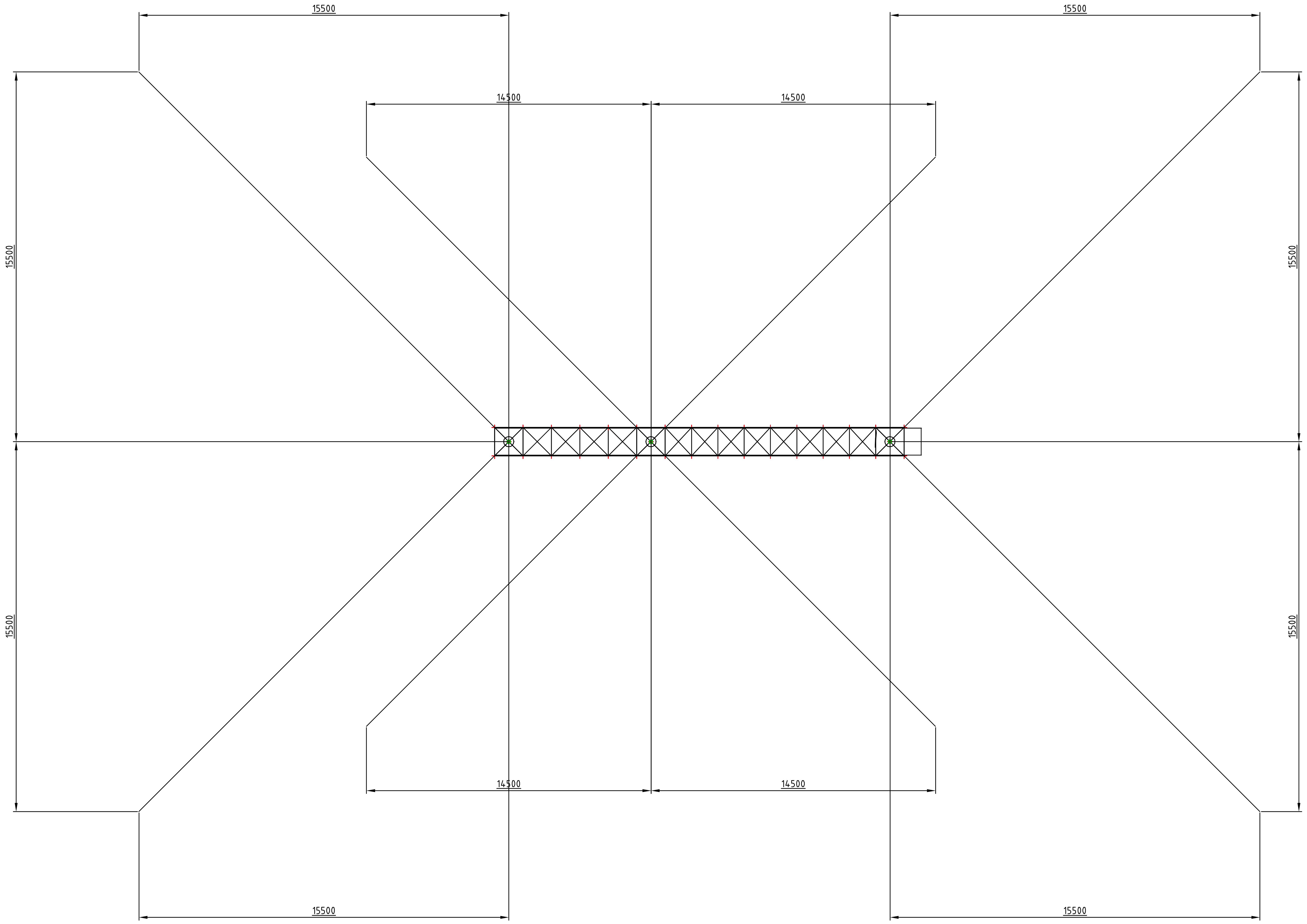
Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,40 = 40%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						





VERBINDING PORTAAL AAN BETONBALK MIDDELS INGESTORTE ANKERS.
AFMETINGEN EN AANTAL N.T.B.

STAAL KWALITEIT : S355

D&C DWG No: D14001 - 0300

D&C Check controle | J. Hollaar | W. van Bergen

Combining Knowledge and Experience

Randstad 380kV Noordring

P. de Jager — Controleur

E.Duwel — Vrijgegeven door

Omschrijving: Definitief Ontwerp
Mast amovatie systeem
Tijdelijke mast YMM74

Rev.	Wijziging	Datum	Naam
03			
02			
01			

Schaal: 1:150 Formaat: A1

Naam: HWI Datum: 17-02-2014

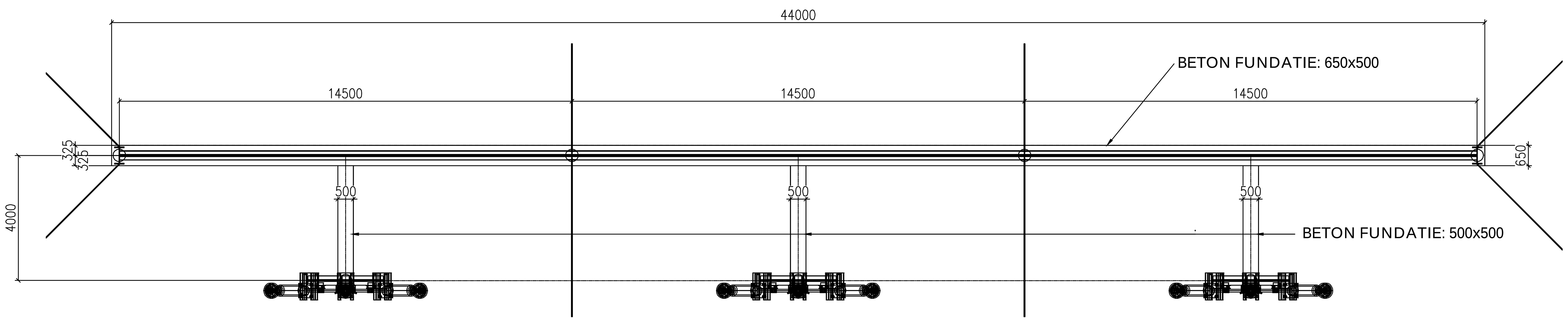
Projekt: Randstad 380kV Noordring

Taking power further

Tekeningnummer: R3N-TEK-0182 blad 001

AutoCAD filename::

Systnr:



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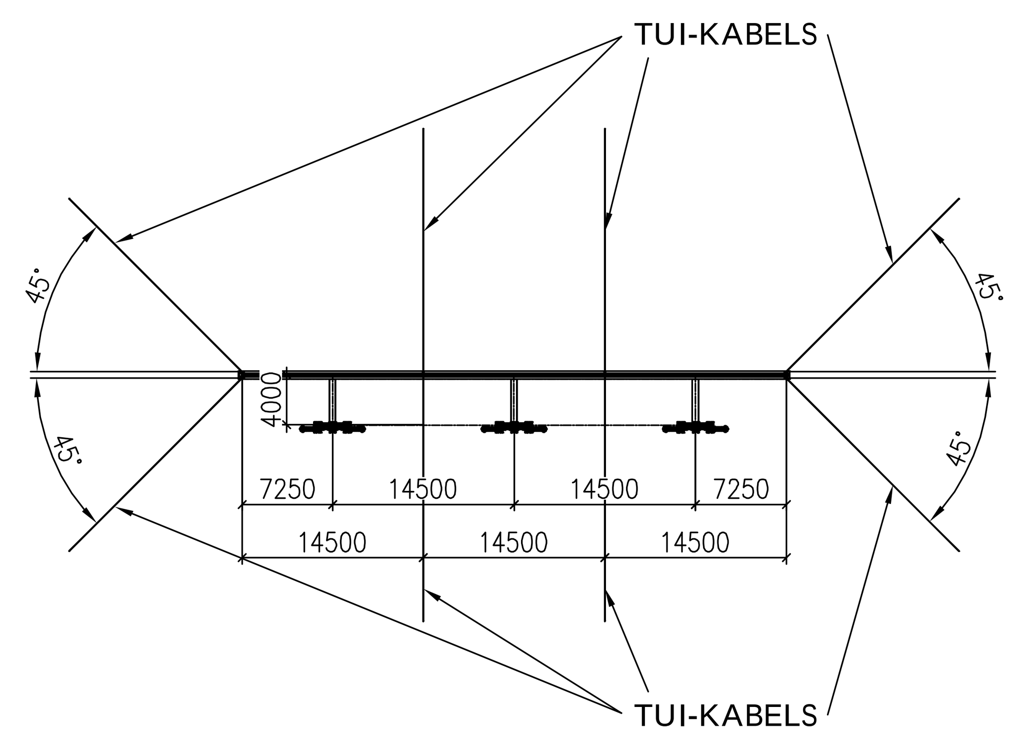
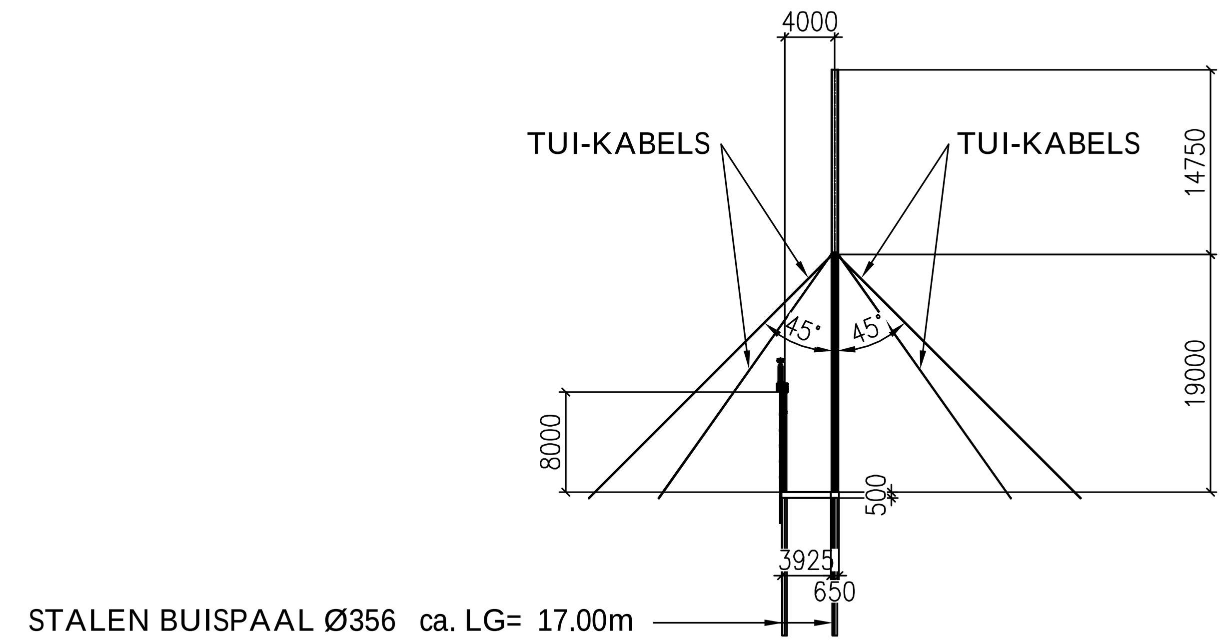
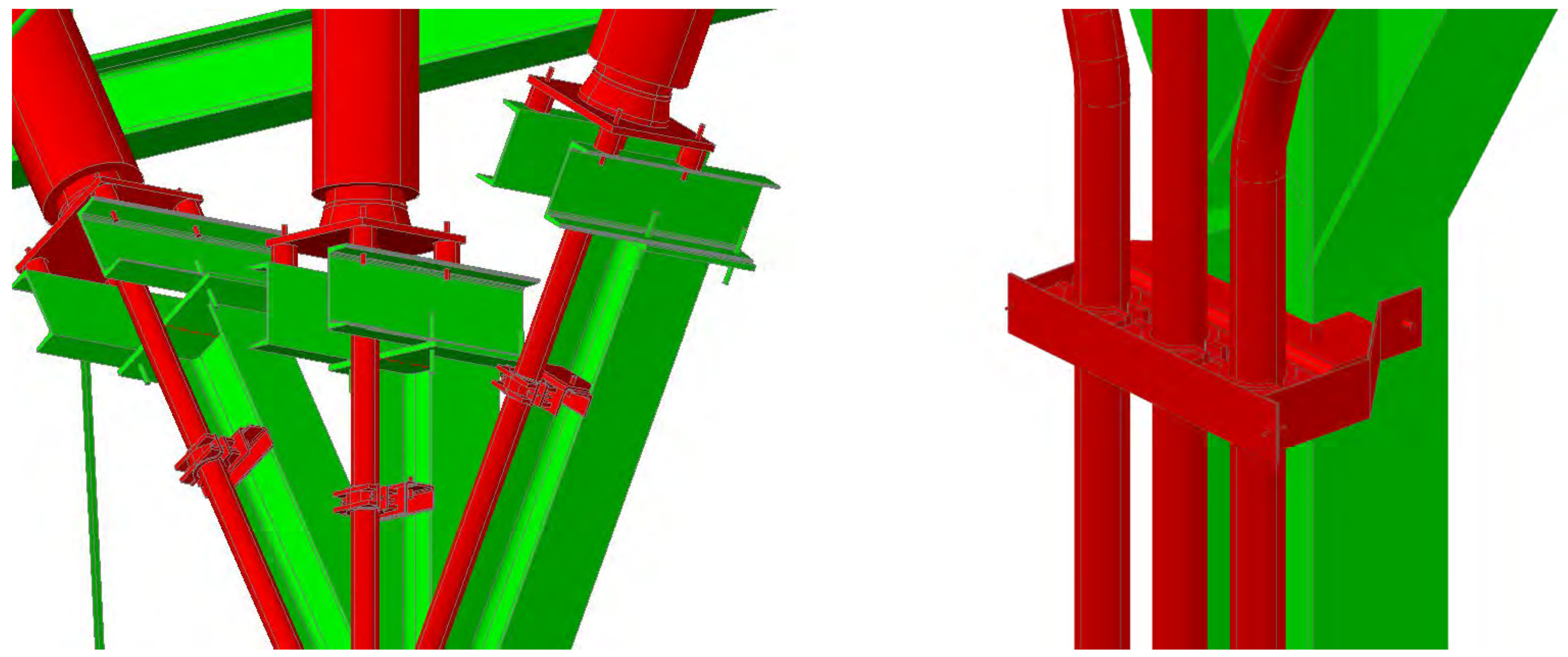


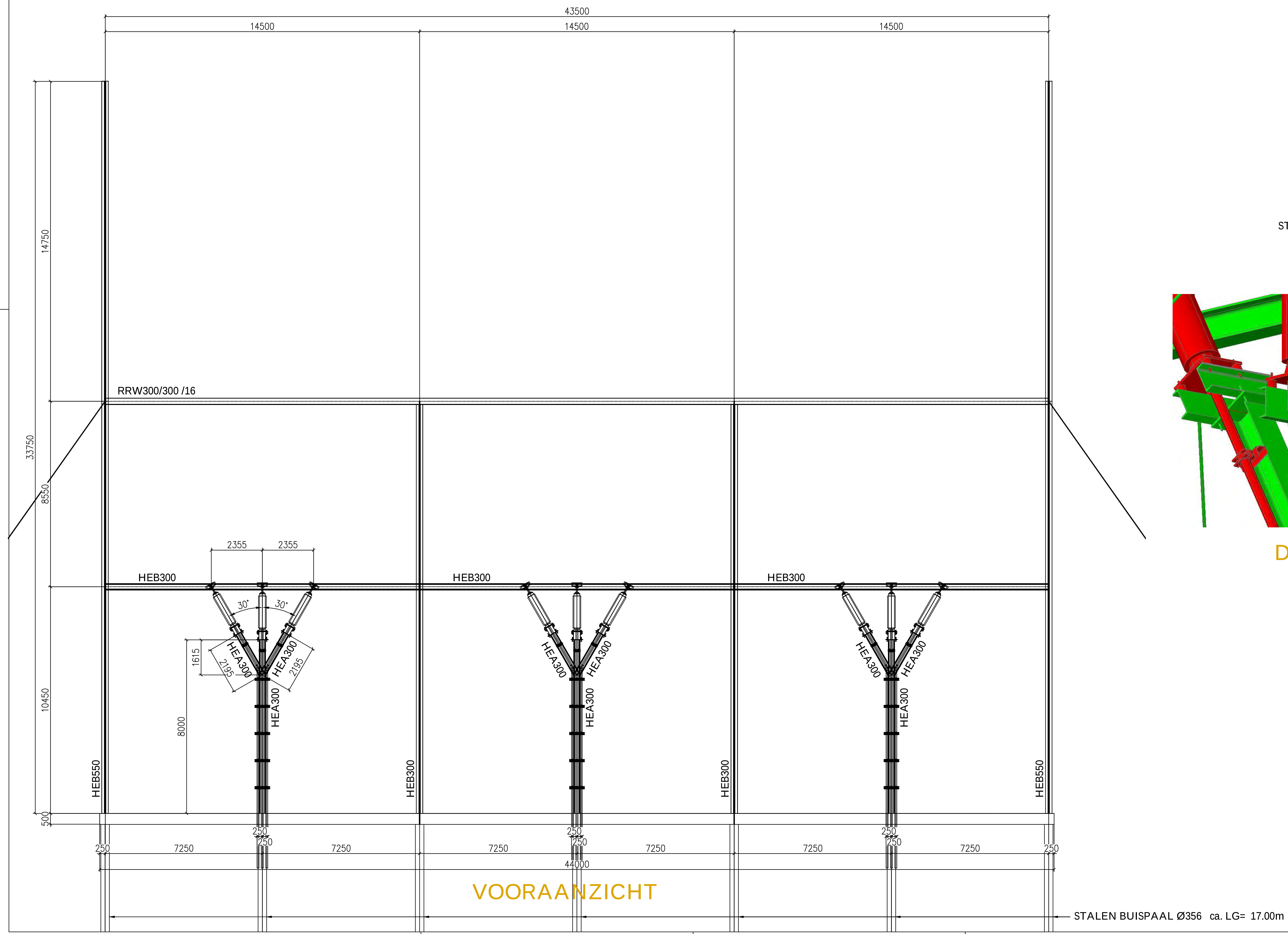
PLAN



PLAN ZIJAANZICHT



DETAILS ELEKTRA KABELS SUPPORT



VOORAANZICHT

D&C DWG No:	D14001 - 0400
D&C Check controle	J. Hollaar / W. van Bergen
Combining Knowledge and Experience — bam — COFELY FABRICOM GDF SUEZ — Randstad 380kV Noordring	D&C ENGINEERING
Controleur	P. de Jager
Vrijgegeven door	E.Duwel
Omschrijving	Definitief Ontwerp Mast amovatie systeem Portaal omleiding YMM53-YMM54 grondkabel
Rev	03 / 02 / 01
Rev / Wijziging / Datum / Naam	
Schaal:	1:100 / 1:20 / 1:10
Formaat:	A1
Naam:	HWI
Datum:	17-02-2014
Projekt:	Randstad 380kV Noordring
TenneT — Taking power further	
Tekeningnummer:	R3N-TEK-0184 blad 001
AutoCAD filename:	
Systeem:	