Bijlagenblad 2 ten behoeve van aanvraag omgevingsvergunning gemeente Molenlanden Project: Beter Benutten KIJ-GT380 kV Status: Definitief Datum: 16-07-2021						
Nr.	**Type**	**Omschrijving**	**Auteur**	**Kenmerk**	**Datum**	**Versie**
13	Rapport	Rapportage Mastconstructie HC+0 & HC+0T	DNV-GL	21-1114	7-7-2021	Rev.0
14	Rapport	Rapportage Mastconstructie S+0	DNV-GL	21-1102	6-7-2021	Rev.0
15	Rapport	Rapportage Mastconstructie S+0 T	DNV-GL	21-1099	5-7-2021	Rev.0
16	Rapport	Rapportage Mastconstructie S+30	DNV-GL	21-1074	2-7-2021	Rev.0
17	Rapport	Rapportage Mastconstructie S+6	DNV-GL	21-1088	5-7-2021	Rev.0
18	Rapport	Rapportage Mastconstructie S+95 & S+95 T	DNV-GL	21-1095	6-7-2021	Rev.0
19	Rapport	Rapportage Mastconstructie WB+0	DNV-GL	21-1106	6-7-2021	Rev.0

Bijlage 13 Rapportage Mastconstructie HC+0 & HC+0T

“TOETSING EN HERONTWERP MASTEN EN FUNDATIES BBB380”

KIJ-GT380 – Rapportage mast HC+0 & HC+0T

TenneT TSO B.V.

Meridian doc. nr.: 002.589.40 0916487
Rapport nr.: 21-1114 Rev.0
Datum: 2021-07-07

Projectnaam:	"Toetsing en herontwerp masten en fundaties BBB380"	DNV GL - Energy Energy Advisory Postbus 9035 6800 ET ARNHEM
Rapport titel:	KIJ-GT380 – Rapportage mast HC+0 & HC+0T	
Klant:	TenneT TSO B.V.	
Contactpersoon:	[redacted]	
Datum:	2021-07-07	
Project nr.:	10166260	[redacted]
Organisatie unit:	TDT	
Meridian doc.nr.:	002.589.40 0916487	
Rapport nr.:	21-1114 Rev.0	

Geschreven door:	Beoordeeld door:	Goedgekeurd door:
[redacted]		

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Trefwoorden:

Versie	Datum	Reden voor uitgave	Auteur	Beoordeeld	Goedgekeurd
0	2021-07-07	Eerste uitgave	[redacted]		

DNV GL Netherlands B.V.

Inhoud

1 INLEIDING

1.1 Inleiding

Om in de toekomst meer elektriciteit te kunnen transporteren is het noodzakelijk om naast de nieuwbouw van verbindingen bestaande hoogspanningsverbindingen aan te passen zodat er een grotere transportcapaciteit mogelijk wordt gemaakt.

Om die reden is de opdrachtgever (OG) voornemens de bestaande 380 kV-koppelnetring op te waarderen. Het opwaarderen van de bestaande verbindingen valt onder het programma "Beter benutten bestaande 380 kV-ring" en omvat de volgende deelprojecten:

- Opwaardering 380 kV-verbinding Lelystad – Ens (LLS-ENS380)
- Opwaardering 380 kV-verbinding Diemen – Lelystad (DIM-LLS380)
- Opwaardering 380 kV-verbinding Rilland – Zandvliet (RLL-ZVL380)
- Opwaardering 380 kV-verbinding Krimpen aan den IJssel - Geertruidenberg (KIJ-GT380)
- Opwaardering 380 kV-verbinding Ens - Zwolle (ENS-ZL380)
- Opwaardering 380 kV-verbinding Maasbracht - Eindhoven (MBT-EHV380)

Om te komen tot een DO waarmee de werkzaamheden kunnen worden gestart is door TenneT aan DNV GL opdracht verstrekt voor de volgende onderdelen:

1. In eerste fase het opstellen en creëren van:

1.1 E-studie deel 1

1.2 Uitgangspuntenrapporten ten behoeve van de constructieve analyse van masten en fundaties

1.3 Sonderingmodellen

1.4 Fundatiemodellen

1.5 Mastmodellen

2. In tweede fase de uitvoering van de DO-fase bevattende:

2.1 Toetsing conform het uitgangspuntenrapport van de bestaande fundaties

2.2 Globale specificatie van benodigde fundatieversterkingen ten behoeve van aanbesteding

2.3 Toetsing conform het uitgangspuntenrapport van de bestaande masten

2.4 Globale specificatie van benodigde mastversterkingen ten behoeve van aanbesteding

2.5 E-studie deel 2

In deze studie wordt voor de lijn Krimpen aan den IJssel - Geertruidenberg de controle van de mastconstructie van masttypen HC+0 en HC+0T gerapporteerd.

Inhoudelijk is de Nederlandse versie van de rapportage ongewijzigd ten opzichte van de Engelse versie. Om deze reden zijn de bijlagen in dit rapport één op één overgenomen uit de Engelse versie. Hierdoor wijkt het revisienummer van de bijlagen af van het revisienummer van de rapportage.

1.2 Doelstelling en scope van dit rapport

Het doel van deze studie is om te bepalen of de in dit rapport beschreven bestaande mast geschikt is om te worden uitgerust met de ACCCZ-Warsaw geleider.

Nadat de wijzigingen zijn toegepast dient aantoonbaar geverifieerd te worden dat het systeem voldoet aan de vigerende eisen.

1.3 Relatie overige documenten

1.3.1 Verificatie & validatie plan

De door TenneT aangeleverde set met eisen is beoordeeld op relevantie en voor de relevante eisen is aangegeven in welk document wordt aangetoond dat er aan de eis wordt voldaan. De resultaten hiervan zijn opgenomen in het rapport "Verificatie & Validatieplan 380 kV verbinding Krimpen aan den IJssel - Geertruidenberg" [1].

1.3.2 E-studie deel 1

In de rapportage "KIJ-GT380 - E-studie deel 1" [2] is bepaald welke aanpassingen benodigd zijn om de ACCCZ Warsaw geleider toe te passen binnen de verbinding Krimpen aan den IJssel - Geertruidenberg. Uit de E-studie volgt dat de volgende aanpassingen vereist zijn:

- Mast 2 HC+0 – Toepassing van postisolatoren aan één zijde van de ondertraverse om de bretellen te fixeren. Het binnenste circuit moet worden gefixeerd met twee post isolatoren.
- Mast 15 HC+0 - Toepassing van postisolatoren aan één zijde van de ondertraverse om de bretellen te fixeren. Het binnenste circuit moet worden gefixeerd met twee post isolatoren. De positie van het aangrijpingspunt van de geleider aan de boventraverse moet 1,5m naar binnen worden verschoven;
- Mast 38 HC+0 – Toepassing van postisolatoren aan één zijde van de ondertraverse om de bretellen te fixeren. Het binnenste circuit moet worden gefixeerd met twee post isolatoren.
- Mast 54 HC+0 – Toepassing van postisolatoren aan één zijde van de ondertraverse om de bretellen te fixeren. Het binnenste circuit moet worden gefixeerd met twee post isolatoren. De positie van het aangrijpingspunt van de geleider aan de boventraverse moet 1,5m naar binnen worden verschoven;
- Mast 69 HC+0T – Toepassing van postisolatoren aan één zijde van de ondertraverse om de bretellen te fixeren. Het binnenste circuit moet worden gefixeerd met twee post isolatoren. Het aangrijpingspunt van de bliksemdraad aan de boventraverse moet 0,3m horizontaal naar buiten worden verschoven;
- Mast 83 HC+0 - Toepassing van postisolatoren aan één zijde van de ondertraverse om de bretellen te fixeren. Het binnenste circuit moet worden gefixeerd met twee post isolatoren. Het aangrijpingspunt van de bliksemdraad aan de boventraverse moet 0,3m horizontaal naar buiten worden verschoven.

Bovenstaande maatregelen zijn het meest relevant voor de constructieve analyse die dit rapport bevat. Zie rapportage "KIJ-GT380 - E-studie deel 1" [2] voor een complete lijst van de benodigde aanpassingen.

1.3.3 Uitgangspunten rapport

De uitgangspunten op basis waarvan de berekeningen in deze rapportage zijn uitgevoerd zijn opgenomen in het rapport “Uitgangspuntenrapport 380kV verbinding Krimpen aan den IJssel - Geertruidenberg” [3]

2 EISEN

In onderstaande Tabel 1 zijn de eisen opgenomen die binnen deze rapportage worden getoetst.

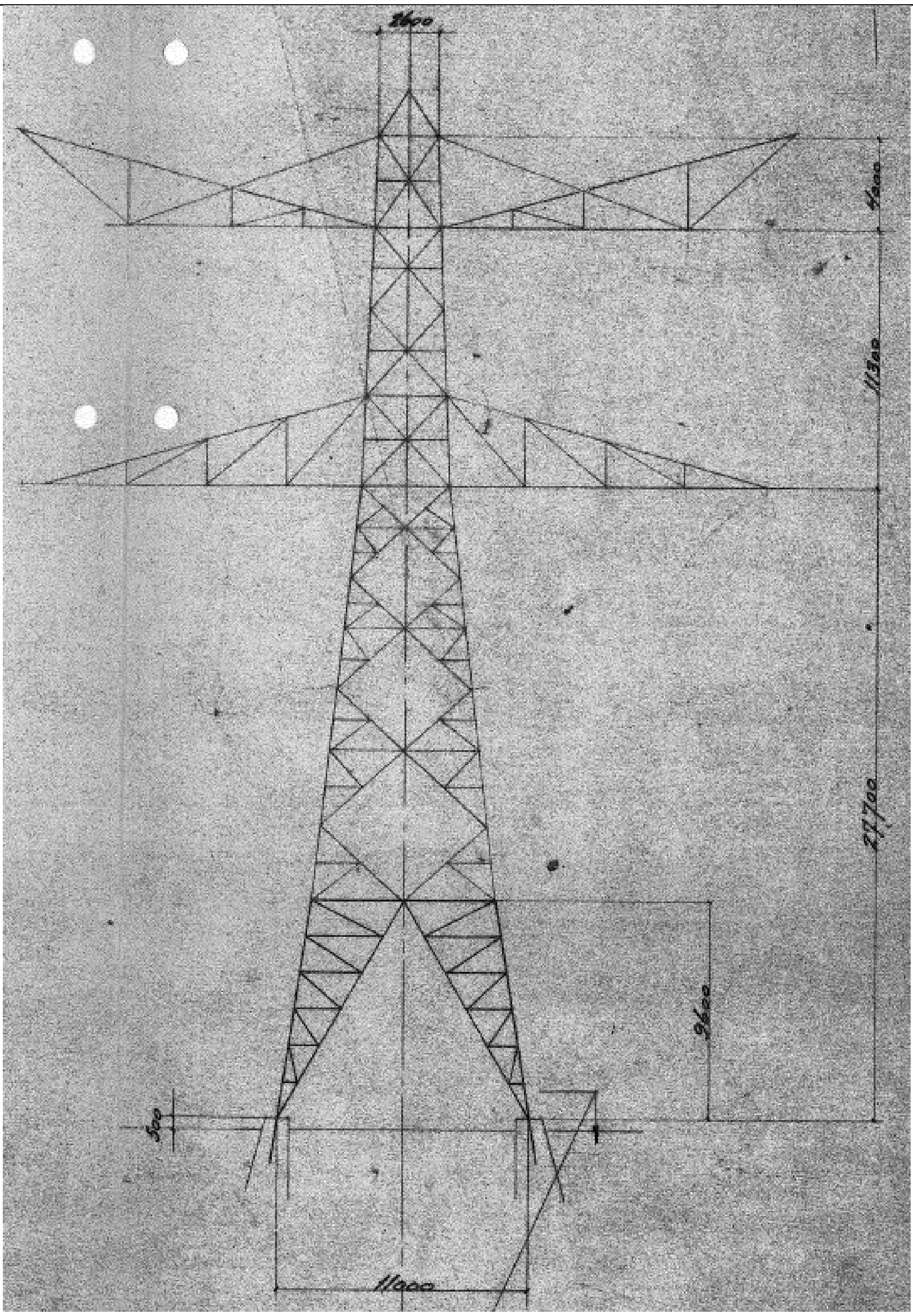
Tabel 1 Relevante eisen

Eis Id	Titel	Eis Tekst	Bewijsvoering
BO Eis: H2.7-6	Omgeving, beperkings factoren	Het ontwerp dient geverifieerd te worden op de uitvoerbaarheid.	Tabel 13
PVE.05.001 5.14	Masten	Aanwijzingen t.a.v. klimvoorziening en valbeveiliging: Huidige klimweg blijft gehandhaafd en zal voldoen aan de eisen zoals opgenomen in de NEN 1060:1977. Valbeveiliging is/zal worden uitgevoerd in het type "latch way". Indien staaldelen in de nabijheid (aangrenzend profiel) van de klimweg gewijzigd worden, dient geverifieerd te worden dat de klimvoorziening in overeenstemming is met de NEN 1060:1977.	Tabel 13

3 BEREKENINGEN

3.1 Mastbeeld

Het mastbeeld op basis van de Asset-data is weergegeven in Figuur 1.



Figuur 1 Mastbeeld HC+0

3.2 Mastenlijst

In deze rapportage worden masttypen HC+0 en HC+0T getoetst. Er zijn vijf masten van het type HC+0 en één mast van het type HC+0T. De geometrie en de constructie van de masttypen HC+0 en HC+0T komen met elkaar overeen, alleen beschikt de mast van het type HC+0T over een extra telecominstallatie. Drie masten van het type HC+0 (mast 2, 15 en 38) staan in windgebied II, de overige twee masten (mast 54 en 83) staan in windgebied III. De mast van het type HC+0T (mast 69) staat ook in windgebied III.

Bij de masten is rekening gehouden met verhoogde windbelasting als gevolg van een hogere aangrenzende mast (hoger is een negatieve waarde). De wind en weight span van de verschillende masten zijn in Tabel 2 weergegeven.

Binnen de masten van het type HC+0 kan geen van de masten worden aangewezen als maatgevend, om deze reden worden alle masten locatie specifiek geanalyseerd.

Tabel 2 Mastnummers

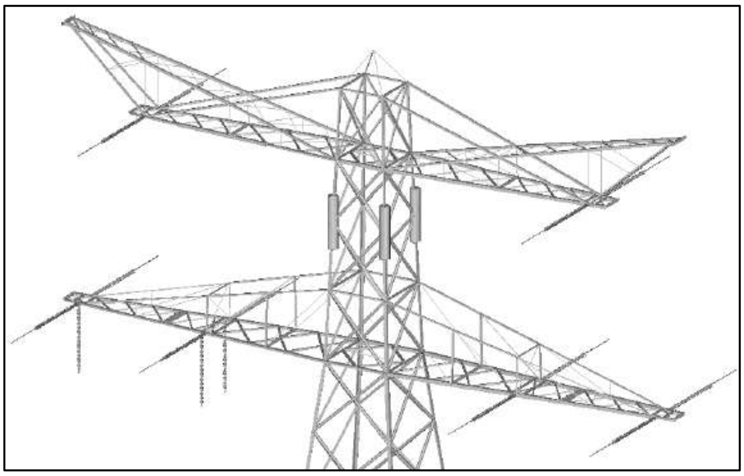
Mastnummer	Masttype	Maatgevend mastnummer	Wind span (m)	Weight span (m)	Hoogteverschil
2	HC+0	**2**	221	222	0.1
15	HC+0	**15**	381	287	-28.8
38	HC+0	**38**	363	362	0.2
54	HC+0	**54**	481	287	-75.1
69	HC+0T	**69**	334	249	-23.1
83	HC+0	**83**	377	195	-44.6

3.3 Telecominstallatie

Mast 69 bevat een telecominstallatie ter plaatse van de ondertraverse. De gegevens van deze installatie zijn weergegeven in Tabel 3. De locatie van de installatie is weergegeven in Figuur 2.

Tabel 3 Gegevens telecominstallatie op mast 69

Object	Aantal	$A_{frontaal}$/m [m²/m]	$A_{frontaal}$ [m²]	Massa [kg]
Kathrein 80020892	3		1,02	45
Radio 2217 3 st + 1 Power 6302	3		0,21	52
Radio 2212 RRU	3		0,14	20
FTTA-box	3		0,11	15
Schotel 300 mm	1		0,07	25
Hybride kabel (22mm) 3x	per m	0,07		4,5
Voeding KPN 3x1 13mm	per m	0,04		0,9
RG214-50 1x1	per m	0,01		0,2
Bevestigingsbuis 60.3 x 5 mm	6m		0,36	42
Bevestigingsbuis 60.3 x 5 m	6m		0,36	42
Totaal		0,085 m^2/m	2,3 m^2	255 kg



Figuur 2 Positie telecominstallatie op mast 69

3.4 Uitgangspunten berekening

De berekening is uitgevoerd op basis van de uitgangspunten zoals opgenomen in het uitgangspuntenrapport [3]. Hierin is een volledig overzicht opgenomen van de belastingcombinaties en toegepaste belastingfactoren

Tabel 4 Uitgangspunten berekening

Algemeen	Norm	NEN-EN50341-2-15:2019
	Windgebied	II - Mast 2, 15, 38
		III - Mast 54,69, 83
	Terreincategorie	II (onbebouwde omgeving)
	Reductiefactor cdir	1,00
Situatie initieel	Gevolgklasse	CC2-0
	Betrouwbaarheidsniveau	Afkeur CC2-0
	Referentieperiode	30 jaar
Situatie na aanpassingen	Gevolgklasse	CC2
	Betrouwbaarheidsniveau	Verbouw
	Referentieperiode	50 jaar

3.5 Proces stappen

Het proces van het bepalen van eventueel benodigde verstevigingen bestaat uit de volgende stappen:

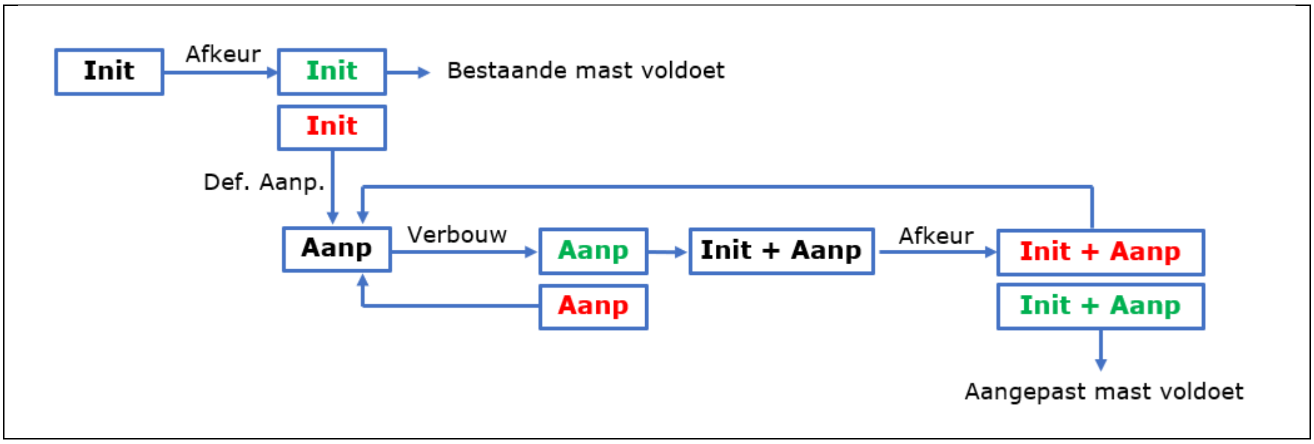
Stap 1: Toets bestaande (Init) mast op Afkeur

Stap 2: Definiëren benodigde aanpassingen indien initiële mast niet voldoet aan toets op Afkeur (Def. Aanp.)

Stap 3: Het toetsen van (alleen) de uitgewerkte aanpassingen (Aanp) op Verbouw

Stap 4: Het opnieuw toetsen van de complete mast inclusief aanpassingen (Initi + Aanp) op Afkeur

Het hierboven omschreven proces is in Figuur 3 weergegeven.



Figuur 3 Proces diagram

3.6 Geleiderbelastingen

De berekening is uitgevoerd met het geleiderbelastingenprogramma van DNV GL. In Appendix A zijn de resultaten van de geleiderbelastingen samengevat.

3.7 Reacties op de fundering

De oplegreacties op de fundering worden ontleend aan de uitvoer van het geleiderbelastingenprogramma, zie ook Appendix A.

3.8 Modellering

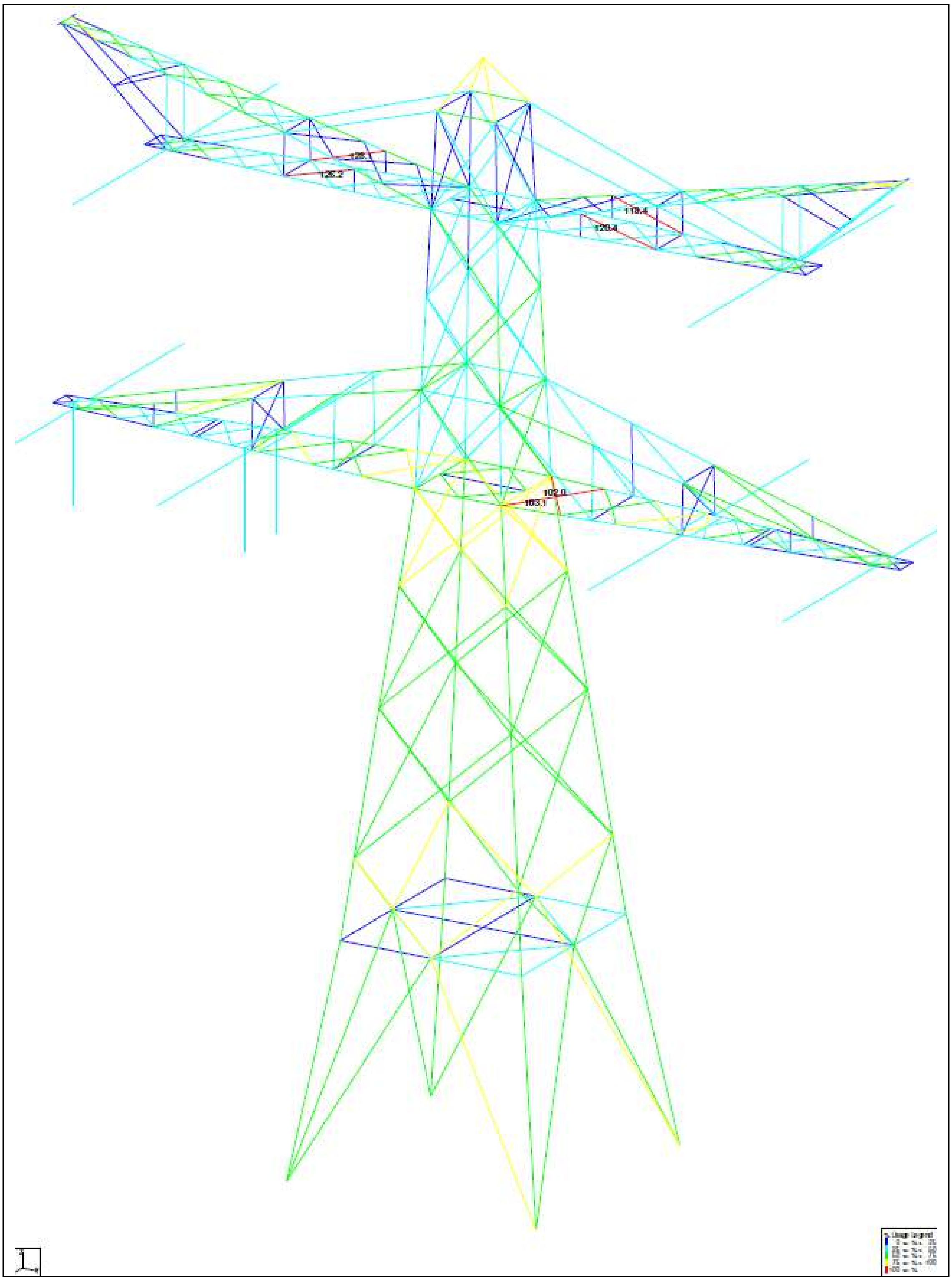
Op basis van de as-built tekeningen is de mast in PLS-TOWER ingevoerd. De hoofdelementen zijn gemodelleerd. Niet-dragende profielen als knikverkorters zijn weggelaten en worden separaat getoetst. De profielen inclusief de boutverbindingen zijn in PLS-TOWER ingevoerd en getoetst. Aan de hand van een FEM-analyse is bepaald wat de effecten zijn van het aanpassen van het aangrijpingspunt van de geleider en de bliksemdraad op de boventraverse. Controle van de schetsplaten en andere detailverbindingen valt buiten de scope.

De geleiderbelastingen vanuit het geleiderbelastingenprogramma zijn als invoer voor de belastingen gebruikt.

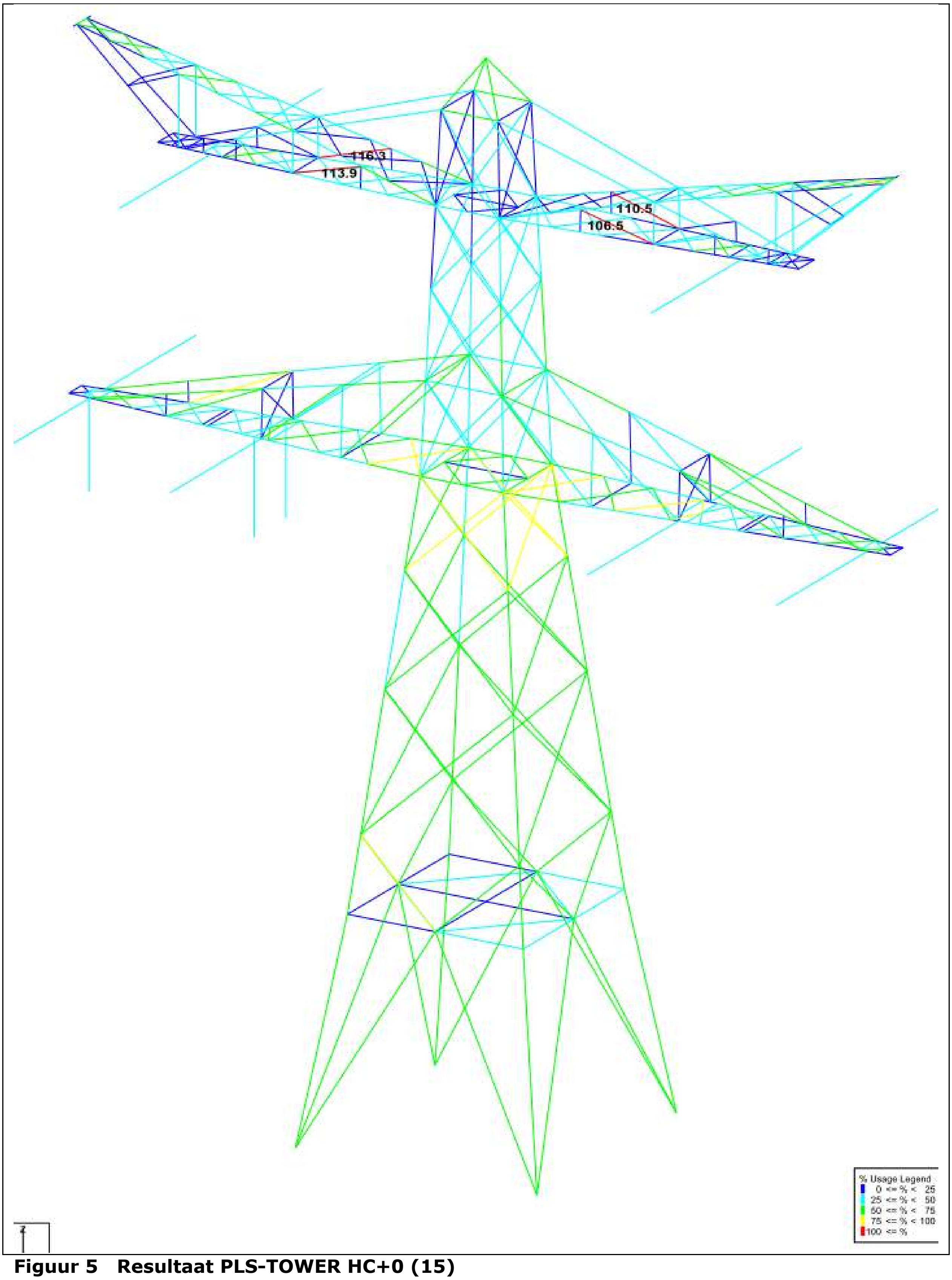
Diagonalen in voor- en achtervlak respectievelijk de twee zijvlakken zijn samengenomen in een groep en de toetsing wordt per staafgroep uitgevoerd. Ingeval dat een element uit een groep is overbelast, geldt dit voor alle elementen uit de betreffende groep.

4 TOETSING MAST

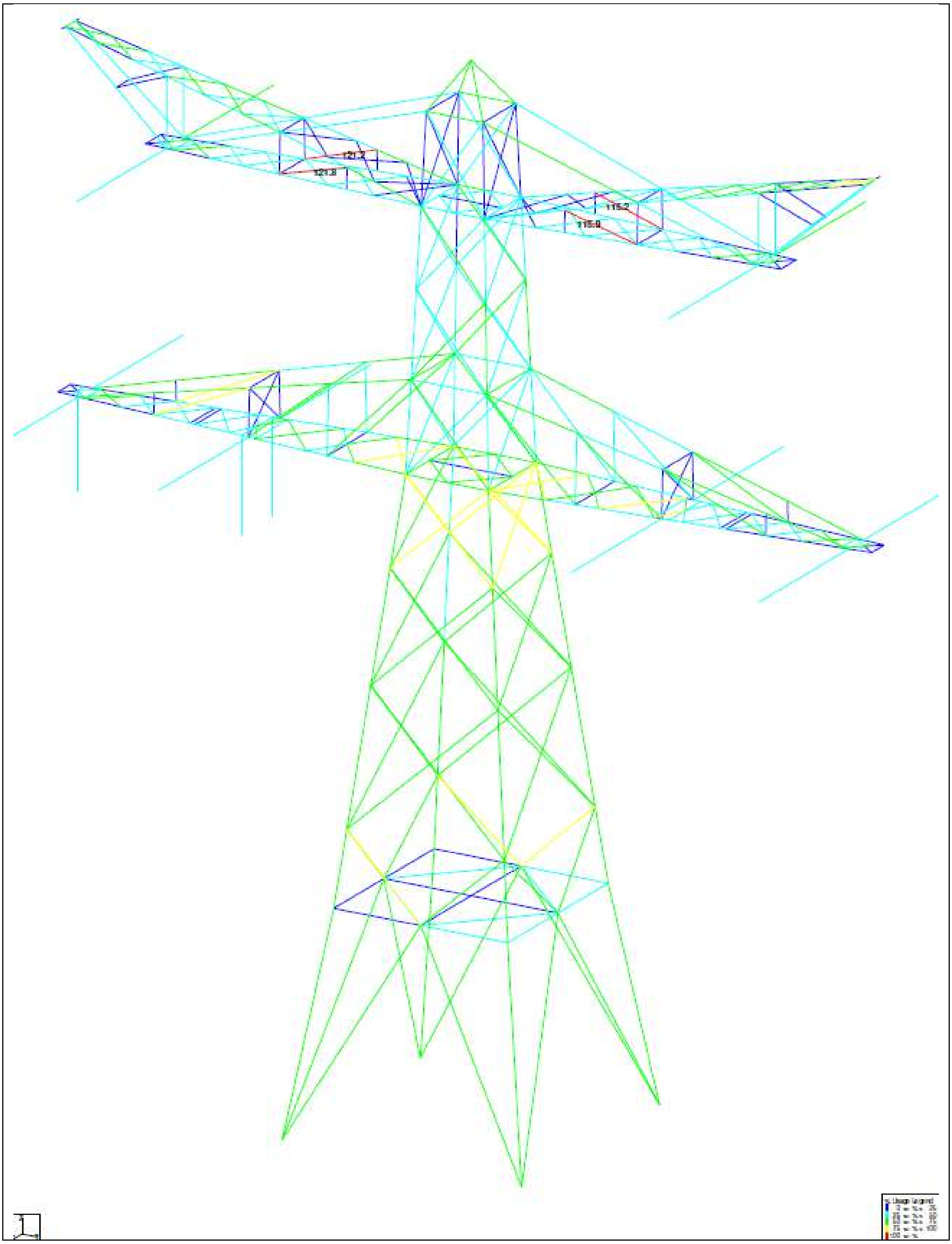
Het resultaat van de controle van de mastconstructie type HC+0 en HC+0T met belastingen op afkeurniveau is weergegeven in Figuur 4 tot Figuur 9.



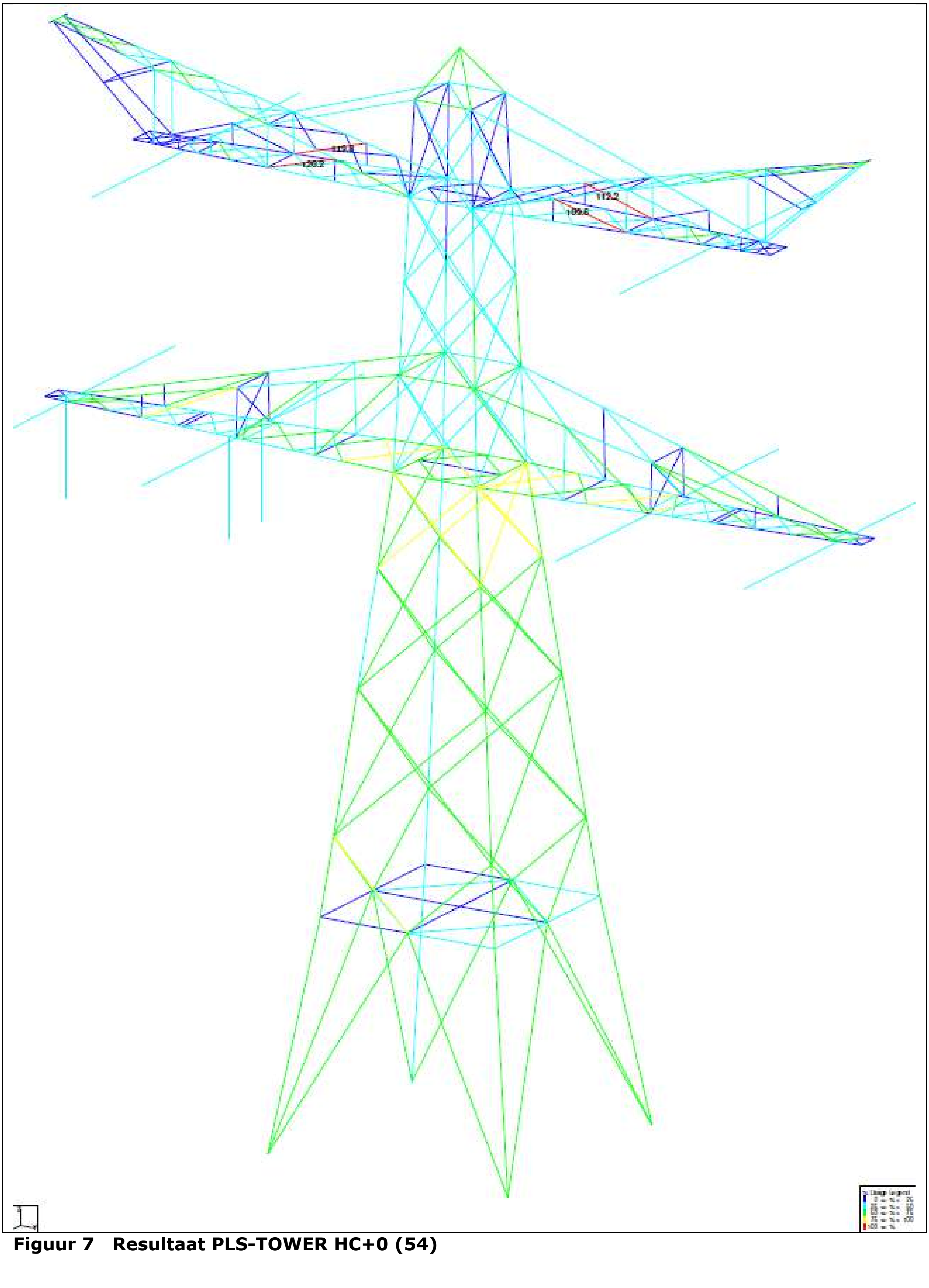
Figuur 4 Resultaat PLS-TOWER HC+0 (2)



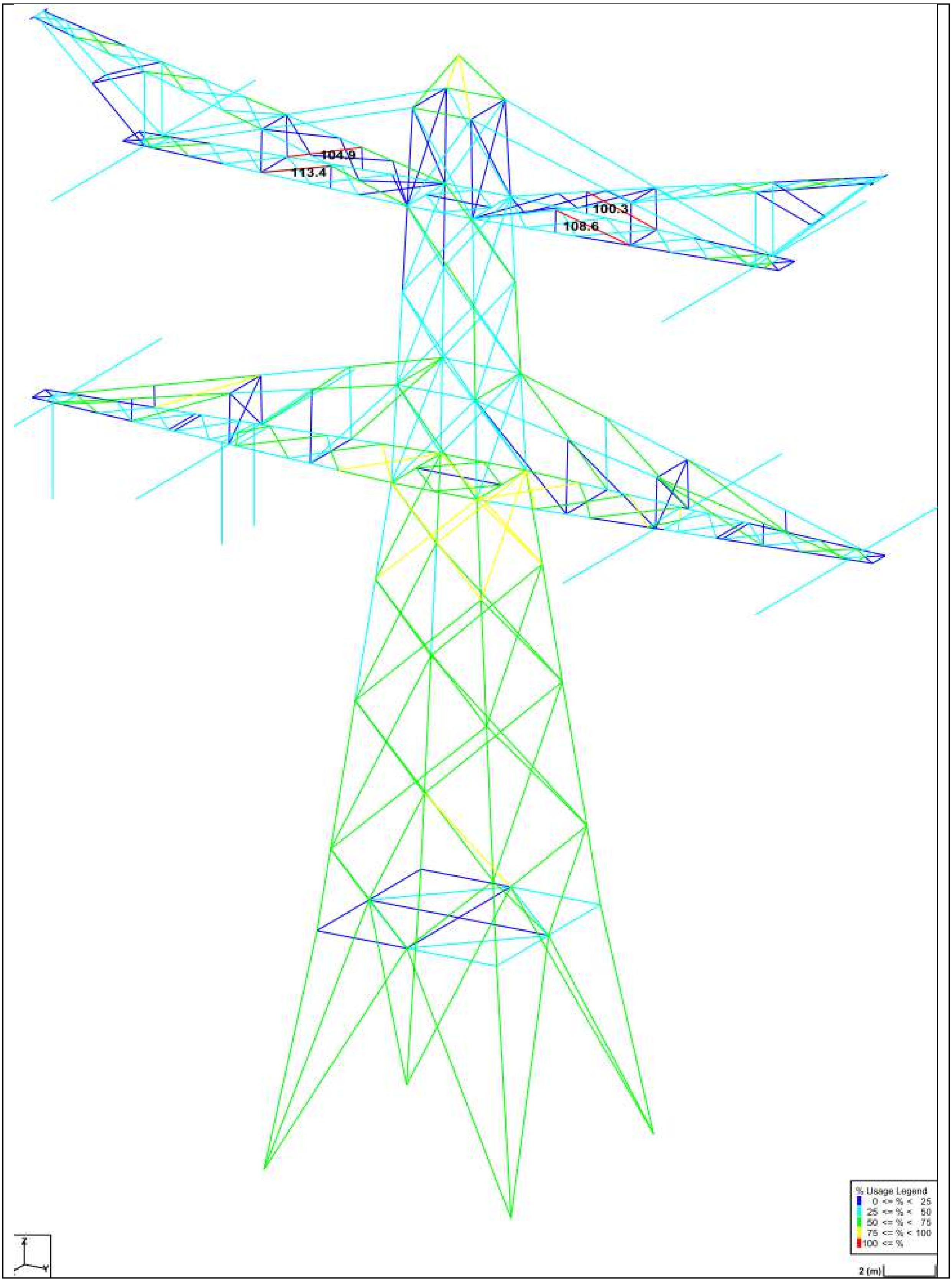
Figuur 5 Resultaat PLS-TOWER HC+0 (15)



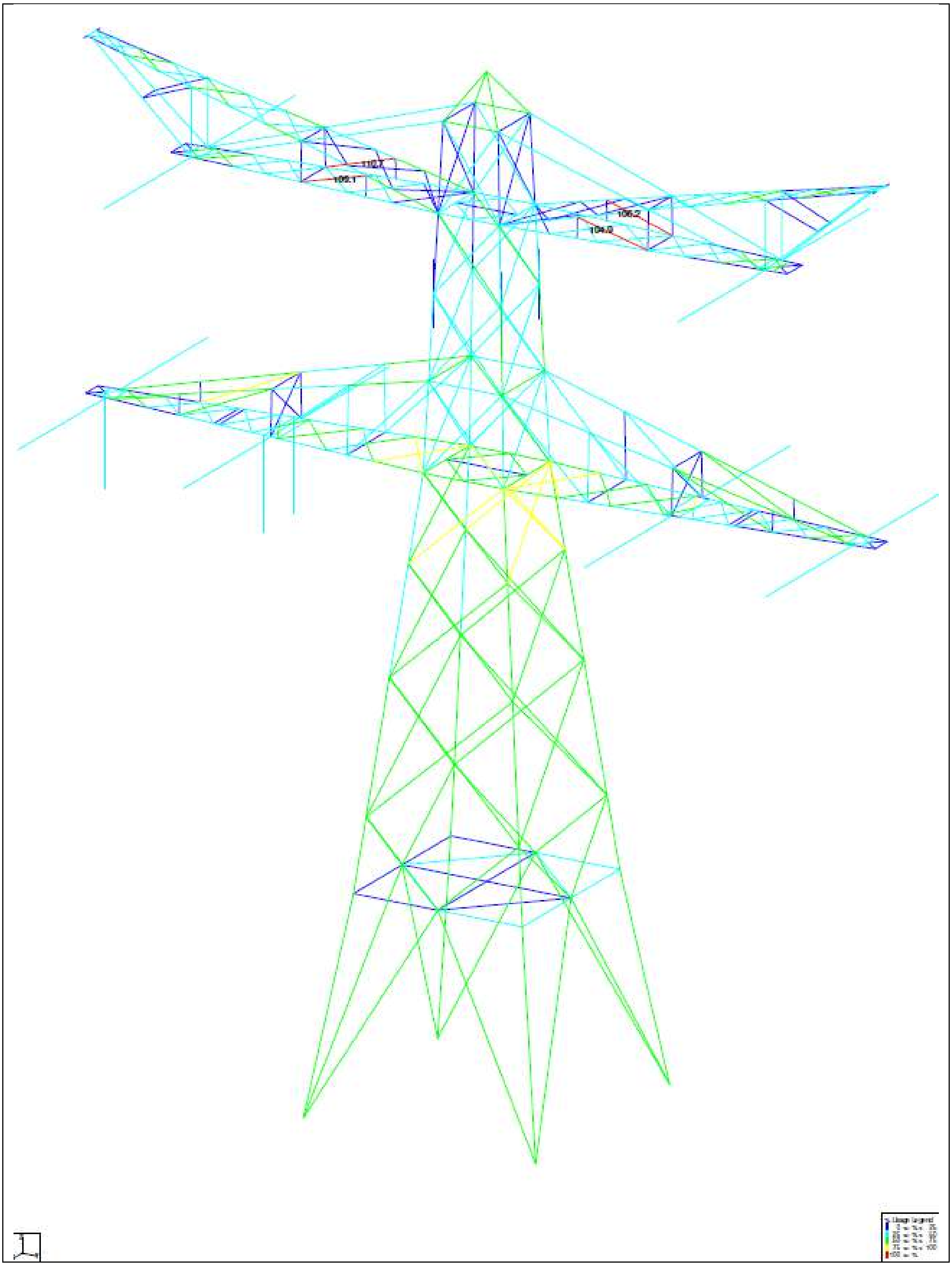
Figuur 6 Resultaat PLS-TOWER HC+0 (38)



Figuur 7 Resultaat PLS-TOWER HC+0 (54)



Figuur 8 Resultaat PLS-TOWER HC+0 (83)



Figuur 9 Resultaat PLS-TOWER HC+0T (69)

De resultaten van de controles van profielen, knikverkorters en ankers randstijl zijn opgenomen in Tabel 5.

Tabel 5 Samenvatting controle

Controle van	Beoordeling		Referentie
Profielen		Voldoen niet	Figuur 4 Figuur 5 Figuur 6 Figuur 7 Figuur 8 Figuur 9
Knikverkorters	Voldoen		Appendix C
Ankers en voetplaat	Voldoen		Appendix D

5 AANPASSINGEN

5.1 Inleiding

Een versterkingsvoorstel om de mast aan afkeurniveau te laten voldoen en nieuwe onderdelen aan verbouwniveau is uitgewerkt. In Tabel 6 zijn de benodigde aanpassingen per mast samengevat.

Tabel 6 Samenvatting aanpassingen per mast voor type HC+0 en HC+0T

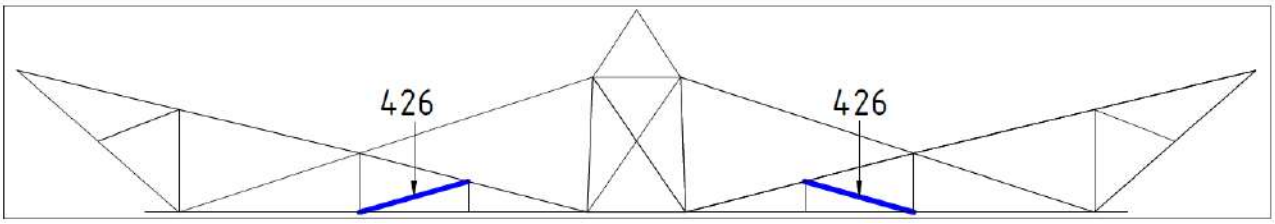
Tower nr.	Vervanging diagonal zijvlak boventraverse	Aanpassing aangrijpingspunt bliksemdraad	Aanpassing aangrijpingspunt geleider	Vervanging bouten diagonaal ondervlak ondertraverse	Toepassing postisolatoren voor fixatie bretelle
2	x			x	x
15	x		x		x
38	x				x
54	x		x		x
83	x	x			x
69T	x	x			x

De aanpassing van het aangrijpingspunt van de geleider en de bliksemdraad zijn vereist vanuit de E-studie.

5.2 Aanpassingen

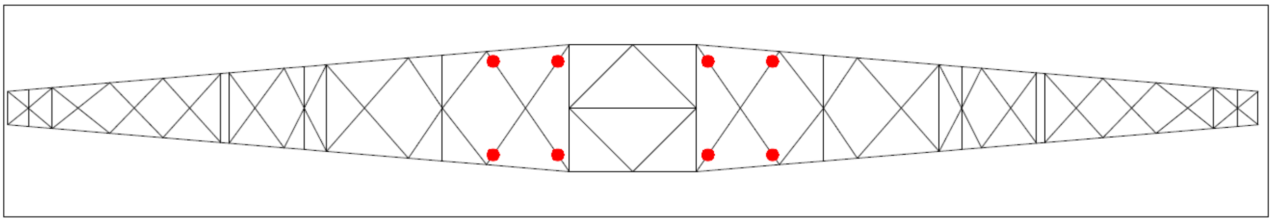
Conform berekening, zie Appendix B, moet er een diagonaal uit het zijvlak van de boventraverse worden vervangen. Deze aanpassing geldt voor alle masten van het type HC+0 en HC+0T.

In Figuur 10 is de betreffende diagonaal weergegeven. Voor afmetingen profielen en bouten, zie Appendix E.



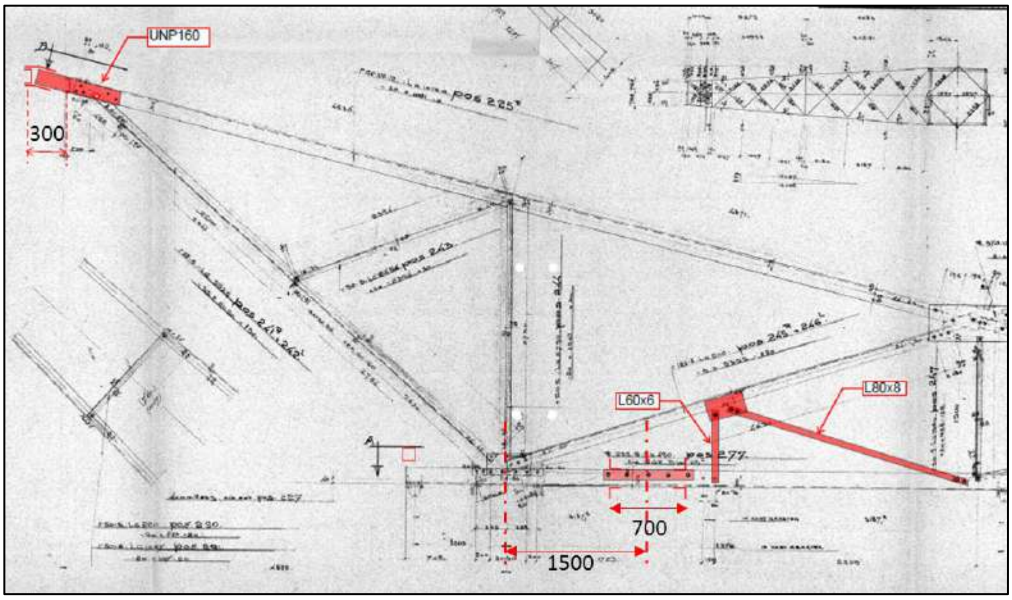
Figuur 10 Vooraanzicht boventraverse met te vervangen diagonalen

Van een aantal diagonalen in het ondervlak van de ondertraverse van mast 2 moeten de bouten worden vervangen, zoals weergegeven in Figuur 11.



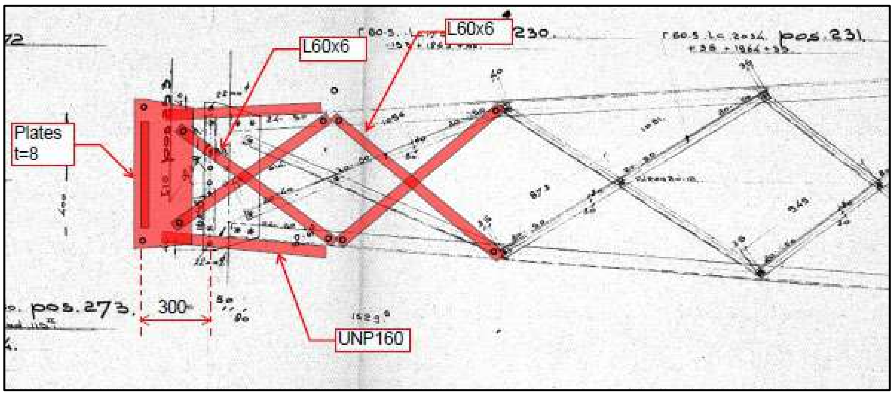
Figuur 11 Vervanging bouten diagonaal ondervlak ondertraverse mast 2

De E-studie heeft aangetoond dat het noodzakelijk is om het aangrijpingspunt van de bliksemdraad aan mast 69 en 83 en het aangrijpingspunt van de geleider aan de boventraverse van mast 15 en 54 aan te passen. In Figuur 12 is weergegeven welke aanpassingen benodigd zijn in het zijvlak van de boventraverse. De aanpassingen aan de constructie ten gevolge van de verplaatsingen van de bliksemdraad en geleider zijn beide weergegeven in Figuur 12, echter gelden de aanpassingen voor de geleider alleen voor mast 15 en 54 en de aanpassingen voor de bliksemdraad alleen voor mast 69 en 83. Voor overzichten per mast, zie tekeningen in Appendix E.



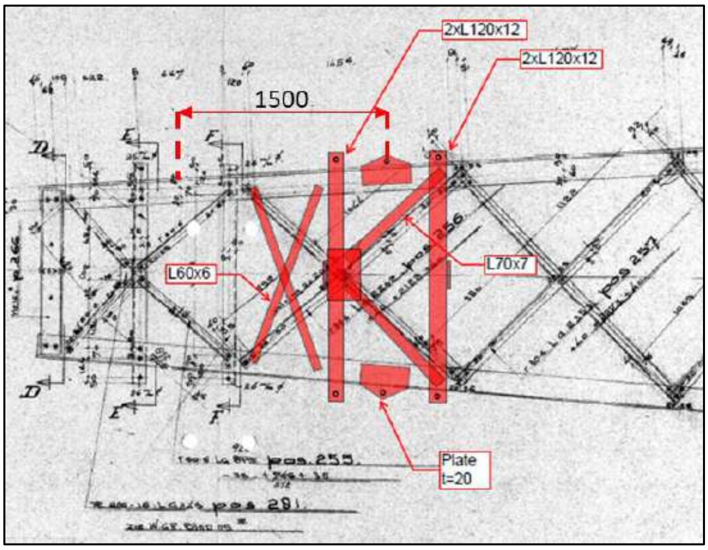
Figuur 12 Vooraanzicht boventraverse na aanpassing constructie ten gevolge van verplaatsing van aangrijpingspunten geleider en bliksemdraad

In Figuur 13 zijn de benodigde aanpassingen in de windverbanden in het bovenvlak van de boventraverse weergegeven om de aanpassing aan de bliksemdraad mogelijk te maken.



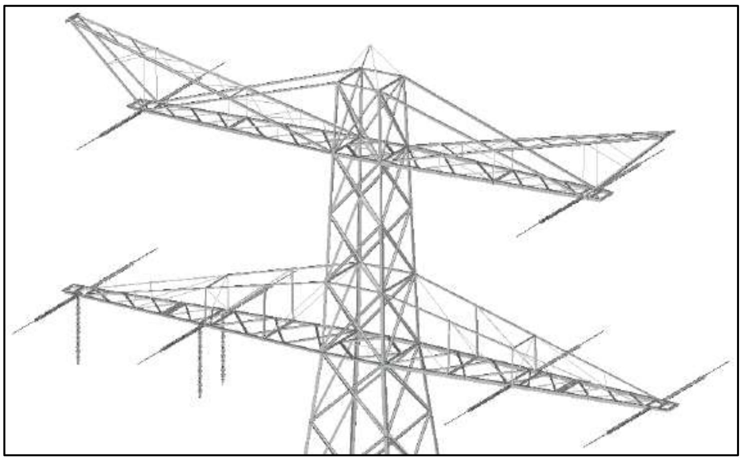
Figuur 13 Bovenaanzicht boventraverse met additionele verbanden voor aanpassing bliksemdraad

In Figuur 14 zijn de benodigde aanpassingen in de windverbanden in het ondervlak van de boventraverse weergegeven om de aanpassing aan de geleider mogelijk te maken.

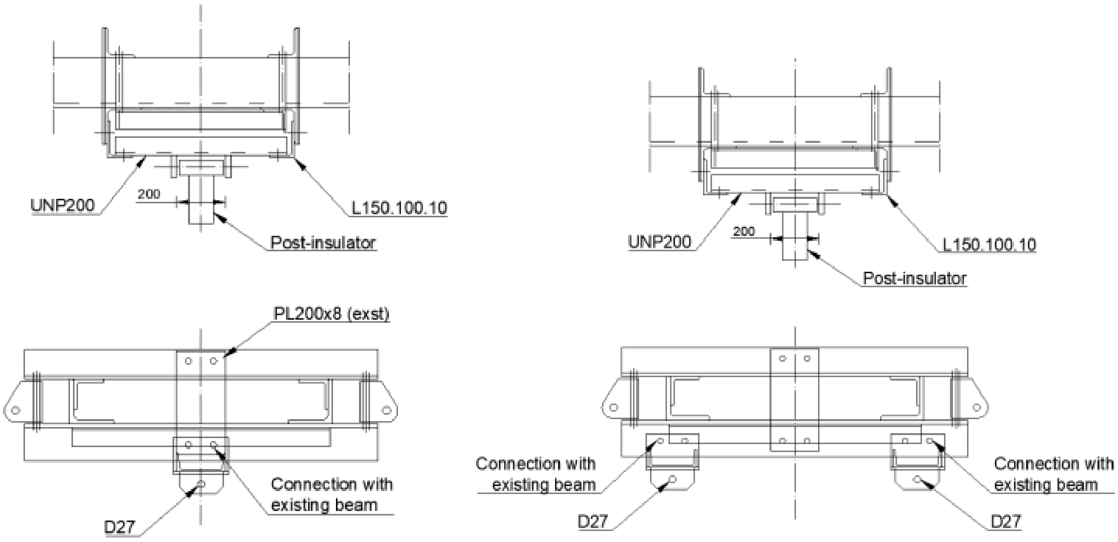


Figuur 14 Bovenaanzicht ondervlak boventraverse met additionele verbanden voor aanpassing geleider

Als laatste is het vanuit de E-studie een vereiste om de bretellen aan de ondertraverse te fixeren. De berekeningen met betrekking tot de verbinding van de postisolatoren aan de ondertraverse staan in Appendix D. Voor het binnenste circuit is het in sommige gevallen noodzakelijk om twee postisolatoren toe te passen. In Figuur 15 zijn de dubbele postisolatoren weergegeven. Een voorstel voor de verbinding van de postisolatoren aan de ondertraverse is weergegeven in Figuur 16.



Figuur 15 Postisolatoren ondertraverse mast 2, 15, 38, 54, 69 en 83



Figuur 16 Verbinding postisolatoren aan ondertraverse

Een overzicht van het nettogewicht van de profielen die nodig zijn voor de aanpassingen zijn weergegeven in Tabel 7 tot en met Tabel 12. Het gewicht van de onderdelen voor de verbinding van de postisolatoren en van eventueel benodigde schetsplaten is niet meegenomen.

Tabel 7 Gewichten profielen voor aanpassingen mast 2

Staafgroep	Profiel	Materiaal	Bouten	Profiel nw.	Materiaal nw.	Bouten nw.	Maatregel	Aantal	Lengte (m)	Gewicht (kg)
426	L50.5	S235	1M16-5.6t	L55.6	S355	1M16-8.8t	Profiel uitgewisseld	4	3.35	66.03
								4	**3.35**	**66.03**

Tabel 8 Gewichten profielen voor aanpassingen mast 15

Staafgroep	Profiel	Materiaal	Bouten	Profiel nw.	Materiaal nw.	Bouten nw.	Maatregel	Aantal	Lengte (m)	Gewicht (kg)
426	L50.5	S235	1M16-5.6t	L50.7	S355	1M16-8.8t	Profiel uitgewisseld	4	3.35	69.44
431				L120.12	S355	2M24-8.8t	Profiel toegevoegd	4	1.70	147.52
432				L120.12	S355	2M24-8.8t	Profiel toegevoegd	4	1.70	147.52
433				L70.7	S355	2M20-8.8t	Profiel toegevoegd	4	1.21	35.92
434				L60.6	S355	1M20-8.8t	Profiel toegevoegd	4	1.70	37.06
435				L80.8	S355	2M20-8.8t	Profiel toegevoegd	4	2.85	110.58
436				L60.6	S355	1M20-8.8t	Profiel toegevoegd	4	0.90	19.62
								28	**13.42**	**567.66**

Tabel 9 Gewichten profielen voor aanpassingen mast 38

Staafgroep	Profiel	Materiaal	Bouten	Profiel nw.	Materiaal nw.	Bouten nw.	Maatregel	Aantal	Lengte (m)	Gewicht (kg)
426	L50.5	S235	1M16-5.6t	L50.7	S355	1M16-8.8t	Profiel uitgewisseld	4	3.35	69.44
								4	**3.35**	**69.44**

Tabel 10 Gewichten profielen voor aanpassingen mast 54

Staafgroep	Profiel	Materiaal	Bouten	Profiel nw.	Materiaal nw.	Bouten nw.	Maatregel	Aantal	Lengte (m)	Gewicht (kg)
426	L50.5	S235	1M16-5.6t	L50.7	S355	1M16-8.8t	Profiel uitgewisseld	4	3.35	69.44
431				L120.12	S355	2M24-8.8t	Profiel toegevoegd	4	1.70	147.52
432				L120.12	S355	2M24-8.8t	Profiel toegevoegd	4	1.70	147.52
433				L70.7	S355	2M20-8.8t	Profiel toegevoegd	4	1.21	35.92
434				L60.6	S355	1M20-8.8t	Profiel toegevoegd	4	1.70	37.06
435				L80.8	S355	2M20-8.8t	Profiel toegevoegd	4	2.85	110.58
436				L60.6	S355	1M20-8.8t	Profiel toegevoegd	4	0.90	19.62
								28	**13.42**	**567.66**

Tabel 11 Gewichten profielen voor aanpassingen mast 83

Staafgroep	Profiel	Materiaal	Bouten	Profiel nw.	Materiaal nw.	Bouten nw.	Maatregel	Aantal	Lengte (m)	Gewicht (kg)
426	L50.5	S235	1M16-5.6t	L50.7	S355	1M16-8.8t	Profiel uitgewisseld	4	3.35	69.44
429	UNP160	S235	1M16-5.6t	UNP160	S355	1M16-8.8t	Profiel uitgewisseld	2	0.76	28.80
116				UNP160	S355	5M24-8.8t	Profiel toegevoegd	4	0.96	72.54
431				L60.6	S355	1M20-8.8t	Profiel toegevoegd	4	1.36	29.64
432				L60.6	S355	1M20-8.8t	Profiel toegevoegd	4	1.26	27.47
								18	**7.70**	**227.89**

Tabel 12 Gewichten profielen voor aanpassingen mast 69T

Staafgroep	Profiel	Materiaal	Bouten	Profiel nw.	Materiaal nw.	Bouten nw.	Maatregel	Aantal	Lengte (m)	Gewicht (kg)
426	L50.5	S235	1M16-5.6t	L50.6	S355	1M16-8.8t	Profiel uitgewisseld	4	3.35	60.19
429	UNP160	S235	1M16-5.6t	UNP160	S355	1M16-8.8t	Profiel uitgewisseld	2	0.76	28.80
116				UNP160	S355	5M24-8.8t	Profiel toegevoegd	4	0.96	72.54
431				L60.6	S355	1M20-8.8t	Profiel toegevoegd	4	1.36	29.64
432				L60.6	S355	1M20-8.8t	Profiel toegevoegd	4	1.26	27.47
								18	**7.70**	**218.65**

5.3 Eisen verificatie

De verificatie van de van toepassing zijnde eisen is uitgevoerd in onderstaande Tabel 13.

Tabel 13 Verificatie eisen

Eis Id	Eis Tekst	Ja	Nee	N.v.t.	toelichting
BO Eis: H2.7-6	Aanpassingen uitvoerbaar?	X			De toe te voegen staalonderdelen zijn met geboute verbindingen te bevestigen. Dit is een bewezen methode.
PVE.05.001 5.14	Staaldelen in nabijheid van klimweg gewijzigd?	X			De wijzigingen in de nabijheid van de klimweg (diagonalen) zijn in te passen zonder negatieve invloed op de begaanbaarheid.
	klimvoorziening nog in overeenstemming is met de NEN 1060:1964?			X	Geen wijzigingen

6 REFERENTIES

[1] „002.589.40 0817486 - 20-0473 - Verificatie & validatieplan 380kV verbinding Krimpen aan de IJssel - Geertruidenberg”.

[2] „002.589.40 0808624 - 20-0472 - E-studie deel 1 380kV verbinding Krimpen aan de IJssel - Geertruidenberg”.

[3] „002.589.40 0808629 - 20-0345 - Uitgangspuntenrapport 380kV verbinding Krimpen aan de IJssel - Geertruidenberg”.

APPENDIX A CONDUCTOR LOADS

Content

Data

Norm	NEN-EN50341-2-15:2019
Initial	
Consequence class	CC2-0
Reliability level	Afkeur
Reference period	30 jaar
After adjustment	
Consequence class	CC2
Reliability level	Verbouw
Reference period	50 jaar
Wind zone	II
Wind speed	27 m/s
Terrain categorie	II
Reduction factor Cdir	1,00
Ice region	B
Tower type	Hoekmast
Tower height	45 m
Max. Span	300 m
Line angle	129°
Catenary	1400 m
Wind span	221 m
EDS Weight span	221 m
Min. Weight span	219 m
Max. Weight span	223 m

ISSUE	DATE	REVISION	CHK'D	APP'D
0.0	2021-02-10			

Client: TenneT Taking power further

DNV·GL

Title:

Berekening masttype HC+0 II

JOB No.	-	DATE	-
DRAWN	-	CHKD	-
DESIGN	-	APPD	-

Document name:

KIJ-GT_HC+0 II_2_Report.pdf

Project number:

Project client number:

0.0

Project: KIJ-GT
Tower: HC+0 II
Number: 2

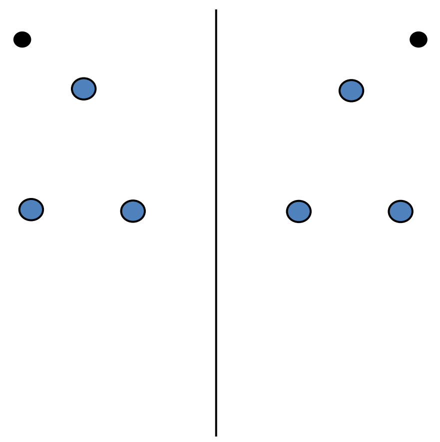
Conductor loads — Auteur: TBR, Versie: v11.6

General

Description	HC+0 II
Tower type	Hoekmast
Number of circuits	2
Configuration	2-circuit-donau
Number of earth wires	2

Starting points

Norm	NEN-EN50341-2-15:2019
Consequence class	CC2-0
Reliability level initial	Afkeur CC2-0
Reference period intial	30 jaar
Consequence class modified	CC2
Reliability level modified	Verbouw
Reference period modified	50 jaar
Wind zone	II
Terrain category	27,0 m/s
Reduction factor c_{dir}	II
Ice region phase conductor	1,00
Ice region earth conductor	B
	B



Configuratie geleiders

Conductors back

Description	Voltage	Conductor Back	Bundle Ba	Ice region	Additional weight	Additional diameter	Catenary P_{back}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Conductors ahead

Description	Voltage	Conductor Ahead	Bundle Ah	Ice region	Additional weight	Additional diameter	Catenary P_{ahead}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Insulators *(1)*

Description	Suspension	Weight [kN]	Length [m]	Wind area [m^2]
Circuit 1	Afspanketting	2,00	4,83	1,00
Circuit 2	Afspanketting	2,00	4,83	1,00
Bliksemdraad 1	Vast (Bliksemdraad)	0,10	0,30	0,05
Bliksemdraad 2	Vast (Bliksemdraad)	0,10	0,30	0,05

1. Properties apply to the entire isolator set

Suspension height and position in mast

Circuits	Designation	Number	Suspension height	Attach point	Position in tower Horizontal distance
Circuit 1	21	380ct1f1	27,7 m	27,7 m	17,7 m
Circuit 1	20	380ct1f2	27,7 m	27,7 m	9,5 m
Circuit 1	22	380ct1f3	39,0 m	39,0 m	13,6 m
Circuit 2	10	380ct2f1	27,7 m	27,7 m	-17,7 m
Circuit 2	11	380ct2f2	27,7 m	27,7 m	-9,5 m
Circuit 2	12	380ct2f3	39,0 m	39,0 m	-13,6 m
Bliksemdraad 1	1	bl1	42,9 m	43,2 m	-18,4 m
Bliksemdraad 2	3	bl2	42,9 m	43,2 m	18,4 m

Project: KIJ-GT
Tower: HC+0 II
Number: 2

Height adjustment adjacent masts (wind and weight span adjustment)

	Back		Ahead		
Height increase for wind pressure	0,0	m	0,0	m	(positive: higher)
Height decrease for vertical load	0,0	m	0,0	m	(negative: decrease, more weight span)

Decrease: Niet in 0,9EG-combinaties

Height difference adjacent tower and change of direction with respect to Line direction

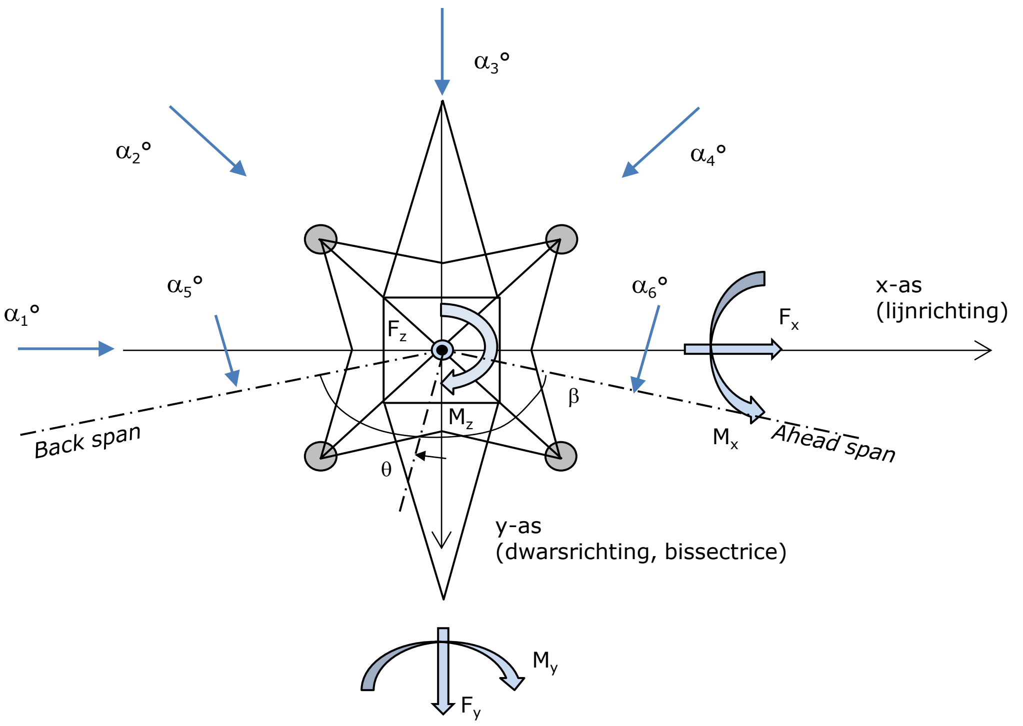
			Hoogteverschil		Richtingsverandering	
Circuits	Aanduiding	Nummer	Δh_back	Δh_ahead	Δy_back	Δy_ahead
Circuit 1	21	380ct1f1	0,2	-0,3 m	0,0	0,0 m
Circuit 1	20	380ct1f2	0,2	-0,3 m	0,0	0,0 m
Circuit 1	22	380ct1f3	0,2	-0,3 m	0,0	0,0 m
Circuit 2	10	380ct2f1	0,2	-0,3 m	0,0	0,0 m
Circuit 2	11	380ct2f2	0,2	-0,3 m	0,0	0,0 m
Circuit 2	12	380ct2f3	0,2	-0,3 m	0,0	0,0 m
Bliksemdraad 1	1	bl1	0,2	-0,3 m	0,0	0,0 m
Bliksemdraad 2	3	bl2	0,2	-0,3 m	0,0	0,0 m

Line and tower data

		Back	Ahead
		142,0	300,0 m
Ruling span $\sqrt{(\Sigma L^3/\Sigma L)}$		142,0	300,0 m
Line angle	β	129 °	
Tower orientation with respect to bis	θ	0 °	
Section length		142	300 m
Height bottom of tower to ground level		0,5 m	
Wind directions considered	α_1	0 °	
Wind directions according to:	α_2	45 °	
Geleiderbelastingen	α_3	90 °	
	α_4	135 °	
	α_5	64,5 °	
	α_6	115,5 °	

Wind directions apply to the main direction of mast construction, not to the bisector.

Windrichtingen en positieve richtingen belastingen



Considered number of wind directions	
1a	6
3	6
4	1
6	1
Overig	1

Project: KIJ-GT
Tower: HC+0 II
Number: 2

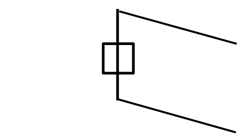
Absence of conductors

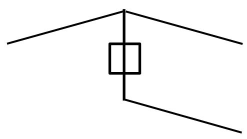
		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	380ct1f1	1	0	1	0	1	0
Circuit 1	380ct1f2	1	0	1	0	1	0
Circuit 1	380ct1f3	1	0	1	0	1	0
Circuit 2	380ct2f1	0	1	1	0	1	0
Circuit 2	380ct2f2	0	1	1	0	1	0
Circuit 2	380ct2f3	0	1	1	0	1	0
Bliksemdraad 1	bl1	1	0	1	0	1	0
Bliksemdraad 2	bl2	0	1	1	0	1	0

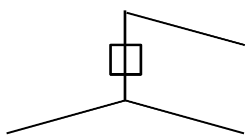
Load situations SPLS

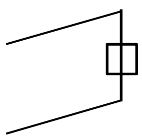
Considered situations SPLS: 1 up to 6, All possible situations

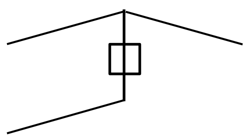
Principle of load situations:

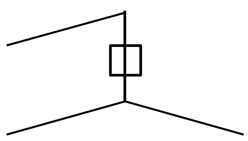

1. Ba All cts


2. Ba ct1


3. Ba ct2


4. Ah All cts

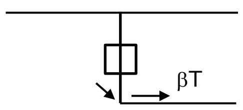

5. Ah ct1


6. Ah ct2

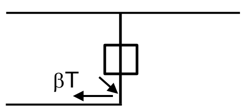
Load situation 5a. Conductor failure

Considered situations conductor failure 5a: 1, design assumption is symmetry back and ahead

Principle of load situations:



1. Ba



2. Ah

Project: KIJ-GT
Tower: HC+0 II
Number: 2

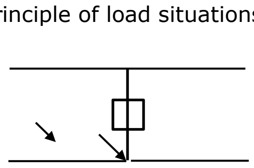
Load situations LC6. Construction and maintenance
Under 6a, the load due to the presence of a line verhicle or line bicycle in combination with point load on the traverse is assesed.
Combination 6b does not contain any loads in conductor or on traverse. This combination has been added to be able to combine with separate control platforms, etc. The situations are applied in ULS and in every SPLS situation (in case of angle tower).

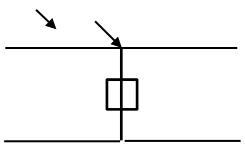
3,0 kN	2,0 kN
1,0 kN	1,0 kN

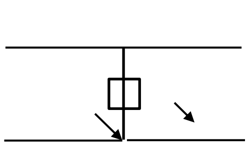
Considered situations construction and maintenance 6a: 1 up to 4, all possible situations

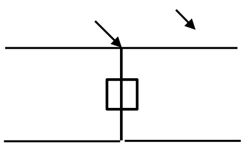
Presence line vehicle: Circuit, load present in all conductors of a circuit

Principle of load situations:


1. Ba Ct1


2. Ba Ct2


3. Ah Ct1


4. Ah Ct2

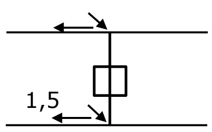
Load situations 8. Galloping as a static load

Conductor		
Suspension tower phase	0,866 W	1,5 W
Suspension tower earth	1,5 EDS	1,5 W
Strain tower phase and earth	1,5 EDS	1,5 W

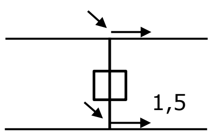
Considered situations galloping 8: None (existing structure)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principle of load situations:



1. Ba



2. Ah

Load combination 8. Galloping as a dynamic load
Only applies to tension towers
Load consists of EDS tensile load in one of the conductors on one side of the tower
Can be converted by user to fatigue spectrum via the load spectrum of table 4.11 / NL.1

Project: KIJ-GT
Tower: HC+0 II
Number: 2

Tower structure

Properties

Tower type	Hoekmast	
Tower designation	HC+0 II	
Base plate w.r.t. ground level	0,5	m
Tower height w.r.t. base plate	45,0	m
Tower self weight	425,0	kN

Width and slope at foundation	x-ri.	y-ri.	
Leg spread	11,00	11,00	m
Inclination of main leg	0,156	0,156	-
Horizontal force factor	1,1	1,1	-

Calculation Wind load

Dynamic factor G_T	1,00 *(Masthoogte < 60 m)*
Wind load diagonally to tower body proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Wind load diagonally on traverse proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Magnification factor diagonal wind to tower body	(1+0,2sin^2(2phi))
Magnification factor diagonal wind to cross arm	(1+0,2sin^2(2phi))
Magnification factor wind parallel to perpendicular to cross a	0,4

Properties mast sections longitudinal direction (front view, yz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	9,60	11,00	8,00	9,60	0,156	91,20	11,46	0,13	3,28
Middenstuk 1	18,90	8,00	5,84	9,30	0,116	64,36	10,66	0,17	3,08
Middenstuk 2	27,70	5,84	3,80	8,80	0,116	42,42	9,83	0,23	2,80
Bovenstuk 1	35,50	3,80	3,19	7,80	0,039	27,26	6,61	0,24	2,75
Bovenstuk 2	43,00	3,19	2,60	7,50	0,039	21,71	5,25	0,24	2,76
Topstuk	45,00	2,60		2,00		2,60	0,24	0,09	3,45
Ondertraverse	27,70	15,80		4,00		31,60	5,89	0,19	2,99
Boventraverse	39,00	16,95		4,20		35,60	7,55	0,21	2,88

Properties tower sections transversal direction (side view, xz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	9,60	11,00	8,00	9,60	0,156	91,20	11,46	0,13	3,28
Middenstuk 1	18,90	8,00	5,84	9,30	0,116	64,36	10,66	0,17	3,08
Middenstuk 2	27,70	5,84	3,80	8,80	0,116	42,42	9,83	0,23	2,80
Bovenstuk 1	35,50	3,80	3,19	7,80	0,039	27,26	6,61	0,24	2,75
Bovenstuk 2	43,00	3,19	2,60	7,50	0,039	21,71	5,25	0,24	2,76
Topstuk	45,00	2,60		2,00		2,60	0,24	0,09	3,45
Ondertraverse	27,70	15,80		4,00		31,60	5,89	0,19	2,99
Boventraverse	39,00	16,95		4,20		35,60	7,55	0,21	2,88

Note: Surface transverse direction is reduced in calculation.

DNV·GL

Project: KIJ-GT
Tower: HC+0 II
Number: 2

Wind surface feeders telecom installations

Part	A (m^2/m)	Factor	Δh	A_1
Broekstuk 1				
Middenstuk 1				
Middenstuk 2				
Bovenstuk 1				
Bovenstuk 2				

Input antennas

Description	A (m^2)	h (m)	C_f (m)
Antenne 1			
Schotel			
Schotel			

Tower section loads longitudinal (x-direction) per wind direction

Description	p_w	F_{x1}	F_{x2}	F_{x3}	F_{x4}	h_{ef}	M_{y1}	M_{y2}	M_{y3}	M_{y4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,85	32,0	27,1	0,0	-27,1	4,8	153,5	130,2	0,0	-130,2
Middenstuk 1	0,96	31,5	26,8	0,0	-26,8	14,3	449,3	381,2	0,0	-381,2
Middenstuk 2	1,12	30,7	26,0	0,0	-26,0	23,3	714,7	606,4	0,0	-606,4
Bovenstuk 1	1,22	22,3	18,9	0,0	-18,9	31,6	703,5	596,9	0,0	-596,9
Bovenstuk 2	1,29	18,7	15,9	0,0	-15,9	39,3	734,2	623,0	0,0	-623,0
Topstuk	1,33	1,1	0,9	0,0	-0,9	44,0	48,5	41,2	0,0	-41,2
Ondertraverse	1,19	41,9	24,9	0,0	-24,9	29,0	1216,5	722,6	0,0	-722,6
Boventraverse	1,30	56,6	33,6	0,0	-33,6	40,4	2288,5	1359,3	0,0	-1359,3
Totaal		234,8	174,1	0,0	-174,1		6308,6	4460,8	0,0	-4460,8

Tower section loads transversal (y-direction) per wind direction

Description	p_w	F_{y1}	F_{y2}	F_{y3}	F_{x4}	h_{ef}	M_{x1}	M_{x2}	M_{x3}	M_{x4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,85	0,0	27,1	32,0	27,1	4,8	0,0	130,2	153,5	130,2
Middenstuk 1	0,96	0,0	26,8	31,5	26,8	14,3	0,0	381,2	449,3	381,2
Middenstuk 2	1,12	0,0	26,0	30,7	26,0	23,3	0,0	606,4	714,7	606,4
Bovenstuk 1	1,22	0,0	18,9	22,3	18,9	31,6	0,0	596,9	703,5	596,9
Bovenstuk 2	1,29	0,0	15,9	18,7	15,9	39,3	0,0	623,0	734,2	623,0
Topstuk	1,33	0,0	0,9	1,1	0,9	44,0	0,0	41,2	48,5	41,2
Ondertraverse	1,19	0,0	24,9	16,8	24,9	29,0	0,0	722,6	486,6	722,6
Boventraverse	1,30	0,0	33,6	22,7	33,6	40,4	0,0	1359,3	915,4	1359,3
Total		0,0	174,1	175,7	174,1		0,0	4460,8	4205,6	4460,8

Resulting loads from mast construction incl. Antenna without conductors level foundation (char. Value)

Load / wind direction	F_x	F_y	F_z	M_x	M_y	M_z
	[kN]	[kN]	[kN]	[kNm]	[kNm]	[kNm]
Permanente belasting	0	0	425	0	0	0
Windrichting 0°	235	0	0	0	6309	0
Windrichting 45°	174	174	0	4461	4461	0
Windrichting 90°	0	176	0	4206	0	0
Windrichting 135°	-174	174	0	4461	-4461	0

Project: KIJ-GT
Tower: HC+0 II
Number: 2

Intermediate results for conductor loads

Conductors back

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Conductors ahead

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Vertical load back

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Vertical load ahead

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	[N/m]	[N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Insulators

Conductor	$G_{isolator}$ [kN]	Number -	$F_{v,iso}$ [kN]	Length [m]	Wind surf. [m^2]	Wind heigth [m]	Pressure [kN/m^2]	Drag factor [-]	$F_{h,iso}$ [kN]
380ct1f1	2,00	1	2	4,8	1,0	28,20	1,18	1,2	1,42
380ct1f2	2,00	1	2	4,8	1,0	28,20	1,18	1,2	1,42
380ct1f3	2,00	1	2	4,8	1,0	39,50	1,30	1,2	1,55
380ct2f1	2,00	1	2	4,8	1,0	28,20	1,18	1,2	1,42
380ct2f2	2,00	1	2	4,8	1,0	28,20	1,18	1,2	1,42
380ct2f3	2,00	1	2	4,8	1,0	39,50	1,30	1,2	1,55
bl1	0,10	0,5	0,05	0,3	0,1	43,40	1,33	1,2	0,08
bl2	0,10	0,5	0,05	0,3	0,1	43,40	1,33	1,2	0,08

Project: KIJ-GT
Tower: HC+0 II
Number: 2

Wind load back

Conductor	Height wind [m]	Pressure [kN/m²]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	27,1	1,17	0,62	0,74	1,05	28,25	64,2	76,4	46,9	121,7	144,9
380ct1f2	27,1	1,17	0,62	0,74	1,05	28,25	64,2	76,4	46,9	121,7	144,9
380ct1f3	38,4	1,29	0,65	0,77	1,02	28,25	72,0	85,2	46,9	140,5	166,2
380ct2f1	27,1	1,17	0,62	0,74	1,05	28,25	64,2	76,4	46,9	121,7	144,9
380ct2f2	27,1	1,17	0,62	0,74	1,05	28,25	64,2	76,4	46,9	121,7	144,9
380ct2f3	38,4	1,29	0,65	0,77	1,02	28,25	72,0	85,2	46,9	140,5	166,2
bl1	42,4	1,32	0,66	0,77	1,15	22,24	22,1	26,1	41,5	43,1	50,9
bl2	42,4	1,32	0,66	0,77	1,15	22,13	22,0	26,0	41,4	43,0	50,8

Wind load ahead

Conductor	Height wind [m]	Pressure [kN/m²]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	22,7	1,11	0,60	0,64	1,07	28,25	60,3	64,0	46,9	112,7	119,5
380ct1f2	22,7	1,11	0,60	0,64	1,07	28,25	60,3	64,0	46,9	112,7	119,5
380ct1f3	34,0	1,24	0,64	0,67	1,03	28,25	69,3	73,4	46,9	133,8	141,7
380ct2f1	22,7	1,11	0,60	0,64	1,07	28,25	60,3	64,0	46,9	112,7	119,5
380ct2f2	22,7	1,11	0,60	0,64	1,07	28,25	60,3	64,0	46,9	112,7	119,5
380ct2f3	34,0	1,24	0,64	0,67	1,03	28,25	69,3	73,4	46,9	133,8	141,7
bl1	38,2	1,28	0,65	0,68	1,16	22,24	21,4	22,6	41,5	41,4	43,8
bl2	38,2	1,28	0,65	0,68	1,16	22,13	21,3	22,5	41,4	41,3	43,7

		Auteur:	TBR
Conductor loads		Versie:	v11.6

Starting points

Consequence class	Afkeur CC2-0
Reference period	30 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp °C	γ_G $G_{k,mast}$	γ_G $G_{k,geleider}$	Q_{pk}	γ_Q Q_{wk}	Q_{ik}	γ_a A_k
ULS 1a	Wind	10°	1,05	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,12	0,00	0,0
ULS 3	Wind+ice	-5°	1,05	1,05	0,00	0,34	0,97	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,05	0,00	0,34	0,97	0,0
ULS 4	Cold+wind	-20°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,05	0,00	0,22	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,05	1,05	1,20	0,22	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 7	Permanent	10°	1,15	1,15	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G G_k	γ_Q Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,05	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,05	1,05	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,05	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,05	1,05	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,05	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,05	1,05	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,05	1,05	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	0,94	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,28	0,88	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	6
Number of load combinations for ULS	46
Number of load combinations for SPLS	222
Number of load combinations for SLS	15
Number of concentrated loads	5377

Project: KIJ-GT
Tower: HC+0 II
Number: 2

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift
Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-32,5	29,8	15,8	17,7	4,4	5,3
380ct1f1	-97,4	100,8	50,2	57,8	10,2	14,2
380ct1f2	-97,4	100,8	50,2	57,8	10,2	14,2
380ct1f3	-99,6	104,0	53,0	63,1	10,2	14,2
380ct2f1	-97,4	100,8	50,2	57,8	10,2	14,2
380ct2f2	-97,4	100,8	50,2	57,8	10,2	14,2
380ct2f3	-99,6	104,0	53,0	63,1	10,2	14,2
bl2	-32,7	29,9	16,0	17,7	4,4	5,3
Post 1	0,0	0,0	0,0	0,0	0,0	
Post 2	0,0	0,0	0,0	0,0	0,0	
Post 3	0,0	0,0	0,0	0,0	0,0	

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	219,8	220,2	220,8
380ct1f1	220,2	220,2	220,8
380ct1f2	220,2	220,2	220,8
380ct1f3	220,1	220,2	220,8
380ct2f1	220,2	220,2	220,8
380ct2f2	220,2	220,2	220,8
380ct2f3	220,1	220,2	220,8
bl2	219,8	220,1	220,8
Post 1			
Post 2			
Post 3			

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	222,3	221,2
380ct1f1	221,6	221,0
380ct1f2	221,6	221,0
380ct1f3	221,7	221,0
380ct2f1	221,6	221,0
380ct2f2	221,6	221,0
380ct2f3	221,7	221,0
bl2	222,3	221,2
Post 1		
Post 2		
Post 3		

Envelop of weight span over all combinations (incl. 0,9 combinations) For all conductors		Wind / Weight span ratio
Max. weight span	222,5 m	1,007 -
Min. weight span	219,3 m	0,992 -

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Project: KIJ-GT
Tower: HC+0 II
Number: 2

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	32,5	27,7	5,3	-36,1	33,4
380ct1f1	96,1	100,8	14,2	-109,6	114,7
380ct1f2	96,1	100,8	14,2	-109,6	114,7
380ct1f3	96,2	103,9	14,2	-112,2	118,8
380ct2f1	96,1	100,8	14,2	-109,6	114,7
380ct2f2	96,1	100,8	14,2	-109,6	114,7
380ct2f3	96,2	103,9	14,2	-112,2	118,8
bl2	32,7	27,6	5,3	-36,4	33,5
Post 1	2,4	2,4	3,5	0,0	
Post 2	2,4	2,4	3,5	0,0	
Post 3	2,4	2,4	3,5	0,0	

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	13,5	6,5	1,6	-15,0	15,0
380ct1f1	57,9	27,6	8,9	-64,2	64,2
380ct1f2	57,9	27,6	8,9	-64,2	64,2
380ct1f3	57,9	27,6	8,9	-64,2	64,2
380ct2f1	57,9	27,6	8,9	-64,2	64,2
380ct2f2	57,9	27,6	8,9	-64,2	64,2
380ct2f3	57,9	27,6	8,9	-64,2	64,2
bl2	13,5	6,5	1,6	-15,0	15,0
Post 1	0,0	0,0	3,0	0,0	
Post 2	0,0	0,0	3,0	0,0	
Post 3	0,0	0,0	3,0	0,0	

1 **Control uplift SLS-wind**

Combinatie	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	0,0	0,0
	380ct1f1	0,0	0,0
	380ct1f2	0,0	0,0
	380ct1f3	0,0	0,0
	380ct2f1	0,0	0,0
	380ct2f2	0,0	0,0
	380ct2f3	0,0	0,0
	bl2	0,0	0,0
	Post 1	0,0	
	Post 2	0,0	
	Post 3	0,0	

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		27	652	103	21114	949	0
ULS 1a_0,9_0		24	378	102	12127	742	-89
ULS 1a_0,9_0,9_90		16	633	89	20548	603	0
ULS 3_0		31	569	144	18306	1027	-34
SLS 7		0	357	98	11435	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

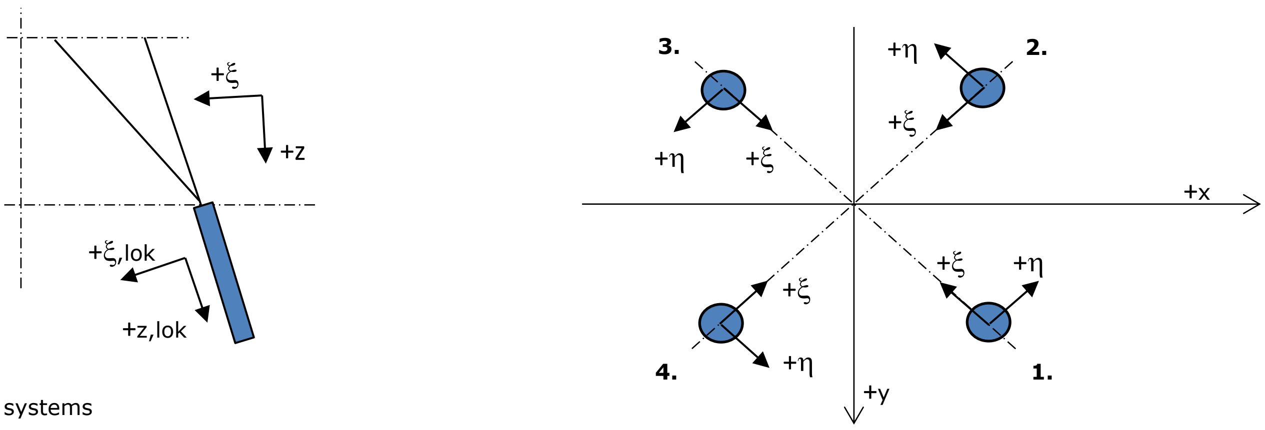
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	27	849	550	25841	949	0
ULS 1a_0,9_0,9_90	16	831	471	25275	603	0
SLS 7	0	357	523	11435	0	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_90	27	849	484	**25858**	949	0
SPLS 4_90 Ah All Cts	-589	335	502	10354	**-19055**	-34
SPLS 6a_90 Ba Ct2 Ba Ct1	86	411	571	13107	2682	**-3322**
SPLS 3_0,9_115,5 Ba All Cts	556	381	473	**11768**	**18385**	18

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_115,5 Ba All Cts	254	262	**1504**	-5	-365	-32	1541
2	SPLS 1a_0 Ba All Cts	127	-117	**692**	-7	-172	-19	709
3	SPLS 4_90 Ah All Cts	-87	-88	**521**	0	-124	-8	534
4	SPLS 3_64,5 Ah All Cts	-253	260	**1491**	5	-362	-33	1527

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 4_0,9_90 Ah All Cts	-48	-46	**-285**	-2	66	3	-292
2	SPLS 3_0,9_64,5 Ah All Cts	-211	220	**-1255**	-6	305	27	-1285
3	SPLS 3_0,9_115,5 Ba All Cts	210	219	**-1252**	6	303	27	-1283
4	SPLS 1a_0,9_0 Ba All Cts	81	-77	**-444**	3	112	14	-455

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 6a_90 Ah Ct2 Ba Ct2	118	-30	246	**105**	-62	-7	252
2	SPLS 4_0,9_90 Ba Ct1	-117	-30	-240	**104**	61	8	-245
3	SPLS 6a_90 Ba Ct1 Ba Ct2	20	175	-554	**109**	138	15	-568
4	SPLS 3_64,5 Ba Ct1	-3	159	462	**110**	-115	-12	474

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	SPLS 3_115,5 Ah Ct1	-1	152	427	**-108**	-107	-12	438
2	SPLS 3_64,5 Ba Ct2	43	112	-199	**-109**	49	5	-203
3	SPLS 6a_90 Ba Ct2 Ba Ct1	175	24	-575	**-107**	140	13	-589
4	SPLS 6a_90 Ba Ct2 Ba Ct1	-181	31	617	**-106**	-150	-14	631

Project: KIJ-GT
Tower: HC+0 II
Number: 2

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 6a_90 Ah All Cts Ba Ct2	-14	-57	**-224**	**30**	51	1	-229
2	SPLS 3_0,9_64,5 Ah Ct1	-113	250	**-1047**	**-97**	256	25	-1072
3	SPLS 3_0,9_115,5 Ba Ct1	108	251	**-1043**	**101**	254	23	-1068
4	SPLS 1a_0,9_0 Ba All Cts	81	-77	**-444**	**3**	112	14	-455

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	112	112	651	0	-158	-14	666
2	SLS 7	-67	67	-389	0	95	9	-398
3	SLS 7	67	67	-389	0	95	9	-398
4	SLS 7	-112	112	651	0	-158	-14	666

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	SPLS 3_115,5 Ba All Cts	254	262	**1504**	-5	-365	-32	1541
Max. tension	SPLS 3_0,9_64,5 Ah All Cts	-211	220	**-1255**	-6	305	27	-1285
Max. pos. torsie	SPLS 3_64,5 Ba Ct1	-3	159	462	**110**	-115	-12	474
Max. neg. torsie	SPLS 3_64,5 Ba Ct2	43	112	-199	**-109**	49	5	-203
Comb. tension+torsie	SPLS 3_0,9_115,5 Ba Ct1	108	251	**-1043**	**101**	254	23	-1068

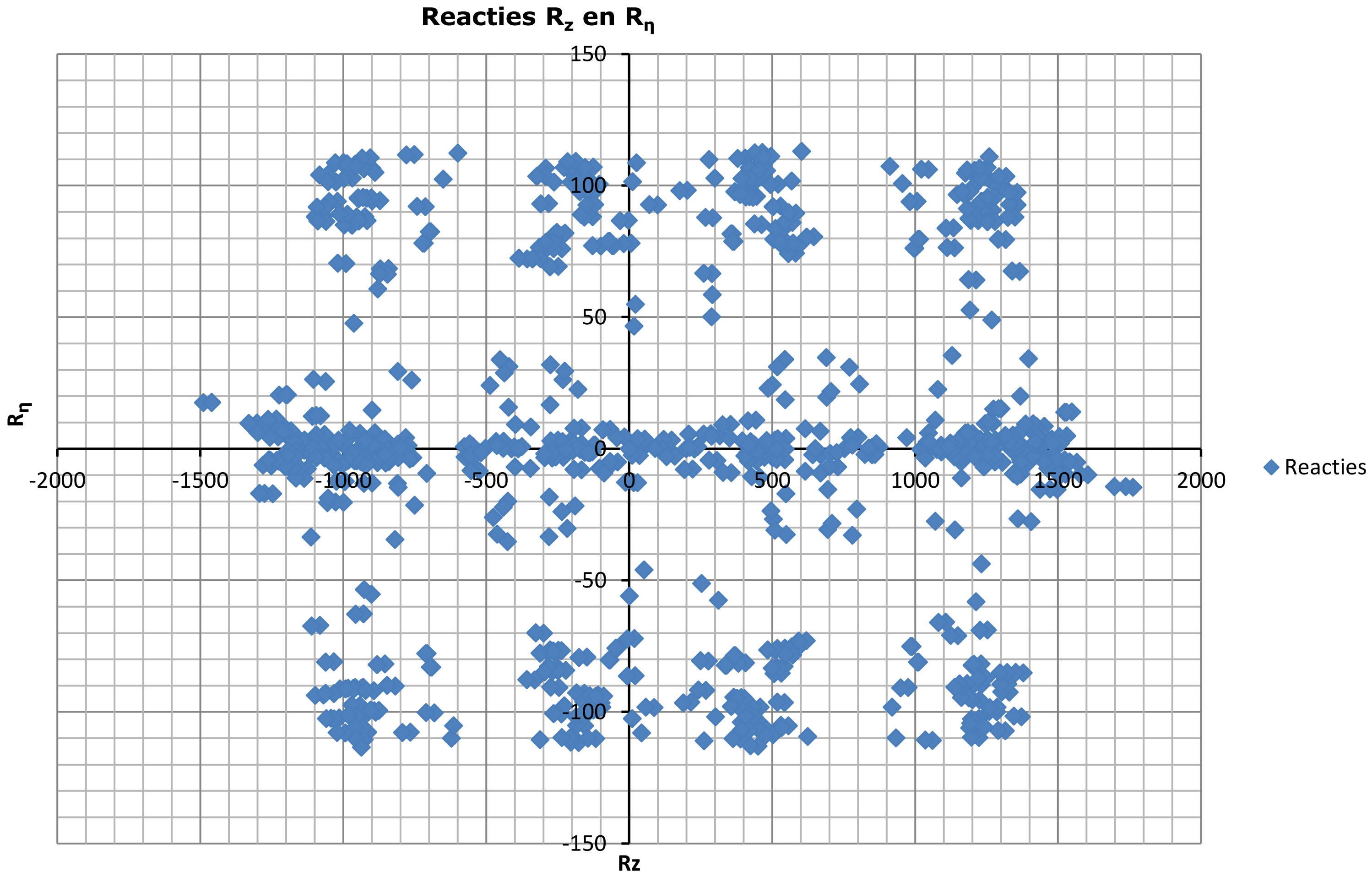
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	112	112	**651**	0	-158	-14	666
2	SLS 1a_90	-153	161	**-888**	-6	222	26	-910
3	SLS 1a_90	160	170	**-936**	7	233	27	-959
4	SLS 1a_0	-56	61	**367**	4	-83	-2	376

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_90	205	215	**1198**	-7	-297	-32	1227
2	SLS 1a_0	-7	20	**-105**	-9	19	-4	-108
3	SLS 7	67	67	**-389**	0	95	9	-398
4	SLS 1a_90	-198	206	**1150**	6	-286	-32	1178

Project: KIJ-GT
Tower: HC+0 II
Number: 2



Project: KIJ-GT
Tower: HC+0 II
Number: 2

Auteur: TBR
Versie: v11.6

Conductor loads

Starting points

Consequence class Verbouw CC2
Reference period 50 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,15	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,40	0,00	0,0
ULS 3	Wind+ice	-5°	1,15	1,15	0,00	0,42	1,30	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,15	0,00	0,42	1,30	0,0
ULS 4	Cold+wind	-20°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,15	0,00	0,28	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,15	1,15	1,30	0,28	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 7	Permanent	10°	1,30	1,30	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,15	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,15	1,15	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,15	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,15	1,15	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,15	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,15	1,15	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,15	1,15	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	1,00	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,30	1,00	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	6
Number of load combinations for ULS	46
Number of load combinations for SPLS	222
Number of load combinations for SLS	15
Number of concentrated loads	5377

Project: KIJ-GT
Tower: HC+0 II
Number: 2

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-34,1	33,2	16,7	20,9	4,7	5,7
380ct1f1	-107,4	116,2	57,1	68,0	11,1	15,9
380ct1f2	-107,4	116,2	57,1	68,0	11,1	15,9
380ct1f3	-110,1	120,1	60,7	74,6	11,1	15,9
380ct2f1	-107,4	116,2	57,1	68,0	11,1	15,9
380ct2f2	-107,4	116,2	57,1	68,0	11,1	15,9
380ct2f3	-110,1	120,1	60,7	74,6	11,1	15,9
bl2	-34,4	33,2	16,8	20,9	4,7	5,7
Post 1	0,0	0,0	0,0	0,0	0,0	
Post 2	0,0	0,0	0,0	0,0	0,0	
Post 3	0,0	0,0	0,0	0,0	0,0	

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	219,7	220,2	220,8
380ct1f1	220,2	220,2	220,8
380ct1f2	220,2	220,2	220,8
380ct1f3	220,1	220,2	220,8
380ct2f1	220,2	220,2	220,8
380ct2f2	220,2	220,2	220,8
380ct2f3	220,1	220,2	220,8
bl2	219,7	220,1	220,8
Post 1			
Post 2			
Post 3			

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	222,5	221,3
380ct1f1	221,7	221,1
380ct1f2	221,7	221,1
380ct1f3	221,9	221,1
380ct2f1	221,7	221,1
380ct2f2	221,7	221,1
380ct2f3	221,9	221,1
bl2	222,5	221,2
Post 1		
Post 2		
Post 3		

Envelop of weight span over all combinations (incl. 0,9 combinations)

For all conductors		Wind / Weight span ratio
Max. weight span	223,1 m	1,009 -
Min. weight span	218,9 m	0,990 -

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Project: KIJ-GT
Tower: HC+0 II
Number: 2

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	32,9	32,1	5,7	-38,0	39,0
380ct1f1	98,7	114,5	15,9	-121,0	132,5
380ct1f2	98,7	114,5	15,9	-121,0	132,5
380ct1f3	98,8	118,8	15,9	-124,2	138,5
380ct2f1	98,7	114,5	15,9	-121,0	132,5
380ct2f2	98,7	114,5	15,9	-121,0	132,5
380ct2f3	98,8	118,8	15,9	-124,2	138,5
bl2	33,2	32,1	5,7	-38,3	39,0
Post 1	3,0	3,0	3,9	0,0	
Post 2	3,0	3,0	3,9	0,0	
Post 3	3,0	3,0	3,9	0,0	

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	13,5	6,5	1,6	-15,0	15,0
380ct1f1	57,9	27,6	8,9	-64,2	64,2
380ct1f2	57,9	27,6	8,9	-64,2	64,2
380ct1f3	57,9	27,6	8,9	-64,2	64,2
380ct2f1	57,9	27,6	8,9	-64,2	64,2
380ct2f2	57,9	27,6	8,9	-64,2	64,2
380ct2f3	57,9	27,6	8,9	-64,2	64,2
bl2	13,5	6,5	1,6	-15,0	15,0
Post 1	0,0	0,0	3,0	0,0	
Post 2	0,0	0,0	3,0	0,0	
Post 3	0,0	0,0	3,0	0,0	

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	0,0	0,0
	380ct1f1	0,0	0,0
	380ct1f2	0,0	0,0
	380ct1f3	0,0	0,0
	380ct2f1	0,0	0,0
	380ct2f2	0,0	0,0
	380ct2f3	0,0	0,0
	bl2	0,0	0,0
	Post 1	0,0	
	Post 2	0,0	
	Post 3	0,0	

Project: KIJ-GT
Tower: HC+0 II
Number: 2

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		49	753	113	24402	1672	0
ULS 1a_0,9_0		39	407	111	13062	1231	-111
ULS 1a_0,9_0,9_90		33	727	89	23614	1166	-1
ULS 3_0		68	638	167	20506	2230	-39
SLS 7		0	357	98	11435	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

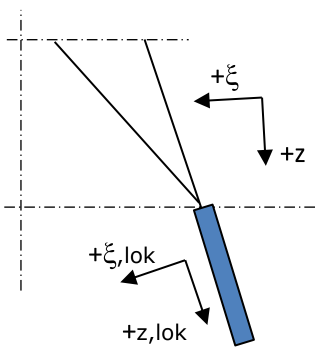
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	49	999	602	30290	1672	0
ULS 1a_0,9_0,9_90	33	973	471	29502	1166	-1
SLS 7	0	357	523	11435	0	0

Foundation loads, selection of load combinations based on greatest value

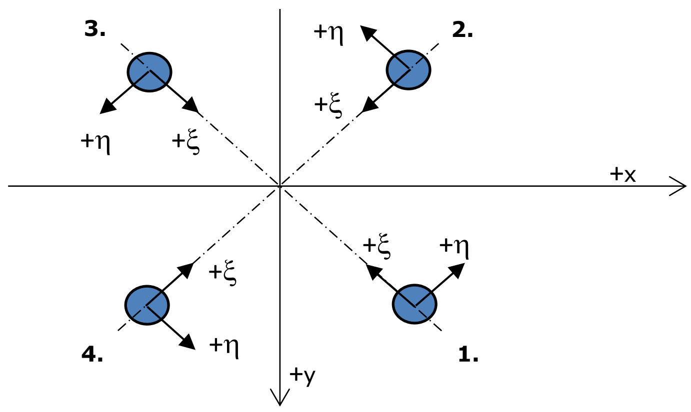
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_90	49	999	493	**30318**	1672	0
SPLS 4_90 Ah All Cts	-605	342	550	10580	**-19553**	-33
SPLS 6a_90 Ba Ct2 Ba Ct1	108	430	622	13703	3405	**-3420**
ULS 1a_0,9_115,5	136	985	494	**29880**	**5599**	48

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems



Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_115,5	294	315	**1762**	-15	-430	-41	1804
2	SPLS 1a_0 Ba All Cts	133	-123	**729**	-7	-181	-20	747
3	SPLS 3_135 Ah All Cts	-96	-90	**547**	4	-132	-11	560
4	ULS 1a_64,5	-259	279	**1548**	14	-380	-38	1585

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 4_0,9_90 Ah All Cts	-50	-47	**-296**	-2	69	3	-303
2	ULS 1a_0,9_0,9_64,5	-213	237	**-1293**	-17	318	32	-1324
3	ULS 1a_0,9_115,5	245	270	**-1489**	18	364	35	-1525
4	SPLS 1a_0,9_0 Ba All Cts	85	-81	**-466**	3	117	15	-477

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 6a_90 Ah Ct2 Ba Ct2	127	-29	279	**110**	-69	-8	285
2	SPLS 3_0,9_115,5 Ah Ct2	-247	94	-987	**108**	242	23	-1011
3	SPLS 6a_90 Ba Ct1 Ba Ct2	26	185	-600	**112**	149	16	-615
4	SPLS 6a_90 Ba Ct1 Ba Ct2	-25	185	603	**113**	-149	-16	618

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	SPLS 3_115,5 Ah Ct1	0	159	450	**-113**	-112	-13	461
2	SPLS 6a_90 Ah Ct1 Ba Ct1	-82	242	-937	**-113**	229	22	-959
3	SPLS 6a_90 Ba Ct2 Ba Ct1	185	30	-622	**-110**	152	14	-637
4	SPLS 6a_90 Ba Ct2 Ba Ct1	-184	30	624	**-109**	-152	-14	639

Project: KIJ-GT
Tower: HC+0 II
Number: 2

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 6a_90 Ah All Cts Ba Ct2	-15	-57	**-226**	**29**	51	1	-232
2	SPLS 3_0,9_64,5 Ah Ct1	-111	256	**-1060**	**-103**	260	25	-1086
3	ULS 1a_0,9_115,5	245	270	**-1489**	**18**	364	35	-1525
4	SPLS 1a_0,9_0 Ba All Cts	85	-81	**-466**	**3**	117	15	-477

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	112	112	651	0	-158	-14	666
2	SLS 7	-67	67	-389	0	95	9	-398
3	SLS 7	67	67	-389	0	95	9	-398
4	SLS 7	-112	112	651	0	-158	-14	666

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_115,5	294	315	**1762**	-15	-430	-41	1804
Max. tension	ULS 1a_0,9_115,5	245	270	**-1489**	18	364	35	-1525
Max. pos. torsie	SPLS 6a_90 Ba Ct1 Ba Ct2	-25	185	603	**113**	-149	-16	618
Max. neg. torsie	SPLS 6a_90 Ah Ct1 Ba Ct1	-82	242	-937	**-113**	229	22	-959
Comb. tension+torsie	ULS 1a_0,9_115,5	245	270	**-1489**	**18**	364	35	-1525

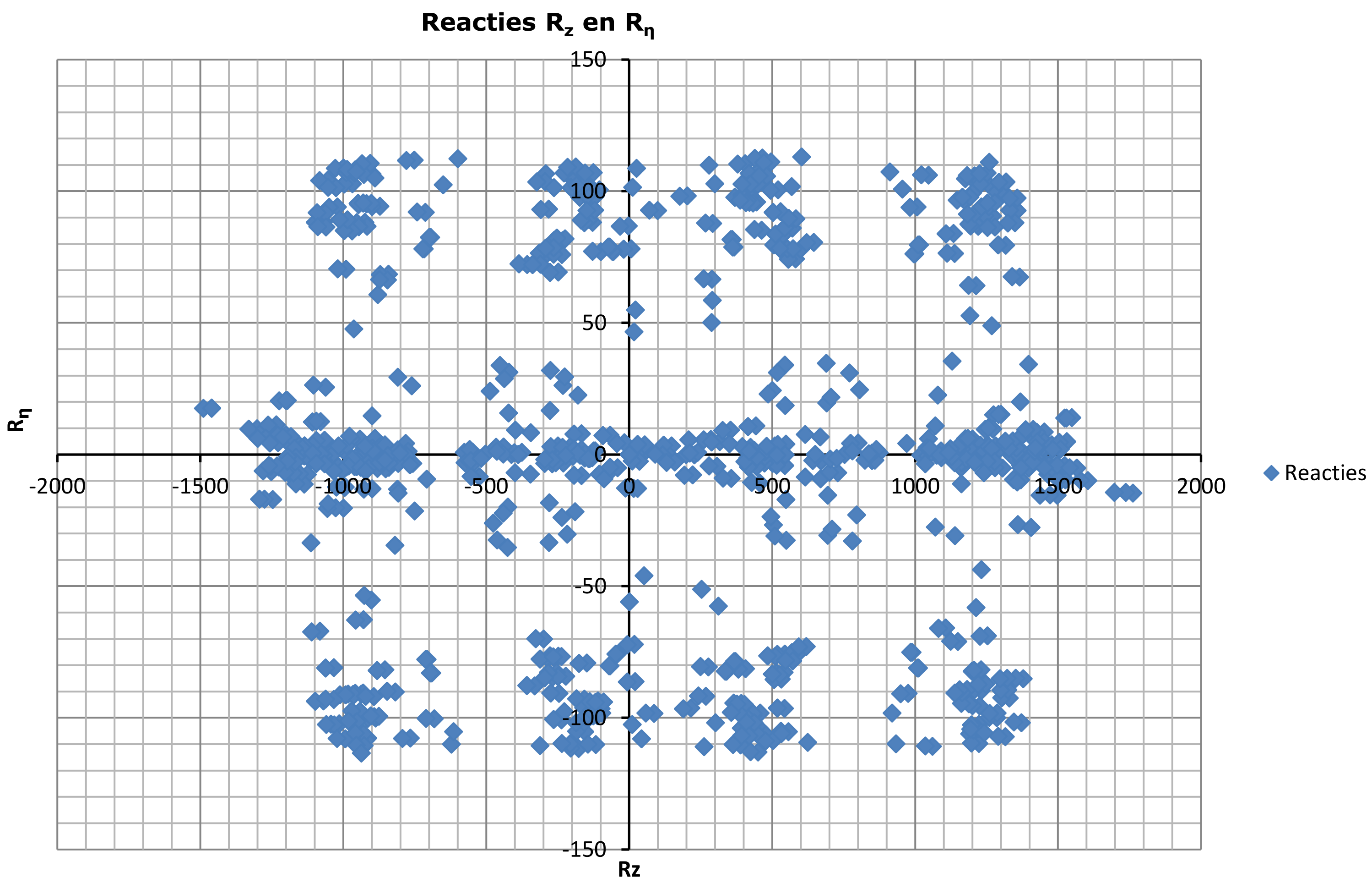
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	112	112	**651**	0	-158	-14	666
2	SLS 1a_90	-159	168	**-923**	-6	231	27	-945
3	SLS 1a_90	168	177	**-979**	7	244	28	-1002
4	SLS 1a_0	-53	58	**351**	4	-78	-1	359

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_90	213	222	**1240**	-7	-308	-34	1270
2	SLS 1a_0	-4	17	**-89**	-9	15	-5	-91
3	SLS 7	67	67	**-389**	0	95	9	-398
4	SLS 1a_90	-204	213	**1184**	6	-295	-33	1213

Project: KIJ-GT
Tower: HC+0 II
Number: 2



Content

Data

Norm	NEN-EN50341-2-15:2019
Initial	
Consequence class	CC2-0
Reliability level	Afkeur
Reference period	30 jaar
After adjustment	
Consequence class	CC2
Reliability level	Verbouw
Reference period	50 jaar
Wind zone	II
Wind speed	27 m/s
Terrain categorie	II
Reduction factor Cdir	1.00
Ice region	B
Tower type	Hoekmast
Tower height	45 m
Max. Span	454 m
Line angle	138°
Catenary	1400 m
Wind span	380 m
EDS Weight span	287 m
Min. Weight span	-18 m
Max. Weight span	288 m

ISSUE	DATE	REVISION	CHK'D	APP'D
0.0	2021-05-17			

Client: TenneT Taking power further

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Title:

Berekening masttype HC+0 II

JOB No.	-	DATE	-
DRAWN	-	CHKD	-
DESIGN	-	APPD	-

Document name:

KIJ-GT_HC+0 II_15_Report.pdf

Project number:

Project client number:

0.0

Conductor loads

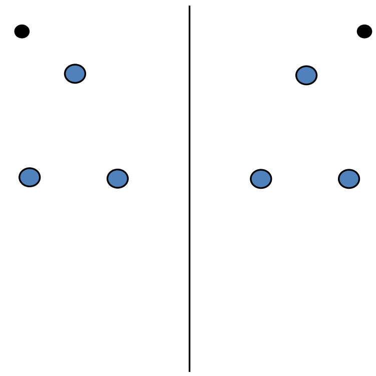
Auteur: TBR
Versie: v11.7

General

Description	HC+0 II
Tower type	Hoekmast
Number of circuits	2
Configuration	2-circuit-donau
Number of earth wires	2

Starting points

Norm	NEN-EN50341-2-15:2019
Consequence class	CC2-0
Reliability level initial	Afkeur CC2-0
Reference period intial	30 jaar
Consequence class modified	CC2
Reliability level modified	Verbouw
Reference period modified	50 jaar
Wind zone	II
Wind speed (m/s)	27.0 m/s
Terrain category	II
Reduction factor c_{dir}	1.00
Ice region phase conductor	B
Ice region earth conductor	B



Configuratie geleiders

Conductors back

Description	Voltage	Conductor Back	Bundle Ba	Ice region	Additional weight	Additional diameter	Catenary P_{back}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Conductors ahead

Description	Voltage	Conductor Ahead	Bundle Ah	Ice region	Additional weight	Additional diameter	Catenary P_{ahead}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Insulators *(1)*

Description	Suspension	Weight [kN]	Length [m]	Wind area [m^2]
Circuit 1	Afspanketting	2.00	4.83	1.00
Circuit 2	Afspanketting	2.00	4.83	1.00
Bliksemdraad 1	Vast (Bliksemdraad)	0.10	0.30	0.05
Bliksemdraad 2	Vast (Bliksemdraad)	0.10	0.30	0.05

1. Properties apply to the entire isolator set

Suspension height and position in mast

Circuits	Designation	Number	Suspension height	Attach point	Position in tower Horizontal distance
Circuit 1	21	380ct1f1	27.7 m	27.7 m	17.7 m
Circuit 1	20	380ct1f2	27.7 m	27.7 m	9.5 m
Circuit 1	22	380ct1f3	39.0 m	39.0 m	12.1 m
Circuit 2	10	380ct2f1	27.7 m	27.7 m	-17.7 m
Circuit 2	11	380ct2f2	27.7 m	27.7 m	-9.5 m
Circuit 2	12	380ct2f3	39.0 m	39.0 m	-12.1 m
Bliksemdraad 1	1	bl1	42.9 m	43.2 m	-18.4 m
Bliksemdraad 2	3	bl2	42.9 m	43.2 m	18.4 m

Project: KIJ-GT
Tower: HC+0 II
Number: 15

Height adjustment adjacent masts (wind and weight span adjustment)

	Back	Ahead	
Height increase for wind pressure	0.0 m	0.0 m	(positive: higher)
Height decrease for vertical load	0.0 m	0.0 m	(negative: decrease, more weight span)

Decrease: Niet in 0,9EG-combinaties

Height difference adjacent tower and change of direction with respect to Line direction

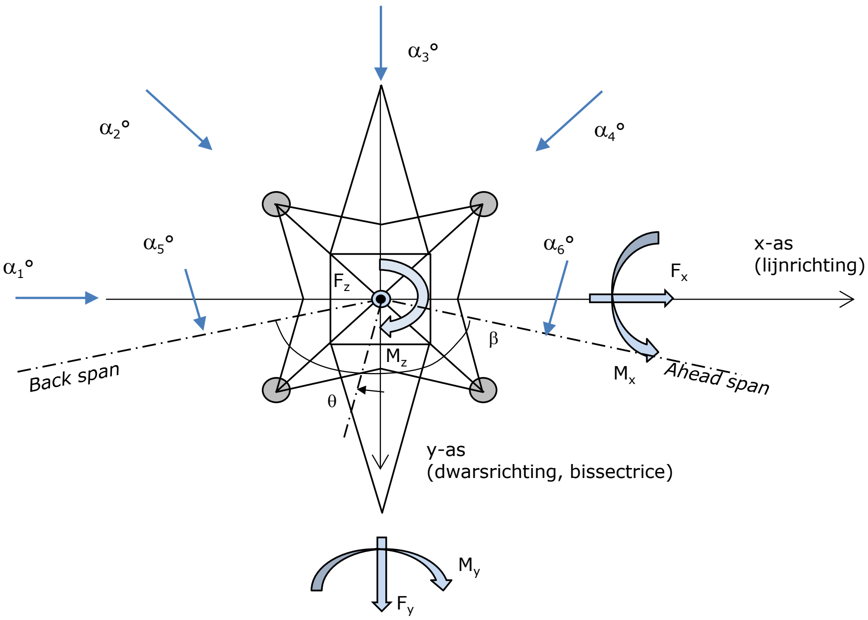
			Hoogteverschil		Richtingsverandering	
Circuits	Aanduiding	Nummer	Δh_back	Δh_ahead	Δy_back	Δy_ahead
Circuit 1	21	380ct1f1	30.6	-0.3 m	0.0	0.0 m
Circuit 1	20	380ct1f2	30.6	-0.3 m	0.0	0.0 m
Circuit 1	22	380ct1f3	35.8	-0.3 m	0.0	0.0 m
Circuit 2	10	380ct2f1	30.6	-0.3 m	0.0	0.0 m
Circuit 2	11	380ct2f2	30.6	-0.3 m	0.0	0.0 m
Circuit 2	12	380ct2f3	35.8	-0.3 m	0.0	0.0 m
Bliksemdraad 1	1	bl1	42.0	-0.6 m	0.0	0.0 m
Bliksemdraad 2	3	bl2	42.0	-0.6 m	0.0	0.0 m

Line and tower data

		Back	Ahead
		454.0	306.0 m
Ruling span $\sqrt{(\Sigma L^3/\Sigma L)}$		552.7	373.0 m
Line angle	β	138 °	
Tower orientation with respect to bis	θ	0 °	
Section length		2418	3703 m
Height bottom of tower to ground level		0.5 m	
Wind directions considered	α_1	0 °	
Wind directions according to:	α_2	45 °	
Geleiderbelastingen	α_3	90 °	
	α_4	135 °	
	α_5	69 °	
	α_6	111 °	

Wind directions apply to the main direction of mast construction, not to the bisector.

Windrichtingen en positieve richtingen belastingen



Project: KIJ-GT
Tower: HC+0 II
Number: 15

Considered number of wind directions	
1a	6
3	6
4	1
6	1
Overig	1

Project: KIJ-GT
Tower: HC+0 II
Number: 15

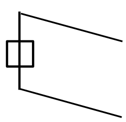
Absence of conductors

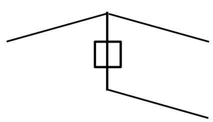
		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	380ct1f1	1	0	1	0	1	0
Circuit 1	380ct1f2	1	0	1	0	1	0
Circuit 1	380ct1f3	1	0	1	0	1	0
Circuit 2	380ct2f1	0	1	1	0	1	0
Circuit 2	380ct2f2	0	1	1	0	1	0
Circuit 2	380ct2f3	0	1	1	0	1	0
Bliksemdraad 1	bl1	1	0	1	0	1	0
Bliksemdraad 2	bl2	0	1	1	0	1	0

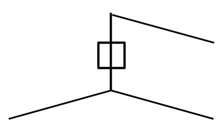
Load situations SPLS

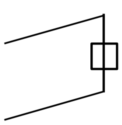
Considered situations SPLS: 1 up to 6, All possible situations

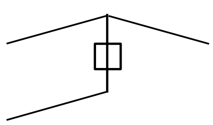
Principle of load situations:

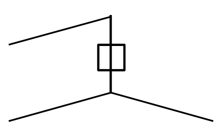

1. Ba All cts


2. Ba ct1


3. Ba ct2


4. Ah All cts

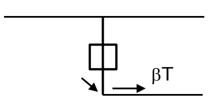

5. Ah ct1


6. Ah ct2

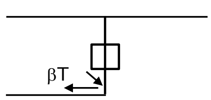
Load situation 5a. Conductor failure

Considered situations conductor failure 5a: 1, design assumption is symmetry back and ahead

Principle of load situations:



1. Ba



2. Ah

Project: KIJ-GT
Tower: HC+0 II
Number: 15

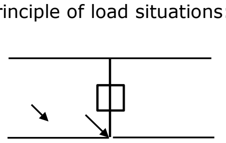
Load situations LC6. Construction and maintenance
Under 6a, the load due to the presence of a line verhicle or line bicycle in combination with point load on the traverse is assesed.
Combination 6b does not contain any loads in conductor or on traverse. This combination has been added to be able to combine with separate control platforms, etc. The situations are applied in ULS and in every SPLS situation (in case of angle tower).

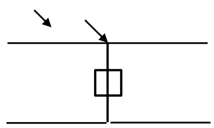
	Phase	Earth
Line vehicle	3.0 kN	2.0 kN
Concentrated load cross arm	1.0 kN	1.0 kN

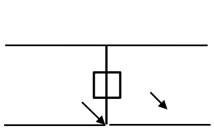
Beschouwde situaties bouw- en onderhoud 6a: 1 t/m 4, alle mogelijke situaties.

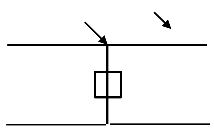
Presence line vehicle: Circuit, belasting tegelijk aanwezig in alle geleiders per circuit.

Principle of load situations:


1. Ba Ct1


2. Ba Ct2


3. Ah Ct1


4. Ah Ct2

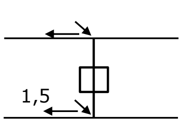
Load situations 8. Galloping as a static load

Conductor				
Suspension tower phase	0.866	W	1.5	W
Suspension tower earth	1.5	EDS	1.5	W
Strain tower phase and earth	1.5	EDS	1.5	W

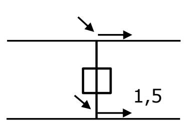
Considered situations galloping 8: None (existing structure)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principle of load situations:



1. Ba



2. Ah

Load combination 8. Galloping as a dynamic load
Only applies to tension towers
Load consists of EDS tensile load in one of the conductors on one side of the tower
Can be converted by user to fatigue spectrum via the load spectrum of table 4.11 / NL.1

Project: KIJ-GT
Tower: HC+0 II
Number: 15

Tower structure

Properties

Tower type	Hoekmast		
Tower designation	HC+0 II		
Base plate w.r.t. ground level	0.5		m
Tower height w.r.t. base plate	45.0		m
Tower self weight	425.0		kN
Width and slope at foundation	x-ri.	y-ri.	
Leg spread	11.00	11.00	m
Inclination of main leg	0.156	0.156	-
Horizontal force factor	1.1	1.1	-

Calculation Wind load

Dynamic factor G_T	1.00 *(Masthoogte < 60 m)*
Wind load diagonally to tower body proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Wind load diagonally on traverse proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Magnification factor diagonal wind to tower body	(1+0,2sin^2(2phi))
Magnification factor diagonal wind to cross arm	(1+0,2sin^2(2phi))
Magnification factor wind parallel to perpendicular to cross ar	0.4

Properties mast sections longitudinal direction (front view, yz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	9.60	11.00	8.00	9.60	0.156	91.20	11.46	0.13	3.28
Middenstuk 1	18.90	8.00	5.84	9.30	0.116	64.36	10.66	0.17	3.08
Middenstuk 2	27.70	5.84	3.80	8.80	0.116	42.42	9.83	0.23	2.80
Bovenstuk 1	35.50	3.80	3.19	7.80	0.039	27.26	6.61	0.24	2.75
Bovenstuk 2	43.00	3.19	2.60	7.50	0.039	21.71	5.25	0.24	2.76
Topstuk	45.00	2.60		2.00		2.60	0.24	0.09	3.45
Ondertraverse	27.70	15.80		4.00		31.60	5.89	0.19	2.99
Boventraverse	39.00	16.95		4.20		35.60	7.55	0.21	2.88

Properties tower sections transversal direction (side view, xz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	9.60	11.00	8.00	9.60	0.156	91.20	11.46	0.13	3.28
Middenstuk 1	18.90	8.00	5.84	9.30	0.116	64.36	10.66	0.17	3.08
Middenstuk 2	27.70	5.84	3.80	8.80	0.116	42.42	9.83	0.23	2.80
Bovenstuk 1	35.50	3.80	3.19	7.80	0.039	27.26	6.61	0.24	2.75
Bovenstuk 2	43.00	3.19	2.60	7.50	0.039	21.71	5.25	0.24	2.76
Topstuk	45.00	2.60		2.00		2.60	0.24	0.09	3.45
Ondertraverse	27.70	15.80		4.00		31.60	5.89	0.19	2.99
Boventraverse	39.00	16.95		4.20		35.60	7.55	0.21	2.88

Note: Surface transverse direction is reduced in calculation.

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Project: KIJ-GT
Tower: HC+0 II
Number: 15

Wind surface feeders telecom installations

Part	A (m^2/m)	Factor	Δh	A_1
Broekstuk 1				
Middenstuk 1				
Middenstuk 2				
Bovenstuk 1				
Bovenstuk 2				

Input antennas

Description	A (m^2)	h (m)	C_f (m)
Antenne 1			
Schotel			
Schotel			

Tower section loads longitudinal (x-direction) per wind direction

Description	p_w	F_{x1}	F_{x2}	F_{x3}	F_{x4}	h_{ef}	M_{y1}	M_{y2}	M_{y3}	M_{y4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0.85	32.0	27.1	0.0	-27.1	4.8	153.5	130.2	0.0	-130.2
Middenstuk 1	0.96	31.5	26.8	0.0	-26.8	14.3	449.3	381.2	0.0	-381.2
Middenstuk 2	1.12	30.7	26.0	0.0	-26.0	23.3	714.7	606.4	0.0	-606.4
Bovenstuk 1	1.22	22.3	18.9	0.0	-18.9	31.6	703.5	596.9	0.0	-596.9
Bovenstuk 2	1.29	18.7	15.9	0.0	-15.9	39.3	734.2	623.0	0.0	-623.0
Topstuk	1.33	1.1	0.9	0.0	-0.9	44.0	48.5	41.2	0.0	-41.2
Ondertraverse	1.19	41.9	24.9	0.0	-24.9	29.0	1216.5	722.6	0.0	-722.6
Boventraverse	1.30	56.6	33.6	0.0	-33.6	40.4	2288.5	1359.3	0.0	-1359.3
Totaal		234.8	174.1	0.0	-174.1		6308.6	4460.8	0.0	-4460.8

Tower section loads transversal (y-direction) per wind direction

Description	p_w	F_{y1}	F_{y2}	F_{y3}	F_{x4}	h_{ef}	M_{x1}	M_{x2}	M_{x3}	M_{x4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0.85	0.0	27.1	32.0	27.1	4.8	0.0	130.2	153.5	130.2
Middenstuk 1	0.96	0.0	26.8	31.5	26.8	14.3	0.0	381.2	449.3	381.2
Middenstuk 2	1.12	0.0	26.0	30.7	26.0	23.3	0.0	606.4	714.7	606.4
Bovenstuk 1	1.22	0.0	18.9	22.3	18.9	31.6	0.0	596.9	703.5	596.9
Bovenstuk 2	1.29	0.0	15.9	18.7	15.9	39.3	0.0	623.0	734.2	623.0
Topstuk	1.33	0.0	0.9	1.1	0.9	44.0	0.0	41.2	48.5	41.2
Ondertraverse	1.19	0.0	24.9	16.8	24.9	29.0	0.0	722.6	486.6	722.6
Boventraverse	1.30	0.0	33.6	22.7	33.6	40.4	0.0	1359.3	915.4	1359.3
Total		0.0	174.1	175.7	174.1		0.0	4460.8	4205.6	4460.8

Resulting loads from mast construction incl. Antenna without conductors level foundation (char. Value)

Load / wind direction	F_x	F_y	F_z	M_x	M_y	M_z
	[kN]	[kN]	[kN]	[kNm]	[kNm]	[kNm]
Permanente belasting	0	0	425	0	0	0
Windrichting 0°	235	0	0	0	6309	0
Windrichting 45°	174	174	0	4461	4461	0
Windrichting 90°	0	176	0	4206	0	0
Windrichting 135°	-174	174	0	4461	-4461	0

Project: KIJ-GT
Tower: HC+0 II
Number: 15

Intermediate results for conductor loads

Conductors back

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27.7	571.0	14.98	62700	1.88E-05
Circuit 2	ACCCZ-Warsaw	27.7	571.0	14.98	62700	1.88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21.8	281.1	9.81	75000	1.89E-05
Bliksemdraad 2	OPGW 226	21.7	264.0	9.80	81000	2.30E-05

Conductors ahead

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27.7	571.0	14.98	62700	1.88E-05
Circuit 2	ACCCZ-Warsaw	27.7	571.0	14.98	62700	1.88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21.8	281.1	9.81	75000	1.89E-05
Bliksemdraad 2	OPGW 226	21.7	264.0	9.80	81000	2.30E-05

Vertical load back

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	3	2	45.8	B	4+0,2d	9.5	28.6
Circuit 2	3	2	45.8	B	4+0,2d	9.5	28.6
Bliksemdraad 1	1	2	10.0	B	4+0,2d	8.4	8.4
Bliksemdraad 2	1	2	10.0	B	4+0,2d	8.3	8.3

Vertical load ahead

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	[N/m]	[N/m]
Circuit 1	3	2	45.8	B	4+0,2d	9.5	28.6
Circuit 2	3	2	45.8	B	4+0,2d	9.5	28.6
Bliksemdraad 1	1	2	10.0	B	4+0,2d	8.4	8.4
Bliksemdraad 2	1	2	10.0	B	4+0,2d	8.3	8.3

Insulators

Conductor	$G_{isolator}$ [kN]	Number -	$F_{v,iso}$ [kN]	Length [m]	Wind surf. [m^2]	Wind heigth [m]	Pressure [kN/m^2]	Drag factor [-]	$F_{h,iso}$ [kN]
380ct1f1	2.00	1	2	4.8	1.0	28.20	1.18	1.2	1.42
380ct1f2	2.00	1	2	4.8	1.0	28.20	1.18	1.2	1.42
380ct1f3	2.00	1	2	4.8	1.0	39.50	1.30	1.2	1.55
380ct2f1	2.00	1	2	4.8	1.0	28.20	1.18	1.2	1.42
380ct2f2	2.00	1	2	4.8	1.0	28.20	1.18	1.2	1.42
380ct2f3	2.00	1	2	4.8	1.0	39.50	1.30	1.2	1.55
bl1	0.10	0.5	0.05	0.3	0.1	43.40	1.33	1.2	0.08
bl2	0.10	0.5	0.05	0.3	0.1	43.40	1.33	1.2	0.08

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Project: KIJ-GT
Tower: HC+0 II
Number: 15

Wind load back

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	31.2	1.21	0.58	0.51	1.04	28.25	62.5	55.0	46.9	119.9	105.5
380ct1f2	31.2	1.21	0.58	0.51	1.04	28.25	62.5	55.0	46.9	119.9	105.5
380ct1f3	45.1	1.34	0.61	0.54	1.01	28.25	70.4	61.8	46.9	139.1	122.3
380ct2f1	31.2	1.21	0.58	0.51	1.04	28.25	62.5	55.0	46.9	119.9	105.5
380ct2f2	31.2	1.21	0.58	0.51	1.04	28.25	62.5	55.0	46.9	119.9	105.5
380ct2f3	45.1	1.34	0.61	0.54	1.01	28.25	70.4	61.8	46.9	139.1	122.3
bl1	53.0	1.40	0.63	0.55	1.13	22.24	22.1	19.4	41.5	43.7	38.4
bl2	53.0	1.40	0.63	0.55	1.14	22.13	22.0	19.4	41.4	43.6	38.3

Wind load ahead

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	22.5	1.10	0.56	0.48	1.07	28.25	55.8	47.5	46.9	104.2	88.7
380ct1f2	22.5	1.10	0.56	0.48	1.07	28.25	55.8	47.5	46.9	104.2	88.7
380ct1f3	33.8	1.24	0.59	0.50	1.03	28.25	64.2	54.5	46.9	123.9	105.2
380ct2f1	22.5	1.10	0.56	0.48	1.07	28.25	55.8	47.5	46.9	104.2	88.7
380ct2f2	22.5	1.10	0.56	0.48	1.07	28.25	55.8	47.5	46.9	104.2	88.7
380ct2f3	33.8	1.24	0.59	0.50	1.03	28.25	64.2	54.5	46.9	123.9	105.2
bl1	37.9	1.28	0.60	0.51	1.16	22.24	19.8	16.8	41.5	38.3	32.5
bl2	37.9	1.28	0.60	0.51	1.16	22.13	19.7	16.7	41.4	38.2	32.4

Project: KIJ-GT
Tower: HC+0 II
Number: 15

Auteur: TBR
Versie: v11.7

Conductor loads

Starting points

Consequence class Afkeur CC2-0
Reference period 30 jaar

ULS	(strength)	**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1.05	1.05	0.00	1.12	0.00	0.0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0.90	1.05	0.00	1.12	0.00	0.0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0.90	0.90	0.00	1.12	0.00	0.0
ULS 3	Wind+ice	-5°	1.05	1.05	0.00	0.34	0.97	0.0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0.90	1.05	0.00	0.34	0.97	0.0
ULS 4	Cold+wind	-20°	1.05	1.05	0.00	0.22	0.00	0.0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0.90	1.05	0.00	0.22	0.00	0.0
ULS 5a	Torsional loads	10°	1.00	1.00	1.00	0.00	0.00	1.0
ULS 5b	Longitudinal loads	10°	1.00	1.00	0.00	0.00	0.00	1.0
ULS 6	Construction + maintenance	5°	1.05	1.05	1.20	0.22	0.00	0.0
ULS 6_0,9	Construction + maintenance	5°	1.05	1.05	0.00	0.22	0.00	0.0
ULS 7	Permanent	10°	1.15	1.15	0.00	0.00	0.00	0.0
ULS 8	Special	10°	1.00	1.00	0.00	0.00	0.00	1.0
SPLS	(strength, for angle towers: absence of conductors)			γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1.05	1.05	0.0	0.78	0.00	0.0
SPLS 1a_0,9	Wind 0,9	10°	0.90	1.05	0.0	0.78	0.00	0.0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0.90	1.05	0.0	0.78	0.00	0.0
SPLS 3	Wind+ice	-5°	1.05	1.05	0.0	0.36	0.34	0.0
SPLS 3_0,9	Wind+ice 0,9	-5°	0.90	1.05	0.0	0.36	0.34	0.0
SPLS 4	Cold+wind	-20°	1.05	1.05	0.0	0.24	0.00	0.0
SPLS 4_0,9	Cold+wind 0,9	-20°	0.90	1.05	0.0	0.24	0.00	0.0
SPLS 6	Maintenance	5°	1.05	1.05	1.2	0.24	0.0	0.0
SPLS 6_0,9	Maintenance	5°	1.05	1.05	0.0	0.24	0.0	0.0
SLS	(deformations, fatigue, EDS)							
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1.00	1.00	0.0	0.94	0.0	0.0
SLS 3	Wind+ice	-5°	1.00	1.00	0.0	0.28	0.88	0.0
SLS 4	Wind	-20°	1.00	1.00	0.0	0.19	0.0	0.0
SLS 6	Maintenance	5°	1.00	1.00	0.0	0.19	0.0	0.0
SLS 7	EDS, no wind	10°	1.00	1.00	0.0	0.00	0.0	0.0

Number of wind directions	6
Number of load combinations for ULS	46
Number of load combinations for SPLS	222
Number of load combinations for SLS	15
Number of concentrated loads	5377

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Project: KIJ-GT
Tower: HC+0 II
Number: 15

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-29.5	29.2	17.4	13.6	3.0	4.9
380ct1f1	-104.4	101.7	54.6	45.3	12.2	13.8
380ct1f2	-104.4	101.7	54.6	45.3	12.2	13.8
380ct1f3	-106.9	103.7	59.2	48.7	11.0	13.8
380ct2f1	-104.4	101.7	54.6	45.3	12.2	13.8
380ct2f2	-104.4	101.7	54.6	45.3	12.2	13.8
380ct2f3	-106.9	103.7	59.2	48.7	11.0	13.8
bl2	-29.5	29.3	17.4	13.5	3.0	4.9
Post 1	0.0	0.0	0.0	0.0	0.0	
Post 2	0.0	0.0	0.0	0.0	0.0	
Post 3	0.0	0.0	0.0	0.0	0.0	

Min. Weight span (m)

Weight spar Combinatie1			
Geleider	SLS 1a	SLS 4	SLS 7
bl1	110.3	230.7	244.0
380ct1f1	241.7	280.9	286.7
380ct1f2	241.7	280.9	286.7
380ct1f3	207.1	263.3	270.7
380ct2f1	241.7	280.9	286.7
380ct2f2	241.7	280.9	286.7
380ct2f3	207.1	263.3	270.7
bl2	110.4	229.0	244.0
Post 1			
Post 2			
Post 3			

Max. Weight span (m)

Weight spar Combinatie1		
Geleider	ULS 1a	ULS 3
bl1	239.9	246.8
380ct1f1	285.7	287.3
380ct1f2	285.7	287.3
380ct1f3	269.1	271.3
380ct2f1	285.7	287.3
380ct2f2	285.7	287.3
380ct2f3	269.1	271.3
bl2	239.9	246.1
Post 1		
Post 2		
Post 3		

Envelop of weight span over all combinations (incl. 0,9 combinations)		
For all conductors		Wind / Weight span ratio
Max. weight span	287.3 m	0.756 -
Min. weight span	44.9 m	0.118 -

Project: KIJ-GT
Tower: HC+0 II
Number: 15

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	29.2	27.9	4.9	-33.8	31.5
380ct1f1	88.2	92.4	13.8	-115.5	111.2
380ct1f2	88.2	92.4	13.8	-115.5	111.2
380ct1f3	92.2	98.3	13.8	-118.7	113.8
380ct2f1	88.2	92.4	13.8	-115.5	111.2
380ct2f2	88.2	92.4	13.8	-115.5	111.2
380ct2f3	92.2	98.3	13.8	-118.7	113.8
bl2	29.3	27.9	4.9	-33.7	31.6
Post 1	2.4	2.4	3.5	0.0	
Post 2	2.4	2.4	3.5	0.0	
Post 3	2.4	2.4	3.5	0.0	

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	14.0	5.4	1.6	-15.0	15.0
380ct1f1	59.9	23.0	9.1	-64.2	64.2
380ct1f2	59.9	23.0	9.1	-64.2	64.2
380ct1f3	59.9	23.0	9.1	-64.2	64.2
380ct2f1	59.9	23.0	9.1	-64.2	64.2
380ct2f2	59.9	23.0	9.1	-64.2	64.2
380ct2f3	59.9	23.0	9.1	-64.2	64.2
bl2	14.0	5.4	1.6	-15.0	15.0
Post 1	0.0	0.0	3.0	0.0	
Post 2	0.0	0.0	3.0	0.0	
Post 3	0.0	0.0	3.0	0.0	

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	0.0	0.0
	380ct1f1	0.0	0.0
	380ct1f2	0.0	0.0
	380ct1f3	0.0	0.0
	380ct2f1	0.0	0.0
	380ct2f2	0.0	0.0
	380ct2f3	0.0	0.0
	bl2	0.0	0.0
	Post 1	0.0	
	Post 2	0.0	
	Post 3	0.0	

Project: KIJ-GT
Tower: HC+0 II
Number: 15

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		-44	624	104	20247	-1453	0
ULS 1a_0,9_0		13	321	119	10268	404	-89
ULS 1a_0,9_0,9_90		-44	599	85	19469	-1461	0
ULS 3_0		1	494	172	15875	19	-25
SLS 7		0	297	115	9500	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

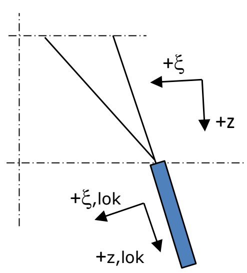
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	-44	821	550	24974	-1453	0
ULS 1a_0,9_0,9_90	-44	796	467	24196	-1461	0
SLS 7	0	297	540	9500	0	0

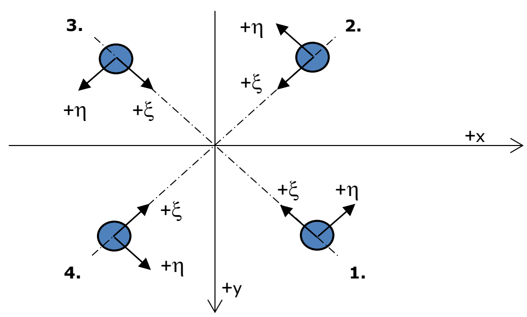
Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_90	-44	821	485	**24991**	-1453	0
SPLS 3_0 Ba All Cts	589	190	539	6017	**18577**	-25
SPLS 3_69 Ba Ct2	251	418	557	13152	7895	**-3053**
SPLS 1a_0,9_69 Ah All Cts	-468	445	443	**13204**	**-15718**	-22

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg





Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_111 Ba All Cts	233	240	**1375**	-5	-334	-30	1408
2	SPLS 1a_0 Ba All Cts	136	-127	**748**	-7	-186	-21	766
3	SPLS 3_135 Ah All Cts	-101	-94	**573**	4	-138	-11	587
4	SPLS 3_69 Ah All Cts	-244	251	**1442**	5	-350	-31	1476

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-57	-53	**-325**	-3	78	6	-333
2	SPLS 1a_0,9_69 Ah All Cts	-201	215	**-1204**	-11	294	28	-1233
3	SPLS 3_0,9_111 Ba All Cts	189	197	**-1122**	6	273	25	-1149
4	SPLS 1a_0,9_0 Ba All Cts	91	-87	**-499**	3	126	15	-511

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_69 Ba Ct1	252	118	1059	**95**	-262	-28	1085
2	SPLS 3_0,9_111 Ah Ct2	-216	81	-860	**95**	210	20	-881
3	SPLS 3_69 Ba Ct1	69	211	-796	**101**	198	22	-815
4	SPLS 3_69 Ba Ct1	9	136	357	**102**	-90	-11	366

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	SPLS 3_111 Ah Ct1	-12	129	325	**-100**	-83	-11	333
2	SPLS 3_69 Ba Ct2	53	88	-100	**-100**	25	3	-102

Project: KIJ-GT
Tower: HC+0 II
Number: 15

3	SPLS 3_0,9_69 Ba Ct2	214	76	-834	**-98**	205	20	-854
4	SPLS 3_0,9_69 Ba Ct2	-131	-5	363	**-96**	-88	-8	372

Project: KIJ-GT
Tower: HC+0 II
Number: 15

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_n [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-57	-53	**-325**	**-3**	78	6	-333
2	SPLS 1a_0,9_69 Ah Ct1	-116	236	**-1011**	**-85**	249	26	-1035
3	SPLS 1a_0,9_90 Ba Ct1	96	223	**-903**	**90**	226	26	-925
4	SPLS 1a_0,9_0 Ba All Cts	91	-87	**-499**	**3**	126	15	-511

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_n [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	97	98	567	0	-138	-13	581
2	SLS 7	-51	51	-297	0	72	7	-304
3	SLS 7	51	51	-297	0	72	7	-304
4	SLS 7	-97	98	567	0	-138	-13	581

Envelope of load combinations for all of the legs

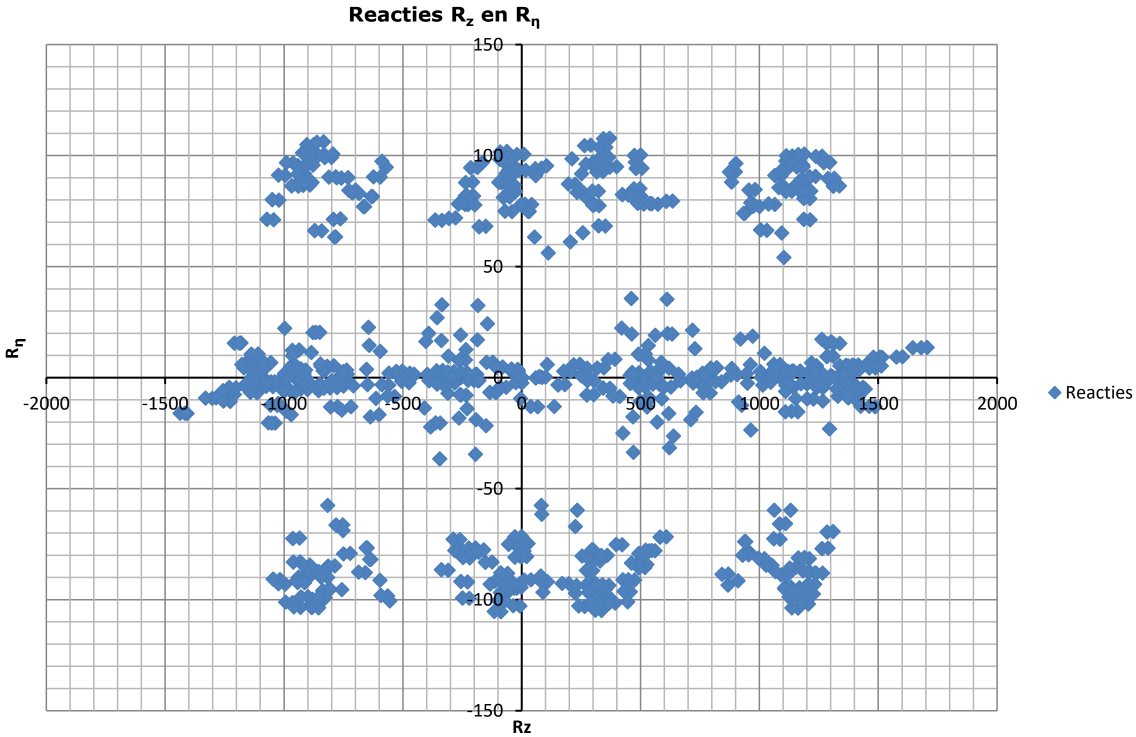
Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_n [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	SPLS 3_69 Ah All Cts	-244	251	**1442**	5	-350	-31	1476
Max. tension	SPLS 1a_0,9_69 Ah All Cts	-201	215	**-1204**	-11	294	28	-1233
Max. pos. torsie	SPLS 3_69 Ba Ct1	9	136	357	**102**	-90	-11	366
Max. neg. torsie	SPLS 3_69 Ba Ct2	53	88	-100	**-100**	25	3	-102
Comb. tension+torsie	SPLS 1a_0,9_69 Ah Ct1	-116	236	**-1011**	**-85**	249	26	-1035

Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_n [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	97	98	**567**	0	-138	-13	581
2	SLS 1a_90	-156	165	**-910**	-6	227	26	-932
3	SLS 1a_90	140	148	**-811**	6	204	24	-831
4	SLS 1a_0	-43	48	**291**	4	-64	0	298

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_n [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_90	185	193	**1075**	-6	-268	-30	1101
2	SLS 1a_0	7	5	**-21**	-9	-1	-6	-21
3	SLS 7	51	51	**-297**	0	72	7	-304
4	SLS 1a_90	-201	210	**1174**	6	-291	-32	1202


Reacties R_z en R_η
150
100
50
0
-50
-100
-150
-2000
-1500
-1000
-500
0
500
1000
1500
2000
R_η
Rz
Reacties

DNV·GL

Project: KIJ-GT
Tower: HC+0 II
Number: 15

Conductor loads		Auteur:	TBR
		Versie:	v11.7

Starting points

Consequence class Verbouw CC2
Reference period 50 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1.15	1.15	0.00	1.40	0.00	0.0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0.90	1.15	0.00	1.40	0.00	0.0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0.90	0.90	0.00	1.40	0.00	0.0
ULS 3	Wind+ice	-5°	1.15	1.15	0.00	0.42	1.30	0.0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0.90	1.15	0.00	0.42	1.30	0.0
ULS 4	Cold+wind	-20°	1.15	1.15	0.00	0.28	0.00	0.0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0.90	1.15	0.00	0.28	0.00	0.0
ULS 5a	Torsional loads	10°	1.00	1.00	1.00	0.00	0.00	1.0
ULS 5b	Longitudinal loads	10°	1.00	1.00	0.00	0.00	0.00	1.0
ULS 6	Construction + maintenance	5°	1.15	1.15	1.30	0.28	0.00	0.0
ULS 6_0,9	Construction + maintenance	5°	1.15	1.15	0.00	0.28	0.00	0.0
ULS 7	Permanent	10°	1.30	1.30	0.00	0.00	0.00	0.0
ULS 8	Special	10°	1.00	1.00	0.00	0.00	0.00	1.0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1.15	1.15	0.0	0.78	0.00	0.0
SPLS 1a_0,9	Wind 0,9	10°	0.90	1.15	0.0	0.78	0.00	0.0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0.90	1.15	0.0	0.78	0.00	0.0
SPLS 3	Wind+ice	-5°	1.15	1.15	0.0	0.36	0.34	0.0
SPLS 3_0,9	Wind+ice 0,9	-5°	0.90	1.15	0.0	0.36	0.34	0.0
SPLS 4	Cold+wind	-20°	1.15	1.15	0.0	0.24	0.00	0.0
SPLS 4_0,9	Cold+wind 0,9	-20°	0.90	1.15	0.0	0.24	0.00	0.0
SPLS 6	Maintenance	5°	1.15	1.15	1.2	0.24	0.0	0.0
SPLS 6_0,9	Maintenance	5°	1.15	1.15	0.0	0.24	0.0	0.0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1.00	1.00	0.0	1.00	0.0	0.0
SLS 3	Wind+ice	-5°	1.00	1.00	0.0	0.30	1.00	0.0
SLS 4	Wind	-20°	1.00	1.00	0.0	0.20	0.0	0.0
SLS 6	Maintenance	5°	1.00	1.00	0.0	0.20	0.0	0.0
SLS 7	EDS, no wind	10°	1.00	1.00	0.0	0.00	0.0	0.0

Number of wind directions	6
Number of load combinations for ULS	46
Number of load combinations for SPLS	222
Number of load combinations for SLS	15
Number of concentrated loads	5377

Project: KIJ-GT
Tower: HC+0 II
Number: 15

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-35.0	31.8	21.0	16.1	3.3	5.3
380ct1f1	-123.0	118.1	65.3	53.2	14.4	16.2
380ct1f2	-123.0	118.1	65.3	53.2	14.4	16.2
380ct1f3	-126.1	120.7	71.2	57.6	13.0	16.2
380ct2f1	-123.0	118.1	65.3	53.2	14.4	16.2
380ct2f2	-123.0	118.1	65.3	53.2	14.4	16.2
380ct2f3	-126.1	120.7	71.2	57.6	13.0	16.2
bl2	-35.0	32.1	21.0	16.1	3.3	5.3
Post 1	0.0	0.0	0.0	0.0	0.0	
Post 2	0.0	0.0	0.0	0.0	0.0	
Post 3	0.0	0.0	0.0	0.0	0.0	

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	98.9	229.9	244.0
380ct1f1	237.2	280.7	286.7
380ct1f2	237.2	280.7	286.7
380ct1f3	201.0	263.0	270.7
380ct2f1	237.2	280.7	286.7
380ct2f2	237.2	280.7	286.7
380ct2f3	201.0	263.0	270.7
bl2	99.0	228.2	244.0
Post 1			
Post 2			
Post 3			

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	239.5	249.3
380ct1f1	285.8	288.4
380ct1f2	285.8	288.4
380ct1f3	269.1	272.6
380ct2f1	285.8	288.4
380ct2f2	285.8	288.4
380ct2f3	269.1	272.6
bl2	239.5	248.6
Post 1		
Post 2		
Post 3		

Envelop of weight span over all combinations (incl. 0,9 combinations)		
For all conductors		Wind / Weight span ratio
Max. weight span	288.4 m	0.759 -
Min. weight span	-17.8 m	-0.047 -

DNV·GL

Project: KIJ-GT
Tower: HC+0 II
Number: 15

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	30.2	33.4	5.3	-40.2	35.0
380ct1f1	92.9	109.2	16.2	-136.3	129.3
380ct1f2	92.9	109.2	16.2	-136.3	129.3
380ct1f3	96.7	116.7	16.2	-140.4	132.5
380ct2f1	92.9	109.2	16.2	-136.3	129.3
380ct2f2	92.9	109.2	16.2	-136.3	129.3
380ct2f3	96.7	116.7	16.2	-140.4	132.5
bl2	30.3	33.3	5.3	-40.2	35.3
Post 1	3.0	3.0	3.9	0.0	
Post 2	3.0	3.0	3.9	0.0	
Post 3	3.0	3.0	3.9	0.0	

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	14.0	5.4	1.6	-15.0	15.0
380ct1f1	59.9	23.0	9.1	-64.2	64.2
380ct1f2	59.9	23.0	9.1	-64.2	64.2
380ct1f3	59.9	23.0	9.1	-64.2	64.2
380ct2f1	59.9	23.0	9.1	-64.2	64.2
380ct2f2	59.9	23.0	9.1	-64.2	64.2
380ct2f3	59.9	23.0	9.1	-64.2	64.2
bl2	14.0	5.4	1.6	-15.0	15.0
Post 1	0.0	0.0	3.0	0.0	
Post 2	0.0	0.0	3.0	0.0	
Post 3	0.0	0.0	3.0	0.0	

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	0.0	0.0
	380ct1f1	0.0	0.0
	380ct1f2	0.0	0.0
	380ct1f3	0.0	0.0
	380ct2f1	0.0	0.0
	380ct2f2	0.0	0.0
	380ct2f3	0.0	0.0
	bl2	0.0	0.0
	Post 1	0.0	
	Post 2	0.0	
	Post 3	0.0	

Project: KIJ-GT
Tower: HC+0 II
Number: 15

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		-61	739	110	24016	-2038	0
ULS 1a_0,9_0		15	351	130	11249	431	-111
ULS 1a_0,9_0,9_90		-62	703	78	22885	-2051	0
ULS 3_0		-7	576	202	18520	-259	-31
SLS 7		0	297	115	9500	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

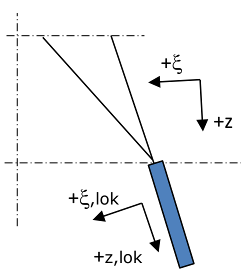
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	-61	985	599	29903	-2038	0
ULS 1a_0,9_0,9_90	-62	949	460	28773	-2051	0
SLS 7	0	297	540	9500	0	0

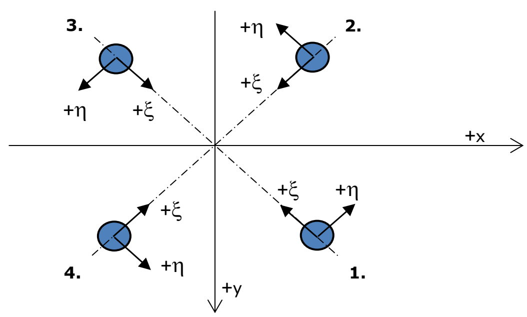
Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_90	-61	985	491	**29932**	-2038	0
SPLS 3_0 Ba All Cts	623	203	589	6431	**19684**	-25
SPLS 3_69 Ba Ct2	269	436	610	13747	8465	**-3219**
ULS 1a_0,9_69	-118	971	485	**29457**	**-4834**	-40

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg





Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_111	249	268	**1487**	-13	-366	-37	1523
2	SPLS 1a_0 Ba All Cts	144	-134	**792**	-7	-197	-22	811
3	SPLS 3_135 Ah All Cts	-108	-102	**619**	4	-149	-12	634
4	ULS 1a_69	-286	305	**1706**	14	-418	-41	1747

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-62	-58	**-356**	-3	85	7	-365
2	ULS 1a_0,9_69	-238	261	**-1437**	-16	353	35	-1472
3	ULS 1a_0,9_111	200	222	**-1210**	16	298	31	-1239
4	SPLS 1a_0,9_0 Ba All Cts	96	-92	**-528**	3	133	16	-541

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_69 Ba Ct1	265	124	1113	**100**	-275	-29	1140
2	SPLS 3_0,9_111 Ah Ct2	-229	87	-915	**101**	223	21	-937
3	SPLS 3_69 Ba Ct1	72	222	-834	**106**	207	23	-854
4	SPLS 3_69 Ba Ct1	10	142	369	**108**	-93	-11	378

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	SPLS 3_111 Ah Ct1	-14	135	335	**-105**	-85	-11	343
2	SPLS 3_69 Ba Ct2	59	90	-88	**-105**	22	2	-90

Project: KIJ-GT
Tower: HC+0 II
Number: 15

3	SPLS 3_0,9_69 Ba Ct2	227	80	-886	**-103**	217	21	-907
4	SPLS 3_0,9_69 Ba Ct2	-135	-9	367	**-102**	-89	-8	376

Project: KIJ-GT
Tower: HC+0 II
Number: 15

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-62	-58	**-356**	**-3**	85	7	-365
2	ULS 1a_0,9_69	-238	261	**-1437**	**-16**	353	35	-1472
3	ULS 1a_0,9_111	200	222	**-1210**	**16**	298	31	-1239
4	SPLS 1a_0,9_0 Ba All Cts	96	-92	**-528**	**3**	133	16	-541

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	97	98	567	0	-138	-13	581
2	SLS 7	-51	51	-297	0	72	7	-304
3	SLS 7	51	51	-297	0	72	7	-304
4	SLS 7	-97	98	567	0	-138	-13	581

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_69	-286	305	**1706**	14	-418	-41	1747
Max. tension	ULS 1a_0,9_69	-238	261	**-1437**	-16	353	35	-1472
Max. pos. torsie	SPLS 3_69 Ba Ct1	10	142	369	**108**	-93	-11	378
Max. neg. torsie	SPLS 3_69 Ba Ct2	59	90	-88	**-105**	22	2	-90
Comb. tension+torsie	ULS 1a_0,9_69	-238	261	**-1437**	**-16**	353	35	-1472

Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	97	98	**567**	0	-138	-13	581
2	SLS 1a_90	-164	173	**-956**	-7	239	27	-979
3	SLS 1a_90	146	155	**-847**	6	213	25	-868
4	SLS 1a_0	-39	45	**275**	4	-60	1	281

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_90	191	200	**1110**	-6	-277	-31	1137
2	SLS 1a_0	11	3	**-5**	-9	-6	-7	-5
3	SLS 7	51	51	**-297**	0	72	7	-304
4	SLS 1a_90	-209	219	**1219**	7	-303	-33	1249

Content

Data

Norm	NEN-EN50341-2-15:2019
Initial	
Consequence class	CC2-0
Reliability level	Afkeur
Reference period	30 jaar
After adjustment	
Consequence class	CC2
Reliability level	Verbouw
Reference period	50 jaar
Wind zone	II
Wind speed	27 m/s
Terrain categorie	II
Reduction factor Cdir	1,00
Ice region	B
Tower type	Hoekmast
Tower height	45 m
Max. Span	402 m
Line angle	131°
Catenary	1400 m
Wind span	363 m
EDS Weight span	363 m
Min. Weight span	360 m
Max. Weight span	364 m

ISSUE	DATE	REVISION	CHK'D	APP'D
0.0	2021-02-10			

Client:

Title:

Berekening masttype HC+0 II

JOB No.	-	DATE	-
DRAWN	-	CHKD	-
DESIGN	-	APPD	-

Document name:

KIJ-GT_HC+0 II_38_Report.pdf

Project number:

Project client number:

0.0

Project: KIJ-GT
Tower: HC+0 II
Number: 38

Conductor loads

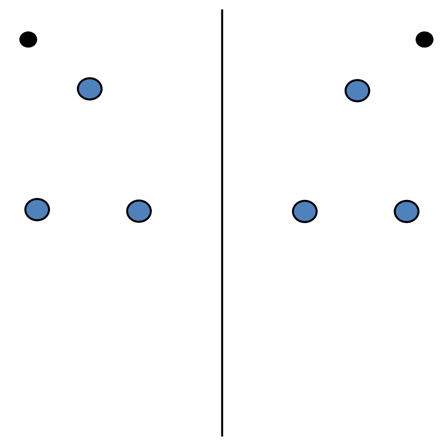
Auteur: TBR
Versie: v11.6

General

Description	HC+0 II
Tower type	Hoekmast
Number of circuits	2
Configuration	2-circuit-donau
Number of earth wires	2

Starting points

Norm	NEN-EN50341-2-15:2019
Consequence class	CC2-0
Reliability level initial	Afkeur CC2-0
Reference period intial	30 jaar
Consequence class modified	CC2
Reliability level modified	Verbouw
Reference period modified	50 jaar
Wind zone	II
Terrain category	27,0 m/s
Reduction factor c_{dir}	II
Ice region phase conductor	1,00
Ice region earth conductor	B
	B



Configuratie geleiders

Conductors back

Description	Voltage	Conductor Back	Bundle Ba	Ice region	Additional weight	Additional diameter	Catenary P_{back}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Conductors ahead

Description	Voltage	Conductor Ahead	Bundle Ah	Ice region	Additional weight	Additional diameter	Catenary P_{ahead}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Insulators *(1)*

Description	Suspension	Weight [kN]	Length [m]	Wind area [m^2]
Circuit 1	Afspanketting	2,00	4,83	1,00
Circuit 2	Afspanketting	2,00	4,83	1,00
Bliksemdraad 1	Vast (Bliksemdraad)	0,10	0,30	0,05
Bliksemdraad 2	Vast (Bliksemdraad)	0,10	0,30	0,05

1. Properties apply to the entire isolator set

Suspension height and position in mast

Circuits	Designation	Number	Suspension height	Attach point	Position in tower Horizontal distance
Circuit 1	21	380ct1f1	27,7 m	27,7 m	17,7 m
Circuit 1	20	380ct1f2	27,7 m	27,7 m	9,5 m
Circuit 1	22	380ct1f3	39,0 m	39,0 m	13,6 m
Circuit 2	10	380ct2f1	27,7 m	27,7 m	-17,7 m
Circuit 2	11	380ct2f2	27,7 m	27,7 m	-9,5 m
Circuit 2	12	380ct2f3	39,0 m	39,0 m	-13,6 m
Bliksemdraad 1	1	bl1	42,9 m	43,2 m	-18,4 m
Bliksemdraad 2	3	bl2	42,9 m	43,2 m	18,4 m

Project: KIJ-GT
Tower: HC+0 II
Number: 38

Height adjustment adjacent masts (wind and weight span adjustment)

	Back	Ahead	
Height increase for wind pressure	0,0 m	0,0 m	(positive: higher)
Height decrease for vertical load	0,0 m	0,0 m	(negative: decrease, more weight span)

Decrease: Niet in 0,9EG-combinaties

Height difference adjacent tower and change of direction with respect to Line direction

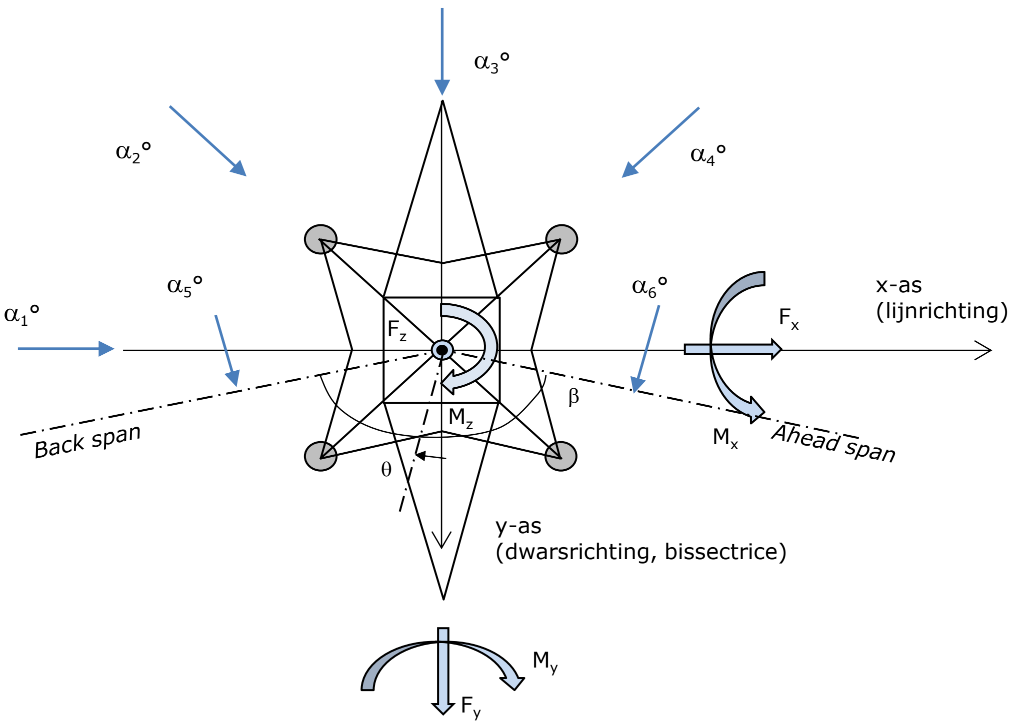
			Hoogteverschil		Richtingsverandering	
Circuits	Aanduiding	Nummer	Δh_back	Δh_ahead	Δy_back	Δy_ahead
Circuit 1	21	380ct1f1	0,1	0,4 m	0,0	0,0 m
Circuit 1	20	380ct1f2	0,1	0,4 m	0,0	0,0 m
Circuit 1	22	380ct1f3	0,1	0,4 m	0,0	0,0 m
Circuit 2	10	380ct2f1	0,1	0,4 m	0,0	0,0 m
Circuit 2	11	380ct2f2	0,1	0,4 m	0,0	0,0 m
Circuit 2	12	380ct2f3	0,1	0,4 m	0,0	0,0 m
Bliksemdraad 1	1	bl1	-0,1	0,0 m	0,0	0,0 m
Bliksemdraad 2	3	bl2	-0,1	0,0 m	0,0	0,0 m

Line and tower data

		Back	Ahead
		324,0	402,0 m
Ruling span $\sqrt{(\Sigma L^3/\Sigma L)}$		324,0	366,3 m
Line angle	β	131 °	
Tower orientation with respect to bis	θ	0 °	
Section length		324	3403 m
Height bottom of tower to ground level		0,5 m	
Wind directions considered	α_1	0 °	
Wind directions according to:	α_2	45 °	
Geleiderbelastingen	α_3	90 °	
	α_4	135 °	
	α_5	65,5 °	
	α_6	114,5 °	

Wind directions apply to the main direction of mast construction, not to the bisector.

Windrichtingen en positieve richtingen belastingen



Considered number of wind directions	
1a	6
3	6
4	1
6	1
Overig	1

Project: KIJ-GT
Tower: HC+0 II
Number: 38

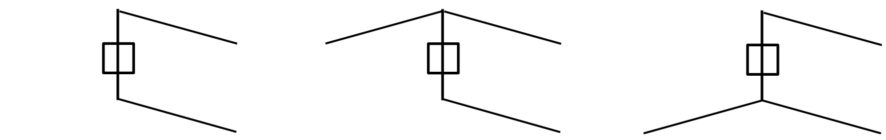
Absence of conductors

		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	380ct1f1	1	0	1	0	1	0
Circuit 1	380ct1f2	1	0	1	0	1	0
Circuit 1	380ct1f3	1	0	1	0	1	0
Circuit 2	380ct2f1	0	1	1	0	1	0
Circuit 2	380ct2f2	0	1	1	0	1	0
Circuit 2	380ct2f3	0	1	1	0	1	0
Bliksemdraad 1	bl1	1	0	1	0	1	0
Bliksemdraad 2	bl2	0	1	1	0	1	0

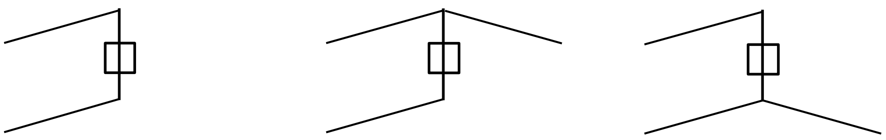
Load situations SPLS

Considered situations SPLS: 1 up to 6, All possible situations

Principle of load situations:



1. Ba All cts 2. Ba ct1 3. Ba ct2

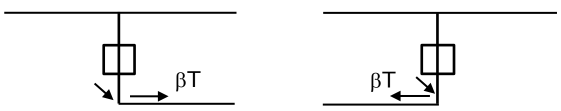


4. Ah All cts 5. Ah ct1 6. Ah ct2

Load situation 5a. Conductor failure

Considered situations conductor failure 5a: 1, design assumption is symmetry back and ahead

Principle of load situations:



1. Ba 2. Ah

Project: KIJ-GT
Tower: HC+0 II
Number: 38

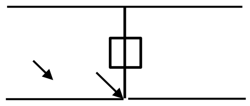
Load situations LC6. Construction and maintenance
Under 6a, the load due to the presence of a line verhicle or line bicycle in combination with point load on the traverse is assesed.
Combination 6b does not contain any loads in conductor or on traverse. This combination has been added to be able to combine with separate control platforms, etc. The situations are applied in ULS and in every SPLS situation (in case of angle tower).

3,0 kN	2,0 kN
1,0 kN	1,0 kN

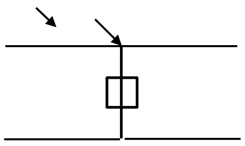
Considered situations construction and maintenance 6a: 1 up to 4, all possible situations

Presence line vehicle: Circuit, load present in all conductors of a circuit

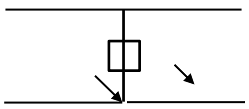
Principle of load situations:



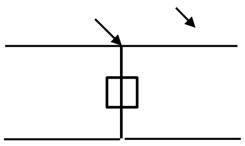
1. Ba Ct1



2. Ba Ct2



3. Ah Ct1



4. Ah Ct2

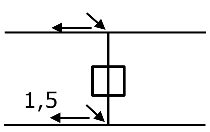
Load situations 8. Galloping as a static load

Conductor		
Suspension tower phase	0,866 W	1,5 W
Suspension tower earth	1,5 EDS	1,5 W
Strain tower phase and earth	1,5 EDS	1,5 W

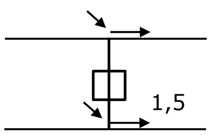
Considered situations galloping 8: None (existing structure)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principle of load situations:



1. Ba



2. Ah

Load combination 8. Galloping as a dynamic load
Only applies to tension towers
Load consists of EDS tensile load in one of the conductors on one side of the tower
Can be converted by user to fatigue spectrum via the load spectrum of table 4.11 / NL.1

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Project: KIJ-GT
Tower: HC+0 II
Number: 38

Tower structure

Properties

Tower type	Hoekmast	
Tower designation	HC+0 II	
Base plate w.r.t. ground level	0,5	m
Tower height w.r.t. base plate	45,0	m
Tower self weight	425,0	kN

Width and slope at foundation	x-ri.	y-ri.	
Leg spread	11,00	11,00	m
Inclination of main leg	0,156	0,156	-
Horizontal force factor	1,1	1,1	-

Calculation Wind load

Dynamic factor G_T	1,00 *(Masthoogte < 60 m)*
Wind load diagonally to tower body proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Wind load diagonally on traverse proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Magnification factor diagonal wind to tower body	(1+0,2sin^2(2phi))
Magnification factor diagonal wind to cross arm	(1+0,2sin^2(2phi))
Magnification factor wind parallel to perpendicular to cross a	0,4

Properties mast sections longitudinal direction (front view, yz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	9,60	11,00	8,00	9,60	0,156	91,20	11,46	0,13	3,28
Middenstuk 1	18,90	8,00	5,84	9,30	0,116	64,36	10,66	0,17	3,08
Middenstuk 2	27,70	5,84	3,80	8,80	0,116	42,42	9,83	0,23	2,80
Bovenstuk 1	35,50	3,80	3,19	7,80	0,039	27,26	6,61	0,24	2,75
Bovenstuk 2	43,00	3,19	2,60	7,50	0,039	21,71	5,25	0,24	2,76
Topstuk	45,00	2,60		2,00		2,60	0,24	0,09	3,45
Ondertraverse	27,70	15,80		4,00		31,60	5,89	0,19	2,99
Boventraverse	39,00	16,95		4,20		35,60	7,55	0,21	2,88

Properties tower sections transversal direction (side view, xz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	9,60	11,00	8,00	9,60	0,156	91,20	11,46	0,13	3,28
Middenstuk 1	18,90	8,00	5,84	9,30	0,116	64,36	10,66	0,17	3,08
Middenstuk 2	27,70	5,84	3,80	8,80	0,116	42,42	9,83	0,23	2,80
Bovenstuk 1	35,50	3,80	3,19	7,80	0,039	27,26	6,61	0,24	2,75
Bovenstuk 2	43,00	3,19	2,60	7,50	0,039	21,71	5,25	0,24	2,76
Topstuk	45,00	2,60		2,00		2,60	0,24	0,09	3,45
Ondertraverse	27,70	15,80		4,00		31,60	5,89	0,19	2,99
Boventraverse	39,00	16,95		4,20		35,60	7,55	0,21	2,88

Note: Surface transverse direction is reduced in calculation.

Project: KIJ-GT
Tower: HC+0 II
Number: 38

Wind surface feeders telecom installations

Part	A (m^2/m)	Factor	Δh	A_1
Broekstuk 1				
Middenstuk 1				
Middenstuk 2				
Bovenstuk 1				
Bovenstuk 2				

Input antennas

Description	A (m^2)	h (m)	C_f (m)
Antenne 1			
Schotel			
Schotel			

Tower section loads longitudinal (x-direction) per wind direction

Description	p_w	F_{x1}	F_{x2}	F_{x3}	F_{x4}	h_{ef}	M_{y1}	M_{y2}	M_{y3}	M_{y4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,85	32,0	27,1	0,0	-27,1	4,8	153,5	130,2	0,0	-130,2
Middenstuk 1	0,96	31,5	26,8	0,0	-26,8	14,3	449,3	381,2	0,0	-381,2
Middenstuk 2	1,12	30,7	26,0	0,0	-26,0	23,3	714,7	606,4	0,0	-606,4
Bovenstuk 1	1,22	22,3	18,9	0,0	-18,9	31,6	703,5	596,9	0,0	-596,9
Bovenstuk 2	1,29	18,7	15,9	0,0	-15,9	39,3	734,2	623,0	0,0	-623,0
Topstuk	1,33	1,1	0,9	0,0	-0,9	44,0	48,5	41,2	0,0	-41,2
Ondertraverse	1,19	41,9	24,9	0,0	-24,9	29,0	1216,5	722,6	0,0	-722,6
Boventraverse	1,30	56,6	33,6	0,0	-33,6	40,4	2288,5	1359,3	0,0	-1359,3
Totaal		234,8	174,1	0,0	-174,1		6308,6	4460,8	0,0	-4460,8

Tower section loads transversal (y-direction) per wind direction

Description	p_w	F_{y1}	F_{y2}	F_{y3}	F_{x4}	h_{ef}	M_{x1}	M_{x2}	M_{x3}	M_{x4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,85	0,0	27,1	32,0	27,1	4,8	0,0	130,2	153,5	130,2
Middenstuk 1	0,96	0,0	26,8	31,5	26,8	14,3	0,0	381,2	449,3	381,2
Middenstuk 2	1,12	0,0	26,0	30,7	26,0	23,3	0,0	606,4	714,7	606,4
Bovenstuk 1	1,22	0,0	18,9	22,3	18,9	31,6	0,0	596,9	703,5	596,9
Bovenstuk 2	1,29	0,0	15,9	18,7	15,9	39,3	0,0	623,0	734,2	623,0
Topstuk	1,33	0,0	0,9	1,1	0,9	44,0	0,0	41,2	48,5	41,2
Ondertraverse	1,19	0,0	24,9	16,8	24,9	29,0	0,0	722,6	486,6	722,6
Boventraverse	1,30	0,0	33,6	22,7	33,6	40,4	0,0	1359,3	915,4	1359,3
Total		0,0	174,1	175,7	174,1		0,0	4460,8	4205,6	4460,8

Resulting loads from mast construction incl. Antenna without conductors level foundation (char. Value)

Load / wind direction	F_x	F_y	F_z	M_x	M_y	M_z
	[kN]	[kN]	[kN]	[kNm]	[kNm]	[kNm]
Permanente belasting	0	0	425	0	0	0
Windrichting 0°	235	0	0	0	6309	0
Windrichting 45°	174	174	0	4461	4461	0
Windrichting 90°	0	176	0	4206	0	0
Windrichting 135°	-174	174	0	4461	-4461	0

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Project: KIJ-GT
Tower: HC+0 II
Number: 38

Intermediate results for conductor loads

Conductors back

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Conductors ahead

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Vertical load back

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Vertical load ahead

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	[N/m]	[N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Insulators

Conductor	$G_{isolator}$ [kN]	Number -	$F_{v,iso}$ [kN]	Length [m]	Wind surf. [m^2]	Wind heigth [m]	Pressure [kN/m^2]	Drag factor [-]	$F_{h,iso}$ [kN]
380ct1f1	2,00	1	2	4,8	1,0	28,20	1,18	1,2	1,42
380ct1f2	2,00	1	2	4,8	1,0	28,20	1,18	1,2	1,42
380ct1f3	2,00	1	2	4,8	1,0	39,50	1,30	1,2	1,55
380ct2f1	2,00	1	2	4,8	1,0	28,20	1,18	1,2	1,42
380ct2f2	2,00	1	2	4,8	1,0	28,20	1,18	1,2	1,42
380ct2f3	2,00	1	2	4,8	1,0	39,50	1,30	1,2	1,55
bl1	0,10	0,5	0,05	0,3	0,1	43,40	1,33	1,2	0,08
bl2	0,10	0,5	0,05	0,3	0,1	43,40	1,33	1,2	0,08

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Project: KIJ-GT
Tower: HC+0 II
Number: 38

Wind load back

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	22,0	1,10	0,56	0,63	1,07	28,25	55,7	62,5	46,9	103,7	116,5
380ct1f2	22,0	1,10	0,56	0,63	1,07	28,25	55,7	62,5	46,9	103,7	116,5
380ct1f3	33,3	1,24	0,59	0,67	1,03	28,25	64,2	72,1	46,9	123,8	138,9
380ct2f1	22,0	1,10	0,56	0,63	1,07	28,25	55,7	62,5	46,9	103,7	116,5
380ct2f2	22,0	1,10	0,56	0,63	1,07	28,25	55,7	62,5	46,9	103,7	116,5
380ct2f3	33,3	1,24	0,59	0,67	1,03	28,25	64,2	72,1	46,9	123,8	138,9
bl1	37,5	1,28	0,60	0,68	1,16	22,24	19,8	22,2	41,5	38,4	43,0
bl2	37,5	1,28	0,60	0,68	1,16	22,13	19,8	22,1	41,4	38,3	42,9

Wind load ahead

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	18,8	1,05	0,55	0,47	1,08	28,25	52,5	44,8	46,9	96,6	82,3
380ct1f2	18,8	1,05	0,55	0,47	1,08	28,25	52,5	44,8	46,9	96,6	82,3
380ct1f3	30,1	1,20	0,58	0,50	1,04	28,25	62,1	52,8	46,9	118,7	100,9
380ct2f1	18,8	1,05	0,55	0,47	1,08	28,25	52,5	44,8	46,9	96,6	82,3
380ct2f2	18,8	1,05	0,55	0,47	1,08	28,25	52,5	44,8	46,9	96,6	82,3
380ct2f3	30,1	1,20	0,58	0,50	1,04	28,25	62,1	52,8	46,9	118,7	100,9
bl1	34,4	1,25	0,60	0,51	1,16	22,24	19,2	16,3	41,5	37,0	31,5
bl2	34,4	1,25	0,60	0,51	1,17	22,13	19,2	16,3	41,4	37,0	31,4

Project: KIJ-GT
Tower: HC+0 II
Number: 38

Auteur: TBR
Versie: v11.6

Conductor loads

Starting points

Consequence class Afkeur CC2-0
Reference period 30 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,05	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,12	0,00	0,0
ULS 3	Wind+ice	-5°	1,05	1,05	0,00	0,34	0,97	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,05	0,00	0,34	0,97	0,0
ULS 4	Cold+wind	-20°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,05	0,00	0,22	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,05	1,05	1,20	0,22	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 7	Permanent	10°	1,15	1,15	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,05	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,05	1,05	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,05	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,05	1,05	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,05	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,05	1,05	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,05	1,05	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	0,94	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,28	0,88	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	6
Number of load combinations for ULS	46
Number of load combinations for SPLS	222
Number of load combinations for SLS	15
Number of concentrated loads	5377

Project: KIJ-GT
Tower: HC+0 II
Number: 38

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-29,5	28,4	17,3	15,7	5,4	6,0
380ct1f1	-101,9	97,4	56,0	52,1	14,7	17,2
380ct1f2	-101,9	97,4	56,0	52,1	14,7	17,2
380ct1f3	-105,1	99,2	61,4	56,1	14,7	17,2
380ct2f1	-101,9	97,4	56,0	52,1	14,7	17,2
380ct2f2	-101,9	97,4	56,0	52,1	14,7	17,2
380ct2f3	-105,1	99,2	61,4	56,1	14,7	17,2
bl2	-29,7	28,5	17,3	15,7	5,4	6,0
Post 1	0,0	0,0	0,0	0,0	0,0	
Post 2	0,0	0,0	0,0	0,0	0,0	
Post 3	0,0	0,0	0,0	0,0	0,0	

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	363,3	363,4	363,3
380ct1f1	361,2	361,4	361,6
380ct1f2	361,2	361,4	361,6
380ct1f3	360,8	361,1	361,3
380ct2f1	361,2	361,4	361,6
380ct2f2	361,2	361,4	361,6
380ct2f3	360,8	361,1	361,3
bl2	363,3	363,4	363,3
Post 1			
Post 2			
Post 3			

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	363,7	363,4
380ct1f1	361,5	361,6
380ct1f2	361,5	361,6
380ct1f3	361,3	361,4
380ct2f1	361,5	361,6
380ct2f2	361,5	361,6
380ct2f3	361,3	361,4
bl2	363,7	363,4
Post 1		
Post 2		
Post 3		

Envelop of weight span over all combinations (incl. 0,9 combinations)		
For all conductors		Wind / Weight span ratio
Max. weight span	363,9 m	1,002 -
Min. weight span	360,4 m	0,993 -

Project: KIJ-GT
Tower: HC+0 II
Number: 38

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	29,5	28,9	6,0	-33,7	31,6
380ct1f1	88,5	101,1	17,2	-114,7	110,2
380ct1f2	88,5	101,1	17,2	-114,7	110,2
380ct1f3	93,5	105,1	17,2	-119,0	113,0
380ct2f1	88,5	101,1	17,2	-114,7	110,2
380ct2f2	88,5	101,1	17,2	-114,7	110,2
380ct2f3	93,5	105,1	17,2	-119,0	113,0
bl2	29,7	28,9	6,0	-33,7	31,7
Post 1	2,4	2,4	3,5	0,0	
Post 2	2,4	2,4	3,5	0,0	
Post 3	2,4	2,4	3,5	0,0	

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	13,7	6,2	2,1	-15,0	15,0
380ct1f1	58,4	26,6	11,2	-64,2	64,2
380ct1f2	58,4	26,6	11,2	-64,2	64,2
380ct1f3	58,4	26,6	11,2	-64,2	64,2
380ct2f1	58,4	26,6	11,2	-64,2	64,2
380ct2f2	58,4	26,6	11,2	-64,2	64,2
380ct2f3	58,4	26,6	11,2	-64,2	64,2
bl2	13,6	6,2	2,1	-15,0	15,0
Post 1	0,0	0,0	3,0	0,0	
Post 2	0,0	0,0	3,0	0,0	
Post 3	0,0	0,0	3,0	0,0	

1 **Control uplift SLS-wind**

Combinatie	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	0,0	0,0
	380ct1f1	0,0	0,0
	380ct1f2	0,0	0,0
	380ct1f3	0,0	0,0
	380ct2f1	0,0	0,0
	380ct2f2	0,0	0,0
	380ct2f3	0,0	0,0
	bl2	0,0	0,0
	Post 1	0,0	
	Post 2	0,0	
	Post 3	0,0	

Project: KIJ-GT
Tower: HC+0 II
Number: 38

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		-85	656	147	21300	-2804	0
ULS 1a_0,9_0		14	367	146	11755	425	-89
ULS 1a_0,9_0,9_90		-93	629	126	20455	-3059	0
ULS 3_0		10	563	213	18125	325	-28
SLS 7		0	344	140	11011	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

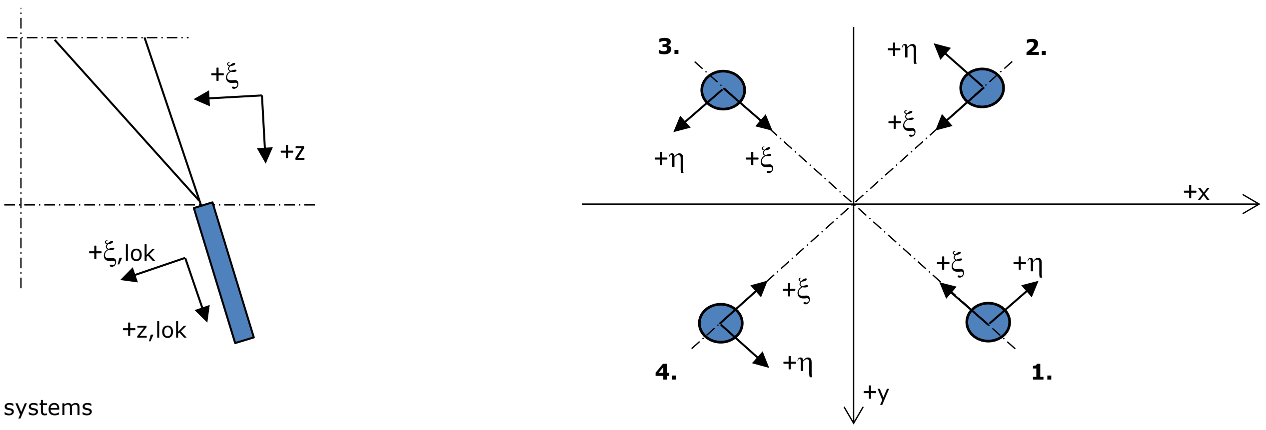
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	-85	853	593	26027	-2804	0
ULS 1a_0,9_0,9_90	-93	826	508	25183	-3059	0
SLS 7	0	344	565	11011	0	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_90	-85	853	528	**26044**	-2804	0
SPLS 3_65,5 Ah All Cts	-560	369	541	11368	**-18506**	-17
SPLS 3_65,5 Ba Ct2	231	460	586	14623	7175	**-3224**
ULS 1a_0,9_65,5	-123	835	528	**25436**	**-4956**	-37

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_114,5 Ba All Cts	235	242	**1389**	-5	-337	-30	1423
2	SPLS 1a_0 Ba All Cts	130	-120	**710**	-7	-177	-20	727
3	SPLS 3_135 Ah All Cts	-92	-86	**524**	4	-126	-10	537
4	ULS 1a_65,5	-256	272	**1529**	12	-373	-35	1566

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-48	-43	**-269**	-3	64	5	-276
2	ULS 1a_0,9_65,5	-206	226	**-1250**	-14	305	29	-1280
3	SPLS 3_0,9_114,5 Ba All Cts	190	198	**-1128**	6	274	25	-1156
4	SPLS 1a_0,9_0 Ba All Cts	83	-79	**-454**	3	115	14	-465

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_65,5 Ba Ct1	262	121	1090	**100**	-270	-29	1117
2	SPLS 3_0,9_65,5 Ba Ct1	-102	-36	-179	**98**	46	7	-183
3	SPLS 3_65,5 Ba Ct1	69	219	-813	**106**	203	23	-833
4	SPLS 3_65,5 Ba Ct1	-4	157	455	**108**	-114	-13	466

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	SPLS 3_65,5 Ba Ct2	124	269	1137	**-103**	-278	-27	1165
2	SPLS 3_65,5 Ba Ct2	42	107	-192	**-105**	46	4	-197
3	SPLS 3_0,9_65,5 Ba Ct2	223	75	-861	**-104**	211	21	-882
4	SPLS 3_0,9_65,5 Ba Ct2	-152	8	470	**-102**	-113	-10	481

Project: KIJ-GT
Tower: HC+0 II
Number: 38

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-48	-43	**-269**	**-3**	64	5	-276
2	SPLS 3_0,9_65,5 Ah Ct2	-241	120	**-1061**	**85**	255	20	-1087
3	SPLS 3_0,9_114,5 Ba Ct2	222	98	**-941**	**-88**	227	19	-963
4	SPLS 1a_0,9_0 Ba All Cts	83	-79	**-454**	**3**	115	14	-465

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	110	110	642	0	-156	-14	657
2	SLS 7	-62	62	-359	0	87	8	-368
3	SLS 7	62	62	-359	0	87	8	-368
4	SLS 7	-110	110	642	0	-156	-14	657

Envelope of load combinations for all of the legs

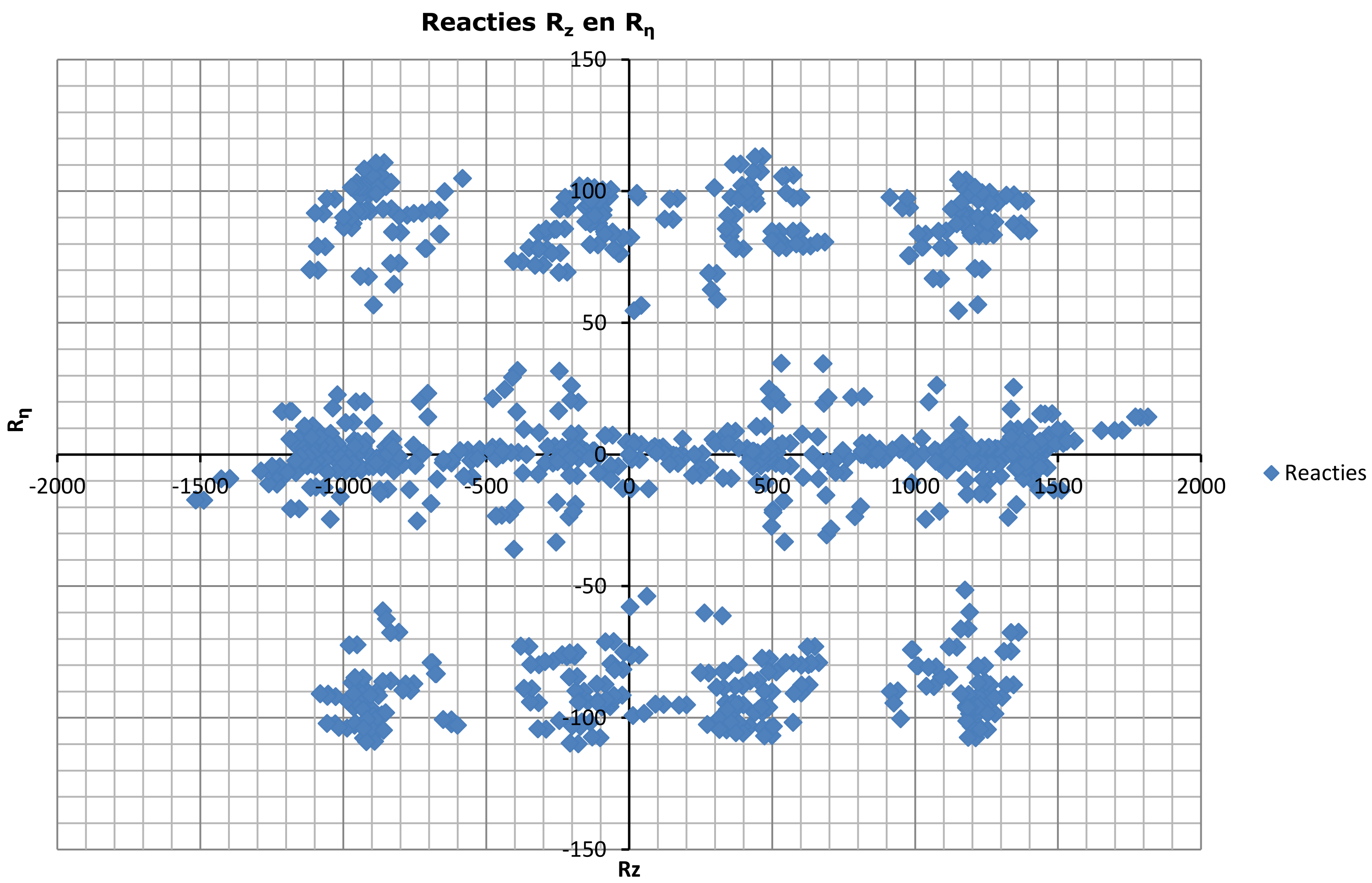
Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_65,5	-256	272	**1529**	12	-373	-35	1566
Max. tension	ULS 1a_0,9_65,5	-206	226	**-1250**	-14	305	29	-1280
Max. pos. torsie	SPLS 3_65,5 Ba Ct1	-4	157	455	**108**	-114	-13	466
Max. neg. torsie	SPLS 3_65,5 Ba Ct2	42	107	-192	**-105**	46	4	-197
Comb. tension+torsie	SPLS 3_0,9_65,5 Ah Ct2	-241	120	**-1061**	**85**	255	20	-1087

Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	110	110	**642**	0	-156	-14	657
2	SLS 1a_90	-172	181	**-1006**	-6	250	28	-1031
3	SLS 1a_90	137	145	**-796**	6	200	24	-815
4	SLS 1a_0	-55	61	**363**	4	-82	-2	372

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 3_90	188	190	**1095**	-1	-267	-25	1122
2	SLS 1a_0	-3	15	**-80**	-9	13	-5	-82
3	SLS 7	62	62	**-359**	0	87	8	-368
4	SLS 1a_90	-221	230	**1289**	6	-319	-34	1320


Reacties Rz en Rη
150
100
50
0
-50
-100
-150
-2000
-1500
-1000
-500
0
500
1000
1500
2000
Rη
Rz
Reacties

Project: KIJ-GT
Tower: HC+0 II
Number: 38

Auteur: TBR
Versie: v11.6

Conductor loads

Starting points

Consequence class Verbouw CC2
Reference period 50 jaar

ULS (strength)		NEN-EN50341-2-15:2019						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,15	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,40	0,00	0,0
ULS 3	Wind+ice	-5°	1,15	1,15	0,00	0,42	1,30	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,15	0,00	0,42	1,30	0,0
ULS 4	Cold+wind	-20°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,15	0,00	0,28	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,15	1,15	1,30	0,28	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 7	Permanent	10°	1,30	1,30	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,15	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,15	1,15	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,15	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,15	1,15	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,15	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,15	1,15	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,15	1,15	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	1,00	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,30	1,00	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	6
Number of load combinations for ULS	46
Number of load combinations for SPLS	222
Number of load combinations for SLS	15
Number of concentrated loads	5377

Project: KIJ-GT
Tower: HC+0 II
Number: 38

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-33,9	30,5	20,5	18,7	5,8	6,5
380ct1f1	-117,9	112,9	66,1	61,1	16,8	20,3
380ct1f2	-117,9	112,9	66,1	61,1	16,8	20,3
380ct1f3	-121,9	115,2	72,7	66,4	16,8	20,3
380ct2f1	-117,9	112,9	66,1	61,1	16,8	20,3
380ct2f2	-117,9	112,9	66,1	61,1	16,8	20,3
380ct2f3	-121,9	115,2	72,7	66,4	16,8	20,3
bl2	-33,9	30,6	20,5	18,7	5,8	6,5
Post 1	0,0	0,0	0,0	0,0	0,0	
Post 2	0,0	0,0	0,0	0,0	0,0	
Post 3	0,0	0,0	0,0	0,0	0,0	

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	363,3	363,4	363,3
380ct1f1	361,1	361,4	361,6
380ct1f2	361,1	361,4	361,6
380ct1f3	360,7	361,1	361,3
380ct2f1	361,1	361,4	361,6
380ct2f2	361,1	361,4	361,6
380ct2f3	360,7	361,1	361,3
bl2	363,3	363,4	363,3
Post 1			
Post 2			
Post 3			

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	363,8	363,4
380ct1f1	361,6	361,6
380ct1f2	361,6	361,6
380ct1f3	361,3	361,4
380ct2f1	361,6	361,6
380ct2f2	361,6	361,6
380ct2f3	361,3	361,4
bl2	363,8	363,4
Post 1		
Post 2		
Post 3		

Envelop of weight span over all combinations (incl. 0,9 combinations)		
For all conductors		Wind / Weight span ratio
Max. weight span	364,0 m	1,003 -
Min. weight span	360,0 m	0,992 -

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Project: KIJ-GT
Tower: HC+0 II
Number: 38

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	30,4	34,2	6,5	-39,4	34,7
380ct1f1	92,4	118,1	20,3	-133,0	128,0
380ct1f2	92,4	118,1	20,3	-133,0	128,0
380ct1f3	97,1	123,0	20,3	-139,1	131,5
380ct2f1	92,4	118,1	20,3	-133,0	128,0
380ct2f2	92,4	118,1	20,3	-133,0	128,0
380ct2f3	97,1	123,0	20,3	-139,1	131,5
bl2	30,6	34,1	6,5	-39,4	35,0
Post 1	3,0	3,0	3,9	0,0	
Post 2	3,0	3,0	3,9	0,0	
Post 3	3,0	3,0	3,9	0,0	

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	13,7	6,2	2,1	-15,0	15,0
380ct1f1	58,4	26,6	11,2	-64,2	64,2
380ct1f2	58,4	26,6	11,2	-64,2	64,2
380ct1f3	58,4	26,6	11,2	-64,2	64,2
380ct2f1	58,4	26,6	11,2	-64,2	64,2
380ct2f2	58,4	26,6	11,2	-64,2	64,2
380ct2f3	58,4	26,6	11,2	-64,2	64,2
bl2	13,6	6,2	2,1	-15,0	15,0
Post 1	0,0	0,0	3,0	0,0	
Post 2	0,0	0,0	3,0	0,0	
Post 3	0,0	0,0	3,0	0,0	

1 **Control uplift SLS-wind**

Combinatie	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	0,0	0,0
	380ct1f1	0,0	0,0
	380ct1f2	0,0	0,0
	380ct1f3	0,0	0,0
	380ct2f1	0,0	0,0
	380ct2f2	0,0	0,0
	380ct2f3	0,0	0,0
	bl2	0,0	0,0
	Post 1	0,0	
	Post 2	0,0	
	Post 3	0,0	

Project: KIJ-GT
Tower: HC+0 II
Number: 38

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		-105	769	161	24990	-3463	0
ULS 1a_0,9_0		18	400	159	12829	533	-111
ULS 1a_0,9_0,9_90		-118	729	126	23770	-3882	0
ULS 3_0		16	650	249	20929	522	-34
SLS 7		0	344	140	11011	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

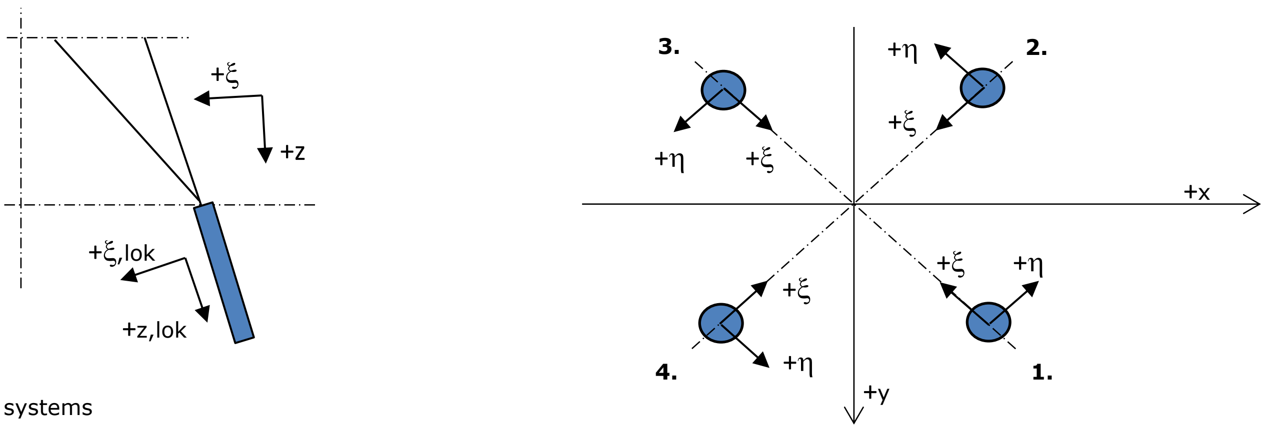
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	-105	1015	649	30878	-3463	0
ULS 1a_0,9_0,9_90	-118	975	508	29658	-3882	0
SLS 7	0	344	565	11011	0	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_90	-105	1015	541	**30906**	-3463	0
SPLS 3_0 Ba All Cts	611	234	607	7434	**19309**	-25
SPLS 3_65,5 Ba Ct2	251	480	640	15289	7829	**-3368**
ULS 1a_0,9_65,5	-158	989	541	**30052**	**-6301**	-47

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_114,5	252	272	**1511**	-14	-370	-36	1548
2	SPLS 1a_0 Ba All Cts	137	-127	**750**	-7	-186	-21	768
3	SPLS 3_135 Ah All Cts	-99	-93	**563**	4	-136	-11	577
4	ULS 1a_65,5	-303	323	**1814**	14	-443	-42	1857

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-52	-47	**-293**	-3	70	5	-300
2	ULS 1a_0,9_65,5	-250	274	**-1517**	-17	371	36	-1554
3	ULS 1a_0,9_114,5	199	222	**-1215**	16	298	30	-1244
4	SPLS 1a_0,9_0 Ba All Cts	87	-83	**-479**	3	121	15	-490

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_65,5 Ba Ct1	276	128	1151	**104**	-285	-31	1179
2	SPLS 3_0,9_65,5 Ba Ct1	-104	-40	-175	**102**	46	7	-179
3	SPLS 3_65,5 Ba Ct1	73	230	-857	**111**	214	25	-878
4	SPLS 3_65,5 Ba Ct1	-2	163	466	**113**	-117	-14	478

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	SPLS 3_65,5 Ba Ct2	133	285	1211	**-108**	-296	-28	1240
2	SPLS 3_65,5 Ba Ct2	47	108	-179	**-110**	43	3	-183
3	SPLS 3_0,9_65,5 Ba Ct2	236	82	-919	**-109**	225	22	-941
4	SPLS 3_0,9_65,5 Ba Ct2	-156	5	473	**-107**	-114	-10	485

Project: KIJ-GT
Tower: HC+0 II
Number: 38

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-52	-47	**-293**	**-3**	70	5	-300
2	ULS 1a_0,9_65,5	-250	274	**-1517**	**-17**	371	36	-1554
3	SPLS 3_0,9_90 Ba Ct2	238	92	**-962**	**-103**	233	21	-985
4	SPLS 1a_0,9_0 Ba All Cts	87	-83	**-479**	**3**	121	15	-490

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	110	110	642	0	-156	-14	657
2	SLS 7	-62	62	-359	0	87	8	-368
3	SLS 7	62	62	-359	0	87	8	-368
4	SLS 7	-110	110	642	0	-156	-14	657

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_65,5	-303	323	**1814**	14	-443	-42	1857
Max. tension	ULS 1a_0,9_65,5	-250	274	**-1517**	-17	371	36	-1554
Max. pos. torsie	SPLS 3_65,5 Ba Ct1	-2	163	466	**113**	-117	-14	478
Max. neg. torsie	SPLS 3_65,5 Ba Ct2	47	108	-179	**-110**	43	3	-183
Comb. tension+torsie	ULS 1a_0,9_65,5	-250	274	**-1517**	**-17**	371	36	-1554

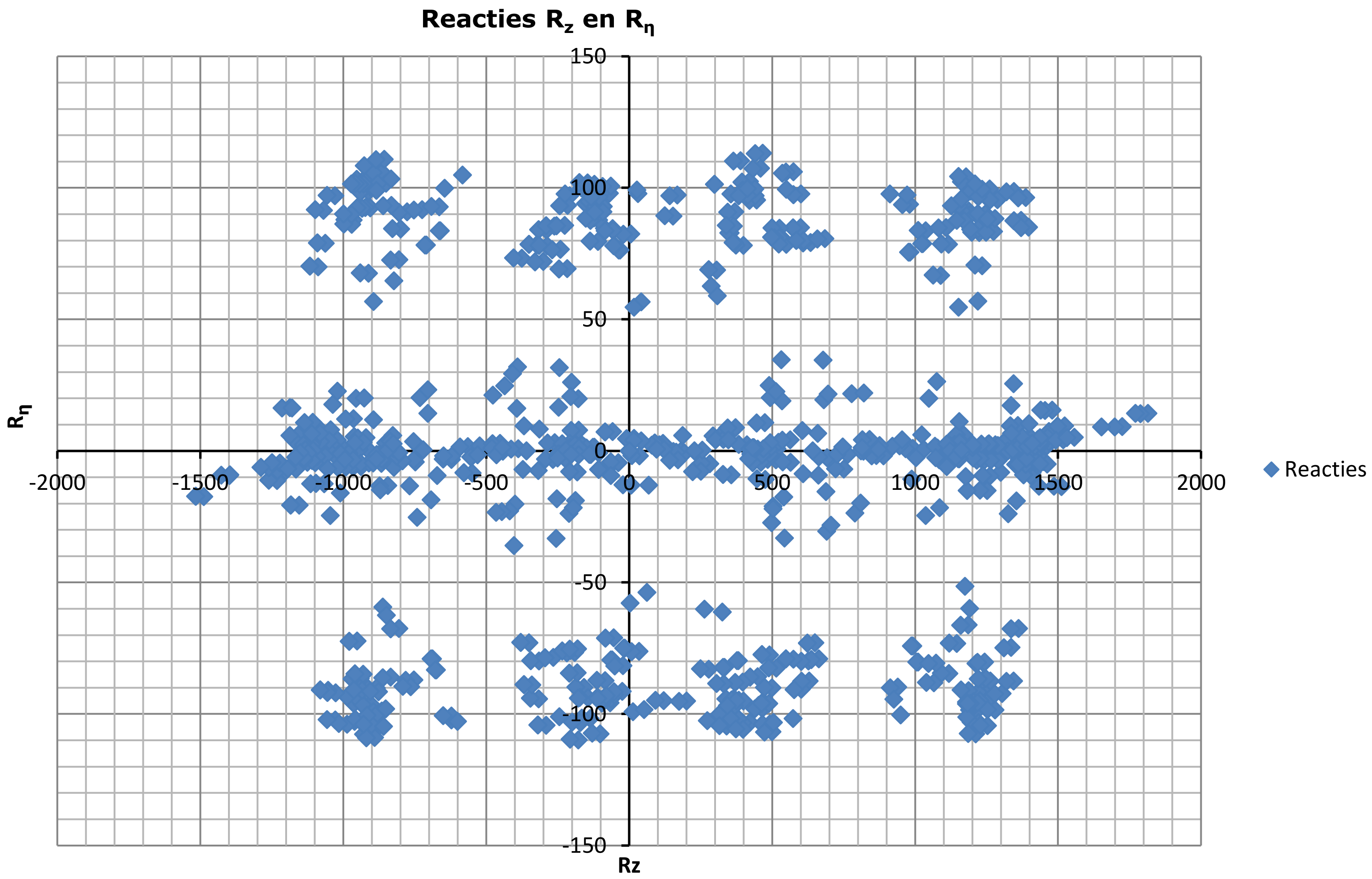
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	110	110	**642**	0	-156	-14	657
2	SLS 1a_90	-181	190	**-1054**	-7	262	29	-1080
3	SLS 1a_90	143	151	**-827**	6	208	25	-847
4	SLS 1a_0	-52	58	**347**	4	-78	-1	355

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 3_90	196	198	**1141**	-1	-279	-27	1169
2	SLS 1a_0	0	13	**-65**	-9	9	-5	-66
3	SLS 7	62	62	**-359**	0	87	8	-368
4	SLS 1a_90	-229	239	**1337**	7	-331	-35	1369

Project: KIJ-GT
Tower: HC+0 II
Number: 38



Content

ISSUE	DATE	REVISION	CHK'D	APP'D
0.0	2021-02-10			

Data

Norm	NEN-EN50341-2-15:2019
Initial	
Consequence class	CC2-0
Reliability level	Afkeur
Reference period	30 jaar
After adjustment	
Consequence class	CC2
Reliability level	Verbouw
Reference period	50 jaar
Wind zone	III
Wind speed	24,5 m/s
Terrain categorie	II
Reduction factor Cdir	1,00
Ice region	B
Tower type	Hoekmast
Tower height	45 m
Max. Span	555 m
Line angle	134°
Catenary	1400 m
Wind span	477 m
EDS Weight span	285 m
Min. Weight span	-298 m
Max. Weight span	287 m

Client: TenneT Taking power further

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Title:

Berekening masttype HC+0

JOB No.	-	DATE	-
DRAWN	-	CHKD	-
DESIGN	-	APPD	-

Document name:

KIJ-GT_HC+0_54_Report.pdf

Project number:

Project client number:

0.0

Project: KIJ-GT
Tower: HC+0
Number: 54

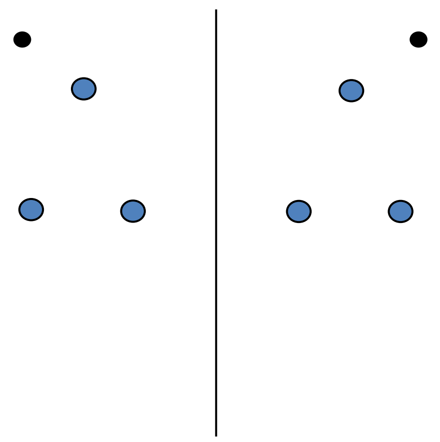
Conductor loads		Auteur:	TBR
		Versie:	v11.6

General

Description	HC+0
Tower type	Hoekmast
Number of circuits	2
Configuration	2-circuit-donau
Number of earth wires	2

Starting points

Norm	NEN-EN50341-2-15:2019
Consequence class	CC2-0
Reliability level initial	Afkeur CC2-0
Reference period intial	30 jaar
Consequence class modified	CC2
Reliability level modified	Verbouw
Reference period modified	50 jaar
Wind zone	III
Terrain category	24,5 m/s
Reduction factor c_{dir}	II
Ice region phase conductor	1,00
Ice region earth conductor	B
	B



Configuratie geleiders

Conductors back

Description	Voltage	Conductor Back	Bundle Ba	Ice region	Additional weight	Additional diameter	Catenary P_{back}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Conductors ahead

Description	Voltage	Conductor Ahead	Bundle Ah	Ice region	Additional weight	Additional diameter	Catenary P_{ahead}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Insulators *(1)*

Description	Suspension	Weight [kN]	Length [m]	Wind area [m^2]
Circuit 1	Afspanketting	2,00	4,83	1,00
Circuit 2	Afspanketting	2,00	4,83	1,00
Bliksemdraad 1	Vast (Bliksemdraad)	0,10	0,30	0,05
Bliksemdraad 2	Vast (Bliksemdraad)	0,10	0,30	0,05

1. Properties apply to the entire isolator set

Suspension height and position in mast

Circuits	Designation	Number	Suspension height	Attach point	Position in tower Horizontal distance
Circuit 1	21	380ct1f1	27,7 m	27,7 m	17,7 m
Circuit 1	20	380ct1f2	27,7 m	27,7 m	9,5 m
Circuit 1	22	380ct1f3	39,0 m	39,0 m	12,1 m
Circuit 2	10	380ct2f1	27,7 m	27,7 m	-17,7 m
Circuit 2	11	380ct2f2	27,7 m	27,7 m	-9,5 m
Circuit 2	12	380ct2f3	39,0 m	39,0 m	-12,1 m
Bliksemdraad 1	1	bl1	42,9 m	43,2 m	-18,4 m
Bliksemdraad 2	3	bl2	42,9 m	43,2 m	18,4 m

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Project: KIJ-GT
Tower: HC+0
Number: 54

Height adjustment adjacent masts (wind and weight span adjustment)

	Back	Ahead	
Height increase for wind pressure	0,0 m	0,0 m	(positive: higher)
Height decrease for vertical load	0,0 m	0,0 m	(negative: decrease, more weight span)

Decrease: Niet in 0,9EG-combinaties

Height difference adjacent tower and change of direction with respect to Line direction

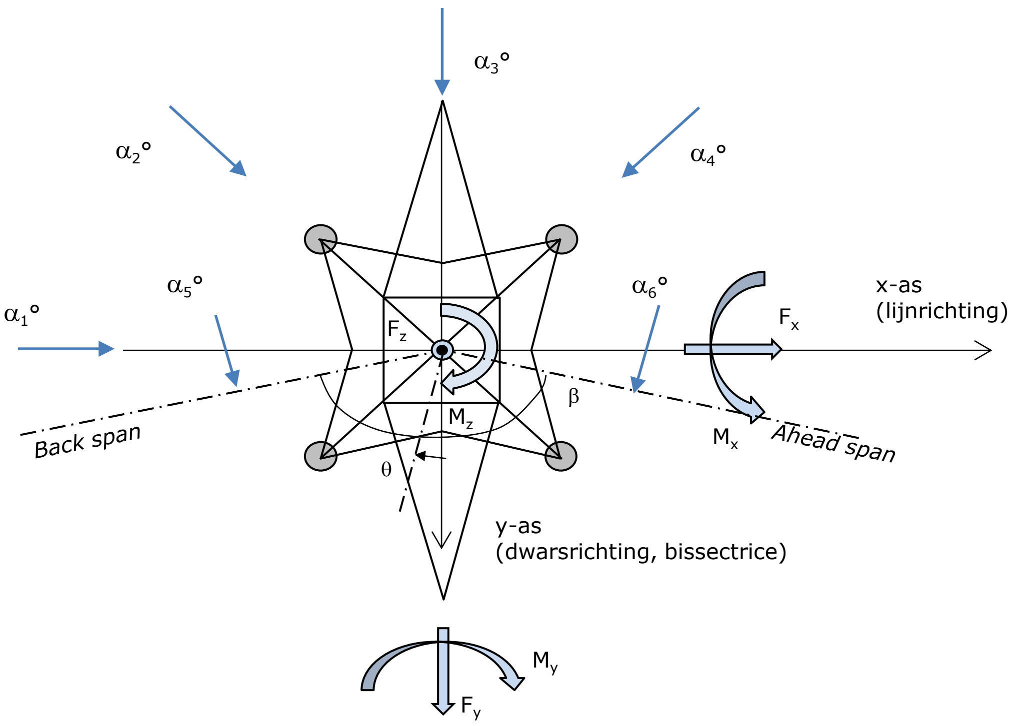
			Hoogteverschil		Richtingsverandering	
Circuits	Aanduiding	Nummer	Δh_back	Δh_ahead	Δy_back	Δy_ahead
Circuit 1	21	380ct1f1	76,0	0,2 m	0,0	0,0 m
Circuit 1	20	380ct1f2	76,0	0,2 m	0,0	0,0 m
Circuit 1	22	380ct1f3	91,7	0,2 m	0,0	0,0 m
Circuit 2	10	380ct2f1	76,0	0,2 m	0,0	0,0 m
Circuit 2	11	380ct2f2	76,0	0,2 m	0,0	0,0 m
Circuit 2	12	380ct2f3	91,7	0,2 m	0,0	0,0 m
Bliksemdraad 1	1	bl1	98,5	-0,1 m	0,0	0,0 m
Bliksemdraad 2	3	bl2	98,5	-0,1 m	0,0	0,0 m

Line and tower data

		Back	Ahead
		555,0	399,0 m
Ruling span $\sqrt{(\Sigma L^3/\Sigma L)}$		626,3	377,7 m
Line angle	β	134 °	
Tower orientation with respect to bis	θ	0 °	
Section length		1851	2580 m
Height bottom of tower to ground level		0,5 m	
Wind directions considered	α_1	0 °	
Wind directions according to:	α_2	45 °	
Geleiderbelastingen	α_3	90 °	
	α_4	135 °	
	α_5	67 °	
	α_6	113 °	

Wind directions apply to the main direction of mast construction, not to the bisector.

Windrichtingen en positieve richtingen belastingen



Considered number of wind directions	
1a	6
3	6
4	1
6	1
Overig	1

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Project: KIJ-GT
Tower: HC+0
Number: 54

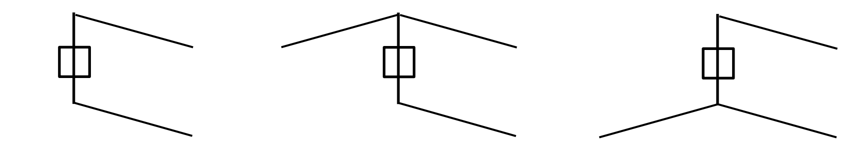
Absence of conductors

		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	380ct1f1	1	0	1	0	1	0
Circuit 1	380ct1f2	1	0	1	0	1	0
Circuit 1	380ct1f3	1	0	1	0	1	0
Circuit 2	380ct2f1	0	1	1	0	1	0
Circuit 2	380ct2f2	0	1	1	0	1	0
Circuit 2	380ct2f3	0	1	1	0	1	0
Bliksemdraad 1	bl1	1	0	1	0	1	0
Bliksemdraad 2	bl2	0	1	1	0	1	0

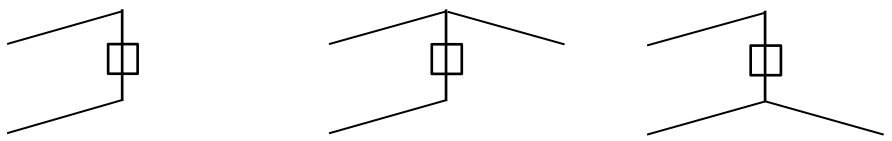
Load situations SPLS

Considered situations SPLS: 1 up to 6, All possible situations

Principle of load situations:



1. Ba All cts 2. Ba ct1 3. Ba ct2

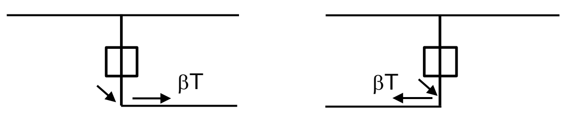


4. Ah All cts 5. Ah ct1 6. Ah ct2

Load situation 5a. Conductor failure

Considered situations conductor failure 5a: 1, design assumption is symmetry back and ahead

Principle of load situations:



1. Ba 2. Ah

Project: KIJ-GT
Tower: HC+0
Number: 54

Load situations LC6. Construction and maintenance

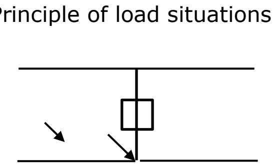
Under 6a, the load due to the presence of a line verhicle or line bicycle in combination with point load on the traverse is assesed.
Combination 6b does not contain any loads in conductor or on traverse. This combination has been added to be able to combine with separate control platforms, etc. The situations are applied in ULS and in every SPLS situation (in case of angle tower).

3,0 kN	2,0 kN
1,0 kN	1,0 kN

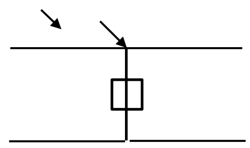
Considered situations construction and maintenance 6a: 1 up to 4, all possible situations

Presence line vehicle: Circuit, load present in all conductors of a circuit

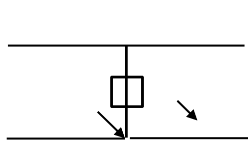
Principle of load situations:



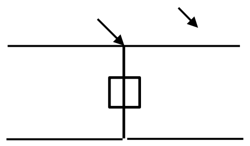
1. Ba Ct1



2. Ba Ct2



3. Ah Ct1



4. Ah Ct2

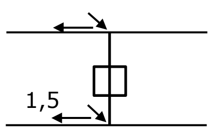
Load situations 8. Galloping as a static load

Conductor		
Suspension tower phase	0,866 W	1,5 W
Suspension tower earth	1,5 EDS	1,5 W
Strain tower phase and earth	1,5 EDS	1,5 W

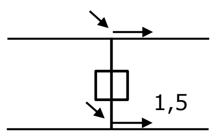
Considered situations galloping 8: None (existing structure)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principle of load situations:



1. Ba



2. Ah

Load combination 8. Galloping as a dynamic load

Only applies to tension towers
Load consists of EDS tensile load in one of the conductors on one side of the tower
Can be converted by user to fatigue spectrum via the load spectrum of table 4.11 / NL.1

Project: KIJ-GT
Tower: HC+0
Number: 54

Tower structure

Properties

Tower type	Hoekmast	
Tower designation	HC+0	
Base plate w.r.t. ground level	0,5	m
Tower height w.r.t. base plate	45,0	m
Tower self weight	394,0	kN

Width and slope at foundation	x-ri.	y-ri.	
Leg spread	11,00	11,00	m
Inclination of main leg	0,156	0,156	-
Horizontal force factor	1,1	1,1	-

Calculation Wind load

Dynamic factor G_T	1,00 *(Masthoogte < 60 m)*
Wind load diagonally to tower body proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Wind load diagonally on traverse proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Magnification factor diagonal wind to tower body	(1+0,2sin^2(2phi))
Magnification factor diagonal wind to cross arm	(1+0,2sin^2(2phi))
Magnification factor wind parallel to perpendicular to cross a	0,4

Properties mast sections longitudinal direction (front view, yz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	9,60	11,00	8,00	9,60	0,156	91,20	11,46	0,13	3,28
Middenstuk 1	18,90	8,00	5,84	9,30	0,116	64,36	10,66	0,17	3,08
Middenstuk 2	27,70	5,84	3,80	8,80	0,116	42,42	9,83	0,23	2,80
Bovenstuk 1	35,50	3,80	3,19	7,80	0,039	27,26	6,61	0,24	2,75
Bovenstuk 2	43,00	3,19	2,60	7,50	0,039	21,71	5,25	0,24	2,76
Topstuk	45,00	2,60		2,00		2,60	0,24	0,09	3,45
Ondertraverse	27,70	15,80		4,00		31,60	5,89	0,19	2,99
Boventraverse	39,00	16,95		4,20		35,60	7,55	0,21	2,88

Properties tower sections transversal direction (side view, xz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	9,60	11,00	8,00	9,60	0,156	91,20	11,46	0,13	3,28
Middenstuk 1	18,90	8,00	5,84	9,30	0,116	64,36	10,66	0,17	3,08
Middenstuk 2	27,70	5,84	3,80	8,80	0,116	42,42	9,83	0,23	2,80
Bovenstuk 1	35,50	3,80	3,19	7,80	0,039	27,26	6,61	0,24	2,75
Bovenstuk 2	43,00	3,19	2,60	7,50	0,039	21,71	5,25	0,24	2,76
Topstuk	45,00	2,60		2,00		2,60	0,24	0,09	3,45
Ondertraverse	27,70	15,80		4,00		31,60	5,89	0,19	2,99
Boventraverse	39,00	16,95		4,20		35,60	7,55	0,21	2,88

Note: Surface transverse direction is reduced in calculation.

Project: KIJ-GT
Tower: HC+0
Number: 54

Wind surface feeders telecom installations

Part	A (m^2/m)	Factor	Δh	A_1
Broekstuk 1				
Middenstuk 1				
Middenstuk 2				
Bovenstuk 1				
Bovenstuk 2				

Input antennas

Description	A (m^2)	h (m)	C_f (m)
Antenne 1			
Schotel			
Schotel			

Tower section loads longitudinal (x-direction) per wind direction

Description	p_w	F_{x1}	F_{x2}	F_{x3}	F_{x4}	h_{ef}	M_{y1}	M_{y2}	M_{y3}	M_{y4}
	[kN/m²]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,70	26,3	22,3	0,0	-22,3	4,8	126,4	107,2	0,0	-107,2
Middenstuk 1	0,79	26,0	22,0	0,0	-22,0	14,3	369,9	313,9	0,0	-313,9
Middenstuk 2	0,92	25,3	21,4	0,0	-21,4	23,3	588,5	499,3	0,0	-499,3
Bovenstuk 1	1,01	18,3	15,6	0,0	-15,6	31,6	579,2	491,5	0,0	-491,5
Bovenstuk 2	1,06	15,4	13,1	0,0	-13,1	39,3	604,6	513,0	0,0	-513,0
Topstuk	1,10	0,9	0,8	0,0	-0,8	44,0	39,9	33,9	0,0	-33,9
Ondertraverse	0,98	34,5	20,5	0,0	-20,5	29,0	1001,6	594,9	0,0	-594,9
Boventraverse	1,07	46,6	27,7	0,0	-27,7	40,4	1884,3	1119,2	0,0	-1119,2
Totaal		193,3	143,4	0,0	-143,4		5194,4	3673,0	0,0	-3673,0

Tower section loads transversal (y-direction) per wind direction

Description	p_w	F_{y1}	F_{y2}	F_{y3}	F_{x4}	h_{ef}	M_{x1}	M_{x2}	M_{x3}	M_{x4}
	[kN/m²]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,70	0,0	22,3	26,3	22,3	4,8	0,0	107,2	126,4	107,2
Middenstuk 1	0,79	0,0	22,0	26,0	22,0	14,3	0,0	313,9	369,9	313,9
Middenstuk 2	0,92	0,0	21,4	25,3	21,4	23,3	0,0	499,3	588,5	499,3
Bovenstuk 1	1,01	0,0	15,6	18,3	15,6	31,6	0,0	491,5	579,2	491,5
Bovenstuk 2	1,06	0,0	13,1	15,4	13,1	39,3	0,0	513,0	604,6	513,0
Topstuk	1,10	0,0	0,8	0,9	0,8	44,0	0,0	33,9	39,9	33,9
Ondertraverse	0,98	0,0	20,5	13,8	20,5	29,0	0,0	594,9	400,7	594,9
Boventraverse	1,07	0,0	27,7	18,7	27,7	40,4	0,0	1119,2	753,7	1119,2
Total		0,0	143,4	144,6	143,4		0,0	3673,0	3462,9	3673,0

Resulting loads from mast construction incl. Antenna without conductors level foundation (char. Value)

Load / wind direction	F_x	F_y	F_z	M_x	M_y	M_z
	[kN]	[kN]	[kN]	[kNm]	[kNm]	[kNm]
Permanente belasting	0	0	394	0	0	0
Windrichting 0°	193	0	0	0	5194	0
Windrichting 45°	143	143	0	3673	3673	0
Windrichting 90°	0	145	0	3463	0	0
Windrichting 135°	-143	143	0	3673	-3673	0

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Project: KIJ-GT
Tower: HC+0
Number: 54

Intermediate results for conductor loads

Conductors back

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Conductors ahead

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Vertical load back

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Vertical load ahead

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	[N/m]	[N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Insulators

Conductor	$G_{isolator}$ [kN]	Number -	$F_{v,iso}$ [kN]	Length [m]	Wind surf. [m^2]	Wind heigth [m]	Pressure [kN/m^2]	Drag factor [-]	$F_{h,iso}$ [kN]
380ct1f1	2,00	1	2	4,8	1,0	28,20	0,97	1,2	1,17
380ct1f2	2,00	1	2	4,8	1,0	28,20	0,97	1,2	1,17
380ct1f3	2,00	1	2	4,8	1,0	39,50	1,07	1,2	1,28
380ct2f1	2,00	1	2	4,8	1,0	28,20	0,97	1,2	1,17
380ct2f2	2,00	1	2	4,8	1,0	28,20	0,97	1,2	1,17
380ct2f3	2,00	1	2	4,8	1,0	39,50	1,07	1,2	1,28
bl1	0,10	0,5	0,05	0,3	0,1	43,40	1,09	1,2	0,07
bl2	0,10	0,5	0,05	0,3	0,1	43,40	1,09	1,2	0,07

Project: KIJ-GT
Tower: HC+0
Number: 54

Wind load back

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	47,8	1,12	0,60	0,56	1,06	28,25	60,7	56,4	46,9	113,9	105,7
380ct1f2	47,8	1,12	0,60	0,56	1,06	28,25	60,7	56,4	46,9	113,9	105,7
380ct1f3	67,0	1,22	0,63	0,58	1,04	28,25	67,3	62,4	46,9	129,4	120,0
380ct2f1	47,8	1,12	0,60	0,56	1,06	28,25	60,7	56,4	46,9	113,9	105,7
380ct2f2	47,8	1,12	0,60	0,56	1,06	28,25	60,7	56,4	46,9	113,9	105,7
380ct2f3	67,0	1,22	0,63	0,58	1,04	28,25	67,3	62,4	46,9	129,4	120,0
bl1	75,5	1,26	0,63	0,59	1,16	22,24	20,6	19,1	41,5	39,9	37,0
bl2	75,5	1,26	0,63	0,59	1,16	22,13	20,6	19,1	41,4	39,8	36,9

Wind load ahead

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	18,8	0,86	0,53	0,48	1,14	28,25	43,8	39,6	46,9	76,9	69,4
380ct1f2	18,8	0,86	0,53	0,48	1,14	28,25	43,8	39,6	46,9	76,9	69,4
380ct1f3	30,1	0,99	0,57	0,51	1,10	28,25	52,1	46,9	46,9	94,5	85,1
380ct2f1	18,8	0,86	0,53	0,48	1,14	28,25	43,8	39,6	46,9	76,9	69,4
380ct2f2	18,8	0,86	0,53	0,48	1,14	28,25	43,8	39,6	46,9	76,9	69,4
380ct2f3	30,1	0,99	0,57	0,51	1,10	28,25	52,1	46,9	46,9	94,5	85,1
bl1	34,5	1,03	0,58	0,52	1,20	22,24	15,8	14,2	41,5	29,5	26,5
bl2	34,5	1,03	0,58	0,52	1,20	22,13	15,7	14,1	41,4	29,4	26,5

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Project: KIJ-GT
Tower: HC+0
Number: 54

Conductor loads Auteur: TBR
Versie: v11.6

Starting points

Consequence class	Afkeur CC2-0
Reference period	30 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,05	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,12	0,00	0,0
ULS 3	Wind+ice	-5°	1,05	1,05	0,00	0,34	0,97	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,05	0,00	0,34	0,97	0,0
ULS 4	Cold+wind	-20°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,05	0,00	0,22	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,05	1,05	1,20	0,22	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 7	Permanent	10°	1,15	1,15	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS	(strength, for angle towers: absence of conductors)			γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,05	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,05	1,05	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,05	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,05	1,05	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,05	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,05	1,05	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,05	1,05	0,0	0,24	0,0	0,0
SLS	(deformations, fatigue, EDS)							
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	0,94	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,28	0,88	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	6
Number of load combinations for ULS	46
Number of load combinations for SPLS	222
Number of load combinations for SLS	15
Number of concentrated loads	5377

Project: KIJ-GT
Tower: HC+0
Number: 54

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-28,5	28,6	19,1	13,5	1,5	5,9
380ct1f1	-102,3	97,9	60,8	47,5	8,7	17,2
380ct1f2	-102,3	97,9	60,8	47,5	8,7	17,2
380ct1f3	-104,2	99,2	65,5	49,4	5,9	17,2
380ct2f1	-102,3	97,9	60,8	47,5	8,7	17,2
380ct2f2	-102,3	97,9	60,8	47,5	8,7	17,2
380ct2f3	-104,2	99,2	65,5	49,4	5,9	17,2
bl2	-28,5	28,7	19,1	13,4	1,5	5,9
Post 1	0,0	0,0	0,0	0,0	0,0	
Post 2	0,0	0,0	0,0	0,0	0,0	
Post 3	0,0	0,0	0,0	0,0	0,0	

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	-47,0	189,0	211,4
380ct1f1	188,0	274,4	284,7
380ct1f2	188,0	274,4	284,7
380ct1f3	107,6	231,7	245,0
380ct2f1	188,0	274,4	284,7
380ct2f2	188,0	274,4	284,7
380ct2f3	107,6	231,7	245,0
bl2	-47,0	186,3	211,2
Post 1			
Post 2			
Post 3			

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	202,2	215,7
380ct1f1	281,7	285,4
380ct1f2	281,7	285,4
380ct1f3	240,7	245,8
380ct2f1	281,7	285,4
380ct2f2	281,7	285,4
380ct2f3	240,7	245,8
bl2	201,9	214,3
Post 1		
Post 2		
Post 3		

Envelop of weight span over all combinations (incl. 0,9 combinations) For all conductors		Wind / Weight span ratio
Max. weight span	285,6 m	0,599 -
Min. weight span	-170,9 m	-0,358 -

Project: KIJ-GT
Tower: HC+0
Number: 54

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	28,6	28,8	5,9	-33,7	31,3
380ct1f1	86,5	99,0	17,2	-115,7	108,7
380ct1f2	86,5	99,0	17,2	-115,7	108,7
380ct1f3	89,8	102,7	17,2	-118,5	110,7
380ct2f1	86,5	99,0	17,2	-115,7	108,7
380ct2f2	86,5	99,0	17,2	-115,7	108,7
380ct2f3	89,8	102,7	17,2	-118,5	110,7
bl2	28,7	28,7	5,9	-33,7	31,4
Post 1	1,9	1,9	3,5	0,0	
Post 2	1,9	1,9	3,5	0,0	
Post 3	1,9	1,9	3,5	0,0	

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	13,8	5,9	2,1	-15,0	15,0
380ct1f1	59,1	25,1	11,1	-64,2	64,2
380ct1f2	59,1	25,1	11,1	-64,2	64,2
380ct1f3	59,1	25,1	11,1	-64,2	64,2
380ct2f1	59,1	25,1	11,1	-64,2	64,2
380ct2f2	59,1	25,1	11,1	-64,2	64,2
380ct2f3	59,1	25,1	11,1	-64,2	64,2
bl2	13,8	5,9	2,0	-15,0	15,0
Post 1	0,0	0,0	3,0	0,0	
Post 2	0,0	0,0	3,0	0,0	
Post 3	0,0	0,0	3,0	0,0	

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	-0,1	0,0
	380ct1f1	0,0	0,0
	380ct1f2	0,0	0,0
	380ct1f3	0,0	0,0
	380ct2f1	0,0	0,0
	380ct2f2	0,0	0,0
	380ct2f3	0,0	0,0
	bl2	-0,1	0,0
	Post 1	0,0	
	Post 2	0,0	
	Post 3	0,0	

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Project: KIJ-GT
Tower: HC+0
Number: 54

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		-78	650	83	21099	-2581	0
ULS 1a_0,9_0		13	354	115	11336	396	-73
ULS 1a_0,9_0,9_90		-82	621	62	20176	-2694	0
ULS 3_0		1	541	167	17400	23	-19
SLS 7		0	324	112	10368	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

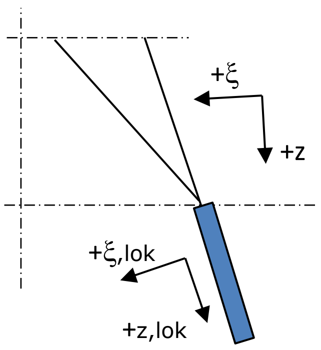
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	-78	812	497	24966	-2581	0
ULS 1a_0,9_0,9_90	-82	782	417	24043	-2694	0
SLS 7	0	324	506	10368	0	0

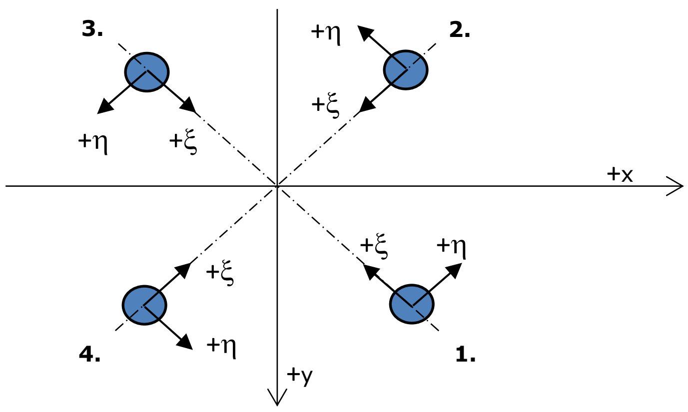
Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_90	-78	812	436	**24983**	-2581	0
SPLS 3_67 Ah All Cts	-551	351	456	10854	**-18120**	-10
SPLS 3_67 Ba Ct2	236	430	527	13479	7420	**-2991**
ULS 1a_0,9_67	-118	812	426	**24967**	**-4569**	-28

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg





Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_113 Ba All Cts	224	230	**1321**	-4	-321	-29	1353
2	SPLS 1a_0 Ba All Cts	123	-115	**677**	-6	-168	-18	693
3	SPLS 3_135 Ah All Cts	-91	-87	**523**	3	-126	-10	535
4	ULS 1a_67	-246	259	**1463**	9	-357	-34	1499

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-53	-49	**-300**	-2	72	6	-308
2	ULS 1a_0,9_67	-206	221	**-1236**	-11	302	28	-1266
3	SPLS 3_0,9_113 Ba All Cts	181	188	**-1076**	5	261	23	-1102
4	SPLS 1a_0,9_0 Ba All Cts	79	-76	**-436**	2	109	13	-447

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_67 Ba Ct1	251	118	1059	**94**	-261	-27	1084
2	SPLS 3_0,9_67 Ba Ct1	-93	-38	-152	**93**	38	5	-155
3	SPLS 3_67 Ba Ct1	73	210	-810	**97**	200	21	-830
4	SPLS 3_67 Ba Ct1	0	140	399	**99**	-99	-11	409

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	SPLS 3_67 Ba Ct2	119	256	1082	**-97**	-265	-26	1108
2	SPLS 3_67 Ba Ct2	44	95	-144	**-98**	36	4	-147
3	SPLS 3_0,9_67 Ba Ct2	213	77	-834	**-96**	205	21	-854
4	SPLS 3_0,9_67 Ba Ct2	-134	1	393	**-94**	-96	-9	402

Project: KIJ-GT
Tower: HC+0
Number: 54

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-53	-49	**-300**	**-2**	72	6	-308
2	SPLS 1a_0,9_67 Ah Ct1	-125	239	**-1050**	**-81**	258	26	-1075
3	SPLS 3_0,9_90 Ba Ct1	81	216	**-856**	**95**	210	21	-877
4	SPLS 1a_0,9_0 Ba All Cts	79	-76	**-436**	**2**	109	13	-447

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	103	103	598	0	-145	-13	612
2	SLS 7	-59	59	-345	0	84	8	-353
3	SLS 7	59	59	-345	0	84	8	-353
4	SLS 7	-103	103	598	0	-145	-13	612

Envelope of load combinations for all of the legs

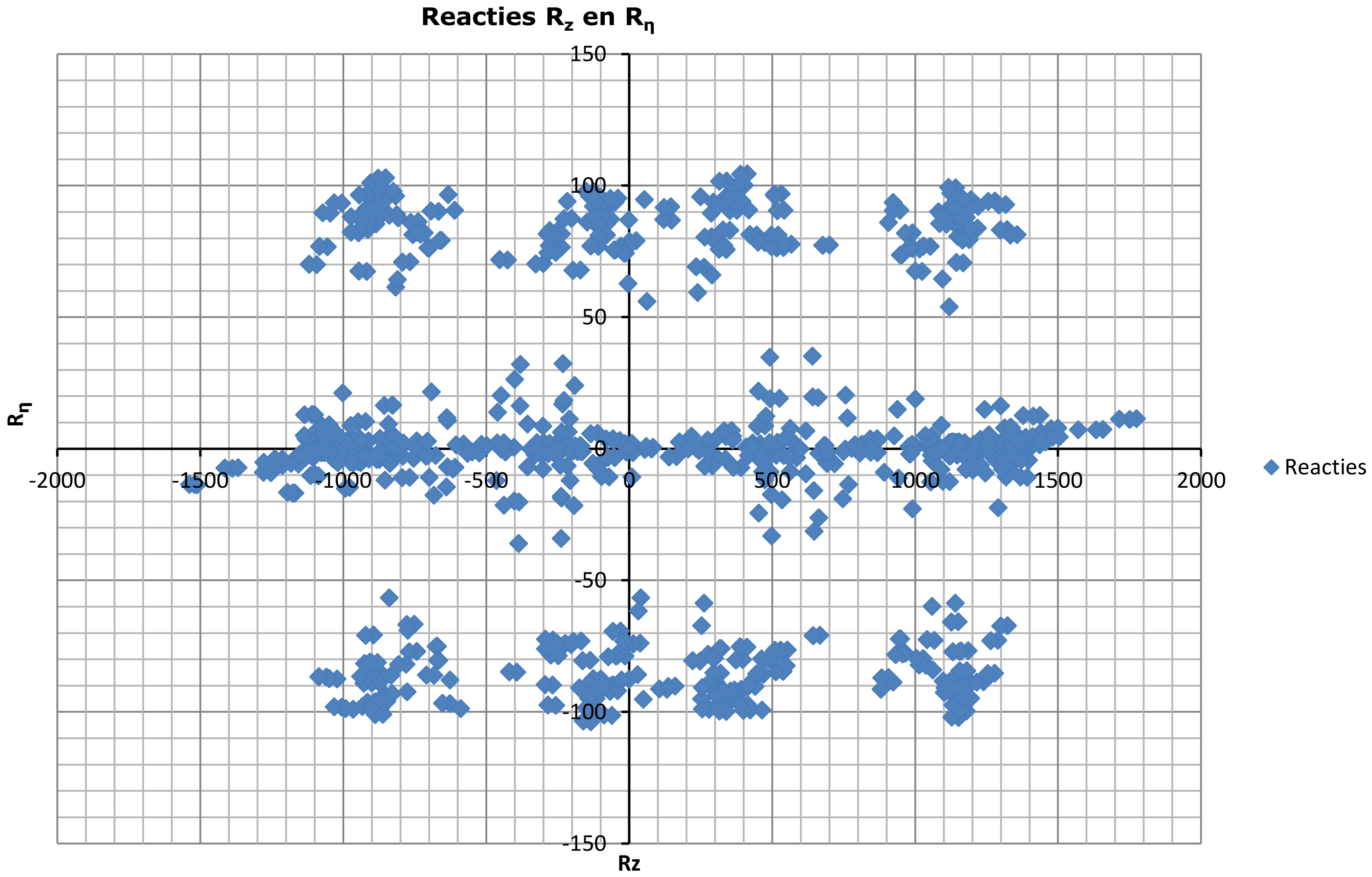
Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_67	-246	259	**1463**	9	-357	-34	1499
Max. tension	ULS 1a_0,9_67	-206	221	**-1236**	-11	302	28	-1266
Max. pos. torsie	SPLS 3_67 Ba Ct1	0	140	399	**99**	-99	-11	409
Max. neg. torsie	SPLS 3_67 Ba Ct2	44	95	-144	**-98**	36	4	-147
Comb. tension+torsie	SPLS 1a_0,9_67 Ah Ct1	-125	239	**-1050**	**-81**	258	26	-1075

Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_113 Ah All Cts	-41	-38	**-242**	-2	56	3	-248
2	ULS 1a_67	-203	218	**-1220**	-11	298	28	-1249
3	SPLS 3_113 Ba All Cts	178	186	**-1060**	5	257	23	-1086
4	SPLS 3_67 Ba All Cts	41	-38	**-238**	2	55	3	-244

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_113 Ba All Cts	224	230	**1321**	-4	-321	-29	1353
2	SPLS 3_67 Ba All Cts	86	-82	**500**	-3	-119	-8	512
3	SPLS 3_113 Ah All Cts	-82	-78	**476**	2	-113	-8	488
4	ULS 1a_67	-246	259	**1463**	9	-357	-34	1499


Reacties R_z en R_η
150
100
50
0
-50
-100
-150
-2000
-1500
-1000
-500
0
500
1000
1500
2000
R_η
Rz
Reacties

DNV·GL

Project: KIJ-GT
Tower: HC+0
Number: 54

Conductor loads — Auteur: TBR, Versie: v11.6

Starting points

Consequence class: Verbouw CC2
Reference period: 50 jaar

ULS (strength)		NEN-EN50341-2-15:2019						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,15	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,40	0,00	0,0
ULS 3	Wind+ice	-5°	1,15	1,15	0,00	0,42	1,30	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,15	0,00	0,42	1,30	0,0
ULS 4	Cold+wind	-20°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,15	0,00	0,28	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,15	1,15	1,30	0,28	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 7	Permanent	10°	1,30	1,30	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,15	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,15	1,15	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,15	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,15	1,15	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,15	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,15	1,15	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,15	1,15	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	1,00	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,30	1,00	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	6
Number of load combinations for ULS	46
Number of load combinations for SPLS	222
Number of load combinations for SLS	15
Number of concentrated loads	5377

Project: KIJ-GT
Tower: HC+0
Number: 54

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-34,1	30,6	23,3	16,0	1,7	6,4
380ct1f1	-120,9	113,6	73,4	55,7	10,3	20,2
380ct1f2	-120,9	113,6	73,4	55,7	10,3	20,2
380ct1f3	-123,4	115,3	79,3	58,1	6,7	20,2
380ct2f1	-120,9	113,6	73,4	55,7	10,3	20,2
380ct2f2	-120,9	113,6	73,4	55,7	10,3	20,2
380ct2f3	-123,4	115,3	79,3	58,1	6,7	20,2
bl2	-34,1	30,7	23,2	16,0	1,6	6,4
Post 1	0,0	0,0	0,0	0,0	0,0	
Post 2	0,0	0,0	0,0	0,0	0,0	
Post 3	0,0	0,0	0,0	0,0	0,0	

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	-69,3	187,6	211,4
380ct1f1	178,4	273,9	284,7
380ct1f2	178,4	273,9	284,7
380ct1f3	94,4	231,0	245,0
380ct2f1	178,4	273,9	284,7
380ct2f2	178,4	273,9	284,7
380ct2f3	94,4	231,0	245,0
bl2	-69,3	184,9	211,2
Post 1			
Post 2			
Post 3			

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	200,5	219,6
380ct1f1	281,4	287,3
380ct1f2	281,4	287,3
380ct1f3	240,1	248,1
380ct2f1	281,4	287,3
380ct2f2	281,4	287,3
380ct2f3	240,1	248,1
bl2	200,2	218,3
Post 1		
Post 2		
Post 3		

Envelop of weight span over all combinations (incl. 0,9 combinations) For all conductors		Wind / Weight span ratio
Max. weight span	287,3 m	0,602 -
Min. weight span	-298,4 m	-0,625 -

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Project: KIJ-GT
Tower: HC+0
Number: 54

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	29,6	34,6	6,4	-40,5	33,8
380ct1f1	91,2	117,1	20,2	-137,2	126,3
380ct1f2	91,2	117,1	20,2	-137,2	126,3
380ct1f3	94,3	122,2	20,2	-140,7	128,8
380ct2f1	91,2	117,1	20,2	-137,2	126,3
380ct2f2	91,2	117,1	20,2	-137,2	126,3
380ct2f3	94,3	122,2	20,2	-140,7	128,8
bl2	29,7	34,5	6,4	-40,5	34,1
Post 1	2,4	2,4	3,9	0,0	
Post 2	2,4	2,4	3,9	0,0	
Post 3	2,4	2,4	3,9	0,0	

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	13,8	5,9	2,1	-15,0	15,0
380ct1f1	59,1	25,1	11,1	-64,2	64,2
380ct1f2	59,1	25,1	11,1	-64,2	64,2
380ct1f3	59,1	25,1	11,1	-64,2	64,2
380ct2f1	59,1	25,1	11,1	-64,2	64,2
380ct2f2	59,1	25,1	11,1	-64,2	64,2
380ct2f3	59,1	25,1	11,1	-64,2	64,2
bl2	13,8	5,9	2,0	-15,0	15,0
Post 1	0,0	0,0	3,0	0,0	
Post 2	0,0	0,0	3,0	0,0	
Post 3	0,0	0,0	3,0	0,0	

1 **Control uplift SLS-wind**

Combinatie	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	-0,1	0,0
	380ct1f1	0,0	0,0
	380ct1f2	0,0	0,0
	380ct1f3	0,0	0,0
	380ct2f1	0,0	0,0
	380ct2f2	0,0	0,0
	380ct2f3	0,0	0,0
	bl2	-0,1	0,0
	Post 1	0,0	
	Post 2	0,0	
	Post 3	0,0	

Project: KIJ-GT
Tower: HC+0
Number: 54

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		-108	772	83	25073	-3565	0
ULS 1a_0,9_0		13	388	125	12456	401	-92
ULS 1a_0,9_0,9_90		-115	728	47	23718	-3759	0
ULS 3_0		-9	632	196	20337	-300	-25
SLS 7		0	324	112	10368	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

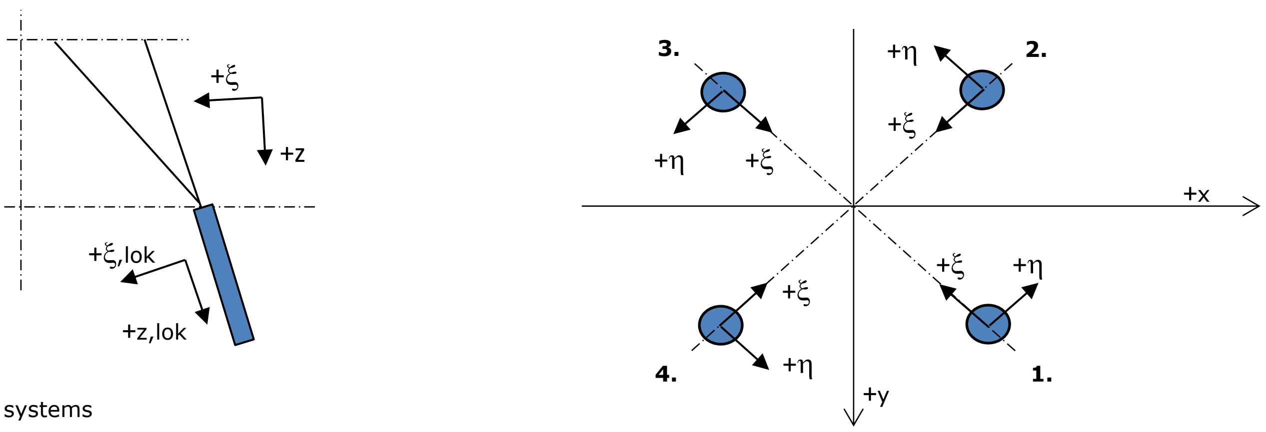
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	-108	974	536	29921	-3565	0
ULS 1a_0,9_0,9_90	-115	931	402	28566	-3759	0
SLS 7	0	324	506	10368	0	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_90	-108	974	435	**29949**	-3565	0
SPLS 3_67 Ah All Cts	-580	363	502	11246	**-19072**	-11
SPLS 3_67 Ba Ct2	255	450	577	14141	8008	**-3158**
ULS 1a_0,9_67	-166	973	422	**29879**	**-6300**	-36

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_113 Ba All Cts	237	243	**1396**	-4	-339	-31	1430
2	SPLS 1a_0 Ba All Cts	130	-122	**718**	-6	-178	-19	735
3	SPLS 3_135 Ah All Cts	-99	-94	**565**	3	-136	-11	579
4	ULS 1a_67	-298	314	**1774**	11	-433	-41	1817

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-58	-54	**-330**	-2	79	6	-338
2	ULS 1a_0,9_67	-256	275	**-1539**	-14	375	35	-1576
3	SPLS 3_0,9_113 Ba All Cts	192	199	**-1137**	5	276	25	-1164
4	SPLS 1a_0,9_0 Ba All Cts	83	-80	**-463**	2	116	14	-474

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_67 Ba Ct1	265	124	1117	**99**	-275	-28	1144
2	SPLS 3_0,9_67 Ba Ct1	-96	-42	-151	**98**	38	5	-155
3	SPLS 3_67 Ba Ct1	76	222	-852	**103**	211	22	-873
4	SPLS 3_67 Ba Ct1	2	146	413	**104**	-102	-11	423

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	SPLS 3_67 Ba Ct2	127	272	1151	**-102**	-282	-28	1179
2	SPLS 3_67 Ba Ct2	50	97	-135	**-104**	33	4	-138
3	SPLS 3_0,9_67 Ba Ct2	226	83	-889	**-101**	218	22	-910
4	SPLS 3_0,9_67 Ba Ct2	-139	-1	399	**-99**	-98	-9	409

Project: KIJ-GT
Tower: HC+0
Number: 54

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-58	-54	**-330**	**-2**	79	6	-338
2	ULS 1a_0,9_67	-256	275	**-1539**	**-14**	375	35	-1576
3	SPLS 3_0,9_90 Ba Ct1	85	228	**-905**	**101**	222	22	-926
4	SPLS 1a_0,9_0 Ba All Cts	83	-80	**-463**	**2**	116	14	-474

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	103	103	598	0	-145	-13	612
2	SLS 7	-59	59	-345	0	84	8	-353
3	SLS 7	59	59	-345	0	84	8	-353
4	SLS 7	-103	103	598	0	-145	-13	612

Envelope of load combinations for all of the legs

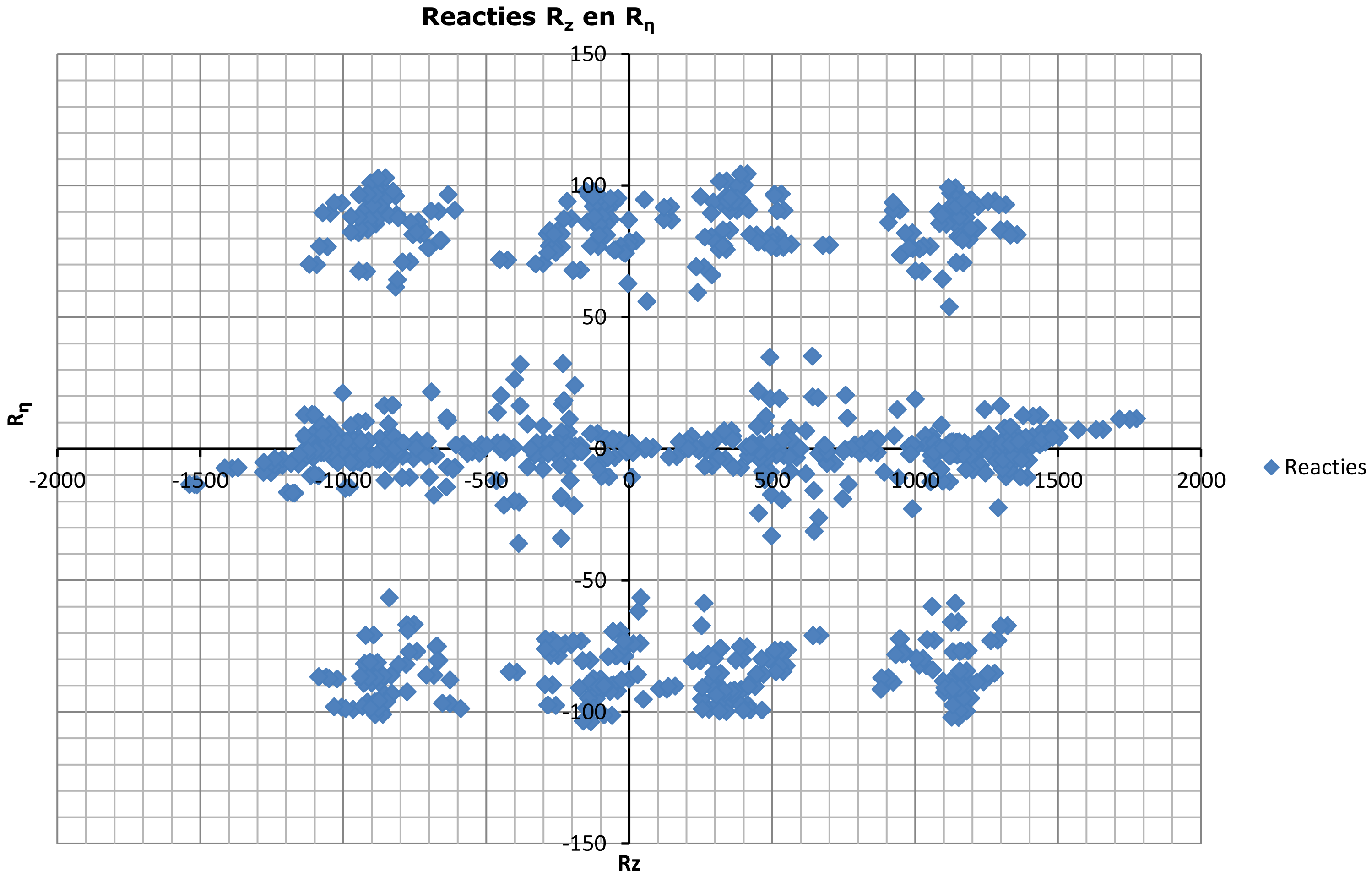
Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_67	-298	314	**1774**	11	-433	-41	1817
Max. tension	ULS 1a_0,9_67	-256	275	**-1539**	-14	375	35	-1576
Max. pos. torsie	SPLS 3_67 Ba Ct1	2	146	413	**104**	-102	-11	423
Max. neg. torsie	SPLS 3_67 Ba Ct2	50	97	-135	**-104**	33	4	-138
Comb. tension+torsie	ULS 1a_0,9_67	-256	275	**-1539**	**-14**	375	35	-1576

Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_113 Ah All Cts	-44	-41	**-260**	-2	61	3	-266
2	ULS 1a_67	-251	271	**-1513**	-14	369	35	-1549
3	SPLS 3_113 Ba All Cts	187	194	**-1110**	5	270	24	-1137
4	SPLS 3_67 Ba All Cts	43	-40	**-254**	2	59	3	-261

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_113 Ba All Cts	237	243	**1396**	-4	-339	-31	1430
2	SPLS 3_67 Ba All Cts	93	-89	**540**	-3	-129	-9	553
3	SPLS 3_113 Ah All Cts	-89	-85	**517**	2	-123	-9	530
4	ULS 1a_67	-298	314	**1774**	11	-433	-41	1817


Reacties R_z en R_η
150
100
50
0
-50
-100
-150
-2000
-1500
-1000
-500
0
500
1000
1500
2000
R_η
Rz
Reacties

Content

Data

Norm	NEN-EN50341-2-15:2019
Initial	
Consequence class	CC2-0
Reliability level	Afkeur
Reference period	30 jaar
After adjustment	
Consequence class	CC2
Reliability level	Verbouw
Reference period	50 jaar
Wind zone	III
Wind speed	24.5 m/s
Terrain categorie	II
Reduction factor Cdir	1.00
Ice region	B
Tower type	Hoekmast
Tower height	45 m
Max. Span	395 m
Line angle	133°
Catenary	1400 m
Wind span	376 m
EDS Weight span	194 m
Min. Weight span	-283 m
Max. Weight span	199 m

ISSUE	DATE	REVISION	CHK'D	APP'D
0.0	2021-04-28			

Client:

Title:

Berekening masttype HC+0

JOB No.	-	DATE	-
DRAWN	-	CHKD	-
DESIGN	-	APPD	-

Document name:

KIJ-GT_HC+0_83_Report.pdf

Project number:

Project client number:

0.0

Project: KIJ-GT
Tower: HC+0
Number: 83

Auteur: TBR
Versie: v11.7

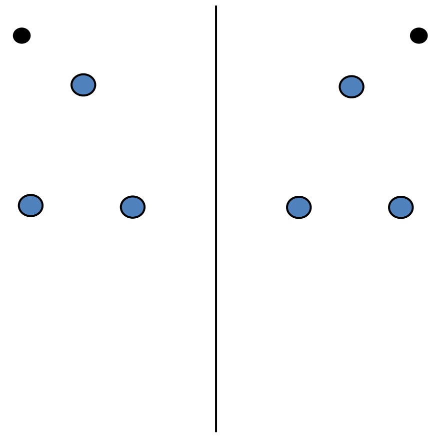
Conductor loads

General

Description	HC+0
Tower type	Hoekmast
Number of circuits	2
Configuration	2-circuit-donau
Number of earth wires	2

Starting points

Norm	NEN-EN50341-2-15:2019
Consequence class	CC2-0
Reliability level initial	Afkeur CC2-0
Reference period intial	30 jaar
Consequence class modified	CC2
Reliability level modified	Verbouw
Reference period modified	50 jaar
Wind zone	III
Wind speed (m/s)	24.5 m/s
Terrain category	II
Reduction factor c_{dir}	1.00
Ice region phase conductor	B
Ice region earth conductor	B


Configuratie geleiders

Conductors back

Description	Voltage	Conductor Back	Bundle Ba	Ice region	Additional weight	Additional diameter	Catenary P_{back}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Conductors ahead

Description	Voltage	Conductor Ahead	Bundle Ah	Ice region	Additional weight	Additional diameter	Catenary P_{ahead}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Insulators *(1)*

Description	Suspension	Weight [kN]	Length [m]	Wind area [m^2]
Circuit 1	Afspanketting	2.00	4.83	1.00
Circuit 2	Afspanketting	2.00	4.83	1.00
Bliksemdraad 1	Vast (Bliksemdraad)	0.10	0.30	0.05
Bliksemdraad 2	Vast (Bliksemdraad)	0.10	0.30	0.05

1. Properties apply to the entire isolator set

Suspension height and position in mast

Circuits	Designation	Number	Suspension height	Attach point	Position in tower Horizontal distance
Circuit 1	21	380ct1f1	27.7 m	27.7 m	17.7 m
Circuit 1	20	380ct1f2	27.7 m	27.7 m	9.5 m
Circuit 1	22	380ct1f3	39.0 m	39.0 m	13.6 m
Circuit 2	10	380ct2f1	27.7 m	27.7 m	-17.7 m
Circuit 2	11	380ct2f2	27.7 m	27.7 m	-9.5 m
Circuit 2	12	380ct2f3	39.0 m	39.0 m	-13.6 m
Bliksemdraad 1	1	bl1	42.9 m	43.2 m	-18.7 m
Bliksemdraad 2	3	bl2	42.9 m	43.2 m	18.7 m

Project: KIJ-GT
Tower: HC+0
Number: 83

Height adjustment adjacent masts (wind and weight span adjustment)

	Back	Ahead	
Height increase for wind pressure	0.0 m	0.0 m	(positive: higher)
Height decrease for vertical load	0.0 m	0.0 m	(negative: decrease, more weight span)

Decrease: Niet in 0,9EG-combinaties

Height difference adjacent tower and change of direction with respect to Line direction

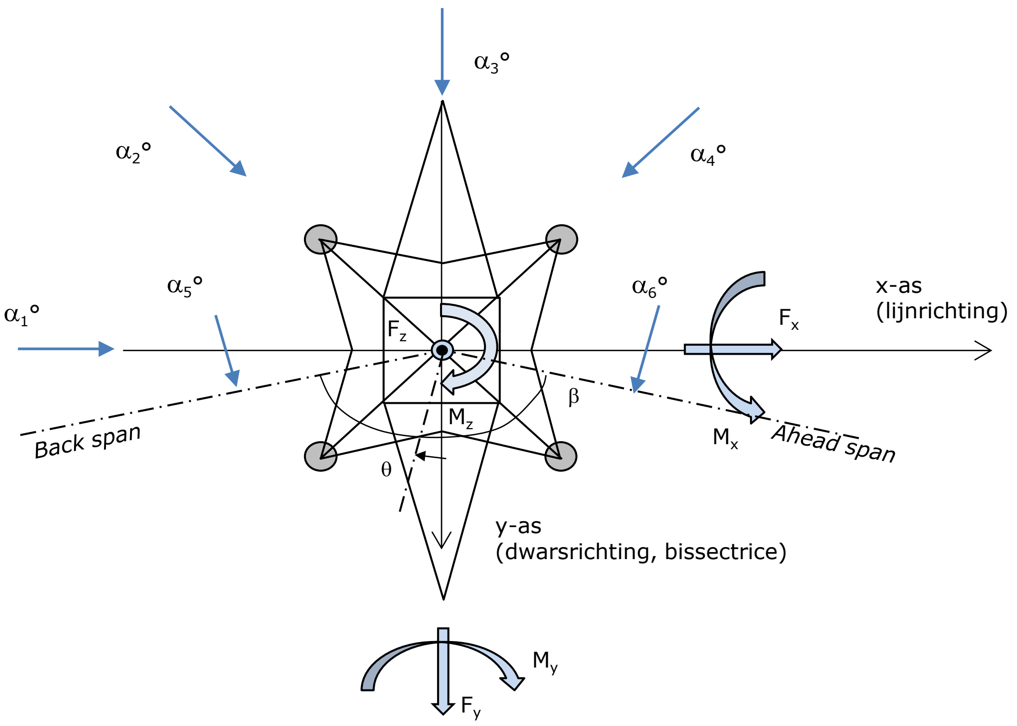
			Hoogteverschil		Richtingsverandering	
Circuits	Aanduiding	Nummer	Δh_back	Δh_ahead	Δy_back	Δy_ahead
Circuit 1	21	380ct1f1	-2.5	48.4 m	0.0	0.0 m
Circuit 1	20	380ct1f2	-2.5	48.4 m	0.0	0.0 m
Circuit 1	22	380ct1f3	-2.5	53.4 m	0.0	0.0 m
Circuit 2	10	380ct2f1	-2.5	48.4 m	0.0	0.0 m
Circuit 2	11	380ct2f2	-2.5	48.4 m	0.0	0.0 m
Circuit 2	12	380ct2f3	-2.5	53.4 m	0.0	0.0 m
Bliksemdraad 1	1	bl1	-2.8	59.3 m	0.0	0.0 m
Bliksemdraad 2	3	bl2	-2.8	59.3 m	0.0	0.0 m

Line and tower data

		Back	Ahead
		395.0	356.0 m
Ruling span $\sqrt{(\Sigma L^3/\Sigma L)}$		395.0	441.8 m
Line angle	β	133 °	
Tower orientation with respect to bi:	θ	0 °	
Section length		790	1672 m
Height bottom of tower to ground level		0.5 m	
Wind directions considered	α_1	0 °	
Wind directions according to:	α_2	45 °	
Geleiderbelastingen	α_3	90 °	
	α_4	135 °	
	α_5	66.5 °	
	α_6	113.5 °	

Wind directions apply to the main direction of mast construction, not to the bisector.

Windrichtingen en positieve richtingen belastingen



Considered number of wind directions	
1a	6
3	6
4	1
6	1
Overig	1

Project: KIJ-GT
Tower: HC+0
Number: 83

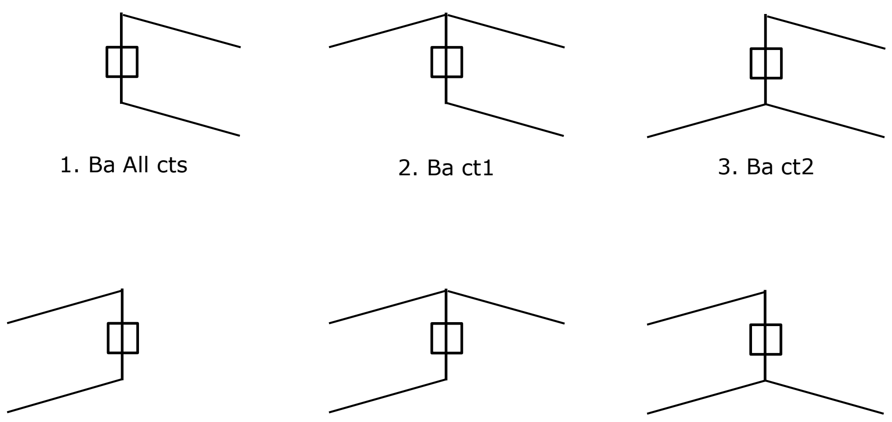
Absence of conductors

		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	380ct1f1	1	0	1	0	1	0
Circuit 1	380ct1f2	1	0	1	0	1	0
Circuit 1	380ct1f3	1	0	1	0	1	0
Circuit 2	380ct2f1	0	1	1	0	1	0
Circuit 2	380ct2f2	0	1	1	0	1	0
Circuit 2	380ct2f3	0	1	1	0	1	0
Bliksemdraad 1	bl1	1	0	1	0	1	0
Bliksemdraad 2	bl2	0	1	1	0	1	0

Load situations SPLS

Considered situations SPLS: 1 up to 6, All possible situations

Principle of load situations:

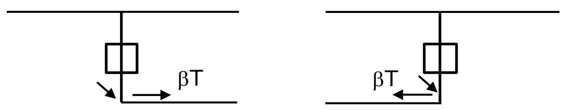


1. Ba All cts
2. Ba ct1
3. Ba ct2
4. Ah All cts
5. Ah ct1
6. Ah ct2

Load situation 5a. Conductor failure

Considered situations conductor failure 5a: 1, design assumption is symmetry back and ahead

Principle of load situations:



1. Ba
2. Ah

Project: KIJ-GT
Tower: HC+0
Number: 83

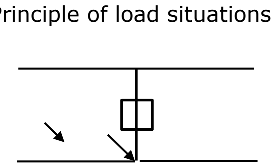
Load situations LC6. Construction and maintenance
Under 6a, the load due to the presence of a line verhicle or line bicycle in combination with point load on the traverse is assesed.
Combination 6b does not contain any loads in conductor or on traverse. This combination has been added to be able to combine with separate control platforms, etc. The situations are applied in ULS and in every SPLS situation (in case of angle tower).

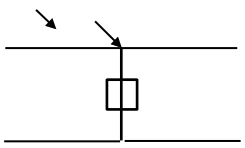
	Phase	Earth
Line vehicle	3.0 kN	2.0 kN
Concentrated load cross arm	1.0 kN	1.0 kN

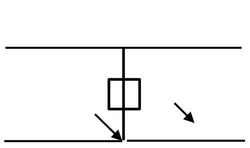
Beschouwde situaties bouw- en onderhoud 6a: 1 t/m 4, alle mogelijke situaties.

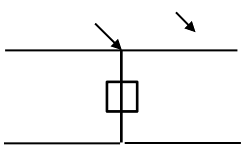
Presence line vehicle: Circuit, belasting tegelijk aanwezig in alle geleiders per circuit.

Principle of load situations:


1. Ba Ct1


2. Ba Ct2


3. Ah Ct1


4. Ah Ct2

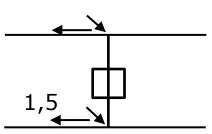
Load situations 8. Galloping as a static load

Conductor		
Suspension tower phase	0.866 W	1.5 W
Suspension tower earth	1.5 EDS	1.5 W
Strain tower phase and earth	1.5 EDS	1.5 W

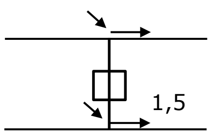
Considered situations galloping 8: None (existing structure)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principle of load situations:



1. Ba



2. Ah

Load combination 8. Galloping as a dynamic load
Only applies to tension towers
Load consists of EDS tensile load in one of the conductors on one side of the tower
Can be converted by user to fatigue spectrum via the load spectrum of table 4.11 / NL.1

DNV·GL

Project: KIJ-GT
Tower: HC+0
Number: 83

Tower structure

Properties

Tower type	Hoekmast		
Tower designation	HC+0		
Base plate w.r.t. ground level	0.5	m	
Tower height w.r.t. base plate	45.0	m	
Tower self weight	394.0	kN	
Width and slope at foundation	x-ri.	y-ri.	
Leg spread	11.00	11.00	m
Inclination of main leg	0.156	0.156	-
Horizontal force factor	1.1	1.1	-

Calculation Wind load

Dynamic factor G_T	1.00 *(Masthoogte < 60 m)*
Wind load diagonally to tower body proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Wind load diagonally on traverse proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Magnification factor diagonal wind to tower body	(1+0,2sin^2(2phi))
Magnification factor diagonal wind to cross arm	(1+0,2sin^2(2phi))
Magnification factor wind parallel to perpendicular to cross a	0.4

Properties mast sections longitudinal direction (front view, yz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	9.60	11.00	8.00	9.60	0.156	91.20	11.46	0.13	3.28
Middenstuk 1	18.90	8.00	5.84	9.30	0.116	64.36	10.66	0.17	3.08
Middenstuk 2	27.70	5.84	3.80	8.80	0.116	42.42	9.83	0.23	2.80
Bovenstuk 1	35.50	3.80	3.19	7.80	0.039	27.26	6.61	0.24	2.75
Bovenstuk 2	43.00	3.19	2.60	7.50	0.039	21.71	5.25	0.24	2.76
Topstuk	45.00	2.60		2.00		2.60	0.24	0.09	3.45
Ondertraverse	27.70	15.80		4.00		31.60	5.89	0.19	2.99
Boventraverse	39.00	16.95		4.20		35.60	7.55	0.21	2.88

Properties tower sections transversal direction (side view, xz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	9.60	11.00	8.00	9.60	0.156	91.20	11.46	0.13	3.28
Middenstuk 1	18.90	8.00	5.84	9.30	0.116	64.36	10.66	0.17	3.08
Middenstuk 2	27.70	5.84	3.80	8.80	0.116	42.42	9.83	0.23	2.80
Bovenstuk 1	35.50	3.80	3.19	7.80	0.039	27.26	6.61	0.24	2.75
Bovenstuk 2	43.00	3.19	2.60	7.50	0.039	21.71	5.25	0.24	2.76
Topstuk	45.00	2.60		2.00		2.60	0.24	0.09	3.45
Ondertraverse	27.70	15.80		4.00		31.60	5.89	0.19	2.99
Boventraverse	39.00	16.95		4.20		35.60	7.55	0.21	2.88

Note: Surface transverse direction is reduced in calculation.

DNV·GL

Project: KIJ-GT
Tower: HC+0
Number: 83

Wind surface feeders telecom installations

Part	A (m^2/m)	Factor	Δh	A_1
Broekstuk 1				
Middenstuk 1				
Middenstuk 2				
Bovenstuk 1				
Bovenstuk 2				

Input antennas

Description	A (m^2)	h (m)	C_f (m)
Antenne 1			
Schotel			
Schotel			

Tower section loads longitudinal (x-direction) per wind direction

Description	p_w	F_{x1}	F_{x2}	F_{x3}	F_{x4}	h_{ef}	M_{y1}	M_{y2}	M_{y3}	M_{y4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0.70	26.3	22.3	0.0	-22.3	4.8	126.4	107.2	0.0	-107.2
Middenstuk 1	0.79	26.0	22.0	0.0	-22.0	14.3	369.9	313.9	0.0	-313.9
Middenstuk 2	0.92	25.3	21.4	0.0	-21.4	23.3	588.5	499.3	0.0	-499.3
Bovenstuk 1	1.01	18.3	15.6	0.0	-15.6	31.6	579.2	491.5	0.0	-491.5
Bovenstuk 2	1.06	15.4	13.1	0.0	-13.1	39.3	604.6	513.0	0.0	-513.0
Topstuk	1.10	0.9	0.8	0.0	-0.8	44.0	39.9	33.9	0.0	-33.9
Ondertraverse	0.98	34.5	20.5	0.0	-20.5	29.0	1001.6	594.9	0.0	-594.9
Boventraverse	1.07	46.6	27.7	0.0	-27.7	40.4	1884.3	1119.2	0.0	-1119.2
Totaal		193.3	143.4	0.0	-143.4		5194.4	3673.0	0.0	-3673.0

Tower section loads transversal (y-direction) per wind direction

Description	p_w	F_{y1}	F_{y2}	F_{y3}	F_{x4}	h_{ef}	M_{x1}	M_{x2}	M_{x3}	M_{x4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0.70	0.0	22.3	26.3	22.3	4.8	0.0	107.2	126.4	107.2
Middenstuk 1	0.79	0.0	22.0	26.0	22.0	14.3	0.0	313.9	369.9	313.9
Middenstuk 2	0.92	0.0	21.4	25.3	21.4	23.3	0.0	499.3	588.5	499.3
Bovenstuk 1	1.01	0.0	15.6	18.3	15.6	31.6	0.0	491.5	579.2	491.5
Bovenstuk 2	1.06	0.0	13.1	15.4	13.1	39.3	0.0	513.0	604.6	513.0
Topstuk	1.10	0.0	0.8	0.9	0.8	44.0	0.0	33.9	39.9	33.9
Ondertraverse	0.98	0.0	20.5	13.8	20.5	29.0	0.0	594.9	400.7	594.9
Boventraverse	1.07	0.0	27.7	18.7	27.7	40.4	0.0	1119.2	753.7	1119.2
Total		0.0	143.4	144.6	143.4		0.0	3673.0	3462.9	3673.0

Resulting loads from mast construction incl. Antenna without conductors level foundation (char. Value)

Load / wind direction	F_x	F_y	F_z	M_x	M_y	M_z
	[kN]	[kN]	[kN]	[kNm]	[kNm]	[kNm]
Permanente belasting	0	0	394	0	0	0
Windrichting 0°	193	0	0	0	5194	0
Windrichting 45°	143	143	0	3673	3673	0
Windrichting 90°	0	145	0	3463	0	0
Windrichting 135°	-143	143	0	3673	-3673	0

Project: KIJ-GT
Tower: HC+0
Number: 83

Intermediate results for conductor loads

Conductors back

Circuit	Geleider	Diameter [mm]	A [mm²]	G [N/m]	E [N/mm²]	αT [-]
Circuit 1	ACCCZ-Warsaw	27.7	571.0	14.98	62700	1.88E-05
Circuit 2	ACCCZ-Warsaw	27.7	571.0	14.98	62700	1.88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21.8	281.1	9.81	75000	1.89E-05
Bliksemdraad 2	OPGW 226	21.7	264.0	9.80	81000	2.30E-05

Conductors ahead

Circuit	Geleider	Diameter [mm]	A [mm²]	G [N/m]	E [N/mm²]	αT [-]
Circuit 1	ACCCZ-Warsaw	27.7	571.0	14.98	62700	1.88E-05
Circuit 2	ACCCZ-Warsaw	27.7	571.0	14.98	62700	1.88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21.8	281.1	9.81	75000	1.89E-05
Bliksemdraad 2	OPGW 226	21.7	264.0	9.80	81000	2.30E-05

Vertical load back

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	3	2	45.8	B	4+0,2d	9.5	28.6
Circuit 2	3	2	45.8	B	4+0,2d	9.5	28.6
Bliksemdraad 1	1	2	10.0	B	4+0,2d	8.4	8.4
Bliksemdraad 2	1	2	10.0	B	4+0,2d	8.3	8.3

Vertical load ahead

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	[N/m]	[N/m]
Circuit 1	3	2	45.8	B	4+0,2d	9.5	28.6
Circuit 2	3	2	45.8	B	4+0,2d	9.5	28.6
Bliksemdraad 1	1	2	10.0	B	4+0,2d	8.4	8.4
Bliksemdraad 2	1	2	10.0	B	4+0,2d	8.3	8.3

Insulators

Conductor	$G_{isolator}$ [kN]	Number -	$F_{v,iso}$ [kN]	Length [m]	Wind surf. [m²]	Wind heigth [m]	Pressure [kN/m²]	Drag factor [-]	$F_{h,iso}$ [kN]
380ct1f1	2.00	1	2	4.8	1.0	28.20	0.97	1.2	1.17
380ct1f2	2.00	1	2	4.8	1.0	28.20	0.97	1.2	1.17
380ct1f3	2.00	1	2	4.8	1.0	39.50	1.07	1.2	1.28
380ct2f1	2.00	1	2	4.8	1.0	28.20	0.97	1.2	1.17
380ct2f2	2.00	1	2	4.8	1.0	28.20	0.97	1.2	1.17
380ct2f3	2.00	1	2	4.8	1.0	39.50	1.07	1.2	1.28
bl1	0.10	0.5	0.05	0.3	0.1	43.40	1.09	1.2	0.07
bl2	0.10	0.5	0.05	0.3	0.1	43.40	1.09	1.2	0.07

Project: KIJ-GT
Tower: HC+0
Number: 83

Wind load back

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	17.7	0.85	0.54	0.54	1.14	28.25	44.1	43.8	46.9	77.0	76.5
380ct1f2	17.7	0.85	0.54	0.54	1.14	28.25	44.1	43.8	46.9	77.0	76.5
380ct1f3	29.0	0.98	0.58	0.58	1.10	28.25	53.0	52.6	46.9	95.8	95.2
380ct2f1	17.7	0.85	0.54	0.54	1.14	28.25	44.1	43.8	46.9	77.0	76.5
380ct2f2	17.7	0.85	0.54	0.54	1.14	28.25	44.1	43.8	46.9	77.0	76.5
380ct2f3	29.0	0.98	0.58	0.58	1.10	28.25	53.0	52.6	46.9	95.8	95.2
bl1	33.3	1.02	0.59	0.59	1.20	22.24	16.0	15.9	41.5	30.0	29.8
bl2	33.3	1.02	0.59	0.59	1.20	22.13	16.0	15.9	41.4	29.9	29.7

Wind load ahead

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	44.8	1.10	0.61	0.56	1.07	28.25	61.3	55.8	46.9	114.4	104.1
380ct1f2	44.8	1.10	0.61	0.56	1.07	28.25	61.3	55.8	46.9	114.4	104.1
380ct1f3	58.6	1.18	0.63	0.58	1.05	28.25	66.7	60.6	46.9	126.9	115.4
380ct2f1	44.8	1.10	0.61	0.56	1.07	28.25	61.3	55.8	46.9	114.4	104.1
380ct2f2	44.8	1.10	0.61	0.56	1.07	28.25	61.3	55.8	46.9	114.4	104.1
380ct2f3	58.6	1.18	0.63	0.58	1.05	28.25	66.7	60.6	46.9	126.9	115.4
bl1	66.0	1.22	0.64	0.59	1.17	22.24	20.4	18.5	41.5	39.1	35.6
bl2	66.0	1.22	0.64	0.59	1.17	22.13	20.3	18.5	41.4	39.0	35.5

Project: KIJ-GT
Tower: HC+0
Number: 83

Conductor loads

Auteur: TBR
Versie: v11.7

Starting points

Consequence class	Afkeur CC2-0
Reference period	30 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1.05	1.05	0.00	1.12	0.00	0.0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0.90	1.05	0.00	1.12	0.00	0.0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0.90	0.90	0.00	1.12	0.00	0.0
ULS 3	Wind+ice	-5°	1.05	1.05	0.00	0.34	0.97	0.0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0.90	1.05	0.00	0.34	0.97	0.0
ULS 4	Cold+wind	-20°	1.05	1.05	0.00	0.22	0.00	0.0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0.90	1.05	0.00	0.22	0.00	0.0
ULS 5a	Torsional loads	10°	1.00	1.00	1.00	0.00	0.00	1.0
ULS 5b	Longitudinal loads	10°	1.00	1.00	0.00	0.00	0.00	1.0
ULS 6	Construction + maintenance	5°	1.05	1.05	1.20	0.22	0.00	0.0
ULS 6_0,9	Construction + maintenance	5°	1.05	1.05	0.00	0.22	0.00	0.0
ULS 7	Permanent	10°	1.15	1.15	0.00	0.00	0.00	0.0
ULS 8	Special	10°	1.00	1.00	0.00	0.00	0.00	1.0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1.05	1.05	0.0	0.78	0.00	0.0
SPLS 1a_0,9	Wind 0,9	10°	0.90	1.05	0.0	0.78	0.00	0.0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0.90	1.05	0.0	0.78	0.00	0.0
SPLS 3	Wind+ice	-5°	1.05	1.05	0.0	0.36	0.34	0.0
SPLS 3_0,9	Wind+ice 0,9	-5°	0.90	1.05	0.0	0.36	0.34	0.0
SPLS 4	Cold+wind	-20°	1.05	1.05	0.0	0.24	0.00	0.0
SPLS 4_0,9	Cold+wind 0,9	-20°	0.90	1.05	0.0	0.24	0.00	0.0
SPLS 6	Maintenance	5°	1.05	1.05	1.2	0.24	0.0	0.0
SPLS 6_0,9	Maintenance	5°	1.05	1.05	0.0	0.24	0.0	0.0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1.00	1.00	0.0	0.94	0.0	0.0
SLS 3	Wind+ice	-5°	1.00	1.00	0.0	0.28	0.88	0.0
SLS 4	Wind	-20°	1.00	1.00	0.0	0.19	0.0	0.0
SLS 6	Maintenance	5°	1.00	1.00	0.0	0.19	0.0	0.0
SLS 7	EDS, no wind	10°	1.00	1.00	0.0	0.00	0.0	0.0

Number of wind directions	6
Number of load combinations for ULS	46
Number of load combinations for SPLS	222
Number of load combinations for SLS	15
Number of concentrated loads	5377

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Project: KIJ-GT
Tower: HC+0
Number: 83

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-28.1	27.6	14.5	16.3	5.9	1.3
380ct1f1	-98.4	101.9	48.8	54.4	17.8	3.3
380ct1f2	-98.4	101.9	48.8	54.4	17.8	3.3
380ct1f3	-100.3	103.5	52.3	57.5	17.8	3.3
380ct2f1	-98.4	101.9	48.8	54.4	17.8	3.3
380ct2f2	-98.4	101.9	48.8	54.4	17.8	3.3
380ct2f3	-100.3	103.5	52.3	57.5	17.8	3.3
bl2	-28.2	27.8	14.5	16.3	5.9	1.3
Post 50	0.0	0.0	0.0	0.0	0.0	
Post 51	0.0	0.0	0.0	0.0	0.0	
Post 52	0.0	0.0	0.0	0.0	0.0	

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	-77.2	107.7	136.2
380ct1f1	104.8	178.3	194.1
380ct1f2	104.8	178.3	194.1
380ct1f3	62.0	156.2	174.4
380ct2f1	104.8	178.3	194.1
380ct2f2	104.8	178.3	194.1
380ct2f3	62.0	156.2	174.4
bl2	-77.1	103.0	136.3
Post 50			
Post 51			
Post 52			

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	136.3	145.0
380ct1f1	194.6	196.1
380ct1f2	194.6	196.1
380ct1f3	175.1	176.8
380ct2f1	194.6	196.1
380ct2f2	194.6	196.1
380ct2f3	175.1	176.8
bl2	136.4	143.2
Post 50		
Post 51		
Post 52		

Envelop of weight span over all combinations (incl. 0,9 combinations)		
For all conductors		Wind / Weight span ratio
Max. weight span	196.1 m	0.522 -
Min. weight span	-180.7 m	-0.481 -

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Project: KIJ-GT
Tower: HC+0
Number: 83

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	28.1	27.3	5.9	-31.0	31.6
380ct1f1	86.5	97.5	17.8	-109.7	114.3
380ct1f2	86.5	97.5	17.8	-109.7	114.3
380ct1f3	89.0	100.4	17.8	-112.3	116.3
380ct2f1	86.5	97.5	17.8	-109.7	114.3
380ct2f2	86.5	97.5	17.8	-109.7	114.3
380ct2f3	89.0	100.4	17.8	-112.3	116.3
bl2	28.2	27.2	5.9	-31.1	31.5
Post 50	1.9	1.9	3.5	0.0	
Post 51	1.9	1.9	3.5	0.0	
Post 52	1.9	1.9	3.5	0.0	

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	13.8	6.0	2.1	-15.0	15.0
380ct1f1	58.9	25.6	11.5	-64.2	64.2
380ct1f2	58.9	25.6	11.5	-64.2	64.2
380ct1f3	58.9	25.6	11.5	-64.2	64.2
380ct2f1	58.9	25.6	11.5	-64.2	64.2
380ct2f2	58.9	25.6	11.5	-64.2	64.2
380ct2f3	58.9	25.6	11.5	-64.2	64.2
bl2	13.8	6.0	2.1	-15.0	15.0
Post 50	0.0	0.0	3.0	0.0	
Post 51	0.0	0.0	3.0	0.0	
Post 52	0.0	0.0	3.0	0.0	

1 **Control uplift SLS-wind**

Combinatie	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	0.0	-1.0
	380ct1f1	0.0	0.0
	380ct1f2	0.0	0.0
	380ct1f3	0.0	-0.3
	380ct2f1	0.0	0.0
	380ct2f2	0.0	0.0
	380ct2f3	0.0	-0.3
	bl2	0.0	-1.0
	Post 50	0.0	
	Post 51	0.0	
	Post 52	0.0	

Project: KIJ-GT
Tower: HC+0
Number: 83

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		52	623	63	20211	1645	0
ULS 1a_0,9_0		20	351	89	11239	617	-73
ULS 1a_0,9_0,9_90		55	594	46	19312	1751	0
ULS 3_0		10	544	126	17498	316	-23
SLS 7		0	331	88	10583	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

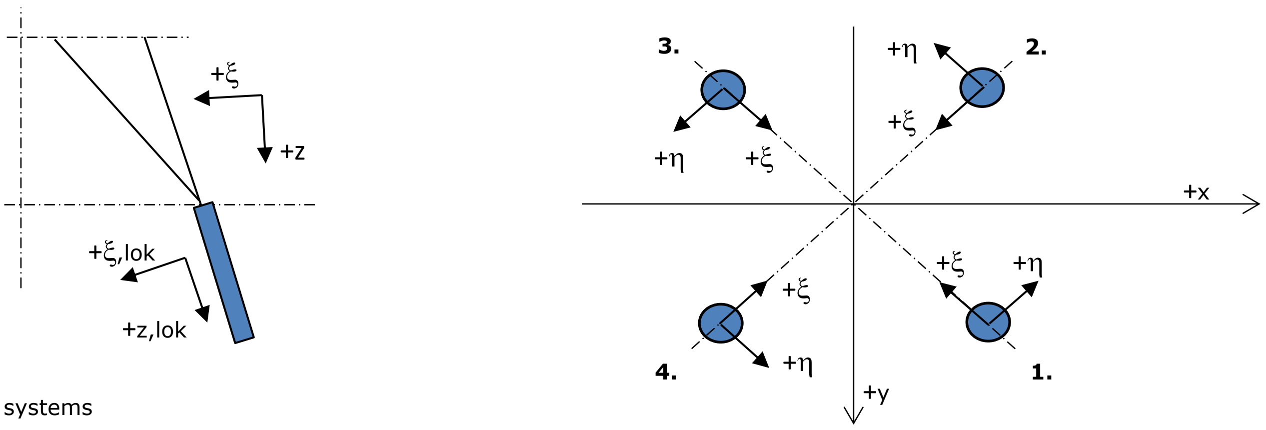
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	52	785	477	24078	1645	0
ULS 1a_0,9_0,9_90	55	756	401	23179	1751	0
SLS 7	0	331	482	10583	0	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_90	52	785	416	**24095**	1645	0
SPLS 3_113.5 Ba All Cts	547	339	424	10466	**17988**	12
SPLS 3_113.5 Ah Ct2	-238	428	513	13243	-7478	**3121**
SPLS 3_0,9_113.5 Ba All Cts	547	339	364	**10483**	**17988**	12

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_113.5 Ba All Cts	237	243	**1399**	-4	-340	-30	1433
2	SPLS 1a_0 Ba All Cts	119	-111	**658**	-6	-163	-18	674
3	SPLS 3_135 Ah All Cts	-94	-89	**535**	3	-129	-11	548
4	SPLS 3_66.5 Ah All Cts	-228	235	**1348**	4	-327	-29	1381

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-50	-47	**-287**	-2	69	5	-294
2	SPLS 3_0,9_66.5 Ah All Cts	-185	192	**-1101**	-5	267	24	-1128
3	SPLS 3_0,9_113.5 Ba All Cts	203	210	**-1203**	5	292	26	-1232
4	SPLS 1a_0,9_0 Ba All Cts	82	-78	**-452**	2	113	13	-463

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_113.5 Ah Ct2	135	-3	376	**97**	-93	-10	385
2	SPLS 3_0,9_113.5 Ah Ct2	-215	75	-829	**99**	205	22	-849
3	SPLS 3_113.5 Ah Ct2	-49	98	-134	**104**	34	5	-137
4	SPLS 3_113.5 Ah Ct2	-114	259	1070	**102**	-263	-27	1096

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	SPLS 3_113.5 Ah Ct1	-3	141	400	**-102**	-98	-10	409
2	SPLS 3_113.5 Ah Ct1	-72	214	-822	**-101**	202	20	-842
3	SPLS 3_0,9_113.5 Ah Ct1	97	-41	-159	**-98**	39	4	-163
4	SPLS 3_0,9_113.5 Ah Ct1	-255	114	1065	**-99**	-261	-26	1090

Project: KIJ-GT
Tower: HC+0
Number: 83

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-50	-47	**-287**	**-2**	69	5	-294
2	SPLS 3_0,9_66.5 Ah Ct1	-89	222	**-905**	**-94**	219	19	-927
3	SPLS 3_0,9_113.5 Ba Ct2	234	111	**-1014**	**-87**	244	20	-1039
4	SPLS 1a_0,9_0 Ba All Cts	82	-78	**-452**	**2**	113	13	-463

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	103	103	601	0	-146	-13	616
2	SLS 7	-62	62	-361	0	88	8	-369
3	SLS 7	62	62	-361	0	88	8	-369
4	SLS 7	-103	103	601	0	-146	-13	616

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	SPLS 3_113.5 Ba All Cts	237	243	**1399**	-4	-340	-30	1433
Max. tension	SPLS 3_0,9_113.5 Ba All Cts	203	210	**-1203**	5	292	26	-1232
Max. pos. torsie	SPLS 3_113.5 Ah Ct2	-49	98	-134	**104**	34	5	-137
Max. neg. torsie	SPLS 3_113.5 Ah Ct1	-3	141	400	**-102**	-98	-10	409
Comb. tension+torsie	SPLS 3_0,9_113.5 Ba Ct2	234	111	**-1014**	**-87**	244	20	-1039

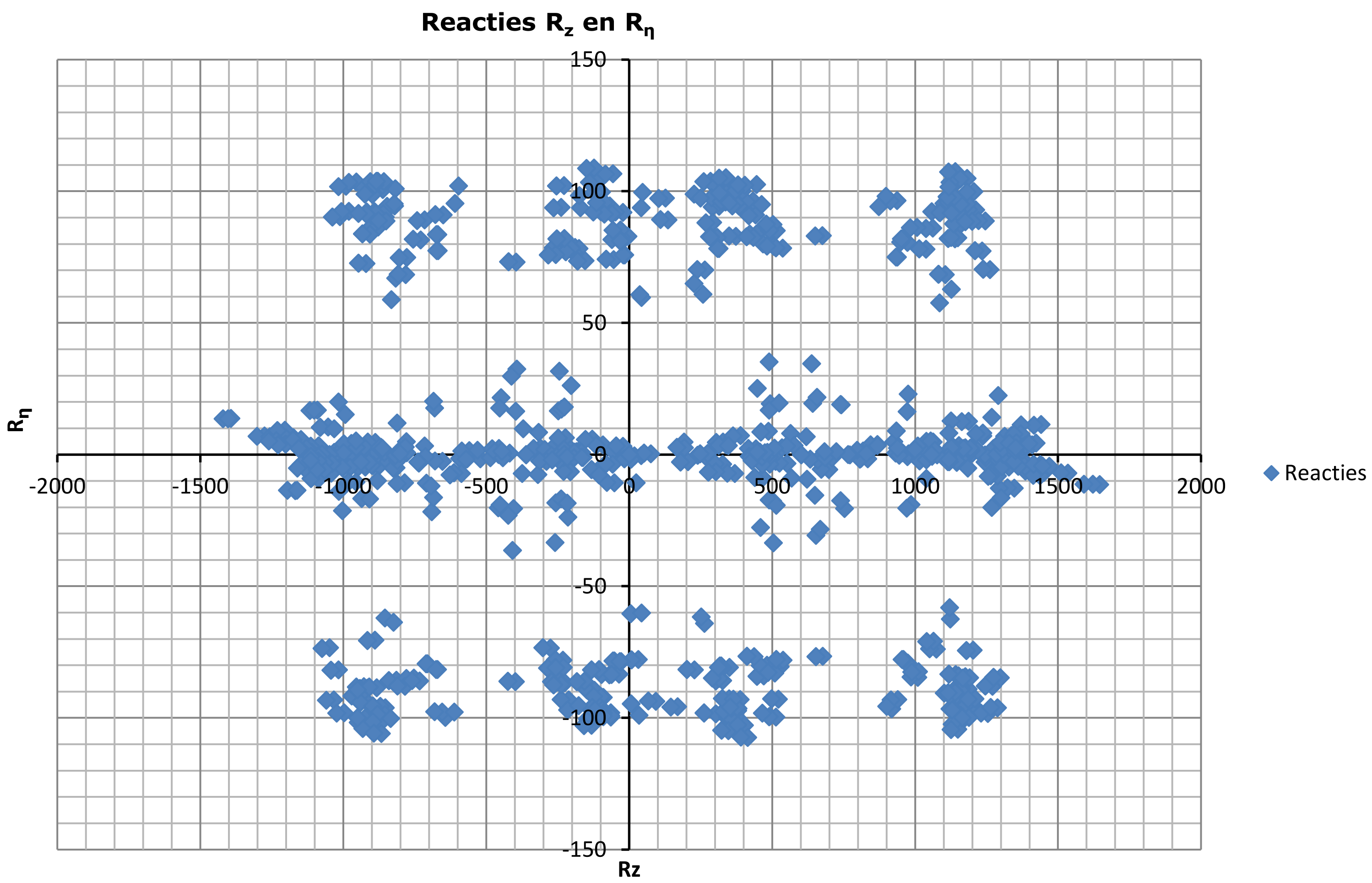
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	103	103	**601**	0	-146	-13	616
2	SLS 1a_90	-137	143	**-794**	-5	198	22	-813
3	SLS 1a_90	157	164	**-913**	5	227	25	-935
4	SLS 1a_0	-56	61	**361**	3	-82	-3	369

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_90	196	203	**1143**	-5	-283	-30	1170
2	SLS 1a_0	-12	22	**-120**	-7	24	-3	-123
3	SLS 7	62	62	**-361**	0	88	8	-369
4	SLS 3_90	-177	178	**1030**	1	-251	-24	1055

Project: KIJ-GT
Tower: HC+0
Number: 83



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Project: KIJ-GT
Tower: HC+0
Number: 83

Conductor loads | Auteur: TBR | Versie: v11.7

Starting points

Consequence class: Verbouw CC2
Reference period: 50 jaar

ULS (strength)		NEN-EN50341-2-15:2019						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1.15	1.15	0.00	1.40	0.00	0.0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0.90	1.15	0.00	1.40	0.00	0.0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0.90	0.90	0.00	1.40	0.00	0.0
ULS 3	Wind+ice	-5°	1.15	1.15	0.00	0.42	1.30	0.0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0.90	1.15	0.00	0.42	1.30	0.0
ULS 4	Cold+wind	-20°	1.15	1.15	0.00	0.28	0.00	0.0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0.90	1.15	0.00	0.28	0.00	0.0
ULS 5a	Torsional loads	10°	1.00	1.00	1.00	0.00	0.00	1.0
ULS 5b	Longitudinal loads	10°	1.00	1.00	0.00	0.00	0.00	1.0
ULS 6	Construction + maintenance	5°	1.15	1.15	1.30	0.28	0.00	0.0
ULS 6_0,9	Construction + maintenance	5°	1.15	1.15	0.00	0.28	0.00	0.0
ULS 7	Permanent	10°	1.30	1.30	0.00	0.00	0.00	0.0
ULS 8	Special	10°	1.00	1.00	0.00	0.00	0.00	1.0
SPLS	(strength, for angle towers: absence of conductors)			γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1.15	1.15	0.0	0.78	0.00	0.0
SPLS 1a_0,9	Wind 0,9	10°	0.90	1.15	0.0	0.78	0.00	0.0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0.90	1.15	0.0	0.78	0.00	0.0
SPLS 3	Wind+ice	-5°	1.15	1.15	0.0	0.36	0.34	0.0
SPLS 3_0,9	Wind+ice 0,9	-5°	0.90	1.15	0.0	0.36	0.34	0.0
SPLS 4	Cold+wind	-20°	1.15	1.15	0.0	0.24	0.00	0.0
SPLS 4_0,9	Cold+wind 0,9	-20°	0.90	1.15	0.0	0.24	0.00	0.0
SPLS 6	Maintenance	5°	1.15	1.15	1.2	0.24	0.0	0.0
SPLS 6_0,9	Maintenance	5°	1.15	1.15	0.0	0.24	0.0	0.0
SLS	(deformations, fatigue, EDS)							
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1.00	1.00	0.0	1.00	0.0	0.0
SLS 3	Wind+ice	-5°	1.00	1.00	0.0	0.30	1.00	0.0
SLS 4	Wind	-20°	1.00	1.00	0.0	0.20	0.0	0.0
SLS 6	Maintenance	5°	1.00	1.00	0.0	0.20	0.0	0.0
SLS 7	EDS, no wind	10°	1.00	1.00	0.0	0.00	0.0	0.0

Number of wind directions	6
Number of load combinations for ULS	46
Number of load combinations for SPLS	222
Number of load combinations for SLS	15
Number of concentrated loads	5377

Project: KIJ-GT
Tower: HC+0
Number: 83

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-30.9	32.5	17.3	19.6	6.5	1.3
380ct1f1	-114.5	119.4	57.3	64.9	20.9	3.5
380ct1f2	-114.5	119.4	57.3	64.9	20.9	3.5
380ct1f3	-116.9	121.4	62.0	68.8	20.9	3.5
380ct2f1	-114.5	119.4	57.3	64.9	20.9	3.5
380ct2f2	-114.5	119.4	57.3	64.9	20.9	3.5
380ct2f3	-116.9	121.4	62.0	68.8	20.9	3.5
bl2	-31.1	32.7	17.3	19.6	6.5	1.3
Post 50	0.0	0.0	0.0	0.0	0.0	
Post 51	0.0	0.0	0.0	0.0	0.0	
Post 52	0.0	0.0	0.0	0.0	0.0	

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	-95.2	106.5	136.2
380ct1f1	96.0	177.8	194.1
380ct1f2	96.0	177.8	194.1
380ct1f3	51.3	155.7	174.4
380ct2f1	96.0	177.8	194.1
380ct2f2	96.0	177.8	194.1
380ct2f3	51.3	155.7	174.4
bl2	-95.1	101.8	136.3
Post 50			
Post 51			
Post 52			

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	137.5	151.1
380ct1f1	195.6	199.4
380ct1f2	195.6	199.4
380ct1f3	176.2	180.4
380ct2f1	195.6	199.4
380ct2f2	195.6	199.4
380ct2f3	176.2	180.4
bl2	137.5	149.4
Post 50		
Post 51		
Post 52		

Envelop of weight span over all combinations (incl. 0,9 combinations)		
For all conductors		Wind / Weight span ratio
Max. weight span	199.4 m	0.531 -
Min. weight span	-282.7 m	-0.753 -

Project: KIJ-GT
Tower: HC+0
Number: 83

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	29.2	32.5	6.5	-34.7	37.4
380ct1f1	91.0	114.7	20.9	-127.8	134.1
380ct1f2	91.0	114.7	20.9	-127.8	134.1
380ct1f3	93.3	118.3	20.9	-131.2	136.7
380ct2f1	91.0	114.7	20.9	-127.8	134.1
380ct2f2	91.0	114.7	20.9	-127.8	134.1
380ct2f3	93.3	118.3	20.9	-131.2	136.7
bl2	29.2	32.4	6.5	-35.0	37.4
Post 50	2.4	2.4	3.9	0.0	
Post 51	2.4	2.4	3.9	0.0	
Post 52	2.4	2.4	3.9	0.0	

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	13.8	6.0	2.1	-15.0	15.0
380ct1f1	58.9	25.6	11.5	-64.2	64.2
380ct1f2	58.9	25.6	11.5	-64.2	64.2
380ct1f3	58.9	25.6	11.5	-64.2	64.2
380ct2f1	58.9	25.6	11.5	-64.2	64.2
380ct2f2	58.9	25.6	11.5	-64.2	64.2
380ct2f3	58.9	25.6	11.5	-64.2	64.2
bl2	13.8	6.0	2.1	-15.0	15.0
Post 50	0.0	0.0	3.0	0.0	
Post 51	0.0	0.0	3.0	0.0	
Post 52	0.0	0.0	3.0	0.0	

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	0.0	-1.0
	380ct1f1	0.0	0.0
	380ct1f2	0.0	0.0
	380ct1f3	0.0	-0.4
	380ct2f1	0.0	0.0
	380ct2f2	0.0	0.0
	380ct2f3	0.0	-0.4
	bl2	0.0	-1.0
	Post 50	0.0	
	Post 51	0.0	
	Post 52	0.0	

Project: KIJ-GT
Tower: HC+0
Number: 83

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		68	736	63	23884	2178	0
ULS 1a_0,9_0		26	383	97	12286	808	-92
ULS 1a_0,9_0,9_90		74	694	33	22575	2358	1
ULS 3_0		15	632	149	20359	484	-28
SLS 7		0	331	88	10583	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

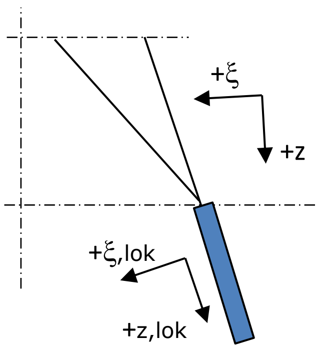
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	68	938	516	28732	2178	0
ULS 1a_0,9_0,9_90	74	896	388	27423	2358	1
SLS 7	0	331	482	10583	0	0

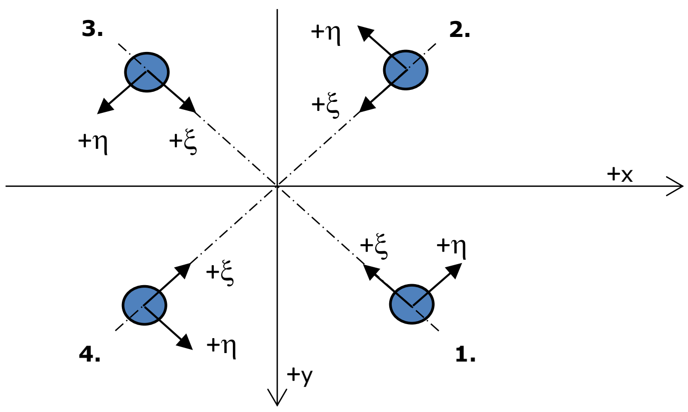
Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_90	68	938	415	**28760**	2178	0
SPLS 3_0 Ba All Cts	599	225	481	7136	**18991**	-21
SPLS 3_113.5 Ah Ct2	-257	449	563	13897	-8092	**3285**
ULS 1a_0,9_113.5	140	917	402	**28043**	**5420**	37

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg





Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_113.5	276	292	**1646**	-11	-402	-39	1685
2	SPLS 1a_0 Ba All Cts	126	-118	**698**	-6	-173	-19	715
3	SPLS 3_135 Ah All Cts	-101	-96	**576**	3	-139	-11	590
4	ULS 1a_66.5	-241	257	**1440**	11	-352	-34	1474

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-55	-51	**-313**	-2	75	6	-321
2	ULS 1a_0,9_66.5	-197	216	**-1195**	-14	293	28	-1224
3	ULS 1a_0,9_113.5	236	255	**-1420**	14	347	33	-1455
4	SPLS 1a_0,9_0 Ba All Cts	86	-83	**-480**	2	120	14	-491

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_113.5 Ah Ct2	139	-6	381	**102**	-94	-10	390
2	SPLS 3_0,9_113.5 Ah Ct2	-228	81	-885	**104**	218	23	-907
3	SPLS 3_113.5 Ah Ct2	-54	100	-123	**109**	32	5	-126
4	SPLS 3_113.5 Ah Ct2	-122	274	1140	**107**	-280	-28	1168

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	SPLS 3_113.5 Ah Ct1	-4	148	413	**-107**	-101	-10	423
2	SPLS 3_113.5 Ah Ct1	-76	226	-867	**-106**	213	21	-888
3	SPLS 3_0,9_113.5 Ah Ct1	101	-45	-159	**-103**	39	4	-162
4	SPLS 3_0,9_113.5 Ah Ct1	-269	121	1125	**-104**	-275	-27	1152

Project: KIJ-GT
Tower: HC+0
Number: 83

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-55	-51	**-313**	**-2**	75	6	-321
2	SPLS 3_0,9_66.5 Ah Ct1	-92	234	**-951**	**-100**	231	21	-974
3	ULS 1a_0,9_113.5	236	255	**-1420**	**14**	347	33	-1455
4	SPLS 1a_0,9_0 Ba All Cts	86	-83	**-480**	**2**	120	14	-491

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	103	103	601	0	-146	-13	616
2	SLS 7	-62	62	-361	0	88	8	-369
3	SLS 7	62	62	-361	0	88	8	-369
4	SLS 7	-103	103	601	0	-146	-13	616

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_113.5	276	292	**1646**	-11	-402	-39	1685
Max. tension	ULS 1a_0,9_113.5	236	255	**-1420**	14	347	33	-1455
Max. pos. torsie	SPLS 3_113.5 Ah Ct2	-54	100	-123	**109**	32	5	-126
Max. neg. torsie	SPLS 3_113.5 Ah Ct1	-4	148	413	**-107**	-101	-10	423
Comb. tension+torsie	ULS 1a_0,9_113.5	236	255	**-1420**	**14**	347	33	-1455

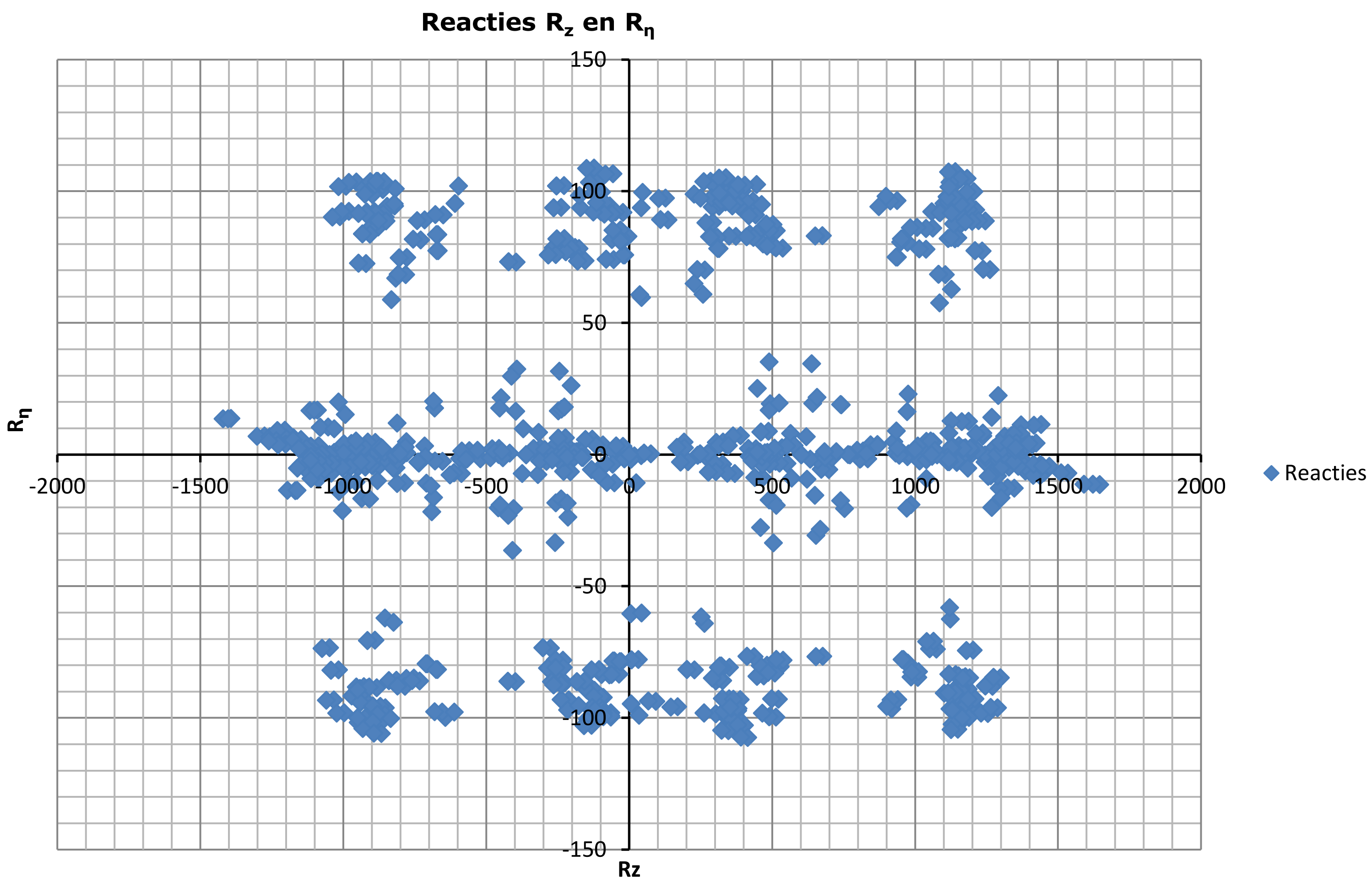
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	103	103	**601**	0	-146	-13	616
2	SLS 1a_90	-142	149	**-826**	-5	206	23	-846
3	SLS 1a_90	164	171	**-956**	5	237	26	-979
4	SLS 1a_0	-53	58	**346**	3	-79	-2	355

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_90	203	211	**1184**	-5	-293	-31	1212
2	SLS 1a_0	-9	20	**-106**	-8	20	-3	-109
3	SLS 7	62	62	**-361**	0	88	8	-369
4	SLS 3_90	-184	186	**1073**	1	-262	-25	1098

Project: KIJ-GT
Tower: HC+0
Number: 83



Content

ISSUE	DATE	REVISION	CHK'D	APP'D
0.0	2021-02-10			

Data

Norm	NEN-EN50341-2-15:2019
Initial	
Consequence class	CC2-0
Reliability level	Afkeur
Reference period	30 jaar
After adjustment	
Consequence class	CC2
Reliability level	Verbouw
Reference period	50 jaar
Wind zone	III
Wind speed	24,5 m/s
Terrain categorie	II
Reduction factor Cdir	1,00
Ice region	B
Tower type	Hoekmast
Tower height	45 m
Max. Span	398 m
Line angle	134°
Catenary	1400 m
Wind span	334 m
EDS Weight span	247 m
Min. Weight span	82 m
Max. Weight span	250 m

Client: TenneT Taking power further

DNV·GL

Title:

Berekening masttype HC+0 T

JOB No.	-	DATE	-
DRAWN	-	CHKD	-
DESIGN	-	APPD	-

Document name:

KIJ-GT_HC+0 T_69_Report.pdf

Project number:

Project client number:

0.0

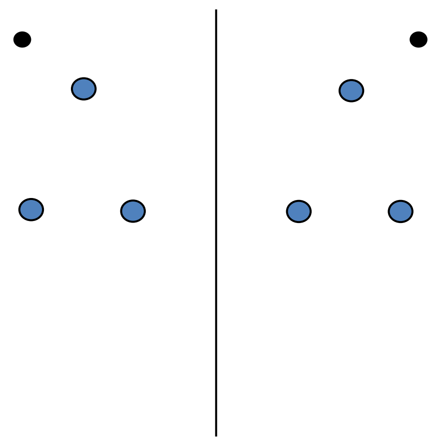
Conductor loads — Auteur: TBR, Versie: v11.6

General

Description	HC+0 T
Tower type	Hoekmast
Number of circuits	2
Configuration	2-circuit-donau
Number of earth wires	2

Starting points

Norm	NEN-EN50341-2-15:2019
Consequence class	CC2-0
Reliability level initial	Afkeur CC2-0
Reference period intial	30 jaar
Consequence class modified	CC2
Reliability level modified	Verbouw
Reference period modified	50 jaar
Wind zone	III
Terrain category	24,5 m/s
Reduction factor c_{dir}	II
Ice region phase conductor	1,00
Ice region earth conductor	B
	B



Configuratie geleiders

Conductors back

Description	Voltage	Conductor Back	Bundle Ba	Ice region	Additional weight	Additional diameter	Catenary P_{back}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Conductors ahead

Description	Voltage	Conductor Ahead	Bundle Ah	Ice region	Additional weight	Additional diameter	Catenary P_{ahead}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Insulators *(1)*

Description	Suspension	Weight [kN]	Length [m]	Wind area [m^2]
Circuit 1	Afspanketting	2,00	4,83	1,00
Circuit 2	Afspanketting	2,00	4,83	1,00
Bliksemdraad 1	Vast (Bliksemdraad)	0,10	0,30	0,05
Bliksemdraad 2	Vast (Bliksemdraad)	0,10	0,30	0,05

1. Properties apply to the entire isolator set

Suspension height and position in mast

Circuits	Designation	Number	Suspension height	Attach point	Position in tower Horizontal distance
Circuit 1	21	380ct1f1	27,7 m	27,7 m	17,7 m
Circuit 1	20	380ct1f2	27,7 m	27,7 m	9,5 m
Circuit 1	22	380ct1f3	39,0 m	39,0 m	13,6 m
Circuit 2	10	380ct2f1	27,7 m	27,7 m	-17,7 m
Circuit 2	11	380ct2f2	27,7 m	27,7 m	-9,5 m
Circuit 2	12	380ct2f3	39,0 m	39,0 m	-13,6 m
Bliksemdraad 1	1	bl1	42,9 m	43,2 m	-18,7 m
Bliksemdraad 2	3	bl2	42,9 m	43,2 m	18,7 m

Project: KIJ-GT
Tower: HC+0 T
Number: 69

Height adjustment adjacent masts (wind and weight span adjustment)

	Back	Ahead	
Height increase for wind pressure	0,0 m	0,0 m	(positive: higher)
Height decrease for vertical load	0,0 m	0,0 m	(negative: decrease, more weight span)
Decrease: Niet in 0,9EG-combinaties			

Height difference adjacent tower and change of direction with respect to Line direction

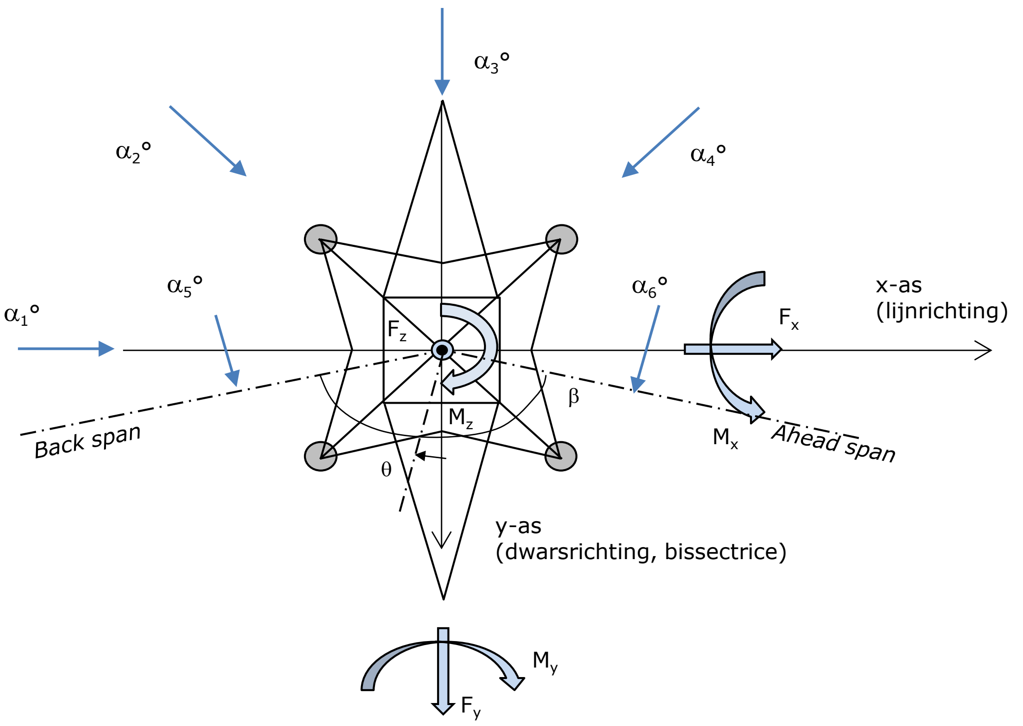
			Hoogteverschil		Richtingsverandering	
Circuits	Aanduiding	Nummer	Δh_back	Δh_ahead	Δy_back	Δy_ahead
Circuit 1	21	380ct1f1	24,5	0,0 m	0,0	0,0 m
Circuit 1	20	380ct1f2	24,5	0,0 m	0,0	0,0 m
Circuit 1	22	380ct1f3	25,0	0,0 m	0,0	0,0 m
Circuit 2	10	380ct2f1	24,5	0,0 m	0,0	0,0 m
Circuit 2	11	380ct2f2	24,5	0,0 m	0,0	0,0 m
Circuit 2	12	380ct2f3	25,0	0,0 m	0,0	0,0 m
Bliksemdraad 1	1	bl1	28,8	-0,4 m	0,0	0,0 m
Bliksemdraad 2	3	bl2	28,8	-0,4 m	0,0	0,0 m

Line and tower data

		Back	Ahead
		398,0	269,0 m
Ruling span $\sqrt{(\Sigma L^3/\Sigma L)}$		389,6	370,9 m
Line angle	β	134 °	
Tower orientation with respect to bis	θ	0 °	
Section length		3064	2521 m
Height bottom of tower to ground level		0,5 m	
Wind directions considered	α_1	0 °	
Wind directions according to:	α_2	45 °	
Geleiderbelastingen	α_3	90 °	
	α_4	135 °	
	α_5	67 °	
	α_6	113 °	

Wind directions apply to the main direction of mast construction, not to the bisector.

Windrichtingen en positieve richtingen belastingen



Considered number of wind directions	
1a	6
3	6
4	1
6	1
Overig	1

Project: KIJ-GT
Tower: HC+0 T
Number: 69

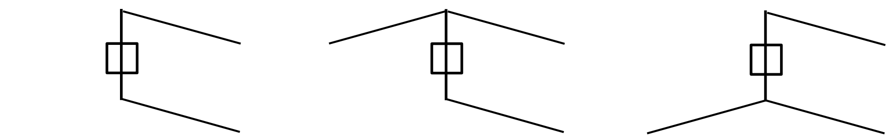
Absence of conductors

		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	380ct1f1	1	0	1	0	1	0
Circuit 1	380ct1f2	1	0	1	0	1	0
Circuit 1	380ct1f3	1	0	1	0	1	0
Circuit 2	380ct2f1	0	1	1	0	1	0
Circuit 2	380ct2f2	0	1	1	0	1	0
Circuit 2	380ct2f3	0	1	1	0	1	0
Bliksemdraad 1	bl1	1	0	1	0	1	0
Bliksemdraad 2	bl2	0	1	1	0	1	0

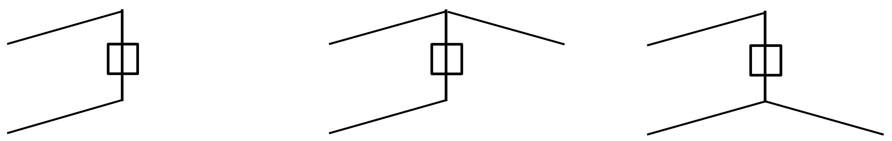
Load situations SPLS

Considered situations SPLS: 1 up to 6, All possible situations

Principle of load situations:



1. Ba All cts 2. Ba ct1 3. Ba ct2

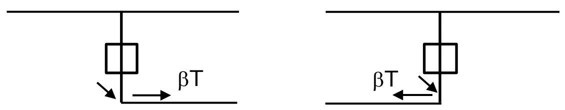


4. Ah All cts 5. Ah ct1 6. Ah ct2

Load situation 5a. Conductor failure

Considered situations conductor failure 5a: 1, design assumption is symmetry back and ahead

Principle of load situations:



1. Ba 2. Ah

Project: KIJ-GT
Tower: HC+0 T
Number: 69

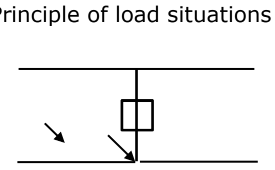
Load situations LC6. Construction and maintenance
Under 6a, the load due to the presence of a line verhicle or line bicycle in combination with point load on the traverse is assesed.
Combination 6b does not contain any loads in conductor or on traverse. This combination has been added to be able to combine with separate control platforms, etc. The situations are applied in ULS and in every SPLS situation (in case of angle tower).

3,0 kN	2,0 kN
1,0 kN	1,0 kN

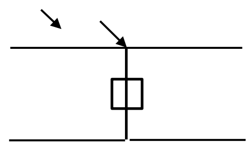
Considered situations construction and maintenance 6a: 1 up to 4, all possible situations

Presence line vehicle: Circuit, load present in all conductors of a circuit

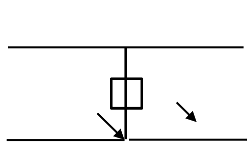
Principle of load situations:



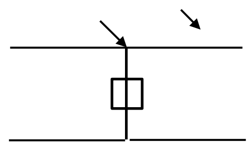
1. Ba Ct1



2. Ba Ct2



3. Ah Ct1



4. Ah Ct2

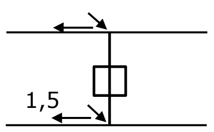
Load situations 8. Galloping as a static load

Conductor		
Suspension tower phase	0,866 W	1,5 W
Suspension tower earth	1,5 EDS	1,5 W
Strain tower phase and earth	1,5 EDS	1,5 W

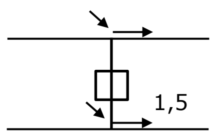
Considered situations galloping 8: None (existing structure)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principle of load situations:



1. Ba



2. Ah

Load combination 8. Galloping as a dynamic load
Only applies to tension towers
Load consists of EDS tensile load in one of the conductors on one side of the tower
Can be converted by user to fatigue spectrum via the load spectrum of table 4.11 / NL.1

Project: KIJ-GT
Tower: HC+0 T
Number: 69

Tower structure

Properties

Tower type	Hoekmast		
Tower designation	HC+0 T		
Base plate w.r.t. ground level	0,5 m		
Tower height w.r.t. base plate	45,0 m		
Tower self weight	394,0 kN		
Width and slope at foundation	x-ri.	y-ri.	
Leg spread	11,00	11,00	m
Inclination of main leg	0,156	0,156	-
Horizontal force factor	1,1	1,1	-

Calculation Wind load

Dynamic factor G_T	1,00 *(Masthoogte < 60 m)*
Wind load diagonally to tower body proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Wind load diagonally on traverse proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Magnification factor diagonal wind to tower body	(1+0,2sin^2(2phi))
Magnification factor diagonal wind to cross arm	(1+0,2sin^2(2phi))
Magnification factor wind parallel to perpendicular to cross a	0,4

Properties mast sections longitudinal direction (front view, yz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	9,60	11,00	8,00	9,60	0,156	91,20	12,23	0,13	3,23
Middenstuk 1	18,90	8,00	5,84	9,30	0,116	64,36	11,40	0,18	3,03
Middenstuk 2	27,70	5,84	3,80	8,80	0,116	42,42	10,53	0,25	2,73
Bovenstuk 1	35,50	3,80	3,19	7,80	0,039	27,26	7,23	0,27	2,66
Bovenstuk 2	43,00	3,19	2,60	7,50	0,039	21,71	5,25	0,24	2,76
Topstuk	45,00	2,60		2,00		2,60	0,24	0,09	3,45
Ondertraverse	27,70	15,80		4,00		31,60	5,89	0,19	2,99
Boventraverse	39,00	16,95		4,20		35,60	7,55	0,21	2,88

Properties tower sections transversal direction (side view, xz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	9,60	11,00	8,00	9,60	0,156	91,20	12,23	0,13	3,23
Middenstuk 1	18,90	8,00	5,84	9,30	0,116	64,36	11,40	0,18	3,03
Middenstuk 2	27,70	5,84	3,80	8,80	0,116	42,42	10,53	0,25	2,73
Bovenstuk 1	35,50	3,80	3,19	7,80	0,039	27,26	7,23	0,27	2,66
Bovenstuk 2	43,00	3,19	2,60	7,50	0,039	21,71	5,25	0,24	2,76
Topstuk	45,00	2,60		2,00		2,60	0,24	0,09	3,45
Ondertraverse	27,70	15,80		4,00		31,60	5,89	0,19	2,99
Boventraverse	39,00	16,95		4,20		35,60	7,55	0,21	2,88

Note: Surface transverse direction is reduced in calculation.

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Project: KIJ-GT
Tower: HC+0 T
Number: 69

Wind surface feeders telecom installations

Part	A (m^2/m)	Factor	Δh	A_1
Broekstuk 1	0,08	1,00	9,6	0,8
Middenstuk 1	0,08	1,00	9,3	0,7
Middenstuk 2	0,08	1,00	8,8	0,7
Bovenstuk 1	0,08	1,00	7,8	0,6
Bovenstuk 2				

Input antennas

Description	A (m^2)	h (m)	C_f (m)
Antenne 1	2,3	35,5	1,5
Schotel			
Schotel			

Tower section loads longitudinal (x-direction) per wind direction

Description	p_w	F_{x1}	F_{x2}	F_{x3}	F_{x4}	h_{ef}	M_{y1}	M_{y2}	M_{y3}	M_{y4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,70	27,7	23,5	0,0	-23,5	4,8	133,1	113,0	0,0	-113,0
Middenstuk 1	0,79	27,3	23,2	0,0	-23,2	14,3	389,0	330,0	0,0	-330,0
Middenstuk 2	0,92	26,4	22,4	0,0	-22,4	23,3	615,5	522,3	0,0	-522,3
Bovenstuk 1	1,01	19,4	16,5	0,0	-16,5	31,6	613,2	520,3	0,0	-520,3
Bovenstuk 2	1,06	15,4	13,1	0,0	-13,1	39,3	604,6	513,0	0,0	-513,0
Topstuk	1,10	0,9	0,8	0,0	-0,8	44,0	39,9	33,9	0,0	-33,9
Ondertraverse	0,98	34,5	20,5	0,0	-20,5	29,0	1001,6	594,9	0,0	-594,9
Boventraverse	1,07	46,6	27,7	0,0	-27,7	40,4	1884,3	1119,2	0,0	-1119,2
Totaal		198,3	147,6	0,0	-147,6		5281,2	3746,6	0,0	-3746,6

Tower section loads transversal (y-direction) per wind direction

Description	p_w	F_{y1}	F_{y2}	F_{y3}	F_{x4}	h_{ef}	M_{x1}	M_{x2}	M_{x3}	M_{x4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,70	0,0	23,5	27,7	23,5	4,8	0,0	113,0	133,1	113,0
Middenstuk 1	0,79	0,0	23,2	27,3	23,2	14,3	0,0	330,0	389,0	330,0
Middenstuk 2	0,92	0,0	22,4	26,4	22,4	23,3	0,0	522,3	615,5	522,3
Bovenstuk 1	1,01	0,0	16,5	19,4	16,5	31,6	0,0	520,3	613,2	520,3
Bovenstuk 2	1,06	0,0	13,1	15,4	13,1	39,3	0,0	513,0	604,6	513,0
Topstuk	1,10	0,0	0,8	0,9	0,8	44,0	0,0	33,9	39,9	33,9
Ondertraverse	0,98	0,0	20,5	13,8	20,5	29,0	0,0	594,9	400,7	594,9
Boventraverse	1,07	0,0	27,7	18,7	27,7	40,4	0,0	1119,2	753,7	1119,2
Total		0,0	147,6	149,6	147,6		0,0	3746,6	3549,7	3746,6

Resulting loads from mast construction incl. Antenna without conductors level foundation (char. Value)

Load / wind direction	F_x	F_y	F_z	M_x	M_y	M_z
	[kN]	[kN]	[kN]	[kNm]	[kNm]	[kNm]
Permanente belasting	0	0	394	0	0	0
Windrichting 0°	202	0	0	0	5408	0
Windrichting 45°	150	150	0	3836	3836	0
Windrichting 90°	0	153	0	3677	0	0
Windrichting 135°	-150	150	0	3836	-3836	0

Project: KIJ-GT
Tower: HC+0 T
Number: 69

Intermediate results for conductor loads

Conductors back

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Conductors ahead

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Vertical load back

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Vertical load ahead

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	[N/m]	[N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Insulators

Conductor	$G_{isolator}$ [kN]	Number -	$F_{v,iso}$ [kN]	Length [m]	Wind surf. [m^2]	Wind heigth [m]	Pressure [kN/m^2]	Drag factor [-]	$F_{h,iso}$ [kN]
380ct1f1	2,00	1	2	4,8	1,0	28,20	0,97	1,2	1,17
380ct1f2	2,00	1	2	4,8	1,0	28,20	0,97	1,2	1,17
380ct1f3	2,00	1	2	4,8	1,0	39,50	1,07	1,2	1,28
380ct2f1	2,00	1	2	4,8	1,0	28,20	0,97	1,2	1,17
380ct2f2	2,00	1	2	4,8	1,0	28,20	0,97	1,2	1,17
380ct2f3	2,00	1	2	4,8	1,0	39,50	1,07	1,2	1,28
bl1	0,10	0,5	0,05	0,3	0,1	43,40	1,09	1,2	0,07
bl2	0,10	0,5	0,05	0,3	0,1	43,40	1,09	1,2	0,07

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Project: KIJ-GT
Tower: HC+0 T
Number: 69

Wind load back

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	31,0	1,00	0,59	0,50	1,10	28,25	55,1	46,7	46,9	100,1	84,9
380ct1f2	31,0	1,00	0,59	0,50	1,10	28,25	55,1	46,7	46,9	100,1	84,9
380ct1f3	42,6	1,09	0,62	0,52	1,07	28,25	61,3	51,8	46,9	113,9	96,4
380ct2f1	31,0	1,00	0,59	0,50	1,10	28,25	55,1	46,7	46,9	100,1	84,9
380ct2f2	31,0	1,00	0,59	0,50	1,10	28,25	55,1	46,7	46,9	100,1	84,9
380ct2f3	42,6	1,09	0,62	0,52	1,07	28,25	61,3	51,8	46,9	113,9	96,4
bl1	49,0	1,13	0,63	0,53	1,19	22,24	18,8	15,9	41,5	35,5	30,0
bl2	49,0	1,13	0,63	0,53	1,19	22,13	18,7	15,8	41,4	35,4	29,9

Wind load ahead

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	23,9	0,93	0,57	0,49	1,12	28,25	50,2	43,3	46,9	89,6	77,3
380ct1f2	23,9	0,93	0,57	0,49	1,12	28,25	50,2	43,3	46,9	89,6	77,3
380ct1f3	35,2	1,03	0,60	0,52	1,09	28,25	57,5	49,6	46,9	105,5	90,9
380ct2f1	23,9	0,93	0,57	0,49	1,12	28,25	50,2	43,3	46,9	89,6	77,3
380ct2f2	23,9	0,93	0,57	0,49	1,12	28,25	50,2	43,3	46,9	89,6	77,3
380ct2f3	35,2	1,03	0,60	0,52	1,09	28,25	57,5	49,6	46,9	105,5	90,9
bl1	39,2	1,06	0,61	0,53	1,20	22,24	17,4	15,0	41,5	32,5	28,0
bl2	39,2	1,06	0,61	0,53	1,20	22,13	17,3	14,9	41,4	32,4	27,9

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Project: KIJ-GT
Tower: HC+0 T
Number: 69

Conductor loads Auteur: TBR
Versie: v11.6

Starting points

Consequence class	Afkeur CC2-0
Reference period	30 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,05	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,12	0,00	0,0
ULS 3	Wind+ice	-5°	1,05	1,05	0,00	0,34	0,97	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,05	0,00	0,34	0,97	0,0
ULS 4	Cold+wind	-20°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,05	0,00	0,22	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,05	1,05	1,20	0,22	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 7	Permanent	10°	1,15	1,15	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS	(strength, for angle towers: absence of conductors)			γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,05	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,05	1,05	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,05	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,05	1,05	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,05	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,05	1,05	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,05	1,05	0,0	0,24	0,0	0,0
SLS	(deformations, fatigue, EDS)							
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	0,94	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,28	0,88	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	6
Number of load combinations for ULS	46
Number of load combinations for SPLS	222
Number of load combinations for SLS	15
Number of concentrated loads	5377

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Project: KIJ-GT
Tower: HC+0 T
Number: 69

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-28,3	28,8	14,8	12,9	3,6	4,4
380ct1f1	-99,2	99,1	49,8	46,9	10,9	12,4
380ct1f2	-99,2	99,1	49,8	46,9	10,9	12,4
380ct1f3	-100,4	100,5	52,9	48,3	10,8	12,4
380ct2f1	-99,2	99,1	49,8	46,9	10,9	12,4
380ct2f2	-99,2	99,1	49,8	46,9	10,9	12,4
380ct2f3	-100,4	100,5	52,9	48,3	10,8	12,4
bl2	-28,4	28,9	14,8	12,9	3,5	4,4
Post 1	0,0	0,0	0,0	0,0	0,0	
Post 2	0,0	0,0	0,0	0,0	0,0	
Post 3	0,0	0,0	0,0	0,0	0,0	

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	155,4	213,3	227,2
380ct1f1	217,6	238,5	247,3
380ct1f2	217,6	238,5	247,3
380ct1f3	209,5	236,3	245,6
380ct2f1	217,6	238,5	247,3
380ct2f2	217,6	238,5	247,3
380ct2f3	209,5	236,3	245,6
bl2	155,4	210,5	227,2
Post 1			
Post 2			
Post 3			

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	226,3	231,8
380ct1f1	246,8	248,4
380ct1f2	246,8	248,4
380ct1f3	244,8	246,7
380ct2f1	246,8	248,4
380ct2f2	246,8	248,4
380ct2f3	244,8	246,7
bl2	226,3	230,9
Post 1		
Post 2		
Post 3		

Envelop of weight span over all combinations (incl. 0,9 combinations) For all conductors		Wind / Weight span ratio
Max. weight span	248,7 m	0,746 -
Min. weight span	118,1 m	0,354 -

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Project: KIJ-GT
Tower: HC+0 T
Number: 69

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	28,8	25,4	4,4	-31,1	31,5
380ct1f1	84,7	93,8	12,4	-110,8	109,5
380ct1f2	84,7	93,8	12,4	-110,8	109,5
380ct1f3	85,0	96,1	12,4	-112,5	111,4
380ct2f1	84,7	93,8	12,4	-110,8	109,5
380ct2f2	84,7	93,8	12,4	-110,8	109,5
380ct2f3	85,0	96,1	12,4	-112,5	111,4
bl2	28,9	25,5	4,4	-31,2	31,6
Post 1	1,9	1,9	3,5	0,0	
Post 2	1,9	1,9	3,5	0,0	
Post 3	1,9	1,9	3,5	0,0	

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	13,8	5,9	1,4	-15,0	15,0
380ct1f1	59,1	25,1	8,2	-64,2	64,2
380ct1f2	59,1	25,1	8,2	-64,2	64,2
380ct1f3	59,1	25,1	8,2	-64,2	64,2
380ct2f1	59,1	25,1	8,2	-64,2	64,2
380ct2f2	59,1	25,1	8,2	-64,2	64,2
380ct2f3	59,1	25,1	8,2	-64,2	64,2
bl2	13,8	5,9	1,4	-15,0	15,0
Post 1	0,0	0,0	3,0	0,0	
Post 2	0,0	0,0	3,0	0,0	
Post 3	0,0	0,0	3,0	0,0	

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	0,0	0,0
	380ct1f1	0,0	0,0
	380ct1f2	0,0	0,0
	380ct1f3	0,0	0,0
	380ct2f1	0,0	0,0
	380ct2f2	0,0	0,0
	380ct2f3	0,0	0,0
	bl2	0,0	0,0
	Post 1	0,0	
	Post 2	0,0	
	Post 3	0,0	

Project: KIJ-GT
Tower: HC+0 T
Number: 69

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		-5	579	101	18742	-170	0
ULS 1a_0,9_0		14	348	109	11155	431	-73
ULS 1a_0,9_0,9_90		-6	550	84	17827	-197	0
ULS 3_0		5	535	156	17216	170	-22
SLS 7		0	324	106	10368	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

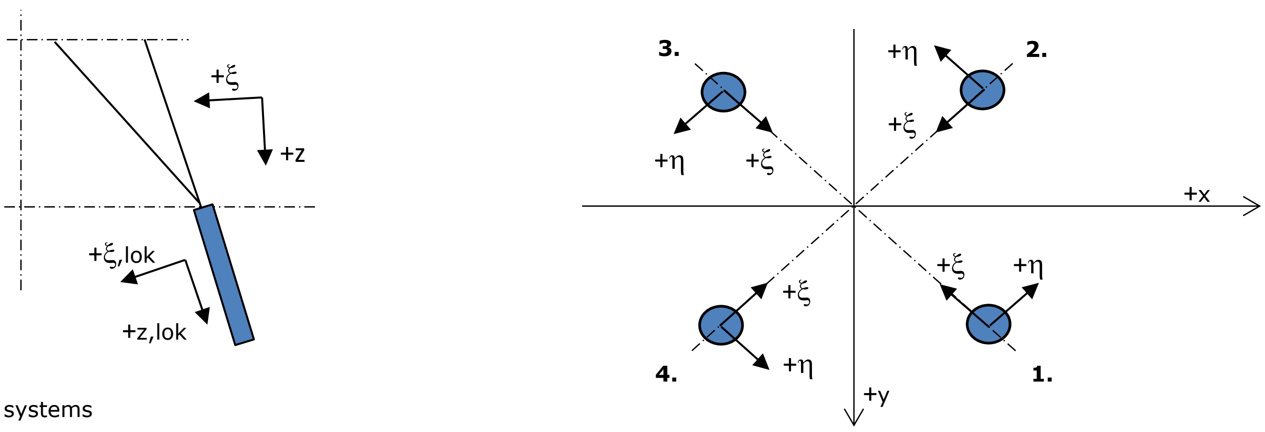
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	-5	750	515	22847	-170	0
ULS 1a_0,9_0,9_90	-6	721	438	21933	-197	0
SLS 7	0	324	500	10368	0	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_90	-5	750	454	**22864**	-170	0
SPLS 3_0 Ba All Cts	570	207	499	6588	**18022**	-20
SPLS 3_67 Ba Ct2	256	417	517	13166	8051	**-2995**
SPLS 3_0,9_67 Ah All Cts	-521	326	424	**10011**	**-17116**	-13

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_113 Ba All Cts	225	232	**1330**	-5	-323	-29	1363
2	SPLS 1a_0 Ba All Cts	123	-114	**676**	-6	-168	-18	692
3	SPLS 3_135 Ah All Cts	-94	-88	**534**	4	-129	-11	547
4	SPLS 3_67 Ah All Cts	-229	236	**1353**	4	-329	-30	1386

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-53	-50	**-304**	-3	73	6	-311
2	SPLS 3_0,9_67 Ah All Cts	-190	197	**-1127**	-5	274	25	-1154
3	SPLS 3_0,9_113 Ba All Cts	185	192	**-1097**	5	266	24	-1123
4	SPLS 1a_0,9_0 Ba All Cts	81	-77	**-445**	3	112	13	-456

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_113 Ah Ct2	126	-8	344	**94**	-84	-8	353
2	SPLS 3_0,9_113 Ah Ct2	-216	80	-856	**96**	209	20	-877
3	SPLS 3_67 Ba Ct1	73	213	-815	**99**	202	22	-835
4	SPLS 3_67 Ba Ct1	10	131	342	**100**	-86	-10	351

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	SPLS 3_113 Ah Ct1	-11	130	333	**-100**	-84	-10	342
2	SPLS 3_113 Ah Ct1	-74	213	-814	**-98**	202	22	-834
3	SPLS 3_0,9_67 Ba Ct2	215	80	-851	**-96**	208	20	-872
4	SPLS 3_0,9_67 Ba Ct2	-127	-7	347	**-95**	-85	-8	356

Project: KIJ-GT
Tower: HC+0 T
Number: 69

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-53	-50	**-304**	**-3**	73	6	-311
2	SPLS 3_0,9_67 Ah Ct1	-88	224	**-901**	**-96**	221	22	-923
3	SPLS 3_0,9_113 Ba Ct1	85	219	**-879**	**95**	215	21	-900
4	SPLS 1a_0,9_0 Ba All Cts	81	-77	**-445**	**3**	112	13	-456

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	102	103	596	0	-145	-13	611
2	SLS 7	-60	60	-346	0	84	8	-355
3	SLS 7	60	60	-346	0	84	8	-355
4	SLS 7	-102	103	596	0	-145	-13	611

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	SPLS 3_67 Ah All Cts	-229	236	**1353**	4	-329	-30	1386
Max. tension	SPLS 3_0,9_67 Ah All Cts	-190	197	**-1127**	-5	274	25	-1154
Max. pos. torsie	SPLS 3_67 Ba Ct1	10	131	342	**100**	-86	-10	351
Max. neg. torsie	SPLS 3_113 Ah Ct1	-11	130	333	**-100**	-84	-10	342
Comb. tension+torsie	SPLS 3_0,9_67 Ah Ct1	-88	224	**-901**	**-96**	221	22	-923

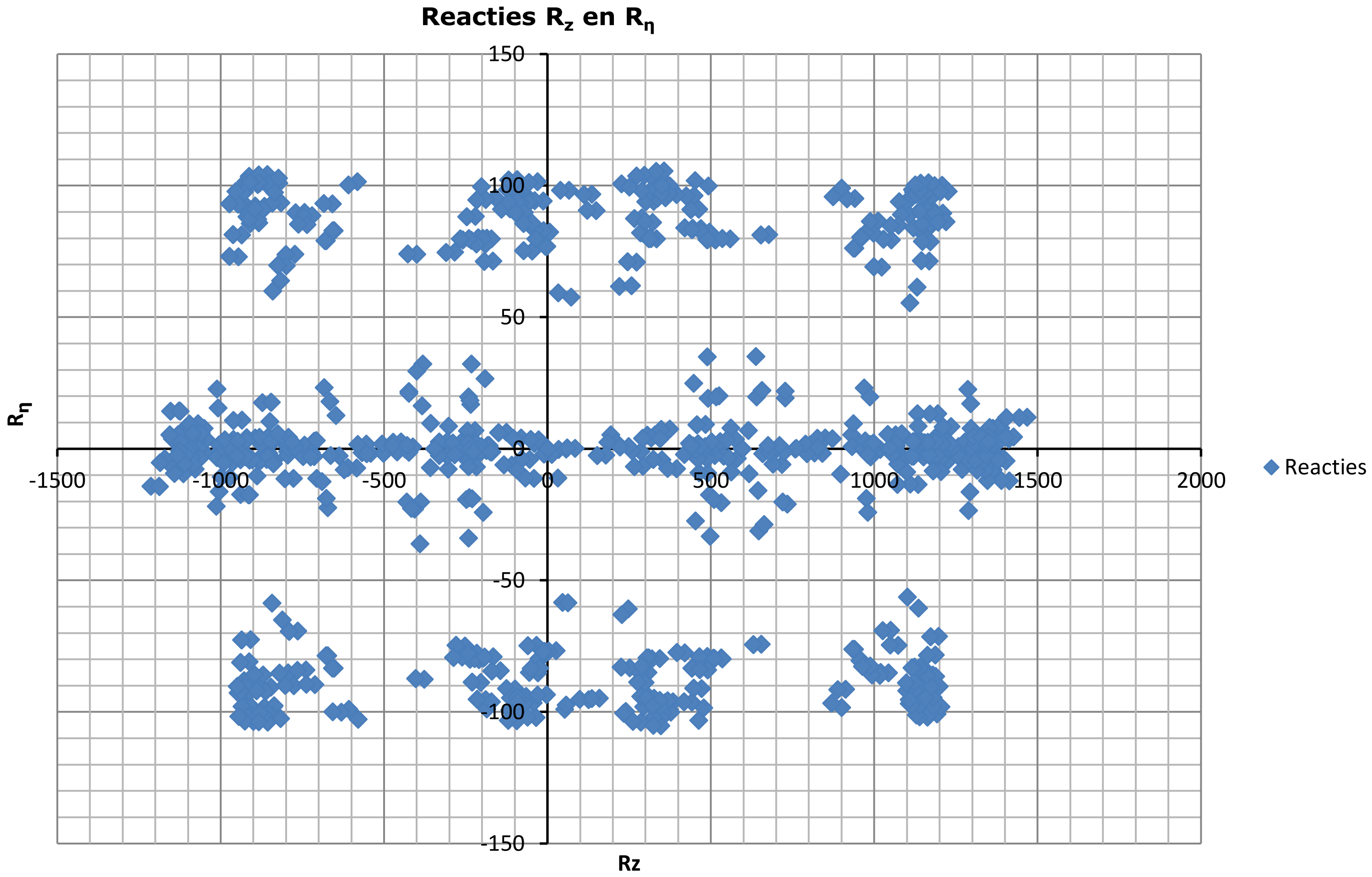
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_113 Ah All Cts	-42	-38	**-244**	-2	57	3	-250
2	SPLS 3_67 Ah All Cts	-187	195	**-1111**	-5	270	24	-1138
3	SPLS 3_113 Ba All Cts	182	189	**-1081**	5	263	24	-1107
4	SPLS 3_67 Ba All Cts	43	-39	**-249**	2	58	3	-255

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_113 Ba All Cts	225	232	**1330**	-5	-323	-29	1363
2	SPLS 3_67 Ba All Cts	86	-82	**499**	-3	-119	-8	511
3	SPLS 3_113 Ah All Cts	-84	-80	**488**	3	-116	-8	500
4	SPLS 3_67 Ah All Cts	-229	236	**1353**	4	-329	-30	1386

Project: KIJ-GT
Tower: HC+0 T
Number: 69



Project: KIJ-GT
Tower: HC+0 T
Number: 69

Auteur: TBR
Versie: v11.6

Conductor loads

Starting points

Consequence class	Verbouw CC2
Reference period	50 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,15	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,40	0,00	0,0
ULS 3	Wind+ice	-5°	1,15	1,15	0,00	0,42	1,30	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,15	0,00	0,42	1,30	0,0
ULS 4	Cold+wind	-20°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,15	0,00	0,28	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,15	1,15	1,30	0,28	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 7	Permanent	10°	1,30	1,30	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,15	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,15	1,15	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,15	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,15	1,15	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,15	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,15	1,15	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,15	1,15	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	1,00	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,30	1,00	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	6
Number of load combinations for ULS	46
Number of load combinations for SPLS	222
Number of load combinations for SLS	15
Number of concentrated loads	5377

Project: KIJ-GT
Tower: HC+0 T
Number: 69

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-30,8	30,9	17,7	15,3	3,9	4,8
380ct1f1	-115,4	115,1	58,8	54,9	12,7	14,4
380ct1f2	-115,4	115,1	58,8	54,9	12,7	14,4
380ct1f3	-116,9	116,9	62,9	56,6	12,6	14,4
380ct2f1	-115,4	115,1	58,8	54,9	12,7	14,4
380ct2f2	-115,4	115,1	58,8	54,9	12,7	14,4
380ct2f3	-116,9	116,9	62,9	56,6	12,6	14,4
bl2	-31,0	31,0	17,7	15,3	3,9	4,8
Post 1	0,0	0,0	0,0	0,0	0,0	
Post 2	0,0	0,0	0,0	0,0	0,0	
Post 3	0,0	0,0	0,0	0,0	0,0	

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	149,1	212,9	227,2
380ct1f1	214,6	238,3	247,3
380ct1f2	214,6	238,3	247,3
380ct1f3	206,0	236,1	245,6
380ct2f1	214,6	238,3	247,3
380ct2f2	214,6	238,3	247,3
380ct2f3	206,0	236,1	245,6
bl2	149,1	210,1	227,2
Post 1			
Post 2			
Post 3			

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	227,0	235,1
380ct1f1	247,2	250,4
380ct1f2	247,2	250,4
380ct1f3	245,2	248,6
380ct2f1	247,2	250,4
380ct2f2	247,2	250,4
380ct2f3	245,2	248,6
bl2	226,9	234,2
Post 1		
Post 2		
Post 3		

Envelop of weight span over all combinations (incl. 0,9 combinations) For all conductors		Wind / Weight span ratio
Max. weight span	250,4 m	0,751 -
Min. weight span	81,5 m	0,244 -

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Project: KIJ-GT
Tower: HC+0 T
Number: 69

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	29,8	29,9	4,8	-34,7	34,0
380ct1f1	89,7	109,9	14,4	-129,1	127,3
380ct1f2	89,7	109,9	14,4	-129,1	127,3
380ct1f3	89,8	112,8	14,4	-131,3	129,7
380ct2f1	89,7	109,9	14,4	-129,1	127,3
380ct2f2	89,7	109,9	14,4	-129,1	127,3
380ct2f3	89,8	112,8	14,4	-131,3	129,7
bl2	29,9	30,1	4,8	-35,0	34,3
Post 1	2,4	2,4	3,9	0,0	
Post 2	2,4	2,4	3,9	0,0	
Post 3	2,4	2,4	3,9	0,0	

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	13,8	5,9	1,4	-15,0	15,0
380ct1f1	59,1	25,1	8,2	-64,2	64,2
380ct1f2	59,1	25,1	8,2	-64,2	64,2
380ct1f3	59,1	25,1	8,2	-64,2	64,2
380ct2f1	59,1	25,1	8,2	-64,2	64,2
380ct2f2	59,1	25,1	8,2	-64,2	64,2
380ct2f3	59,1	25,1	8,2	-64,2	64,2
bl2	13,8	5,9	1,4	-15,0	15,0
Post 1	0,0	0,0	3,0	0,0	
Post 2	0,0	0,0	3,0	0,0	
Post 3	0,0	0,0	3,0	0,0	

1 **Control uplift SLS-wind**

Combinatie	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	0,0	0,0
	380ct1f1	0,0	0,0
	380ct1f2	0,0	0,0
	380ct1f3	0,0	0,0
	380ct2f1	0,0	0,0
	380ct2f2	0,0	0,0
	380ct2f3	0,0	0,0
	bl2	0,0	0,0
	Post 1	0,0	
	Post 2	0,0	
	Post 3	0,0	

Project: KIJ-GT
Tower: HC+0 T
Number: 69

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		-8	679	109	22009	-256	0
ULS 1a_0,9_0		17	380	119	12193	527	-92
ULS 1a_0,9_0,9_90		-10	636	79	20670	-304	-1
ULS 3_0		6	621	183	19972	170	-27
SLS 7		0	324	106	10368	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

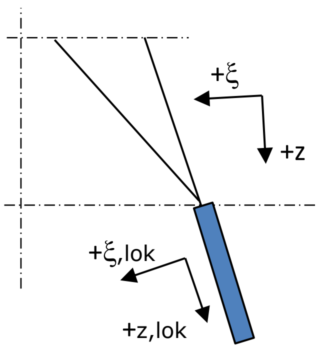
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	-8	894	562	27156	-256	0
ULS 1a_0,9_0,9_90	-10	851	434	25818	-304	-1
SLS 7	0	324	500	10368	0	0

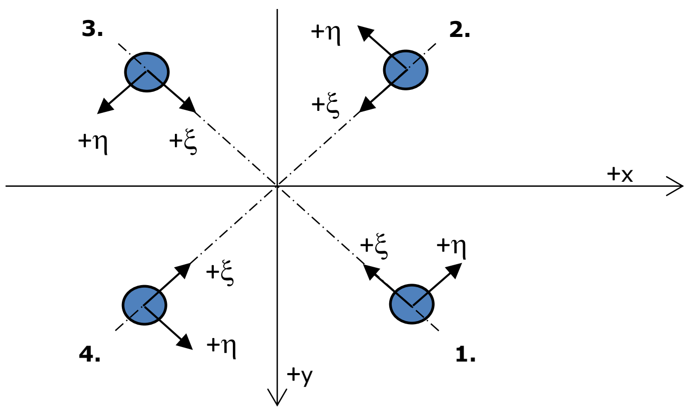
Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_90	-8	894	461	**27184**	-256	0
SPLS 3_0 Ba All Cts	603	222	545	7039	**19111**	-20
SPLS 3_67 Ba Ct2	274	437	566	13823	8635	**-3165**
ULS 1a_0,9_67	-54	876	457	**26596**	**-2638**	-36

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg





Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_113	236	254	**1413**	-12	-346	-34	1447
2	SPLS 1a_0 Ba All Cts	130	-121	**717**	-6	-178	-19	734
3	SPLS 3_135 Ah All Cts	-100	-95	**575**	4	-138	-11	589
4	ULS 1a_67	-246	263	**1467**	12	-360	-36	1502

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-58	-54	**-331**	-3	79	6	-339
2	ULS 1a_0,9_67	-201	221	**-1215**	-14	298	30	-1244
3	SPLS 3_0,9_113 Ba All Cts	195	202	**-1157**	5	281	25	-1184
4	SPLS 1a_0,9_0 Ba All Cts	85	-82	**-472**	2	118	14	-484

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_113 Ah Ct2	131	-11	350	**100**	-85	-8	359
2	SPLS 3_0,9_113 Ah Ct2	-229	86	-911	**101**	223	21	-933
3	SPLS 3_67 Ba Ct1	77	224	-857	**104**	213	23	-878
4	SPLS 3_67 Ba Ct1	11	138	356	**106**	-89	-11	364

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	SPLS 3_113 Ah Ct1	-12	136	347	**-105**	-88	-11	355
2	SPLS 3_113 Ah Ct1	-77	224	-857	**-104**	213	24	-878
3	SPLS 3_0,9_67 Ba Ct2	229	85	-906	**-102**	222	21	-928
4	SPLS 3_0,9_67 Ba Ct2	-132	-10	353	**-100**	-86	-8	362

Project: KIJ-GT
Tower: HC+0 T
Number: 69

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-58	-54	**-331**	**-3**	79	6	-339
2	ULS 1a_0,9_67	-201	221	**-1215**	**-14**	298	30	-1244
3	SPLS 3_0,9_90 Ba Ct2	230	92	**-936**	**-98**	227	21	-958
4	SPLS 1a_0,9_0 Ba All Cts	85	-82	**-472**	**2**	118	14	-484

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	102	103	596	0	-145	-13	611
2	SLS 7	-60	60	-346	0	84	8	-355
3	SLS 7	60	60	-346	0	84	8	-355
4	SLS 7	-102	103	596	0	-145	-13	611

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_67	-246	263	**1467**	12	-360	-36	1502
Max. tension	ULS 1a_0,9_67	-201	221	**-1215**	-14	298	30	-1244
Max. pos. torsie	SPLS 3_67 Ba Ct1	11	138	356	**106**	-89	-11	364
Max. neg. torsie	SPLS 3_113 Ah Ct1	-12	136	347	**-105**	-88	-11	355
Comb. tension+torsie	ULS 1a_0,9_67	-201	221	**-1215**	**-14**	298	30	-1244

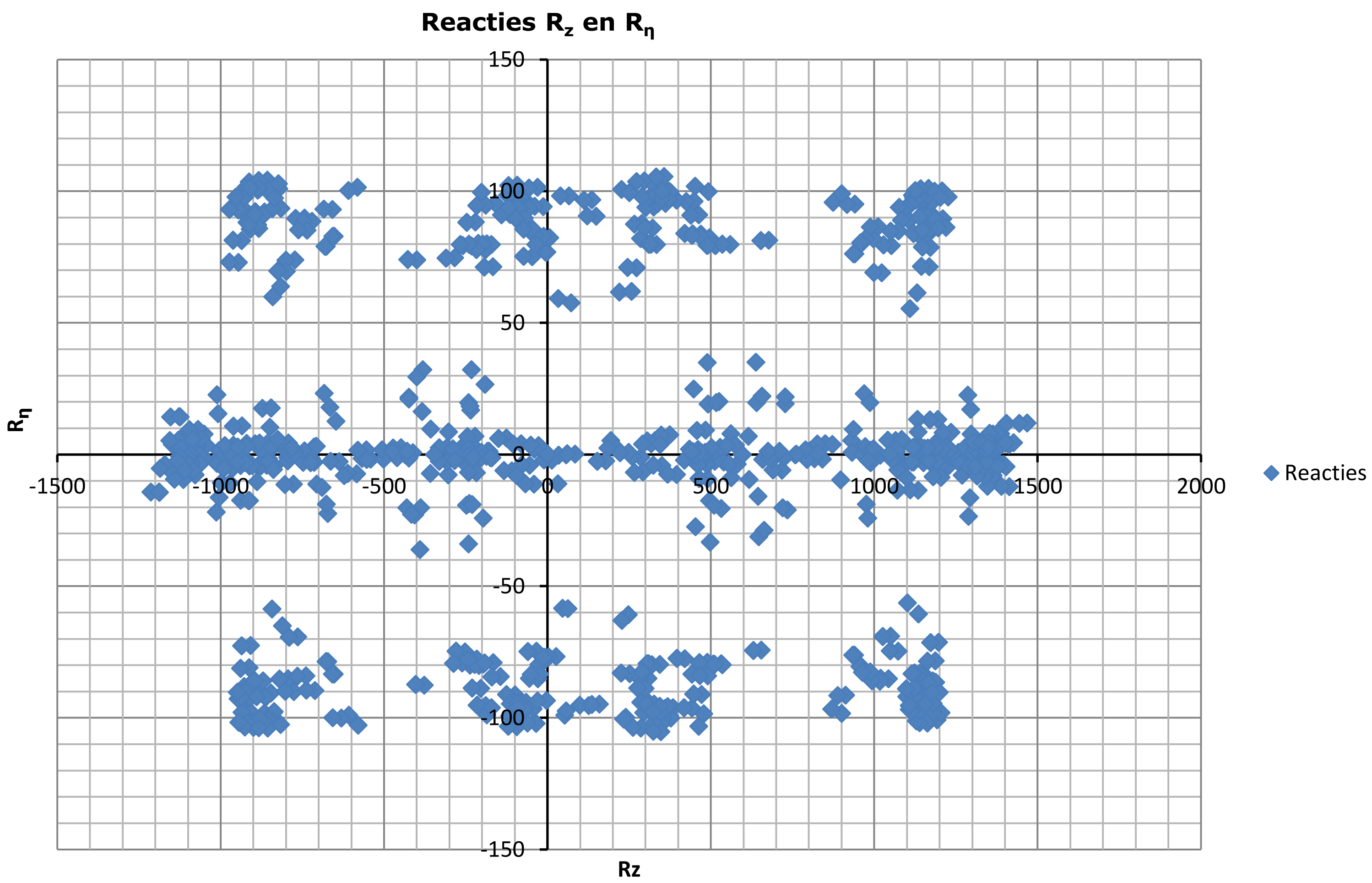
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_113 Ah All Cts	-45	-41	**-260**	-2	61	3	-267
2	ULS 1a_67	-196	217	**-1188**	-14	292	29	-1217
3	SPLS 3_113 Ba All Cts	190	198	**-1130**	5	275	25	-1157
4	SPLS 3_67 Ba All Cts	45	-42	**-266**	2	62	3	-272

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_113	236	254	**1413**	-12	-346	-34	1447
2	SPLS 3_67 Ba All Cts	93	-89	**539**	-3	-128	-9	552
3	SPLS 3_113 Ah All Cts	-91	-87	**528**	3	-126	-9	540
4	ULS 1a_67	-246	263	**1467**	12	-360	-36	1502

Project: KIJ-GT
Tower: HC+0 T
Number: 69



APPENDIX B PLS-TOWER OUTPUT

Assessment of groups for initial mast (afkeur level)

Date 17-8-2020
Author MKh
Version 1.0

KIJ-GT 380
HC+0
2

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
101A	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	85	**-52.7**	SPLS 3_64,5 Ah Ct2	390.5	508.3	777.6	0.13		**11.6**	LS 3_0,9_64,5 Ah All Cts	466.6	508.3	664.6	0.02	
101B	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	74	**-154.5**	ULS 1a_115,5	423.6	506.7	777.6	0.36		**116.0**	ULS 1a_0,9_115,5	466.6	506.7	664.6	0.25	
102A	Leg	180x180x16	S235	8M24-5.6t	0.50	0.50	0.50	54	**-413.9**	SPLS 3_115,5 Ba All Cts	1141.5	674.7	1658.9	0.61		**322.2**	S 3_0,9_115,5 Ba All Cts	1220.3	674.7	1417.8	0.48	
102B	Leg	180x180x16	S235	12M24-5.6t	0.50	0.50	0.50	57	**-466.6**	ULS 1a_115,5	1125.2	1005.5	2488.3	0.46		**343.2**	ULS 1a_0,9_115,5	1220.3	1005.5	2169.3	0.34	
103A	Leg	200x200x20	S235	16M24-5.6t	0.28	0.28	0.28	28	**-813.0**	SPLS 3_115,5 Ba All Cts	1750.2	1181.8	4147.2	0.69		**657.9**	S 3_0,9_115,5 Ba All Cts	1710.7	1181.8	3544.6	0.56	
103B	Leg	200x200x20	S235	12M24-5.6t	0.28	0.28	0.28	35	**-1032.8**	SPLS 3_115,5 Ba All Cts	1704.3	1987.7	3110.4	0.61		**867.8**	S 3_0,9_115,5 Ba All Cts	1710.7	1987.7	2658.5	0.51	
104A	Leg	250x250x20	S235	12M24-5.6t	0.28	0.28	0.28	34	**-1281.1**	SPLS 3_115,5 Ba All Cts	2172.1	1892.2	3110.4	0.68		**1094.6**	S 3_0,9_115,5 Ba All Cts	2244.7	1892.2	2658.5	0.58	
104B	Leg	250x250x20	S235	14M24-5.6t	0.55	0.55	0.55	37	**-1397.2**	SPLS 3_115,5 Ba All Cts	2149.3	2100.4	3628.8	0.67		**1204.2**	S 3_0,9_115,5 Ba All Cts	2244.7	2100.4	3101.5	0.57	
105	Leg	250x250x22	S235	14M24-5.6t	0.17	0.17	0.17	33	**-1421.7**	SPLS 3_115,5 Ba All Cts	2386.8	2100.4	3991.7	0.68		**1205.1**	S 3_0,9_115,5 Ba All Cts	2453.6	2100.4	3411.7	0.57	
106A	Onderregel eerste dwarsarm	200x200x16	S235	12M24-5.6t	1.53	1.00	1.00	63	**-715.2**	SPLS 6a_90 Ah Ct2 Ba Ct2	1211.7	906.5	2488.3	0.79		**495.7**	PLS 6a_90 Ah Ct1 Ba Ct1	1386.2	906.5	2126.8	0.55	
106B	Onderregel eerste dwarsarm	200x200x16	S235	10M24-5.6t	7.64	1.00	1.00	74	**-382.5**	SPLS 6a_90 Ah Ct2 Ba Ct2	1128.4	847.2	2073.6	0.45		**250.9**	PLS 6a_90 Ah Ct1 Ba Ct1	1386.2	847.2	1772.3	0.30	
106C	Onderregel eerste dwarsarm	200x200x16	S235		2.88	1.77	1.00	62	**-639.8**	SPLS 6a_90 Ah Ct2 Ba Ct2	1220.6	0.0	0.0	0.52		**422.3**	PLS 6a_90 Ah Ct1 Ba Ct1	1452.3	0.0	0.0	0.29	
107A	Onderregel eerste dwarsarm	180x180x15	S235	10M24-5.6t	2.78	1.00	1.00	83	**-349.6**	SPLS 6a_90 Ah Ct2 Ba Ct2	887.4	847.2	1944.0	0.41		**221.4**	PLS 6a_90 Ah Ct1 Ba Ct1	1144.0	847.2	1661.5	0.26	
107B	Onderregel eerste dwarsarm	180x180x15	S235	2M20-5.6t	1.63	1.00	1.00	18	**-3.4**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**0.6**	SPLS 1a_0 Ba All Cts	613.8	117.6	297.8	0.01	
107C	Onderregel eerste dwarsarm	180x180x15	S235		18.24	1.00	1.00	83	**-333.3**	SPLS 6a_90 Ah Ct2 Ba Ct2	887.3	0.0	0.0	0.38		**199.8**	PLS 6a_90 Ah Ct1 Ba Ct1	1220.5	0.0	0.0	0.16	
108A	Onderregel tweede dwarsarm	180x180x15	S235	12M24-5.6t	1.12	1.00	1.00	64	**-433.7**	SPLS 6a_90 Ah All Cts Ba Ct2	1011.2	2033.3	2332.8	0.43		**307.8**	LS 3_0,9_64,5 Ah All Cts	1144.0	2033.3	1814.4	0.27	
108B	Onderregel tweede dwarsarm	180x180x15	S235	2M20-5.6t	1.00	1.50	1.00	19	**-3.2**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**0.7**	SPLS 1a_135 Ah Ct1	613.8	117.6	297.8	0.01	
108C	Onderregel tweede dwarsarm	180x180x15	S235		2.77	1.70	1.00	65	**-394.9**	SPLS 6a_90 Ah All Cts Ba Ct2	1010.4	0.0	0.0	0.39		**266.3**	LS 3_0,9_64,5 Ah All Cts	1220.5	0.0	0.0	0.22	
111A	Bovenregel eerste dwarsarm	90x90x9	S235	3M24-5.6t	1.00	1.96	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**118.5**	PLS 6a_90 Ah Ct1 Ba Ct2	205.3	254.2	299.1	0.58	
111B	Bovenregel eerste dwarsarm	90x90x9	S235	3M24-5.6t	1.00	2.04	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**93.0**	PLS 6a_90 Ah Ct1 Ba Ct2	205.3	254.2	299.1	0.45	
112A	Bovenregel eerste dwarsarm	75x75x7#	S235	3M24-5.6t	1.00	1.80	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**79.7**	PLS 6a_90 Ah Ct1 Ba Ct2	131.8	254.2	192.5	0.61	
112B	Bovenregel eerste dwarsarm	75x75x7#	S235	3M24-5.6t	1.00	2.25	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**79.8**	PLS 6a_90 Ah Ct1 Ba Ct2	131.8	254.2	192.5	0.61	
113A	Bovenregel tweede dwarsarm	120x120x13	S235	5M24-5.6t	1.59	1.00	1.00	101	**-214.4**	SPLS 6a_90 Ah All Cts Ba Ct1	355.8	423.6	842.4	0.60		**192.0**	6a_90 Ah All Cts Ba Ct2	418.7	423.6	703.2	0.46	
113B	Bovenregel tweede dwarsarm	120x120x13	S235	5M24-5.6t	1.40	1.00	1.00	102	**-198.4**	SPLS 6a_90 Ah All Cts Ba Ct1	373.5	423.6	842.4	0.53		**185.0**	6a_90 Ah All Cts Ba Ct2	602.4	423.6	720.0	0.44	
113C	Bovenregel tweede dwarsarm	120x120x13	S235		2.70	1.70	1.00	101	**-210.1**	SPLS 6a_90 Ah All Cts Ba Ct1	355.7	0.0	0.0	0.59		**192.7**	6a_90 Ah All Cts Ba Ct2	705.0	0.0	0.0	0.27	
114A	Bovenregel tweede dwarsarm	150x100x12	S235	5M24-5.6t	3.00	1.00	1.00	115	**-182.9**	SPLS 6a_90 Ah All Cts Ba Ct1	301.8	423.6	777.6	0.61		**188.9**	6a_90 Ah All Cts Ba Ct2	582.2	423.6	664.6	0.45	
114B	Bovenregel tweede dwarsarm	150x100x12	S235	4M24-5.6t	3.00	1.00	1.00	104	**-41.6**	SPLS 6a_90 Ah All Cts Ba Ct1	331.5	338.9	622.1	0.13		**36.7**	PLS 6a_90 Ah Ct1 Ba Ct2	582.2	338.9	531.7	0.11	
114C	Bovenregel tweede dwarsarm	150x100x12	S235		3.00	1.00	1.00	115	**-166.5**	SPLS 6a_90 Ah All Cts Ba Ct1	301.8	0.0	0.0	0.55		**171.9**	6a_90 Ah All Cts Ba Ct2	674.5	0.0	0.0	0.25	
115A	Tussenregel tweede dwarsarm	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-30.5**	SPLS 6a_90 Ba Ct1 Ba Ct2	79.8	84.7	77.8	0.39		**11.7**	SPLS 3_0,9_90 Ah Ct2	127.9	84.7	66.5	0.18	
115B	Tussenregel tweede dwarsarm	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-29.6**	SPLS 6a_90 Ba Ct1 Ba Ct2	71.0	84.7	77.8	0.42		**12.5**	SPLS 3_0,9_90 Ah Ct2	127.9	84.7	66.5	0.19	
201L	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-40.6**	SPLS 3_0,9_90 Ah Ct2	114.3	117.6	129.6	0.35		**32.0**	ULS 1a_115,5	145.4	117.6	104.7	0.31	
201T	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-21.8**	SPLS 6a_90 Ba Ct2 Ah Ct2	114.3	117.6	129.6	0.19		**12.4**	PLS 3_0,9_115,5 Ah Ct2	145.4	117.6	104.7	0.12	
202L	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-201.2**	SPLS 3_90 Ba Ct2	425.3	338.9	518.4	0.59		**155.6**	SPLS 3_0,9_90 Ba Ct1	384.5	338.9	350.9	0.46	
202T	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-141.8**	SPLS 3_0,9_90 Ba Ct1	425.3	338.9	518.4	0.42		**157.0**	SPLS 3_90 Ba Ct2	384.5	338.9	350.9	0.46	
203L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-142.9**	SPLS 3_0,9_90 Ba Ct1	406.7	338.9	518.4	0.42		**184.1**	SPLS 3_90 Ba Ct2	384.5	338.9	350.9	0.54	
203T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-142.2**	SPLS 3_90 Ba Ct2	406.7	338.9	518.4	0.42		**128.5**	SPLS 3_0,9_90 Ba Ct1	384.5	338.9	350.9	0.38	
204L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-187.0**	SPLS 3_0,9_90 Ah Ct2	386.8	338.9	518.4	0.55		**166.4**	PLS 3_0,9_115,5 Ba Ct1	384.5	338.9	350.9	0.49	
204T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-176.4**	SPLS 3_90 Ba Ct1	386.8	338.9	518.4	0.52		**162.7**	SPLS 3_0,9_90 Ba Ct2	384.5	338.9	350.9	0.48	
205L	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-373.8**	SPLS 3_64,5 Ba Ct2	449.2	508.3	777.6	0.83		**372.2**	SPLS 3_64,5 Ba Ct2	384.5	508.3	513.8	0.97	
205T	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-348.2**	SPLS 6a_90 Ah Ct2 Ba Ct2	449.2	508.3	777.6	0.78		**335.9**	PLS 6a_90 Ah Ct1 Ba Ct1	384.5	508.3	513.8	0.87	
206L	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-309.6**	SPLS 3_64,5 Ba Ct2	465.9	423.6	777.6	0.73		**305.1**	SPLS 3_64,5 Ba Ct1	456.2	423.6	518.8	0.72	
206T	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-276.9**	SPLS 6a_90 Ah Ct1 Ba Ct1	465.9	423.6	777.6	0.65		**286.3**	PLS 6a_90 Ah Ct2 Ba Ct2	456.2	423.6	518.8	0.68	
207L	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-248.9**	SPLS 3_64,5 Ba Ct1	394.0	338.9	622.1	0.73		**252.0**	SPLS 3_64,5 Ba Ct2	456.2	338.9	421.1	0.74	
207T	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-233.8**	SPLS 6a_90 Ah Ct2 Ba Ct2	394.0	338.9	622.1	0.69		**224.5**	PLS 6a_90 Ah Ct1 Ba Ct1	456.2	338.9	421.1	0.66	
208L	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-210.0**	SPLS 3_64,5 Ba Ct2	332.1	254.2	388.8	0.83		**204.0**	SPLS 3_115,5 Ah Ct1	384.5	254.2	269.2	0.80	
208T	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-188.7**	SPLS 6a_90 Ah Ct1 Ba Ct1	332.1	254.2	388.8	0.74		**193.4**	PLS 6a_90 Ah Ct2 Ba Ct2	384.5	254.2	269.2	0.76	
209L	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-262.8**	SPLS 3_64,5 Ba Ct2	370.1	338.9	570.2	0.78		**243.0**	SPLS 3_0,9_64,5 Ba Ct1	356.4	338.9	475.6	0.72	
209T	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-243.8**	SPLS 3_64,5 Ba Ct1	370.1	338.9	570.2	0.72		**239.0**	SPLS 3_0,9_64,5 Ba Ct2	356.4	338.9	475.6	0.71	
210	Top	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	280	**-13.0**	SPLS 6a_90 Ah Ct2 Ba Ct2	16.5	75.4	86.4	0.79		**12.9**	PLS 6a_90 Ah Ct2 Ba Ct2	52.4	75.4	44.1	0.29	
211L	Tweede dwarsarm in tower	100x100x6	S235	3M24-5.6t	1.00	1.00	1.00	132	**0.0**		113.1	254.2	233.3	0.00		**88.1**	ULS 6a_90 Ah Ct2	161.1	254.2	199.4	0.55	
211T	Tweede dwarsarm in tower	100x100x6	S235	2M24-5.6t	1.00	1.00	1.00	132	**-3.9**	ULS 1a_90	113.1	169.4	155.5	0.03		**2.6**	ULS 1a_0,9_0,9_90	206.4	169.4	132.9	0.02	
109L	Tweede dwarsarm in tower	180x180x15	S235	12M24-5.6t	1.00	2.00	1.00	53	**-534.5**	SPLS 3_115,5 Ba All Cts	1075.9	2033.3	2332.8	0.50		**435.0**	S 3_0,9_115,5 Ba All Cts	1144.0	2033.3	1814.4	0.38	
212T	Tweede dwarsarm in tower	100x100x6	S235	4M24-5.6t	1.00	2.00	1.00	95	**-50.4**	SPLS 3_0,9_64,5 Ba Ct2	144.3	338.9	311.0	0.35		**62.8**	SPLS 3_64,5 Ba Ct2	225.0	338.9	265.8	0.28	
213	Tweede dwarsarm in tower	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	86	**-74.6**	SPLS 3_0,9_64,5 Ba Ct2	265.3	254.2	311.0	0.29		**75.6**	SPLS 3_64,5 Ba Ct2	263.0	254.2	265.8	0.30	
214	Tweede dwarsarm in tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	300	**-0.6**	SPLS 6a_90 Ba Ct1 Ba Ct2	11.8	37.7	43.2	0.05		**0.0**		37.4	37.7	22.0	0.00	
215L	Eerste dwarsarm in tower	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	178	**0.0**		103.8	254.2	311.0	0.00		**118.0**	6a_90 Ba All Cts Ah Ct2	270.5	254.2	265.8	0.46	
215T	Eerste dwarsarm in tower	100x100x8	S235	1M24-5.6t	1.00	1.00	1.00	178	**-53.0**	ULS 1a_0,9_90	83.1	84.7	103.7	0.64		**58.7**	ULS 1a_90	170.5	84.7	88.6	0.69	
110L	Eerste dwarsarm in tower	200x200x16	S235	12M24-5.6t	1.00	2.00	1.00	62	**-585.7**	SPLS 3_115,5 Ba All Cts	1222.1	906.5	2488.3	0.65		**442.3**	PLS 4_0,9_90 Ah All Cts	1386.2	906.5	2126.8	0.49	
216T	Eerste dwarsarm in tower	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	124	**-121.0**	SPLS 6a_90 Ah Ct2 Ba Ct2	151.1	338.9	414.7	0.80		**133.1**	PLS 6a_90 Ba Ct1 Ba Ct2	293.9	338.9	354.5	0.45	
217	Eerste dwarsarm in tower	120x120x11	S235	3M24-5.6t	1.00	1.00	1.00	114	**-168.5**	SPLS 6a_90 Ah Ct2 Ba Ct2	286.0	254.2	427.7	0.66		**169.5**	PLS 6a_90 Ah Ct2 Ba Ct2	356.4	254.2	365.5	0.67	
218	Eerste dwarsarm in tower	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	325	**-0.5**	SPLS 6a_90 Ba Ct1 Ah Ct2	12.6	58.8	54.0	0.04		**0.0**		54.7	58.8	37.0	0.00	
219L	Onderstuk in tower	130x130x12	S235	2M24-5.6t	1.00	1.00	1.00	157	**-47.8**	SPLS 3_115,5 Ba All Cts	235.2	169.4	311.0	0.28		**37.9**	PLS 4_0,9_90 Ah All Cts	363.3	169.4	265.8	0.22	
219T	Onderstuk in tower	130x130x12	S235	2M24-5.6t	1.00	1.00	1.00	157	**-51.5**	SPLS 3_115,5 Ba All Cts	235.2	169.4	311.0	0.30		**41.9**	LS 3_0,9_64,5 Ah All Cts	363.3	169.4	265.8	0.25	
220	Onderstuk in tower	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	311	**-5.2**	ULS 1a_0,9_0,9_45	11.6	37.7	43.2	0.45		**4.6**	ULS 1a_0,9_0,9_45	60.5	37.7	32.0	0.15	
221	Onderstuk in tower	70x70x5#	S235	1M16-5.6t	0.50	1.00	0.50	370	**-0.9**	ULS 7	9.8	37.7	43.2	0.09		**0.0**		74.9	37.7	32.0	0.00	
301	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	1M20-5.6t	0.55	0.55	0.55	123	**-60.0**	SPLS 6a_90 Ah All Cts Ba Ct1	129.7	58.8	86.4	1.02	afschuiving	**60.7**	6a_90 Ah All Cts Ba Ct1	179.7	58.8	69.8	1.03	afschuiving
302	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	110	**-77.6**	SPLS 6a_90 Ah Ct1 Ba Ct1	180.9	117.6	172.8	0.66		**75.7**	PLS 6a_90 Ah Ct1 Ba Ct1	190.7	117.6	139.6	0.64	
303	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	92	**-68.8**	SPLS 6a_90 Ah All Cts Ba Ct1	208.7	117.6	172.8	0.59		**66.0**	6a_90 Ah All Cts Ba Ct1	190.7	117.6	139.6	0.56	
304	Diagonaal onderregel eerste dwarsarm	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	104	**-88.4**	SPLS 6a_90 Ah Ct1 Ba Ct1	143.2	117.6	129.6	0.75		**89.4**	6a_90 Ah All Cts Ba Ct1	170.1	117.6	104.7	0.85	
305	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	92	**-48.0**	SPLS 6a_90 Ah All Cts Ba Ct1	101.8	84.7	77.8	0.62		**51.4**	6a_90 Ah All Cts Ba Ct1	93.3	84.7	59.8	0.86	
306	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	84	**-26.0**	SPLS 6a_90 Ah All Cts Ba Ct1	107.6	84.7	77.8	0.33		**30.0**	6a_90 Ah All Cts Ba Ct1	93.3	84.7	66.5	0.45	
307	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	0.55	0.55	0.55	96	**-35.0**	SPLS 6a_90 Ah All Cts Ba Ct1	98.2	84.7	77.8	0.45		**30.2**	6a_90 Ah All Cts Ba Ct1	93.3	84.7	59.8	0.50	
308	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	89	**-41.3**	SPLS 6a_90 Ah All Cts Ba Ct1	129.6	117.6	129.6	0.35		**41.5**	6a_90 Ah All Cts Ba Ct1	115.9	117.6	104.7	0.40	
309	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-50.9**	SPLS 6a_90 Ah All Cts Ba Ct1	140.4	117.6	129.6	0.43		**49.6**	6a_90 Ah All Cts Ba Ct1	124.8	117.6	104.7	0.47	
310	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	76	**-69.8**	SPLS 6a_90 Ah All Cts Ba Ct1	143.9	117.6	129.6	0.59		**68.3**	6a_90 Ah All Cts Ba Ct1	136.2	117.6	104.7	0.65	
311	Diagonaal onderregel eerste dwarsarm	70x70x6	S235	1M24-5.6t	1.00	1.00	1.00	69	**-31.4**	SPLS 6a_90 Ah All Cts Ba Ct1	99.6	84.7	77.8	0.40		**31.8**	6a_90 Ah All Cts Ba Ct1	76.0	84.7	55.0	0.58	
312	Diagonaal onderregel eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	82	**-1.1**	SPLS 1a_0 Ba All Cts	55.5	37.7	43.2	0.03		**3.5**	ULS 3_0,9_90	37.4	37.7	25.7	0.14	
313	Dwarsligger onderregel eerste dwarsarm	HEA160	S235	2M20-5.6t	2.00	1.00	1.00	48	**-4.1**	SPLS 6a_90 Ah Ct1 Ba Ct1	686.1	117.6	216.0	0.03		**8.7**	PLS 6a_90 Ah Ct2 Ba Ct2	766.1	117.6	0.0	0.07	
314	Dwarsligger onderregel eerste dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	82	**0.0**		314.6	117.6	259.2	0.00		**50.6**	ULS 3_115,5	278.4	117.6	259.2	0.43	
315	Dwarsligger onderregel eerste dwarsarm	HEA160	S235		1.00	1.00	1.00	26	**-1.8**	ULS 1a_0,9_0,9_90	789.3	0.0	0.0	0.00		**4.5**	ULS 3_115,5	916.5	0.0	0.0	0.00	
316	Dwarsligger onderregel eerste dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	37	**0.0**		426.4	117.6	259.2	0.00		**59.2**	ULS 3_0,9_115,5	278.4	117.6	259.2	0.50	
317	Dwarsligger onderregel eerste dwarsarm	HEA160	S235		1.00	1.00	1.00	13	**-10.1**	ULS 3_0,9_90	825.9	0.0	0.0	0.01		**0.0**		916.5	0.0	0.0	0.00	
318	Verticaal eerste dwarsarm	90x90x6#	S235	1M20-5.6t	1.00	1.00	1.00	168	**-18.9**	SPLS 6a_90 Ba All Cts Ah Ct2	61.1	58.8	64.8	0.32		**0.0**		117.5	58.8	52.4	0.00	
319	Verticaal eerste dwarsarm	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	190	**-5.5**	ULS 3_45	29.3	37.7	43.2	0.19		**0.0**		37.4	37.7	22.0	0.00	
320	Verticaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	94	**-0.9**	ULS 7	50.9	37.7	43.2	0.02		**0.0**		37.4	37.7	18.4	0.00	

Assessment of groups for initial mast (afkeur level)

Date 17-8-2020
Author MKh
Version 1.0

KIJ-GT 380
HC+0
2

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
321	Diagonaal eerste dwarsarm	50x50x6	S235	2M16-5.6t	1.00	1.00	1.00	580	**0.0**		5.7	75.4	103.7	0.00		**28.1**	ULS 3_135	62.1	75.4	52.9	0.53	
322	Diagonaal eerste dwarsarm	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	415	**0.0**		12.4	117.6	129.6	0.00		**42.7**	; 6a_90 Ba All Cts Ah Ct2	77.4	117.6	88.7	0.55	
323	Diagonaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	516	**0.0**		4.7	37.7	43.2	0.00		**17.2**	ULS 1a_0	37.4	37.7	22.0	0.78	
324	Dwarsligger bovenregel eerste dwarsarm	65x50x5	S235	1M24-5.6t	1.00	1.00	1.00	220	**-2.9**	ULS 3_0,9_90	21.8	84.7	64.8	0.13		**0.0**		25.9	84.7	8.9	0.00	
325	Tussen diagonaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	171	**-0.3**	SPLS 1a_0 Ah All Cts	27.0	37.7	43.2	0.01		**3.9**	ULS 3_0,9_135	37.4	37.7	18.4	0.21	
401	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	110	**-30.4**	SPLS 6a_90 Ah All Cts Ba Ct1	123.3	117.6	129.6	0.26		**30.3**	; 6a_90 Ah All Cts Ba Ct1	128.8	117.6	104.7	0.29	
402	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	102	**-36.0**	SPLS 6a_90 Ah All Cts Ba Ct1	132.3	117.6	129.6	0.31		**37.6**	PLS 6a_90 Ah Ct1 Ba Ct1	136.1	117.6	104.7	0.36	
403	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	98	**-46.6**	SPLS 6a_90 Ah Ct1 Ba Ct1	136.1	117.6	129.6	0.40		**43.5**	; 6a_90 Ah All Cts Ba Ct1	140.4	117.6	104.7	0.42	
404	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	90	**-47.4**	SPLS 6a_90 Ah Ct1 Ba Ct1	129.0	117.6	129.6	0.40		**46.4**	; 6a_90 Ah All Cts Ba Ct1	119.7	117.6	104.7	0.44	
405	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	81	**-53.3**	SPLS 6a_90 Ah All Cts Ba Ct1	138.2	117.6	129.6	0.45		**53.7**	PLS 6a_90 Ah Ct1 Ba Ct1	123.5	117.6	104.7	0.51	
406	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-69.2**	SPLS 6a_90 Ah Ct1 Ba Ct1	140.4	117.6	129.6	0.59		**65.6**	; 6a_90 Ah All Cts Ba Ct1	131.2	117.6	104.7	0.63	
407	Diagonaal onderregel tweede dwarsarm	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	83	**-26.1**	SPLS 6a_90 Ah All Cts Ba Ct1	79.3	58.8	64.8	0.44		**27.2**	; 6a_90 Ah All Cts Ba Ct1	65.7	58.8	38.8	0.70	
408	Diagonaal onderregel tweede dwarsarm	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	78	**-1.1**	SPLS 1a_0 Ba All Cts	81.4	58.8	64.8	0.02		**3.9**	ULS 3_0,9_135	65.7	58.8	38.8	0.10	
409	Dwarsligger onderregel tweede dwarsarm	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	51	**-0.3**	SPLS 3_0,9_115,5 Ah Ct2	700.0	117.6	216.0	0.00		**4.9**	PLS 6a_90 Ba Ct1 Ba Ct2	766.1	117.6	0.0	0.04	
410	Dwarsligger onderregel tweede dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	44	**0.0**		410.1	117.6	259.2	0.00		**60.7**	ULS 3_0,9_115,5	278.4	117.6	259.2	0.52	
411	Dwarsligger onderregel tweede dwarsarm	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	31	**-8.7**	ULS 3_0,9_90	774.9	117.6	216.0	0.07		**0.0**		766.1	117.6	0.0	0.00	
412	Bovenregel tweede dwarsarm	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	306	**0.0**		56.1	254.2	311.0	0.00		**109.9**	PLS 6a_90 Ba Ct1 Ba Ct2	263.0	254.2	265.8	0.43	
413	Bovenregel tweede dwarsarm	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	238	**0.0**		83.2	254.2	311.0	0.00		**101.5**	PLS 6a_90 Ba Ct1 Ba Ct2	263.0	254.2	265.8	0.40	
414	Diagonaal bovenregel tweede dwarsarm	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	203	**-5.5**	ULS 1a_0	25.4	37.7	51.8	0.22		**5.5**	ULS 1a_0,9_0	44.9	37.7	26.5	0.21	
415	Diagonaal bovenregel tweede dwarsarm	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	189	**-5.3**	SPLS 1a_0,9_0 Ba Ct2	28.1	37.7	51.8	0.19		**5.0**	ULS 1a_0	44.9	37.7	26.5	0.19	
416	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	179	**-5.2**	SPLS 1a_0 Ba All Cts	25.5	37.7	43.2	0.20		**6.1**	; 6a_90 Ah All Cts Ba Ct2	37.4	37.7	22.0	0.28	
417	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	146	**-10.6**	SPLS 6a_90 Ah All Cts Ba Ct2	33.1	37.7	43.2	0.32		**10.9**	; 6a_90 Ah All Cts Ba Ct2	37.4	37.7	22.0	0.49	
418	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	138	**-13.0**	SPLS 6a_90 Ah All Cts Ba Ct2	35.2	37.7	43.2	0.37		**12.8**	; 6a_90 Ah All Cts Ba Ct2	37.4	37.7	22.0	0.58	
419	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	134	**-16.1**	SPLS 6a_90 Ah All Cts Ba Ct2	36.6	37.7	43.2	0.44		**16.1**	; 6a_90 Ah All Cts Ba Ct2	37.4	37.7	22.0	0.73	
420	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	96	**-18.3**	SPLS 6a_90 Ah All Cts Ba Ct2	60.6	58.8	54.0	0.34		**18.6**	; 6a_90 Ah All Cts Ba Ct2	54.7	58.8	32.4	0.58	
421	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	93	**-24.8**	SPLS 6a_90 Ah All Cts Ba Ct2	62.4	58.8	54.0	0.46		**23.9**	; 6a_90 Ah All Cts Ba Ct2	54.7	58.8	32.4	0.74	
422	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	88	**-30.7**	SPLS 6a_90 Ah All Cts Ba Ct2	64.7	58.8	54.0	0.57		**32.7**	; 6a_90 Ah All Cts Ba Ct2	54.7	58.8	37.0	0.88	
423	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-1.4**	SPLS 6a_90 Ba Ct1 Ba Ct2	50.8	37.7	43.2	0.04		**3.9**	PLS 6a_90 Ah Ct2 Ba Ct2	37.4	37.7	22.0	0.18	
424	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**0.0**		25.2	37.7	43.2	0.00		**5.0**	PLS 6a_90 Ba Ct2 Ba Ct1	37.4	37.7	22.0	0.23	
425	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	314	**-3.6**	SPLS 1a_90 Ba Ct1	11.0	37.7	43.2	0.33		**0.0**		37.4	37.7	22.0	0.00	
426	Diagonaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	346	**-12.0**	SPLS 6a_90 Ah Ct2 Ba Ct2	9.4	37.7	43.2	1.28	knik	**1.3**	;PLS 3_0,9_115,5 Ah Ct1	37.4	37.7	22.0	0.06	
427	Diagonaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	266	**0.0**		14.3	37.7	43.2	0.00		**1.1**	ULS 1a_115,5	37.4	37.7	22.0	0.05	
428	Dwarsligger bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	196	**-0.5**	ULS 1a_0,9_90	22.5	37.7	43.2	0.02		**0.5**	ULS 1a_90	37.4	37.7	22.0	0.02	
429	Dwarsligger bovenregel tweede dwarsarm	UNP160	S235	1M16-5.6t	1.00	1.00	1.00	42	**0.0**		288.7	37.7	64.8	0.00		**25.3**	ULS 3_0,9_90	90.7	37.7	48.0	0.67	
430	Dwarsligger ladder tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	112	**0.0**	SPLS 1a_115,5 Ah All Cts	44.1	37.7	43.2	0.00		**0.0**	ULS 1a_0,9_90	37.4	37.7	22.0	0.00	

DNV·GL

Assessment of groups for strengthened mast (afkeur level)

Date 17-8-2020
Author MKh
Version 1.0

KIJ-GT 380
HC+0
2

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
101A	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	85	**-52.7**	SPLS 3_64,5 Ah Ct2	390.5	508.3	777.6	0.14		**11.6**	SPLS 3_0,9_64,5 Ah A	466.6	508.3	664.6	0.02
101B	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	74	**-154.5**	ULS 1a_115,5	423.6	506.7	777.6	0.36		**116.0**	ULS 1a_0,9_115,5	466.6	506.7	664.6	0.25
102A	Leg	180x180x16#	S235	8M24-5.6t	0.50	0.50	0.50	54	**-414.0**	SPLS 3_115,5 Ba All C	1141.5	674.7	1658.9	0.61		**322.1**	SPLS 3_0,9_115,5 Ba	1220.3	674.7	1417.8	0.48
102B	Leg	180x180x16#	S235	12M24-5.6t	0.50	0.50	0.50	57	**-466.7**	ULS 1a_115,5	1125.2	1005.5	2488.3	0.46		**343.2**	ULS 1a_0,9_115,5	1220.3	1005.5	2169.3	0.34
103A	Leg	200x200x20	S235	16M24-5.6t	0.28	0.28	0.28	28	**-813.0**	SPLS 3_115,5 Ba All C	1750.2	1181.8	4147.2	0.69		**657.9**	SPLS 3_0,9_115,5 Ba	1710.7	1181.8	3544.6	0.56
103B	Leg	200x200x20	S235	12M24-5.6t	0.28	0.28	0.28	35	**-1032.8**	SPLS 3_115,5 Ba All C	1704.3	1987.7	3110.4	0.61		**867.7**	SPLS 3_0,9_115,5 Ba	1710.7	1987.7	2658.5	0.51
104A	Leg	250x250x20#	S235	12M24-5.6t	0.28	0.28	0.28	34	**-1281.2**	SPLS 3_115,5 Ba All C	2172.1	1892.2	3110.4	0.68		**1094.6**	SPLS 3_0,9_115,5 Ba	2244.7	1892.2	2658.5	0.58
104B	Leg	250x250x20#	S235	14M24-5.6t	0.55	0.55	0.55	37	**-1397.2**	SPLS 3_115,5 Ba All C	2149.3	2100.4	3628.8	0.67		**1204.2**	SPLS 3_0,9_115,5 Ba	2244.7	2100.4	3101.5	0.57
105	Leg	250x250x22#	S235	14M24-5.6t	0.17	0.17	0.17	33	**-1421.8**	SPLS 3_115,5 Ba All C	2386.8	2100.4	3991.7	0.68		**1205.1**	SPLS 3_0,9_115,5 Ba	2453.6	2100.4	3411.7	0.57
106A	Onderregel eer	200x200x16	S235	12M24-5.6t	1.53	1.00	1.00	63	**-715.2**	SPLS 6a_90 Ah Ct2 Ba	1211.7	906.5	2488.3	0.79		**495.7**	SPLS 6a_90 Ah Ct1 Ba	1386.2	906.5	2126.8	0.55
106B	Onderregel eer	200x200x16	S235	10M24-5.6t	7.64	1.00	1.00	74	**-382.5**	SPLS 6a_90 Ah Ct2 Ba	1128.4	847.2	2073.6	0.45		**250.9**	SPLS 6a_90 Ah Ct1 Ba	1386.2	847.2	1772.3	0.30
106C	Onderregel eer	200x200x16	S235		2.88	1.77	1.00	62	**-639.8**	SPLS 6a_90 Ah Ct2 Ba	1220.6	0.0	0.0	0.52		**422.3**	SPLS 6a_90 Ah Ct1 Ba	1452.3	0.0	0.0	0.29
107A	Onderregel eer	180x180x15#	S235	10M24-5.6t	2.78	1.00	1.00	83	**-349.6**	SPLS 6a_90 Ah Ct2 Ba	887.4	847.2	1944.0	0.41		**221.4**	SPLS 6a_90 Ah Ct1 Ba	1144.0	847.2	1661.5	0.26
107B	Onderregel eer	180x180x15#	S235	2M20-5.6t	1.63	1.00	1.00	18	**-3.4**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**0.6**	SPLS 1a_0 Ba All Cts	613.8	117.6	297.8	0.01
107C	Onderregel eer	180x180x15#	S235		18.24	1.00	1.00	83	**-333.3**	SPLS 6a_90 Ah Ct2 Ba	887.3	0.0	0.0	0.38		**199.8**	SPLS 6a_90 Ah Ct1 Ba	1220.5	0.0	0.0	0.16
108A	Onderregel twe	180x180x15#	S235	12M24-5.6t	1.12	1.00	1.00	64	**-433.5**	SPLS 6a_90 Ah All Cts	1011.2	2033.3	2332.8	0.43		**307.7**	SPLS 3_0,9_64,5 Ah A	1144.0	2033.3	1814.4	0.27
108B	Onderregel twe	180x180x15#	S235	2M20-5.6t	1.00	1.50	1.00	19	**-3.2**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**0.7**	SPLS 1a_135 Ah Ct1	613.8	117.6	297.8	0.01
108C	Onderregel twe	180x180x15#	S235		2.77	1.70	1.00	65	**-394.8**	SPLS 6a_90 Ah All Cts	1010.4	0.0	0.0	0.39		**266.2**	SPLS 3_0,9_64,5 Ah A	1220.5	0.0	0.0	0.22
111A	Bovenregel eer	90x90x9	S235	3M24-5.6t	1.00	1.96	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**118.5**	SPLS 6a_90 Ah Ct1 Ba	205.3	254.2	299.1	0.58
111B	Bovenregel eer	90x90x9	S235	3M24-5.6t	1.00	2.04	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**93.0**	SPLS 6a_90 Ah Ct1 Ba	205.3	254.2	299.1	0.45
112A	Bovenregel eer	75x75x7#	S235	3M24-5.6t	1.00	1.80	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**79.7**	SPLS 6a_90 Ah Ct1 Ba	131.8	254.2	192.5	0.61
112B	Bovenregel eer	75x75x7#	S235	3M24-5.6t	1.00	2.25	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**79.8**	SPLS 6a_90 Ah Ct1 Ba	131.8	254.2	192.5	0.61
113A	Bovenregel twe	120x120x13	S235	5M24-5.6t	1.59	1.00	1.00	101	**-214.6**	SPLS 6a_90 Ah All Cts	355.8	423.6	842.4	0.60		**191.8**	SPLS 6a_90 Ah All Cts	418.7	423.6	703.2	0.46
113B	Bovenregel twe	120x120x13	S235	5M24-5.6t	1.40	1.00	1.00	102	**-198.4**	SPLS 6a_90 Ah All Cts	373.5	423.6	842.4	0.53		**185.0**	SPLS 6a_90 Ah All Cts	602.4	423.6	720.0	0.44
113C	Bovenregel twe	120x120x13	S235		2.70	1.70	1.00	101	**-210.2**	SPLS 6a_90 Ah All Cts	355.7	0.0	0.0	0.59		**192.7**	SPLS 6a_90 Ah All Cts	705.0	0.0	0.0	0.27
114A	Bovenregel twe	150x100x12	S235	5M24-5.6t	3.00	1.00	1.00	115	**-182.9**	SPLS 6a_90 Ah All Cts	301.8	423.6	777.6	0.61		**188.9**	SPLS 6a_90 Ah All Cts	582.2	423.6	664.6	0.45
114B	Bovenregel twe	150x100x12	S235	4M24-5.6t	3.00	1.00	1.00	104	**-41.6**	SPLS 6a_90 Ah All Cts	331.5	338.9	622.1	0.13		**36.8**	SPLS 6a_90 Ah Ct1 Ba	582.2	338.9	531.7	0.11
114C	Bovenregel twe	150x100x12	S235		3.00	1.00	1.00	115	**-166.5**	SPLS 6a_90 Ah All Cts	301.8	0.0	0.0	0.55		**171.9**	SPLS 6a_90 Ah All Cts	674.5	0.0	0.0	0.25
115A	Tussenregel tw	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-30.5**	SPLS 6a_90 Ba Ct1 Ba	79.8	84.7	77.8	0.39		**11.6**	SPLS 3_0,9_90 Ah Ct2	127.9	84.7	66.5	0.18
115B	Tussenregel tw	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-29.6**	SPLS 6a_90 Ba Ct1 Ba	71.0	84.7	77.8	0.42		**12.5**	SPLS 3_0,9_90 Ah Ct2	127.9	84.7	66.5	0.19
201L	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-40.5**	SPLS 3_0,9_90 Ah Ct2	114.3	117.6	129.6	0.35		**32.0**	ULS 1a_115,5	145.4	117.6	104.7	0.31
201T	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-21.8**	SPLS 6a_90 Ba Ct2 Ah	114.3	117.6	129.6	0.19		**12.3**	SPLS 3_0,9_115,5 Ah	145.4	117.6	104.7	0.12
202L	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-201.2**	SPLS 3_90 Ba Ct2	425.3	338.9	518.4	0.59		**155.6**	SPLS 3_0,9_90 Ba Ct1	384.5	338.9	350.9	0.46
202T	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-141.8**	SPLS 3_0,9_90 Ba Ct1	425.3	338.9	518.4	0.42		**157.0**	SPLS 3_90 Ba Ct2	384.5	338.9	350.9	0.46
203L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-142.8**	SPLS 3_0,9_90 Ba Ct1	406.7	338.9	518.4	0.42		**184.1**	SPLS 3_90 Ba Ct2	384.5	338.9	350.9	0.54
203T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-142.2**	SPLS 3_90 Ba Ct2	406.7	338.9	518.4	0.42		**128.5**	SPLS 3_0,9_90 Ba Ct1	384.5	338.9	350.9	0.38
204L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-187.0**	SPLS 3_0,9_90 Ah Ct2	386.8	338.9	518.4	0.55		**166.4**	SPLS 3_0,9_115,5 Ba	384.5	338.9	350.9	0.49
204T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-176.5**	SPLS 3_90 Ba Ct1	386.8	338.9	518.4	0.52		**162.7**	SPLS 3_0,9_90 Ba Ct2	384.5	338.9	350.9	0.48
205L	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-373.8**	SPLS 3_64,5 Ba Ct2	449.2	508.3	777.6	0.83		**372.2**	SPLS 3_64,5 Ba Ct2	384.5	508.3	513.8	0.97
205T	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-348.2**	SPLS 6a_90 Ah Ct2 Ba	449.2	508.3	777.6	0.78		**335.9**	SPLS 6a_90 Ah Ct1 Ba	384.5	508.3	513.8	0.87
206L	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-309.6**	SPLS 3_64,5 Ba Ct2	465.9	423.6	777.6	0.73		**305.1**	SPLS 3_64,5 Ba Ct1	456.2	423.6	518.8	0.72
206T	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-276.9**	SPLS 6a_90 Ah Ct1 Ba	465.9	423.6	777.6	0.65		**286.3**	SPLS 6a_90 Ah Ct2 Ba	456.2	423.6	518.8	0.68
207L	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-248.9**	SPLS 3_64,5 Ba Ct1	394.0	338.9	622.1	0.73		**252.0**	SPLS 3_64,5 Ba Ct2	456.2	338.9	421.1	0.74
207T	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-233.8**	SPLS 6a_90 Ah Ct2 Ba	394.0	338.9	622.1	0.69		**224.5**	SPLS 6a_90 Ah Ct1 Ba	456.2	338.9	421.1	0.66
208L	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-210.0**	SPLS 3_64,5 Ba Ct2	332.1	254.2	388.8	0.83		**204.0**	SPLS 3_115,5 Ah Ct1	384.5	254.2	269.2	0.80
208T	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-188.7**	SPLS 6a_90 Ah Ct1 Ba	332.1	254.2	388.8	0.74		**193.4**	SPLS 6a_90 Ah Ct2 Ba	384.5	254.2	269.2	0.76
209L	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-262.8**	SPLS 3_64,5 Ba Ct2	370.1	338.9	570.2	0.78		**243.0**	SPLS 3_0,9_64,5 Ba C	356.4	338.9	475.6	0.72
209T	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-243.8**	SPLS 3_64,5 Ba Ct1	370.1	338.9	570.2	0.72		**239.0**	SPLS 3_0,9_64,5 Ba C	356.4	338.9	475.6	0.71
210	Top	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	280	**-13.0**	SPLS 6a_90 Ah Ct2 Ba	16.5	75.4	86.4	0.78		**12.9**	SPLS 6a_90 Ah Ct2 Ba	52.4	75.4	44.1	0.29
211L	Tweede dwarsa	100x100x6	S235	3M24-5.6t	1.00	1.00	1.00	132	**0.0**		113.1	254.2	233.3	0.00		**88.2**	ULS 6a_90 Ah Ct2	161.1	254.2	199.4	0.55
211T	Tweede dwarsa	100x100x6	S235	2M24-5.6t	1.00	1.00	1.00	132	**-3.9**	ULS 1a_90	113.1	169.4	155.5	0.03		**2.6**	ULS 1a_0,9_0,9_90	206.4	169.4	132.9	0.02
109L	Tweede dwarsa	180x180x15#	S235	12M24-5.6t	1.00	2.00	1.00	53	**-534.6**	SPLS 3_115,5 Ba All C	1075.9	2033.3	2332.8	0.50		**434.9**	SPLS 3_0,9_115,5 Ba	1144.0	2033.3	1814.4	0.38
212T	Tweede dwarsa	100x100x6	S235	4M24-5.6t	1.00	2.00	1.00	95	**-50.4**	SPLS 3_0,9_64,5 Ba C	144.3	338.9	311.0	0.35		**62.8**	SPLS 3_64,5 Ba Ct2	225.0	338.9	265.8	0.28
213	Tweede dwarsa	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	86	**-74.6**	SPLS 3_0,9_64,5 Ba C	265.3	254.2	311.0	0.29		**75.6**	SPLS 3_64,5 Ba Ct2	263.0	254.2	265.8	0.30
214	Tweede dwarsa	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	300	**-0.6**	SPLS 6a_90 Ba Ct1 Ba	11.8	37.7	43.2	0.05		**0.0**		37.4	37.7	22.0	0.00
215L	Eerste dwarsar	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	178	**0.0**		103.8	254.2	311.0	0.00		**118.0**	SPLS 6a_90 Ba All Cts	270.5	254.2	265.8	0.46
215T	Eerste dwarsar	100x100x8	S235	1M24-5.6t	1.00	1.00	1.00	178	**-53.0**	ULS 1a_0,9_90	83.1	84.7	103.7	0.64		**58.7**	ULS 1a_90	170.5	84.7	88.6	0.69
110L	Eerste dwarsar	200x200x16	S235	12M24-5.6t	1.00	2.00	1.00	62	**-585.7**	SPLS 3_115,5 Ba All C	1222.1	906.5	2488.3	0.65		**442.3**	SPLS 4_0,9_90 Ah All	1386.2	906.5	2126.8	0.49
216T	Eerste dwarsar	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	124	**-121.0**	SPLS 6a_90 Ah Ct2 Ba	151.1	338.9	414.7	0.80		**133.1**	SPLS 6a_90 Ba Ct1 Ba	293.9	338.9	354.5	0.45
217	Eerste dwarsar	120x120x11	S235	3M24-5.6t	1.00	1.00	1.00	114	**-168.5**	SPLS 6a_90 Ah Ct2 Ba	286.0	254.2	427.7	0.66		**169.5**	SPLS 6a_90 Ah Ct2 Ba	356.4	254.2	365.5	0.67
218	Eerste dwarsar	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	325	**-0.5**	SPLS 6a_90 Ba Ct1 Ah	12.6	58.8	54.0	0.04		**0.0**		54.7	58.8	37.0	0.00
219L	Onderstuk in to	130x130x12#	S235	2M24-5.6t	1.00	1.00	1.00	157	**-47.8**	SPLS 3_115,5 Ba All C	235.2	169.4	311.0	0.28		**37.9**	SPLS 4_0,9_90 Ah All	363.3	169.4	265.8	0.22
219T	Onderstuk in to	130x130x12#	S235	2M24-5.6t	1.00	1.00	1.00	157	**-51.5**	SPLS 3_115,5 Ba All C	235.2	169.4	311.0	0.30		**41.9**	SPLS 3_0,9_64,5 Ah A	363.3	169.4	265.8	0.25
220	Onderstuk in to	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	311	**-5.2**	ULS 1a_0,9_0,9_45	11.6	37.7	43.2	0.45		**4.6**	ULS 1a_0,9_0,9_45	60.5	37.7	32.0	0.15
221	Onderstuk in to	70x70x5#	S235	1M16-5.6t	0.50	1.00	0.50	370	**-1.0**	ULS 7	11.2	37.7	43.2	0.09		**0.0**		74.9	37.7	32.0	0.00
301	Diagonaal onde	100x100x8	S235	**1M20-8.8t**	0.55	0.55	0.55	123	**-60.0**	SPLS 6a_90 Ah All Cts	129.7	94.1	86.4	0.69		**60.7**	SPLS 6a_90 Ah All Cts	179.7	94.1	69.8	0.87
302	Diagonaal onde	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	110	**-77.6**	SPLS 6a_90 Ah Ct1 Ba	180.9	117.6	172.8	0.66		**75.7**	SPLS 6a_90 Ah Ct1 Ba	190.7	117.6	139.6	0.64
303	Diagonaal onde	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	92	**-68.8**	SPLS 6a_90 Ah All Cts	208.7	117.6	172.8	0.59		**66.0**	SPLS 6a_90 Ah All Cts	190.7	117.6	139.6	0.56
304	Diagonaal onde	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	104	**-88.4**	SPLS 6a_90 Ah Ct1 Ba	143.2	117.6	129.6	0.75		**89.4**	SPLS 6a_90 Ah All Cts	170.1	117.6	104.7	0.85
305	Diagonaal onde	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	92	**-48.0**	SPLS 6a_90 Ah All Cts	101.8	84.7	77.8	0.62		**51.4**	SPLS 6a_90 Ah All Cts	93.3	84.7	59.8	0.86
306	Diagonaal onde	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	84	**-26.0**	SPLS 6a_90 Ah All Cts	107.6	84.7	77.8	0.33		**30.0**	SPLS 6a_90 Ah All Cts	93.3	84.7	66.5	0.45
307	Diagonaal onde	80x80x6#	S235	1M24-5.6t	0.55	0.55	0.55	96	**-35.0**	SPLS 6a_90 Ah All Cts	98.2	84.7	77.8	0.45		**30.2**	SPLS 6a_90 Ah All Cts	93.3	84.7	59.8	0.50
308	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	89	**-41.3**	SPLS 6a_90 Ah All Cts	129.6	117.6	129.6	0.35		**41.5**	SPLS 6a_90 Ah All Cts	115.9	117.6	104.7	0.40
309	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-50.9**	SPLS 6a_90 Ah All Cts	140.4	117.6	129.6	0.43		**49.6**	SPLS 6a_90 Ah All Cts	124.8	117.6	104.7	0.47
310	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	76	**-69.8**	SPLS 6a_90 Ah All Cts	143.9	117.6	129.6	0.59		**68.3**	SPLS 6a_90 Ah All Cts	136.2	117.6	104.7	0.65
311	Diagonaal onde	70x70x6	S235	1M24-5.6t	1.00	1.00	1.00	69	**-31.4**	SPLS 6a_90 Ah All Cts	99.6	84.7	77.8	0.40		**31.8**	SPLS 6a_90 Ah All Cts	76.0	84.7	55.0	0.58
312	Diagonaal onde	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	82	**-1.1**	SPLS 1a_0 Ba All Cts	55.5	37.7	43.2	0.03		**3.5**	ULS 3_0,9_90	37.4	37.7	25.7	0.14
313	Dwarsligger on	HEA160	S235	2M20-5.6t	2.00	1.00	1.00	48	**-4.1**	SPLS 6a_90 Ah Ct1 Ba	686.1	117.6	216.0	0.03		**8.7**	SPLS 6a_90 Ah Ct2 Ba	766.1	117.6	0.0	0.07
314	Dwarsligger on	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	82	**0.0**		314.6	117.6	259.2	0.00		**50.6**	ULS 3_115,5	278.4	117.6	259.2	0.43
315	Dwarsligger on	HEA160	S235		1.00	1.00	1.00	26	**-1.8**	ULS 1a_0,9_0,9_90	789.3	0.0	0.0	0.00		**4.5**	ULS 3_115,5	916.5	0.0	0.0	0.00
316	Dwarsligger on	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	37	**0.0**		426.4	117.6	259.2	0.00		**59.2**	ULS 3_0,9_115,5	278.4	117.6	259.2	0.50
317	Dwarsligger on	HEA160	S235		1.00	1.00	1.00	13	**-10.1**	ULS 3_0,9_90	825.9	0.0	0.0	0.01		**0.0**		916.5	0.0	0.0	0.00

Assessment of groups for strengthened mast (afkeur level)

Date	17-8-2020
Author	MKh
Version	1.0

KIJ-GT 380
HC+0
2

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
318	Verticaal eerste	90x90x6#	S235	1M20-5.6t	1.00	1.00	1.00	168	**-18.9**	SPLS 6a_90 Ba All Cts	61.1	58.8	64.8	0.32		**0.0**		117.5	58.8	52.4	0.00
319	Verticaal eerste	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	190	**-5.5**	ULS 3_45	29.3	37.7	43.2	0.19		**0.0**		37.4	37.7	22.0	0.00
320	Verticaal eerste	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	94	**-0.9**	ULS 7	50.9	37.7	43.2	0.02		**0.0**		37.4	37.7	18.4	0.00
321	Diagonaal eerst	50x50x6	S235	2M16-5.6t	1.00	1.00	1.00	580	**0.0**		5.7	75.4	103.7	0.00		**28.1**	ULS 3_135	62.1	75.4	52.9	0.53
322	Diagonaal eerst	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	415	**0.0**		12.4	117.6	129.6	0.00		**42.7**	SPLS 6a_90 Ba All Cts	77.4	117.6	88.7	0.55
323	Diagonaal eerst	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	516	**0.0**		4.7	37.7	43.2	0.00		**17.2**	ULS 1a_0	37.4	37.7	22.0	0.78
324	Dwarsligger bo	65x50x5	S235	1M24-5.6t	1.00	1.00	1.00	220	**-2.9**	ULS 3_0,9_90	21.8	84.7	64.8	0.13		**0.0**		25.9	84.7	8.9	0.00
325	Tussen diagona	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	171	**-0.3**	SPLS 1a_0 Ah All Cts	27.0	37.7	43.2	0.01		**3.9**	ULS 3_0,9_135	37.4	37.7	18.4	0.21
401	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	110	**-30.4**	SPLS 6a_90 Ah All Cts	123.3	117.6	129.6	0.26		**30.3**	SPLS 6a_90 Ah All Cts	128.8	117.6	104.7	0.29
402	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	102	**-36.0**	SPLS 6a_90 Ah All Cts	132.3	117.6	129.6	0.31		**37.6**	SPLS 6a_90 Ah Ct1 Ba	136.1	117.6	104.7	0.36
403	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	98	**-46.6**	SPLS 6a_90 Ah Ct1 Ba	136.1	117.6	129.6	0.40		**43.5**	SPLS 6a_90 Ah All Cts	140.4	117.6	104.7	0.42
404	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	90	**-47.4**	SPLS 6a_90 Ah Ct1 Ba	129.0	117.6	129.6	0.40		**46.4**	SPLS 6a_90 Ah All Cts	119.7	117.6	104.7	0.44
405	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	81	**-53.3**	SPLS 6a_90 Ah All Cts	138.2	117.6	129.6	0.45		**53.7**	SPLS 6a_90 Ah Ct1 Ba	123.5	117.6	104.7	0.51
406	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-69.2**	SPLS 6a_90 Ah Ct1 Ba	140.4	117.6	129.6	0.59		**65.6**	SPLS 6a_90 Ah All Cts	131.2	117.6	104.7	0.63
407	Diagonaal onde	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	83	**-26.1**	SPLS 6a_90 Ah All Cts	79.3	58.8	64.8	0.44		**27.2**	SPLS 6a_90 Ah All Cts	65.7	58.8	38.8	0.70
408	Diagonaal onde	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	78	**-1.1**	SPLS 1a_0 Ba All Cts	81.4	58.8	64.8	0.02		**3.9**	ULS 3_0,9_135	65.7	58.8	38.8	0.10
409	Dwarsligger on	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	51	**-0.2**	SPLS 3_0,9_115,5 Ah	700.0	117.6	216.0	0.00		**4.9**	SPLS 6a_90 Ba Ct1 Ba	766.1	117.6	0.0	0.04
410	Dwarsligger on	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	44	**0.0**		410.1	117.6	259.2	0.00		**60.7**	ULS 3_0,9_115,5	278.4	117.6	259.2	0.52
411	Dwarsligger on	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	31	**-8.7**	ULS 3_0,9_90	774.9	117.6	216.0	0.07		**0.0**		766.1	117.6	0.0	0.00
412	Bovenregel twe	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	306	**0.0**		56.1	254.2	311.0	0.00		**110.0**	SPLS 6a_90 Ba Ct1 Ba	263.0	254.2	265.8	0.43
413	Bovenregel twe	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	238	**0.0**		83.2	254.2	311.0	0.00		**101.6**	SPLS 6a_90 Ba Ct1 Ba	263.0	254.2	265.8	0.40
414	Diagonaal bove	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	203	**-5.5**	ULS 1a_0	25.4	37.7	51.8	0.22		**5.5**	ULS 1a_0,9_0	44.9	37.7	26.5	0.21
415	Diagonaal bove	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	189	**-5.3**	SPLS 1a_0,9_0 Ba Ct2	28.1	37.7	51.8	0.19		**5.0**	ULS 1a_0	44.9	37.7	26.5	0.19
416	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	179	**-5.2**	SPLS 1a_0 Ba All Cts	25.5	37.7	43.2	0.20		**6.1**	SPLS 6a_90 Ah All Cts	37.4	37.7	22.0	0.28
417	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	146	**-10.6**	SPLS 6a_90 Ah All Cts	33.1	37.7	43.2	0.32		**10.9**	SPLS 6a_90 Ah All Cts	37.4	37.7	22.0	0.49
418	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	138	**-13.0**	SPLS 6a_90 Ah All Cts	35.2	37.7	43.2	0.37		**12.8**	SPLS 6a_90 Ah All Cts	37.4	37.7	22.0	0.58
419	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	134	**-16.1**	SPLS 6a_90 Ah All Cts	36.6	37.7	43.2	0.44		**16.1**	SPLS 6a_90 Ah All Cts	37.4	37.7	22.0	0.73
420	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	96	**-18.3**	SPLS 6a_90 Ah All Cts	60.6	58.8	54.0	0.34		**18.6**	SPLS 6a_90 Ah All Cts	54.7	58.8	32.4	0.58
421	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	93	**-24.8**	SPLS 6a_90 Ah All Cts	62.4	58.8	54.0	0.46		**23.9**	SPLS 6a_90 Ah All Cts	54.7	58.8	32.4	0.74
422	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	88	**-30.7**	SPLS 6a_90 Ah All Cts	64.7	58.8	54.0	0.57		**32.7**	SPLS 6a_90 Ah All Cts	54.7	58.8	37.0	0.88
423	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-1.4**	SPLS 6a_90 Ba Ct1 Ba	50.8	37.7	43.2	0.04		**4.1**	SPLS 6a_90 Ah Ct2 Ba	37.4	37.7	22.0	0.18
424	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**0.0**		25.2	37.7	43.2	0.00		**5.0**	SPLS 6a_90 Ba Ct2 Ba	37.4	37.7	22.0	0.23
425	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	314	**-3.6**	SPLS 1a_90 Ba Ct1	11.0	37.7	43.2	0.33		**0.0**		37.4	37.7	22.0	0.00
426	Diagonaal twee	**55x55x6**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	316	**-12.4**	SPLS 6a_90 Ah Ct2 Ba	14.6	60.3	70.6	0.85		**1.4**	SPLS 3_0,9_115,5 Ah	61.2	60.3	36.0	0.04
427	Diagonaal twee	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	266	**0.0**		14.3	37.7	43.2	0.00		**1.1**	ULS 1a_115,5	37.4	37.7	22.0	0.05
428	Dwarsligger bo	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	196	**-0.5**	ULS 1a_0,9_90	22.5	37.7	43.2	0.02		**0.5**	ULS 1a_90	37.4	37.7	22.0	0.02
429	Dwarsligger bo	UNP160	S235	1M16-5.6t	1.00	1.00	1.00	42	**0.0**		288.7	37.7	64.8	0.00		**25.3**	ULS 3_0,9_90	90.7	37.7	48.0	0.67
430	Dwarsligger lad	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	112	**0.0**	SPLS 1a_115,5 Ah All	44.1	37.7	43.2	0.00		**0.0**	ULS 1a_0,9_90	37.4	37.7	22.0	0.00

DNV·GL

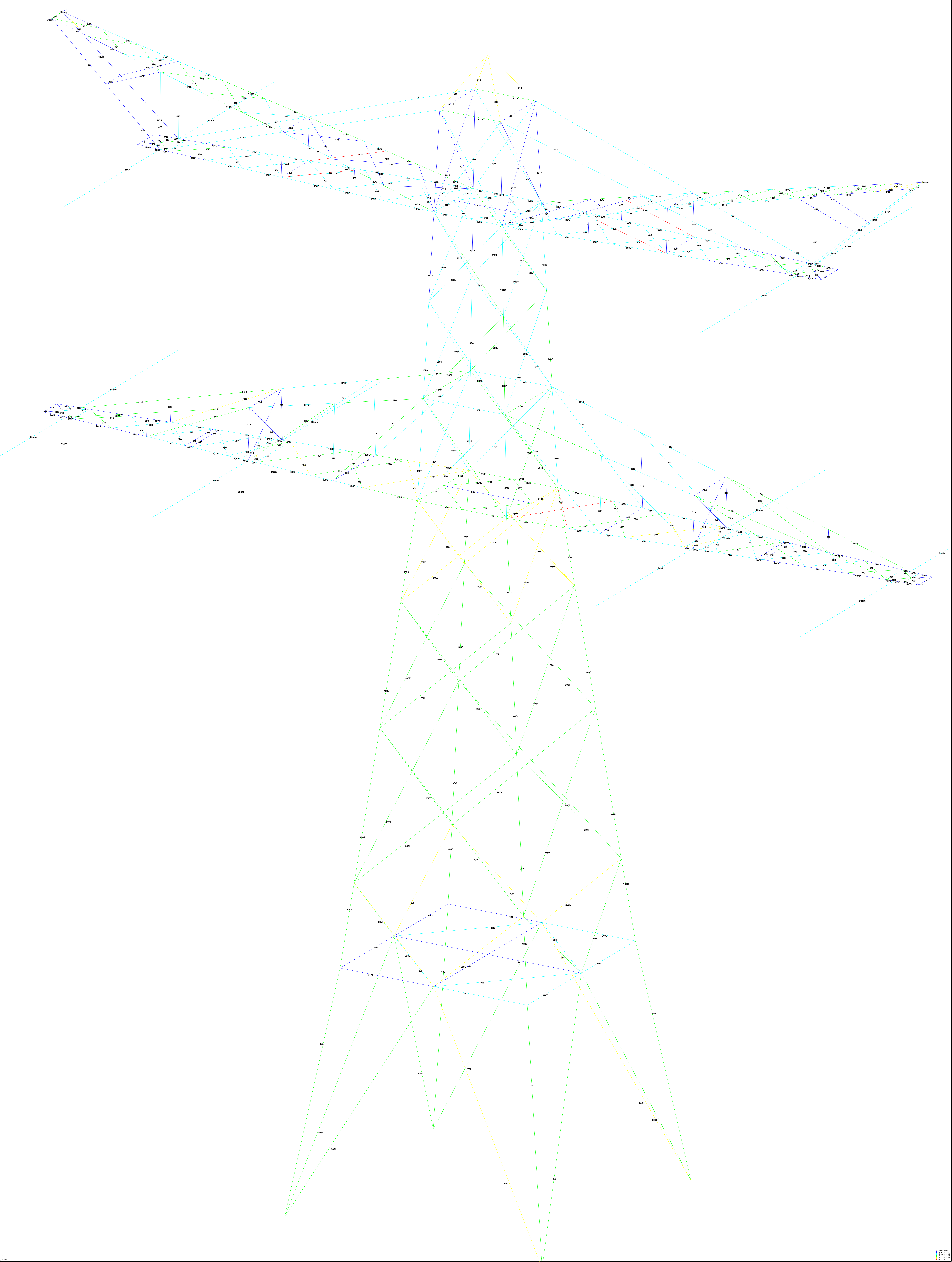
Assessment of groups for strengthened mast (verbouw level)

Date 17-8-2020
Author MKh
Version 1.0

KIJ-GT 380
HC+0
2

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
301	Diagonaal onde	100x100x8	S235	**1M20-8.8t**	0.55	0.55	0.55	123	**-61.7**	SPLS 6a_90 Ah All Cts	129.7	94.1	86.4	0.71		**62.3**	SPLS 6a_90 Ah All Cts	179.7	94.1	69.8	0.89
426	Diagonaal twee	**55x55x6**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	316	**-13.2**	SPLS 6a_90 Ah Ct2 Ba	14.6	60.3	70.6	0.90		**1.6**	SPLS 3_0,9_115,5 Ah (	61.2	60.3	36.0	0.04

DNV GL Nederlands BV, Project: "HC+0 (da) afk (2;38)"
Tower Version 16.39, 11:40:14 vrijdag 14 augustus 2020
Undeformed geometry displayed



Assessment of groups for initial mast (afkeur level)

Date 17-05-21
Author KCh
Version 1.0

KIJ-GT 380
HC+0
15

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
101A	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	85	**-49.1**	ULS 1a_69	390.5	508.3	777.6	0.13		**13.4**	ULS 1a_0,9_0,9_69	466.6	508.3	664.6	0.03	
101B	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	74	**-150.4**	ULS 1a_69	423.6	506.7	777.6	0.36		**114.6**	ULS 1a_0,9_69	466.6	506.7	664.6	0.25	
102A	Leg	180x180x16#	S235	8M24-5.6t	0.50	0.50	0.50	54	**-394.5**	SPLS 3_69 Ah All Cts	1141.5	674.7	1658.9	0.58		**310.0**	SPLS 3_0,9_69 Ah All Cts	1220.3	674.7	1417.8	0.46	
102B	Leg	180x180x16#	S235	12M24-5.6t	0.50	0.50	0.50	57	**-444.4**	ULS 1a_69	1125.2	1005.5	2488.3	0.44		**328.6**	PLS 1a_0,9_90 Ah All Cts	1220.3	1005.5	2169.3	0.33	
103A	Leg	200x200x20	S235	16M24-5.6t	0.28	0.28	0.28	28	**-779.7**	SPLS 3_69 Ah All Cts	1750.2	1181.8	4147.2	0.66		**630.0**	SPLS 3_0,9_69 Ah All Cts	1710.7	1181.8	3544.6	0.53	
103B	Leg	200x200x20	S235	12M24-5.6t	0.28	0.28	0.28	35	**-989.3**	SPLS 3_69 Ah All Cts	1704.3	1987.7	3110.4	0.58		**833.5**	SPLS 3_0,9_69 Ah All Cts	1710.7	1987.7	2658.5	0.49	
104A	Leg	250x250x20#	S235	12M24-5.6t	0.28	0.28	0.28	34	**-1228.1**	SPLS 3_69 Ah All Cts	2172.1	1892.2	3110.4	0.65		**1051.2**	SPLS 3_0,9_69 Ah All Cts	2244.7	1892.2	2658.5	0.56	
104B	Leg	250x250x20#	S235	14M24-5.6t	0.55	0.55	0.55	37	**-1342.6**	SPLS 3_69 Ah All Cts	2149.3	2100.4	3628.8	0.64		**1156.1**	SPLS 3_0,9_69 Ah All Cts	2244.7	2100.4	3101.5	0.55	
105	Leg	250x250x22#	S235	14M24-5.6t	0.17	0.17	0.17	33	**-1367.4**	SPLS 3_69 Ah All Cts	2386.8	2100.4	3991.7	0.65		**1156.0**	SPLS 3_0,9_69 Ah All Cts	2453.6	2100.4	3411.7	0.55	
106A	Onderregel eerste dwarsarm	200x200x16	S235	12M24-5.6t	1.53	1.00	1.00	63	**-652.9**	SPLS 6a_90 Ba Ct2 Ah Ct2	1211.7	906.5	2488.3	0.72		**452.2**	SPLS 3_0,9_69 Ah Ct1	1386.2	906.5	2126.8	0.50	
106B	Onderregel eerste dwarsarm	200x200x16	S235	10M24-5.6t	7.64	1.00	1.00	74	**-350.9**	SPLS 6a_90 Ba Ct2 Ah Ct2	1128.4	847.2	2073.6	0.41		**230.6**	SPLS 3_0,9_69 Ah Ct1	1386.2	847.2	1772.3	0.27	
106C	Onderregel eerste dwarsarm	200x200x16	S235		2.88	1.77	1.00	62	**-585.2**	SPLS 6a_90 Ba Ct2 Ah Ct2	1220.6	0.0	0.0	0.48		**385.7**	SPLS 3_0,9_69 Ah Ct1	1452.3	0.0	0.0	0.27	
107A	Onderregel eerste dwarsarm	180x180x15#	S235	10M24-5.6t	2.78	1.00	1.00	83	**-320.9**	SPLS 6a_90 Ba Ct2 Ah Ct2	887.4	847.2	1944.0	0.38		**204.3**	SPLS 3_0,9_69 Ah Ct1	1144.0	847.2	1661.5	0.24	
107B	Onderregel eerste dwarsarm	180x180x15#	S235	2M20-5.6t	1.63	1.00	1.00	18	**-3.4**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**1.4**	ULS 1a_0,9_0,9_90	613.8	117.6	297.8	0.01	
107C	Onderregel eerste dwarsarm	180x180x15#	S235		18.24	1.00	1.00	83	**-306.4**	SPLS 6a_90 Ba Ct2 Ah Ct2	887.3	0.0	0.0	0.35		**184.8**	SPLS 3_0,9_69 Ah Ct1	1220.5	0.0	0.0	0.15	
108A	Onderregel tweede dwarsarm	180x180x15#	S235	12M24-5.6t	1.12	1.00	1.00	64	**-355.6**	SPLS 6a_90 Ba All Cts Ah Ct2	1011.2	2033.3	2332.8	0.35		**259.3**	SPLS 3_0,9_69 Ah All Cts	1144.0	2033.3	1814.4	0.23	
108B	Onderregel tweede dwarsarm	180x180x15#	S235	2M20-5.6t	1.00	1.50	1.00	19	**-0.3**	SPLS 1a_0,9_135 Ah All Cts	1220.5	117.6	324.0	0.00		**1.8**	ULS 1a_135	613.8	117.6	297.8	0.02	
108C	Onderregel tweede dwarsarm	180x180x15#	S235		2.77	1.70	1.00	65	**-316.0**	SPLS 6a_90 Ba All Cts Ah Ct2	1010.4	0.0	0.0	0.31		**213.1**	SPLS 3_0,9_69 Ah All Cts	1220.5	0.0	0.0	0.17	
111A	Bovenregel eerste dwarsarm	90x90x9	S235	3M24-5.6t	1.00	1.96	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**122.8**	ULS 3_135	205.3	254.2	299.1	0.60	
111B	Bovenregel eerste dwarsarm	90x90x9	S235	3M24-5.6t	1.00	2.04	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**92.2**	PLS 6a_90 Ba Ct1 Ah Ct2	205.3	254.2	299.1	0.45	
112A	Bovenregel eerste dwarsarm	75x75x7#	S235	3M24-5.6t	1.00	1.80	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**79.5**	PLS 6a_90 Ba Ct1 Ah Ct2	131.8	254.2	192.5	0.60	
112B	Bovenregel eerste dwarsarm	75x75x7#	S235	3M24-5.6t	1.00	2.25	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**79.6**	PLS 6a_90 Ba Ct1 Ah Ct2	131.8	254.2	192.5	0.60	
113A	Bovenregel tweede dwarsarm	120x120x13	S235	5M24-5.6t	1.59	1.00	1.00	101	**-197.2**	SPLS 6a_90 Ba All Cts Ah Ct1	355.8	423.6	842.4	0.55		**167.1**	S 6a_90 Ba All Cts Ah Ct2	418.7	423.6	703.2	0.40	
113B	Bovenregel tweede dwarsarm	120x120x13	S235	5M24-5.6t	1.40	1.00	1.00	102	**-180.3**	SPLS 6a_90 Ba All Cts Ah Ct1	373.5	423.6	842.4	0.48		**160.3**	S 6a_90 Ba All Cts Ah Ct2	602.4	423.6	720.0	0.38	
113C	Bovenregel tweede dwarsarm	120x120x13	S235		2.70	1.70	1.00	101	**-192.9**	SPLS 6a_90 Ba All Cts Ah Ct1	355.7	0.0	0.0	0.54		**167.8**	S 6a_90 Ba All Cts Ah Ct2	705.0	0.0	0.0	0.24	
114A	Bovenregel tweede dwarsarm	150x100x12	S235	5M24-5.6t	3.00	1.00	1.00	115	**-160.0**	SPLS 6a_90 Ba All Cts Ah Ct1	301.8	423.6	777.6	0.53		**167.1**	S 6a_90 Ba All Cts Ah Ct2	582.2	423.6	664.6	0.39	
114B	Bovenregel tweede dwarsarm	150x100x12	S235	4M24-5.6t	3.00	1.00	1.00	104	**-37.2**	SPLS 3_0,9_69 Ah All Cts	331.5	338.9	622.1	0.11		**31.5**	S 6a_90 Ba All Cts Ah Ct2	582.2	338.9	531.7	0.09	
114C	Bovenregel tweede dwarsarm	150x100x12	S235		3.00	1.00	1.00	115	**-145.1**	SPLS 6a_90 Ba All Cts Ah Ct1	301.8	0.0	0.0	0.48		**151.8**	S 6a_90 Ba All Cts Ah Ct2	674.5	0.0	0.0	0.23	
115A	Tussenregel tweede dwarsarm	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-26.6**	SPLS 6a_90 Ah Ct1 Ah Ct2	79.8	84.7	77.8	0.34		**9.6**	SPLS 1a_0,9_90 Ah Ct2	127.9	84.7	66.5	0.15	
115B	Tussenregel tweede dwarsarm	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-25.8**	SPLS 6a_90 Ah Ct1 Ah Ct2	71.0	84.7	77.8	0.36		**10.4**	SPLS 1a_0,9_90 Ah Ct2	127.9	84.7	66.5	0.16	
201L	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-36.9**	SPLS 1a_0,9_69 Ah Ct2	114.3	117.6	129.6	0.32		**31.5**	ULS 1a_90	145.4	117.6	104.7	0.30	
201T	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-18.6**	SPLS 6a_90 Ba Ct2 Ah Ct2	114.3	117.6	129.6	0.16		**8.8**	SPLS 1a_0,9_90 Ah Ct2	145.4	117.6	104.7	0.08	
202L	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-169.1**	SPLS 3_69 Ah Ct2	425.3	338.9	518.4	0.50		**124.2**	SPLS 3_0,9_90 Ah Ct1	384.5	338.9	350.9	0.37	
202T	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-119.7**	SPLS 3_0,9_90 Ah Ct1	425.3	338.9	518.4	0.35		**136.7**	SPLS 3_90 Ah Ct2	384.5	338.9	350.9	0.40	
203L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-114.2**	SPLS 3_0,9_90 Ah Ct1	406.7	338.9	518.4	0.34		**154.8**	SPLS 3_69 Ah Ct2	384.5	338.9	350.9	0.46	
203T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-124.1**	SPLS 3_90 Ah Ct2	406.7	338.9	518.4	0.37		**108.7**	SPLS 3_90 Ah Ct2	384.5	338.9	350.9	0.32	
204L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-169.9**	SPLS 3_0,9_69 Ah Ct2	386.8	338.9	518.4	0.50		**132.8**	SPLS 3_0,9_69 Ah Ct1	384.5	338.9	350.9	0.39	
204T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-152.5**	SPLS 3_90 Ah Ct1	386.8	338.9	518.4	0.45		**143.6**	SPLS 3_0,9_90 Ah Ct2	384.5	338.9	350.9	0.42	
205L	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-342.0**	SPLS 3_69 Ba Ct1	449.2	508.3	777.6	0.76		**335.8**	SPLS 3_69 Ba Ct2	384.5	508.3	513.8	0.87	
205T	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-313.0**	SPLS 3_0,9_90 Ah Ct2	449.2	508.3	777.6	0.70		**308.9**	SPLS 3_69 Ba Ct1	384.5	508.3	513.8	0.80	
206L	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-280.7**	SPLS 3_69 Ba Ct2	465.9	423.6	777.6	0.66		**281.1**	SPLS 3_69 Ba Ct1	456.2	423.6	518.8	0.66	
206T	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-255.5**	SPLS 3_69 Ba Ct1	465.9	423.6	777.6	0.60		**257.5**	SPLS 3_0,9_90 Ah Ct2	456.2	423.6	518.8	0.61	
207L	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-230.5**	SPLS 3_69 Ba Ct1	394.0	338.9	622.1	0.68		**227.6**	SPLS 3_69 Ba Ct2	456.2	338.9	421.1	0.67	
207T	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-211.9**	SPLS 3_0,9_69 Ba Ct2	394.0	338.9	622.1	0.63		**206.8**	SPLS 3_69 Ba Ct1	456.2	338.9	421.1	0.61	
208L	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-191.0**	SPLS 3_69 Ba Ct2	332.1	254.2	388.8	0.75		**188.8**	SPLS 3_69 Ba Ct1	384.5	254.2	269.2	0.74	
208T	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-174.7**	SPLS 3_69 Ba Ct1	332.1	254.2	388.8	0.69		**176.6**	SPLS 3_0,9_69 Ba Ct2	384.5	254.2	269.2	0.69	
209L	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-240.1**	SPLS 3_69 Ba Ct2	370.1	338.9	570.2	0.71		**226.4**	SPLS 3_0,9_69 Ba Ct1	356.4	338.9	475.6	0.67	
209T	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-227.7**	SPLS 3_69 Ba Ct1	370.1	338.9	570.2	0.67		**219.0**	SPLS 3_0,9_69 Ba Ct2	356.4	338.9	475.6	0.65	
210	Top	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	280	**-9.6**	SPLS 3_69 Ba Ct2	16.5	75.4	86.4	0.58		**9.6**	SPLS 3_0,9_69 Ba Ct2	52.4	75.4	44.1	0.22	
211L	Tweede dwarsarm in tower	100x100x6	S235	3M24-5.6t	1.00	1.00	1.00	132	**0.0**		113.1	254.2	233.3	0.00		**86.4**	ULS 6a_90 Ah Ct2	161.1	254.2	199.4	0.54	
211T	Tweede dwarsarm in tower	100x100x6	S235	2M24-5.6t	1.00	1.00	1.00	132	**-3.8**	ULS 1a_90	113.1	169.4	155.5	0.03		**2.6**	ULS 1a_0,9_90	206.4	169.4	132.9	0.02	
109L	Tweede dwarsarm in tower	180x180x15#	S235	12M24-5.6t	1.00	2.00	1.00	53	**-483.8**	SPLS 3_69 Ah All Cts	1075.9	2033.3	2332.8	0.45		**399.6**	SPLS 3_0,9_69 Ah All Cts	1144.0	2033.3	1814.4	0.35	
212T	Tweede dwarsarm in tower	100x100x6	S235	4M24-5.6t	1.00	2.00	1.00	95	**-38.2**	ULS 5a Ba 12	144.3	338.9	311.0	0.27		**52.3**	ULS 5a Ba 12	225.0	338.9	265.8	0.23	
213	Tweede dwarsarm in tower	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	86	**-59.5**	ULS 5a Ba 12	265.3	254.2	311.0	0.23		**60.0**	ULS 5a Ba 12	263.0	254.2	265.8	0.24	
214	Tweede dwarsarm in tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	300	**-0.6**	ULS 6a_90 Ah Ct2	11.8	37.7	43.2	0.05		**0.0**		37.4	37.7	22.0	0.00	
215L	Eerste dwarsarm in tower	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	178	**0.0**		103.8	254.2	311.0	0.00		**114.7**	S 6a_90 Ba All Cts Ah Ct2	270.5	254.2	265.8	0.45	
215T	Eerste dwarsarm in tower	100x100x8	S235	1M24-5.6t	1.00	1.00	1.00	178	**-51.7**	ULS 1a_0,9_90	83.1	84.7	103.7	0.62		**58.0**	ULS 1a_90	170.5	84.7	88.6	0.68	
110L	Eerste dwarsarm in tower	200x200x16	S235	12M24-5.6t	1.00	2.00	1.00	62	**-572.8**	SPLS 3_69 Ah All Cts	1222.1	906.5	2488.3	0.63		**412.5**	SPLS 3_0,9_69 Ah All Cts	1386.2	906.5	2126.8	0.46	
216T	Eerste dwarsarm in tower	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	124	**-111.7**	SPLS 3_0,9_69 Ba Ct2	151.1	338.9	414.7	0.74		**122.4**	SPLS 3_69 Ba Ct1	293.9	338.9	354.5	0.42	
217	Eerste dwarsarm in tower	120x120x11	S235	3M24-5.6t	1.00	1.00	1.00	114	**-153.6**	SPLS 3_0,9_69 Ba Ct2	286.0	254.2	427.7	0.60		**154.9**	SPLS 3_69 Ba Ct2	356.4	254.2	365.5	0.61	
218	Eerste dwarsarm in tower	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	325	**-0.5**	SPLS 6a_90 Ah Ct1 Ah Ct2	12.6	58.8	54.0	0.04		**0.0**		54.7	58.8	37.0	0.00	
219L	Onderstuk in tower	130x130x12#	S235	2M24-5.6t	1.00	1.00	1.00	157	**-48.3**	SPLS 3_69 Ah All Cts	235.2	169.4	311.0	0.29		**34.1**	SPLS 3_0,9_69 Ah All Cts	363.3	169.4	265.8	0.20	
219T	Onderstuk in tower	130x130x12#	S235	2M24-5.6t	1.00	1.00	1.00	157	**-52.4**	SPLS 3_69 Ah All Cts	235.2	169.4	311.0	0.31		**38.2**	SPLS 3_0,9_69 Ah All Cts	363.3	169.4	265.8	0.23	
220	Onderstuk in tower	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	311	**-5.5**	SPLS 1a_45 Ah Ct1	11.6	37.7	43.2	0.48		**4.7**	ULS 1a_0,9_0,9_135	60.5	37.7	32.0	0.15	
221	Onderstuk in tower	70x70x5#	S235	1M16-5.6t	0.50	1.00	0.50	370	**-1.0**	SPLS 3_69 Ba Ct2	10.0	37.7	43.2	0.10		**0.0**		74.9	37.7	32.0	0.00	
301	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	1M20-5.6t	0.55	0.55	0.55	123	**-55.0**	SPLS 3_69 Ah All Cts	129.7	58.8	86.4	0.94		**55.0**	SPLS 3_0,9_69 Ah All Cts	179.7	58.8	69.8	0.94	
302	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	110	**-69.7**	SPLS 3_0,9_69 Ah Ct1	180.9	117.6	172.8	0.59		**68.1**	SPLS 3_69 Ah Ct1	190.7	117.6	139.6	0.58	
303	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	92	**-62.2**	SPLS 3_0,9_69 Ah All Cts	208.7	117.6	172.8	0.53		**59.5**	SPLS 3_69 Ah All Cts	190.7	117.6	139.6	0.51	
304	Diagonaal onderregel eerste dwarsarm	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	104	**-80.1**	SPLS 3_69 Ah All Cts	143.2	117.6	129.6	0.68		**80.9**	SPLS 3_0,9_69 Ah All Cts	170.1	117.6	104.7	0.77	
305	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	92	**-43.0**	SPLS 3_69 Ah All Cts	101.8	84.7	77.8	0.55		**46.4**	SPLS 3_69 Ah All Cts	93.3	84.7	59.8	0.78	
306	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	84	**-23.5**	SPLS 3_69 Ah All Cts	107.6	84.7	77.8	0.30		**27.1**	SPLS 3_69 Ah All Cts	93.3	84.7	66.5	0.41	
307	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	0.55	0.55	0.55	96	**-31.7**	SPLS 6a_90 Ba Ct2 Ah Ct2	98.2	84.7	77.8	0.41		**26.8**	SPLS 3_0,9_69 Ah All Cts	93.3	84.7	59.8	0.45	
308	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	89	**-37.1**	SPLS 3_69 Ah All Cts	129.6	117.6	129.6	0.32		**37.4**	SPLS 3_0,9_69 Ah All Cts	115.9	117.6	104.7	0.36	
309	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-46.5**	SPLS 3_0,9_69 Ah All Cts	140.4	117.6	129.6	0.40		**45.1**	SPLS 3_69 Ah All Cts	124.8	117.6	104.7	0.43	
310	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	76	**-63.1**	SPLS 3_69 Ah All Cts	143.9	117.6	129.6	0.54		**62.1**	SPLS 3_0,9_69 Ah All Cts	136.2	117.6	104.7	0.59	
311	Diagonaal onderregel eerste dwarsarm	70x70x6	S235	1M24-5.6t	1.00	1.00	1.00	69	**-27.7**	SPLS 3_69 Ah All Cts	99.6	84.7	77.8	0.36		**28.2**	SPLS 3_0,9_69 Ah All Cts	76.0	84.7	55.0	0.51	
312	Diagonaal onderregel eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	82	**-3.1**	ULS 1a_0,9_0,9_90	55.5	37.7	43.2	0.08		**3.6**	ULS 3_0,9_90	37.4	37.7	25.7	0.14	
313	Dwarsligger onderregel eerste dwarsarm	HEA160	S235	2M20-5.6t	2.00	1.00	1.00	48	**-3.8**	SPLS 3_0,9_69 Ah Ct1	686.1	117.6	216.0	0.03		**7.7**	PLS 6a_90 Ba Ct2 Ah Ct2	766.1	117.6	0.0	0.07	
314	Dwarsligger onderregel eerste dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	82	**0.0**		314.6	117.6	259.2	0.00		**52.7**	ULS 3_69	278.4	117.6	259.2	0.45	
315	Dwarsligger onderregel eerste dwarsarm	HEA160	S235		1.00	1.00	1.00	26	**-1.7**	ULS 1a_0,9_0,9_69	789.3	0.0	0.0	0.00		**4.6**	ULS 3_69	916.5	0.0	0.0	0.01	
316	Dwarsligger onderregel eerste dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	37	**0.0**		426.4	117.6	259.2	0.00		**61.3**	ULS 3_69	278.4	117.6	259.2	0.52	
317	Dwarsligger onderregel eerste dwarsarm	HEA160	S235		1.00	1.00	1.00	13	**-10.5**	ULS 3_0,9_69	825.9	0.0	0.0	0.01		**0.0**		916.5	0.0	0.0	0.00	
318	Verticaal eerste dwarsarm	90x90x6#	S235	1M20-5.6t	1.00	1.00	1.00	168	**-18.1**	SPLS 6a_90 Ba All Cts Ah Ct2	61.1	58.8	64.8	0.31		**0.0**		117.5	58.8	52.4	0.00	
319	Verticaal eerste dwarsarm	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	190	**-5.5**	ULS 3_45	29.3	37.7	43.2	0.19		**0.0**		37.4	37.7	22.0	0.00	
320	Verticaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	94	**-1.0**	ULS 3_135	50.9	37.7	43.2	0.03		**0.0**		37.4	37.7	18.4	0.00	

DNV·GL

Assessment of groups for initial mast (afkeur level)

Date 17-05-21
Author KCh
Version 1.0

KIJ-GT 380
HC+0
15

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
321	Diagonaal eerste dwarsarm	50x50x6	S235	2M16-5.6t	1.00	1.00	1.00	580	**0.0**		5.7	75.4	103.7	0.00		**28.2**	ULS 1a_0	62.1	75.4	52.9	0.53	
322	Diagonaal eerste dwarsarm	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	415	**0.0**		12.4	117.6	129.6	0.00		**40.9**	S 6a_90 Ba All Cts Ah Ct2	77.4	117.6	88.7	0.53	
323	Diagonaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	516	**0.0**		4.7	37.7	43.2	0.00		**18.1**	ULS 1a_0	37.4	37.7	22.0	0.82	
324	Dwarsligger bovenregel eerste dwarsarm	65x50x5	S235	1M24-5.6t	1.00	1.00	1.00	220	**-3.1**	ULS 3_0,9_90	21.8	84.7	64.8	0.14		**0.0**		25.9	84.7	8.9	0.00	
325	Tussen diagonaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	171	**-0.3**	SPLS 1a_0 Ah All Cts	27.0	37.7	43.2	0.01		**4.0**	ULS 3_0,9_45	37.4	37.7	18.4	0.22	
401	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	110	**-32.2**	SPLS 3_69 Ah All Cts	123.3	117.6	129.6	0.27		**32.4**	SPLS 3_0,9_69 Ah All Cts	128.8	117.6	104.7	0.31	
402	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	102	**-38.5**	SPLS 3_0,9_69 Ah All Cts	132.3	117.6	129.6	0.33		**39.2**	SPLS 3_69 Ah Ct1	136.1	117.6	104.7	0.37	
403	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	98	**-48.9**	SPLS 3_69 Ah Ct1	136.1	117.6	129.6	0.42		**47.0**	SPLS 3_0,9_69 Ah All Cts	140.4	117.6	104.7	0.45	
404	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	90	**-51.3**	SPLS 3_69 Ah All Cts	129.0	117.6	129.6	0.44		**47.3**	SPLS 3_0,9_69 Ah All Cts	119.7	117.6	104.7	0.45	
405	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	81	**-59.2**	SPLS 3_69 Ah Ct1	138.2	117.6	129.6	0.50		**58.2**	SPLS 3_0,9_69 Ah All Cts	123.5	117.6	104.7	0.56	
406	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00	
407	Diagonaal onderregel tweede dwarsarm	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	83	**-3.9**	ULS 1a_0	79.3	58.8	64.8	0.07		**1.4**	ULS 1a_0,9_0,9_0	65.7	58.8	38.8	0.04	
408	Diagonaal onderregel tweede dwarsarm	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	78	**-2.2**	ULS 1a_135	81.4	58.8	64.8	0.04		**0.2**	SPLS 1a_0,9_0 Ba All Cts	65.7	58.8	38.8	0.01	
409	Dwarsligger onderregel tweede dwarsarm	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	51	**0.0**		700.0	117.6	216.0	0.00		**7.4**	ULS 3_90	766.1	117.6	0.0	0.06	
410	Dwarsligger onderregel tweede dwarsarm	100x100x12	S235	2M20-5.6t	1.00	1.00	1.00	72	**-11.3**	ULS 3_0,9_90	356.1	117.6	259.2	0.10		**0.9**	SPLS 1a_0,9_0 Ba Ct1	278.4	117.6	259.2	0.01	
411	Dwarsligger onderregel tweede dwarsarm	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	31	**0.0**		774.9	117.6	216.0	0.00		**1.5**	ULS 3_90	766.1	117.6	0.0	0.01	
412	Bovenregel tweede dwarsarm	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	306	**0.0**		56.1	254.2	311.0	0.00		**106.9**	ULS 3_90	263.0	254.2	265.8	0.42	
413	Bovenregel tweede dwarsarm	120x120x8	S235	3M24-5.6t	1.00	2.00	1.00	153	**-3.2**	SPLS 1a_0,9_69 Ah Ct2	145.4	254.2	311.0	0.02		**93.4**	PLS 6a_90 Ah Ct1 Ah Ct2	263.0	254.2	265.8	0.37	
414	Diagonaal bovenregel tweede dwarsarm	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	203	**-5.2**	SPLS 1a_0 Ba All Cts	25.4	37.7	51.8	0.21		**5.2**	SPLS 1a_0,9_0 Ba All Cts	44.9	37.7	26.5	0.20	
415	Diagonaal bovenregel tweede dwarsarm	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	189	**-5.2**	SPLS 1a_0 Ba All Cts	28.1	37.7	51.8	0.19		**5.0**	SPLS 1a_0 Ba All Cts	44.9	37.7	26.5	0.19	
416	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	179	**-6.1**	SPLS 1a_0 Ba All Cts	25.5	37.7	43.2	0.24		**6.1**	SPLS 1a_0,9_0 Ba All Cts	37.4	37.7	22.0	0.28	
417	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	146	**-9.8**	SPLS 6a_90 Ba All Cts Ah Ct2	33.1	37.7	43.2	0.30		**10.0**	S 6a_90 Ba All Cts Ah Ct2	37.4	37.7	22.0	0.45	
418	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	138	**-11.5**	SPLS 6a_90 Ba All Cts Ah Ct2	35.2	37.7	43.2	0.33		**11.2**	S 6a_90 Ba All Cts Ah Ct2	37.4	37.7	22.0	0.51	
419	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	134	**-14.3**	SPLS 6a_90 Ba All Cts Ah Ct2	36.6	37.7	43.2	0.39		**14.3**	S 6a_90 Ba All Cts Ah Ct2	37.4	37.7	22.0	0.65	
420	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	96	**-16.3**	SPLS 6a_90 Ba All Cts Ah Ct2	60.6	58.8	54.0	0.30		**16.5**	S 6a_90 Ba All Cts Ah Ct2	54.7	58.8	32.4	0.51	
421	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	93	**-22.0**	SPLS 6a_90 Ba All Cts Ah Ct2	62.4	58.8	54.0	0.41		**21.1**	S 6a_90 Ba All Cts Ah Ct2	54.7	58.8	32.4	0.65	
422	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	88	**-27.3**	SPLS 6a_90 Ba All Cts Ah Ct2	64.7	58.8	54.0	0.51		**28.9**	S 6a_90 Ba All Cts Ah Ct2	54.7	58.8	37.0	0.78	
423	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-1.2**	SPLS 3_0,9_69 Ba Ct2	50.8	37.7	43.2	0.03		**3.6**	PLS 6a_90 Ah Ct2 Ah Ct1	37.4	37.7	22.0	0.16	
424	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**0.0**		25.2	37.7	43.2	0.00		**8.4**	PLS 6a_90 Ah Ct1 Ah Ct2	37.4	37.7	22.0	0.38	
425	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	314	**-3.1**	SPLS 1a_69 Ba Ct1	11.0	37.7	43.2	0.28		**0.0**		37.4	37.7	22.0	0.00	
426	Diagonaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	346	**-10.9**	SPLS 6a_90 Ah Ct2 Ah Ct1	9.4	37.7	43.2	1.16	knik	**1.1**	SPLS 3_0,9_69 Ba Ct2	37.4	37.7	22.0	0.05	
427	Diagonaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	266	**0.0**		14.3	37.7	43.2	0.00		**0.9**	ULS 1a_69	37.4	37.7	22.0	0.04	
428	Dwarsligger bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	196	**-0.4**	ULS 1a_0,9_90	22.5	37.7	43.2	0.02		**0.6**	ULS 1a_90	37.4	37.7	22.0	0.03	
429	Dwarsligger bovenregel tweede dwarsarm	UNP160	S235	1M16-5.6t	1.00	1.00	1.00	42	**0.0**		288.7	37.7	64.8	0.00		**27.5**	ULS 3_0,9_90	90.7	37.7	48.0	0.73	
430	Dwarsligger ladder tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	112	**0.0**	SPLS 1a_135 Ah All Cts	44.1	37.7	43.2	0.00		**0.0**	SPLS 3_0,9_0 Ah Ct2	37.4	37.7	22.0	0.00	

Assessment of groups for strenghtened mast (afkeur level)

Date 17-05-21
Author KCh
Version 1.0

KIJ-GT 380
HC+0
15

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
101A	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	85	**-49.2**	ULS 1a_69	390.5	508.3	777.6	0.13		**13.3**	ULS 1a_0,9_0,9_69	466.6	508.3	664.6	0.03
101B	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	74	**-150.4**	ULS 1a_69	423.6	506.7	777.6	0.36		**114.5**	ULS 1a_0,9_69	466.6	506.7	664.6	0.25
102A	Leg	180x180x16#	S235	8M24-5.6t	0.50	0.50	0.50	54	**-394.6**	SPLS 3_69 Ah All Cts	1141.5	674.7	1658.9	0.58		**310.0**	SPLS 3_0,9_69 Ah All (	1220.3	674.7	1417.8	0.46
102B	Leg	180x180x16#	S235	12M24-5.6t	0.50	0.50	0.50	57	**-444.4**	ULS 1a_69	1125.2	1005.5	2488.3	0.44		**328.6**	SPLS 1a_0,9_90 Ah All	1220.3	1005.5	2169.3	0.33
103A	Leg	200x200x20	S235	16M24-5.6t	0.28	0.28	0.28	28	**-779.7**	SPLS 3_69 Ah All Cts	1750.2	1181.8	4147.2	0.66		**629.9**	SPLS 3_0,9_69 Ah All (	1710.7	1181.8	3544.6	0.53
103B	Leg	200x200x20	S235	12M24-5.6t	0.28	0.28	0.28	35	**-989.3**	SPLS 3_69 Ah All Cts	1704.3	1987.7	3110.4	0.58		**833.5**	SPLS 3_0,9_69 Ah All (	1710.7	1987.7	2658.5	0.49
104A	Leg	250x250x20#	S235	12M24-5.6t	0.28	0.28	0.28	34	**-1228.1**	SPLS 3_69 Ah All Cts	2172.1	1892.2	3110.4	0.65		**1051.1**	SPLS 3_0,9_69 Ah All (	2244.7	1892.2	2658.5	0.56
104B	Leg	250x250x20#	S235	14M24-5.6t	0.55	0.55	0.55	37	**-1342.6**	SPLS 3_69 Ah All Cts	2149.3	2100.4	3628.8	0.64		**1156.1**	SPLS 3_0,9_69 Ah All (	2244.7	2100.4	3101.5	0.55
105	Leg	250x250x22#	S235	14M24-5.6t	0.17	0.17	0.17	33	**-1367.4**	SPLS 3_69 Ah All Cts	2386.8	2100.4	3991.7	0.65		**1156.0**	SPLS 3_0,9_69 Ah All (	2453.6	2100.4	3411.7	0.55
106A	Onderregel eers	200x200x16	S235	12M24-5.6t	1.53	1.00	1.00	63	**-652.9**	SPLS 6a_90 Ba Ct2 Ah	1211.7	906.5	2488.3	0.72		**452.2**	SPLS 3_0,9_69 Ah Ct1	1386.2	906.5	2126.8	0.50
106B	Onderregel eers	200x200x16	S235	10M24-5.6t	7.64	1.00	1.00	74	**-350.9**	SPLS 6a_90 Ba Ct2 Ah	1128.4	847.2	2073.6	0.41		**230.6**	SPLS 3_0,9_69 Ah Ct1	1386.2	847.2	1772.3	0.27
106C	Onderregel eers	200x200x16	S235		2.88	1.77	1.00	62	**-585.2**	SPLS 6a_90 Ba Ct2 Ah	1220.6	0.0	0.0	0.48		**385.7**	SPLS 3_0,9_69 Ah Ct1	1452.3	0.0	0.0	0.27
107A	Onderregel eers	180x180x15#	S235	10M24-5.6t	2.78	1.00	1.00	83	**-320.9**	SPLS 6a_90 Ba Ct2 Ah	887.4	847.2	1944.0	0.38		**204.3**	SPLS 3_0,9_69 Ah Ct1	1144.0	847.2	1661.5	0.24
107B	Onderregel eers	180x180x15#	S235	2M20-5.6t	1.63	1.00	1.00	18	**-3.4**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**1.4**	ULS 1a_0,9_0,9_90	613.8	117.6	297.8	0.01
107C	Onderregel eers	180x180x15#	S235		18.24	1.00	1.00	83	**-306.4**	SPLS 6a_90 Ba Ct2 Ah	887.3	0.0	0.0	0.35		**184.8**	SPLS 3_0,9_69 Ah Ct1	1220.5	0.0	0.0	0.15
108A	Onderregel twe	180x180x15#	S235	12M24-5.6t	1.12	1.00	1.00	64	**-355.5**	SPLS 6a_90 Ba All Cts	1011.2	2033.3	2332.8	0.35		**259.3**	SPLS 3_0,9_69 Ah All (	1144.0	2033.3	1814.4	0.23
108B	Onderregel twe	180x180x15#	S235	2M20-5.6t	1.00	1.50	1.00	19	**-0.3**	SPLS 1a_0,9_135 Ah A	1220.5	117.6	324.0	0.00		**1.8**	ULS 1a_135	613.8	117.6	297.8	0.02
108C	Onderregel twe	180x180x15#	S235		2.77	1.70	1.00	65	**-315.9**	SPLS 6a_90 Ba All Cts	1010.4	0.0	0.0	0.31		**213.1**	SPLS 3_0,9_69 Ah All (	1220.5	0.0	0.0	0.17
111A	Bovenregel eers	90x90x9	S235	3M24-5.6t	1.00	1.96	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**122.8**	ULS 3_135	205.3	254.2	299.1	0.60
111B	Bovenregel eers	90x90x9	S235	3M24-5.6t	1.00	2.04	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**92.2**	SPLS 6a_90 Ba Ct1 Ah	205.3	254.2	299.1	0.45
112A	Bovenregel eers	75x75x7#	S235	3M24-5.6t	1.00	1.80	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**79.5**	SPLS 6a_90 Ba Ct1 Ah	131.8	254.2	192.5	0.60
112B	Bovenregel eers	75x75x7#	S235	3M24-5.6t	1.00	2.25	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**79.6**	SPLS 6a_90 Ba Ct1 Ah	131.8	254.2	192.5	0.60
113A	Bovenregel twe	120x120x13	S235	5M24-5.6t	1.59	1.00	1.00	101	**-197.4**	SPLS 6a_90 Ba All Cts	355.8	423.6	842.4	0.55		**166.8**	SPLS 6a_90 Ba All Cts	418.7	423.6	703.2	0.40
113B	Bovenregel twe	120x120x13	S235	5M24-5.6t	1.40	1.00	1.00	102	**-180.3**	SPLS 6a_90 Ba All Cts	373.5	423.6	842.4	0.48		**160.3**	SPLS 6a_90 Ba All Cts	602.4	423.6	720.0	0.38
113C	Bovenregel twe	120x120x13	S235		2.70	1.70	1.00	101	**-193.1**	SPLS 6a_90 Ba All Cts	355.7	0.0	0.0	0.54		**167.8**	SPLS 6a_90 Ba All Cts	705.0	0.0	0.0	0.24
114A	Bovenregel twe	150x100x12	S235	5M24-5.6t	3.00	1.00	1.00	115	**-160.0**	SPLS 6a_90 Ba All Cts	301.8	423.6	777.6	0.53		**167.1**	SPLS 6a_90 Ba All Cts	582.2	423.6	664.6	0.39
114B	Bovenregel twe	150x100x12	S235	4M24-5.6t	3.00	1.00	1.00	104	**-37.2**	SPLS 3_0,9_69 Ah All (	331.5	338.9	622.1	0.11		**31.6**	SPLS 6a_90 Ba All Cts	582.2	338.9	531.7	0.09
114C	Bovenregel twe	150x100x12	S235		3.00	1.00	1.00	115	**-145.1**	SPLS 6a_90 Ba All Cts	301.8	0.0	0.0	0.48		**151.8**	SPLS 6a_90 Ba All Cts	674.5	0.0	0.0	0.23
115A	Tussenregel tw	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-26.6**	SPLS 6a_90 Ah Ct1 Ah	79.8	84.7	77.8	0.34		**9.6**	SPLS 1a_0,9_90 Ah Ct	127.9	84.7	66.5	0.14
115B	Tussenregel tw	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-25.8**	SPLS 6a_90 Ah Ct1 Ah	71.0	84.7	77.8	0.36		**10.4**	SPLS 1a_0,9_90 Ah Ct	127.9	84.7	66.5	0.16
201L	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-36.9**	SPLS 1a_0,9_69 Ah Ct	114.3	117.6	129.6	0.32		**31.5**	ULS 1a_90	145.4	117.6	104.7	0.30
201T	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-18.6**	SPLS 6a_90 Ba Ct2 Ah	114.3	117.6	129.6	0.16		**8.8**	SPLS 1a_0,9_90 Ah Ct	145.4	117.6	104.7	0.08
202L	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-169.1**	SPLS 3_69 Ah Ct2	425.3	338.9	518.4	0.50		**124.2**	SPLS 3_0,9_90 Ah Ct1	384.5	338.9	350.9	0.37
202T	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-119.7**	SPLS 3_0,9_90 Ah Ct1	425.3	338.9	518.4	0.35		**136.7**	SPLS 3_90 Ah Ct2	384.5	338.9	350.9	0.40
203L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-114.2**	SPLS 3_0,9_90 Ah Ct1	406.7	338.9	518.4	0.34		**154.8**	SPLS 3_69 Ah Ct2	384.5	338.9	350.9	0.46
203T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-124.1**	SPLS 3_90 Ah Ct2	406.7	338.9	518.4	0.37		**108.7**	SPLS 3_90 Ah Ct2	384.5	338.9	350.9	0.32
204L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-169.9**	SPLS 3_0,9_69 Ah Ct2	386.8	338.9	518.4	0.50		**132.8**	SPLS 3_0,9_69 Ah Ct1	384.5	338.9	350.9	0.39
204T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-152.5**	SPLS 3_90 Ah Ct1	386.8	338.9	518.4	0.45		**143.6**	SPLS 3_0,9_90 Ah Ct2	384.5	338.9	350.9	0.42
205L	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-342.0**	SPLS 3_69 Ba Ct1	449.2	508.3	777.6	0.76		**335.8**	SPLS 3_69 Ba Ct2	384.5	508.3	513.8	0.87
205T	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-313.0**	SPLS 3_0,9_90 Ah Ct2	449.2	508.3	777.6	0.70		**308.9**	SPLS 3_69 Ba Ct1	384.5	508.3	513.8	0.80
206L	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-280.7**	SPLS 3_69 Ba Ct2	465.9	423.6	777.6	0.66		**281.1**	SPLS 3_69 Ba Ct1	456.2	423.6	518.8	0.66
206T	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-255.5**	SPLS 3_69 Ba Ct1	465.9	423.6	777.6	0.60		**257.5**	SPLS 3_0,9_90 Ah Ct2	456.2	423.6	518.8	0.61
207L	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-230.5**	SPLS 3_69 Ba Ct1	394.0	338.9	622.1	0.68		**227.6**	SPLS 3_69 Ba Ct2	456.2	338.9	421.1	0.67
207T	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-211.9**	SPLS 3_0,9_69 Ba Ct2	394.0	338.9	622.1	0.63		**206.8**	SPLS 3_69 Ba Ct1	456.2	338.9	421.1	0.61
208L	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-191.1**	SPLS 3_69 Ba Ct2	332.1	254.2	388.8	0.75		**188.8**	SPLS 3_69 Ba Ct1	384.5	254.2	269.2	0.74
208T	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-174.7**	SPLS 3_69 Ba Ct1	332.1	254.2	388.8	0.69		**176.6**	SPLS 3_0,9_69 Ba Ct2	384.5	254.2	269.2	0.69
209L	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-240.1**	SPLS 3_69 Ba Ct2	370.1	338.9	570.2	0.71		**226.4**	SPLS 3_0,9_69 Ba Ct1	356.4	338.9	475.6	0.67
209T	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-227.7**	SPLS 3_69 Ba Ct1	370.1	338.9	570.2	0.67		**219.0**	SPLS 3_0,9_69 Ba Ct2	356.4	338.9	475.6	0.65
210	Top	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	280	**-9.6**	SPLS 3_69 Ba Ct2	16.5	75.4	86.4	0.58		**9.6**	SPLS 3_0,9_69 Ba Ct2	52.4	75.4	44.1	0.22
211L	Tweede dwarsa	100x100x6	S235	3M24-5.6t	1.00	1.00	1.00	132	**0.0**		113.1	254.2	233.3	0.00		**86.5**	ULS 6a_90 Ah Ct2	161.1	254.2	199.4	0.54
211T	Tweede dwarsa	100x100x6	S235	2M24-5.6t	1.00	1.00	1.00	132	**-3.8**	ULS 1a_90	113.1	169.4	155.5	0.03		**2.6**	ULS 1a_0,9_90	206.4	169.4	132.9	0.02
109L	Tweede dwarsa	180x180x15#	S235	12M24-5.6t	1.00	2.00	1.00	53	**-483.9**	SPLS 3_69 Ah All Cts	1075.9	2033.3	2332.8	0.45		**399.5**	SPLS 3_0,9_69 Ah All (	1144.0	2033.3	1814.4	0.35
212T	Tweede dwarsa	100x100x6	S235	4M24-5.6t	1.00	2.00	1.00	95	**-38.2**	ULS 5a Ba 12	144.3	338.9	311.0	0.26		**52.3**	ULS 5a Ba 12	225.0	338.9	265.8	0.23
213	Tweede dwarsa	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	86	**-59.5**	ULS 5a Ba 12	265.3	254.2	311.0	0.23		**60.0**	ULS 5a Ba 12	263.0	254.2	265.8	0.24
214	Tweede dwarsa	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	300	**-0.6**	ULS 6a_90 Ah Ct2	11.8	37.7	43.2	0.05		**0.0**		37.4	37.7	22.0	0.00
215L	Eerste dwarsarr	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	178	**0.0**		103.8	254.2	311.0	0.00		**114.7**	SPLS 6a_90 Ba All Cts	270.5	254.2	265.8	0.45
215T	Eerste dwarsarr	100x100x8	S235	1M24-5.6t	1.00	1.00	1.00	178	**-51.7**	ULS 1a_0,9_90	83.1	84.7	103.7	0.62		**58.0**	ULS 1a_90	170.5	84.7	88.6	0.68
110L	Eerste dwarsarr	200x200x16	S235	12M24-5.6t	1.00	2.00	1.00	62	**-572.8**	SPLS 3_69 Ah All Cts	1222.1	906.5	2488.3	0.63		**412.5**	SPLS 3_0,9_69 Ah All (	1386.2	906.5	2126.8	0.46
216T	Eerste dwarsarr	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	124	**-111.7**	SPLS 3_0,9_69 Ba Ct2	151.1	338.9	414.7	0.74		**122.4**	SPLS 3_69 Ba Ct1	293.9	338.9	354.5	0.42
217	Eerste dwarsarr	120x120x11	S235	3M24-5.6t	1.00	1.00	1.00	114	**-153.6**	SPLS 3_0,9_69 Ba Ct2	286.0	254.2	427.7	0.60		**154.9**	SPLS 3_69 Ba Ct2	356.4	254.2	365.5	0.61
218	Eerste dwarsarr	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	325	**-0.5**	SPLS 6a_90 Ah Ct1 Ah	12.6	58.8	54.0	0.04		**0.0**		54.7	58.8	37.0	0.00
219L	Onderstuk in to	130x130x12#	S235	2M24-5.6t	1.00	1.00	1.00	157	**-48.3**	SPLS 3_69 Ah All Cts	235.2	169.4	311.0	0.29		**34.1**	SPLS 3_0,9_69 Ah All (	363.3	169.4	265.8	0.20
219T	Onderstuk in to	130x130x12#	S235	2M24-5.6t	1.00	1.00	1.00	157	**-52.4**	SPLS 3_69 Ah All Cts	235.2	169.4	311.0	0.31		**38.2**	SPLS 3_0,9_69 Ah All (	363.3	169.4	265.8	0.23
220	Onderstuk in to	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	311	**-5.5**	SPLS 1a_45 Ah Ct1	11.6	37.7	43.2	0.48		**4.7**	ULS 1a_0,9_0,9_135	60.5	37.7	32.0	0.15
221	Onderstuk in to	70x70x5#	S235	1M16-5.6t	0.50	1.00	0.50	370	**-1.0**	SPLS 3_69 Ba Ct2	10.0	37.7	43.2	0.10		**0.0**		74.9	37.7	32.0	0.00
301	Diagonaal onde	100x100x8	S235	1M20-5.6t	0.55	0.55	0.55	123	**-55.0**	SPLS 3_69 Ah All Cts	129.7	58.8	86.4	0.94		**55.0**	SPLS 3_0,9_69 Ah All (	179.7	58.8	69.8	0.94
302	Diagonaal onde	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	110	**-69.7**	SPLS 3_0,9_69 Ah Ct1	180.9	117.6	172.8	0.59		**68.1**	SPLS 3_69 Ah Ct1	190.7	117.6	139.6	0.58
303	Diagonaal onde	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	92	**-62.2**	SPLS 3_0,9_69 Ah All (	208.7	117.6	172.8	0.53		**59.5**	SPLS 3_69 Ah All Cts	190.7	117.6	139.6	0.51
304	Diagonaal onde	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	104	**-80.1**	SPLS 3_69 Ah All Cts	143.2	117.6	129.6	0.68		**80.9**	SPLS 3_0,9_69 Ah All (	170.1	117.6	104.7	0.77
305	Diagonaal onde	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	92	**-43.0**	SPLS 3_69 Ah All Cts	101.8	84.7	77.8	0.55		**46.4**	SPLS 3_69 Ah All Cts	93.3	84.7	59.8	0.78
306	Diagonaal onde	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	84	**-23.5**	SPLS 3_69 Ah All Cts	107.6	84.7	77.8	0.30		**27.1**	SPLS 3_69 Ah All Cts	93.3	84.7	66.5	0.41
307	Diagonaal onde	80x80x6#	S235	1M24-5.6t	0.55	0.55	0.55	96	**-31.7**	SPLS 6a_90 Ba Ct2 Ah	98.2	84.7	77.8	0.41		**26.8**	SPLS 3_0,9_69 Ah All (	93.3	84.7	59.8	0.45
308	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	89	**-37.1**	SPLS 3_69 Ah All Cts	129.6	117.6	129.6	0.32		**37.4**	SPLS 3_0,9_69 Ah All (	115.9	117.6	104.7	0.36
309	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-46.5**	SPLS 3_0,9_69 Ah All (	140.4	117.6	129.6	0.40		**45.1**	SPLS 3_69 Ah All Cts	124.8	117.6	104.7	0.43
310	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	76	**-63.1**	SPLS 3_69 Ah All Cts	143.9	117.6	129.6	0.54		**62.1**	SPLS 3_0,9_69 Ah All (	136.2	117.6	104.7	0.59
311	Diagonaal onde	70x70x6	S235	1M24-5.6t	1.00	1.00	1.00	69	**-27.7**	SPLS 3_69 Ah All Cts	99.6	84.7	77.8	0.36		**28.2**	SPLS 3_0,9_69 Ah All (	76.0	84.7	55.0	0.51
312	Diagonaal onde	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	82	**-3.1**	ULS 1a_0,9_0,9_90	55.5	37.7	43.2	0.08		**3.6**	ULS 3_0,9_90	37.4	37.7	25.7	0.14
313	Dwarsligger onc	HEA160	S235	2M20-5.6t	2.00	1.00	1.00	48	**-3.8**	SPLS 3_0,9_69 Ah Ct1	686.1	117.6	216.0	0.03		**7.7**	SPLS 6a_90 Ba Ct2 Ah	766.1	117.6	0.0	0.07
314	Dwarsligger onc	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	82	**0.0**		314.6	117.6	259.2	0.00		**52.7**	ULS 3_69	278.4	117.6	259.2	0.45
315	Dwarsligger onc	HEA160	S235		1.00	1.00	1.00	26	**-1.7**	ULS 1a_0,9_0,9_69	789.3	0.0	0.0	0.00		**4.6**	ULS 3_69	916.5	0.0	0.0	0.01
316	Dwarsligger onc	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	37	**0.0**		426.4	117.6	259.2	0.00		**61.3**	ULS 3_69	278.4	117.6	259.2	0.52

Assessment of groups for strengthened mast (afkeur level)

Date 17-05-21
Author KCh
Version 1.0

KIJ-GT 380
HC+0
15

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
317	Dwarsligger onc	HEA160	S235		1.00	1.00	1.00	13	**-10.5**	ULS 3_0,9_69	825.9	0.0	0.0	0.01		**0.0**		916.5	0.0	0.0	0.00
318	Verticaal eerste	90x90x6#	S235	1M20-5.6t	1.00	1.00	1.00	168	**-18.1**	SPLS 6a_90 Ba All Cts	61.1	58.8	64.8	0.31		**0.0**		117.5	58.8	52.4	0.00
319	Verticaal eerste	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	190	**-5.5**	ULS 3_45	29.3	37.7	43.2	0.19		**0.0**		37.4	37.7	22.0	0.00
320	Verticaal eerste	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	94	**-1.0**	ULS 3_135	50.9	37.7	43.2	0.03		**0.0**		37.4	37.7	18.4	0.00
321	Diagonaal eerst	50x50x6	S235	2M16-5.6t	1.00	1.00	1.00	580	**0.0**		5.7	75.4	103.7	0.00		**28.2**	ULS 1a_0	62.1	75.4	52.9	0.53
322	Diagonaal eerst	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	415	**0.0**		12.4	117.6	129.6	0.00		**40.9**	SPLS 6a_90 Ba All Cts	77.4	117.6	88.7	0.53
323	Diagonaal eerst	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	516	**0.0**		4.7	37.7	43.2	0.00		**18.1**	ULS 1a_0	37.4	37.7	22.0	0.82
324	Dwarsligger bov	65x50x5	S235	1M24-5.6t	1.00	1.00	1.00	220	**-3.1**	ULS 3_0,9_90	21.8	84.7	64.8	0.14		**0.0**		25.9	84.7	8.9	0.00
325	Tussen diagona	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	171	**-0.3**	SPLS 1a_0 Ah All Cts	27.0	37.7	43.2	0.01		**4.0**	ULS 3_0,9_45	37.4	37.7	18.4	0.22
401	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	110	**-32.2**	SPLS 3_69 Ah All Cts	123.3	117.6	129.6	0.27		**32.4**	SPLS 3_0,9_69 Ah All (	128.8	117.6	104.7	0.31
402	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	102	**-38.5**	SPLS 3_0,9_69 Ah All (	132.3	117.6	129.6	0.33		**39.2**	SPLS 3_69 Ah Ct1	136.1	117.6	104.7	0.37
403	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	98	**-48.9**	SPLS 3_69 Ah Ct1	136.1	117.6	129.6	0.42		**47.0**	SPLS 3_0,9_69 Ah All (	140.4	117.6	104.7	0.45
404	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	90	**-51.3**	SPLS 3_69 Ah All Cts	129.0	117.6	129.6	0.44		**47.3**	SPLS 3_0,9_69 Ah All (	119.7	117.6	104.7	0.45
405	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	81	**-59.2**	SPLS 3_69 Ah Ct1	138.2	117.6	129.6	0.50		**58.2**	SPLS 3_0,9_69 Ah All (	123.5	117.6	104.7	0.56
406	Diagonaal onde	80x80x6#	S235		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
407	Diagonaal onde	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	83	**-3.9**	ULS 1a_0	79.3	58.8	64.8	0.07		**1.4**	ULS 1a_0,9_0,9_0	65.7	58.8	38.8	0.04
408	Diagonaal onde	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	78	**-2.2**	ULS 1a_135	81.4	58.8	64.8	0.04		**0.2**	SPLS 1a_0,9_0 Ba All (	65.7	58.8	38.8	0.01
409	Dwarsligger onc	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	51	**0.0**		700.0	117.6	216.0	0.00		**7.4**	ULS 3_90	766.1	117.6	0.0	0.06
410	Dwarsligger onc	100x100x12	S235	2M20-5.6t	1.00	1.00	1.00	72	**-11.3**	ULS 3_0,9_90	356.1	117.6	259.2	0.10		**0.9**	SPLS 1a_0,9_0 Ba Ct1	278.4	117.6	259.2	0.01
411	Dwarsligger onc	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	31	**0.0**		774.9	117.6	216.0	0.00		**1.5**	ULS 3_90	766.1	117.6	0.0	0.01
412	Bovenregel twe	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	306	**0.0**		56.1	254.2	311.0	0.00		**107.0**	ULS 3_90	263.0	254.2	265.8	0.42
413	Bovenregel twe	120x120x8	S235	3M24-5.6t	1.00	2.00	1.00	153	**-3.1**	SPLS 1a_0,9_69 Ah Ct1	145.4	254.2	311.0	0.02		**93.5**	SPLS 6a_90 Ah Ct1 Ah	263.0	254.2	265.8	0.37
414	Diagonaal bove	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	203	**-5.2**	SPLS 1a_0 Ba All Cts	25.4	37.7	51.8	0.21		**5.2**	SPLS 1a_0,9_0 Ba All (	44.9	37.7	26.5	0.20
415	Diagonaal bove	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	189	**-5.2**	SPLS 1a_0 Ba All Cts	28.1	37.7	51.8	0.19		**5.0**	SPLS 1a_0 Ba All Cts	44.9	37.7	26.5	0.19
416	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	179	**-6.1**	SPLS 1a_0 Ba All Cts	25.5	37.7	43.2	0.24		**6.1**	SPLS 1a_0,9_0 Ba All (	37.4	37.7	22.0	0.28
417	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	146	**-9.8**	SPLS 6a_90 Ba All Cts	33.1	37.7	43.2	0.30		**10.0**	SPLS 6a_90 Ba All Cts	37.4	37.7	22.0	0.45
418	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	138	**-11.5**	SPLS 6a_90 Ba All Cts	35.2	37.7	43.2	0.33		**11.2**	SPLS 6a_90 Ba All Cts	37.4	37.7	22.0	0.51
419	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	134	**-14.3**	SPLS 6a_90 Ba All Cts	36.6	37.7	43.2	0.39		**14.3**	SPLS 6a_90 Ba All Cts	37.4	37.7	22.0	0.65
420	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	96	**-16.3**	SPLS 6a_90 Ba All Cts	60.6	58.8	54.0	0.30		**16.5**	SPLS 6a_90 Ba All Cts	54.7	58.8	32.4	0.51
421	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	93	**-22.0**	SPLS 6a_90 Ba All Cts	62.4	58.8	54.0	0.41		**21.1**	SPLS 6a_90 Ba All Cts	54.7	58.8	32.4	0.65
422	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	88	**-27.3**	SPLS 6a_90 Ba All Cts	64.7	58.8	54.0	0.51		**28.9**	SPLS 6a_90 Ba All Cts	54.7	58.8	37.0	0.78
423	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-1.2**	SPLS 3_0,9_69 Ba Ct2	50.8	37.7	43.2	0.03		**3.8**	SPLS 6a_90 Ah Ct2 Ah	37.4	37.7	22.0	0.17
424	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**0.0**		25.2	37.7	43.2	0.00		**8.4**	SPLS 6a_90 Ah Ct1 Ah	37.4	37.7	22.0	0.38
425	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	314	**-3.1**	SPLS 1a_69 Ba Ct1	11.0	37.7	43.2	0.28		**0.0**		37.4	37.7	22.0	0.00
426	Diagonaal twee	**50x50x7**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	353	**-11.4**	SPLS 6a_90 Ah Ct2 Ah	13.2	60.3	82.3	0.86		**1.1**	SPLS 3_0,9_69 Ba Ct2	71.3	60.3	42.0	0.03
427	Diagonaal twee	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	266	**0.0**		14.3	37.7	43.2	0.00		**0.9**	ULS 1a_69	37.4	37.7	22.0	0.04
428	Dwarsligger bov	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	196	**-0.4**	ULS 1a_0,9_90	22.5	37.7	43.2	0.02		**0.6**	ULS 1a_90	37.4	37.7	22.0	0.03
429	Dwarsligger bov	UNP160	S235	1M16-5.6t	1.00	1.00	1.00	42	**0.0**		288.7	37.7	64.8	0.00		**27.5**	ULS 3_0,9_90	90.7	37.7	48.0	0.73
430	Dwarsligger lad	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	112	**0.0**	SPLS 1a_135 Ah All Cts	44.1	37.7	43.2	0.00		**0.0**	SPLS 3_0,9_0 Ah Ct2	37.4	37.7	22.0	0.00
431	431	**120x120x12**	S355	2M24-8.8t	1.00	1.00	1.00	69	**0.0**		593.3	271.1	423.4	0.00		**43.4**	43.406	ULS 3_90	448.4	423.4	0.16
432	432	**120x120x12**	S355	2M24-8.8t	2.00	2.00	2.00	64	**0.0**		621.2	271.1	423.4	0.00		**77.0**	77.036	ULS 3_69	448.4	423.4	0.28
433	433	**70x70x7**	S355	2M20-8.8t	1.00	1.00	1.00	89	**-42.3**	SPLS 3_69 Ah Ct1	165.8	188.2	205.8	0.26		**37.8**	37.795	SPLS 3_0,9_6	131.6	180.9	0.29
434	434	**60x60x6**	S355	1M20-8.8t	0.52	0.52	0.52	74	**-2.9**	SPLS 1a_0 Ah Ct1	113.3	94.1	88.2	0.03		**6.0**	6.004	ULS 1a_0,9_4	112.9	80.2	0.07
435	435	**80x80x8**	S355	2M20-8.8t	1.00	1.00	1.00	182	**-24.3**	SPLS 6a_90 Ba All Cts	90.3	188.2	235.2	0.27		**0.0**		0.0	165.3	135.4	0.00
436	436	**60x60x6**	S355	1M20-8.8t	1.00	1.00	1.00	75	**0.0**		112.7	94.1	88.2	0.00		**13.6**	13.559	SPLS 6a_90 E	89.4	60.4	0.22

Notes:
1) Groups 431 to 436 were added to enable the conductor attachment position on the upper crossarm to be moved 1.5m inward

Assessment of groups for strengthened mast (verbouw level)

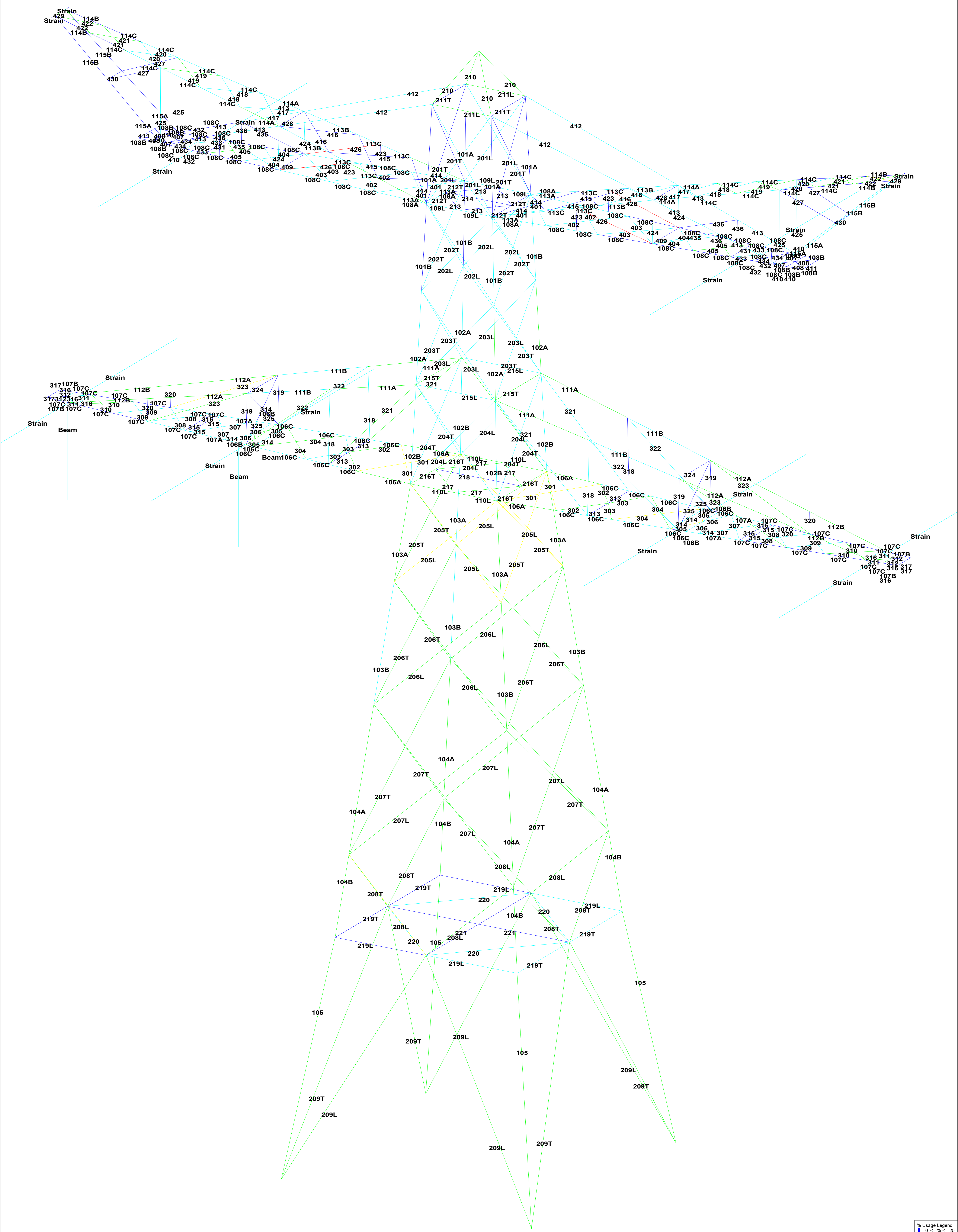
Date	17-05-21
Author	KCh
Version	1.0

KIJ-GT 380
HC+0
15

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
426	Diagonaal tweede dwarsarm	**50x50x7**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	353	**-12.2**	SPLS 6a_90 Ah Ct2 Ah	13.2	60.3	82.3	0.92		**1.4**	SPLS 3_0,9_69 Ba Ct2	71.3	60.3	42.0	0.03
431	New: Horiz 1 under BVNTRVS	**120x120x12**	S355	2M24-8.8t	1.00	1.00	1.00	69	**0.0**		593.3	271.1	423.4	0.00		**50.8**	ULS 3_90	448.4	271.1	423.4	0.19
432	New: Horiz 2 under BVNTRVS	**120x120x12**	S355	2M24-8.8t	2.00	2.00	2.00	64	**0.0**		621.2	271.1	423.4	0.00		**90.8**	ULS 3_69	448.4	271.1	423.4	0.33
433	New: Diag tussen horizontals	**70x70x7**	S355	2M20-8.8t	1.00	1.00	1.00	89	**-44.4**	SPLS 3_69 Ah Ct1	165.8	188.2	205.8	0.27		**39.6**	SPLS 3_0,9_69 Ah All (	131.6	188.2	180.9	0.30
434	New: CD underside	**60x60x6**	S355	1M20-8.8t	0.52	0.52	0.52	74	**-3.0**	SPLS 1a_0 Ah Ct1	113.3	94.1	88.2	0.03		**7.3**	ULS 1a_0,9_45	112.9	94.1	80.2	0.09
435	New: Front bracing boventraverse	**80x80x8**	S355	2M20-8.8t	1.00	1.00	1.00	182	**-26.7**	ULS 3_0	90.3	188.2	235.2	0.30		**0.0**		165.3	188.2	135.4	0.00
436	New: Front bracing boventraverse	**60x60x6**	S355	1M20-8.8t	1.00	1.00	1.00	75	**0.0**		112.7	94.1	88.2	0.00		**14.9**	ULS 3_0	89.4	94.1	60.4	0.25

Notes:
1) Groups 431 to 436 were added to enable the conductor attachment position on the upper crossarm to be moved 1.5m inward

DNV GL Nederlands BV, Project: "HC+0 (da) ini (15)"
Tower Version 16.86, 14:28:42 Monday, 17 May, 2021
Undeformed geometry displayed



% Usage Legend
0 <= % < 25
25 <= % < 50
50 <= % < 75
75 <= % < 100
100 <= %

Z
X Y

1 (m)

DNV·GL

Assessment of groups for initial mast (afkeur level)

Date	17-8-2020
Author	MKh
Version	1.0

KIJ-GT 380
HC+0
38

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
101A	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	85	**-58.3**	SPLS 3_65,5 Ah Ct2	390.5	508.3	777.6	0.15		**10.0**	ULS 1a_0,9_0,9_65,5	466.6	508.3	664.6	0.02	
101B	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	74	**-160.2**	ULS 1a_65,5	423.6	506.7	777.6	0.38		**119.7**	ULS 1a_0,9_90	466.6	506.7	664.6	0.26	
102A	Leg	180x180x16	S235	8M24-5.6t	0.50	0.50	0.50	54	**-412.7**	SPLS 3_65,5 Ah All Cts	1141.5	674.7	1658.9	0.61		**319.9**	LS 3_0,9_65,5 Ah All Cts	1220.3	674.7	1417.8	0.47	
102B	Leg	180x180x16	S235	12M24-5.6t	0.50	0.50	0.50	57	**-483.9**	ULS 1a_65,5	1125.2	1005.5	2488.3	0.48		**341.3**	ULS 1a_0,9_65,5	1220.3	1005.5	2169.3	0.34	
103A	Leg	200x200x20	S235	16M24-5.6t	0.28	0.28	0.28	28	**-817.9**	ULS 1a_65,5	1750.2	1181.8	4147.2	0.69		**651.9**	LS 3_0,9_65,5 Ah All Cts	1710.7	1181.8	3544.6	0.55	
103B	Leg	200x200x20	S235	12M24-5.6t	0.28	0.28	0.28	35	**-1026.9**	SPLS 3_65,5 Ah All Cts	1704.3	1987.7	3110.4	0.60		**860.0**	LS 3_0,9_65,5 Ah All Cts	1710.7	1987.7	2658.5	0.50	
104A	Leg	250x250x20	S235	12M24-5.6t	0.28	0.28	0.28	34	**-1272.7**	SPLS 3_65,5 Ah All Cts	2172.1	1892.2	3110.4	0.67		**1084.4**	LS 3_0,9_65,5 Ah All Cts	2244.7	1892.2	2658.5	0.57	
104B	Leg	250x250x20	S235	14M24-5.6t	0.55	0.55	0.55	37	**-1387.8**	SPLS 3_65,5 Ah All Cts	2149.3	2100.4	3628.8	0.66		**1193.2**	LS 3_0,9_65,5 Ah All Cts	2244.7	2100.4	3101.5	0.57	
105	Leg	250x250x22	S235	14M24-5.6t	0.17	0.17	0.17	33	**-1412.2**	SPLS 3_65,5 Ah All Cts	2386.8	2100.4	3991.7	0.67		**1193.9**	LS 3_0,9_65,5 Ah All Cts	2453.6	2100.4	3411.7	0.57	
106A	Onderregel eerste dwarsarm	200x200x16	S235	12M24-5.6t	1.53	1.00	1.00	63	**-673.3**	SPLS 6a_90 Ah Ct2 Ba Ct2	1211.7	906.5	2488.3	0.74		**454.8**	SPLS 3_0,9_65,5 Ah Ct1	1386.2	906.5	2126.8	0.50	
106B	Onderregel eerste dwarsarm	200x200x16	S235	10M24-5.6t	7.64	1.00	1.00	74	**-362.0**	SPLS 6a_90 Ah Ct2 Ba Ct2	1128.4	847.2	2073.6	0.43		**230.0**	SPLS 3_0,9_65,5 Ah Ct1	1386.2	847.2	1772.3	0.27	
106C	Onderregel eerste dwarsarm	200x200x16	S235		2.88	1.77	1.00	62	**-605.8**	SPLS 6a_90 Ah Ct2 Ba Ct2	1220.6	0.0	0.0	0.50		**387.2**	SPLS 3_0,9_65,5 Ah Ct1	1452.3	0.0	0.0	0.27	
107A	Onderregel eerste dwarsarm	180x180x15	S235	10M24-5.6t	2.78	1.00	1.00	83	**-332.1**	SPLS 6a_90 Ah Ct2 Ba Ct2	887.4	847.2	1944.0	0.39		**203.5**	SPLS 3_0,9_65,5 Ah Ct1	1144.0	847.2	1661.5	0.24	
107B	Onderregel eerste dwarsarm	180x180x15	S235	2M20-5.6t	1.63	1.00	1.00	18	**-3.3**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**0.6**	SPLS 1a_0 Ba All Cts	613.8	117.6	297.8	0.01	
107C	Onderregel eerste dwarsarm	180x180x15	S235		18.24	1.00	1.00	83	**-317.9**	SPLS 6a_90 Ah Ct2 Ba Ct2	887.3	0.0	0.0	0.36		**184.0**	SPLS 3_0,9_65,5 Ah Ct1	1220.5	0.0	0.0	0.15	
108A	Onderregel tweede dwarsarm	180x180x15	S235	12M24-5.6t	1.12	1.00	1.00	64	**-419.3**	SPLS 3_65,5 Ah All Cts	1011.2	2033.3	2332.8	0.41		**300.2**	LS 3_0,9_65,5 Ah All Cts	1144.0	2033.3	1814.4	0.26	
108B	Onderregel tweede dwarsarm	180x180x15	S235	2M20-5.6t	1.00	1.50	1.00	19	**-3.0**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**0.7**	SPLS 1a_135 Ah Ct1	613.8	117.6	297.8	0.01	
108C	Onderregel tweede dwarsarm	180x180x15	S235		2.77	1.70	1.00	65	**-382.6**	SPLS 3_65,5 Ah All Cts	1010.4	0.0	0.0	0.38		**258.6**	LS 3_0,9_65,5 Ah All Cts	1220.5	0.0	0.0	0.21	
111A	Bovenregel eerste dwarsarm	90x90x9	S235	3M24-5.6t	1.00	1.96	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**140.8**	ULS 3_135	205.3	254.2	299.1	0.69	
111B	Bovenregel eerste dwarsarm	90x90x9	S235	3M24-5.6t	1.00	2.04	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**104.3**	ULS 3_135	205.3	254.2	299.1	0.51	
112A	Bovenregel eerste dwarsarm	75x75x7#	S235	3M24-5.6t	1.00	1.80	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**89.2**	ULS 3_135	131.8	254.2	192.5	0.68	
112B	Bovenregel eerste dwarsarm	75x75x7#	S235	3M24-5.6t	1.00	2.25	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**89.3**	ULS 3_135	131.8	254.2	192.5	0.68	
113A	Bovenregel tweede dwarsarm	120x120x13	S235	5M24-5.6t	1.59	1.00	1.00	101	**-197.0**	SPLS 6a_90 Ah All Cts Ba Ct1	355.8	423.6	842.4	0.55		**175.8**	; 6a_90 Ah All Cts Ba Ct2	418.7	423.6	703.2	0.42	
113B	Bovenregel tweede dwarsarm	120x120x13	S235	5M24-5.6t	1.40	1.00	1.00	102	**-181.7**	SPLS 6a_90 Ah All Cts Ba Ct1	373.5	423.6	842.4	0.49		**169.6**	; 6a_90 Ah All Cts Ba Ct2	602.4	423.6	720.0	0.40	
113C	Bovenregel tweede dwarsarm	120x120x13	S235		2.70	1.70	1.00	101	**-192.9**	SPLS 6a_90 Ah All Cts Ba Ct1	355.7	0.0	0.0	0.54		**176.8**	; 6a_90 Ah All Cts Ba Ct2	705.0	0.0	0.0	0.25	
114A	Bovenregel tweede dwarsarm	150x100x12	S235	5M24-5.6t	3.00	1.00	1.00	115	**-166.2**	SPLS 6a_90 Ah All Cts Ba Ct1	301.8	423.6	777.6	0.55		**174.1**	; 6a_90 Ah All Cts Ba Ct2	582.2	423.6	664.6	0.41	
114B	Bovenregel tweede dwarsarm	150x100x12	S235	4M24-5.6t	3.00	1.00	1.00	104	**-38.9**	SPLS 3_0,9_65,5 Ah All Cts	331.5	338.9	622.1	0.12		**35.7**	PLS 6a_90 Ah Ct1 Ba Ct2	582.2	338.9	531.7	0.11	
114C	Bovenregel tweede dwarsarm	150x100x12	S235		3.00	1.00	1.00	115	**-151.1**	SPLS 6a_90 Ah All Cts Ba Ct1	301.8	0.0	0.0	0.50		**158.6**	; 6a_90 Ah All Cts Ba Ct2	674.5	0.0	0.0	0.24	
115A	Tussenregel tweede dwarsarm	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-32.1**	SPLS 6a_90 Ah Ct1 Ah Ct2	79.8	84.7	77.8	0.41		**9.9**	SPLS 3_0,9_90 Ah Ct2	127.9	84.7	66.5	0.15	
115B	Tussenregel tweede dwarsarm	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-31.2**	SPLS 6a_90 Ah Ct1 Ah Ct2	71.0	84.7	77.8	0.44		**10.8**	SPLS 3_0,9_90 Ah Ct2	127.9	84.7	66.5	0.16	
201L	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-42.2**	SPLS 3_0,9_65,5 Ah Ct2	114.3	117.6	129.6	0.37		**34.5**	ULS 1a_90	145.4	117.6	104.7	0.33	
201T	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-22.3**	SPLS 6a_90 Ba Ct2 Ah Ct2	114.3	117.6	129.6	0.19		**10.0**	SPLS 3_0,9_90 Ah Ct2	145.4	117.6	104.7	0.10	
202L	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-193.8**	SPLS 3_90 Ba Ct2	425.3	338.9	518.4	0.57		**146.3**	SPLS 3_0,9_65,5 Ba Ct1	384.5	338.9	350.9	0.43	
202T	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-131.7**	SPLS 3_0,9_65,5 Ba Ct1	425.3	338.9	518.4	0.39		**149.9**	SPLS 3_65,5 Ah Ct2	384.5	338.9	350.9	0.44	
203L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-134.4**	SPLS 3_0,9_65,5 Ba Ct1	406.7	338.9	518.4	0.40		**177.5**	SPLS 3_90 Ba Ct2	384.5	338.9	350.9	0.52	
203T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-135.8**	SPLS 3_90 Ah Ct2	406.7	338.9	518.4	0.40		**120.3**	SPLS 3_0,9_45 Ba Ct1	384.5	338.9	350.9	0.36	
204L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-184.7**	SPLS 3_0,9_65,5 Ah Ct2	386.8	338.9	518.4	0.55		**141.4**	SPLS 3_0,9_65,5 Ah Ct1	384.5	338.9	350.9	0.42	
204T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-164.5**	SPLS 3_90 Ah Ct1	386.8	338.9	518.4	0.49		**157.0**	SPLS 3_0,9_90 Ah Ct2	384.5	338.9	350.9	0.46	
205L	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-365.5**	SPLS 3_65,5 Ba Ct1	449.2	508.3	777.6	0.81		**356.6**	SPLS 3_65,5 Ba Ct2	384.5	508.3	513.8	0.93	
205T	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-324.5**	SPLS 3_0,9_65,5 Ba Ct2	449.2	508.3	777.6	0.72		**318.3**	SPLS 3_65,5 Ba Ct1	384.5	508.3	513.8	0.83	
206L	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-296.9**	SPLS 3_65,5 Ba Ct2	465.9	423.6	777.6	0.70		**300.5**	SPLS 3_65,5 Ba Ct1	456.2	423.6	518.8	0.71	
206T	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-263.3**	SPLS 3_65,5 Ba Ct1	465.9	423.6	777.6	0.62		**267.8**	SPLS 3_0,9_65,5 Ba Ct2	456.2	423.6	518.8	0.63	
207L	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-245.0**	SPLS 3_65,5 Ba Ct1	394.0	338.9	622.1	0.72		**241.9**	SPLS 3_65,5 Ba Ct2	456.2	338.9	421.1	0.71	
207T	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-219.9**	SPLS 3_0,9_65,5 Ba Ct2	394.0	338.9	622.1	0.65		**214.5**	SPLS 3_65,5 Ba Ct1	456.2	338.9	421.1	0.63	
208L	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-201.8**	SPLS 3_65,5 Ba Ct2	332.1	254.2	388.8	0.79		**200.5**	SPLS 3_65,5 Ba Ct1	384.5	254.2	269.2	0.79	
208T	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-182.1**	SPLS 3_65,5 Ba Ct1	332.1	254.2	388.8	0.72		**184.0**	SPLS 3_0,9_65,5 Ba Ct2	384.5	254.2	269.2	0.72	
209L	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-251.3**	SPLS 3_65,5 Ba Ct2	370.1	338.9	570.2	0.74		**240.4**	SPLS 3_0,9_65,5 Ba Ct1	356.4	338.9	475.6	0.71	
209T	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-238.4**	SPLS 3_65,5 Ba Ct1	370.1	338.9	570.2	0.70		**232.3**	SPLS 3_0,9_65,5 Ba Ct2	356.4	338.9	475.6	0.69	
210	Top	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	280	**-11.9**	SPLS 3_65,5 Ba Ct2	16.5	75.4	86.4	0.72		**11.9**	SPLS 3_0,9_65,5 Ba Ct2	52.4	75.4	44.1	0.27	
211L	Tweede dwarsarm in tower	100x100x6	S235	3M24-5.6t	1.00	1.00	1.00	132	**0.0**		113.1	254.2	233.3	0.00		**104.6**	ULS 3_65,5	161.1	254.2	199.4	0.65	
211T	Tweede dwarsarm in tower	100x100x6	S235	2M24-5.6t	1.00	1.00	1.00	132	**-4.1**	ULS 1a_90	113.1	169.4	155.5	0.04		**2.5**	ULS 1a_0,9_0,9_90	206.4	169.4	132.9	0.02	
109L	Tweede dwarsarm in tower	180x180x15	S235	12M24-5.6t	1.00	2.00	1.00	53	**-539.3**	SPLS 3_65,5 Ah All Cts	1075.9	2033.3	2332.8	0.50		**437.9**	LS 3_0,9_65,5 Ah All Cts	1144.0	2033.3	1814.4	0.38	
212T	Tweede dwarsarm in tower	100x100x6	S235	4M24-5.6t	1.00	2.00	1.00	95	**-47.8**	SPLS 3_0,9_65,5 Ba Ct2	144.3	338.9	311.0	0.33		**62.0**	SPLS 3_65,5 Ba Ct2	225.0	338.9	265.8	0.28	
213	Tweede dwarsarm in tower	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	86	**-70.1**	SPLS 3_0,9_65,5 Ba Ct2	265.3	254.2	311.0	0.28		**71.2**	SPLS 3_65,5 Ba Ct2	263.0	254.2	265.8	0.28	
214	Tweede dwarsarm in tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	300	**-0.7**	ULS 3_0	11.8	37.7	43.2	0.06		**0.0**		37.4	37.7	22.0	0.00	
215L	Eerste dwarsarm in tower	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	178	**0.0**		103.8	254.2	311.0	0.00		**126.9**	; 6a_90 Ba All Cts Ah Ct2	270.5	254.2	265.8	0.50	
215T	Eerste dwarsarm in tower	100x100x8	S235	1M24-5.6t	1.00	1.00	1.00	178	**-53.7**	ULS 1a_0,9_90	83.1	84.7	103.7	0.65		**59.9**	ULS 1a_90	170.5	84.7	88.6	0.71	
110L	Eerste dwarsarm in tower	200x200x16	S235	12M24-5.6t	1.00	2.00	1.00	62	**-589.8**	SPLS 3_65,5 Ah All Cts	1222.1	906.5	2488.3	0.65		**414.2**	LS 3_0,9_65,5 Ah All Cts	1386.2	906.5	2126.8	0.46	
216T	Eerste dwarsarm in tower	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	124	**-112.6**	SPLS 3_0,9_65,5 Ba Ct2	151.1	338.9	414.7	0.75		**125.8**	SPLS 3_65,5 Ba Ct1	293.9	338.9	354.5	0.43	
217	Eerste dwarsarm in tower	120x120x11	S235	3M24-5.6t	1.00	1.00	1.00	114	**-156.7**	SPLS 3_0,9_65,5 Ba Ct2	286.0	254.2	427.7	0.62		**158.1**	SPLS 3_65,5 Ba Ct2	356.4	254.2	365.5	0.62	
218	Eerste dwarsarm in tower	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	325	**-0.6**	ULS 3_135	12.6	58.8	54.0	0.05		**0.0**		54.7	58.8	37.0	0.00	
219L	Onderstuk in tower	130x130x12	S235	2M24-5.6t	1.00	1.00	1.00	157	**-47.5**	SPLS 3_65,5 Ah All Cts	235.2	169.4	311.0	0.28		**37.4**	LS 3_0,9_65,5 Ah All Cts	363.3	169.4	265.8	0.22	
219T	Onderstuk in tower	130x130x12	S235	2M24-5.6t	1.00	1.00	1.00	157	**-51.1**	SPLS 3_65,5 Ah All Cts	235.2	169.4	311.0	0.30		**41.5**	LS 3_0,9_65,5 Ah All Cts	363.3	169.4	265.8	0.25	
220	Onderstuk in tower	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	311	**-5.2**	SPLS 1a_0 Ah Ct2	11.6	37.7	43.2	0.45		**4.6**	ULS 1a_0,9_0,9_45	60.5	37.7	32.0	0.15	
221	Onderstuk in tower	70x70x5#	S235	1M16-5.6t	0.50	1.00	0.50	370	**-0.9**	ULS 7	9.7	37.7	43.2	0.09		**0.0**		74.9	37.7	32.0	0.00	
301	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	1M20-5.6t	0.55	0.55	0.55	123	**-55.0**	SPLS 3_65,5 Ah All Cts	129.7	58.8	86.4	0.94		**55.4**	LS 3_0,9_65,5 Ah All Cts	179.7	58.8	69.8	0.94	
302	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	110	**-70.1**	SPLS 3_0,9_65,5 Ah Ct1	180.9	117.6	172.8	0.60		**68.5**	SPLS 3_65,5 Ah Ct1	190.7	117.6	139.6	0.58	
303	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	92	**-62.4**	SPLS 3_0,9_65,5 Ah All Cts	208.7	117.6	172.8	0.53		**59.9**	SPLS 3_65,5 Ah All Cts	190.7	117.6	139.6	0.51	
304	Diagonaal onderregel eerste dwarsarm	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	104	**-80.5**	SPLS 3_65,5 Ah Ct1	143.2	117.6	129.6	0.68		**81.2**	LS 3_0,9_65,5 Ah All Cts	170.1	117.6	104.7	0.78	
305	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	92	**-43.3**	SPLS 3_65,5 Ah All Cts	101.8	84.7	77.8	0.56		**46.6**	LS 3_0,9_65,5 Ah All Cts	93.3	84.7	59.8	0.78	
306	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	84	**-23.4**	SPLS 3_0,9_65,5 Ah All Cts	107.6	84.7	77.8	0.30		**27.0**	SPLS 3_65,5 Ah All Cts	93.3	84.7	66.5	0.41	
307	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	0.55	0.55	0.55	96	**-32.0**	SPLS 6a_90 Ah All Cts Ba Ct1	98.2	84.7	77.8	0.41		**27.1**	LS 3_0,9_65,5 Ah All Cts	93.3	84.7	59.8	0.45	
308	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	89	**-37.6**	SPLS 3_65,5 Ah All Cts	129.6	117.6	129.6	0.32		**37.8**	LS 3_0,9_65,5 Ah All Cts	115.9	117.6	104.7	0.36	
309	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-46.4**	SPLS 3_0,9_65,5 Ah All Cts	140.4	117.6	129.6	0.39		**45.3**	SPLS 3_65,5 Ah All Cts	124.8	117.6	104.7	0.43	
310	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	76	**-63.9**	SPLS 3_65,5 Ah All Cts	143.9	117.6	129.6	0.54		**62.4**	LS 3_0,9_65,5 Ah All Cts	136.2	117.6	104.7	0.60	
311	Diagonaal onderregel eerste dwarsarm	70x70x6	S235	1M24-5.6t	1.00	1.00	1.00	69	**-28.7**	SPLS 3_65,5 Ah All Cts	99.6	84.7	77.8	0.37		**29.1**	LS 3_0,9_65,5 Ah All Cts	76.0	84.7	55.0	0.53	
312	Diagonaal onderregel eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	82	**-1.1**	SPLS 1a_0 Ba All Cts	55.5	37.7	43.2	0.03		**3.3**	ULS 3_0,9_90	37.4	37.7	25.7	0.13	
313	Dwarsligger onderregel eerste dwarsarm	HEA160	S235	2M20-5.6t	2.00	1.00	1.00	48	**-3.6**	SPLS 3_0,9_65,5 Ah Ct1	686.1	117.6	216.0	0.03		**8.4**	PLS 6a_90 Ba Ct2 Ah Ct2	766.1	117.6	0.0	0.07	
314	Dwarsligger onderregel eerste dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	82	**0.0**		314.6	117.6	259.2	0.00		**51.7**	ULS 3_65,5	278.4	117.6	259.2	0.44	
315	Dwarsligger onderregel eerste dwarsarm	HEA160	S235		1.00	1.00	1.00	26	**-1.3**	ULS 1a_0,9_0,9_65,5	789.3	0.0	0.0	0.00		**5.0**	ULS 3_65,5	916.5	0.0	0.0	0.01	
316	Dwarsligger onderregel eerste dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	37	**0.0**		426.4	117.6	259.2	0.00		**59.7**	ULS 3_0,9_65,5	278.4	117.6	259.2	0.51	
317	Dwarsligger onderregel eerste dwarsarm	HEA160	S235		1.00	1.00	1.00	13	**-10.1**	ULS 3_0,9_65,5	825.9	0.0	0.0	0.01		**0.0**		916.5	0.0	0.0	0.00	
318	Verticaal eerste dwarsarm	90x90x6#	S235	1M20-5.6t	1.00	1.00	1.00	168	**-20.7**	SPLS 6a_90 Ba All Cts Ah Ct2	61.1	58.8	64.8	0.35		**0.0**		117.5	58.8	52.4	0.00	
319	Verticaal eerste dwarsarm	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	190	**-5.6**	ULS 3_45	29.3	37.7	43.2	0.19		**0.0**		37.4	37.7	22.0	0.00	
320	Verticaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	94	**-0.9**	ULS 7	50.9	37.7	43.2	0.02		**0.0**		37.4	37.7	18.4	0.00	

DNV·GL

Assessment of groups for initial mast (afkeur level)

Date	17-8-2020
Author	MKh
Version	1.0

KIJ-GT 380
HC+0
38

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
321	Diagonaal eerste dwarsarm	50x50x6	S235	2M16-5.6t	1.00	1.00	1.00	580	**0.0**		5.7	75.4	103.7	0.00		**31.3**	ULS 3_135	62.1	75.4	52.9	0.59	
322	Diagonaal eerste dwarsarm	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	415	**0.0**		12.4	117.6	129.6	0.00		**47.1**	; 6a_90 Ba All Cts Ah Ct2	77.4	117.6	88.7	0.61	
323	Diagonaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	516	**0.0**		4.7	37.7	43.2	0.00		**18.8**	ULS 1a_0	37.4	37.7	22.0	0.85	
324	Dwarsligger bovenregel eerste dwarsarm	65x50x5	S235	1M24-5.6t	1.00	1.00	1.00	220	**-2.9**	ULS 3_0,9_65,5	21.8	84.7	64.8	0.13		**0.0**		25.9	84.7	8.9	0.00	
325	Tussen diagonaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	171	**-0.3**	SPLS 1a_0 Ah All Cts	27.0	37.7	43.2	0.01		**3.9**	ULS 3_0,9_45	37.4	37.7	18.4	0.21	
401	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	110	**-28.7**	SPLS 3_65,5 Ah All Cts	123.3	117.6	129.6	0.24		**28.6**	LS 3_0,9_65,5 Ah All Cts	128.8	117.6	104.7	0.27	
402	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	102	**-34.1**	SPLS 3_0,9_65,5 Ah All Cts	132.3	117.6	129.6	0.29		**35.9**	SPLS 3_65,5 Ah Ct1	136.1	117.6	104.7	0.34	
403	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	98	**-44.8**	SPLS 3_65,5 Ah Ct1	136.1	117.6	129.6	0.38		**41.5**	LS 3_0,9_65,5 Ah All Cts	140.4	117.6	104.7	0.40	
404	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	90	**-45.5**	SPLS 3_65,5 Ah Ct1	129.0	117.6	129.6	0.39		**44.4**	LS 3_0,9_65,5 Ah All Cts	119.7	117.6	104.7	0.42	
405	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	81	**-51.2**	SPLS 3_0,9_65,5 Ah All Cts	138.2	117.6	129.6	0.44		**51.8**	SPLS 3_65,5 Ah Ct1	123.5	117.6	104.7	0.49	
406	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-66.9**	SPLS 3_65,5 Ah Ct1	140.4	117.6	129.6	0.57		**63.1**	LS 3_0,9_65,5 Ah All Cts	131.2	117.6	104.7	0.60	
407	Diagonaal onderregel tweede dwarsarm	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	83	**-24.9**	SPLS 3_65,5 Ah All Cts	79.3	58.8	64.8	0.42		**26.0**	LS 3_0,9_65,5 Ah All Cts	65.7	58.8	38.8	0.67	
408	Diagonaal onderregel tweede dwarsarm	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	78	**-1.1**	SPLS 1a_0 Ba All Cts	81.4	58.8	64.8	0.02		**3.7**	ULS 3_0,9_135	65.7	58.8	38.8	0.09	
409	Dwarsligger onderregel tweede dwarsarm	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	51	**0.0**		700.0	117.6	216.0	0.00		**6.0**	ULS 3_90	766.1	117.6	0.0	0.05	
410	Dwarsligger onderregel tweede dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	44	**0.0**		410.1	117.6	259.2	0.00		**61.7**	ULS 3_0,9_65,5	278.4	117.6	259.2	0.52	
411	Dwarsligger onderregel tweede dwarsarm	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	31	**-8.6**	ULS 3_0,9_65,5	774.9	117.6	216.0	0.07		**0.0**		766.1	117.6	0.0	0.00	
412	Bovenregel tweede dwarsarm	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	306	**0.0**		56.1	254.2	311.0	0.00		**128.9**	ULS 3_65,5	263.0	254.2	265.8	0.51	
413	Bovenregel tweede dwarsarm	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	238	**0.0**		83.2	254.2	311.0	0.00		**116.4**	ULS 3_90	263.0	254.2	265.8	0.46	
414	Diagonaal bovenregel tweede dwarsarm	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	203	**-5.3**	ULS 1a_0	25.4	37.7	51.8	0.21		**5.5**	SPLS 1a_0,9_0 Ba Ct2	44.9	37.7	26.5	0.21	
415	Diagonaal bovenregel tweede dwarsarm	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	189	**-5.4**	SPLS 1a_0,9_0 Ba Ct2	28.1	37.7	51.8	0.19		**4.9**	SPLS 1a_0 Ba All Cts	44.9	37.7	26.5	0.19	
416	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	179	**-5.2**	SPLS 1a_0 Ba All Cts	25.5	37.7	43.2	0.20		**5.6**	PLS 6a_90 Ah Ct2 Ba Ct2	37.4	37.7	22.0	0.26	
417	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	146	**-9.6**	SPLS 6a_90 Ah All Cts Ba Ct2	33.1	37.7	43.2	0.29		**9.9**	; 6a_90 Ah All Cts Ba Ct2	37.4	37.7	22.0	0.45	
418	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	138	**-11.9**	SPLS 6a_90 Ah All Cts Ba Ct2	35.2	37.7	43.2	0.34		**11.7**	; 6a_90 Ah All Cts Ba Ct2	37.4	37.7	22.0	0.53	
419	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	134	**-14.7**	SPLS 6a_90 Ah All Cts Ba Ct2	36.6	37.7	43.2	0.40		**14.7**	; 6a_90 Ah All Cts Ba Ct2	37.4	37.7	22.0	0.67	
420	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	96	**-16.7**	SPLS 6a_90 Ah All Cts Ba Ct2	60.6	58.8	54.0	0.31		**17.0**	; 6a_90 Ah All Cts Ba Ct2	54.7	58.8	32.4	0.53	
421	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	93	**-22.7**	SPLS 6a_90 Ah All Cts Ba Ct2	62.4	58.8	54.0	0.42		**21.8**	; 6a_90 Ah All Cts Ba Ct2	54.7	58.8	32.4	0.68	
422	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	88	**-27.9**	SPLS 6a_90 Ah All Cts Ba Ct2	64.7	58.8	54.0	0.52		**29.7**	; 6a_90 Ah All Cts Ba Ct2	54.7	58.8	37.0	0.80	
423	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-1.2**	SPLS 3_0,9_65,5 Ba Ct1	50.8	37.7	43.2	0.03		**3.7**	PLS 6a_90 Ba Ct2 Ba Ct1	37.4	37.7	22.0	0.17	
424	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**0.0**		25.2	37.7	43.2	0.00		**5.0**	PLS 6a_90 Ba Ct2 Ba Ct1	37.4	37.7	22.0	0.23	
425	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	314	**-3.6**	SPLS 1a_65,5 Ba Ct1	11.0	37.7	43.2	0.33		**0.0**		37.4	37.7	22.0	0.00	
426	Diagonaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	346	**-11.4**	SPLS 6a_90 Ba Ct2 Ba Ct1	9.4	37.7	43.2	1.22	knik	**1.0**	SPLS 3_0,9_65,5 Ba Ct1	37.4	37.7	22.0	0.05	
427	Diagonaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	266	**0.0**		14.3	37.7	43.2	0.00		**1.1**	ULS 1a_114,5	37.4	37.7	22.0	0.05	
428	Dwarsligger bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	196	**-0.5**	ULS 3_0,9_90	22.5	37.7	43.2	0.02		**0.4**	ULS 1a_90	37.4	37.7	22.0	0.02	
429	Dwarsligger bovenregel tweede dwarsarm	UNP160	S235	1M16-5.6t	1.00	1.00	1.00	42	**0.0**		288.7	37.7	64.8	0.00		**26.1**	ULS 3_0,9_65,5	90.7	37.7	48.0	0.69	
430	Dwarsligger ladder tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	112	**0.0**	SPLS 1a_65,5 Ba All Cts	44.1	37.7	43.2	0.00		**0.0**	ULS 1a_0,9_65,5	37.4	37.7	22.0	0.00	

Assessment of groups for strengthened mast (afkeur level)

Date	17-8-2020
Author	MKh
Version	1.0

KIJ-GT 380
HC+0
38

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
101A	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	85	**-58.3**	SPLS 3_65,5 Ah Ct2	390.5	508.3	777.6	0.15		**10.0**	ULS 1a_0,9_0,9_65,5	466.6	508.3	664.6	0.02
101B	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	74	**-160.3**	ULS 1a_65,5	423.6	506.7	777.6	0.38		**119.7**	ULS 1a_0,9_90	466.6	506.7	664.6	0.26
102A	Leg	180x180x16#	S235	8M24-5.6t	0.50	0.50	0.50	54	**-412.8**	SPLS 3_65,5 Ah All Cts	1141.5	674.7	1658.9	0.61		**319.8**	SPLS 3_0,9_65,5 Ah A	1220.3	674.7	1417.8	0.47
102B	Leg	180x180x16#	S235	12M24-5.6t	0.50	0.50	0.50	57	**-483.9**	ULS 1a_65,5	1125.2	1005.5	2488.3	0.48		**341.2**	ULS 1a_0,9_0,9_65,5	1220.3	1005.5	2169.3	0.34
103A	Leg	200x200x20	S235	16M24-5.6t	0.28	0.28	0.28	28	**-817.9**	ULS 1a_65,5	1750.2	1181.8	4147.2	0.69		**651.9**	SPLS 3_0,9_65,5 Ah A	1710.7	1181.8	3544.6	0.55
103B	Leg	200x200x20	S235	12M24-5.6t	0.28	0.28	0.28	35	**-1027.0**	SPLS 3_65,5 Ah All Cts	1704.3	1987.7	3110.4	0.60		**859.9**	SPLS 3_0,9_65,5 Ah A	1710.7	1987.7	2658.5	0.50
104A	Leg	250x250x20#	S235	12M24-5.6t	0.28	0.28	0.28	34	**-1272.8**	SPLS 3_65,5 Ah All Cts	2172.1	1892.2	3110.4	0.67		**1084.3**	SPLS 3_0,9_65,5 Ah A	2244.7	1892.2	2658.5	0.57
104B	Leg	250x250x20#	S235	14M24-5.6t	0.55	0.55	0.55	37	**-1387.8**	SPLS 3_65,5 Ah All Cts	2149.3	2100.4	3628.8	0.66		**1193.1**	SPLS 3_0,9_65,5 Ah A	2244.7	2100.4	3101.5	0.57
105	Leg	250x250x22#	S235	14M24-5.6t	0.17	0.17	0.17	33	**-1412.3**	SPLS 3_65,5 Ah All Cts	2386.8	2100.4	3991.7	0.67		**1193.9**	SPLS 3_0,9_65,5 Ah A	2453.6	2100.4	3411.7	0.57
106A	Onderregel eer	200x200x16	S235	12M24-5.6t	1.53	1.00	1.00	63	**-673.3**	SPLS 6a_90 Ah Ct2 Ba	1211.7	906.5	2488.3	0.74		**454.8**	SPLS 3_0,9_65,5 Ah C	1386.2	906.5	2126.8	0.50
106B	Onderregel eer	200x200x16	S235	10M24-5.6t	7.64	1.00	1.00	74	**-362.0**	SPLS 6a_90 Ah Ct2 Ba	1128.4	847.2	2073.6	0.43		**230.0**	SPLS 3_0,9_65,5 Ah C	1386.2	847.2	1772.3	0.27
106C	Onderregel eer	200x200x16	S235		2.88	1.77	1.00	62	**-605.8**	SPLS 6a_90 Ah Ct2 Ba	1220.6	0.0	0.0	0.50		**387.2**	SPLS 3_0,9_65,5 Ah C	1452.3	0.0	0.0	0.27
107A	Onderregel eer	180x180x15#	S235	10M24-5.6t	2.78	1.00	1.00	83	**-332.1**	SPLS 6a_90 Ah Ct2 Ba	887.4	847.2	1944.0	0.39		**203.5**	SPLS 3_0,9_65,5 Ah C	1144.0	847.2	1661.5	0.24
107B	Onderregel eer	180x180x15#	S235	2M20-5.6t	1.63	1.00	1.00	18	**-3.3**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**0.6**	SPLS 1a_0 Ba All Cts	613.8	117.6	297.8	0.01
107C	Onderregel eer	180x180x15#	S235		18.24	1.00	1.00	83	**-317.9**	SPLS 6a_90 Ah Ct2 Ba	887.3	0.0	0.0	0.36		**184.0**	SPLS 3_0,9_65,5 Ah C	1220.5	0.0	0.0	0.15
108A	Onderregel twe	180x180x15#	S235	12M24-5.6t	1.12	1.00	1.00	64	**-419.1**	SPLS 3_65,5 Ah All Cts	1011.2	2033.3	2332.8	0.41		**300.2**	SPLS 3_0,9_65,5 Ah A	1144.0	2033.3	1814.4	0.26
108B	Onderregel twe	180x180x15#	S235	2M20-5.6t	1.00	1.50	1.00	19	**-3.0**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**0.7**	SPLS 1a_135 Ah Ct1	613.8	117.6	297.8	0.01
108C	Onderregel twe	180x180x15#	S235		2.77	1.70	1.00	65	**-382.5**	SPLS 3_65,5 Ah All Cts	1010.4	0.0	0.0	0.38		**258.6**	SPLS 3_0,9_65,5 Ah A	1220.5	0.0	0.0	0.21
111A	Bovenregel eer	90x90x9	S235	3M24-5.6t	1.00	1.96	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**140.8**	ULS 3_135	205.3	254.2	299.1	0.69
111B	Bovenregel eer	90x90x9	S235	3M24-5.6t	1.00	2.04	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**104.3**	ULS 3_135	205.3	254.2	299.1	0.51
112A	Bovenregel eer	75x75x7#	S235	3M24-5.6t	1.00	1.80	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**89.2**	ULS 3_135	131.8	254.2	192.5	0.68
112B	Bovenregel eer	75x75x7#	S235	3M24-5.6t	1.00	2.25	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**89.3**	ULS 3_135	131.8	254.2	192.5	0.68
113A	Bovenregel twe	120x120x13	S235	5M24-5.6t	1.59	1.00	1.00	101	**-197.2**	SPLS 6a_90 Ah All Cts	355.8	423.6	842.4	0.55		**175.6**	SPLS 6a_90 Ah All Cts	418.7	423.6	703.2	0.42
113B	Bovenregel twe	120x120x13	S235	5M24-5.6t	1.40	1.00	1.00	102	**-181.7**	SPLS 6a_90 Ah All Cts	373.5	423.6	842.4	0.49		**169.6**	SPLS 6a_90 Ah All Cts	602.4	423.6	720.0	0.40
113C	Bovenregel twe	120x120x13	S235		2.70	1.70	1.00	101	**-193.1**	SPLS 6a_90 Ah All Cts	355.7	0.0	0.0	0.54		**176.8**	SPLS 6a_90 Ah All Cts	705.0	0.0	0.0	0.25
114A	Bovenregel twe	150x100x12	S235	5M24-5.6t	3.00	1.00	1.00	115	**-166.2**	SPLS 6a_90 Ah All Cts	301.8	423.6	777.6	0.55		**174.1**	SPLS 6a_90 Ah All Cts	582.2	423.6	664.6	0.41
114B	Bovenregel twe	150x100x12	S235	4M24-5.6t	3.00	1.00	1.00	104	**-38.9**	SPLS 3_0,9_65,5 Ah A	331.5	338.9	622.1	0.12		**35.8**	SPLS 6a_90 Ah Ct1 Ba	582.2	338.9	531.7	0.11
114C	Bovenregel twe	150x100x12	S235		3.00	1.00	1.00	115	**-151.1**	SPLS 6a_90 Ah All Cts	301.8	0.0	0.0	0.50		**158.6**	SPLS 6a_90 Ah All Cts	674.5	0.0	0.0	0.24
115A	Tussenregel tw	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-32.1**	SPLS 6a_90 Ah Ct1 Ah	79.8	84.7	77.8	0.41		**9.9**	SPLS 3_0,9_90 Ah Ct2	127.9	84.7	66.5	0.15
115B	Tussenregel tw	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-31.2**	SPLS 6a_90 Ah Ct1 Ah	71.0	84.7	77.8	0.44		**10.8**	SPLS 3_0,9_90 Ah Ct2	127.9	84.7	66.5	0.16
201L	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-42.2**	SPLS 3_0,9_65,5 Ah C	114.3	117.6	129.6	0.37		**34.5**	ULS 1a_90	145.4	117.6	104.7	0.33
201T	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-22.3**	SPLS 6a_90 Ba Ct2 Ah	114.3	117.6	129.6	0.19		**10.0**	SPLS 3_0,9_90 Ah Ct2	145.4	117.6	104.7	0.10
202L	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-193.9**	SPLS 3_90 Ba Ct2	425.3	338.9	518.4	0.57		**146.3**	SPLS 3_0,9_65,5 Ba C	384.5	338.9	350.9	0.43
202T	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-131.8**	SPLS 3_0,9_65,5 Ba C	425.3	338.9	518.4	0.39		**149.9**	SPLS 3_65,5 Ah Ct2	384.5	338.9	350.9	0.44
203L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-134.4**	SPLS 3_0,9_65,5 Ba C	406.7	338.9	518.4	0.40		**177.5**	SPLS 3_90 Ba Ct2	384.5	338.9	350.9	0.52
203T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-135.8**	SPLS 3_90 Ah Ct2	406.7	338.9	518.4	0.40		**120.3**	SPLS 3_0,9_45 Ba Ct1	384.5	338.9	350.9	0.36
204L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-184.7**	SPLS 3_0,9_65,5 Ah C	386.8	338.9	518.4	0.55		**141.4**	SPLS 3_0,9_65,5 Ah C	384.5	338.9	350.9	0.42
204T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-164.5**	SPLS 3_90 Ah Ct1	386.8	338.9	518.4	0.49		**157.0**	SPLS 3_0,9_90 Ah Ct2	384.5	338.9	350.9	0.46
205L	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-365.5**	SPLS 3_65,5 Ba Ct1	449.2	508.3	777.6	0.81		**356.6**	SPLS 3_65,5 Ba Ct2	384.5	508.3	513.8	0.93
205T	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-324.5**	SPLS 3_0,9_65,5 Ba C	449.2	508.3	777.6	0.72		**318.3**	SPLS 3_65,5 Ba Ct1	384.5	508.3	513.8	0.83
206L	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-296.9**	SPLS 3_65,5 Ba Ct2	465.9	423.6	777.6	0.70		**300.5**	SPLS 3_65,5 Ba Ct1	456.2	423.6	518.8	0.71
206T	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-263.3**	SPLS 3_65,5 Ba Ct1	465.9	423.6	777.6	0.62		**267.8**	SPLS 3_0,9_65,5 Ba C	456.2	423.6	518.8	0.63
207L	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-245.0**	SPLS 3_65,5 Ba Ct1	394.0	338.9	622.1	0.72		**241.9**	SPLS 3_65,5 Ba Ct2	456.2	338.9	421.1	0.71
207T	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-219.9**	SPLS 3_0,9_65,5 Ba C	394.0	338.9	622.1	0.65		**214.6**	SPLS 3_65,5 Ba Ct1	456.2	338.9	421.1	0.63
208L	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-201.8**	SPLS 3_65,5 Ba Ct2	332.1	254.2	388.8	0.79		**200.5**	SPLS 3_65,5 Ba Ct1	384.5	254.2	269.2	0.79
208T	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-182.1**	SPLS 3_65,5 Ba Ct1	332.1	254.2	388.8	0.72		**184.0**	SPLS 3_0,9_65,5 Ba C	384.5	254.2	269.2	0.72
209L	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-251.3**	SPLS 3_65,5 Ba Ct2	370.1	338.9	570.2	0.74		**240.4**	SPLS 3_0,9_65,5 Ba C	356.4	338.9	475.6	0.71
209T	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-238.5**	SPLS 3_65,5 Ba Ct1	370.1	338.9	570.2	0.70		**232.3**	SPLS 3_0,9_65,5 Ba C	356.4	338.9	475.6	0.69
210	Top	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	280	**-11.9**	SPLS 3_65,5 Ba Ct2	16.5	75.4	86.4	0.72		**11.9**	SPLS 3_0,9_65,5 Ba C	52.4	75.4	44.1	0.27
211L	Tweede dwarsa	100x100x6	S235	3M24-5.6t	1.00	1.00	1.00	132	**0.0**		113.1	254.2	233.3	0.00		**104.8**	ULS 3_65,5	161.1	254.2	199.4	0.65
211T	Tweede dwarsa	100x100x6	S235	2M24-5.6t	1.00	1.00	1.00	132	**-4.1**	ULS 1a_90	113.1	169.4	155.5	0.04		**2.5**	ULS 1a_0,9_0,9_90	206.4	169.4	132.9	0.02
109L	Tweede dwarsa	180x180x15#	S235	12M24-5.6t	1.00	2.00	1.00	53	**-539.5**	SPLS 3_65,5 Ah All Cts	1075.9	2033.3	2332.8	0.50		**437.8**	SPLS 3_0,9_65,5 Ah A	1144.0	2033.3	1814.4	0.38
212T	Tweede dwarsa	100x100x6	S235	4M24-5.6t	1.00	2.00	1.00	95	**-47.8**	SPLS 3_0,9_65,5 Ba C	144.3	338.9	311.0	0.33		**62.0**	SPLS 3_65,5 Ba Ct2	225.0	338.9	265.8	0.28
213	Tweede dwarsa	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	86	**-70.1**	SPLS 3_0,9_65,5 Ba C	265.3	254.2	311.0	0.28		**71.2**	SPLS 3_65,5 Ba Ct2	263.0	254.2	265.8	0.28
214	Tweede dwarsa	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	300	**-0.7**	ULS 3_0	11.8	37.7	43.2	0.06		**0.0**		37.4	37.7	22.0	0.00
215L	Eerste dwarsarı	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	178	**0.0**		103.8	254.2	311.0	0.00		**126.9**	SPLS 6a_90 Ba All Cts	270.5	254.2	265.8	0.50
215T	Eerste dwarsarı	100x100x8	S235	1M24-5.6t	1.00	1.00	1.00	178	**-53.7**	ULS 1a_0,9_90	83.1	84.7	103.7	0.65		**59.9**	ULS 1a_90	170.5	84.7	88.6	0.71
110L	Eerste dwarsarı	200x200x16	S235	12M24-5.6t	1.00	2.00	1.00	62	**-589.8**	SPLS 3_65,5 Ah All Cts	1222.1	906.5	2488.3	0.65		**414.2**	SPLS 3_0,9_65,5 Ah A	1386.2	906.5	2126.8	0.46
216T	Eerste dwarsarı	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	124	**-112.6**	SPLS 3_0,9_65,5 Ba C	151.1	338.9	414.7	0.75		**125.8**	SPLS 3_65,5 Ba Ct1	293.9	338.9	354.5	0.43
217	Eerste dwarsarı	120x120x11	S235	3M24-5.6t	1.00	1.00	1.00	114	**-156.7**	SPLS 3_0,9_65,5 Ba C	286.0	254.2	427.7	0.62		**158.1**	SPLS 3_65,5 Ba Ct2	356.4	254.2	365.5	0.62
218	Eerste dwarsarı	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	325	**-0.6**	ULS 3_135	12.6	58.8	54.0	0.05		**0.0**		54.7	58.8	37.0	0.00
219L	Onderstuk in to	130x130x12#	S235	2M24-5.6t	1.00	1.00	1.00	157	**-47.5**	SPLS 3_65,5 Ah All Cts	235.2	169.4	311.0	0.28		**37.4**	SPLS 3_0,9_65,5 Ah A	363.3	169.4	265.8	0.22
219T	Onderstuk in to	130x130x12#	S235	2M24-5.6t	1.00	1.00	1.00	157	**-51.1**	SPLS 3_65,5 Ah All Cts	235.2	169.4	311.0	0.30		**41.5**	SPLS 3_0,9_65,5 Ah A	363.3	169.4	265.8	0.25
220	Onderstuk in to	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	311	**-5.2**	SPLS 1a_0 Ah Ct2	11.6	37.7	43.2	0.45		**4.6**	ULS 1a_0,9_0,9_45	60.5	37.7	32.0	0.15
221	Onderstuk in to	70x70x5#	S235	1M16-5.6t	0.50	1.00	0.50	370	**-1.0**	ULS 7	11.4	37.7	43.2	0.09		**0.0**		74.9	37.7	32.0	0.00
301	Diagonaal onde	100x100x8	S235	1M20-5.6t	0.55	0.55	0.55	123	**-55.0**	SPLS 3_65,5 Ah All Cts	129.7	58.8	86.4	0.94		**55.4**	SPLS 3_0,9_65,5 Ah A	179.7	58.8	69.8	0.94
302	Diagonaal onde	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	110	**-70.1**	SPLS 3_0,9_65,5 Ah C	180.9	117.6	172.8	0.60		**68.5**	SPLS 3_65,5 Ah Ct1	190.7	117.6	139.6	0.58
303	Diagonaal onde	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	92	**-62.4**	SPLS 3_0,9_65,5 Ah A	208.7	117.6	172.8	0.53		**59.9**	SPLS 3_65,5 Ah All Cts	190.7	117.6	139.6	0.51
304	Diagonaal onde	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	104	**-80.5**	SPLS 3_65,5 Ah Ct1	143.2	117.6	129.6	0.68		**81.2**	SPLS 3_0,9_65,5 Ah A	170.1	117.6	104.7	0.78
305	Diagonaal onde	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	92	**-43.3**	SPLS 3_65,5 Ah All Cts	101.8	84.7	77.8	0.56		**46.6**	SPLS 3_0,9_65,5 Ah A	93.3	84.7	59.8	0.78
306	Diagonaal onde	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	84	**-23.4**	SPLS 3_0,9_65,5 Ah A	107.6	84.7	77.8	0.30		**27.0**	SPLS 3_65,5 Ah All Cts	93.3	84.7	66.5	0.41
307	Diagonaal onde	80x80x6#	S235	1M24-5.6t	0.55	0.55	0.55	96	**-32.0**	SPLS 6a_90 Ah All Cts	98.2	84.7	77.8	0.41		**27.1**	SPLS 3_0,9_65,5 Ah A	93.3	84.7	59.8	0.45
308	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	89	**-37.6**	SPLS 3_65,5 Ah All Cts	129.6	117.6	129.6	0.32		**37.8**	SPLS 3_0,9_65,5 Ah A	115.9	117.6	104.7	0.36
309	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-46.4**	SPLS 3_0,9_65,5 Ah A	140.4	117.6	129.6	0.39		**45.3**	SPLS 3_65,5 Ah All Cts	124.8	117.6	104.7	0.43
310	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	76	**-63.9**	SPLS 3_65,5 Ah All Cts	143.9	117.6	129.6	0.54		**62.4**	SPLS 3_0,9_65,5 Ah A	136.2	117.6	104.7	0.60
311	Diagonaal onde	70x70x6	S235	1M24-5.6t	1.00	1.00	1.00	69	**-28.7**	SPLS 3_65,5 Ah All Cts	99.6	84.7	77.8	0.37		**29.1**	SPLS 3_0,9_65,5 Ah A	76.0	84.7	55.0	0.53
312	Diagonaal onde	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	82	**-1.1**	SPLS 1a_0 Ba All Cts	55.5	37.7	43.2	0.03		**3.3**	ULS 3_0,9_90	37.4	37.7	25.7	0.13
313	Dwarsligger on	HEA160	S235	2M20-5.6t	2.00	1.00	1.00	48	**-3.6**	SPLS 3_0,9_65,5 Ah C	686.1	117.6	216.0	0.03		**8.4**	SPLS 6a_90 Ba Ct2 Ah	766.1	117.6	0.0	0.07
314	Dwarsligger on	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	82	**0.0**		314.6	117.6	259.2	0.00		**51.7**	ULS 3_65,5	278.4	117.6	259.2	0.44
315	Dwarsligger on	HEA160	S235		1.00	1.00	1.00	26	**-1.3**	ULS 1a_0,9_0,9_65,5	789.3	0.0	0.0	0.00		**5.0**	ULS 3_65,5	916.5	0.0	0.0	0.01
316	Dwarsligger on	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	37	**0.0**		426.4	117.6	259.2	0.00		**59.7**	ULS 3_0,9_65,5	278.4	117.6	259.2	0.51
317	Dwarsligger on	HEA160	S235		1.00	1.00	1.00	13	**-10.1**	ULS 3_0,9_65,5	825.9	0.0	0.0	0.01		**0.0**		916.5	0.0	0.0	0.00

DNV·GL

Assessment of groups for strengthened mast (afkeur level)

Date 17-8-2020
Author MKh
Version 1.0

KIJ-GT 380
HC+0
38

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
318	Verticaal eerste	90x90x6#	S235	1M20-5.6t	1.00	1.00	1.00	168	**-20.7**	SPLS 6a_90 Ba All Cts	61.1	58.8	64.8	0.35		**0.0**		117.5	58.8	52.4	0.00
319	Verticaal eerste	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	190	**-5.6**	ULS 3_45	29.3	37.7	43.2	0.19		**0.0**		37.4	37.7	22.0	0.00
320	Verticaal eerste	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	94	**-0.9**	ULS 7	50.9	37.7	43.2	0.02		**0.0**		37.4	37.7	18.4	0.00
321	Diagonaal eerst	50x50x6	S235	2M16-5.6t	1.00	1.00	1.00	580	**0.0**		5.7	75.4	103.7	0.00		**31.3**	ULS 3_135	62.1	75.4	52.9	0.59
322	Diagonaal eerst	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	415	**0.0**		12.4	117.6	129.6	0.00		**47.1**	SPLS 6a_90 Ba All Cts	77.4	117.6	88.7	0.61
323	Diagonaal eerst	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	516	**0.0**		4.7	37.7	43.2	0.00		**18.8**	ULS 1a_0	37.4	37.7	22.0	0.85
324	Dwarsligger bo	65x50x5	S235	1M24-5.6t	1.00	1.00	1.00	220	**-2.9**	ULS 3_0,9_65,5	21.8	84.7	64.8	0.13		**0.0**		25.9	84.7	8.9	0.00
325	Tussen diagona	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	171	**-0.3**	SPLS 1a_0 Ah All Cts	27.0	37.7	43.2	0.01		**3.9**	ULS 3_0,9_45	37.4	37.7	18.4	0.21
401	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	110	**-28.7**	SPLS 3_65,5 Ah All Cts	123.3	117.6	129.6	0.24		**28.6**	SPLS 3_0,9_65,5 Ah A	128.8	117.6	104.7	0.27
402	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	102	**-34.2**	SPLS 3_0,9_65,5 Ah A	132.3	117.6	129.6	0.29		**35.9**	SPLS 3_65,5 Ah Ct1	136.1	117.6	104.7	0.34
403	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	98	**-44.8**	SPLS 3_65,5 Ah Ct1	136.1	117.6	129.6	0.38		**41.5**	SPLS 3_0,9_65,5 Ah A	140.4	117.6	104.7	0.40
404	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	90	**-45.5**	SPLS 3_65,5 Ah Ct1	129.0	117.6	129.6	0.39		**44.4**	SPLS 3_0,9_65,5 Ah A	119.7	117.6	104.7	0.42
405	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	81	**-51.2**	SPLS 3_0,9_65,5 Ah A	138.2	117.6	129.6	0.44		**51.8**	SPLS 3_65,5 Ah Ct1	123.5	117.6	104.7	0.49
406	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-66.9**	SPLS 3_65,5 Ah Ct1	140.4	117.6	129.6	0.57		**63.1**	SPLS 3_0,9_65,5 Ah A	131.2	117.6	104.7	0.60
407	Diagonaal onde	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	83	**-24.9**	SPLS 3_65,5 Ah All Cts	79.3	58.8	64.8	0.42		**26.0**	SPLS 3_0,9_65,5 Ah A	65.7	58.8	38.8	0.67
408	Diagonaal onde	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	78	**-1.1**	SPLS 1a_0 Ba All Cts	81.4	58.8	64.8	0.02		**3.7**	ULS 3_0,9_135	65.7	58.8	38.8	0.09
409	Dwarsligger ond	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	51	**0.0**		700.0	117.6	216.0	0.00		**6.1**	ULS 3_90	766.1	117.6	0.0	0.05
410	Dwarsligger ond	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	44	**0.0**		410.1	117.6	259.2	0.00		**61.7**	ULS 3_0,9_65,5	278.4	117.6	259.2	0.52
411	Dwarsligger ond	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	31	**-8.6**	ULS 3_0,9_65,5	774.9	117.6	216.0	0.07		**0.0**		766.1	117.6	0.0	0.00
412	Bovenregel twe	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	306	**0.0**		56.1	254.2	311.0	0.00		**129.0**	ULS 3_65,5	263.0	254.2	265.8	0.51
413	Bovenregel twe	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	238	**0.0**		83.2	254.2	311.0	0.00		**116.6**	ULS 3_90	263.0	254.2	265.8	0.46
414	Diagonaal bove	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	203	**-5.3**	ULS 1a_0	25.4	37.7	51.8	0.21		**5.5**	SPLS 1a_0,9_0 Ba Ct2	44.9	37.7	26.5	0.21
415	Diagonaal bove	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	189	**-5.4**	SPLS 1a_0,9_0 Ba Ct2	28.1	37.7	51.8	0.19		**4.9**	SPLS 1a_0 Ba All Cts	44.9	37.7	26.5	0.19
416	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	179	**-5.2**	SPLS 1a_0 Ba All Cts	25.5	37.7	43.2	0.20		**5.6**	SPLS 6a_90 Ah Ct2 Ba	37.4	37.7	22.0	0.26
417	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	146	**-9.6**	SPLS 6a_90 Ah All Cts	33.1	37.7	43.2	0.29		**9.9**	SPLS 6a_90 Ah All Cts	37.4	37.7	22.0	0.45
418	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	138	**-11.9**	SPLS 6a_90 Ah All Cts	35.2	37.7	43.2	0.34		**11.7**	SPLS 6a_90 Ah All Cts	37.4	37.7	22.0	0.53
419	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	134	**-14.7**	SPLS 6a_90 Ah All Cts	36.6	37.7	43.2	0.40		**14.7**	SPLS 6a_90 Ah All Cts	37.4	37.7	22.0	0.67
420	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	96	**-16.7**	SPLS 6a_90 Ah All Cts	60.6	58.8	54.0	0.31		**17.0**	SPLS 6a_90 Ah All Cts	54.7	58.8	32.4	0.53
421	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	93	**-22.7**	SPLS 6a_90 Ah All Cts	62.4	58.8	54.0	0.42		**21.8**	SPLS 6a_90 Ah All Cts	54.7	58.8	32.4	0.68
422	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	88	**-27.9**	SPLS 6a_90 Ah All Cts	64.7	58.8	54.0	0.52		**29.7**	SPLS 6a_90 Ah All Cts	54.7	58.8	37.0	0.80
423	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-1.3**	SPLS 3_0,9_65,5 Ba C	50.8	37.7	43.2	0.03		**3.9**	SPLS 6a_90 Ba Ct2 Ba	37.4	37.7	22.0	0.18
424	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**0.0**		25.2	37.7	43.2	0.00		**5.0**	SPLS 6a_90 Ba Ct2 Ba	37.4	37.7	22.0	0.23
425	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	314	**-3.7**	SPLS 1a_65,5 Ba Ct1	11.0	37.7	43.2	0.33		**0.0**		37.4	37.7	22.0	0.00
426	Diagonaal twee	**50x50x7**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	353	**-11.9**	SPLS 6a_90 Ba Ct2 Ba	13.2	60.3	82.3	0.90		**1.1**	SPLS 3_0,9_65,5 Ba C	71.3	60.3	42.0	0.03
427	Diagonaal twee	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	266	**0.0**		14.3	37.7	43.2	0.00		**1.1**	ULS 1a_114,5	37.4	37.7	22.0	0.05
428	Dwarsligger bo	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	196	**-0.5**	ULS 3_0,9_90	22.5	37.7	43.2	0.02		**0.4**	ULS 1a_90	37.4	37.7	22.0	0.02
429	Dwarsligger bo	UNP160	S235	1M16-5.6t	1.00	1.00	1.00	42	**0.0**		288.7	37.7	64.8	0.00		**26.1**	ULS 3_0,9_65,5	90.7	37.7	48.0	0.69
430	Dwarsligger lad	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	112	**0.0**	SPLS 1a_65,5 Ba All Ct	44.1	37.7	43.2	0.00		**0.0**	ULS 1a_0,9_65,5	37.4	37.7	22.0	0.00

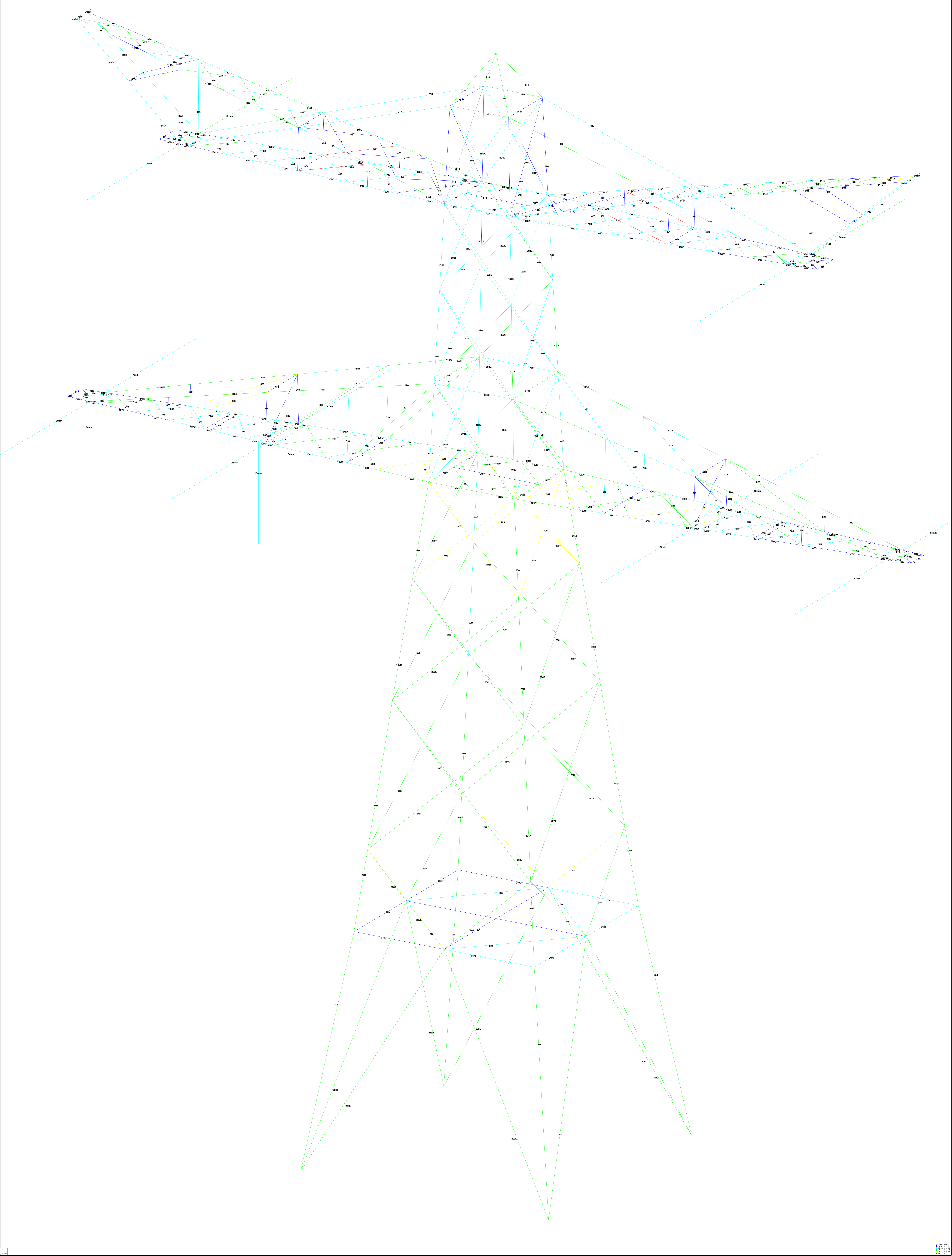
Assessment of groups for strengthened mast (verbouw level)

Date	17-8-2020
Author	MKh
Version	1.0

KIJ-GT 380
HC+0
38

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
426	Diagonaal twee	**50x50x7**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	353	**-12.8**	SPLS 6a 90 Ba Ct2 Ba	13.2	60.3	82.3	0.96		**1.3**	SPLS 3 0.9 65.5 Ba Ct	71.3	60.3	42.0	0.03

DNV GL Nederlands BV, Project: "HC+0 (da) afk (2;38)"
Tower Version 16.39, 11:51:44 vrijdag 14 augustus 2020
Undeformed geometry displayed



Assessment of groups for initial mast (afkeur level)

Date	18-8-2020
Author	MKh
Version	1.0

KIJ-GT 380
HC+0
54

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
101A	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	85	**-49.9**	ULS 1a_67	390.5	508.3	777.6	0.13		**20.1**	ULS 1a_0,9_0,9_67	466.6	508.3	664.6	0.04	
101B	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	74	**-154.4**	ULS 1a_67	423.6	506.7	777.6	0.36		**122.0**	ULS 1a_0,9_67	466.6	506.7	664.6	0.26	
102A	Leg	180x180x16	S235	8M24-5.6t	0.50	0.50	0.50	54	**-388.0**	SPLS 3_67 Ah All Cts	1141.5	674.7	1658.9	0.58		**312.9**	SPLS 3_0,9_67 Ah All Cts	1220.3	674.7	1417.8	0.46	
102B	Leg	180x180x16	S235	12M24-5.6t	0.50	0.50	0.50	57	**-451.0**	ULS 1a_67	1125.2	1005.5	2488.3	0.45		**340.1**	ULS 1a_0,9_67	1220.3	1005.5	2169.3	0.34	
103A	Leg	200x200x20	S235	16M24-5.6t	0.28	0.28	0.28	28	**-783.0**	ULS 1a_67	1750.2	1181.8	4147.2	0.66		**638.1**	SPLS 3_0,9_67 Ah All Cts	1710.7	1181.8	3544.6	0.54	
103B	Leg	200x200x20	S235	12M24-5.6t	0.28	0.28	0.28	35	**-984.2**	SPLS 3_67 Ah All Cts	1704.3	1987.7	3110.4	0.58		**842.0**	SPLS 3_0,9_67 Ah All Cts	1710.7	1987.7	2658.5	0.49	
104A	Leg	250x250x20	S235	12M24-5.6t	0.28	0.28	0.28	34	**-1225.0**	SPLS 3_67 Ah All Cts	2172.1	1892.2	3110.4	0.65		**1062.2**	SPLS 3_0,9_67 Ah All Cts	2244.7	1892.2	2658.5	0.56	
104B	Leg	250x250x20	S235	14M24-5.6t	0.55	0.55	0.55	37	**-1338.3**	SPLS 3_67 Ah All Cts	2149.3	2100.4	3628.8	0.64		**1168.3**	SPLS 3_0,9_67 Ah All Cts	2244.7	2100.4	3101.5	0.56	
105	Leg	250x250x22	S235	14M24-5.6t	0.17	0.17	0.17	33	**-1362.3**	SPLS 3_67 Ah All Cts	2386.8	2100.4	3991.7	0.65		**1168.9**	SPLS 3_0,9_67 Ah All Cts	2453.6	2100.4	3411.7	0.56	
106A	Onderregel eerste dwarsarm	200x200x16	S235	12M24-5.6t	1.53	1.00	1.00	63	**-663.6**	SPLS 6a_90 Ba Ct2 Ah Ct2	1211.7	906.5	2488.3	0.73		**451.5**	SPLS 3_0,9_67 Ah Ct1	1386.2	906.5	2126.8	0.50	
106B	Onderregel eerste dwarsarm	200x200x16	S235	10M24-5.6t	7.64	1.00	1.00	74	**-357.3**	SPLS 6a_90 Ba Ct2 Ah Ct2	1128.4	847.2	2073.6	0.42		**232.1**	SPLS 3_0,9_67 Ah Ct1	1386.2	847.2	1772.3	0.27	
106C	Onderregel eerste dwarsarm	200x200x16	S235		2.88	1.77	1.00	62	**-597.7**	SPLS 6a_90 Ba Ct2 Ah Ct2	1220.6	0.0	0.0	0.49		**385.7**	SPLS 3_0,9_67 Ah Ct1	1452.3	0.0	0.0	0.27	
107A	Onderregel eerste dwarsarm	180x180x15	S235	10M24-5.6t	2.78	1.00	1.00	83	**-328.1**	SPLS 6a_90 Ba Ct2 Ah Ct2	887.4	847.2	1944.0	0.39		**205.7**	SPLS 3_0,9_67 Ah Ct1	1144.0	847.2	1661.5	0.24	
107B	Onderregel eerste dwarsarm	180x180x15	S235	2M20-5.6t	1.63	1.00	1.00	18	**-3.3**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**0.5**	SPLS 1a_0 Ba All Cts	613.8	117.6	297.8	0.00	
107C	Onderregel eerste dwarsarm	180x180x15	S235		18.24	1.00	1.00	83	**-314.3**	SPLS 6a_90 Ba Ct2 Ah Ct2	887.3	0.0	0.0	0.35		**186.8**	SPLS 3_0,9_67 Ah Ct1	1220.5	0.0	0.0	0.15	
108A	Onderregel tweede dwarsarm	180x180x15	S235	12M24-5.6t	1.12	1.00	1.00	64	**-357.7**	SPLS 6a_90 Ba All Cts Ah Ct2	1011.2	2033.3	2332.8	0.35		**259.0**	SPLS 3_0,9_67 Ah All Cts	1144.0	2033.3	1814.4	0.23	
108B	Onderregel tweede dwarsarm	180x180x15	S235	2M20-5.6t	1.00	1.50	1.00	19	**-0.2**	SPLS 1a_0,9_135 Ah All Cts	1220.5	117.6	324.0	0.00		**1.6**	ULS 1a_135	613.8	117.6	297.8	0.01	
108C	Onderregel tweede dwarsarm	180x180x15	S235		2.77	1.70	1.00	65	**-319.4**	SPLS 6a_90 Ba All Cts Ah Ct2	1010.4	0.0	0.0	0.32		**213.9**	SPLS 3_0,9_67 Ah All Cts	1220.5	0.0	0.0	0.18	
111A	Bovenregel eerste dwarsarm	90x90x9	S235	3M24-5.6t	1.00	1.96	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**133.2**	ULS 3_135	205.3	254.2	299.1	0.65	
111B	Bovenregel eerste dwarsarm	90x90x9	S235	3M24-5.6t	1.00	2.04	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**96.5**	ULS 3_135	205.3	254.2	299.1	0.47	
112A	Bovenregel eerste dwarsarm	75x75x7#	S235	3M24-5.6t	1.00	1.80	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**82.2**	6a_90 Ba All Cts Ah Ct2	131.8	254.2	192.5	0.62	
112B	Bovenregel eerste dwarsarm	75x75x7#	S235	3M24-5.6t	1.00	2.25	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**82.2**	6a_90 Ba All Cts Ah Ct2	131.8	254.2	192.5	0.62	
113A	Bovenregel tweede dwarsarm	120x120x13	S235	5M24-5.6t	1.59	1.00	1.00	101	**-194.2**	SPLS 6a_90 Ba All Cts Ah Ct1	355.8	423.6	842.4	0.55		**165.8**	6a_90 Ba All Cts Ah Ct2	418.7	423.6	703.2	0.40	
113B	Bovenregel tweede dwarsarm	120x120x13	S235	5M24-5.6t	1.40	1.00	1.00	102	**-177.6**	SPLS 6a_90 Ba All Cts Ah Ct1	373.5	423.6	842.4	0.48		**159.1**	6a_90 Ba All Cts Ah Ct2	602.4	423.6	720.0	0.38	
113C	Bovenregel tweede dwarsarm	120x120x13	S235		2.70	1.70	1.00	101	**-190.1**	SPLS 6a_90 Ba All Cts Ah Ct1	355.7	0.0	0.0	0.53		**166.6**	6a_90 Ba All Cts Ah Ct2	705.0	0.0	0.0	0.24	
114A	Bovenregel tweede dwarsarm	150x100x12	S235	5M24-5.6t	3.00	1.00	1.00	115	**-156.3**	SPLS 6a_90 Ba All Cts Ah Ct1	301.8	423.6	777.6	0.52		**165.0**	6a_90 Ba All Cts Ah Ct2	582.2	423.6	664.6	0.39	
114B	Bovenregel tweede dwarsarm	150x100x12	S235	4M24-5.6t	3.00	1.00	1.00	104	**-39.5**	SPLS 1a_0,9_67 Ah All Cts	331.5	338.9	622.1	0.12		**31.8**	6a_90 Ba All Cts Ah Ct2	582.2	338.9	531.7	0.09	
114C	Bovenregel tweede dwarsarm	150x100x12	S235		3.00	1.00	1.00	115	**-141.7**	SPLS 6a_90 Ba All Cts Ah Ct1	301.8	0.0	0.0	0.47		**150.0**	6a_90 Ba All Cts Ah Ct2	674.5	0.0	0.0	0.22	
115A	Tussenregel tweede dwarsarm	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-27.5**	SPLS 6a_90 Ah Ct1 Ah Ct2	79.8	84.7	77.8	0.35		**11.0**	SPLS 1a_0,9_67 Ah Ct2	127.9	84.7	66.5	0.17	
115B	Tussenregel tweede dwarsarm	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-26.7**	SPLS 6a_90 Ah Ct1 Ah Ct2	71.0	84.7	77.8	0.38		**11.7**	SPLS 1a_0,9_67 Ah Ct2	127.9	84.7	66.5	0.18	
201L	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-38.8**	SPLS 1a_0,9_67 Ah Ct2	114.3	117.6	129.6	0.34		**31.7**	ULS 1a_67	145.4	117.6	104.7	0.30	
201T	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-19.6**	SPLS 6a_90 Ba Ct2 Ah Ct2	114.3	117.6	129.6	0.17		**9.9**	SPLS 1a_0,9_90 Ah Ct2	145.4	117.6	104.7	0.09	
202L	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-168.2**	SPLS 3_67 Ah Ct2	425.3	338.9	518.4	0.50		**123.5**	SPLS 3_0,9_90 Ah Ct1	384.5	338.9	350.9	0.36	
202T	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-115.9**	SPLS 3_0,9_45 Ba Ct1	425.3	338.9	518.4	0.34		**134.1**	SPLS 3_67 Ah Ct2	384.5	338.9	350.9	0.40	
203L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-113.3**	SPLS 3_0,9_90 Ah Ct1	406.7	338.9	518.4	0.33		**153.8**	SPLS 3_67 Ah Ct2	384.5	338.9	350.9	0.45	
203T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-121.2**	SPLS 3_67 Ah Ct2	406.7	338.9	518.4	0.36		**106.2**	SPLS 3_0,9_45 Ba Ct1	384.5	338.9	350.9	0.31	
204L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-172.8**	SPLS 3_0,9_67 Ah Ct2	386.8	338.9	518.4	0.51		**136.4**	SPLS 3_0,9_90 Ba Ct1	384.5	338.9	350.9	0.40	
204T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-149.9**	SPLS 3_67 Ba Ct1	386.8	338.9	518.4	0.44		**145.9**	SPLS 3_0,9_67 Ah Ct2	384.5	338.9	350.9	0.43	
205L	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-340.2**	SPLS 3_67 Ba Ct2	449.2	508.3	777.6	0.76		**336.6**	SPLS 3_67 Ba Ct2	384.5	508.3	513.8	0.88	
205T	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-306.0**	SPLS 3_0,9_67 Ba Ct2	449.2	508.3	777.6	0.68		**301.0**	SPLS 3_67 Ba Ct1	384.5	508.3	513.8	0.78	
206L	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-280.5**	SPLS 3_67 Ba Ct2	465.9	423.6	777.6	0.66		**277.5**	SPLS 3_67 Ba Ct1	456.2	423.6	518.8	0.66	
206T	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-248.9**	SPLS 3_67 Ba Ct1	465.9	423.6	777.6	0.59		**252.3**	SPLS 3_0,9_67 Ba Ct2	456.2	423.6	518.8	0.60	
207L	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-226.5**	SPLS 3_67 Ba Ct1	394.0	338.9	622.1	0.67		**228.5**	SPLS 3_67 Ba Ct2	456.2	338.9	421.1	0.67	
207T	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-207.1**	SPLS 3_0,9_67 Ba Ct2	394.0	338.9	622.1	0.61		**202.8**	SPLS 3_67 Ba Ct1	456.2	338.9	421.1	0.60	
208L	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-190.9**	SPLS 3_67 Ba Ct2	332.1	254.2	388.8	0.75		**185.5**	SPLS 3_67 Ba Ct1	384.5	254.2	269.2	0.73	
208T	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-172.1**	SPLS 3_67 Ba Ct1	332.1	254.2	388.8	0.68		**172.8**	SPLS 3_0,9_67 Ba Ct2	384.5	254.2	269.2	0.68	
209L	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-238.1**	SPLS 3_67 Ba Ct2	370.1	338.9	570.2	0.70		**219.0**	SPLS 3_0,9_67 Ba Ct1	356.4	338.9	475.6	0.65	
209T	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-222.9**	SPLS 3_67 Ba Ct1	370.1	338.9	570.2	0.66		**215.2**	SPLS 3_0,9_67 Ba Ct2	356.4	338.9	475.6	0.64	
210	Top	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	280	**-10.1**	SPLS 3_67 Ba Ct2	16.5	75.4	86.4	0.61		**10.0**	SPLS 3_0,9_67 Ba Ct2	52.4	75.4	44.1	0.23	
211L	Tweede dwarsarm in tower	100x100x6	S235	3M24-5.6t	1.00	1.00	1.00	132	**0.0**		113.1	254.2	233.3	0.00		**92.4**	ULS 3_135	161.1	254.2	199.4	0.57	
211T	Tweede dwarsarm in tower	100x100x6	S235	2M24-5.6t	1.00	1.00	1.00	132	**-3.7**	ULS 1a_90	113.1	169.4	155.5	0.03		**2.7**	ULS 1a_0,9_90	206.4	169.4	132.9	0.02	
109L	Tweede dwarsarm in tower	180x180x15	S235	12M24-5.6t	1.00	2.00	1.00	53	**-459.1**	SPLS 3_67 Ah All Cts	1075.9	2033.3	2332.8	0.43		**392.7**	SPLS 3_0,9_67 Ah All Cts	1144.0	2033.3	1814.4	0.34	
212T	Tweede dwarsarm in tower	100x100x6	S235	4M24-5.6t	1.00	2.00	1.00	95	**-36.8**	ULS 5a Ba 12	144.3	338.9	311.0	0.26		**50.9**	ULS 5a Ba 12	225.0	338.9	265.8	0.23	
213	Tweede dwarsarm in tower	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	86	**-58.8**	ULS 5a Ba 12	265.3	254.2	311.0	0.23		**59.3**	ULS 5a Ba 12	263.0	254.2	265.8	0.23	
214	Tweede dwarsarm in tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	300	**-0.6**	SPLS 6a_90 Ba Ct1 Ah Ct2	11.8	37.7	43.2	0.05		**0.0**		37.4	37.7	22.0	0.00	
215L	Eerste dwarsarm in tower	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	178	**0.0**		103.8	254.2	311.0	0.00		**127.3**	6a_90 Ba All Cts Ah Ct2	270.5	254.2	265.8	0.50	
215T	Eerste dwarsarm in tower	100x100x8	S235	1M24-5.6t	1.00	1.00	1.00	178	**-52.2**	ULS 1a_0,9_90	83.1	84.7	103.7	0.63		**57.4**	ULS 1a_90	170.5	84.7	88.6	0.68	
110L	Eerste dwarsarm in tower	200x200x16	S235	12M24-5.6t	1.00	2.00	1.00	62	**-561.8**	SPLS 6a_90 Ba All Cts Ah Ct2	1222.1	906.5	2488.3	0.62		**413.4**	SPLS 3_0,9_67 Ah All Cts	1386.2	906.5	2126.8	0.46	
216T	Eerste dwarsarm in tower	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	124	**-110.3**	SPLS 3_0,9_67 Ba Ct2	151.1	338.9	414.7	0.73		**121.3**	SPLS 3_67 Ba Ct2	293.9	338.9	354.5	0.41	
217	Eerste dwarsarm in tower	120x120x11	S235	3M24-5.6t	1.00	1.00	1.00	114	**-151.1**	SPLS 3_0,9_67 Ba Ct2	286.0	254.2	427.7	0.59		**152.3**	SPLS 3_67 Ba Ct2	356.4	254.2	365.5	0.60	
218	Eerste dwarsarm in tower	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	325	**-0.6**	SPLS 6a_90 Ba Ct1 Ah Ct2	12.6	58.8	54.0	0.04		**0.0**		54.7	58.8	37.0	0.00	
219L	Onderstuk in tower	130x130x12	S235	2M24-5.6t	1.00	1.00	1.00	157	**-46.1**	SPLS 3_67 Ah All Cts	235.2	169.4	311.0	0.27		**36.8**	SPLS 3_0,9_67 Ah All Cts	363.3	169.4	265.8	0.22	
219T	Onderstuk in tower	130x130x12	S235	2M24-5.6t	1.00	1.00	1.00	157	**-49.3**	SPLS 3_67 Ah All Cts	235.2	169.4	311.0	0.29		**40.5**	SPLS 3_0,9_67 Ah All Cts	363.3	169.4	265.8	0.24	
220	Onderstuk in tower	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	311	**-4.8**	SPLS 1a_0 Ah Ct2	11.6	37.7	43.2	0.41		**3.5**	SPLS 1a_0,9_45 Ah Ct2	60.5	37.7	32.0	0.11	
221	Onderstuk in tower	70x70x5#	S235	1M16-5.6t	0.50	1.00	0.50	370	**-0.9**	ULS 7	9.8	37.7	43.2	0.09		**0.0**		74.9	37.7	32.0	0.00	
301	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	1M20-5.6t	0.55	0.55	0.55	123	**-53.9**	SPLS 3_67 Ah All Cts	129.7	58.8	86.4	0.92		**54.8**	SPLS 3_0,9_67 Ah All Cts	179.7	58.8	69.8	0.93	
302	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	110	**-68.9**	SPLS 3_0,9_67 Ah Ct1	180.9	117.6	172.8	0.59		**67.3**	SPLS 3_67 Ah Ct1	190.7	117.6	139.6	0.57	
303	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	92	**-61.5**	SPLS 3_0,9_67 Ah All Cts	208.7	117.6	172.8	0.52		**58.9**	SPLS 3_67 Ah All Cts	190.7	117.6	139.6	0.50	
304	Diagonaal onderregel eerste dwarsarm	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	104	**-78.5**	SPLS 3_67 Ah Ct1	143.2	117.6	129.6	0.67		**80.4**	SPLS 3_0,9_67 Ah All Cts	170.1	117.6	104.7	0.77	
305	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	92	**-42.6**	SPLS 3_67 Ah All Cts	101.8	84.7	77.8	0.55		**45.8**	SPLS 3_0,9_67 Ah All Cts	93.3	84.7	59.8	0.77	
306	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	84	**-23.1**	SPLS 3_0,9_67 Ah All Cts	107.6	84.7	77.8	0.30		**26.6**	SPLS 3_67 Ah All Cts	93.3	84.7	66.5	0.40	
307	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	0.55	0.55	0.55	96	**-31.3**	SPLS 6a_90 Ba All Cts Ah Ct1	98.2	84.7	77.8	0.40		**27.2**	SPLS 3_0,9_67 Ah All Cts	93.3	84.7	59.8	0.45	
308	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	89	**-36.6**	SPLS 3_67 Ah All Cts	129.6	117.6	129.6	0.31		**37.4**	SPLS 3_0,9_67 Ah All Cts	115.9	117.6	104.7	0.36	
309	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-45.9**	SPLS 3_0,9_67 Ah All Cts	140.4	117.6	129.6	0.39		**44.1**	SPLS 3_67 Ah All Cts	124.8	117.6	104.7	0.42	
310	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	76	**-62.1**	SPLS 3_67 Ah All Cts	143.9	117.6	129.6	0.53		**61.7**	SPLS 3_0,9_67 Ah All Cts	136.2	117.6	104.7	0.59	
311	Diagonaal onderregel eerste dwarsarm	70x70x6	S235	1M24-5.6t	1.00	1.00	1.00	69	**-27.9**	SPLS 3_67 Ah All Cts	99.6	84.7	77.8	0.36		**28.7**	SPLS 3_0,9_67 Ah All Cts	76.0	84.7	55.0	0.52	
312	Diagonaal onderregel eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	82	**-1.0**	SPLS 1a_0 Ba All Cts	55.5	37.7	43.2	0.03		**3.5**	ULS 3_0,9_67	37.4	37.7	25.7	0.14	
313	Dwarsligger onderregel eerste dwarsarm	HEA160	S235	2M20-5.6t	2.00	1.00	1.00	48	**-3.8**	SPLS 3_0,9_67 Ah Ct1	686.1	117.6	216.0	0.03		**8.3**	PLS 6a_90 Ba Ct2 Ah Ct2	766.1	117.6	0.0	0.07	
314	Dwarsligger onderregel eerste dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	82	**0.0**		314.6	117.6	259.2	0.00		**51.7**	ULS 3_67	278.4	117.6	259.2	0.44	
315	Dwarsligger onderregel eerste dwarsarm	HEA160	S235		1.00	1.00	1.00	26	**-1.9**	ULS 1a_0,9_0,9_67	789.3	0.0	0.0	0.00		**4.7**	ULS 3_67	916.5	0.0	0.0	0.01	
316	Dwarsligger onderregel eerste dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	37	**0.0**		426.4	117.6	259.2	0.00		**60.2**	ULS 3_0,9_67	278.4	117.6	259.2	0.51	
317	Dwarsligger onderregel eerste dwarsarm	HEA160	S235		1.00	1.00	1.00	13	**-10.3**	ULS 3_0,9_67	825.9	0.0	0.0	0.01		**0.0**		916.5	0.0	0.0	0.00	
318	Verticaal eerste dwarsarm	90x90x6#	S235	1M20-5.6t	1.00	1.00	1.00	168	**-20.6**	SPLS 6a_90 Ba All Cts Ah Ct2	61.1	58.8	64.8	0.35		**0.0**		117.5	58.8	52.4	0.00	
319	Verticaal eerste dwarsarm	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	190	**-5.8**	ULS 3_45	29.3	37.7	43.2	0.20		**0.0**		37.4	37.7	22.0	0.00	
320	Verticaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	94	**-0.9**	ULS 7	50.9	37.7	43.2	0.02		**0.0**		37.4	37.7	18.4	0.00	
321	Diagonaal eerste dwarsarm	50x50x6	S235	2M16-5.6t	1.00	1.00	1.00	580	**0.0**		5.7	75.4	103.7	0.00		**31.5**	ULS 3_135	62.1	75.4	52.9	0.60	
322	Diagonaal eerste dwarsarm	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	415	**0.0**		12.4	117.6	129.6	0.00		**46.8**	6a_90 Ba All Cts Ah Ct2	77.4	117.6	88.7	0.60	

Assessment of groups for initial mast (afkeur level)

Date	18-8-2020
Author	MKh
Version	1.0

KIJ-GT 380
HC+0
54

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
323	Diagonaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	516	**0.0**		4.7	37.7	43.2	0.00		**16.8**	ULS 1a_135	37.4	37.7	22.0	0.76	
324	Dwarsligger bovenregel eerste dwarsarm	65x50x5	S235	1M24-5.6t	1.00	1.00	1.00	220	**-3.0**	ULS 3_0,9_67	21.8	84.7	64.8	0.14		**0.0**		25.9	84.7	8.9	0.00	
325	Tussen diagonaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	171	**-0.1**	SPLS 1a_0 Ah All Cts	27.0	37.7	43.2	0.00		**3.9**	ULS 3_0,9_45	37.4	37.7	18.4	0.21	
401	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	110	**-31.4**	SPLS 3_67 Ah All Cts	123.3	117.6	129.6	0.27		**32.1**	SPLS 3_0,9_67 Ah All Cts	128.8	117.6	104.7	0.31	
402	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	102	**-38.1**	SPLS 3_0,9_67 Ah All Cts	132.3	117.6	129.6	0.32		**38.5**	SPLS 3_67 Ah Ct1	136.1	117.6	104.7	0.37	
403	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	98	**-47.9**	SPLS 3_67 Ah Ct1	136.1	117.6	129.6	0.41		**46.6**	SPLS 3_0,9_67 Ah All Cts	140.4	117.6	104.7	0.45	
404	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	90	**-50.6**	SPLS 3_67 Ah Ct1	129.0	117.6	129.6	0.43		**46.6**	SPLS 3_0,9_67 Ah Ct1	119.7	117.6	104.7	0.45	
405	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	81	**-58.2**	SPLS 3_67 Ah Ct1	138.2	117.6	129.6	0.50		**57.2**	SPLS 3_0,9_67 Ah All Cts	123.5	117.6	104.7	0.55	
406	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00	
407	Diagonaal onderregel tweede dwarsarm	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	83	**-3.3**	ULS 1a_0	79.3	58.8	64.8	0.06		**0.9**	LS 1a_0,9_135 Ah All Cts	65.7	58.8	38.8	0.02	
408	Diagonaal onderregel tweede dwarsarm	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	78	**-2.0**	ULS 1a_135	81.4	58.8	64.8	0.03		**0.2**	LS 1a_0,9_135 Ah All Cts	65.7	58.8	38.8	0.00	
409	Dwarsligger onderregel tweede dwarsarm	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	51	**0.0**		700.0	117.6	216.0	0.00		**7.2**	ULS 3_90	766.1	117.6	0.0	0.06	
410	Dwarsligger onderregel tweede dwarsarm	100x100x12	S235	2M20-5.6t	1.00	1.00	1.00	72	**-11.0**	ULS 3_0,9_67	356.1	117.6	259.2	0.09		**0.8**	SPLS 1a_0,9_135 Ah Ct1	278.4	117.6	259.2	0.01	
411	Dwarsligger onderregel tweede dwarsarm	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	31	**0.0**		774.9	117.6	216.0	0.00		**1.4**	ULS 3_90	766.1	117.6	0.0	0.01	
412	Bovenregel tweede dwarsarm	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	306	**-0.4**	ULS 1a_0,9_0,9_67	56.1	254.2	311.0	0.01		**114.3**	ULS 3_113	263.0	254.2	265.8	0.45	
413	Bovenregel tweede dwarsarm	120x120x8	S235	3M24-5.6t	2.00	2.00	2.00	238	**-11.7**	SPLS 1a_0,9_67 Ah Ct2	83.2	254.2	311.0	0.14		**97.8**	PLS 6a_90 Ba Ct2 Ah Ct2	263.0	254.2	265.8	0.39	
414	Diagonaal bovenregel tweede dwarsarm	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	203	**-4.6**	SPLS 1a_0 Ba All Cts	25.4	37.7	51.8	0.18		**4.6**	SPLS 1a_0,9_0 Ba All Cts	44.9	37.7	26.5	0.18	
415	Diagonaal bovenregel tweede dwarsarm	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	189	**-4.6**	SPLS 1a_0,9_0 Ba All Cts	28.1	37.7	51.8	0.17		**4.4**	SPLS 1a_0 Ba All Cts	44.9	37.7	26.5	0.17	
416	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	179	**-5.5**	SPLS 1a_0 Ba All Cts	25.5	37.7	43.2	0.21		**6.1**	6a_90 Ba All Cts Ah Ct2	37.4	37.7	22.0	0.28	
417	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	146	**-9.6**	SPLS 6a_90 Ba All Cts Ah Ct2	33.1	37.7	43.2	0.29		**9.9**	6a_90 Ba All Cts Ah Ct2	37.4	37.7	22.0	0.45	
418	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	138	**-11.2**	SPLS 6a_90 Ba All Cts Ah Ct2	35.2	37.7	43.2	0.32		**11.0**	6a_90 Ba All Cts Ah Ct2	37.4	37.7	22.0	0.50	
419	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	134	**-14.0**	SPLS 6a_90 Ba All Cts Ah Ct2	36.6	37.7	43.2	0.38		**14.0**	6a_90 Ba All Cts Ah Ct2	37.4	37.7	22.0	0.64	
420	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	96	**-16.0**	SPLS 6a_90 Ba All Cts Ah Ct2	60.6	58.8	54.0	0.30		**16.2**	6a_90 Ba All Cts Ah Ct2	54.7	58.8	32.4	0.50	
421	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	93	**-21.6**	SPLS 6a_90 Ba All Cts Ah Ct2	62.4	58.8	54.0	0.40		**20.8**	6a_90 Ba All Cts Ah Ct2	54.7	58.8	32.4	0.64	
422	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	88	**-26.8**	SPLS 6a_90 Ba All Cts Ah Ct2	64.7	58.8	54.0	0.50		**28.5**	6a_90 Ba All Cts Ah Ct2	54.7	58.8	37.0	0.77	
423	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-1.0**	SPLS 3_0,9_67 Ba Ct2	50.8	37.7	43.2	0.03		**3.9**	PLS 6a_90 Ba Ct2 Ah Ct2	37.4	37.7	22.0	0.18	
424	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**0.0**		25.2	37.7	43.2	0.00		**9.3**	PLS 6a_90 Ba Ct2 Ah Ct2	37.4	37.7	22.0	0.42	
425	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	314	**-3.1**	SPLS 1a_67 Ba Ct1	11.0	37.7	43.2	0.28		**0.0**		37.4	37.7	22.0	0.00	
426	Diagonaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	346	**-11.3**	SPLS 6a_90 Ba Ct2 Ah Ct2	9.4	37.7	43.2	1.20	knik	**0.8**	SPLS 3_0,9_67 Ba Ct2	37.4	37.7	22.0	0.04	
427	Diagonaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	266	**0.0**		14.3	37.7	43.2	0.00		**0.9**	ULS 1a_67	37.4	37.7	22.0	0.04	
428	Dwarsligger bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	196	**-0.3**	ULS 1a_0,9_90	22.5	37.7	43.2	0.02		**0.6**	ULS 1a_90	37.4	37.7	22.0	0.03	
429	Dwarsligger bovenregel tweede dwarsarm	UNP160	S235	1M16-5.6t	1.00	1.00	1.00	42	**0.0**		288.7	37.7	64.8	0.00		**26.5**	ULS 3_0,9_67	90.7	37.7	48.0	0.70	
430	Dwarsligger ladder tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	112	**0.0**	SPLS 1a_67 Ba All Cts	44.1	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00	
431	New: Horiz 1 under BVNTRVS	120x120x12	S355	2M24-8.8t	1.00	1.00	1.00	69	**0.0**		593.3	271.1	423.4	0.00		**42.1**	ULS 3_67	448.4	271.1	423.4	0.16	
432	New: Horiz 2 under BVNTRVS	120x120x12	S355	2M24-8.8t	2.00	2.00	2.00	64	**0.0**		621.2	271.1	423.4	0.00		**75.6**	ULS 3_67	448.4	271.1	423.4	0.28	
433	New: Diag tussen horizontals	70x70x7	S355	2M20-8.8t	1.00	1.00	1.00	89	**-41.8**	SPLS 3_67 Ah Ct1	165.8	188.2	205.8	0.25		**37.3**	SPLS 3_0,9_67 Ah All Cts	131.6	188.2	180.9	0.28	
434	New: CD underside	60x60x6	S355	1M20-8.8t	0.52	0.52	0.52	74	**-2.4**	SPLS 1a_135 Ba Ct1	113.3	94.1	88.2	0.03		**5.4**	ULS 1a_0,9_45	112.9	94.1	80.2	0.07	
435	New: Front bracing boventraverse	80x80x8	S355	2M20-8.8t	1.00	1.00	1.00	182	**-28.3**	SPLS 6a_90 Ba All Cts Ah Ct2	90.3	188.2	235.2	0.31		**0.0**		165.3	188.2	135.4	0.00	
436	New: Front bracing boventraverse	60x60x6	S355	1M20-8.8t	1.00	1.00	1.00	75	**-0.5**	ULS 1a_0,9_0,9_67	112.7	94.1	88.2	0.01		**15.9**	6a_90 Ba All Cts Ah Ct2	89.4	94.1	60.4	0.26	

DNV·GL

Assessment of groups for strengthened mast (afkeur level)

Date 18-8-2020
Author MKh
Version 1.0

KIJ-GT 380
HC+0
54

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
101A	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	85	**-49.9**	ULS 1a_67	390.5	508.3	777.6	0.13		**20.0**	ULS 1a_0,9_0,9_67	466.6	508.3	664.6	0.04
101B	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	74	**-154.5**	ULS 1a_67	423.6	506.7	777.6	0.36		**122.0**	ULS 1a_0,9_67	466.6	506.7	664.6	0.26
102A	Leg	180x180x16#	S235	8M24-5.6t	0.50	0.50	0.50	54	**-388.0**	SPLS 3_67 Ah All Cts	1141.5	674.7	1658.9	0.58		**312.8**	SPLS 3_0,9_67 Ah All (	1220.3	674.7	1417.8	0.46
102B	Leg	180x180x16#	S235	12M24-5.6t	0.50	0.50	0.50	57	**-451.0**	ULS 1a_67	1125.2	1005.5	2488.3	0.45		**340.0**	ULS 1a_0,9_67	1220.3	1005.5	2169.3	0.34
103A	Leg	200x200x20	S235	16M24-5.6t	0.28	0.28	0.28	28	**-783.1**	ULS 1a_67	1750.2	1181.8	4147.2	0.66		**638.1**	SPLS 3_0,9_67 Ah All (	1710.7	1181.8	3544.6	0.54
103B	Leg	200x200x20	S235	12M24-5.6t	0.28	0.28	0.28	35	**-984.2**	SPLS 3_67 Ah All Cts	1704.3	1987.7	3110.4	0.58		**841.9**	SPLS 3_0,9_67 Ah All (	1710.7	1987.7	2658.5	0.49
104A	Leg	250x250x20#	S235	12M24-5.6t	0.28	0.28	0.28	34	**-1225.1**	SPLS 3_67 Ah All Cts	2172.1	1892.2	3110.4	0.65		**1062.1**	SPLS 3_0,9_67 Ah All (	2244.7	1892.2	2658.5	0.56
104B	Leg	250x250x20#	S235	14M24-5.6t	0.55	0.55	0.55	37	**-1338.4**	SPLS 3_67 Ah All Cts	2149.3	2100.4	3628.8	0.64		**1168.3**	SPLS 3_0,9_67 Ah All (	2244.7	2100.4	3101.5	0.56
105	Leg	250x250x22#	S235	14M24-5.6t	0.17	0.17	0.17	33	**-1362.4**	SPLS 3_67 Ah All Cts	2386.8	2100.4	3991.7	0.65		**1168.8**	SPLS 3_0,9_67 Ah All (	2453.6	2100.4	3411.7	0.56
106A	Onderregel eer	200x200x16	S235	12M24-5.6t	1.53	1.00	1.00	63	**-663.6**	SPLS 6a_90 Ba Ct2 Ah	1211.7	906.5	2488.3	0.73		**451.5**	SPLS 3_0,9_67 Ah Ct1	1386.2	906.5	2126.8	0.50
106B	Onderregel eer	200x200x16	S235	10M24-5.6t	7.64	1.00	1.00	74	**-357.3**	SPLS 6a_90 Ba Ct2 Ah	1128.4	847.2	2073.6	0.42		**232.1**	SPLS 3_0,9_67 Ah Ct1	1386.2	847.2	1772.3	0.27
106C	Onderregel eer	200x200x16	S235		2.88	1.77	1.00	62	**-597.7**	SPLS 6a_90 Ba Ct2 Ah	1220.6	0.0	0.0	0.49		**385.7**	SPLS 3_0,9_67 Ah Ct1	1452.3	0.0	0.0	0.27
107A	Onderregel eer	180x180x15#	S235	10M24-5.6t	2.78	1.00	1.00	83	**-328.1**	SPLS 6a_90 Ba Ct2 Ah	887.4	847.2	1944.0	0.39		**205.7**	SPLS 3_0,9_67 Ah Ct1	1144.0	847.2	1661.5	0.24
107B	Onderregel eer	180x180x15#	S235	2M20-5.6t	1.63	1.00	1.00	18	**-3.3**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**0.5**	SPLS 1a_0 Ba All Cts	613.8	117.6	297.8	0.00
107C	Onderregel eer	180x180x15#	S235		18.24	1.00	1.00	83	**-314.3**	SPLS 6a_90 Ba Ct2 Ah	887.3	0.0	0.0	0.35		**186.8**	SPLS 3_0,9_67 Ah Ct1	1220.5	0.0	0.0	0.15
108A	Onderregel twe	180x180x15#	S235	12M24-5.6t	1.12	1.00	1.00	64	**-357.5**	SPLS 6a_90 Ba All Cts	1011.2	2033.3	2332.8	0.35		**259.0**	SPLS 3_0,9_67 Ah All (	1144.0	2033.3	1814.4	0.23
108B	Onderregel twe	180x180x15#	S235	2M20-5.6t	1.00	1.50	1.00	19	**-0.2**	SPLS 1a_0,9_135 Ah A	1220.5	117.6	324.0	0.00		**1.6**	ULS 1a_135	613.8	117.6	297.8	0.01
108C	Onderregel twe	180x180x15#	S235		2.77	1.70	1.00	65	**-319.2**	SPLS 6a_90 Ba All Cts	1010.4	0.0	0.0	0.32		**213.9**	SPLS 3_0,9_67 Ah All (	1220.5	0.0	0.0	0.18
111A	Bovenregel eer	90x90x9	S235	3M24-5.6t	1.00	1.96	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**133.2**	ULS 3_135	205.3	254.2	299.1	0.65
111B	Bovenregel eer	90x90x9	S235	3M24-5.6t	1.00	2.04	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**96.5**	ULS 3_135	205.3	254.2	299.1	0.47
112A	Bovenregel eer	75x75x7#	S235	3M24-5.6t	1.00	1.80	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**82.2**	SPLS 6a_90 Ba All Cts	131.8	254.2	192.5	0.62
112B	Bovenregel eer	75x75x7#	S235	3M24-5.6t	1.00	2.25	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**82.2**	SPLS 6a_90 Ba All Cts	131.8	254.2	192.5	0.62
113A	Bovenregel twe	120x120x13	S235	5M24-5.6t	1.59	1.00	1.00	101	**-194.5**	SPLS 6a_90 Ba All Cts	355.8	423.6	842.4	0.55		**165.6**	SPLS 6a_90 Ba All Cts	418.7	423.6	703.2	0.40
113B	Bovenregel twe	120x120x13	S235	5M24-5.6t	1.40	1.00	1.00	102	**-177.5**	SPLS 6a_90 Ba All Cts	373.5	423.6	842.4	0.48		**159.1**	SPLS 6a_90 Ba All Cts	602.4	423.6	720.0	0.38
113C	Bovenregel twe	120x120x13	S235		2.70	1.70	1.00	101	**-190.3**	SPLS 6a_90 Ba All Cts	355.7	0.0	0.0	0.54		**166.6**	SPLS 6a_90 Ba All Cts	705.0	0.0	0.0	0.24
114A	Bovenregel twe	150x100x12	S235	5M24-5.6t	3.00	1.00	1.00	115	**-156.3**	SPLS 6a_90 Ba All Cts	301.8	423.6	777.6	0.52		**165.0**	SPLS 6a_90 Ba All Cts	582.2	423.6	664.6	0.39
114B	Bovenregel twe	150x100x12	S235	4M24-5.6t	3.00	1.00	1.00	104	**-39.5**	SPLS 1a_0,9_67 Ah All	331.5	338.9	622.1	0.12		**31.8**	SPLS 6a_90 Ba All Cts	582.2	338.9	531.7	0.09
114C	Bovenregel twe	150x100x12	S235		3.00	1.00	1.00	115	**-141.7**	SPLS 6a_90 Ba All Cts	301.8	0.0	0.0	0.47		**150.0**	SPLS 6a_90 Ba All Cts	674.5	0.0	0.0	0.22
115A	Tussenregel tw	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-27.5**	SPLS 6a_90 Ah Ct1 Ah	79.8	84.7	77.8	0.35		**11.0**	SPLS 1a_0,9_67 Ah Ct	127.9	84.7	66.5	0.16
115B	Tussenregel tw	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-26.7**	SPLS 6a_90 Ah Ct1 Ah	71.0	84.7	77.8	0.38		**11.7**	SPLS 1a_0,9_67 Ah Ct	127.9	84.7	66.5	0.18
201L	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-38.8**	SPLS 1a_0,9_67 Ah Ct	114.3	117.6	129.6	0.34		**31.7**	ULS 1a_67	145.4	117.6	104.7	0.30
201T	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-19.6**	SPLS 6a_90 Ba Ct2 Ah	114.3	117.6	129.6	0.17		**9.9**	SPLS 1a_0,9_90 Ah Ct	145.4	117.6	104.7	0.09
202L	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-168.2**	SPLS 3_67 Ah Ct2	425.3	338.9	518.4	0.50		**123.5**	SPLS 3_0,9_90 Ah Ct1	384.5	338.9	350.9	0.36
202T	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-115.9**	SPLS 3_0,9_45 Ba Ct1	425.3	338.9	518.4	0.34		**134.1**	SPLS 3_67 Ah Ct2	384.5	338.9	350.9	0.40
203L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-113.3**	SPLS 3_0,9_90 Ah Ct1	406.7	338.9	518.4	0.33		**153.8**	SPLS 3_67 Ah Ct2	384.5	338.9	350.9	0.45
203T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-121.2**	SPLS 3_67 Ah Ct2	406.7	338.9	518.4	0.36		**106.2**	SPLS 3_0,9_45 Ba Ct1	384.5	338.9	350.9	0.31
204L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-172.8**	SPLS 3_0,9_67 Ah Ct2	386.8	338.9	518.4	0.51		**136.4**	SPLS 3_0,9_90 Ba Ct1	384.5	338.9	350.9	0.40
204T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-149.9**	SPLS 3_67 Ba Ct1	386.8	338.9	518.4	0.44		**145.9**	SPLS 3_0,9_67 Ah Ct2	384.5	338.9	350.9	0.43
205L	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-340.2**	SPLS 3_67 Ba Ct2	449.2	508.3	777.6	0.76		**336.6**	SPLS 3_67 Ba Ct2	384.5	508.3	513.8	0.88
205T	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-306.0**	SPLS 3_0,9_67 Ba Ct2	449.2	508.3	777.6	0.68		**301.0**	SPLS 3_67 Ba Ct1	384.5	508.3	513.8	0.78
206L	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-280.5**	SPLS 3_67 Ba Ct2	465.9	423.6	777.6	0.66		**277.5**	SPLS 3_67 Ba Ct1	456.2	423.6	518.8	0.66
206T	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-248.9**	SPLS 3_67 Ba Ct1	465.9	423.6	777.6	0.59		**252.3**	SPLS 3_0,9_67 Ba Ct2	456.2	423.6	518.8	0.60
207L	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-226.5**	SPLS 3_67 Ba Ct1	394.0	338.9	622.1	0.67		**228.5**	SPLS 3_67 Ba Ct2	456.2	338.9	421.1	0.67
207T	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-207.0**	SPLS 3_0,9_67 Ba Ct2	394.0	338.9	622.1	0.61		**202.8**	SPLS 3_67 Ba Ct1	456.2	338.9	421.1	0.60
208L	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-190.9**	SPLS 3_67 Ba Ct2	332.1	254.2	388.8	0.75		**185.5**	SPLS 3_67 Ba Ct1	384.5	254.2	269.2	0.73
208T	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-172.1**	SPLS 3_67 Ba Ct1	332.1	254.2	388.8	0.68		**172.8**	SPLS 3_0,9_67 Ba Ct2	384.5	254.2	269.2	0.68
209L	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-238.1**	SPLS 3_67 Ba Ct2	370.1	338.9	570.2	0.70		**219.0**	SPLS 3_0,9_67 Ba Ct1	356.4	338.9	475.6	0.65
209T	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-222.9**	SPLS 3_67 Ba Ct1	370.1	338.9	570.2	0.66		**215.2**	SPLS 3_0,9_67 Ba Ct2	356.4	338.9	475.6	0.64
210	Top	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	280	**-10.1**	SPLS 3_67 Ba Ct2	16.5	75.4	86.4	0.61		**10.0**	SPLS 3_0,9_67 Ba Ct2	52.4	75.4	44.1	0.23
211L	Tweede dwarsa	100x100x6	S235	3M24-5.6t	1.00	1.00	1.00	132	**0.0**		113.1	254.2	233.3	0.00		**92.5**	ULS 3_135	161.1	254.2	199.4	0.57
211T	Tweede dwarsa	100x100x6	S235	2M24-5.6t	1.00	1.00	1.00	132	**-3.7**	ULS 1a_90	113.1	169.4	155.5	0.03		**2.7**	ULS 1a_0,9_90	206.4	169.4	132.9	0.02
109L	Tweede dwarsa	180x180x15#	S235	12M24-5.6t	1.00	2.00	1.00	53	**-459.2**	SPLS 3_67 Ah All Cts	1075.9	2033.3	2332.8	0.43		**392.6**	SPLS 3_0,9_67 Ah All (	1144.0	2033.3	1814.4	0.34
212T	Tweede dwarsa	100x100x6	S235	4M24-5.6t	1.00	2.00	1.00	95	**-36.8**	ULS 5a Ba 12	144.3	338.9	311.0	0.26		**50.9**	ULS 5a Ba 12	225.0	338.9	265.8	0.23
213	Tweede dwarsa	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	86	**-58.8**	ULS 5a Ba 12	265.3	254.2	311.0	0.23		**59.3**	ULS 5a Ba 12	263.0	254.2	265.8	0.23
214	Tweede dwarsa	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	300	**-0.6**	SPLS 6a_90 Ba Ct1 Ah	11.8	37.7	43.2	0.05		**0.0**		37.4	37.7	22.0	0.00
215L	Eerste dwarsar	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	178	**0.0**		103.8	254.2	311.0	0.00		**127.3**	SPLS 6a_90 Ba All Cts	270.5	254.2	265.8	0.50
215T	Eerste dwarsar	100x100x8	S235	1M24-5.6t	1.00	1.00	1.00	178	**-52.2**	ULS 1a_0,9_90	83.1	84.7	103.7	0.63		**57.4**	ULS 1a_90	170.5	84.7	88.6	0.68
110L	Eerste dwarsar	200x200x16	S235	12M24-5.6t	1.00	2.00	1.00	62	**-561.8**	SPLS 6a_90 Ba All Cts	1222.1	906.5	2488.3	0.62		**413.4**	SPLS 3_0,9_67 Ah All (	1386.2	906.5	2126.8	0.46
216T	Eerste dwarsar	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	124	**-110.3**	SPLS 3_0,9_67 Ba Ct2	151.1	338.9	414.7	0.73		**121.3**	SPLS 3_67 Ba Ct2	293.9	338.9	354.5	0.41
217	Eerste dwarsar	120x120x11	S235	3M24-5.6t	1.00	1.00	1.00	114	**-151.1**	SPLS 3_0,9_67 Ba Ct2	286.0	254.2	427.7	0.59		**152.3**	SPLS 3_67 Ba Ct2	356.4	254.2	365.5	0.60
218	Eerste dwarsar	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	325	**-0.6**	SPLS 6a_90 Ba Ct1 Ah	12.6	58.8	54.0	0.04		**0.0**		54.7	58.8	37.0	0.00
219L	Onderstuk in to	130x130x12#	S235	2M24-5.6t	1.00	1.00	1.00	157	**-46.1**	SPLS 3_67 Ah All Cts	235.2	169.4	311.0	0.27		**36.8**	SPLS 3_0,9_67 Ah All (	363.3	169.4	265.8	0.22
219T	Onderstuk in to	130x130x12#	S235	2M24-5.6t	1.00	1.00	1.00	157	**-49.3**	SPLS 3_67 Ah All Cts	235.2	169.4	311.0	0.29		**40.5**	SPLS 3_0,9_67 Ah All (	363.3	169.4	265.8	0.24
220	Onderstuk in to	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	311	**-4.8**	SPLS 1a_0 Ah Ct2	11.6	37.7	43.2	0.41		**3.5**	SPLS 1a_0,9_45 Ah Ct	60.5	37.7	32.0	0.11
221	Onderstuk in to	70x70x5#	S235	1M16-5.6t	0.50	1.00	0.50	370	**-1.0**	ULS 7	11.3	37.7	43.2	0.09		**0.0**		74.9	37.7	32.0	0.00
301	Diagonaal onde	100x100x8	S235	1M20-5.6t	0.55	0.55	0.55	123	**-53.9**	SPLS 3_67 Ah All Cts	129.7	58.8	86.4	0.92		**54.8**	SPLS 3_0,9_67 Ah All (	179.7	58.8	69.8	0.93
302	Diagonaal onde	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	110	**-68.9**	SPLS 3_0,9_67 Ah Ct1	180.9	117.6	172.8	0.59		**67.3**	SPLS 3_67 Ah Ct1	190.7	117.6	139.6	0.57
303	Diagonaal onde	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	92	**-61.5**	SPLS 3_0,9_67 Ah All (	208.7	117.6	172.8	0.52		**58.9**	SPLS 3_67 Ah All Cts	190.7	117.6	139.6	0.50
304	Diagonaal onde	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	104	**-78.5**	SPLS 3_67 Ah Ct1	143.2	117.6	129.6	0.67		**80.4**	SPLS 3_0,9_67 Ah All (	170.1	117.6	104.7	0.77
305	Diagonaal onde	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	92	**-42.6**	SPLS 3_67 Ah All Cts	101.8	84.7	77.8	0.55		**45.8**	SPLS 3_0,9_67 Ah All (	93.3	84.7	59.8	0.77
306	Diagonaal onde	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	84	**-23.1**	SPLS 3_0,9_67 Ah All (	107.6	84.7	77.8	0.30		**26.6**	SPLS 3_67 Ah All Cts	93.3	84.7	66.5	0.40
307	Diagonaal onde	80x80x6#	S235	1M24-5.6t	0.55	0.55	0.55	96	**-31.3**	SPLS 6a_90 Ba All Cts	98.2	84.7	77.8	0.40		**27.2**	SPLS 3_0,9_67 Ah All (	93.3	84.7	59.8	0.45
308	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	89	**-36.6**	SPLS 3_67 Ah All Cts	129.6	117.6	129.6	0.31		**37.4**	SPLS 3_0,9_67 Ah All (	115.9	117.6	104.7	0.36
309	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-45.9**	SPLS 3_0,9_67 Ah All (	140.4	117.6	129.6	0.39		**44.1**	SPLS 3_67 Ah All Cts	124.8	117.6	104.7	0.42
310	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	76	**-62.1**	SPLS 3_67 Ah All Cts	143.9	117.6	129.6	0.53		**61.7**	SPLS 3_0,9_67 Ah All (	136.2	117.6	104.7	0.59
311	Diagonaal onde	70x70x6	S235	1M24-5.6t	1.00	1.00	1.00	69	**-27.9**	SPLS 3_67 Ah All Cts	99.6	84.7	77.8	0.36		**28.7**	SPLS 3_0,9_67 Ah All (	76.0	84.7	55.0	0.52
312	Diagonaal onde	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	82	**-1.0**	SPLS 1a_0 Ba All Cts	55.5	37.7	43.2	0.03		**3.5**	ULS 3_0,9_67	37.4	37.7	25.7	0.14
313	Dwarsligger on	HEA160	S235	2M20-5.6t	2.00	1.00	1.00	48	**-3.8**	SPLS 3_0,9_67 Ah Ct1	686.1	117.6	216.0	0.03		**8.3**	SPLS 6a_90 Ba Ct2 Ah	766.1	117.6	0.0	0.07
314	Dwarsligger on	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	82	**0.0**		314.6	117.6	259.2	0.00		**51.7**	ULS 3_67	278.4	117.6	259.2	0.44
315	Dwarsligger on	HEA160	S235		1.00	1.00	1.00	26	**-1.9**	ULS 1a_0,9_0,9_67	789.3	0.0	0.0	0.00		**4.7**	ULS 3_67	916.5	0.0	0.0	0.01
316	Dwarsligger on	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	37	**0.0**		426.4	117.6	259.2	0.00		**60.2**	ULS 3_0,9_67	278.4	117.6	259.2	0.51
317	Dwarsligger on	HEA160	S235		1.00	1.00	1.00	13	**-10.3**	ULS 3_0,9_67	825.9	0.0	0.0	0.01		**0.0**		916.5	0.0	0.0	0.00

Assessment of groups for strengthened mast (afkeur level)

Date	18-8-2020
Author	MKh
Version	1.0

KIJ-GT 380
HC+0
54

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
318	Verticaal eerste	90x90x6#	S235	1M20-5.6t	1.00	1.00	1.00	168	**-20.6**	SPLS 6a_90 Ba All Cts	61.1	58.8	64.8	0.35		**0.0**		117.5	58.8	52.4	0.00
319	Verticaal eerste	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	190	**-5.8**	ULS 3_45	29.3	37.7	43.2	0.20		**0.0**		37.4	37.7	22.0	0.00
320	Verticaal eerste	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	94	**-0.9**	ULS 7	50.9	37.7	43.2	0.02		**0.0**		37.4	37.7	18.4	0.00
321	Diagonaal eerst	50x50x6	S235	2M16-5.6t	1.00	1.00	1.00	580	**0.0**		5.7	75.4	103.7	0.00		**31.5**	ULS 3_135	62.1	75.4	52.9	0.60
322	Diagonaal eerst	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	415	**0.0**		12.4	117.6	129.6	0.00		**46.8**	SPLS 6a_90 Ba All Cts	77.4	117.6	88.7	0.60
323	Diagonaal eerst	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	516	**0.0**		4.7	37.7	43.2	0.00		**16.8**	ULS 1a_135	37.4	37.7	22.0	0.76
324	Dwarsligger bov	65x50x5	S235	1M24-5.6t	1.00	1.00	1.00	220	**-3.0**	ULS 3_0,9_67	21.8	84.7	64.8	0.14		**0.0**		25.9	84.7	8.9	0.00
325	Tussen diagona	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	171	**-0.1**	SPLS 1a_0 Ah All Cts	27.0	37.7	43.2	0.00		**3.9**	ULS 3_0,9_45	37.4	37.7	18.4	0.21
401	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	110	**-31.4**	SPLS 3_67 Ah All Cts	123.3	117.6	129.6	0.27		**32.1**	SPLS 3_0,9_67 Ah All (	128.8	117.6	104.7	0.31
402	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	102	**-38.1**	SPLS 3_0,9_67 Ah All (	132.3	117.6	129.6	0.32		**38.5**	SPLS 3_67 Ah Ct1	136.1	117.6	104.7	0.37
403	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	98	**-47.9**	SPLS 3_67 Ah Ct1	136.1	117.6	129.6	0.41		**46.6**	SPLS 3_0,9_67 Ah All (	140.4	117.6	104.7	0.45
404	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	90	**-50.6**	SPLS 3_67 Ah Ct1	129.0	117.6	129.6	0.43		**46.6**	SPLS 3_0,9_67 Ah Ct1	119.7	117.6	104.7	0.45
405	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	81	**-58.2**	SPLS 3_67 Ah Ct1	138.2	117.6	129.6	0.50		**57.2**	SPLS 3_0,9_67 Ah All (	123.5	117.6	104.7	0.55
406	Diagonaal onde	80x80x6#	S235		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
407	Diagonaal onde	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	83	**-3.3**	ULS 1a_0	79.3	58.8	64.8	0.06		**0.9**	SPLS 1a_0,9_135 Ah A	65.7	58.8	38.8	0.02
408	Diagonaal onde	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	78	**-2.0**	ULS 1a_135	81.4	58.8	64.8	0.03		**0.2**	SPLS 1a_0,9_135 Ah A	65.7	58.8	38.8	0.00
409	Dwarsligger ond	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	51	**0.0**		700.0	117.6	216.0	0.00		**7.2**	ULS 3_90	766.1	117.6	0.0	0.06
410	Dwarsligger ond	100x100x12	S235	2M20-5.6t	1.00	1.00	1.00	72	**-11.0**	ULS 3_0,9_67	356.1	117.6	259.2	0.09		**0.8**	SPLS 1a_0,9_135 Ah C	278.4	117.6	259.2	0.01
411	Dwarsligger ond	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	31	**0.0**		774.9	117.6	216.0	0.00		**1.4**	ULS 3_90	766.1	117.6	0.0	0.01
412	Bovenregel twe	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	306	**-0.2**	ULS 1a_0,9_0,9_67	56.1	254.2	311.0	0.00		**114.4**	ULS 3_113	263.0	254.2	265.8	0.45
413	Bovenregel twe	120x120x8	S235	3M24-5.6t	2.00	2.00	2.00	238	**-11.7**	SPLS 1a_0,9_67 Ah Ct	83.2	254.2	311.0	0.14		**98.0**	SPLS 6a_90 Ba Ct2 Ah	263.0	254.2	265.8	0.39
414	Diagonaal bove	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	203	**-4.6**	SPLS 1a_0 Ba All Cts	25.4	37.7	51.8	0.18		**4.6**	SPLS 1a_0,9_0 Ba All (	44.9	37.7	26.5	0.18
415	Diagonaal bove	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	189	**-4.6**	SPLS 1a_0,9_0 Ba All (	28.1	37.7	51.8	0.17		**4.4**	SPLS 1a_0 Ba All Cts	44.9	37.7	26.5	0.17
416	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	179	**-5.5**	SPLS 1a_0 Ba All Cts	25.5	37.7	43.2	0.21		**6.1**	SPLS 6a_90 Ba All Cts	37.4	37.7	22.0	0.28
417	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	146	**-9.6**	SPLS 6a_90 Ba All Cts	33.1	37.7	43.2	0.29		**9.9**	SPLS 6a_90 Ba All Cts	37.4	37.7	22.0	0.45
418	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	138	**-11.2**	SPLS 6a_90 Ba All Cts	35.2	37.7	43.2	0.32		**11.0**	SPLS 6a_90 Ba All Cts	37.4	37.7	22.0	0.50
419	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	134	**-14.0**	SPLS 6a_90 Ba All Cts	36.6	37.7	43.2	0.38		**14.0**	SPLS 6a_90 Ba All Cts	37.4	37.7	22.0	0.64
420	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	96	**-16.0**	SPLS 6a_90 Ba All Cts	60.6	58.8	54.0	0.30		**16.2**	SPLS 6a_90 Ba All Cts	54.7	58.8	32.4	0.50
421	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	93	**-21.6**	SPLS 6a_90 Ba All Cts	62.4	58.8	54.0	0.40		**20.8**	SPLS 6a_90 Ba All Cts	54.7	58.8	32.4	0.64
422	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	88	**-26.8**	SPLS 6a_90 Ba All Cts	64.7	58.8	54.0	0.50		**28.5**	SPLS 6a_90 Ba All Cts	54.7	58.8	37.0	0.77
423	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-1.0**	SPLS 3_0,9_67 Ba Ct2	50.8	37.7	43.2	0.03		**4.1**	SPLS 6a_90 Ba Ct2 Ah	37.4	37.7	22.0	0.19
424	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**0.0**		25.2	37.7	43.2	0.00		**9.3**	SPLS 6a_90 Ba Ct2 Ah	37.4	37.7	22.0	0.42
425	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	314	**-3.1**	SPLS 1a_67 Ba Ct1	11.0	37.7	43.2	0.28		**0.0**		37.4	37.7	22.0	0.00
426	Diagonaal twee	**50x50x7**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	353	**-11.8**	SPLS 6a_90 Ba Ct2 Ah	13.2	60.3	82.3	0.89		**0.8**	SPLS 3_0,9_67 Ba Ct2	71.3	60.3	42.0	0.02
427	Diagonaal twee	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	266	**0.0**		14.3	37.7	43.2	0.00		**0.9**	ULS 1a_67	37.4	37.7	22.0	0.04
428	Dwarsligger bov	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	196	**-0.3**	ULS 1a_0,9_90	22.5	37.7	43.2	0.02		**0.6**	ULS 1a_90	37.4	37.7	22.0	0.03
429	Dwarsligger bov	UNP160	S235	1M16-5.6t	1.00	1.00	1.00	42	**0.0**		288.7	37.7	64.8	0.00		**26.5**	ULS 3_0,9_67	90.7	37.7	48.0	0.70
430	Dwarsligger lad	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	112	**0.0**	SPLS 1a_67 Ba All Cts	44.1	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00
431	New: Horiz 1 ur	120x120x12	**S355**	**2M24-8.8t**	1.00	1.00	1.00	69	**0.0**		593.3	271.1	423.4	0.00		**42.1**	ULS 3_67	448.4	271.1	423.4	0.16
432	New: Horiz 2 ur	120x120x12	**S355**	**2M24-8.8t**	2.00	2.00	2.00	64	**0.0**		621.2	271.1	423.4	0.00		**75.6**	ULS 3_67	448.4	271.1	423.4	0.28
433	New: Diag tuss	70x70x7	**S355**	**2M20-8.8t**	1.00	1.00	1.00	89	**-41.8**	SPLS 3_67 Ah Ct1	165.8	188.2	205.8	0.25		**37.3**	SPLS 3_0,9_67 Ah All (	131.6	188.2	180.9	0.28
434	New: CD under	60x60x6	**S355**	**1M20-8.8t**	0.52	0.52	0.52	74	**-2.4**	SPLS 1a_135 Ba Ct1	113.3	94.1	88.2	0.03		**5.4**	ULS 1a_0,9_45	112.9	94.1	80.2	0.07
435	New: Front brac	80x80x8	**S355**	**2M20-8.8t**	1.00	1.00	1.00	182	**-28.4**	SPLS 6a_90 Ba All Cts	90.3	188.2	235.2	0.31		**0.0**		165.3	188.2	135.4	0.00
436	New: Front brac	60x60x6	**S355**	**1M20-8.8t**	1.00	1.00	1.00	75	**-0.4**	ULS 1a_0,9_0,9_67	112.7	94.1	88.2	0.00		**16.0**	SPLS 6a_90 Ba All Cts	89.4	94.1	60.4	0.26

Notes:
1) Groups 431 to 436 were added to enable the conductor attachment position on the upper crossarm to be moved 1.5m inward

Assessment of groups for strengthened mast (verbouw level)

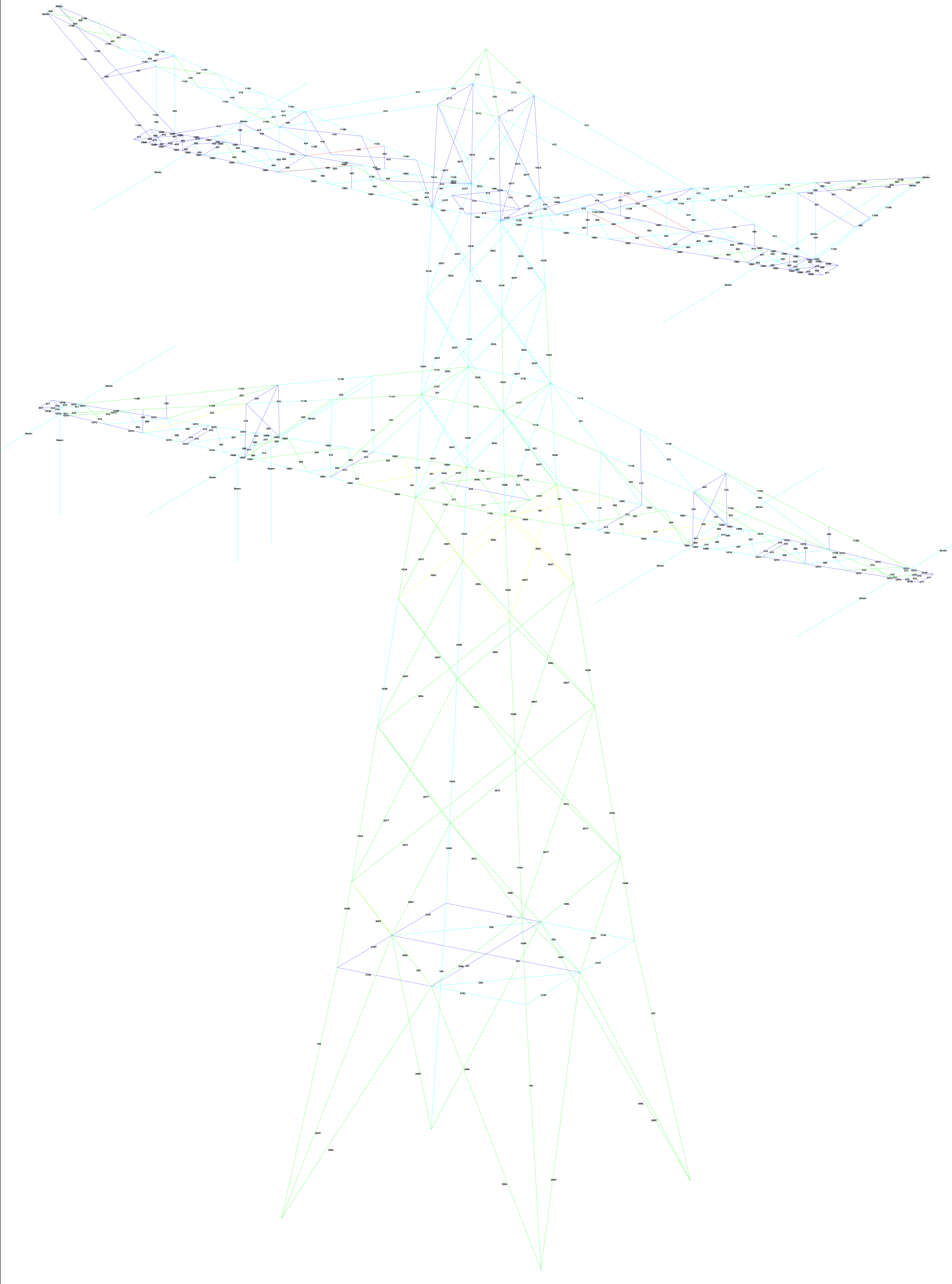
Date 18-8-2020
Author MKh
Version 1.0

KIJ-GT 380
HC+0
54

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
426	Diagonaal tweede dwarsarm	**50x50x7**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	353	**-12.7**	SPLS 6a_90 Ba Ct2 Ah	13.2	60.3	82.3	0.96		**1.1**	SPLS 3_0,9_67 Ba Ct2	71.3	60.3	42.0	0.03
431	New: Horiz 1 under BVNTRVS	120x120x12	**S355**	**2M24-8.8t**	1.00	1.00	1.00	69	**0.0**		593.3	271.1	423.4	0.00		**49.3**	ULS 3_67	448.4	271.1	423.4	0.18
432	New: Horiz 2 under BVNTRVS	120x120x12	**S355**	**2M24-8.8t**	2.00	2.00	2.00	64	**0.0**		621.2	271.1	423.4	0.00		**89.3**	ULS 3_67	448.4	271.1	423.4	0.33
433	New: Diag tussen horizontals	70x70x7	**S355**	**2M20-8.8t**	1.00	1.00	1.00	89	**-44.0**	SPLS 3_67 Ah Ct1	165.8	188.2	205.8	0.27		**39.2**	SPLS 3_0,9_67 Ah All (	131.6	188.2	180.9	0.30
434	New: CD underside	60x60x6	**S355**	**1M20-8.8t**	0.52	0.52	0.52	74	**-2.5**	SPLS 1a_135 Ba Ct1	113.3	94.1	88.2	0.03		**6.6**	ULS 1a_0,9_45	112.9	94.1	80.2	0.08
435	New: Front bracing boventraverse	80x80x8	**S355**	**2M20-8.8t**	1.00	1.00	1.00	182	**-31.2**	ULS 3_0	90.3	188.2	235.2	0.35		**3.3**	ULS 1a_0,9_0,9_67	165.3	188.2	135.4	0.02
436	New: Front bracing boventraverse	60x60x6	**S355**	**1M20-8.8t**	1.00	1.00	1.00	75	**-2.6**	ULS 1a_0,9_0,9_67	112.7	94.1	88.2	0.03		**17.7**	ULS 3_0	89.4	94.1	60.4	0.29

Notes:
1) Groups 431 to 436 were added to enable the conductor attachment position on the upper crossarm to be moved 1.5m inward

DNV GL Nederlands BV, Project: "HC+0 (da) afk (54)"
Tower Version 16.39, 11:01:26 dinsdag 18 augustus 2020
Undeformed geometry displayed



% Usage Legend
0 <= % < 25
25 <= % < 50
50 <= % < 75
75 <= % < 100
100 <= %

DNV·GL

Assessment of groups for initial mast (afkeur level)

Date	28-04-21
Author	KCh
Version	1.0

KIJ-GT 380
HC+0
83

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
101A	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	85	-53.7	SPLS 3_113,5 Ba Ct2	390.5	508.3	777.6	0.14		21.0	ULS 1a_0,9_0,9_113,5	466.6	508.3	664.6	0.05	
101B	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	74	-145.4	SPLS 3_113,5 Ba Ct2	423.6	506.7	777.6	0.34		111.5	ULS 1a_0,9_113,5	466.6	506.7	664.6	0.24	
102A	Leg	180x180x16	S235	8M24-5.6t	0.50	0.50	0.50	54	-377.2	SPLS 3_66,5 Ah All Cts	1141.5	674.7	1658.9	0.56		308.5	S 3_0,9_113,5 Ba All Cts	1220.3	674.7	1417.8	0.46	
102B	Leg	180x180x16	S235	12M24-5.6t	0.50	0.50	0.50	57	-420.1	SPLS 3_66,5 Ah All Cts	1125.2	1005.5	2488.3	0.42		325.8	S 3_0,9_113,5 Ba All Cts	1220.3	1005.5	2169.3	0.32	
103A	Leg	200x200x20	S235	16M24-5.6t	0.28	0.28	0.28	28	-746.0	SPLS 3_113,5 Ba All Cts	1750.2	1181.8	4147.2	0.63		631.0	S 3_0,9_113,5 Ba All Cts	1710.7	1181.8	3544.6	0.53	
103B	Leg	200x200x20	S235	12M24-5.6t	0.28	0.28	0.28	35	-955.7	SPLS 3_113,5 Ba All Cts	1704.3	1987.7	3110.4	0.56		832.1	S 3_0,9_113,5 Ba All Cts	1710.7	1987.7	2658.5	0.49	
104A	Leg	250x250x20	S235	12M24-5.6t	0.28	0.28	0.28	34	-1193.2	SPLS 3_113,5 Ba All Cts	2172.1	1892.2	3110.4	0.63		1049.3	S 3_0,9_113,5 Ba All Cts	2244.7	1892.2	2658.5	0.55	
104B	Leg	250x250x20	S235	14M24-5.6t	0.55	0.55	0.55	37	-1305.4	SPLS 3_113,5 Ba All Cts	2149.3	2100.4	3628.8	0.62		1153.8	S 3_0,9_113,5 Ba All Cts	2244.7	2100.4	3101.5	0.55	
105	Leg	250x250x22	S235	14M24-5.6t	0.17	0.17	0.17	33	-1329.1	SPLS 3_113,5 Ba All Cts	2386.8	2100.4	3991.7	0.63		1154.2	S 3_0,9_113,5 Ba All Cts	2453.6	2100.4	3411.7	0.55	
106A	Onderregel eerste dwarsarm	200x200x16	S235	12M24-5.6t	1.53	1.00	1.00	63	-658.0	SPLS 6a_90 Ah Ct2 Ba Ct2	1211.7	906.5	2488.3	0.73		458.3	PLS 3_0,9_113,5 Ba Ct1	1386.2	906.5	2126.8	0.51	
106B	Onderregel eerste dwarsarm	200x200x16	S235	10M24-5.6t	7.64	1.00	1.00	74	-356.6	SPLS 6a_90 Ah Ct2 Ba Ct2	1128.4	847.2	2073.6	0.42		239.8	PLS 3_0,9_113,5 Ba Ct1	1386.2	847.2	1772.3	0.28	
106C	Onderregel eerste dwarsarm	200x200x16	S235		2.88	1.77	1.00	62	-593.0	SPLS 6a_90 Ah Ct2 Ba Ct2	1220.6	0.0	0.0	0.49		393.0	PLS 3_0,9_113,5 Ba Ct1	1452.3	0.0	0.0	0.27	
107A	Onderregel eerste dwarsarm	180x180x15	S235	10M24-5.6t	2.78	1.00	1.00	83	-327.6	SPLS 6a_90 Ah Ct2 Ba Ct2	887.4	847.2	1944.0	0.39		213.1	PLS 3_0,9_113,5 Ba Ct1	1144.0	847.2	1661.5	0.25	
107B	Onderregel eerste dwarsarm	180x180x15	S235	2M20-5.6t	1.63	1.00	1.00	18	-3.5	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		0.3	SPLS 1a_0 Ba All Cts	613.8	117.6	297.8	0.00	
107C	Onderregel eerste dwarsarm	180x180x15	S235		###	1.00	1.00	83	-314.0	SPLS 6a_90 Ah Ct2 Ba Ct2	887.3	0.0	0.0	0.35		194.5	PLS 3_0,9_113,5 Ba Ct1	1220.5	0.0	0.0	0.16	
108A	Onderregel tweede dwarsarm	180x180x15	S235	12M24-5.6t	1.12	1.00	1.00	64	-409.0	SPLS 6a_90 Ah All Cts Ba Ct2	1011.2	2033.3	2332.8	0.40		300.8	S 3_0,9_113,5 Ba All Cts	1144.0	2033.3	1814.4	0.26	
108B	Onderregel tweede dwarsarm	180x180x15	S235	2M20-5.6t	1.00	1.50	1.00	19	-3.5	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		0.6	SPLS 1a_45 Ba Ct1	613.8	117.6	297.8	0.00	
108C	Onderregel tweede dwarsarm	180x180x15	S235		2.77	1.70	1.00	65	-376.3	SPLS 6a_90 Ah All Cts Ba Ct2	1010.4	0.0	0.0	0.37		261.3	S 3_0,9_113,5 Ba All Cts	1220.5	0.0	0.0	0.21	
111A	Bovenregel eerste dwarsarm	90x90x9	S235	3M24-5.6t	1.00	1.96	1.00	294	0.0		47.4	254.2	349.9	0.00		125.5	ULS 3_0	205.3	254.2	299.1	0.61	
111B	Bovenregel eerste dwarsarm	90x90x9	S235	3M24-5.6t	1.00	2.04	1.00	294	-6.3	SPLS 3_0,9_113,5 Ba All Cts	47.4	254.2	349.9	0.13		92.4	6a_90 Ah All Cts Ba Ct2	205.3	254.2	299.1	0.45	
112A	Bovenregel eerste dwarsarm	75x75x7#	S235	3M24-5.6t	1.00	1.80	1.00	370	-9.3	SPLS 3_0,9_113,5 Ba All Cts	21.6	254.2	272.2	0.43		82.4	6a_90 Ah All Cts Ba Ct2	131.8	254.2	192.5	0.62	
112B	Bovenregel eerste dwarsarm	75x75x7#	S235	3M24-5.6t	1.00	2.25	1.00	370	-9.3	SPLS 3_0,9_113,5 Ba All Cts	21.6	254.2	272.2	0.43		82.4	6a_90 Ah All Cts Ba Ct2	131.8	254.2	192.5	0.63	
113A	Bovenregel tweede dwarsarm	120x120x13	S235	5M24-5.6t	1.59	1.00	1.00	101	-187.6	SPLS 6a_90 Ah All Cts Ba Ct1	355.8	423.6	842.4	0.53		174.3	6a_90 Ah All Cts Ba Ct2	418.7	423.6	703.2	0.42	
113B	Bovenregel tweede dwarsarm	120x120x13	S235	5M24-5.6t	1.40	1.00	1.00	102	-174.0	SPLS 6a_90 Ah All Cts Ba Ct1	373.5	423.6	842.4	0.47		169.4	6a_90 Ah All Cts Ba Ct2	602.4	423.6	720.0	0.40	
113C	Bovenregel tweede dwarsarm	120x120x13	S235		2.70	1.70	1.00	101	-183.9	SPLS 6a_90 Ah All Cts Ba Ct1	355.7	0.0	0.0	0.52		175.8	6a_90 Ah All Cts Ba Ct2	705.0	0.0	0.0	0.25	
114A	Bovenregel tweede dwarsarm	150x100x12	S235	5M24-5.6t	3.00	1.00	1.00	115	-159.7	SPLS 6a_90 Ah All Cts Ba Ct1	301.8	423.6	777.6	0.53		174.3	6a_90 Ah All Cts Ba Ct2	582.2	423.6	664.6	0.41	
114B	Bovenregel tweede dwarsarm	150x100x12	S235	3M24-8.8t	7.59	1.48	1.00	104	-31.4	SPLS 3_0,9_113,5 Ba All Cts	332.0	406.7	466.6	0.09		30.0	PLS 6a_90 Ah Ct1 Ba Ct2	402.4	406.7	397.2	0.08	
114C	Bovenregel tweede dwarsarm	150x100x12	S235		3.00	1.00	1.00	115	-145.8	SPLS 6a_90 Ah All Cts Ba Ct1	301.8	0.0	0.0	0.48		160.4	6a_90 Ah All Cts Ba Ct2	674.5	0.0	0.0	0.24	
115A	Tussenregel tweede dwarsarm	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	-32.0	SPLS 6a_90 Ba Ct1 Ba Ct2	79.8	84.7	77.8	0.41		11.3	PLS 3_0,9_113,5 Ba Ct2	127.9	84.7	66.5	0.17	
115B	Tussenregel tweede dwarsarm	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	-31.3	SPLS 6a_90 Ba Ct1 Ba Ct2	71.0	84.7	77.8	0.44		12.1	PLS 3_0,9_113,5 Ba Ct2	127.9	84.7	66.5	0.18	
201L	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	-41.9	SPLS 3_0,9_113,5 Ba Ct2	114.3	117.6	129.6	0.37		34.9	SPLS 1a_90 Ah Ct1	145.4	117.6	104.7	0.33	
201T	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	-21.3	SPLS 6a_90 Ah Ct2 Ba Ct2	114.3	117.6	129.6	0.19		13.3	SPLS 3_0,9_90 Ba Ct2	145.4	117.6	104.7	0.13	
202L	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	-183.0	SPLS 3_90 Ah Ct2	425.3	338.9	518.4	0.54		141.1	SPLS 3_0,9_90 Ba Ct1	384.5	338.9	350.9	0.42	
202T	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	-134.0	SPLS 3_0,9_113,5 Ah Ct1	425.3	338.9	518.4	0.40		144.8	SPLS 3_90 Ba Ct2	384.5	338.9	350.9	0.43	
203L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	-129.3	SPLS 3_0,9_90 Ba Ct1	406.7	338.9	518.4	0.38		167.3	SPLS 3_90 Ah Ct2	384.5	338.9	350.9	0.49	
203T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	-131.5	SPLS 3_90 Ba Ct2	406.7	338.9	518.4	0.39		121.9	PLS 3_0,9_113,5 Ah Ct1	384.5	338.9	350.9	0.36	
204L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	-185.1	SPLS 3_0,9_113,5 Ba Ct2	386.8	338.9	518.4	0.55		167.3	SPLS 3_0,9_90 Ah Ct1	384.5	338.9	350.9	0.49	
204T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	-165.9	SPLS 3_113,5 Ah Ct1	386.8	338.9	518.4	0.49		157.6	SPLS 3_0,9_90 Ba Ct2	384.5	338.9	350.9	0.47	
205L	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	-352.5	SPLS 3_113,5 Ah Ct2	449.2	508.3	777.6	0.78		349.2	PLS 3_0,9_113,5 Ah Ct2	384.5	508.3	513.8	0.91	
205T	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	-316.9	SPLS 3_0,9_113,5 Ah Ct2	449.2	508.3	777.6	0.71		310.8	SPLS 3_113,5 Ah Ct1	384.5	508.3	513.8	0.81	
206L	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	-290.8	SPLS 3_113,5 Ah Ct2	465.9	423.6	777.6	0.69		284.3	SPLS 3_113,5 Ah Ct2	456.2	423.6	518.8	0.67	
206T	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	-257.0	SPLS 3_113,5 Ah Ct1	465.9	423.6	777.6	0.61		261.2	PLS 3_0,9_113,5 Ah Ct2	456.2	423.6	518.8	0.62	
207L	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	-229.4	SPLS 3_113,5 Ah Ct1	394.0	338.9	622.1	0.68		236.7	SPLS 3_113,5 Ah Ct2	456.2	338.9	421.1	0.70	
207T	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	-214.1	SPLS 3_0,9_113,5 Ah Ct2	394.0	338.9	622.1	0.63		209.3	SPLS 3_113,5 Ah Ct1	456.2	338.9	421.1	0.62	
208L	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	-197.7	SPLS 3_113,5 Ah Ct2	332.1	254.2	388.8	0.78		187.9	SPLS 3_113,5 Ah Ct1	384.5	254.2	269.2	0.74	
208T	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	-177.5	SPLS 3_113,5 Ah Ct1	332.1	254.2	388.8	0.70		178.4	PLS 3_0,9_113,5 Ah Ct2	384.5	254.2	269.2	0.70	
209L	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	-249.2	SPLS 3_113,5 Ah Ct2	370.1	338.9	570.2	0.74		222.2	PLS 3_0,9_113,5 Ah Ct1	356.4	338.9	475.6	0.66	
209T	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	-230.3	SPLS 3_113,5 Ah Ct1	370.1	338.9	570.2	0.68		222.9	PLS 3_0,9_113,5 Ah Ct2	356.4	338.9	475.6	0.66	
210	Top	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	280	-12.9	SPLS 3_113,5 Ah Ct2	16.5	75.4	86.4	0.78		12.8	PLS 3_0,9_113,5 Ah Ct2	52.4	75.4	44.1	0.29	
211L	Tweede dwarsarm in tower	100x100x6	S235	3M24-5.6t	1.00	1.00	1.00	132	0.0		113.1	254.2	233.3	0.00		93.9	ULS 6a_90 Ba Ct2	161.1	254.2	199.4	0.58	
211T	Tweede dwarsarm in tower	100x100x6	S235	2M24-5.6t	1.00	1.00	1.00	132	-3.6	ULS 1a_90	113.1	169.4	155.5	0.03		2.7	ULS 1a_0,9_90	206.4	169.4	132.9	0.02	
109L	Tweede dwarsarm in tower	180x180x15	S235	12M24-5.6t	1.00	2.00	1.00	53	-504.0	SPLS 3_66,5 Ah All Cts	1075.9	2033.3	2332.8	0.47		429.3	S 3_0,9_113,5 Ba All Cts	1144.0	2033.3	1814.4	0.38	
212T	Tweede dwarsarm in tower	100x100x6	S235	4M24-5.6t	1.00	2.00	1.00	95	-47.3	ULS 5a Ba 12	144.3	338.9	311.0	0.33		59.7	ULS 5a Ba 12	225.0	338.9	265.8	0.27	
213	Tweede dwarsarm in tower	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	86	-68.4	ULS 5a Ba 12	265.3	254.2	311.0	0.27		68.8	SPLS 3_113,5 Ah Ct2	263.0	254.2	265.8	0.27	
214	Tweede dwarsarm in tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	300	-0.6	SPLS 6a_90 Ah Ct1 Ba Ct2	11.8	37.7	43.2	0.05		0.0		37.4	37.7	22.0	0.00	
215L	Eerste dwarsarm in tower	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	178	0.0		103.8	254.2	311.0	0.00		126.3	6a_90 Ah All Cts Ba Ct2	270.5	254.2	265.8	0.50	
215T	Eerste dwarsarm in tower	100x100x8	S235	1M24-5.6t	1.00	1.00	1.00	178	-50.2	ULS 1a_0,9_90	83.1	84.7	103.7	0.60		55.4	ULS 1a_90	170.5	84.7	88.6	0.65	
110L	Eerste dwarsarm in tower	200x200x16	S235	12M24-5.6t	1.00	2.00	1.00	62	-561.8	SPLS 3_66,5 Ah All Cts	1222.1	906.5	2488.3	0.62		421.9	S 3_0,9_113,5 Ba All Cts	1386.2	906.5	2126.8	0.47	
216T	Eerste dwarsarm in tower	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	124	-112.1	SPLS 3_0,9_113,5 Ah Ct2	151.1	338.9	414.7	0.74		121.4	SPLS 3_113,5 Ah Ct2	293.9	338.9	354.5	0.41	
217	Eerste dwarsarm in tower	120x120x11	S235	3M24-5.6t	1.00	1.00	1.00	114	-151.3	SPLS 3_0,9_113,5 Ah Ct2	286.0	254.2	427.7	0.60		152.5	SPLS 3_113,5 Ah Ct2	356.4	254.2	365.5	0.60	
218	Eerste dwarsarm in tower	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	325	-0.5	SPLS 6a_90 Ah All Cts Ba Ct2	12.6	58.8	54.0	0.04		0.0		54.7	58.8	37.0	0.00	
219L	Onderstuk in tower	130x130x12	S235	2M24-5.6t	1.00	1.00	1.00	157	-45.0	SPLS 3_113,5 Ba All Cts	235.2	169.4	311.0	0.27		36.2	S 3_0,9_113,5 Ba All Cts	363.3	169.4	265.8	0.21	
219T	Onderstuk in tower	130x130x12	S235	2M24-5.6t	1.00	1.00	1.00	157	-48.2	SPLS 3_113,5 Ba All Cts	235.2	169.4	311.0	0.28		40.0	S 3_0,9_113,5 Ba All Cts	363.3	169.4	265.8	0.24	
220	Onderstuk in tower	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	311	-4.5	SPLS 1a_135 Ba Ct1	11.6	37.7	43.2	0.39		3.5	ULS 1a_0,9_0,9_135	60.5	37.7	32.0	0.11	
221	Onderstuk in tower	70x70x5#	S235	1M16-5.6t	0.50	1.00	0.50	370	-1.0	ULS 7	11.2	37.7	43.2	0.09		0.0		74.9	37.7	32.0	0.00	
301	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	1M20-5.6t	0.55	0.55	0.55	123	-53.8	SPLS 3_113,5 Ba All Cts	129.7	58.8	86.4	0.91		55.0	S 3_0,9_113,5 Ba All Cts	179.7	58.8	69.8	0.94	
302	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	110	-69.0	SPLS 3_0,9_113,5 Ba Ct1	180.9	117.6	172.8	0.59		67.3	SPLS 3_113,5 Ba Ct1	190.7	117.6	139.6	0.57	
303	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	92	-61.7	SPLS 3_0,9_113,5 Ba All Cts	208.7	117.6	172.8	0.53		58.9	SPLS 3_113,5 Ba All Cts	190.7	117.6	139.6	0.50	
304	Diagonaal onderregel eerste dwarsarm	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	104	-78.1	SPLS 3_113,5 Ba Ct1	143.2	117.6	129.6	0.66		81.0	S 3_0,9_113,5 Ba All Cts	170.1	117.6	104.7	0.77	
305	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	92	-42.6	SPLS 3_113,5 Ba All Cts	101.8	84.7	77.8	0.55		45.8	S 3_0,9_113,5 Ba All Cts	93.3	84.7	59.8	0.77	
306	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	84	-23.1	SPLS 3_0,9_113,5 Ba All Cts	107.6	84.7	77.8	0.30		26.6	SPLS 3_113,5 Ba All Cts	93.3	84.7	66.5	0.40	
307	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	0.55	0.55	0.55	96	-31.0	SPLS 6a_90 Ah All Cts Ba Ct1	98.2	84.7	77.8	0.40		27.5	S 3_0,9_113,5 Ba All Cts	93.3	84.7	59.8	0.46	
308	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	89	-36.3	SPLS 3_113,5 Ba All Cts	129.6	117.6	129.6	0.31		37.7	S 3_0,9_113,5 Ba All Cts	115.9	117.6	104.7	0.36	
309	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	-46.2	SPLS 3_0,9_113,5 Ba All Cts	140.4	117.6	129.6	0.39		43.8	SPLS 3_113,5 Ba All Cts	124.8	117.6	104.7	0.42	
310	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	76	-61.5	SPLS 3_113,5 Ba All Cts	143.9	117.6	129.6	0.52		62.1	S 3_0,9_113,5 Ba All Cts	136.2	117.6	104.7	0.59	
311	Diagonaal onderregel eerste dwarsarm	70x70x6	S235	1M24-5.6t	1.00	1.00	1.00	69	-27.7	SPLS 3_113,5 Ba All Cts	99.6	84.7	77.8	0.36		28.8	S 3_0,9_113,5 Ba All Cts	76.0	84.7	55.0	0.52	
312	Diagonaal onderregel eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	82	-0.8	SPLS 1a_0 Ba All Cts	55.5	37.7	43.2	0.02		3.7	ULS 3_0,9_90	37.4	37.7	25.7	0.14	
313	Dwarsligger onderregel eerste dwarsarm	HEA160	S235	2M20-5.6t	2.00	1.00	1.00	48	-4.1	SPLS 3_0,9_113,5 Ba Ct1	686.1	117.6	216.0	0.03		8.2	PLS 6a_90 Ah Ct2 Ba Ct2	766.1	117.6	0.0	0.07	
314	Dwarsligger onderregel eerste dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	82	0.0		314.6	117.6	259.2	0.00		51.2	ULS 3_113,5	278.4	117.6	259.2	0.44	
315	Dwarsligger onderregel eerste dwarsarm	HEA160	S235		1.00	1.00	1.00	26	-2.0	ULS 1a_0,9_113,5	789.3	0.0	0.0	0.00		4.4	ULS 3_66,5	916.5	0.0	0.0	0.00	
316	Dwarsligger onderregel eerste dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	37	0.0		426.4	117.6	259.2	0.00		60.0	ULS 3_0,9_113,5	278.4	117.6	259.2	0.51	
317	Dwarsligger onderregel eerste dwarsarm	HEA160	S235		1.00	1.00	1.00	13	-10.4	ULS 3_0,9_113,5	825.9	0.0	0.0	0.01		0.0		916.5	0.0	0.0	0.00	
318	Verticaal eerste dwarsarm	90x90x6#	S235	1M20-5.6t	1.00	1.00	1.00	168	-19.8	ULS 3_0	61.1	58.8	64.8	0.34		0.0		117.5	58.8	52.4	0.00	
319	Verticaal eerste dwarsarm	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	190	-6.0	ULS 3_135	29.3	37.7	43.2	0.20		0.0		37.4	37.7	22.0	0.00	
320	Verticaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	94	-0.9	ULS 7	50.9	37.7	43.2	0.02		0.0		37.4	37.7	18.4	0.00	

DNV·GL

Assessment of groups for initial mast (afkeur level)

Date	28-04-21
Author	KCh
Version	1.0

KIJ-GT 380
HC+0
83

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
321	Diagonaal eerste dwarsarm	50x50x6	S235	2M16-5.6t	1.00	1.00	1.00	580	**0.0**		5.7	75.4	103.7	0.00		**31.4**	ULS 3_0	62.1	75.4	52.9	0.59	
322	Diagonaal eerste dwarsarm	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	415	**0.0**		12.4	117.6	129.6	0.00		**44.9**	ULS 3_0	77.4	117.6	88.7	0.58	
323	Diagonaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	516	**0.0**		4.7	37.7	43.2	0.00		**17.0**	ULS 3_0	37.4	37.7	22.0	0.77	
324	Dwarsligger bovenregel eerste dwarsarr	65x50x5	S235	1M24-5.6t	1.00	1.00	1.00	220	**-3.0**	ULS 3_0,9_113,5	21.8	84.7	64.8	0.14		**0.0**		25.9	84.7	8.9	0.00	
325	Tussen diagonaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	171	**-0.1**	SPLS 1a_0 Ah All Cts	27.0	37.7	43.2	0.00		**4.0**	ULS 3_0,9_135	37.4	37.7	18.4	0.22	
401	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	110	**-27.4**	SPLS 3_113,5 Ba All Cts	123.3	117.6	129.6	0.23		**28.1**	S 3_0,9_113,5 Ba All Cts	128.8	117.6	104.7	0.27	
402	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	102	**-33.5**	SPLS 3_0,9_113,5 Ba All Cts	132.3	117.6	129.6	0.29		**34.1**	SPLS 3_113,5 Ba Ct1	136.1	117.6	104.7	0.33	
403	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	98	**-42.2**	SPLS 3_113,5 Ba Ct1	136.1	117.6	129.6	0.36		**41.0**	S 3_0,9_113,5 Ba All Cts	140.4	117.6	104.7	0.39	
404	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	90	**-43.2**	SPLS 3_113,5 Ba Ct1	129.0	117.6	129.6	0.37		**43.4**	S 3_0,9_113,5 Ba All Cts	119.7	117.6	104.7	0.41	
405	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	81	**-49.9**	SPLS 3_0,9_113,5 Ba All Cts	138.2	117.6	129.6	0.42		**49.1**	SPLS 3_113,5 Ba Ct1	123.5	117.6	104.7	0.47	
406	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-63.3**	SPLS 3_113,5 Ba Ct1	140.4	117.6	129.6	0.54		**61.8**	S 3_0,9_113,5 Ba All Cts	131.2	117.6	104.7	0.59	
407	Diagonaal onderregel tweede dwarsarm	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	83	**-24.6**	SPLS 3_113,5 Ba All Cts	79.3	58.8	64.8	0.42		**26.3**	S 3_0,9_113,5 Ba All Cts	65.7	58.8	38.8	0.68	
408	Diagonaal onderregel tweede dwarsarm	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	78	**-0.9**	SPLS 1a_0 Ba Ct1	81.4	58.8	64.8	0.01		**4.3**	ULS 3_0,9_0	65.7	58.8	38.8	0.11	
409	Dwarsligger onderregel tweede dwarsarr	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	51	**-0.7**	ULS 1a_0,9_0,9_113,5	700.0	117.6	216.0	0.01		**5.0**	PLS 6a_90 Ah Ct1 Ba Ct2	766.1	117.6	0.0	0.04	
410	Dwarsligger onderregel tweede dwarsarr	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	44	**0.0**		410.1	117.6	259.2	0.00		**62.1**	ULS 3_0,9_113,5	278.4	117.6	259.2	0.53	
411	Dwarsligger onderregel tweede dwarsarr	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	31	**-8.9**	ULS 3_0,9_113,5	774.9	117.6	216.0	0.08		**0.0**		766.1	117.6	0.0	0.00	
412	Bovenregel tweede dwarsarm	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	306	**-10.3**	SPLS 1a_0,9_113,5 Ba Ct2	56.1	254.2	311.0	0.18		**115.9**	ULS 3_90	263.0	254.2	265.8	0.46	
413	Bovenregel tweede dwarsarm	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	238	**-17.1**	SPLS 1a_0,9_113,5 Ba Ct2	83.2	254.2	311.0	0.21		**106.6**	PLS 6a_90 Ah Ct2 Ba Ct2	263.0	254.2	265.8	0.42	
414	Diagonaal bovenregel tweede dwarsarm	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	203	**-4.3**	SPLS 1a_0 Ba All Cts	25.4	37.7	51.8	0.17		**4.5**	SPLS 1a_0,9_0 Ba Ct2	44.9	37.7	26.5	0.17	
415	Diagonaal bovenregel tweede dwarsarm	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	189	**-4.6**	SPLS 1a_0 Ba Ct2	28.1	37.7	51.8	0.16		**4.2**	SPLS 1a_0,9_0 Ba All Cts	44.9	37.7	26.5	0.16	
416	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	179	**-4.5**	SPLS 1a_0 Ba All Cts	25.5	37.7	43.2	0.17		**5.0**	6a_90 Ah All Cts Ba Ct2	37.4	37.7	22.0	0.23	
417	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	146	**-8.7**	SPLS 6a_90 Ah All Cts Ba Ct2	33.1	37.7	43.2	0.26		**9.2**	6a_90 Ah All Cts Ba Ct2	37.4	37.7	22.0	0.42	
418	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	138	**-11.1**	SPLS 6a_90 Ah All Cts Ba Ct2	35.2	37.7	43.2	0.32		**10.5**	6a_90 Ah All Cts Ba Ct2	37.4	37.7	22.0	0.48	
419	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	134	**-13.1**	SPLS 6a_90 Ah All Cts Ba Ct2	36.6	37.7	43.2	0.36		**13.8**	6a_90 Ah All Cts Ba Ct2	37.4	37.7	22.0	0.62	
420	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	96	**-16.0**	SPLS 6a_90 Ah All Cts Ba Ct2	60.6	58.8	54.0	0.30		**15.1**	6a_90 Ah All Cts Ba Ct2	54.7	58.8	32.4	0.47	
421	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	93	**-19.3**	SPLS 6a_90 Ah All Cts Ba Ct2	62.4	58.8	54.0	0.36		**20.6**	6a_90 Ah All Cts Ba Ct2	54.7	58.8	32.4	0.64	
422	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00	
423	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-1.3**	SPLS 3_0,9_113,5 Ah Ct1	50.8	37.7	43.2	0.04		**3.7**	PLS 6a_90 Ba Ct2 Ba Ct1	37.4	37.7	22.0	0.17	
424	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**0.0**		25.2	37.7	43.2	0.00		**4.8**	PLS 6a_90 Ah Ct2 Ah Ct1	37.4	37.7	22.0	0.22	
425	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	314	**-3.6**	SPLS 3_113,5 Ah Ct2	11.0	37.7	43.2	0.33		**0.0**		37.4	37.7	22.0	0.00	
426	Diagonaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	346	**-11.3**	SPLS 6a_90 Ba Ct2 Ba Ct1	9.4	37.7	43.2	1.20	knik	**1.5**	SPLS 3_0,9_113,5 Ah Ct1	37.4	37.7	22.0	0.07	
427	Diagonaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	266	**0.0**		14.3	37.7	43.2	0.00		**1.0**	SPLS 1a_66,5 Ba Ct2	37.4	37.7	22.0	0.05	
428	Dwarsligger bovenregel tweede dwarsar	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	196	**-0.5**	ULS 3_0,9_90	22.5	37.7	43.2	0.02		**0.5**	ULS 1a_0,9_0,9_90	37.4	37.7	22.0	0.02	
429	Dwarsligger bovenregel tweede dwarsar	UNP160	S355	1M16-8.8t	1.00	1.00	1.00	40	**0.0**		405.2	60.3	88.2	0.00		**25.9**	ULS 3_0,9_90	123.5	60.3	65.3	0.43	
430	Dwarsligger ladder tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	112	**0.0**	SPLS 6a_90 Ah Ct1 Ba Ct2	44.1	37.7	43.2	0.00		**0.0**	SPLS 1a_0,9_66,5 Ba Ct2	37.4	37.7	22.0	0.00	

DNV·GL

Assessment of groups for strengthened mast (afkeur level)

Date 28-04-21
Author KCh
Version 1.0

KIJ-GT 380
HC+0
83

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
101A	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	85	**-53.8**	SPLS 3_113,5 Ba Ct2	390.5	508.3	777.6	0.14		**21.0**	ULS 1a_0,9_0,9_113,5	466.6	508.3	664.6	0.04
101B	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	74	**-145.4**	SPLS 3_113,5 Ba Ct2	423.6	506.7	777.6	0.34		**111.5**	ULS 1a_0,9_113,5	466.6	506.7	664.6	0.24
102A	Leg	180x180x16#	S235	8M24-5.6t	0.50	0.50	0.50	54	**-377.2**	SPLS 3_66,5 Ah All Cts	1141.5	674.7	1658.9	0.56		**308.4**	SPLS 3_0,9_113,5 Ba /	1220.3	674.7	1417.8	0.46
102B	Leg	180x180x16#	S235	12M24-5.6t	0.50	0.50	0.50	57	**-420.2**	SPLS 3_66,5 Ah All Cts	1125.2	1005.5	2488.3	0.42		**325.8**	SPLS 3_0,9_113,5 Ba /	1220.3	1005.5	2169.3	0.32
103A	Leg	200x200x20	S235	16M24-5.6t	0.28	0.28	0.28	28	**-746.0**	SPLS 3_113,5 Ba All Ct	1750.2	1181.8	4147.2	0.63		**630.9**	SPLS 3_0,9_113,5 Ba /	1710.7	1181.8	3544.6	0.53
103B	Leg	200x200x20	S235	12M24-5.6t	0.28	0.28	0.28	35	**-955.8**	SPLS 3_113,5 Ba All Ct	1704.3	1987.7	3110.4	0.56		**832.1**	SPLS 3_0,9_113,5 Ba /	1710.7	1987.7	2658.5	0.49
104A	Leg	250x250x20#	S235	12M24-5.6t	0.28	0.28	0.28	34	**-1193.3**	SPLS 3_113,5 Ba All Ct	2172.1	1892.2	3110.4	0.63		**1049.2**	SPLS 3_0,9_113,5 Ba /	2244.7	1892.2	2658.5	0.55
104B	Leg	250x250x20#	S235	14M24-5.6t	0.55	0.55	0.55	37	**-1305.5**	SPLS 3_113,5 Ba All Ct	2149.3	2100.4	3628.8	0.62		**1153.7**	SPLS 3_0,9_113,5 Ba /	2244.7	2100.4	3101.5	0.55
105	Leg	250x250x22#	S235	14M24-5.6t	0.17	0.17	0.17	33	**-1329.2**	SPLS 3_113,5 Ba All Ct	2386.8	2100.4	3991.7	0.63		**1154.1**	SPLS 3_0,9_113,5 Ba /	2453.6	2100.4	3411.7	0.55
106A	Onderregel eer:	200x200x16	S235	12M24-5.6t	1.53	1.00	1.00	63	**-658.0**	SPLS 6a_90 Ah Ct2 Ba	1211.7	906.5	2488.3	0.73		**458.3**	SPLS 3_0,9_113,5 Ba (	1386.2	906.5	2126.8	0.51
106B	Onderregel eer:	200x200x16	S235	10M24-5.6t	7.64	1.00	1.00	74	**-356.6**	SPLS 6a_90 Ah Ct2 Ba	1128.4	847.2	2073.6	0.42		**239.8**	SPLS 3_0,9_113,5 Ba (	1386.2	847.2	1772.3	0.28
106C	Onderregel eer:	200x200x16	S235		2.88	1.77	1.00	62	**-593.0**	SPLS 6a_90 Ah Ct2 Ba	1220.6	0.0	0.0	0.49		**393.0**	SPLS 3_0,9_113,5 Ba (	1452.3	0.0	0.0	0.27
107A	Onderregel eer:	180x180x15#	S235	10M24-5.6t	2.78	1.00	1.00	83	**-327.6**	SPLS 6a_90 Ah Ct2 Ba	887.4	847.2	1944.0	0.39		**213.1**	SPLS 3_0,9_113,5 Ba (	1144.0	847.2	1661.5	0.25
107B	Onderregel eer:	180x180x15#	S235	2M20-5.6t	1.63	1.00	1.00	18	**-3.5**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**0.3**	SPLS 1a_0 Ba All Cts	613.8	117.6	297.8	0.00
107C	Onderregel eer:	180x180x15#	S235		18.24	1.00	1.00	83	**-314.0**	SPLS 6a_90 Ah Ct2 Ba	887.3	0.0	0.0	0.35		**194.5**	SPLS 3_0,9_113,5 Ba (	1220.5	0.0	0.0	0.16
108A	Onderregel twe	180x180x15#	S235	12M24-5.6t	1.12	1.00	1.00	64	**-408.9**	SPLS 6a_90 Ah All Cts	1011.2	2033.3	2332.8	0.40		**300.8**	SPLS 3_0,9_113,5 Ba /	1144.0	2033.3	1814.4	0.26
108B	Onderregel twe	180x180x15#	S235	2M20-5.6t	1.00	1.50	1.00	19	**-3.5**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**0.6**	SPLS 1a_45 Ba Ct1	613.8	117.6	297.8	0.00
108C	Onderregel twe	180x180x15#	S235		2.77	1.70	1.00	65	**-376.1**	SPLS 6a_90 Ah All Cts	1010.4	0.0	0.0	0.37		**261.3**	SPLS 3_0,9_113,5 Ba /	1220.5	0.0	0.0	0.21
111A	Bovenregel eer:	90x90x9	S235	3M24-5.6t	1.00	1.96	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**125.5**	ULS 3_0	205.3	254.2	299.1	0.61
111B	Bovenregel eer:	90x90x9	S235	3M24-5.6t	1.00	2.04	1.00	294	**-6.3**	SPLS 3_0,9_113,5 Ba /	47.4	254.2	349.9	0.13		**92.4**	SPLS 6a_90 Ah All Cts	205.3	254.2	299.1	0.45
112A	Bovenregel eer:	75x75x7#	S235	3M24-5.6t	1.00	1.80	1.00	370	**-9.3**	SPLS 3_0,9_113,5 Ba /	21.6	254.2	272.2	0.43		**82.4**	SPLS 6a_90 Ah All Cts	131.8	254.2	192.5	0.62
112B	Bovenregel eer:	75x75x7#	S235	3M24-5.6t	1.00	2.25	1.00	370	**-9.3**	SPLS 3_0,9_113,5 Ba /	21.6	254.2	272.2	0.43		**82.4**	SPLS 6a_90 Ah All Cts	131.8	254.2	192.5	0.63
113A	Bovenregel twe	120x120x13	S235	5M24-5.6t	1.59	1.00	1.00	101	**-187.8**	SPLS 6a_90 Ah All Cts	355.8	423.6	842.4	0.53		**174.1**	SPLS 6a_90 Ah All Cts	418.7	423.6	703.2	0.42
113B	Bovenregel twe	120x120x13	S235	5M24-5.6t	1.40	1.00	1.00	102	**-174.0**	SPLS 6a_90 Ah All Cts	373.5	423.6	842.4	0.47		**169.4**	SPLS 6a_90 Ah All Cts	602.4	423.6	720.0	0.40
113C	Bovenregel twe	120x120x13	S235		2.70	1.70	1.00	101	**-184.1**	SPLS 6a_90 Ah All Cts	355.7	0.0	0.0	0.52		**175.7**	SPLS 6a_90 Ah All Cts	705.0	0.0	0.0	0.25
114A	Bovenregel twe	150x100x12	S235	5M24-5.6t	3.00	1.00	1.00	115	**-159.7**	SPLS 6a_90 Ah All Cts	301.8	423.6	777.6	0.53		**174.3**	SPLS 6a_90 Ah All Cts	582.2	423.6	664.6	0.41
114B	Bovenregel twe	150x100x12	S235	3M24-8.8t	7.59	1.48	1.00	104	**-31.4**	SPLS 3_0,9_113,5 Ba /	332.0	406.7	466.6	0.09		**30.0**	SPLS 6a_90 Ah Ct1 Ba	402.4	406.7	397.2	0.08
114C	Bovenregel twe	150x100x12	S235		3.00	1.00	1.00	115	**-145.8**	SPLS 6a_90 Ah All Cts	301.8	0.0	0.0	0.48		**160.4**	SPLS 6a_90 Ah All Cts	674.5	0.0	0.0	0.24
115A	Tussenregel twe	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-32.0**	SPLS 6a_90 Ba Ct1 Ba	79.8	84.7	77.8	0.41		**11.3**	SPLS 3_0,9_113,5 Ba (	127.9	84.7	66.5	0.17
115B	Tussenregel twe	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-31.3**	SPLS 6a_90 Ba Ct1 Ba	71.0	84.7	77.8	0.44		**12.1**	SPLS 3_0,9_113,5 Ba (	127.9	84.7	66.5	0.18
201L	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-41.9**	SPLS 3_0,9_113,5 Ba (	114.3	117.6	129.6	0.37		**34.9**	SPLS 1a_90 Ah Ct1	145.4	117.6	104.7	0.33
201T	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-21.3**	SPLS 6a_90 Ah Ct2 Ba	114.3	117.6	129.6	0.19		**13.3**	SPLS 3_0,9_90 Ba Ct2	145.4	117.6	104.7	0.13
202L	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-183.0**	SPLS 3_90 Ah Ct2	425.3	338.9	518.4	0.54		**141.1**	SPLS 3_0,9_90 Ba Ct1	384.5	338.9	350.9	0.42
202T	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-134.0**	SPLS 3_0,9_113,5 Ah (	425.3	338.9	518.4	0.40		**144.8**	SPLS 3_90 Ba Ct2	384.5	338.9	350.9	0.43
203L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-129.3**	SPLS 3_0,9_90 Ba Ct1	406.7	338.9	518.4	0.38		**167.3**	SPLS 3_90 Ah Ct2	384.5	338.9	350.9	0.49
203T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-131.5**	SPLS 3_90 Ba Ct2	406.7	338.9	518.4	0.39		**121.9**	SPLS 3_0,9_113,5 Ah (	384.5	338.9	350.9	0.36
204L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-185.1**	SPLS 3_0,9_113,5 Ba (	386.8	338.9	518.4	0.55		**167.3**	SPLS 3_0,9_90 Ah Ct1	384.5	338.9	350.9	0.49
204T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-165.9**	SPLS 3_113,5 Ah Ct1	386.8	338.9	518.4	0.49		**157.6**	SPLS 3_0,9_90 Ba Ct2	384.5	338.9	350.9	0.47
205L	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-352.5**	SPLS 3_113,5 Ah Ct2	449.2	508.3	777.6	0.78		**349.2**	SPLS 3_0,9_113,5 Ah (	384.5	508.3	513.8	0.91
205T	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-316.9**	SPLS 3_0,9_113,5 Ah (	449.2	508.3	777.6	0.71		**310.8**	SPLS 3_113,5 Ah Ct1	384.5	508.3	513.8	0.81
206L	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-290.9**	SPLS 3_113,5 Ah Ct2	465.9	423.6	777.6	0.69		**284.3**	SPLS 3_113,5 Ah Ct2	456.2	423.6	518.8	0.67
206T	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-257.0**	SPLS 3_113,5 Ah Ct1	465.9	423.6	777.6	0.61		**261.2**	SPLS 3_0,9_113,5 Ah (	456.2	423.6	518.8	0.62
207L	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-229.4**	SPLS 3_113,5 Ah Ct1	394.0	338.9	622.1	0.68		**236.7**	SPLS 3_113,5 Ah Ct2	456.2	338.9	421.1	0.70
207T	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-214.1**	SPLS 3_0,9_113,5 Ah (	394.0	338.9	622.1	0.63		**209.3**	SPLS 3_113,5 Ah Ct1	456.2	338.9	421.1	0.62
208L	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-197.7**	SPLS 3_113,5 Ah Ct2	332.1	254.2	388.8	0.78		**187.9**	SPLS 3_113,5 Ah Ct1	384.5	254.2	269.2	0.74
208T	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-177.5**	SPLS 3_113,5 Ah Ct1	332.1	254.2	388.8	0.70		**178.4**	SPLS 3_0,9_113,5 Ah (	384.5	254.2	269.2	0.70
209L	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-249.2**	SPLS 3_113,5 Ah Ct2	370.1	338.9	570.2	0.74		**222.2**	SPLS 3_0,9_113,5 Ah (	356.4	338.9	475.6	0.66
209T	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-230.3**	SPLS 3_113,5 Ah Ct1	370.1	338.9	570.2	0.68		**222.9**	SPLS 3_0,9_113,5 Ah (	356.4	338.9	475.6	0.66
210	Top	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	280	**-12.9**	SPLS 3_113,5 Ah Ct2	16.5	75.4	86.4	0.78		**12.8**	SPLS 3_0,9_113,5 Ah (	52.4	75.4	44.1	0.29
211L	Tweede dwarsa	100x100x6	S235	3M24-5.6t	1.00	1.00	1.00	132	**0.0**		113.1	254.2	233.3	0.00		**94.0**	ULS 6a_90 Ba Ct2	161.1	254.2	199.4	0.58
211T	Tweede dwarsa	100x100x6	S235	2M24-5.6t	1.00	1.00	1.00	132	**-3.6**	ULS 1a_90	113.1	169.4	155.5	0.03		**2.7**	ULS 1a_0,9_90	206.4	169.4	132.9	0.02
109L	Tweede dwarsa	180x180x15#	S235	12M24-5.6t	1.00	2.00	1.00	53	**-504.2**	SPLS 3_66,5 Ah All Cts	1075.9	2033.3	2332.8	0.47		**429.1**	SPLS 3_0,9_113,5 Ba /	1144.0	2033.3	1814.4	0.38
212T	Tweede dwarsa	100x100x6	S235	4M24-5.6t	1.00	2.00	1.00	95	**-47.3**	ULS 5a Ba 12	144.3	338.9	311.0	0.33		**59.8**	ULS 5a Ba 12	225.0	338.9	265.8	0.27
213	Tweede dwarsa	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	86	**-68.4**	ULS 5a Ba 12	265.3	254.2	311.0	0.27		**68.8**	SPLS 3_113,5 Ah Ct2	263.0	254.2	265.8	0.27
214	Tweede dwarsa	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	300	**-0.6**	SPLS 6a_90 Ah Ct1 Ba	11.8	37.7	43.2	0.05		**0.0**		37.4	37.7	22.0	0.00
215L	Eerste dwarsarr	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	178	**0.0**		103.8	254.2	311.0	0.00		**126.3**	SPLS 6a_90 Ah All Cts	270.5	254.2	265.8	0.50
215T	Eerste dwarsarr	100x100x8	S235	1M24-5.6t	1.00	1.00	1.00	178	**-50.2**	ULS 1a_0,9_90	83.1	84.7	103.7	0.60		**55.4**	ULS 1a_90	170.5	84.7	88.6	0.65
110L	Eerste dwarsarr	200x200x16	S235	12M24-5.6t	1.00	2.00	1.00	62	**-561.8**	SPLS 3_66,5 Ah All Cts	1222.1	906.5	2488.3	0.62		**421.9**	SPLS 3_0,9_113,5 Ba /	1386.2	906.5	2126.8	0.47
216T	Eerste dwarsarr	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	124	**-112.1**	SPLS 3_0,9_113,5 Ah (	151.1	338.9	414.7	0.74		**121.4**	SPLS 3_113,5 Ah Ct2	293.9	338.9	354.5	0.41
217	Eerste dwarsarr	120x120x11	S235	3M24-5.6t	1.00	1.00	1.00	114	**-151.3**	SPLS 3_0,9_113,5 Ah (	286.0	254.2	427.7	0.60		**152.5**	SPLS 3_113,5 Ah Ct2	356.4	254.2	365.5	0.60
218	Eerste dwarsarr	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	325	**-0.5**	SPLS 6a_90 Ah All Cts	12.6	58.8	54.0	0.04		**0.0**		54.7	58.8	37.0	0.00
219L	Onderstuk in to	130x130x12#	S235	2M24-5.6t	1.00	1.00	1.00	157	**-45.0**	SPLS 3_113,5 Ba All Ct	235.2	169.4	311.0	0.27		**36.2**	SPLS 3_0,9_113,5 Ba /	363.3	169.4	265.8	0.21
219T	Onderstuk in to	130x130x12#	S235	2M24-5.6t	1.00	1.00	1.00	157	**-48.2**	SPLS 3_113,5 Ba All Ct	235.2	169.4	311.0	0.28		**40.0**	SPLS 3_0,9_113,5 Ba /	363.3	169.4	265.8	0.24
220	Onderstuk in to	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	311	**-4.5**	SPLS 1a_135 Ba Ct1	11.6	37.7	43.2	0.39		**3.5**	ULS 1a_0,9_0,9_135	60.5	37.7	32.0	0.11
221	Onderstuk in to	70x70x5#	S235	1M16-5.6t	0.50	1.00	0.50	370	**-0.9**	ULS 7	9.9	37.7	43.2	0.09		**0.0**		74.9	37.7	32.0	0.00
301	Diagonaal onde	100x100x8	S235	1M20-5.6t	0.55	0.55	0.55	123	**-53.8**	SPLS 3_113,5 Ba All Ct	129.7	58.8	86.4	0.91		**55.0**	SPLS 3_0,9_113,5 Ba /	179.7	58.8	69.8	0.94
302	Diagonaal onde	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	110	**-69.0**	SPLS 3_0,9_113,5 Ba (	180.9	117.6	172.8	0.59		**67.3**	SPLS 3_113,5 Ba Ct1	190.7	117.6	139.6	0.57
303	Diagonaal onde	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	92	**-61.7**	SPLS 3_0,9_113,5 Ba /	208.7	117.6	172.8	0.53		**58.9**	SPLS 3_113,5 Ba All Ct	190.7	117.6	139.6	0.50
304	Diagonaal onde	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	104	**-78.1**	SPLS 3_113,5 Ba Ct1	143.2	117.6	129.6	0.66		**81.0**	SPLS 3_0,9_113,5 Ba /	170.1	117.6	104.7	0.77
305	Diagonaal onde	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	92	**-42.6**	SPLS 3_113,5 Ba All Ct	101.8	84.7	77.8	0.55		**45.8**	SPLS 3_0,9_113,5 Ba /	93.3	84.7	59.8	0.77
306	Diagonaal onde	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	84	**-23.1**	SPLS 3_0,9_113,5 Ba /	107.6	84.7	77.8	0.30		**26.6**	SPLS 3_113,5 Ba All Ct	93.3	84.7	66.5	0.40
307	Diagonaal onde	80x80x6#	S235	1M24-5.6t	0.55	0.55	0.55	96	**-31.0**	SPLS 6a_90 Ah All Cts	98.2	84.7	77.8	0.40		**27.5**	SPLS 3_0,9_113,5 Ba /	93.3	84.7	59.8	0.46
308	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	89	**-36.3**	SPLS 3_113,5 Ba All Ct	129.6	117.6	129.6	0.31		**37.7**	SPLS 3_0,9_113,5 Ba /	115.9	117.6	104.7	0.36
309	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-46.2**	SPLS 3_0,9_113,5 Ba /	140.4	117.6	129.6	0.39		**43.8**	SPLS 3_113,5 Ba All Ct	124.8	117.6	104.7	0.42
310	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	76	**-61.5**	SPLS 3_113,5 Ba All Ct	143.9	117.6	129.6	0.52		**62.1**	SPLS 3_0,9_113,5 Ba /	136.2	117.6	104.7	0.59
311	Diagonaal onde	70x70x6	S235	1M24-5.6t	1.00	1.00	1.00	69	**-27.7**	SPLS 3_113,5 Ba All Ct	99.6	84.7	77.8	0.36		**28.8**	SPLS 3_0,9_113,5 Ba /	76.0	84.7	55.0	0.52
312	Diagonaal onde	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	82	**-0.8**	SPLS 1a_0 Ba All Cts	55.5	37.7	43.2	0.02		**3.7**	ULS 3_0,9_90	37.4	37.7	25.7	0.14
313	Dwarsligger onc	HEA160	S235	2M20-5.6t	2.00	1.00	1.00	48	**-4.1**	SPLS 3_0,9_113,5 Ba (	686.1	117.6	216.0	0.03		**8.2**	SPLS 6a_90 Ah Ct2 Ba	766.1	117.6	0.0	0.07
314	Dwarsligger onc	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	82	**0.0**		314.6	117.6	259.2	0.00		**51.2**	ULS 3_113,5	278.4	117.6	259.2	0.44
315	Dwarsligger onc	HEA160	S235		1.00	1.00	1.00	26	**-2.0**	ULS 1a_0,9_113,5	789.3	0.0	0.0	0.00		**4.4**	ULS 3_66,5	916.5	0.0	0.0	0.00
316	Dwarsligger onc	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	37	**0.0**		426.4	117.6	259.2	0.00		**60.0**	ULS 3_0,9_113,5	278.4	117.6	259.2	0.51

DNV·GL

Assessment of groups for strenghtened mast (afkeur level)

Date	28-04-21
Author	KCh
Version	1.0

KIJ-GT 380
HC+0
83

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
317	Dwarsligger ond	HEA160	S235		1.00	1.00	1.00	13	**-10.4**	ULS 3_0,9_113,5	825.9	0.0	0.0	0.01		**0.0**		916.5	0.0	0.0	0.00
318	Verticaal eerste	90x90x6#	S235	1M20-5.6t	1.00	1.00	1.00	168	**-19.8**	ULS 3_0	61.1	58.8	64.8	0.34		**0.0**		117.5	58.8	52.4	0.00
319	Verticaal eerste	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	190	**-6.0**	ULS 3_135	29.3	37.7	43.2	0.20		**0.0**		37.4	37.7	22.0	0.00
320	Verticaal eerste	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	94	**-0.9**	ULS 7	50.9	37.7	43.2	0.02		**0.0**		37.4	37.7	18.4	0.00
321	Diagonaal eerst	50x50x6	S235	2M16-5.6t	1.00	1.00	1.00	580	**0.0**		5.7	75.4	103.7	0.00		**31.4**	ULS 3_0	62.1	75.4	52.9	0.59
322	Diagonaal eerst	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	415	**0.0**		12.4	117.6	129.6	0.00		**44.9**	ULS 3_0	77.4	117.6	88.7	0.58
323	Diagonaal eerst	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	516	**0.0**		4.7	37.7	43.2	0.00		**17.0**	ULS 3_0	37.4	37.7	22.0	0.77
324	Dwarsligger bov	65x50x5	S235	1M24-5.6t	1.00	1.00	1.00	220	**-3.0**	ULS 3_0,9_113,5	21.8	84.7	64.8	0.14		**0.0**		25.9	84.7	8.9	0.00
325	Tussen diagona	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	171	**-0.1**	SPLS 1a_0 Ah All Cts	27.0	37.7	43.2	0.00		**4.0**	ULS 3_0,9_135	37.4	37.7	18.4	0.22
401	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	110	**-27.4**	SPLS 3_113,5 Ba All Ct	123.3	117.6	129.6	0.23		**28.1**	SPLS 3_0,9_113,5 Ba	128.8	117.6	104.7	0.27
402	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	102	**-33.5**	SPLS 3_0,9_113,5 Ba	132.3	117.6	129.6	0.29		**34.1**	SPLS 3_113,5 Ba Ct1	136.1	117.6	104.7	0.33
403	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	98	**-42.2**	SPLS 3_113,5 Ba Ct1	136.1	117.6	129.6	0.36		**41.0**	SPLS 3_0,9_113,5 Ba	140.4	117.6	104.7	0.39
404	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	90	**-43.2**	SPLS 3_113,5 Ba Ct1	129.0	117.6	129.6	0.37		**43.4**	SPLS 3_0,9_113,5 Ba	119.7	117.6	104.7	0.41
405	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	81	**-49.9**	SPLS 3_0,9_113,5 Ba	138.2	117.6	129.6	0.42		**49.1**	SPLS 3_113,5 Ba Ct1	123.5	117.6	104.7	0.47
406	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-63.3**	SPLS 3_113,5 Ba Ct1	140.4	117.6	129.6	0.54		**61.8**	SPLS 3_0,9_113,5 Ba	131.2	117.6	104.7	0.59
407	Diagonaal onde	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	83	**-24.6**	SPLS 3_113,5 Ba All Ct	79.3	58.8	64.8	0.42		**26.3**	SPLS 3_0,9_113,5 Ba	65.7	58.8	38.8	0.68
408	Diagonaal onde	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	78	**-0.9**	SPLS 1a_0 Ba Ct1	81.4	58.8	64.8	0.01		**4.3**	ULS 3_0,9_0	65.7	58.8	38.8	0.11
409	Dwarsligger ond	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	51	**-0.7**	ULS 1a_0,9_0,9_113,5	700.0	117.6	216.0	0.01		**5.0**	SPLS 6a_90 Ah Ct1 Ba	766.1	117.6	0.0	0.04
410	Dwarsligger ond	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	44	**0.0**		410.1	117.6	259.2	0.00		**62.1**	ULS 3_0,9_113,5	278.4	117.6	259.2	0.53
411	Dwarsligger ond	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	31	**-8.9**	ULS 3_0,9_113,5	774.9	117.6	216.0	0.08		**0.0**		766.1	117.6	0.0	0.00
412	Bovenregel twe	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	306	**-10.1**	SPLS 1a_0,9_113,5 Ba	56.1	254.2	311.0	0.18		**116.1**	ULS 3_90	263.0	254.2	265.8	0.46
413	Bovenregel twe	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	238	**-16.9**	SPLS 1a_0,9_113,5 Ba	83.2	254.2	311.0	0.20		**106.7**	SPLS 6a_90 Ah Ct2 Ba	263.0	254.2	265.8	0.42
414	Diagonaal bove	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	203	**-4.3**	SPLS 1a_0 Ba All Cts	25.4	37.7	51.8	0.17		**4.5**	SPLS 1a_0,9_0 Ba Ct2	44.9	37.7	26.5	0.17
415	Diagonaal bove	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	189	**-4.6**	SPLS 1a_0 Ba Ct2	28.1	37.7	51.8	0.16		**4.2**	SPLS 1a_0,9_0 Ba All (	44.9	37.7	26.5	0.16
416	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	179	**-4.5**	SPLS 1a_0 Ba All Cts	25.5	37.7	43.2	0.17		**5.0**	SPLS 6a_90 Ah All Cts	37.4	37.7	22.0	0.23
417	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	146	**-8.7**	SPLS 6a_90 Ah All Cts	33.1	37.7	43.2	0.26		**9.2**	SPLS 6a_90 Ah All Cts	37.4	37.7	22.0	0.42
418	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	138	**-11.1**	SPLS 6a_90 Ah All Cts	35.2	37.7	43.2	0.32		**10.5**	SPLS 6a_90 Ah All Cts	37.4	37.7	22.0	0.48
419	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	134	**-13.1**	SPLS 6a_90 Ah All Cts	36.6	37.7	43.2	0.36		**13.8**	SPLS 6a_90 Ah All Cts	37.4	37.7	22.0	0.62
420	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	96	**-16.0**	SPLS 6a_90 Ah All Cts	60.6	58.8	54.0	0.30		**15.1**	SPLS 6a_90 Ah All Cts	54.7	58.8	32.4	0.47
421	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	93	**-19.3**	SPLS 6a_90 Ah All Cts	62.4	58.8	54.0	0.36		**20.6**	SPLS 6a_90 Ah All Cts	54.7	58.8	32.4	0.64
422	Diagonaal bove	60x60x5	S235		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
423	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-1.4**	SPLS 3_0,9_113,5 Ah (	50.8	37.7	43.2	0.04		**3.9**	SPLS 6a_90 Ba Ct2 Ba	37.4	37.7	22.0	0.18
424	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**0.0**		25.2	37.7	43.2	0.00		**4.8**	SPLS 6a_90 Ah Ct2 Ah	37.4	37.7	22.0	0.22
425	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	314	**-3.6**	SPLS 3_113,5 Ah Ct2	11.0	37.7	43.2	0.33		**0.0**		37.4	37.7	22.0	0.00
426	Diagonaal twee	**50x50x7**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	353	**-11.8**	SPLS 6a_90 Ba Ct2 Ba	13.2	60.3	82.3	0.89		**1.6**	SPLS 3_0,9_113,5 Ah (	71.3	60.3	42.0	0.04
427	Diagonaal twee	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	266	**0.0**		14.3	37.7	43.2	0.00		**1.0**	SPLS 1a_66,5 Ba Ct2	37.4	37.7	22.0	0.05
428	Dwarsligger bov	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	196	**-0.5**	ULS 3_0,9_90	22.5	37.7	43.2	0.02		**0.5**	ULS 1a_0,9_0,9_90	37.4	37.7	22.0	0.02
429	Dwarsligger bov	UNP160	**S355**	**1M16-8.8t**	1.00	1.00	1.00	40	**0.0**		405.2	60.3	88.2	0.00		**25.9**	ULS 3_0,9_90	123.5	60.3	65.3	0.43
430	Dwarsligger lad	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	112	**0.0**	SPLS 6a_90 Ah Ct1 Ba	44.1	37.7	43.2	0.00		**0.0**	SPLS 1a_0,9_66,5 Ba (	37.4	37.7	22.0	0.00
116	0	**UNP160**	**S355**	**5M24-8.8t**	1.00	3.10	1.00	51	**-29.7**	SPLS 6a_90 Ah Ct1 Ba	503.8	677.8	661.5	0.06		**15.4**	SPLS 6a_90 Ba Ct1 Ah	472.1	677.8	565.4	0.03
431	Diagonaal bove	**60x60x6**	**S355**	**1M20-8.8t**	0.55	0.55	0.55	64	**-19.6**	SPLS 6a_90 Ah All Cts	122.5	94.1	88.2	0.22		**18.2**	SPLS 6a_90 Ah All Cts	89.4	94.1	60.4	0.30
432	Diagonaal bove	**60x60x6**	**S355**	**1M20-8.8t**	0.55	0.55	0.55	59	**-20.0**	SPLS 6a_90 Ba Ct1 Ah	126.0	94.1	88.2	0.23		**21.7**	SPLS 6a_90 Ba Ct2 Ah	89.4	94.1	60.4	0.36

Notes:
1) Groups 116, 429, 431 and 432 have been added/ edited to move the earthwire attachment point 0.3m horizontally outward
2) The bolts on group 114B have been changed due to the modification of the earthwire attachment point

Assessment of groups for strengthened mast (verbouw level)

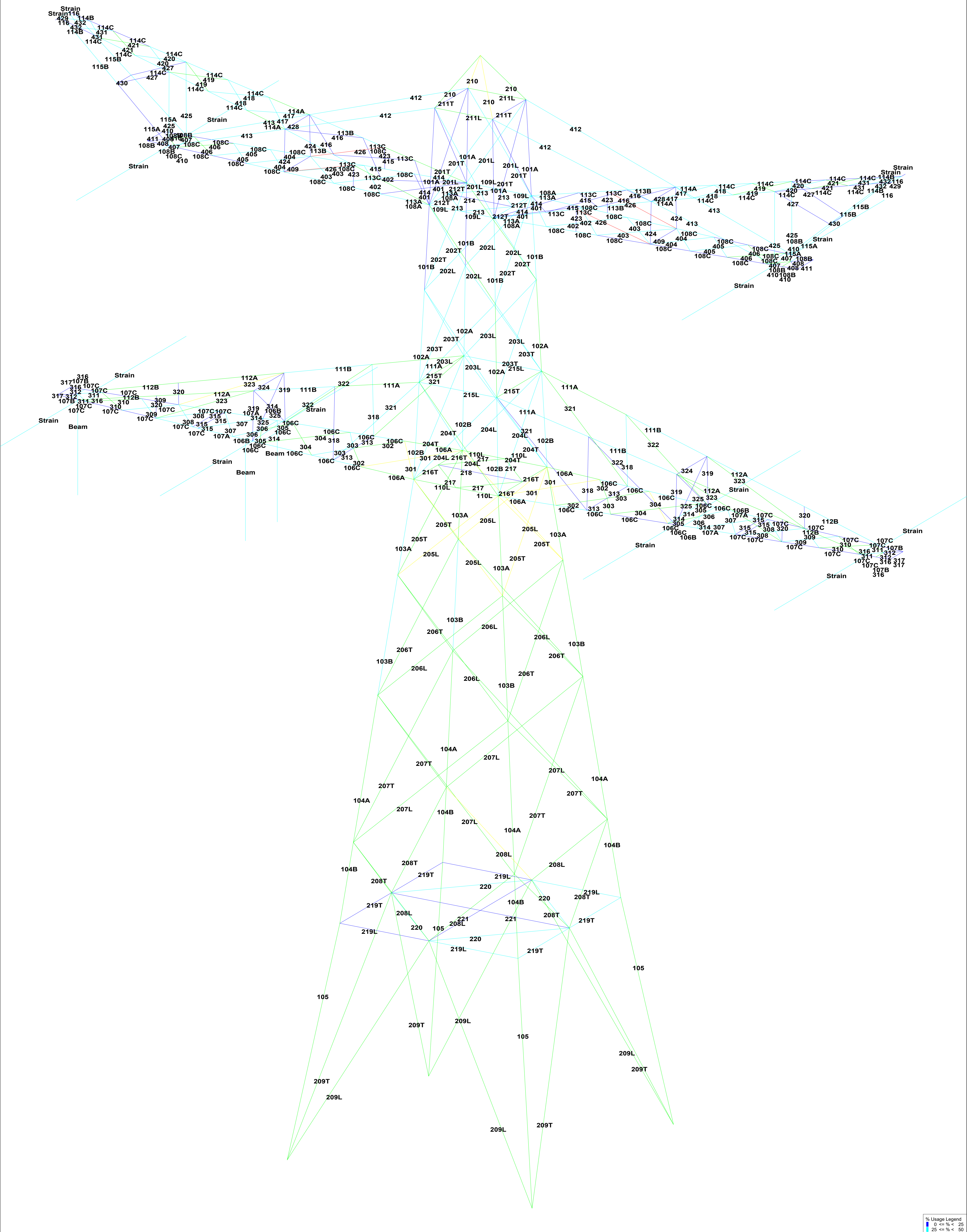
Date 28-04-21
Author KCh
Version 1.0

KIJ-GT 380
HC+0
83

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
114B	Bovenregel twe	150x100x12	S235	**3M24-8.8t**	7.59	1.48	1.00	104	**-34.2**	ULS 1a_0.9_0.9_113.5	332.0	406.7	466.6	0.10		**31.6**	SPLS 6a_90 Ah Ct1 Ba	402.4	406.7	397.2	0.08
426	Diagonaal twee	**50x50x7**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	353	**-12.6**	SPLS 6a_90 Ba Ct2 Ba	13.2	60.3	82.3	0.95		**1.9**	SPLS 3_0.9_113.5 Ah (	71.3	60.3	42.0	0.04
429	Dwarsligger bov	UNP160	**S355**	**1M16-8.8t**	1.00	1.00	1.00	40	**0.0**		405.2	60.3	88.2	0.00		**30.3**	ULS 3_0.9_90	123.5	60.3	65.3	0.50
116		**UNP160**	**S355**	**5M24-8.8t**	1.00	3.10	1.00	51	**-30.8**	SPLS 6a_90 Ah Ct1 Ba	503.8	677.8	661.5	0.06		**16.4**	ULS 1a_0.9_113.5	472.1	677.8	565.4	0.03
431	Diagonaal bove	**60x60x6**	**S355**	**1M20-8.8t**	0.55	0.55	0.55	64	**-20.4**	SPLS 6a_90 Ah All Cts	122.5	94.1	88.2	0.23		**18.9**	SPLS 6a_90 Ah All Cts	89.4	94.1	60.4	0.31
432	Diagonaal bove	**60x60x6**	**S355**	**1M20-8.8t**	0.55	0.55	0.55	59	**-20.8**	SPLS 6a_90 Ba Ct1 Ah	126.0	94.1	88.2	0.24		**22.5**	SPLS 6a_90 Ba Ct2 Ah	89.4	94.1	60.4	0.37

Notes:
1) Groups 116, 429, 431 and 432 have been added/ edited to move the earthwire attachment point 0.3m horizontally outward
2) The bolts on group 114B have been changed due to the modification of the earthwire attachment point

DNV GL Nederlands BV, Project: "HC+0 (da) ini (83)"
Tower Version 16.63, 14:33:30 Wednesday, 28 April, 2021
Undeformed geometry displayed



% Usage Legend
0 <= % < 25
25 <= % < 50
50 <= % < 75
75 <= % < 100
100 <= %

1 (m)

Assessment of groups for initial mast (afkeur level)

Date 17-8-2020
Author MKh
Version 1.0

KIJ-GT 380
HC+0T
69

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
101A	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	85	**-49.0**	SPLS 3_67 Ah Ct2	390.5	508.3	777.6	0.13		**9.1**	ULS 1a_0,9_0,9_67	466.6	508.3	664.6	0.02	
101B	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	74	**-131.9**	SPLS 3_67 Ah Ct2	423.6	506.7	777.6	0.31		**95.9**	SPLS 3_0,9_67 Ah All Cts	466.6	506.7	664.6	0.21	
102A	Leg	180x180x16	S235	8M24-5.6t	0.50	0.50	0.50	54	**-368.6**	SPLS 3_67 Ah All Cts	1141.5	674.7	1658.9	0.55		**283.5**	SPLS 3_0,9_67 Ah All Cts	1220.3	674.7	1417.8	0.42	
102B	Leg	180x180x16	S235	12M24-5.6t	0.50	0.50	0.50	57	**-402.0**	SPLS 3_67 Ah All Cts	1125.2	1005.5	2488.3	0.40		**297.0**	SPLS 3_0,9_67 Ah All Cts	1220.3	1005.5	2169.3	0.30	
103A	Leg	200x200x20	S235	16M24-5.6t	0.28	0.28	0.28	28	**-729.0**	SPLS 3_67 Ah All Cts	1750.2	1181.8	4147.2	0.62		**580.9**	SPLS 3_0,9_67 Ah All Cts	1710.7	1181.8	3544.6	0.49	
103B	Leg	200x200x20	S235	12M24-5.6t	0.28	0.28	0.28	35	**-929.1**	SPLS 3_67 Ah All Cts	1704.3	1987.7	3110.4	0.55		**774.4**	SPLS 3_0,9_67 Ah All Cts	1710.7	1987.7	2658.5	0.45	
104A	Leg	250x250x20	S235	12M24-5.6t	0.28	0.28	0.28	34	**-1156.8**	SPLS 3_67 Ah All Cts	2172.1	1892.2	3110.4	0.61		**980.7**	SPLS 3_0,9_67 Ah All Cts	2244.7	1892.2	2658.5	0.52	
104B	Leg	250x250x20	S235	14M24-5.6t	0.55	0.55	0.55	37	**-1266.1**	SPLS 3_67 Ah All Cts	2149.3	2100.4	3628.8	0.60		**1080.8**	SPLS 3_0,9_67 Ah All Cts	2244.7	2100.4	3101.5	0.51	
105	Leg	250x250x22	S235	14M24-5.6t	0.17	0.17	0.17	33	**-1290.1**	SPLS 3_67 Ah All Cts	2386.8	2100.4	3991.7	0.61		**1080.1**	SPLS 3_0,9_67 Ah All Cts	2453.6	2100.4	3411.7	0.51	
106A	Onderregel eerste dwarsarm	200x200x16	S235	12M24-5.6t	1.53	1.00	1.00	63	**-645.2**	SPLS 6a_90 Ba Ct2 Ah Ct2	1211.7	906.5	2488.3	0.71		**424.6**	SPLS 3_0,9_67 Ah Ct1	1386.2	906.5	2126.8	0.47	
106B	Onderregel eerste dwarsarm	200x200x16	S235	10M24-5.6t	7.64	1.00	1.00	74	**-346.7**	SPLS 6a_90 Ba Ct2 Ah Ct2	1128.4	847.2	2073.6	0.41		**217.0**	SPLS 3_0,9_67 Ah Ct1	1386.2	847.2	1772.3	0.26	
106C	Onderregel eerste dwarsarm	200x200x16	S235		2.88	1.77	1.00	62	**-578.5**	SPLS 6a_90 Ba Ct2 Ah Ct2	1220.6	0.0	0.0	0.47		**362.3**	SPLS 3_0,9_67 Ah Ct1	1452.3	0.0	0.0	0.25	
107A	Onderregel eerste dwarsarm	180x180x15	S235	10M24-5.6t	2.78	1.00	1.00	83	**-317.2**	SPLS 6a_90 Ba Ct2 Ah Ct2	887.4	847.2	1944.0	0.37		**192.3**	SPLS 3_0,9_67 Ah Ct1	1144.0	847.2	1661.5	0.23	
107B	Onderregel eerste dwarsarm	180x180x15	S235	2M20-5.6t	1.63	1.00	1.00	18	**-3.4**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**0.7**	ULS 1a_0,9_0,9_67	613.8	117.6	297.8	0.01	
107C	Onderregel eerste dwarsarm	180x180x15	S235		18.24	1.00	1.00	83	**-303.0**	SPLS 6a_90 Ba Ct2 Ah Ct2	887.3	0.0	0.0	0.34		**174.1**	SPLS 3_0,9_67 Ah Ct1	1220.5	0.0	0.0	0.14	
108A	Onderregel tweede dwarsarm	180x180x15	S235	12M24-5.6t	1.12	1.00	1.00	64	**-413.0**	SPLS 6a_90 Ba All Cts Ah Ct2	1011.2	2033.3	2332.8	0.41		**290.7**	SPLS 3_0,9_67 Ah All Cts	1144.0	2033.3	1814.4	0.25	
108B	Onderregel tweede dwarsarm	180x180x15	S235	2M20-5.6t	1.00	1.50	1.00	19	**-3.2**	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		**0.7**	SPLS 1a_135 Ah Ct1	613.8	117.6	297.8	0.01	
108C	Onderregel tweede dwarsarm	180x180x15	S235		2.77	1.70	1.00	65	**-379.1**	SPLS 6a_90 Ba All Cts Ah Ct2	1010.4	0.0	0.0	0.38		**253.0**	SPLS 3_0,9_67 Ah All Cts	1220.5	0.0	0.0	0.21	
111A	Bovenregel eerste dwarsarm	90x90x9	S235	3M24-5.6t	1.00	1.96	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**114.3**	PLS 6a_90 Ah Ct1 Ba Ct2	205.3	254.2	299.1	0.56	
111B	Bovenregel eerste dwarsarm	90x90x9	S235	3M24-5.6t	1.00	2.04	1.00	294	**0.0**		47.4	254.2	349.9	0.00		**89.0**	PLS 6a_90 Ah Ct1 Ba Ct2	205.3	254.2	299.1	0.43	
112A	Bovenregel eerste dwarsarm	75x75x7#	S235	3M24-5.6t	1.00	1.80	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**76.0**	PLS 6a_90 Ah Ct1 Ba Ct2	131.8	254.2	192.5	0.58	
112B	Bovenregel eerste dwarsarm	75x75x7#	S235	3M24-5.6t	1.00	2.25	1.00	370	**0.0**		21.6	254.2	272.2	0.00		**76.1**	PLS 6a_90 Ah Ct1 Ba Ct2	131.8	254.2	192.5	0.58	
113A	Bovenregel tweede dwarsarm	120x120x13	S235	5M24-5.6t	1.59	1.00	1.00	101	**-189.2**	SPLS 6a_90 Ba All Cts Ah Ct1	355.8	423.6	842.4	0.53		**163.9**	S 6a_90 Ba All Cts Ah Ct2	418.7	423.6	703.2	0.39	
113B	Bovenregel tweede dwarsarm	120x120x13	S235	5M24-5.6t	1.40	1.00	1.00	102	**-174.2**	SPLS 6a_90 Ba All Cts Ah Ct1	373.5	423.6	842.4	0.47		**157.5**	S 6a_90 Ba All Cts Ah Ct2	602.4	423.6	720.0	0.37	
113C	Bovenregel tweede dwarsarm	120x120x13	S235		2.70	1.70	1.00	101	**-185.1**	SPLS 6a_90 Ba All Cts Ah Ct1	355.7	0.0	0.0	0.52		**164.5**	S 6a_90 Ba All Cts Ah Ct2	705.0	0.0	0.0	0.23	
114A	Bovenregel tweede dwarsarm	150x100x12	S235	5M24-5.6t	3.00	1.00	1.00	115	**-158.7**	SPLS 6a_90 Ba All Cts Ah Ct1	301.8	423.6	777.6	0.53		**162.7**	S 6a_90 Ba All Cts Ah Ct2	582.2	423.6	664.6	0.38	
114B	Bovenregel tweede dwarsarm	150x100x12	S235	4M24-5.6t	3.00	1.00	1.00	104	**-34.0**	SPLS 6a_90 Ah All Cts Ba Ct1	331.5	338.9	622.1	0.10		**28.5**	PLS 6a_90 Ba Ct2 Ah Ct2	582.2	338.9	531.7	0.08	
114C	Bovenregel tweede dwarsarm	150x100x12	S235		3.00	1.00	1.00	115	**-144.0**	SPLS 6a_90 Ba All Cts Ah Ct1	301.8	0.0	0.0	0.48		**147.7**	S 6a_90 Ba All Cts Ah Ct2	674.5	0.0	0.0	0.22	
115A	Tussenregel tweede dwarsarm	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-20.7**	SPLS 6a_90 Ah Ct1 Ah Ct2	79.8	84.7	77.8	0.27		**4.5**	ULS 1a_0,9_0,9_67	127.9	84.7	66.5	0.07	
115B	Tussenregel tweede dwarsarm	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	**-19.8**	SPLS 6a_90 Ah Ct1 Ah Ct2	71.0	84.7	77.8	0.28		**5.4**	ULS 1a_0,9_0,9_67	127.9	84.7	66.5	0.08	
201L	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	**-30.2**	SPLS 1a_0,9_67 Ah Ct2	114.3	117.6	129.6	0.26		**28.1**	ULS 1a_90	145.4	117.6	104.7	0.27	
201T	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	1.00	0.53	158	**-12.8**	ULS 3_90	85.5	117.6	129.6	0.15		**5.7**	SPLS 1a_0,9_90 Ah Ct2	145.4	117.6	104.7	0.05	
202L	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-179.1**	SPLS 3_90 Ah Ct2	425.3	338.9	518.4	0.53		**138.1**	SPLS 3_0,9_90 Ah Ct1	384.5	338.9	350.9	0.41	
202T	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	**-128.7**	SPLS 3_0,9_45 Ba Ct1	425.3	338.9	518.4	0.38		**142.8**	SPLS 3_90 Ah Ct2	384.5	338.9	350.9	0.42	
203L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-127.4**	SPLS 3_0,9_90 Ah Ct1	406.7	338.9	518.4	0.38		**164.4**	SPLS 3_90 Ah Ct2	384.5	338.9	350.9	0.49	
203T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	**-130.0**	SPLS 3_135 Ah Ct2	406.7	338.9	518.4	0.38		**118.3**	SPLS 3_0,9_45 Ba Ct1	384.5	338.9	350.9	0.35	
204L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-172.2**	SPLS 3_0,9_90 Ah Ct2	386.8	338.9	518.4	0.51		**142.1**	SPLS 3_0,9_90 Ba Ct1	384.5	338.9	350.9	0.42	
204T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	**-158.8**	SPLS 3_67 Ba Ct1	386.8	338.9	518.4	0.47		**147.6**	SPLS 3_0,9_90 Ah Ct2	384.5	338.9	350.9	0.44	
205L	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-337.7**	SPLS 3_67 Ba Ct1	449.2	508.3	777.6	0.75		**333.6**	SPLS 3_67 Ba Ct2	384.5	508.3	513.8	0.87	
205T	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	**-311.1**	SPLS 3_0,9_67 Ba Ct2	449.2	508.3	777.6	0.69		**305.9**	SPLS 3_67 Ba Ct1	384.5	508.3	513.8	0.80	
206L	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-278.8**	SPLS 3_67 Ba Ct2	465.9	423.6	777.6	0.66		**277.5**	SPLS 3_67 Ba Ct1	456.2	423.6	518.8	0.66	
206T	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	**-253.1**	SPLS 3_67 Ba Ct1	465.9	423.6	777.6	0.60		**256.1**	SPLS 3_0,9_67 Ba Ct2	456.2	423.6	518.8	0.60	
207L	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-227.6**	SPLS 3_67 Ba Ct1	394.0	338.9	622.1	0.67		**225.9**	SPLS 3_67 Ba Ct2	456.2	338.9	421.1	0.67	
207T	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	**-210.9**	SPLS 3_0,9_67 Ba Ct2	394.0	338.9	622.1	0.62		**204.9**	SPLS 3_67 Ba Ct1	456.2	338.9	421.1	0.60	
208L	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-189.6**	SPLS 3_67 Ba Ct2	332.1	254.2	388.8	0.75		**186.4**	SPLS 3_67 Ba Ct1	384.5	254.2	269.2	0.73	
208T	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	**-173.2**	SPLS 3_67 Ba Ct1	332.1	254.2	388.8	0.68		**175.8**	SPLS 3_0,9_67 Ba Ct2	384.5	254.2	269.2	0.69	
209L	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-237.2**	SPLS 3_67 Ba Ct2	370.1	338.9	570.2	0.70		**222.0**	SPLS 3_0,9_67 Ba Ct1	356.4	338.9	475.6	0.66	
209T	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	**-224.3**	SPLS 3_67 Ba Ct1	370.1	338.9	570.2	0.66		**216.6**	SPLS 3_0,9_67 Ba Ct2	356.4	338.9	475.6	0.64	
210	Top	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	280	**-6.5**	SPLS 3_67 Ah Ct2	16.5	75.4	86.4	0.39		**6.4**	SPLS 3_0,9_67 Ah Ct2	52.4	75.4	44.1	0.15	
211L	Tweede dwarsarm in tower	100x100x6	S235	3M24-5.6t	1.00	1.00	1.00	132	**0.0**		113.1	254.2	233.3	0.00		**85.2**	ULS 6a_90 Ah Ct2	161.1	254.2	199.4	0.53	
211T	Tweede dwarsarm in tower	100x100x6	S235	2M24-5.6t	1.00	1.00	1.00	132	**-3.5**	ULS 1a_90	113.1	169.4	155.5	0.03		**2.3**	ULS 1a_0,9_90	206.4	169.4	132.9	0.02	
109L	Tweede dwarsarm in tower	180x180x15	S235	12M24-5.6t	1.00	2.00	1.00	53	**-494.2**	SPLS 3_113 Ba All Cts	1075.9	2033.3	2332.8	0.46		**404.4**	SPLS 3_0,9_67 Ah All Cts	1144.0	2033.3	1814.4	0.35	
212T	Tweede dwarsarm in tower	100x100x6	S235	4M24-5.6t	1.00	2.00	1.00	95	**-46.0**	SPLS 3_0,9_113 Ah Ct2	144.3	338.9	311.0	0.32		**59.1**	ULS 5a Ba 12	225.0	338.9	265.8	0.26	
213	Tweede dwarsarm in tower	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	86	**-69.0**	ULS 5a Ba 12	265.3	254.2	311.0	0.27		**69.5**	ULS 5a Ba 12	263.0	254.2	265.8	0.27	
214	Tweede dwarsarm in tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	300	**-0.6**	SPLS 6a_90 Ba Ct1 Ba Ct2	11.8	37.7	43.2	0.05		**0.0**		37.4	37.7	22.0	0.00	
215L	Eerste dwarsarm in tower	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	178	**0.0**		103.8	254.2	311.0	0.00		**109.2**	S 6a_90 Ba All Cts Ah Ct2	270.5	254.2	265.8	0.43	
215T	Eerste dwarsarm in tower	100x100x8	S235	1M24-5.6t	1.00	1.00	1.00	178	**-47.0**	ULS 1a_0,9_90	83.1	84.7	103.7	0.57		**53.4**	ULS 1a_90	170.5	84.7	88.6	0.63	
110L	Eerste dwarsarm in tower	200x200x16	S235	12M24-5.6t	1.00	2.00	1.00	62	**-544.9**	SPLS 3_113 Ba All Cts	1222.1	906.5	2488.3	0.60		**385.2**	SPLS 3_0,9_67 Ah All Cts	1386.2	906.5	2126.8	0.42	
216T	Eerste dwarsarm in tower	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	124	**-107.2**	SPLS 3_0,9_67 Ba Ct2	151.1	338.9	414.7	0.71		**118.7**	PLS 6a_90 Ah Ct1 Ah Ct2	293.9	338.9	354.5	0.40	
217	Eerste dwarsarm in tower	120x120x11	S235	3M24-5.6t	1.00	1.00	1.00	114	**-150.1**	SPLS 6a_90 Ba Ct2 Ah Ct2	286.0	254.2	427.7	0.59		**151.1**	PLS 6a_90 Ba Ct2 Ah Ct2	356.4	254.2	365.5	0.59	
218	Eerste dwarsarm in tower	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	325	**-0.5**	SPLS 6a_90 Ba Ct1 Ba Ct2	12.6	58.8	54.0	0.04		**0.0**		54.7	58.8	37.0	0.00	
219L	Onderstuk in tower	130x130x12	S235	2M24-5.6t	1.00	1.00	1.00	157	**-45.7**	SPLS 3_67 Ah All Cts	235.2	169.4	311.0	0.27		**32.0**	SPLS 3_0,9_67 Ah All Cts	363.3	169.4	265.8	0.19	
219T	Onderstuk in tower	130x130x12	S235	2M24-5.6t	1.00	1.00	1.00	157	**-49.4**	SPLS 3_67 Ah All Cts	235.2	169.4	311.0	0.29		**35.7**	SPLS 3_0,9_67 Ah All Cts	363.3	169.4	265.8	0.21	
220	Onderstuk in tower	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	311	**-4.9**	SPLS 1a_135 Ba Ct1	11.6	37.7	43.2	0.43		**4.0**	ULS 1a_0,9_0,9_135	60.5	37.7	32.0	0.12	
221	Onderstuk in tower	70x70x5#	S235	1M16-5.6t	0.50	1.00	0.50	370	**-1.0**	SPLS 3_67 Ba Ct2	10.0	37.7	43.2	0.10		**0.0**		74.9	37.7	32.0	0.00	
301	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	1M20-5.6t	0.55	0.55	0.55	123	**-53.2**	SPLS 6a_90 Ba All Cts Ah Ct1	129.7	58.8	86.4	0.90		**52.8**	S 6a_90 Ba All Cts Ah Ct1	179.7	58.8	69.8	0.90	
302	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	110	**-67.9**	SPLS 6a_90 Ba Ct1 Ah Ct1	180.9	117.6	172.8	0.58		**66.4**	PLS 6a_90 Ba Ct1 Ah Ct1	190.7	117.6	139.6	0.56	
303	Diagonaal onderregel eerste dwarsarm	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	92	**-60.1**	SPLS 6a_90 Ba All Cts Ah Ct1	208.7	117.6	172.8	0.51		**57.8**	S 6a_90 Ba All Cts Ah Ct1	190.7	117.6	139.6	0.49	
304	Diagonaal onderregel eerste dwarsarm	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	104	**-78.3**	SPLS 6a_90 Ba All Cts Ah Ct1	143.2	117.6	129.6	0.67		**77.7**	S 6a_90 Ba All Cts Ah Ct1	170.1	117.6	104.7	0.74	
305	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	92	**-41.9**	SPLS 6a_90 Ba All Cts Ah Ct1	101.8	84.7	77.8	0.54		**45.2**	S 6a_90 Ba All Cts Ah Ct1	93.3	84.7	59.8	0.76	
306	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	84	**-23.0**	SPLS 6a_90 Ba All Cts Ah Ct1	107.6	84.7	77.8	0.30		**26.5**	S 6a_90 Ba All Cts Ah Ct1	93.3	84.7	66.5	0.40	
307	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	1M24-5.6t	0.55	0.55	0.55	96	**-31.2**	SPLS 6a_90 Ba Ct2 Ah Ct2	98.2	84.7	77.8	0.40		**25.7**	S 6a_90 Ba All Cts Ah Ct1	93.3	84.7	59.8	0.43	
308	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	89	**-36.4**	SPLS 6a_90 Ba All Cts Ah Ct1	129.6	117.6	129.6	0.31		**35.8**	S 6a_90 Ba All Cts Ah Ct1	115.9	117.6	104.7	0.34	
309	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-44.6**	SPLS 6a_90 Ba All Cts Ah Ct1	140.4	117.6	129.6	0.38		**44.1**	S 6a_90 Ba All Cts Ah Ct1	124.8	117.6	104.7	0.42	
310	Diagonaal onderregel eerste dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	76	**-61.5**	SPLS 6a_90 Ba All Cts Ah Ct1	143.9	117.6	129.6	0.52		**59.3**	S 6a_90 Ba All Cts Ah Ct1	136.2	117.6	104.7	0.57	
311	Diagonaal onderregel eerste dwarsarm	70x70x6	S235	1M24-5.6t	1.00	1.00	1.00	69	**-26.9**	SPLS 6a_90 Ba All Cts Ah Ct1	99.6	84.7	77.8	0.35		**27.0**	S 6a_90 Ba All Cts Ah Ct1	76.0	84.7	55.0	0.49	
312	Diagonaal onderregel eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	82	**-2.0**	ULS 1a_0,9_0,9_90	55.5	37.7	43.2	0.05		**3.6**	ULS 3_0,9_113	37.4	37.7	25.7	0.14	
313	Dwarsligger onderregel eerste dwarsarm	HEA160	S235	2M20-5.6t	2.00	1.00	1.00	48	**-3.6**	SPLS 3_0,9_90 Ah Ct1	686.1	117.6	216.0	0.03		**7.7**	PLS 6a_90 Ba Ct2 Ah Ct2	766.1	117.6	0.0	0.07	
314	Dwarsligger onderregel eerste dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	82	**0.0**		314.6	117.6	259.2	0.00		**50.3**	ULS 3_67	278.4	117.6	259.2	0.43	
315	Dwarsligger onderregel eerste dwarsarm	HEA160	S235		1.00	1.00	1.00	26	**-1.5**	ULS 1a_0,9_67	789.3	0.0	0.0	0.00		**4.5**	ULS 3_67	916.5	0.0	0.0	0.00	
316	Dwarsligger onderregel eerste dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	37	**0.0**		426.4	117.6	259.2	0.00		**58.7**	ULS 3_67	278.4	117.6	259.2	0.50	
317	Dwarsligger onderregel eerste dwarsarm	HEA160	S235		1.00	1.00	1.00	13	**-10.2**	ULS 3_0,9_90	825.9	0.0	0.0	0.01		**0.0**		916.5	0.0	0.0	0.00	
318	Verticaal eerste dwarsarm	90x90x6#	S235	1M20-5.6t	1.00	1.00	1.00	168	**-17.2**	SPLS 6a_90 Ba All Cts Ah Ct2	61.1	58.8	64.8	0.29		**0.0**		117.5	58.8	52.4	0.00	
319	Verticaal eerste dwarsarm	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	190	**-5.3**	ULS 3_45	29.3	37.7	43.2	0.18		**0.0**		37.4	37.7	22.0	0.00	
320	Verticaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	94	**-1.0**	SPLS 6a_90 Ah Ct1 Ba Ct2	50.9	37.7	43.2	0.03		**0.0**		37.4	37.7	18.4	0.00	

DNV·GL

Assessment of groups for initial mast (afkeur level)

Date	17-8-2020
Author	MKh
Version	1.0

KIJ-GT 380
HC+0T
69

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
321	Diagonaal eerste dwarsarm	50x50x6	S235	2M16-5.6t	1.00	1.00	1.00	580	**0.0**		5.7	75.4	103.7	0.00		**25.9**	ULS 1a_0	62.1	75.4	52.9	0.49	
322	Diagonaal eerste dwarsarm	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	415	**0.0**		12.4	117.6	129.6	0.00		**38.6**	; 6a_90 Ba All Cts Ah Ct2	77.4	117.6	88.7	0.50	
323	Diagonaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	516	**0.0**		4.7	37.7	43.2	0.00		**16.6**	ULS 1a_0	37.4	37.7	22.0	0.75	
324	Dwarsligger bovenregel eerste dwarsarm	65x50x5	S235	1M24-5.6t	1.00	1.00	1.00	220	**-3.0**	ULS 3_0,9_90	21.8	84.7	64.8	0.14		**0.0**		25.9	84.7	8.9	0.00	
325	Tussen diagonaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	171	**-0.2**	SPLS 1a_0 Ah All Cts	27.0	37.7	43.2	0.01		**3.9**	ULS 3_0,9_135	37.4	37.7	18.4	0.21	
401	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	110	**-27.1**	SPLS 6a_90 Ba All Cts Ah Ct1	123.3	117.6	129.6	0.23		**26.2**	; 6a_90 Ba All Cts Ah Ct1	128.8	117.6	104.7	0.25	
402	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	102	**-31.2**	SPLS 3_0,9_67 Ah All Cts	132.3	117.6	129.6	0.27		**33.1**	PLS 6a_90 Ba Ct1 Ah Ct1	136.1	117.6	104.7	0.32	
403	Diagonaal onderregel tweede dwarsarm	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	98	**-41.3**	SPLS 6a_90 Ba Ct1 Ah Ct1	136.1	117.6	129.6	0.35		**37.9**	SPLS 3_0,9_67 Ah All Cts	140.4	117.6	104.7	0.36	
404	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	90	**-41.8**	SPLS 6a_90 Ba Ct1 Ah Ct1	129.0	117.6	129.6	0.36		**40.5**	SPLS 3_0,9_67 Ah All Cts	119.7	117.6	104.7	0.39	
405	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	81	**-46.7**	SPLS 3_0,9_67 Ah All Cts	138.2	117.6	129.6	0.40		**47.4**	PLS 6a_90 Ba Ct1 Ah Ct1	123.5	117.6	104.7	0.45	
406	Diagonaal onderregel tweede dwarsarm	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-61.0**	SPLS 6a_90 Ba Ct1 Ah Ct1	140.4	117.6	129.6	0.52		**57.5**	SPLS 3_0,9_67 Ah All Cts	131.2	117.6	104.7	0.55	
407	Diagonaal onderregel tweede dwarsarm	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	83	**-23.2**	SPLS 6a_90 Ba All Cts Ah Ct2	79.3	58.8	64.8	0.39		**24.0**	SPLS 3_0,9_67 Ah All Cts	65.7	58.8	38.8	0.62	
408	Diagonaal onderregel tweede dwarsarm	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	78	**-1.0**	SPLS 1a_0 Ba All Cts	81.4	58.8	64.8	0.02		**3.9**	ULS 3_0,9_0	65.7	58.8	38.8	0.10	
409	Dwarsligger onderregel tweede dwarsarm	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	51	**0.0**		700.0	117.6	216.0	0.00		**4.7**	ULS 3_90	766.1	117.6	0.0	0.04	
410	Dwarsligger onderregel tweede dwarsarm	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	44	**0.0**		410.1	117.6	259.2	0.00		**59.7**	ULS 3_0,9_67	278.4	117.6	259.2	0.51	
411	Dwarsligger onderregel tweede dwarsarm	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	31	**-8.7**	ULS 3_0,9_90	774.9	117.6	216.0	0.07		**0.0**		766.1	117.6	0.0	0.00	
412	Bovenregel tweede dwarsarm	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	306	**0.0**		56.1	254.2	311.0	0.00		**104.4**	ULS 3_90	263.0	254.2	265.8	0.41	
413	Bovenregel tweede dwarsarm	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	238	**0.0**		83.2	254.2	311.0	0.00		**92.8**	ULS 6a_90 Ah Ct2	263.0	254.2	265.8	0.37	
414	Diagonaal bovenregel tweede dwarsarm	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	203	**-5.0**	SPLS 1a_0 Ba All Cts	25.4	37.7	51.8	0.20		**5.0**	SPLS 1a_0,9_0 Ba All Cts	44.9	37.7	26.5	0.19	
415	Diagonaal bovenregel tweede dwarsarm	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	189	**-5.1**	SPLS 1a_0 Ba All Cts	28.1	37.7	51.8	0.18		**4.8**	SPLS 1a_0 Ba All Cts	44.9	37.7	26.5	0.18	
416	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	179	**-5.1**	SPLS 1a_0 Ba All Cts	25.5	37.7	43.2	0.20		**5.4**	; 6a_90 Ba All Cts Ah Ct2	37.4	37.7	22.0	0.25	
417	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	146	**-9.4**	SPLS 6a_90 Ba All Cts Ah Ct2	33.1	37.7	43.2	0.28		**9.6**	; 6a_90 Ba All Cts Ah Ct2	37.4	37.7	22.0	0.43	
418	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	138	**-11.5**	SPLS 6a_90 Ba All Cts Ah Ct2	35.2	37.7	43.2	0.33		**11.2**	; 6a_90 Ba All Cts Ah Ct2	37.4	37.7	22.0	0.51	
419	Diagonaal bovenregel tweede dwarsarm	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	134	**-14.1**	SPLS 6a_90 Ba All Cts Ah Ct2	36.6	37.7	43.2	0.39		**14.1**	; 6a_90 Ba All Cts Ah Ct2	37.4	37.7	22.0	0.64	
420	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	96	**-16.1**	SPLS 6a_90 Ba All Cts Ah Ct2	60.6	58.8	54.0	0.30		**16.3**	; 6a_90 Ba All Cts Ah Ct2	54.7	58.8	32.4	0.50	
421	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	93	**-21.7**	SPLS 6a_90 Ba All Cts Ah Ct2	62.4	58.8	54.0	0.40		**20.9**	; 6a_90 Ba All Cts Ah Ct2	54.7	58.8	32.4	0.65	
422	Diagonaal bovenregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	88	**-27.7**	SPLS 6a_90 Ba Ct2 Ah Ct2	64.7	58.8	54.0	0.51		**29.2**	PLS 6a_90 Ba Ct2 Ah Ct2	54.7	58.8	37.0	0.79	
423	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-1.5**	SPLS 3_0,9_67 Ba Ct1	50.8	37.7	43.2	0.04		**3.1**	PLS 6a_90 Ah Ct2 Ah Ct1	37.4	37.7	22.0	0.14	
424	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**0.0**		25.2	37.7	43.2	0.00		**4.9**	PLS 6a_90 Ba Ct2 Ba Ct1	37.4	37.7	22.0	0.22	
425	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	314	**-3.5**	SPLS 1a_113 Ba All Cts	11.0	37.7	43.2	0.31		**0.0**		37.4	37.7	22.0	0.00	
426	Diagonaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	346	**-10.5**	SPLS 6a_90 Ah Ct2 Ah Ct1	9.4	37.7	43.2	1.11	knik	**1.3**	SPLS 3_0,9_90 Ba Ct1	37.4	37.7	22.0	0.06	
427	Diagonaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	266	**0.0**		14.3	37.7	43.2	0.00		**1.1**	ULS 1a_113	37.4	37.7	22.0	0.05	
428	Dwarsligger bovenregel tweede dwarsarı	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	196	**-0.4**	ULS 3_0,9_90	22.5	37.7	43.2	0.02		**0.4**	ULS 1a_90	37.4	37.7	22.0	0.02	
429	Dwarsligger bovenregel tweede dwarsarı	UNP160	S235	1M16-5.6t	1.00	1.00	1.00	42	**0.0**		288.7	37.7	64.8	0.00		**25.9**	ULS 3_0,9_90	90.7	37.7	48.0	0.69	
430	Dwarsligger ladder tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	112	**0.0**	SPLS 6a_90 Ah Ct1 Ah Ct2	44.1	37.7	43.2	0.00		**0.0**	PLS 1a_0,9_67 Ba All Cts	37.4	37.7	22.0	0.00	

Assessment of groups for strengthened mast (afkeur level)

Date 17-8-2020
Author MKh
Version 1.0

KIJ-GT 380
HC+0T
69

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
101A	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	85	-50.1	SPLS 3_67 Ah Ct2	390.5	508.3	777.6	0.13		9.2	SPLS 1a_0,9_67 Ah All	466.6	508.3	664.6	0.02
101B	Leg	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	74	-135.3	SPLS 3_67 Ah Ct2	423.6	506.7	777.6	0.32		97.3	SPLS 3_0,9_67 Ah All (	466.6	506.7	664.6	0.21
102A	Leg	180x180x16#	S235	8M24-5.6t	0.50	0.50	0.50	54	-369.6	SPLS 3_67 Ah All Cts	1141.5	674.7	1658.9	0.55		284.3	SPLS 3_0,9_67 Ah All (	1220.3	674.7	1417.8	0.42
102B	Leg	180x180x16#	S235	12M24-5.6t	0.50	0.50	0.50	57	-403.0	SPLS 3_67 Ah All Cts	1125.2	1005.5	2488.3	0.40		297.7	SPLS 3_0,9_67 Ah All (	1220.3	1005.5	2169.3	0.30
103A	Leg	200x200x20	S235	16M24-5.6t	0.28	0.28	0.28	28	-730.3	SPLS 3_67 Ah All Cts	1750.2	1181.8	4147.2	0.62		581.6	SPLS 3_0,9_67 Ah All (	1710.7	1181.8	3544.6	0.49
103B	Leg	200x200x20	S235	12M24-5.6t	0.28	0.28	0.28	35	-930.2	SPLS 3_67 Ah All Cts	1704.3	1987.7	3110.4	0.55		775.0	SPLS 3_0,9_67 Ah All (	1710.7	1987.7	2658.5	0.45
104A	Leg	250x250x20#	S235	12M24-5.6t	0.28	0.28	0.28	34	-1157.7	SPLS 3_67 Ah All Cts	2172.1	1892.2	3110.4	0.61		981.3	SPLS 3_0,9_67 Ah All (	2244.7	1892.2	2658.5	0.52
104B	Leg	250x250x20#	S235	14M24-5.6t	0.55	0.55	0.55	37	-1266.9	SPLS 3_67 Ah All Cts	2149.3	2100.4	3628.8	0.60		1081.3	SPLS 3_0,9_67 Ah All (	2244.7	2100.4	3101.5	0.51
105	Leg	250x250x22#	S235	14M24-5.6t	0.17	0.17	0.17	33	-1290.9	SPLS 3_67 Ah All Cts	2386.8	2100.4	3991.7	0.61		1080.6	SPLS 3_0,9_67 Ah All (	2453.6	2100.4	3411.7	0.51
106A	Onderregel eer	200x200x16	S235	12M24-5.6t	1.53	1.00	1.00	63	-645.0	SPLS 6a_90 Ba Ct2 Ah	1211.7	906.5	2488.3	0.71		424.5	SPLS 3_0,9_67 Ah Ct1	1386.2	906.5	2126.8	0.47
106B	Onderregel eer	200x200x16	S235	10M24-5.6t	7.64	1.00	1.00	74	-346.5	SPLS 6a_90 Ba Ct2 Ah	1128.4	847.2	2073.6	0.41		216.9	SPLS 3_0,9_67 Ah Ct1	1386.2	847.2	1772.3	0.26
106C	Onderregel eer	200x200x16	S235		2.88	1.77	1.00	62	-578.4	SPLS 6a_90 Ba Ct2 Ah	1220.6	0.0	0.0	0.47		362.2	SPLS 3_0,9_67 Ah Ct1	1452.3	0.0	0.0	0.25
107A	Onderregel eer	180x180x15#	S235	10M24-5.6t	2.78	1.00	1.00	83	-317.1	SPLS 6a_90 Ba Ct2 Ah	887.4	847.2	1944.0	0.37		192.2	SPLS 3_0,9_67 Ah Ct1	1144.0	847.2	1661.5	0.23
107B	Onderregel eer	180x180x15#	S235	2M20-5.6t	1.63	1.00	1.00	18	-3.4	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		0.7	ULS 1a_0,9_0,9_67	613.8	117.6	297.8	0.01
107C	Onderregel eer	180x180x15#	S235		18.24	1.00	1.00	83	-302.8	SPLS 6a_90 Ba Ct2 Ah	887.3	0.0	0.0	0.34		173.9	SPLS 3_0,9_67 Ah Ct1	1220.5	0.0	0.0	0.14
108A	Onderregel twe	180x180x15#	S235	12M24-5.6t	1.12	1.00	1.00	64	-401.5	SPLS 6a_90 Ba All Cts	1011.2	2033.3	2332.8	0.40		269.9	SPLS 3_0,9_67 Ah All (	1144.0	2033.3	1814.4	0.24
108B	Onderregel twe	180x180x15#	S235	2M20-5.6t	1.00	1.50	1.00	19	-3.2	ULS 3_0,9_0	1220.5	117.6	324.0	0.03		0.6	SPLS 1a_135 Ah Ct1	613.8	117.6	297.8	0.01
108C	Onderregel twe	180x180x15#	S235		2.77	1.70	1.00	65	-367.8	SPLS 6a_90 Ba All Cts	1010.4	0.0	0.0	0.36		231.8	SPLS 3_0,9_67 Ah All (	1220.5	0.0	0.0	0.19
111A	Bovenregel eer	90x90x9	S235	3M24-5.6t	1.00	1.96	1.00	294	0.0		47.4	254.2	349.9	0.00		114.3	SPLS 6a_90 Ah Ct1 Ba	205.3	254.2	299.1	0.56
111B	Bovenregel eer	90x90x9	S235	3M24-5.6t	1.00	2.04	1.00	294	0.0		47.4	254.2	349.9	0.00		88.9	SPLS 6a_90 Ah Ct1 Ba	205.3	254.2	299.1	0.43
112A	Bovenregel eer	75x75x7#	S235	3M24-5.6t	1.00	1.80	1.00	370	0.0		21.6	254.2	272.2	0.00		76.0	SPLS 6a_90 Ah Ct1 Ba	131.8	254.2	192.5	0.58
112B	Bovenregel eer	75x75x7#	S235	3M24-5.6t	1.00	2.25	1.00	370	0.0		21.6	254.2	272.2	0.00		76.0	SPLS 6a_90 Ah Ct1 Ba	131.8	254.2	192.5	0.58
113A	Bovenregel twe	120x120x13	S235	5M24-5.6t	1.59	1.00	1.00	101	-192.3	SPLS 6a_90 Ba All Cts	355.8	423.6	842.4	0.54		175.3	SPLS 6a_90 Ba All Cts	418.7	423.6	703.2	0.42
113B	Bovenregel twe	120x120x13	S235	5M24-5.6t	1.40	1.00	1.00	102	-178.7	SPLS 6a_90 Ba All Cts	373.5	423.6	842.4	0.48		170.1	SPLS 6a_90 Ba All Cts	602.4	423.6	720.0	0.40
113C	Bovenregel twe	120x120x13	S235		2.70	1.70	1.00	101	-188.6	SPLS 6a_90 Ba All Cts	355.7	0.0	0.0	0.53		176.6	SPLS 6a_90 Ba All Cts	705.0	0.0	0.0	0.25
114A	Bovenregel twe	150x100x12	S235	5M24-5.6t	3.00	1.00	1.00	115	-164.7	SPLS 6a_90 Ba All Cts	301.8	423.6	777.6	0.55		176.1	SPLS 6a_90 Ba All Cts	582.2	423.6	664.6	0.42
114B	Bovenregel twe	150x100x12	S235	**3M24-8.8t**	**7.59**	**1.48**	1.00	104	-27.2	SPLS 3_0,9_67 Ah All (	332.0	406.7	466.6	0.08		31.5	SPLS 6a_90 Ba Ct1 Ah	402.4	406.7	397.2	0.08
114C	Bovenregel twe	150x100x12	S235		3.00	1.00	1.00	115	-150.5	SPLS 6a_90 Ba All Cts	301.8	0.0	0.0	0.50		161.8	SPLS 6a_90 Ba All Cts	674.5	0.0	0.0	0.24
115A	Tussenregel tw	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	-32.0	SPLS 6a_90 Ah Ct1 Ah	79.8	84.7	77.8	0.41		8.7	SPLS 3_0,9_90 Ah Ct2	127.9	84.7	66.5	0.13
115B	Tussenregel tw	100x100x6	S235	1M24-5.6t	1.00	1.00	1.00	162	-31.3	SPLS 6a_90 Ah Ct1 Ah	71.0	84.7	77.8	0.44		9.5	SPLS 3_0,9_90 Ah Ct2	127.9	84.7	66.5	0.14
201L	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	0.53	0.53	131	-37.2	SPLS 3_0,9_67 Ah Ct2	114.3	117.6	129.6	0.33		29.0	ULS 1a_90	145.4	117.6	104.7	0.28
201T	Diagonaal	100x100x6	S235	2M20-5.6t	0.53	**0.53**	0.53	131	-20.5	SPLS 6a_90 Ba Ct2 Ah	114.3	117.6	129.6	0.18		10.2	SPLS 3_0,9_90 Ah Ct2	145.4	117.6	104.7	0.10
202L	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	-177.8	SPLS 3_90 Ah Ct2	425.3	338.9	518.4	0.52		136.5	SPLS 3_0,9_90 Ah Ct1	384.5	338.9	350.9	0.40
202T	Diagonaal	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	83	-128.6	SPLS 3_0,9_45 Ba Ct1	425.3	338.9	518.4	0.38		142.7	SPLS 3_90 Ah Ct2	384.5	338.9	350.9	0.42
203L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	-126.0	SPLS 3_0,9_90 Ah Ct1	406.7	338.9	518.4	0.37		163.2	SPLS 3_90 Ah Ct2	384.5	338.9	350.9	0.48
203T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	89	-130.0	SPLS 3_135 Ah Ct2	406.7	338.9	518.4	0.38		118.2	SPLS 3_0,9_45 Ba Ct1	384.5	338.9	350.9	0.35
204L	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	-171.4	SPLS 3_0,9_90 Ah Ct2	386.8	338.9	518.4	0.51		141.1	SPLS 3_0,9_90 Ba Ct1	384.5	338.9	350.9	0.42
204T	Diagonaal	150x150x10	S235	4M24-5.6t	0.52	0.52	0.52	95	-158.9	SPLS 3_67 Ba Ct1	386.8	338.9	518.4	0.47		147.6	SPLS 3_0,9_90 Ah Ct2	384.5	338.9	350.9	0.44
205L	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	-337.2	SPLS 3_67 Ba Ct1	449.2	508.3	777.6	0.75		333.2	SPLS 3_67 Ba Ct2	384.5	508.3	513.8	0.87
205T	Diagonaal	150x150x10	S235	6M24-5.6t	0.28	0.55	0.28	69	-310.3	SPLS 3_0,9_67 Ba Ct2	449.2	508.3	777.6	0.69		305.2	SPLS 3_67 Ba Ct1	384.5	508.3	513.8	0.79
206L	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	-278.4	SPLS 3_67 Ba Ct2	465.9	423.6	777.6	0.66		277.1	SPLS 3_67 Ba Ct1	456.2	423.6	518.8	0.65
206T	Diagonaal	150x150x12	S235	5M24-5.6t	0.27	0.55	0.27	86	-252.5	SPLS 3_67 Ba Ct1	465.9	423.6	777.6	0.60		255.5	SPLS 3_0,9_67 Ba Ct2	456.2	423.6	518.8	0.60
207L	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	-227.3	SPLS 3_67 Ba Ct1	394.0	338.9	622.1	0.67		225.6	SPLS 3_67 Ba Ct2	456.2	338.9	421.1	0.67
207T	Diagonaal	150x150x12	S235	4M24-5.6t	0.27	0.55	0.27	106	-210.4	SPLS 3_0,9_67 Ba Ct2	394.0	338.9	622.1	0.62		204.4	SPLS 3_67 Ba Ct1	456.2	338.9	421.1	0.60
208L	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	-189.4	SPLS 3_67 Ba Ct2	332.1	254.2	388.8	0.75		186.2	SPLS 3_67 Ba Ct1	384.5	254.2	269.2	0.73
208T	Diagonaal	150x150x10	S235	3M24-5.6t	0.55	1.00	0.55	106	-172.8	SPLS 3_67 Ba Ct1	332.1	254.2	388.8	0.68		175.4	SPLS 3_0,9_67 Ba Ct2	384.5	254.2	269.2	0.69
209L	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	-236.7	SPLS 3_67 Ba Ct2	370.1	338.9	570.2	0.70		221.5	SPLS 3_0,9_67 Ba Ct1	356.4	338.9	475.6	0.65
209T	Diagonaal	120x120x11	S235	4M24-5.6t	0.17	0.25	0.17	79	-223.7	SPLS 3_67 Ba Ct1	370.1	338.9	570.2	0.66		216.1	SPLS 3_0,9_67 Ba Ct2	356.4	338.9	475.6	0.64
210	Top	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	280	-11.5	SPLS 6a_90 Ba Ct2 Ah	16.5	75.4	86.4	0.70		11.5	SPLS 6a_90 Ba Ct2 Ah	52.4	75.4	44.1	0.26
211L	Tweede dwarsa	100x100x6	S235	3M24-5.6t	1.00	1.00	1.00	132	0.0		113.1	254.2	233.3	0.00		86.9	ULS 6a_90 Ah Ct2	161.1	254.2	199.4	0.54
211T	Tweede dwarsa	100x100x6	S235	2M24-5.6t	1.00	1.00	1.00	132	-3.6	ULS 1a_90	113.1	169.4	155.5	0.03		2.3	ULS 1a_0,9_90	206.4	169.4	132.9	0.02
109L	Tweede dwarsa	180x180x15#	S235	12M24-5.6t	1.00	2.00	1.00	53	-489.7	SPLS 3_113 Ba All Cts	1075.9	2033.3	2332.8	0.46		394.8	SPLS 3_0,9_67 Ah All (	1144.0	2033.3	1814.4	0.35
212T	Tweede dwarsa	100x100x6	S235	4M24-5.6t	1.00	2.00	1.00	95	-44.3	ULS 5a Ba 12	144.3	338.9	311.0	0.31		58.5	ULS 5a Ba 12	225.0	338.9	265.8	0.26
213	Tweede dwarsa	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	86	-67.7	ULS 5a Ba 12	265.3	254.2	311.0	0.27		68.2	ULS 5a Ba 12	263.0	254.2	265.8	0.27
214	Tweede dwarsa	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	300	-0.6	SPLS 6a_90 Ba Ct1 Ba	11.8	37.7	43.2	0.05		0.0		37.4	37.7	22.0	0.00
215L	Eerste dwarsarr	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	178	0.0		103.8	254.2	311.0	0.00		109.3	SPLS 6a_90 Ba All Cts	270.5	254.2	265.8	0.43
215T	Eerste dwarsarr	100x100x8	S235	1M24-5.6t	1.00	1.00	1.00	178	-47.1	ULS 1a_0,9_90	83.1	84.7	103.7	0.57		53.6	ULS 1a_90	170.5	84.7	88.6	0.63
110L	Eerste dwarsarr	200x200x16	S235	12M24-5.6t	1.00	2.00	1.00	62	-545.0	SPLS 3_113 Ba All Cts	1222.1	906.5	2488.3	0.60		385.2	SPLS 3_0,9_67 Ah All (	1386.2	906.5	2126.8	0.43
216T	Eerste dwarsarr	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	124	-106.8	SPLS 3_0,9_67 Ba Ct2	151.1	338.9	414.7	0.71		118.2	SPLS 6a_90 Ah Ct1 Ah	293.9	338.9	354.5	0.40
217	Eerste dwarsarr	120x120x11	S235	3M24-5.6t	1.00	1.00	1.00	114	-149.5	SPLS 6a_90 Ba Ct2 Ah	286.0	254.2	427.7	0.59		150.5	SPLS 6a_90 Ba Ct2 Ah	356.4	254.2	365.5	0.59
218	Eerste dwarsarr	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	325	-0.5	SPLS 6a_90 Ba Ct1 Ba	12.6	58.8	54.0	0.04		0.0		54.7	58.8	37.0	0.00
219L	Onderstuk in to	130x130x12#	S235	2M24-5.6t	1.00	1.00	1.00	157	-45.7	SPLS 3_67 Ah All Cts	235.2	169.4	311.0	0.27		32.0	SPLS 3_0,9_67 Ah All (	363.3	169.4	265.8	0.19
219T	Onderstuk in to	130x130x12#	S235	2M24-5.6t	1.00	1.00	1.00	157	-49.4	SPLS 3_67 Ah All Cts	235.2	169.4	311.0	0.29		35.7	SPLS 3_0,9_67 Ah All (	363.3	169.4	265.8	0.21
220	Onderstuk in to	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	311	-5.0	SPLS 1a_135 Ba Ct1	11.6	37.7	43.2	0.43		3.9	ULS 1a_0,9_0,9_135	60.5	37.7	32.0	0.12
221	Onderstuk in to	70x70x5#	S235	1M16-5.6t	0.50	1.00	0.50	370	-1.1	SPLS 3_67 Ba Ct2	11.1	37.7	43.2	0.10		0.0		74.9	37.7	32.0	0.00
301	Diagonaal onde	100x100x8	S235	1M20-5.6t	0.55	0.55	0.55	123	-53.2	SPLS 6a_90 Ba All Cts	129.7	58.8	86.4	0.90		52.8	SPLS 6a_90 Ba All Cts	179.7	58.8	69.8	0.90
302	Diagonaal onde	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	110	-67.9	SPLS 6a_90 Ba Ct1 Ah	180.9	117.6	172.8	0.58		66.3	SPLS 6a_90 Ba Ct1 Ah	190.7	117.6	139.6	0.56
303	Diagonaal onde	100x100x8	S235	2M20-5.6t	1.00	1.00	1.00	92	-60.1	SPLS 6a_90 Ba All Cts	208.7	117.6	172.8	0.51		57.8	SPLS 6a_90 Ba All Cts	190.7	117.6	139.6	0.49
304	Diagonaal onde	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	104	-78.3	SPLS 6a_90 Ba All Cts	143.2	117.6	129.6	0.67		77.7	SPLS 6a_90 Ba All Cts	170.1	117.6	104.7	0.74
305	Diagonaal onde	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	92	-41.9	SPLS 6a_90 Ba All Cts	101.8	84.7	77.8	0.54		45.2	SPLS 6a_90 Ba All Cts	93.3	84.7	59.8	0.76
306	Diagonaal onde	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	84	-23.0	SPLS 6a_90 Ba All Cts	107.6	84.7	77.8	0.30		26.5	SPLS 6a_90 Ba All Cts	93.3	84.7	66.5	0.40
307	Diagonaal onde	80x80x6#	S235	1M24-5.6t	0.55	0.55	0.55	96	-31.2	SPLS 6a_90 Ba Ct2 Ah	98.2	84.7	77.8	0.40		25.7	SPLS 6a_90 Ba All Cts	93.3	84.7	59.8	0.43
308	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	89	-36.4	SPLS 6a_90 Ba All Cts	129.6	117.6	129.6	0.31		35.8	SPLS 6a_90 Ba All Cts	115.9	117.6	104.7	0.34
309	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	-44.6	SPLS 6a_90 Ba All Cts	140.4	117.6	129.6	0.38		44.1	SPLS 6a_90 Ba All Cts	124.8	117.6	104.7	0.42
310	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	76	-61.5	SPLS 6a_90 Ba All Cts	143.9	117.6	129.6	0.52		59.3	SPLS 6a_90 Ba All Cts	136.2	117.6	104.7	0.57
311	Diagonaal onde	70x70x6	S235	1M24-5.6t	1.00	1.00	1.00	69	-26.9	SPLS 6a_90 Ba All Cts	99.6	84.7	77.8	0.35		27.0	SPLS 6a_90 Ba All Cts	76.0	84.7	55.0	0.49
312	Diagonaal onde	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	82	-2.0	ULS 1a_0,9_0,9_90	55.5	37.7	43.2	0.05		3.6	ULS 3_0,9_113	37.4	37.7	25.7	0.14
313	Dwarsligger on	HEA160	S235	2M20-5.6t	2.00	1.00	1.00	48	-3.6	SPLS 3_0,9_90 Ah Ct1	686.1	117.6	216.0	0.03		7.6	SPLS 6a_90 Ba Ct2 Ah	766.1	117.6	0.0	0.07
314	Dwarsligger on	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	82	0.0		314.6	117.6	259.2	0.00		50.3	ULS 3_67	278.4	117.6	259.2	0.43
315	Dwarsligger on	HEA160	S235		1.00	1.00	1.00	26	-1.5	ULS 1a_0,9_67	789.3	0.0	0.0	0.00		4.5	ULS 3_67	916.5	0.0	0.0	0.00
316	Dwarsligger on	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	37	0.0		426.4	117.6	259.2	0.00		58.7	ULS 3_67	278.4	117.6	259.2	0.50

Assessment of groups for strengthened mast (afkeur level)

Date	17-8-2020
Author	MKh
Version	1.0

KIJ-GT 380
HC+0T
69

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
317	Dwarsligger ond	HEA160	S235		1.00	1.00	1.00	13	**-10.2**	ULS 3_0,9_90	825.9	0.0	0.0	0.01		**0.0**		916.5	0.0	0.0	0.00
318	Verticaal eerste	90x90x6#	S235	1M20-5.6t	1.00	1.00	1.00	168	**-17.2**	SPLS 6a_90 Ba All Cts	61.1	58.8	64.8	0.29		**0.0**		117.5	58.8	52.4	0.00
319	Verticaal eerste	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	190	**-5.3**	ULS 3_45	29.3	37.7	43.2	0.18		**0.0**		37.4	37.7	22.0	0.00
320	Verticaal eerste	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	94	**-1.0**	SPLS 6a_90 Ah Ct1 Ba	50.9	37.7	43.2	0.03		**0.0**		37.4	37.7	18.4	0.00
321	Diagonaal eerst	50x50x6	S235	2M16-5.6t	1.00	1.00	1.00	580	**0.0**		5.7	75.4	103.7	0.00		**26.0**	ULS 1a_0	62.1	75.4	52.9	0.49
322	Diagonaal eerst	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	415	**0.0**		12.4	117.6	129.6	0.00		**38.6**	SPLS 6a_90 Ba All Cts	77.4	117.6	88.7	0.50
323	Diagonaal eerst	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	516	**0.0**		4.7	37.7	43.2	0.00		**16.6**	ULS 1a_0	37.4	37.7	22.0	0.75
324	Dwarsligger bov	65x50x5	S235	1M24-5.6t	1.00	1.00	1.00	220	**-3.0**	ULS 3_0,9_90	21.8	84.7	64.8	0.14		**0.0**		25.9	84.7	8.9	0.00
325	Tussen diagona	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	171	**-0.2**	SPLS 1a_0 Ah All Cts	27.0	37.7	43.2	0.01		**3.9**	ULS 3_0,9_135	37.4	37.7	18.4	0.21
401	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	110	**-27.2**	SPLS 6a_90 Ba All Cts	123.3	117.6	129.6	0.23		**26.1**	SPLS 6a_90 Ba All Cts	128.8	117.6	104.7	0.25
402	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	102	**-31.2**	SPLS 3_0,9_67 Ah All (	132.3	117.6	129.6	0.27		**33.3**	SPLS 6a_90 Ba Ct1 Ah	136.1	117.6	104.7	0.32
403	Diagonaal onde	90x90x6#	S235	2M20-5.6t	0.55	0.55	0.55	98	**-41.6**	SPLS 6a_90 Ba Ct1 Ah	136.1	117.6	129.6	0.35		**37.8**	SPLS 3_0,9_67 Ah All (	140.4	117.6	104.7	0.36
404	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	90	**-42.0**	SPLS 6a_90 Ba Ct1 Ah	129.0	117.6	129.6	0.36		**40.4**	SPLS 3_0,9_67 Ah All (	119.7	117.6	104.7	0.39
405	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	81	**-46.6**	SPLS 3_0,9_67 Ah All (	138.2	117.6	129.6	0.40		**47.6**	SPLS 6a_90 Ba Ct1 Ah	123.5	117.6	104.7	0.45
406	Diagonaal onde	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	79	**-61.3**	SPLS 6a_90 Ba Ct1 Ah	140.4	117.6	129.6	0.52		**57.4**	SPLS 3_0,9_67 Ah All (	131.2	117.6	104.7	0.55
407	Diagonaal onde	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	83	**-22.7**	SPLS 6a_90 Ba All Cts	79.3	58.8	64.8	0.39		**23.6**	SPLS 3_0,9_67 Ah All (	65.7	58.8	38.8	0.61
408	Diagonaal onde	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	78	**-1.0**	SPLS 1a_0 Ba All Cts	81.4	58.8	64.8	0.02		**3.8**	ULS 3_0,9_135	65.7	58.8	38.8	0.10
409	Dwarsligger ond	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	51	**0.0**		700.0	117.6	216.0	0.00		**5.0**	ULS 3_90	766.1	117.6	0.0	0.04
410	Dwarsligger ond	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	44	**0.0**		410.1	117.6	259.2	0.00		**59.7**	ULS 3_0,9_67	278.4	117.6	259.2	0.51
411	Dwarsligger ond	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	31	**-8.6**	ULS 3_0,9_90	774.9	117.6	216.0	0.07		**0.0**		766.1	117.6	0.0	0.00
412	Bovenregel twe	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	306	**0.0**		56.1	254.2	311.0	0.00		**109.5**	SPLS 6a_90 Ah Ct1 Ah	263.0	254.2	265.8	0.43
413	Bovenregel twe	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	238	**0.0**		83.2	254.2	311.0	0.00		**100.9**	SPLS 6a_90 Ah Ct1 Ah	263.0	254.2	265.8	0.40
414	Diagonaal bove	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	203	**-4.6**	ULS 1a_0	25.4	37.7	51.8	0.18		**4.8**	SPLS 1a_0,9_0 Ba Ct2	44.9	37.7	26.5	0.18
415	Diagonaal bove	50x50x6	S235	1M16-5.6t	0.55	0.55	0.55	189	**-4.9**	SPLS 1a_0 Ba All Cts	28.1	37.7	51.8	0.18		**4.4**	SPLS 1a_0 Ba All Cts	44.9	37.7	26.5	0.17
416	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	179	**-4.8**	SPLS 1a_0 Ba All Cts	25.5	37.7	43.2	0.19		**5.1**	SPLS 1a_0 Ba All Cts	37.4	37.7	22.0	0.23
417	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	146	**-9.0**	SPLS 6a_90 Ba All Cts	33.1	37.7	43.2	0.27		**9.4**	SPLS 6a_90 Ba All Cts	37.4	37.7	22.0	0.43
418	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	138	**-11.4**	SPLS 6a_90 Ba All Cts	35.2	37.7	43.2	0.32		**10.7**	SPLS 6a_90 Ba All Cts	37.4	37.7	22.0	0.49
419	Diagonaal bove	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	134	**-13.4**	SPLS 6a_90 Ba All Cts	36.6	37.7	43.2	0.37		**14.0**	SPLS 6a_90 Ba All Cts	37.4	37.7	22.0	0.63
420	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	96	**-16.3**	SPLS 6a_90 Ba All Cts	60.6	58.8	54.0	0.30		**15.4**	SPLS 6a_90 Ba All Cts	54.7	58.8	32.4	0.48
421	Diagonaal bove	60x60x5	S235	1M20-5.6t	0.55	0.55	0.55	93	**-19.7**	SPLS 6a_90 Ba All Cts	62.4	58.8	54.0	0.36		**20.9**	SPLS 6a_90 Ba All Cts	54.7	58.8	32.4	0.65
422	Diagonaal bove	60x60x5	S235		**0.00**	**0.00**	**0.00**	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
423	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-1.5**	SPLS 3_0,9_90 Ba Ct1	50.8	37.7	43.2	0.04		**3.2**	SPLS 6a_90 Ah Ct2 Ah	37.4	37.7	22.0	0.15
424	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**0.0**		25.2	37.7	43.2	0.00		**4.4**	SPLS 6a_90 Ah Ct1 Ba	37.4	37.7	22.0	0.20
425	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	314	**-3.5**	SPLS 3_90 Ba Ct2	11.0	37.7	43.2	0.31		**0.0**		37.4	37.7	22.0	0.00
426	Diagonaal twee	**50x50x6**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	346	**-10.6**	SPLS 6a_90 Ah Ct2 Ah	11.9	60.3	70.6	0.89		**1.7**	SPLS 3_0,9_90 Ba Ct1	61.2	60.3	36.0	0.05
427	Diagonaal twee	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	266	**0.0**		14.3	37.7	43.2	0.00		**1.0**	SPLS 1a_113 Ah Ct2	37.4	37.7	22.0	0.04
428	Dwarsligger bov	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	196	**-0.6**	ULS 3_0,9_90	22.5	37.7	43.2	0.02		**0.4**	ULS 1a_0,9_0,9_90	37.4	37.7	22.0	0.02
429	Dwarsligger bov	UNP160	**S355**	**1M16-8.8t**	1.00	1.00	1.00	40	**0.0**		405.2	60.3	88.2	0.00		**25.3**	ULS 3_0,9_90	123.5	60.3	65.3	0.42
430	Dwarsligger lad	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	112	**0.0**	SPLS 1a_135 Ah All Ct:	44.1	37.7	43.2	0.00		**0.0**	SPLS 3_0,9_0 Ah Ct2	37.4	37.7	22.0	0.00
116	116	**UNP160**	S355	5M24-8.8t	1.00	3.10	1.00	51	**-30.1**	SPLS 6a_90 Ba Ct1 Ah	503.8	677.8	661.5	0.06		**15.5**	15.533	SPLS 6a_90 E	472.1	565.4	0.03
431	431	**60x60x6**	S355	1M20-8.8t	0.55	0.55	0.55	64	**-19.9**	SPLS 6a_90 Ba All Cts	122.5	94.1	88.2	0.23		**18.5**	18.484	SPLS 6a_90 E	89.4	60.4	0.31
432	432	**60x60x6**	S355	1M20-8.8t	0.55	0.55	0.55	59	**-20.3**	SPLS 6a_90 Ba Ct1 Ah	126.0	94.1	88.2	0.23		**22.3**	22.279	SPLS 6a_90 E	89.4	60.4	0.37

Notes:
1) Groups 116, 429, 431 and 432 have been added/ edited to move the earthwire attachment point 0.3m horizontally outward
2) The bolts on group 114B have been changed due to the modification of the earthwire attachment point

DNV·GL

<u>Assessment of groups for strengthened mast (verbouw level)</u>

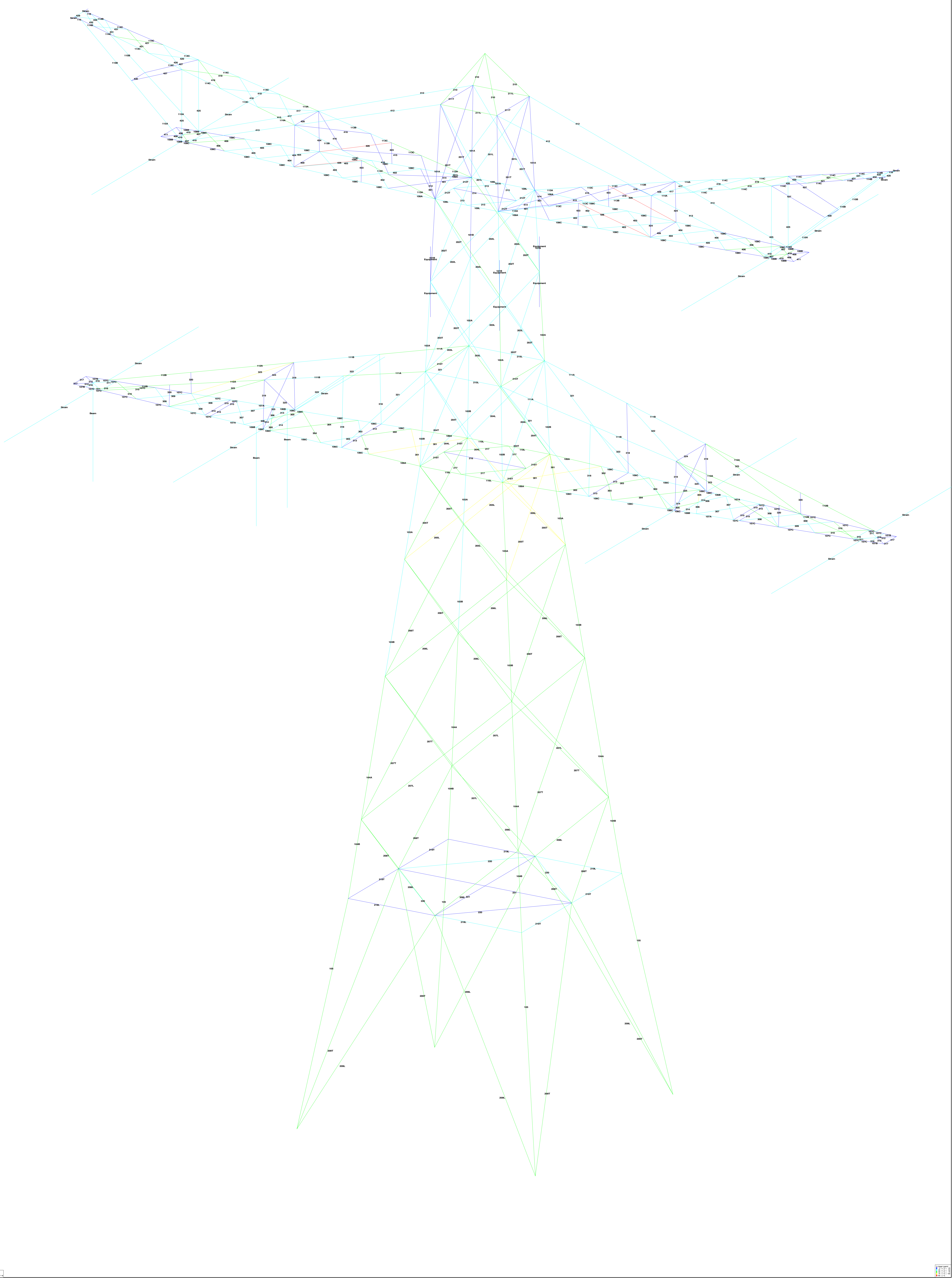
Date 17-8-2020
Author MKh
Version 1.0

KIJ-GT 380
HC+0T
69

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)
114B	Bovenregel twe	150x100x12	S235	**3M24-8.8t**	**7.59**	**1.48**	1.00	104	**-28.4**	SPLS 3_0.9_67 Ah All (	332.0	406.7	466.6	0.09		**33.2**	SPLS 6a_90 Ba Ct1 Ah	402.4	406.7	397.2
426	Diagonaal twee	**50x50x6**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	346	**-11.3**	SPLS 6a_90 Ah Ct2 Ah	11.9	60.3	70.6	0.95		**2.1**	SPLS 3_0.9_90 Ba Ct1	61.2	60.3	36.0
429	Dwarsligger bo\	UNP160	**S355**	**1M16-8.8t**	1.00	1.00	1.00	40	**0.0**		405.2	60.3	88.2	0.00		**29.6**	ULS 3_0.9_90	123.5	60.3	65.3
116		**UNP160**	S355	5M24-8.8t	1.00	3.10	1.00	51	**-31.1**	SPLS 6a_90 Ba Ct1 Ah	503.8	677.8	661.5	0.06		**16.1**	SPLS 6a_90 Ba Ct2 Ah	472.1	677.8	565.4
431	Diagonaal bove	**60x60x6**	S355	1M20-8.8t	0.55	0.55	0.55	64	**-20.6**	SPLS 6a_90 Ba All Cts	122.5	94.1	88.2	0.23		**19.2**	SPLS 6a_90 Ba All Cts	89.4	94.1	60.4
432	Diagonaal bove	**60x60x6**	S355	1M20-8.8t	0.55	0.55	0.55	59	**-20.9**	SPLS 6a_90 Ba Ct1 Ah	126.0	94.1	88.2	0.24		**23.0**	SPLS 6a_90 Ba Ct2 Ah	89.4	94.1	60.4

Notes:
1) Groups 116, 429, 431 and 432 have been added/ edited to move the earthwire attachment point 0.3m horizontally outward
2) The bolts on group 114B have been changed due to the modification of the earthwire attachment point

DNV GL Nederlands BV, Project: "HC+0 (da) T afk"
Tower Version 16.39, 15:55:52 vrijdag 14 augustus 2020
Undeformed geometry displayed



APPENDIX C REDUNDANT MEMBERS CHECK

DNV·GL

Knikverkorters initial construction (afkeur)

Date: 2020-08-18
Author: Muhammed Khan
Version: 1.8

KIJ-GT
HC+0
Mast numbers: 2/15/38/54/69T/83

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness (-)	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Net Section Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type
13	Onderstuk	Enkele staaf	L50.5	S235	M16	5.6	0.52	0	53	**23.9**	**0.13**	63.5	37.7	33.6	37.4	0.72	0.71	
18	Onderstuk	Enkele staaf	L60.5	S235	M16	5.6	1.62	80	138	**23.9**	**0.00**	42.7	37.7	37.3	60.5	1.05	0.64	
11	Onderstuk	Enkele staaf	L50.5	S235	M16	5.6	1.23	0	126	**23.9**	**0.31**	38.9	37.7	33.6	37.4	0.72	0.71	
17	Onderstuk	Enkele staaf	L60.5	S235	M16	5.6	1.91	57	163	**23.9**	**0.00**	35.1	37.7	37.3	60.5	1.05	0.68	
10	Onderstuk	Enkele staaf	L60.5	S235	M16	5.6	1.83	0	156	**23.9**	**0.46**	37.0	37.7	37.3	60.5	1.05	0.65	
16	Onderstuk	Enkele staaf	L70.6	S235	M16	5.6	2.25	45	164	**23.9**	**0.00**	48.3	37.7	44.8	107.1	1.71	0.63	
9	Onderstuk	Enkele staaf	L70.6	S235	M16	5.6	2.49	0	182	**23.9**	**0.62**	42.3	37.7	44.8	107.1	1.71	0.63	
15	Onderstuk	Enkele staaf	L70.6	S235	M16	5.6	2.76	35	201	**23.9**	**0.00**	36.8	37.7	44.8	107.1	1.71	0.65	
8	Onderstuk	Enkele staaf	L80.6	S235	M16	5.6	3.15	0	200	**23.9**	**0.79**	42.5	37.7	44.8	141.7	2.25	0.63	
14	Onderstuk	Enkele staaf	L80.6	S235	M16	5.6	3.40	27	216	**23.9**	**0.76**	38.1	37.7	44.8	141.7	2.25	0.63	
23	Pootverband	Enkele staaf	L50.5	S235	M16	5.6	1.25	0	128	**3.7**	**0.31**	38.2	37.7	33.6	37.4	0.72	0.44	
26	Pootverband	Enkele staaf	L50.5	S235	M16	5.6	2.76	77	284	**3.7**	**0.00**	13.0	37.7	33.6	37.4	0.72	0.29	
22	Pootverband	Kniksteun en verticale steun	L50.5	S235	M16	5.6	2.67	0	176	**3.7**	**0.33**	20.8	37.7	33.6	37.4	0.54	0.64	
25	Pootverband	Enkele staaf	L50.5	S235	M16	5.6	2.99	64	307	**3.7**	**0.00**	11.4	37.7	33.6	37.4	0.72	0.32	
21	Pootverband	Kniksteun en verticale steun	L50.5	S235	M16	5.6	4.08	0	270	**3.7**	**0.51**	11.8	37.7	33.6	37.4	0.54	0.98	
24	Pootverband	Enkele staaf	L60.5	S235	M16	5.6	3.39	53	288	**3.7**	**0.00**	15.3	37.7	37.3	60.5	1.05	0.24	
20	Tussenschot	Kniksteun en verticale steun	L60.5	S235	M16	5.6	5.66	0	309	**2.4**	**0.71**	11.7	37.7	37.3	60.5	0.81	0.91	
27	Tussenschot	Kruisende staaf halverwege	L70.5	S235	M16	5.6	7.86	0	368	**2.4**	**0.98**	10.5	37.7	37.3	89.3	1.78	0.55	
69	1e tussenstuk	Enkele staaf	L70.5	S235	M16	5.6	2.48	50	180	**21.7**	**0.00**	36.0	37.7	37.3	89.3	1.78	0.60	
59	1e tussenstuk	Enkele staaf	L60.5	S235	M16	5.6	1.86	0	158	**21.7**	**0.47**	36.3	37.7	37.3	60.5	1.05	0.60	
60	1e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.45	0	149	**21.7**	**0.36**	32.2	37.7	33.6	37.4	0.72	0.67	
70	1e tussenstuk	Enkele staaf	L60.5	S235	M16	5.6	2.11	54	179	**21.7**	**0.00**	30.8	37.7	37.3	60.5	1.05	0.70	
61	1e tussenstuk	Enkele staaf	L80.6	S235	M16	5.6	2.91	0	185	**21.7**	**0.73**	47.6	37.7	44.8	141.7	2.25	0.58	
71	1e tussenstuk	Enkele staaf	L60.5	S235	M16	5.6	2.06	38	175	**21.7**	**0.00**	31.8	37.7	37.3	60.5	1.05	0.68	
62	1e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.48	0	152	**21.7**	**0.37**	31.4	37.7	33.6	37.4	0.72	0.69	
63	2e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.19	0	122	**17.5**	**0.30**	40.2	37.7	33.6	37.4	0.72	0.52	
72	2e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.73	54	177	**17.5**	**0.00**	25.8	37.7	33.6	37.4	0.72	0.68	
64	2e tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	2.52	0	216	**17.5**	**0.63**	28.3	37.7	44.8	72.6	1.24	0.62	
73	2e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.68	37	173	**17.5**	**0.00**	26.8	37.7	33.6	37.4	0.72	0.65	
65	2e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.22	0	125	**17.5**	**0.31**	39.2	37.7	33.6	37.4	0.72	0.52	
66	2e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	0.94	0	97	**17.5**	**0.24**	49.9	37.7	33.6	37.4	0.72	0.52	
74	2e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.37	54	141	**17.5**	**0.00**	34.5	37.7	33.6	37.4	0.72	0.52	
67	2e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	2.02	0	208	**17.5**	**0.51**	20.8	37.7	33.6	37.4	0.72	0.84	
75	2e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.32	37	136	**17.5**	**0.00**	36.0	37.7	33.6	37.4	0.72	0.52	
68	2e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	0.97	0	100	**17.5**	**0.24**	48.7	37.7	33.6	37.4	0.72	0.52	

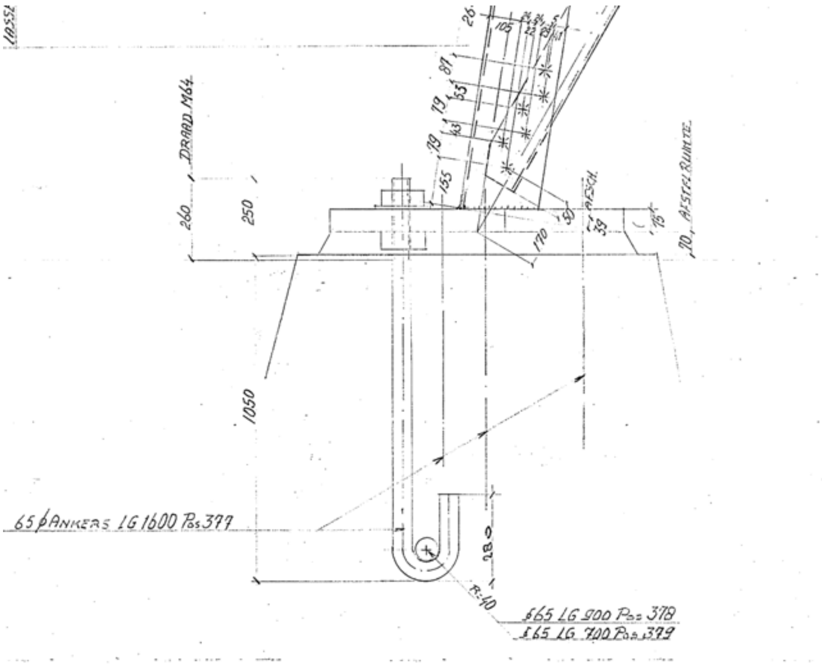
Note: The sizes of the redundant members and the imposed loads are the same for all HC+0 masts (2, 15, 38, 54, 69T and 83). Therefore only one table is provided in Appendix C but it is applicable for all HC+0 masts.

APPENDIX D ANCHOR CHECKS AND OTHER CALCULATIONS

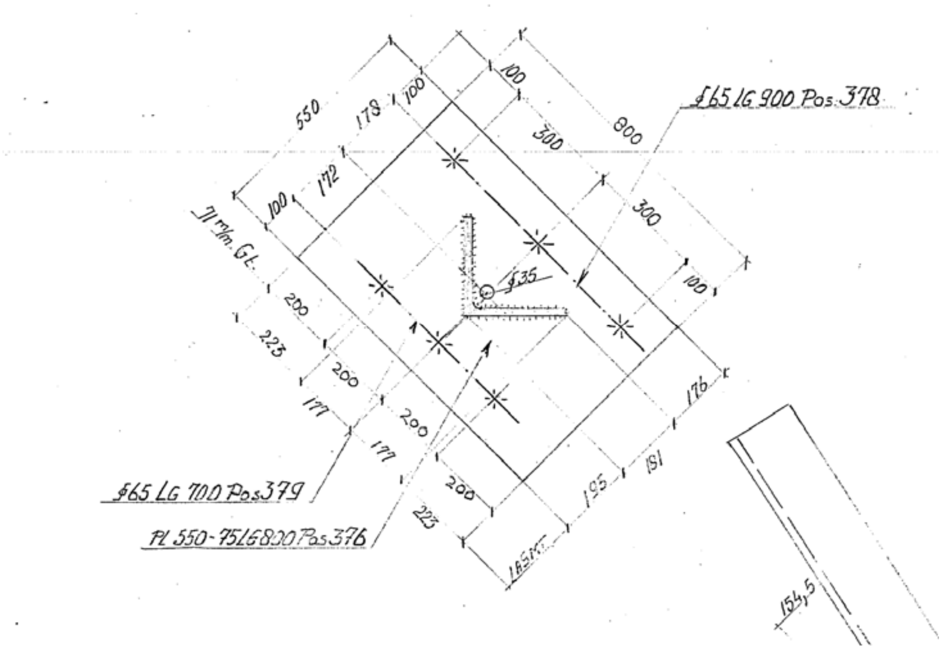
ANCHORS HC+0 & HC+0 T

Drawings provided for tower structure HC+0 & HC+0 T don't include anchors. However from other data it is certain that 6 anchor bolts are present. The figures below are used of tower structure EA+0. The position of anchor bolts and plate thickness should be verified in field study. The tower legs are connected to the foundation with a foot plate 550x800x75 mm and six anchors with diameter 65 mm.

De anchor rods are connected to a horizontal rod "schieter" which allows for distribution of the tensile force to the concrete.



Figuur 1 Anchor detail



Figuur 2 Voetplaat

Loads

Five HC+0 tower exist in KIJ-GT. The tower with maximum reaction force is tower 38 in wind zone II. Towers in WZIII have lower reaction forces and are not considered:

Omhullenden ongeacht stijl

Belasting	Combinatie	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. druk	ULS 1a_65,5	-256	272	**1529**	12	-373	-35	1566
Max. trek	ULS 1a_0,9_65,5	-206	226	**-1249**	-14	305	29	-1280
Max. pos. torsie	SPLS 3_65,5 Ba Ct1	-4	157	455	**108**	-114	-13	466
Max. neg. torsie	SPLS 3_65,5 Ba Ct2	42	107	-192	**-105**	46	4	-197
Comb. trek+torsie	SPLS 3_0,9_65,5 Ah Ct2	-241	120	**-1061**	**85**	255	20	-1087

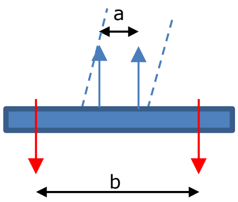
The loads coming for tower type HC+0 T are based on structure number 69 in wind zone III:

Omhullenden ongeacht stijl

Belasting	Combinatie	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. druk	SPLS 3_67 Ah All Cts	-229	236	**1353**	4	-329	-30	1386
Max. trek	SPLS 3_0,9_67 Ah All Cts	-190	197	**-1127**	-5	274	25	-1154
Max. pos. torsie	SPLS 3_67 Ba Ct1	10	131	342	**100**	-86	-10	351
Max. neg. torsie	SPLS 3_113 Ah Ct1	-11	130	333	**-100**	-84	-10	342
Comb. trek+torsie	SPLS 3_0,9_67 Ah Ct1	-88	224	**-901**	**-96**	221	22	-923

Voetplaat en ankers

The strength of the foot plate will be determined assuming a horizontal yield line across the length of the plate. The tensile force is distributed to two point loads each separated by half of the diagonal width of the tower leg.



Figuur 3 Scheme for check of foot plate

a: 1/2 · 250 / √2 = 88 mm

b: 350 mm

The eccentricity becomes 1/2 · (350-88) = 131 mm

In the spreadsheet the anchor bolts and foot plate have been checked. The concrete strength is assumed to be equal or more than C20/25. This assumption is higher than what would be derived for old designation K225 but is based on findings in similar projects. The assumption should be verified with concrete cilinder tests. The foot plate is embedded in concrete. The anchor bolts will not be loaded by bending.

Both tower fulfill the required strength. See the output:

Tower 38: U.C. = 208 / 655 = 0,32 ≤ 1,00 OK

Tower 69: U.C. = 188 / 655 = 0,29 ≤ 1,00 OK

Conclusion: The foot plates of tower structure HC+0 have sufficient strength.

Project:	Krimpen - Geertruidenberg 380	Datum:	20-8-2020
		Versie:	2.5

Ankers

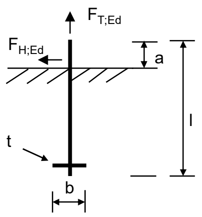
Volgens NEN-EN 1992-1-1 en 1993-1-8 met NB

Kolomvoetplaatverbindingen

Onderdeel:	**HC+0 II**	***Toetsingen***		
		Ankerbout op trek	0.32	***OK***
		Ankerbout op afschuiving	0.19	***OK***
		Schieter	0.45	***OK***

Invoer

Ankerdiameter		**M64**	
Ankerkwaliteit		**4.6**	
Draad		Gesneden	
Ankerlengte	l =	1300	mm
Anker boven beton	a =	250	mm



Belasting op ankergroep

T: de uitwendige trekkracht op de anker groep.

Trekbelasting	T =	**1249**	kN
Schuifkracht	$F_{H,Ed}$ =	**305**	kN
Aantal (n) ankers voor trek		6	
Aantal ankers voor afschuiving		6	
$F_{T;Ed} = T / n =$		208.2	kN
$F_{v;Ed} = F_{H,Ed} / n =$		50.8	kN

Ankergegevens

$d_b =$	64.00	mm
$A_{b;s} =$	2676	mm^2
$f_{yb} =$	240	N/mm^2
$f_{ub} =$	400	N/mm^2
γ_{Mb}	1.25	-
$\alpha_{red;2}$	0.85	-
$\alpha_b = 0{,}44 - 0{,}0003 f_{yb} =$	0.37	-
Capaciteit per anker		
$F_{T;Rd} = 0{,}9 \alpha_{red;2} f_{ub} A_s / \gamma_{M2} =$	**655.1**	kN
$F_{v;Rd} = \alpha_b f_{ub} A_s / \gamma_{Mb} =$	**267.9**	kN

Voetplaat

$F_{t,Rd}$: de trekkracht in de ankers waarbij de voetplaat vloeit.

Staalsoort		**S235**	
Dikte	t =	75	mm
Breedte	b_{ef} =	267	mm
Hefboomsarm	m =	131	mm
$M_{pl,Rd} = 1/4 b_{ef} t_p^2 f_{yd} =$		88.2	kNm
$F_{t,Rd} = M_{pl,Rd} / m =$		673.6	kN

Toets schieter

$$\frac{\sigma_b'}{f_{cd}} = \frac{13.7}{40.0} = 0.34 \quad \textit{OK}$$

$$\frac{F_{T,Ed}}{F_{v;Rd}} = \frac{208}{460} = 0.45 \quad \textit{OK}$$

Capaciteit beton

Betonkwaliteit	**C20/25**	
$f_{ck} =$	20	N/mm^2
$k_b =$	3	-
$\gamma_{Mc} =$	1.5	-
$f_{cd} = f_{ck} k_b / \gamma_{Mc} =$	40	MPa

Schieter

Diameter	$d_S =$	**65**	mm
Lengte	$b =$	**233**	mm
Spreiding	$c = t\sqrt{(f_{yd} / 3 f_{jd})} =$	92	mm
Effectieve lengte	$b_{eff} = \min(b; d+2c)$	233	mm
Doorsnede schieter	$A_S = \pi/4 \, d_S^2 =$	3318	mm^2
Verdeelde belasting	$q = F_{T,Ed} / b_{eff} =$	893	kN/m
Betondruk	$\sigma_b' = q / d_S =$	13.7	MPa
Schuifspanning schieter			
Belasting	$F_{T,Ed} =$	208	kN
Toelaatbaar	$F_{v,Rd} = f_{yd} / \sqrt{3} \times A_s =$	460	kN

Sterkte voetplaat

$$\frac{F_{T,Ed}}{F_{t;Rd}} = \frac{208.2}{673.6} = 0.31 \quad \textit{OK}$$

Toets trek op anker

$$\frac{F_{T,Ed}}{F_{T;Rd}} = \frac{208.2}{655.1} = 0.32 \quad \textit{OK}$$

Toets trek op voetplaat

$$\frac{T}{n \times F_{t;Rd}} = \frac{1249.0}{4041.3} = 0.31 \quad \textit{OK}$$

Toets afschuiving anker

$$\frac{F_{v,Ed}}{F_{v;Rd}} = \frac{50.8}{267.9} = 0.19 \quad \textit{OK}$$

DNV·GL

Project: Krimpen - Geertruidenberg 380

Datum: 20-8-2020
Versie: 2.5

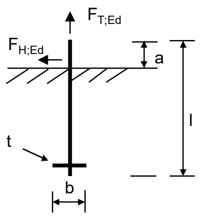
Ankers

Volgens NEN-EN 1992-1-1 en 1993-1-8 met NB
Kolomvoetplaatverbindingen

Onderdeel:	**HC+0 T**	**Toetsingen**		
		Ankerbout op trek	0.29	**OK**
		Ankerbout op afschuiving	0.17	**OK**
		Schieter	0.41	**OK**

Invoer

Ankerdiameter		**M64**	
Ankerkwaliteit		**4.6**	
Draad		Gesneden	
Ankerlengte	l =	1300	mm
Anker boven beton	a =	250	mm



Belasting op ankergroep

T: de uitwendige trekkracht op de anker groep.

Trekbelasting	T =	**1127**	kN
Schuifkracht	$F_{H,Ed}$ =	**274**	kN
Aantal (n) ankers voor trek		6	
Aantal ankers voor afschuiving		6	
$F_{T;Ed} = T / n =$		187.8	kN
$F_{v;Ed} = F_{H,Ed} / n =$		45.7	kN

Ankergegevens

d_b =	64.00	mm
$A_{b;s}$ =	2676	mm^2
f_{yb} =	240	N/mm^2
f_{ub} =	400	N/mm^2
γ_{Mb}	1.25	-
$\alpha_{red;2}$	0.85	-
$\alpha_b = 0{,}44 - 0{,}0003 f_{yb}$ =	0.37	-

Capaciteit per anker

$F_{T;Rd} = 0{,}9\alpha_{red;2} f_{ub} A_s / \gamma_{M2}$ =	**655.1**	kN
$F_{v;Rd} = \alpha_b f_{ub} A_s / \gamma_{Mb}$ =	**267.9**	kN

Voetplaat

$F_{t,Rd}$: de trekkracht in de ankers waarbij de voetplaat vloeit.

Staalsoort		**S235**	
Dikte	t =	75	mm
Breedte	b_{ef} =	267	mm
Hefboomsarm	m =	131	mm
$M_{pl,Rd} = 1/4 b_{ef} t_p^2 f_{yd}$ =		88.2	kNm
$F_{t,Rd} = M_{pl,Rd} / m$ =		673.6	kN

Toets schieter

$$\frac{\sigma_b'}{f_{cd}} = \frac{12.4}{40.0} = 0.31 \quad \textbf{OK}$$

$$\frac{F_{T,Ed}}{F_{v;Rd}} = \frac{188}{460} = 0.41 \quad \textbf{OK}$$

Capaciteit beton

Betonkwaliteit	**C20/25**	
f_{ck} =	20	N/mm^2
k_b =	3	-
γ_{Mc} =	1.5	-
$f_{cd} = f_{ck} k_b / \gamma_{Mc}$ =	40	MPa

Schieter

Diameter	d_S =	**65**	mm
Lengte	b =	**233**	mm
Spreiding	$c = t\sqrt{(f_{yd} / 3f_{jd})}$ =	92	mm
Effectieve lengte	$b_{eff} = \min(b; d+2c)$	233	mm
Doorsnede schieter	$A_S = \pi/4\, d_S^2$ =	3318	mm^2
Verdeelde belasting	$q = F_{T,Ed} / b_{eff}$ =	806	kN/m
Betondruk	$\sigma_b' = q / d_S$ =	12.4	MPa

Schuifspanning schieter

Belasting	$F_{T,Ed}$ =	188	kN
Toelaatbaar	$F_{v,Rd} = f_{yd} / \sqrt{3} \times A_s$ =	460	kN

Sterkte voetplaat

$$\frac{F_{T,Ed}}{F_{t;Rd}} = \frac{187.8}{673.6} = 0.28 \quad \textbf{OK}$$

Toets trek op anker

$$\frac{F_{T,Ed}}{F_{T;Rd}} = \frac{187.8}{655.1} = 0.29 \quad \textbf{OK}$$

Toets trek op voetplaat

$$\frac{T}{n \times F_{t;Rd}} = \frac{1127.0}{4041.3} = 0.28 \quad \textbf{OK}$$

Toets afschuiving anker

$$\frac{F_{v,Ed}}{F_{v;Rd}} = \frac{45.7}{267.9} = 0.17 \quad \textbf{OK}$$

CALCULATION OF POST INSULATOR LOADS

The following parameters are calculated:

- The forces on the insulator attachment due to wind loading and weight
- The required measurements of the components

The diagram below is a representation of the loads on the insulator:

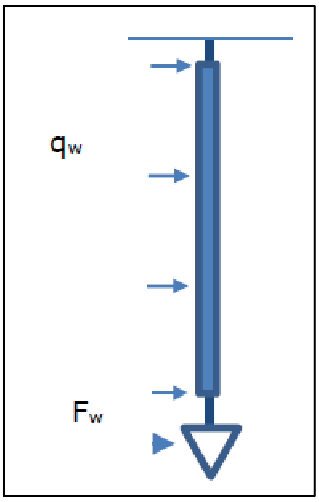


Figure 1: Diagrammatic representation of the loads on the post insulator

1. Forces on the insulator attachment

Wind pressure based on non-urban terrain in wind zone II at a height of 28.2 m: q_h = 1.18 kN/m^2

Wind load per meter based on an insulator diameter of 0.2 m and a drag factor of 1.2:

$\underline{q_w}$ = 1.2 x 0.2 x 1.18 = $\underline{0.29 \text{ kN/m}}$

Before calculating (F_w), the drag factor (C_C) is first calculated:

$V_w = (2 \times 1180/\ 1.25)^{0.5} = 43.45 \text{ m.s}^{-1}$

Re = 43.45 x 0.036 / (15 x 10^{-6}) = 104280

$\underline{C_c}$ = $\underline{0.9}$

Then calculate F_w based on a supported length of 9 m and a structural factor of 1:

F_w = 9 x 1 x 0.9 x 3 x 0.036 x 1.18 = 1.032 kN

Calculate the moment based on the wind loading and the point load:

$M_w = 0.5 \times 0.29 \times 4^2 + 4 \times 1.032 = 6.45$ kNm

Design values:

M_{ED} = 1.4 x 6.45 = 9.03 kNm

V_{ED} = 1.4 x (1.032 + 3.5 x 0.29) = 2.87 kN

2. Assessment of the pin

The figure below is a sketch of the insulator attachment mechanism indicating the location of the pin.

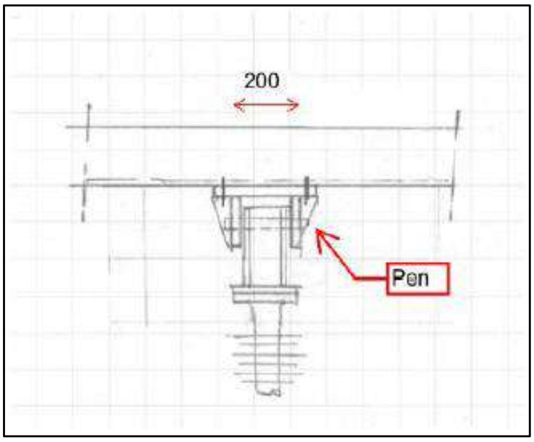


Figure 2: Post insulator attachment mechanism

Calculation of the shear force on the pin:

Assuming a total vertical weight of 5 kN and an attachment fit of 200 mm:

F_V = 9.03 /0.2 + 5/2 = 47.65 kN

Using a pin with a diameter of 25 mm is sufficient; see the attached spreadsheet calculation at the end of this appendix. A minimum flange thickness of 15 mm is required.

3. Console thickness

This will be determined in the subsequent design phases.

4. Attachment to the crossarm

The figure below depicts the additional members required for attachment to the crossarm.

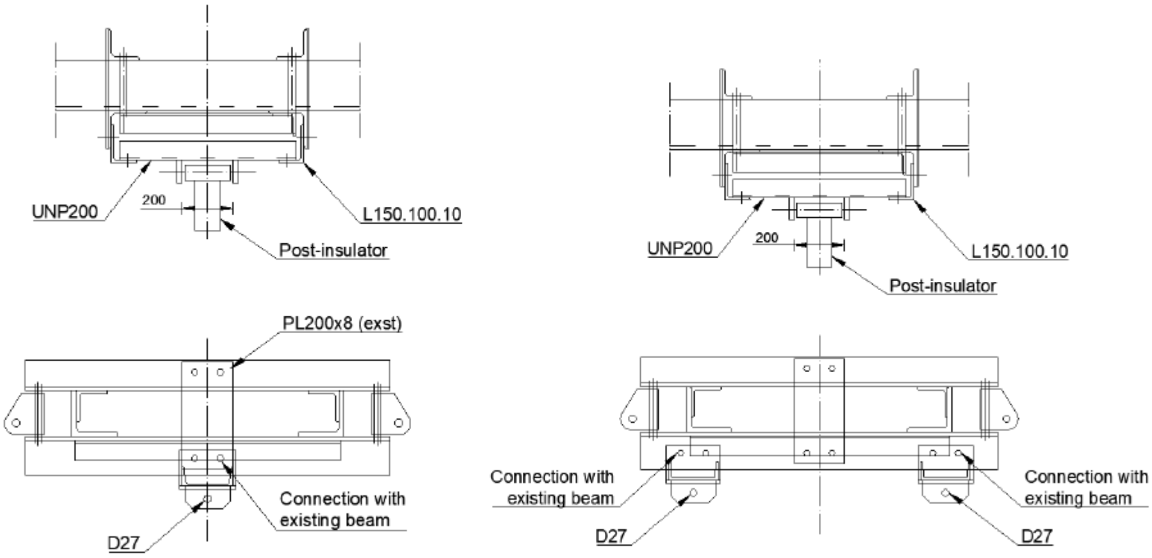


Figure 3: Overview of the new members required for attachment

M = 0.5 x 9.03 + 0.25 x 5 x 0.6 = 5.27 kNm

Proposition: 2 x L100.10: M_{rd} = 2 x 24750 x 355 x 10^{-3} = 17.5 kNm

U.C. = 5.27/ 17.5 = 0.30 < 1 OK

Project: BBB - KIJ GT
Mast: HC+0

DNV·GL

Pen-gatverbinding

Datum: 2020-08-18
Auteur: MKh
Versie: 1.3

Onderwerp	**Post Insulator Attachment**	Toetsing sterkte	0.65 < 1,0 OK

Input

Dikte	15	mm
Gat	27	mm
Pendiameter	25	mm
Ringdikte	5	mm
Eindafstand	40	mm
Randafstand	35	mm
Staalsoort	S235	
Kwaliteit pen	8.8	

Belasting

F_{Ed} = 47.7 kN

$\gamma_{m0,staal}$	1.20
$\gamma_{m0,pen}$	1.00
γ_{m2}	1.25
$\gamma_{m6,ser}$	1.00

Toetsing

Afstanden

Randafstand	OK
Eindafstand	OK
Dikte	OK

Sterkte-eisen

Afschuifsterkte pen	0.25	< 1,0 OK
Buigsterkte pen	0.65	< 1,0 OK
Combinatie M + V	0.48	< 1,0 OK
Stuik plaat	0.43	< 1,0 OK

Berekeningen

Controle eind- en randafstand

Aan de eisen van óf A óf B moet voldaan worden

Type A

Rand	$a > F_{Ed}\,\gamma_{m0} / 2tf_y + 2\,d0/3$ =	26 mm	OK
Eind	$c > F_{Ed}\,\gamma_{m0} / 2tf_y + d0/3$ =	17 mm	OK

Type B

Min. eindafstand	$e > 1{,}6d_0$ =	43 mm	Niet OK
Min. randafstand	$e > 1{,}25d_0$ =	34 mm	OK
Min. dikte	$t > 0{,}7\sqrt{(F_{Ed}\,\gamma_{m0} / f_y)}$ =	11 mm	OK

Pen

A =	491	mm^2
W_{el} =	1534	mm^2

Excentriciteit

e = (132-102)+t*clip*/2 = 20 mm

Materiaalsterktes

$f_y = \min(f_{y,staal}, f_{yp})$ =	235	N/mm^2
f_{yp} =	640	N/mm^2
f_{up} =	800	N/mm^2
$f_{y,staal}$	235	N/mm^2
$f_{t,staal}$	360	N/mm^2

Afschuiving

$F_{v,Rd} = 0{,}6A\,f_{up} / \gamma_{m2}$ = 188 kN

U.C. 0.25 < 1,0 OK

Stuik

$F_{b,Rd} = 1{,}5\,t\,d\,f_y / \gamma_{m0}$ = 110 kN

U.C. 0.43 < 1,0 OK

Buigweerstand

$M_{Ed} = F_{Ed}\,e$ = 0.95 kNm

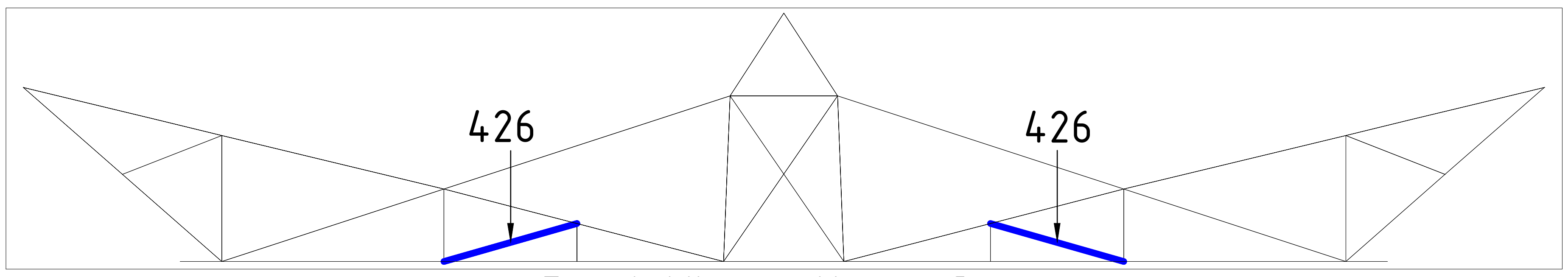
$M_{Rd} = 1{,}5\,W_{el}\,f_{yp} / \gamma_{m0}$ = 1.47 kNm

U.C. = 0.65 < 1,0 OK

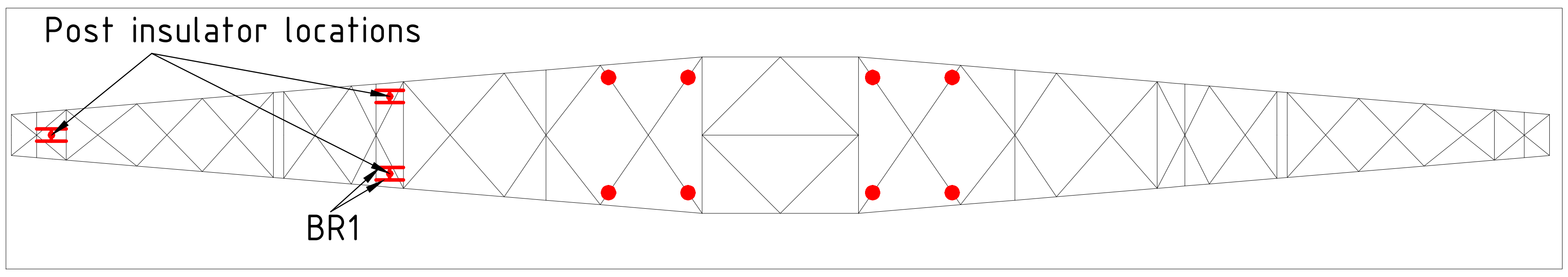
$(M_{Ed} / M_{Rd})2 + (F_{v,Ed} / F_{v,Rd})^2$ = 0.48 < 1,0 OK

APPENDIX E DRAWINGS

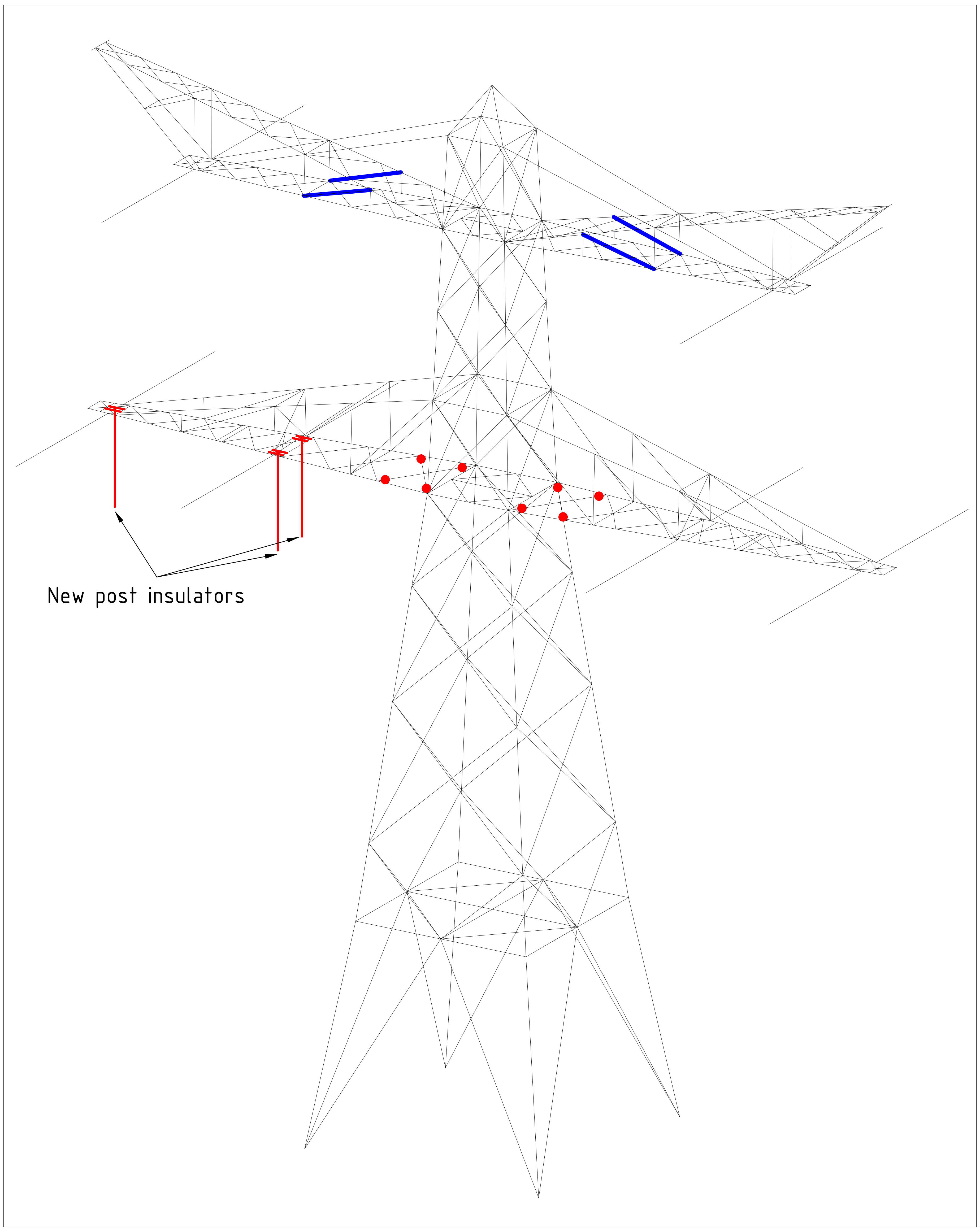
Initial Profiles and Bolts					Final Profiles and Bolts			
Group label	Profile type (ini)	Profile size (ini)	Steel quality (ini)	Bolt size and quality (ini)	Profile type (new)	Profile size (new)	Steel quality (new)	Bolt size and quality (new)
426	EA	L50x5	S235 t<=40	M16-5.6t-NEN2012	EA	L55x6	S355 t<=40	M16-8.8t-NEN2012
BR1					EA	L100x10	S355 t<=40	M24-8.8t-NEN2012



Front View - Upper Crossarm



Under View - Lower Crossarm



Overview

Notes and legend:

- New redundants according to drawing
- Size for new redundants is 50x50x5
- Other changes according to the table
- All changes are symmetrical unless otherwise indicated
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

Red line: New bracing/ insulator
Blue line: Profile exchanged
Green line: New redundant
Red dot: Bolt exchanged

00	18-8-2020	Version 1.0

DNV·GL

Projectname: Mastconstructies KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-027

Design state: FINAL		Scale: -		
Drawn by: MuK	18-8-20	Units: m		
Checked by: TBR	19-8-20	Project no: 10166260		
Approved by: JHu	20-8-20	Company: TenneT		

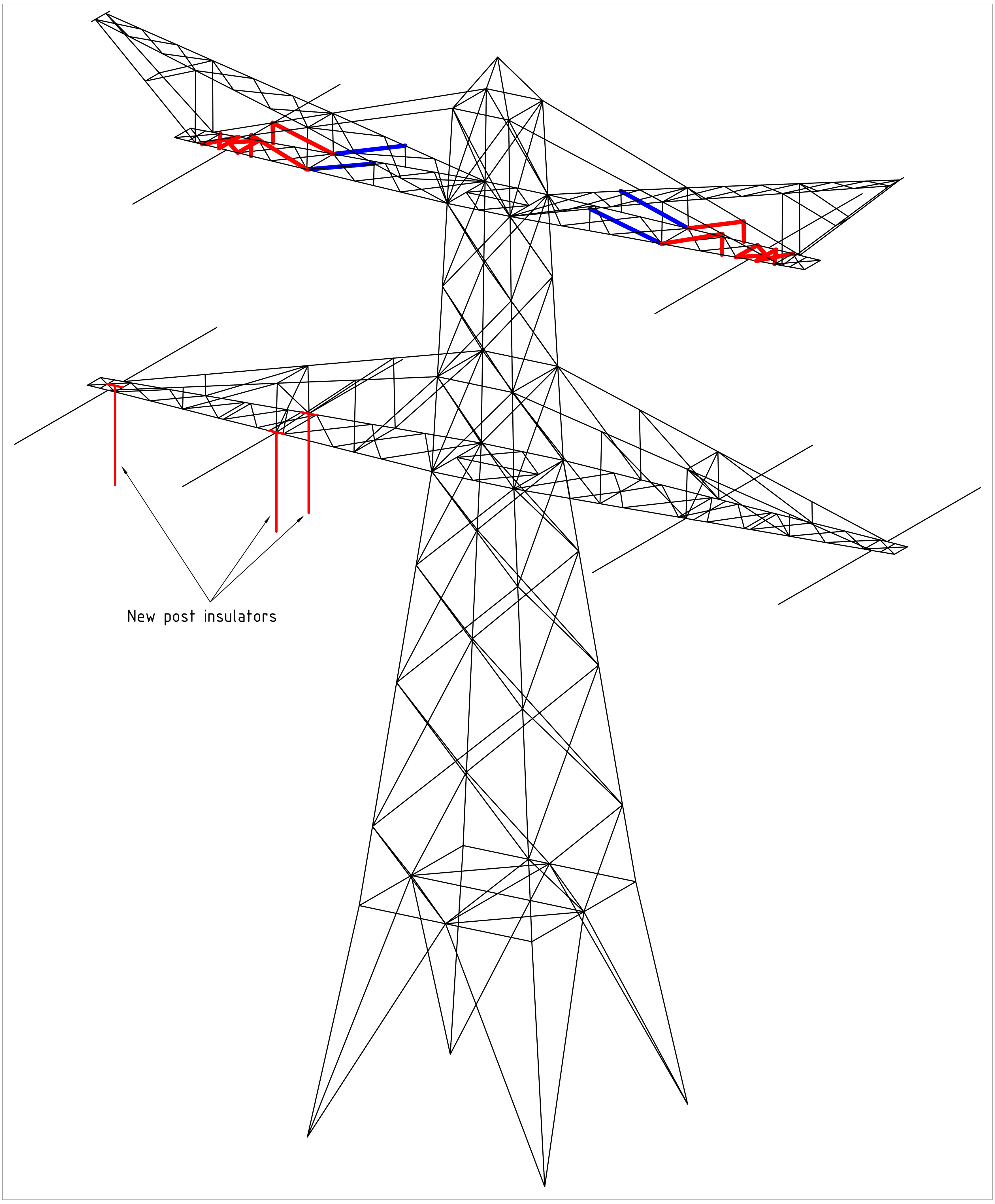
Description: Modifications overview for mast type HC+0 Mast 2

Revision: 00

Format: A2

DNV GL Energy & Sustainability, Utrechtseweg 310, 6812 AR Arnhem, tel: +31 26 3 56 91 11, www.dnvgl.com

Initial Profiles and Bolts					Final Profiles and Bolts			
Group label	Profile type (ini)	Profile size (ini)	Steel quality (ini)	Bolt size and quality (ini)	Profile type (new)	Profile size (new)	Steel quality (new)	Bolt size and quality (new)
426	EA	L50x5	S235 t<=40	M16-5.6t-NEN2012	EA	L50x7	S355 t<=40	M16-8.8t-NEN2012
431					EA	L120x12	S355 t<=40	M24-8.8t-NEN2012
432					EA	L120x12	S355 t<=40	M24-8.8t-NEN2012
433					EA	L70x7	S355 t<=40	M20-8.8t-NEN2012
434					EA	L60x6	S355 t<=40	M20-8.8t-NEN2012
435					EA	L80x8	S355 t<=40	M20-8.8t-NEN2012
436					EA	L60x6	S355 t<=40	M20-8.8t-NEN2012



Overview

Notes and legend:

- New redundants according to drawing
- Size for new redundants is 50x50x5
- Other changes according to the table
- All changes are symmetrical unless otherwise indicated
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

New bracing/ insulators
Profile exchanged
New redundant
Bolt exchanged

01	17-05-2021	Dimension added
00	18-8-2020	Version 1.0

DNV·GL

Projectname: Tower Structures KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-029

Design state: FINAL

Scale: -

Drawn by: KCh 17-05-2021

Units: m

Checked by: TBR 17-05-2021

Project no: 10166260

Approved by: JHu 17-05-2021

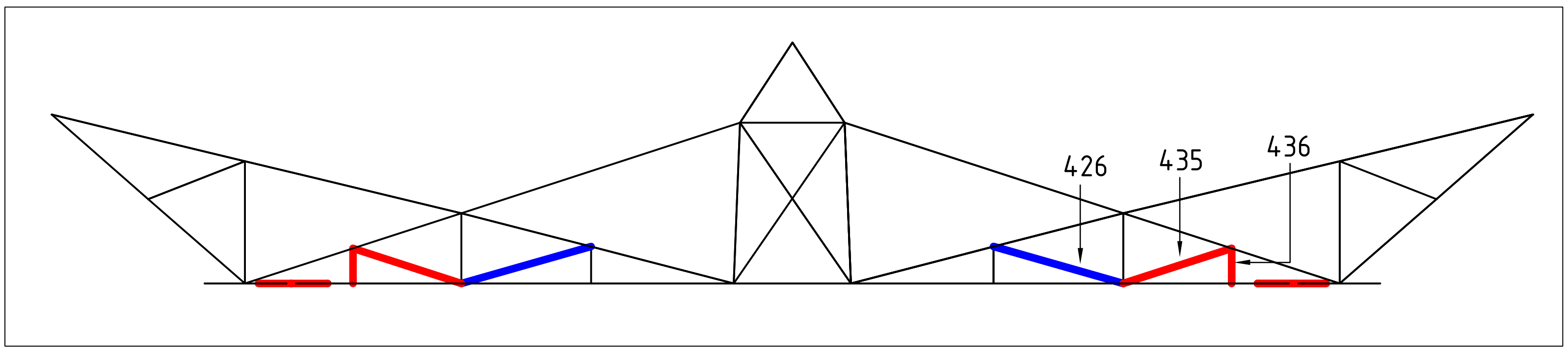
Company: TenneT

Description: Modifications overview for tower type HC+0 (tower 15) page 1 of 2

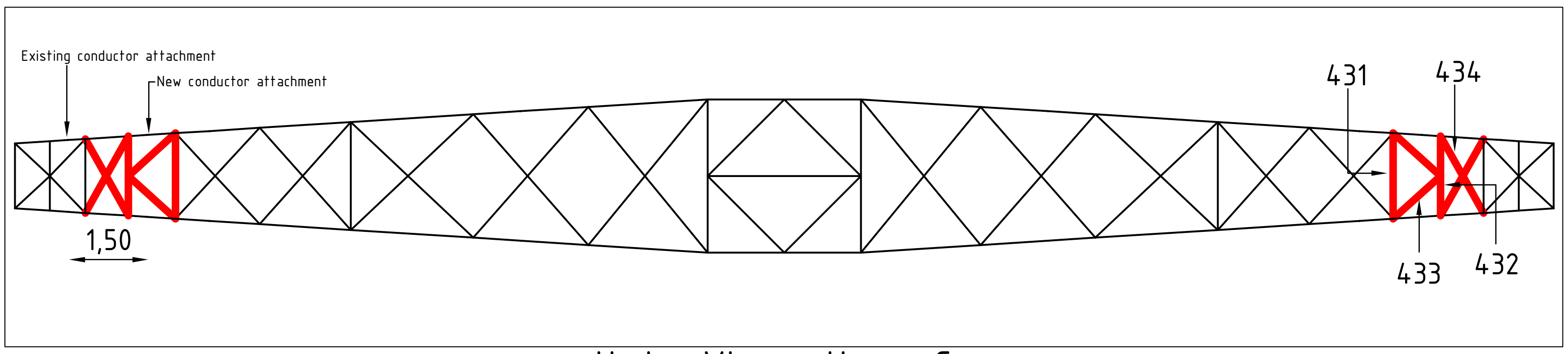
Revision: 01

Format: A2

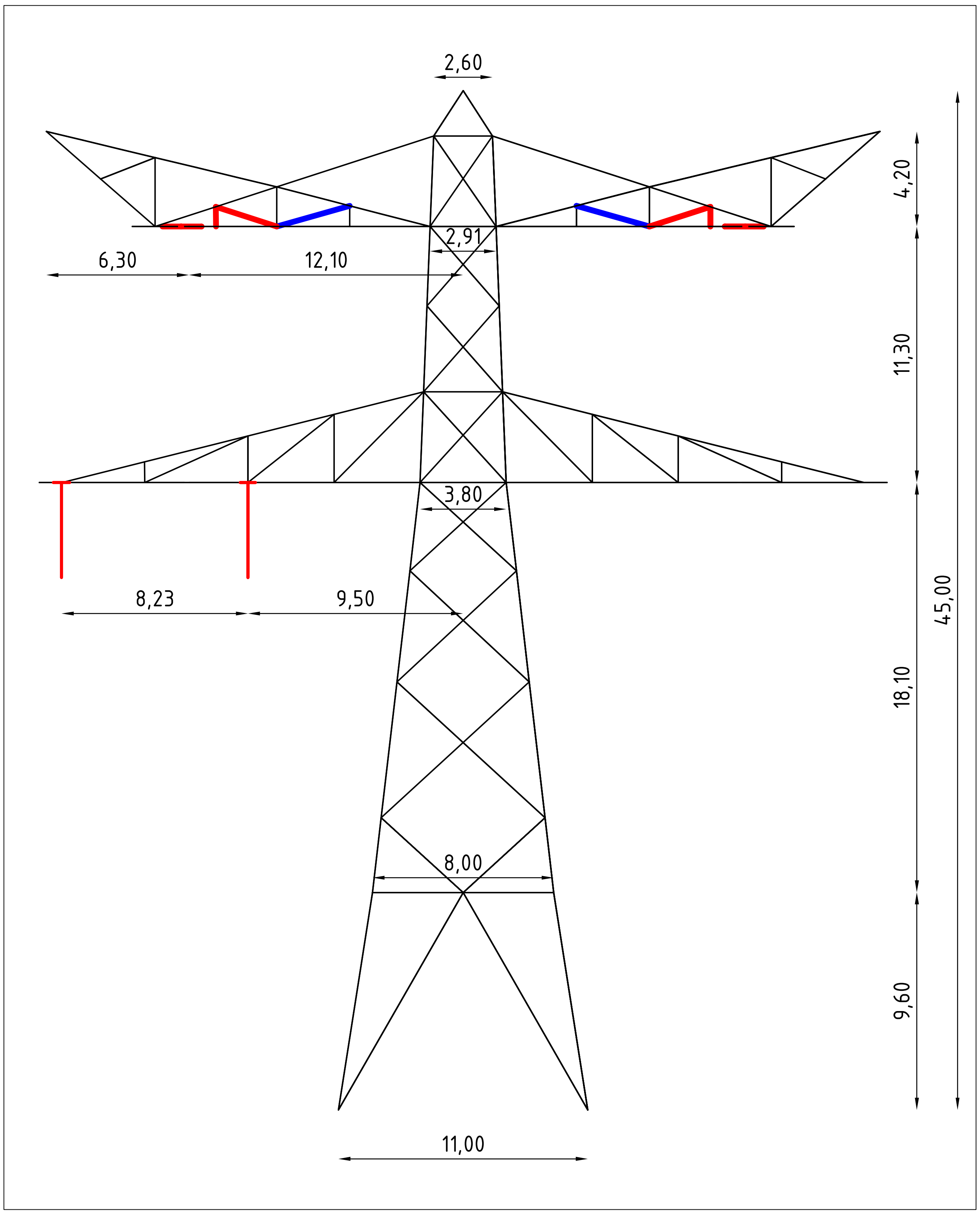
DNV GL Energy & Sustainability, Utrechtseweg 310, 6812 AR Arnhem, tel: +31 26 3 56 91 11, www.dnvgl.com



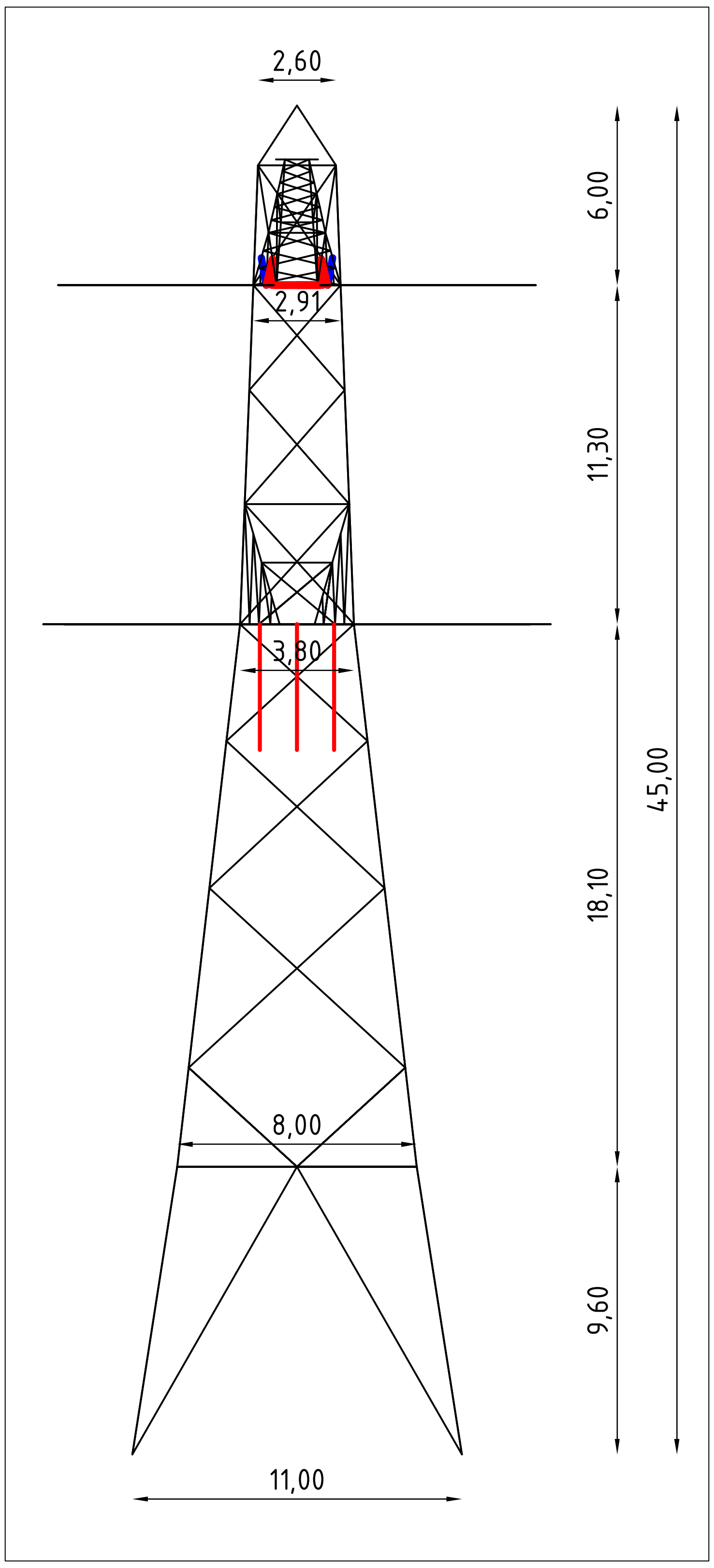
Front View - Upper Crossarm



Under View - Upper Crossarm



Front View



Side View

Notes and legend:

- New redundants according to drawing
- Size for new redundants is 50x50x5
- Other changes according to the table
- All changes are symmetrical unless otherwise indicated
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

New bracing/ insulators
Profile exchanged
New redundant
Bolt exchanged

01	17-05-2021	Dimension added
00	18-8-2020	Version 1.0

DNV·GL

Projectname: Tower Structures KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-029

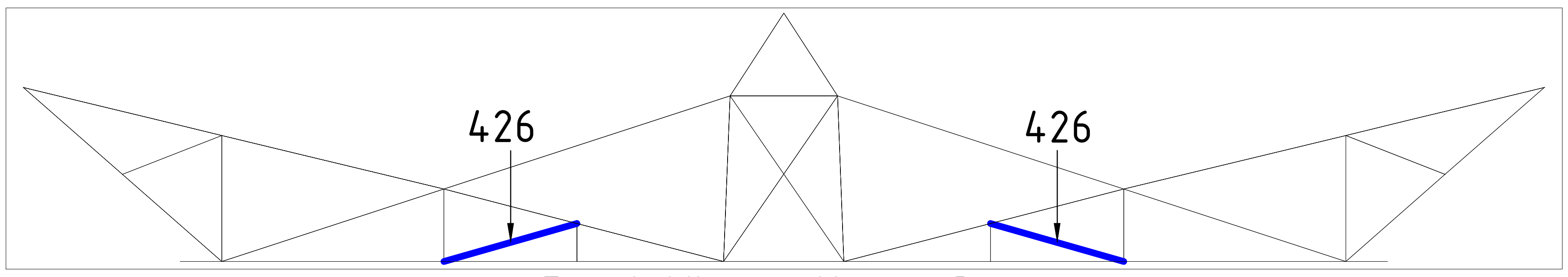
Design state:	FINAL		Scale:	-
Drawn by:	KCh	17-05-2021	Units:	m
Checked by:	TBR	17-05-2021	Project no:	10166260
Approved by:	JHu	17-05-2021	Company:	TenneT

Description: Modifications overview for tower type HC+0 (tower 15) page 2 of 2

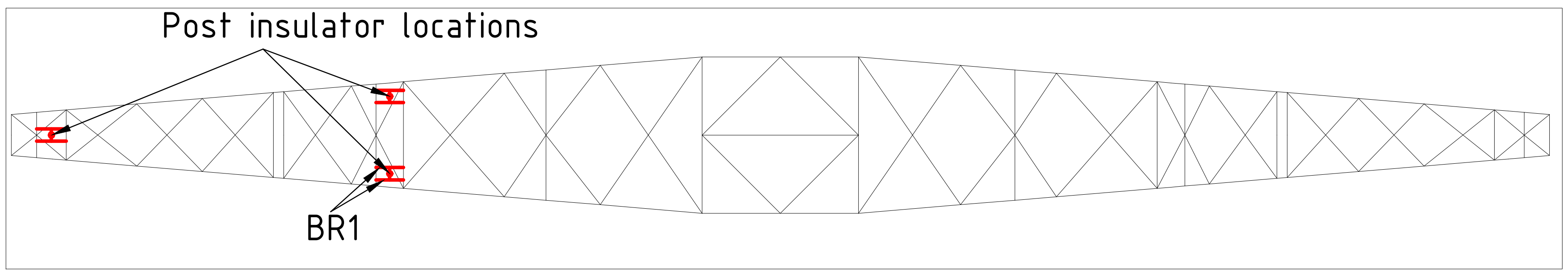
Revision: 01

Format: A2

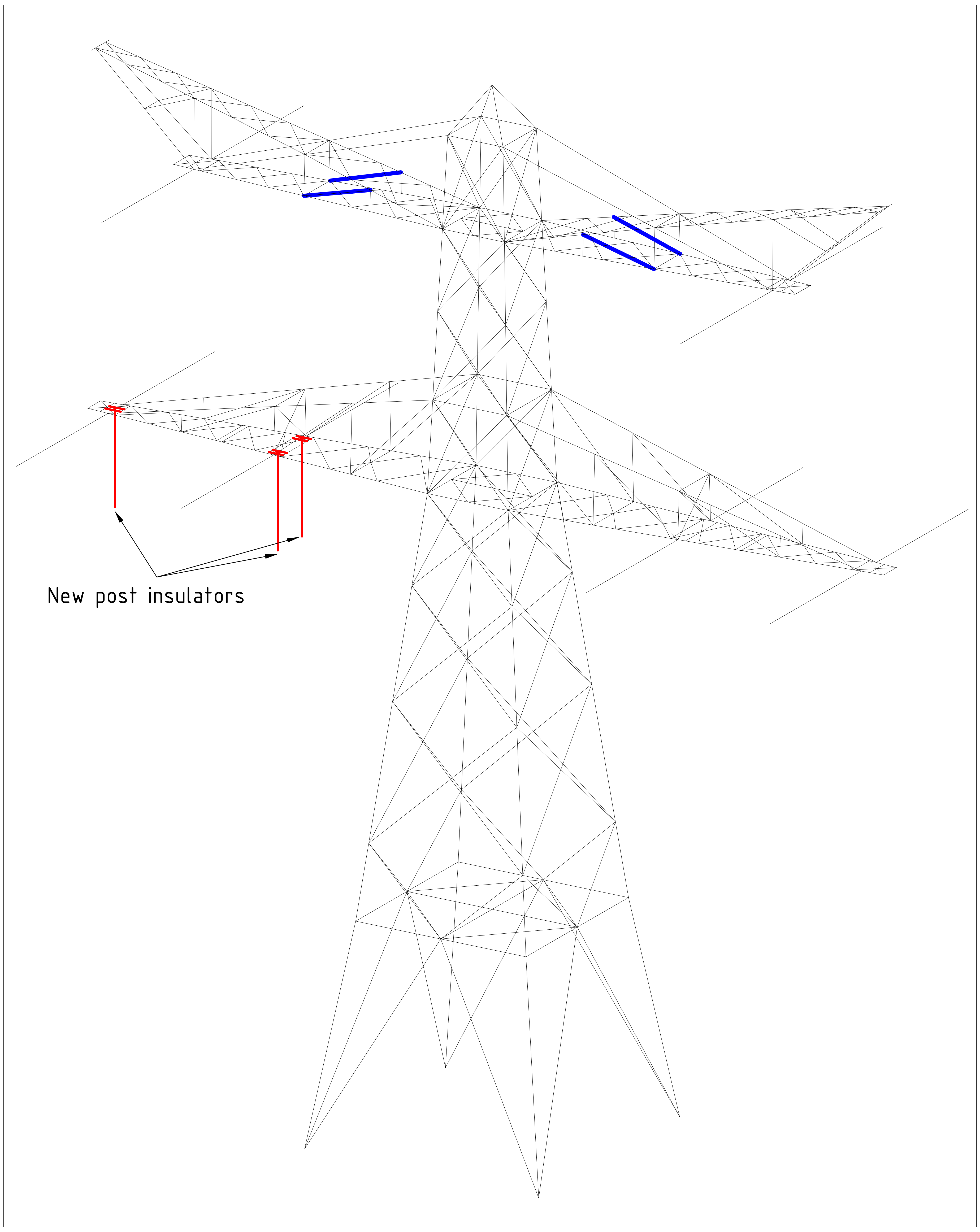
Initial Profiles and Bolts					Final Profiles and Bolts			
Group label	Profile type (ini)	Profile size (ini)	Steel quality (ini)	Bolt size and quality (ini)	Profile type (new)	Profile size (new)	Steel quality (new)	Bolt size and quality (new)
426	EA	L50x5	S235 t<=40	M16-5.6t-NEN2012	EA	L50x7	S355 t<=40	M16-8.8t-NEN2012
BR1					EA	L100x10	S355 t<=40	M24-8.8t-NEN2012



Front View - Upper Crossarm



Under View - Lower Crossarm



Overview

Notes and legend:

- New redundants according to drawing
- Size for new redundants is 50x50x5
- Other changes according to the table
- All changes are symmetrical unless otherwise indicated
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

New bracing/ insulator (red line)
Profile exchanged (blue line)
New redundant (green line)
Bolt exchanged (red dot)

00	18-8-2020	Version 1.0

DNV·GL

Projectname: Mastconstructies KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-028

Design state: FINAL | Scale: -

Drawn by: MuK 18-8-20 | Units: m

Checked by: TBR 19-8-20 | Project no: 10166260

Approved by: JHu 20-8-20 | Company: TenneT

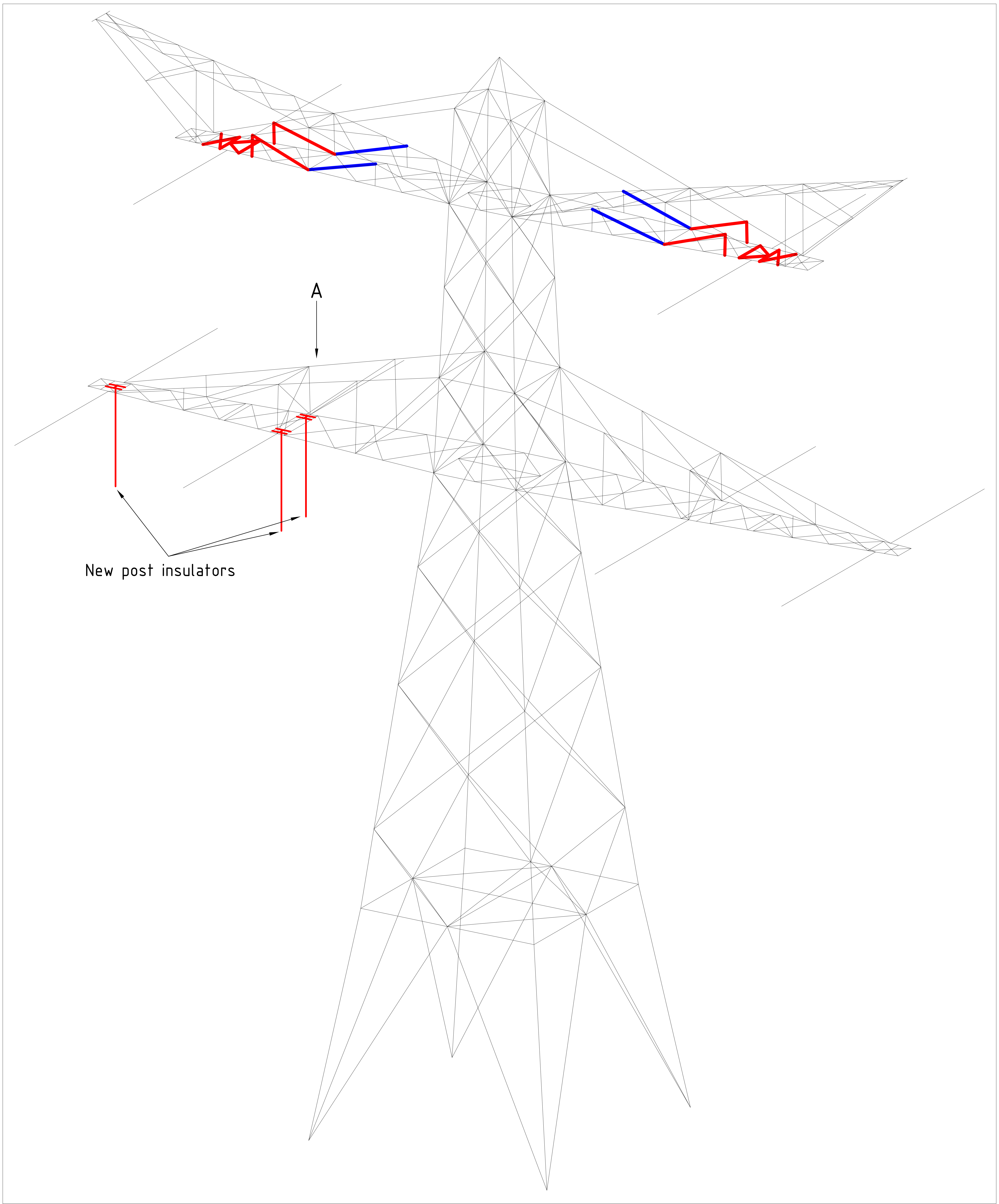
Description: Modifications overview for mast type HC+0 Mast 38

Revision: 00

Format: A2

DNV GL Energy & Sustainability, Utrechtseweg 310, 6812 AR Arnhem, tel: +31 26 3 56 91 11, www.dnvgl.com

	Initial Profiles and Bolts				Final Profiles and Bolts			
Group label	Profile type (ini)	Profile size (ini)	Steel quality (ini)	Bolt size and quality (ini)	Profile type (new)	Profile size (new)	Steel quality (new)	Bolt size and quality (new)
426	EA	L50x5	S235 t<=40	M16-5.6t-NEN2012	EA	L50x7	S355 t<=40	M16-8.8t-NEN2012
431					EA	L120x12	S355 t<=40	M24-8.8t-NEN2012
432					EA	L120x12	S355 t<=40	M24-8.8t-NEN2012
433					EA	L70x7	S355 t<=40	M20-8.8t-NEN2012
434					EA	L60x6	S355 t<=40	M20-8.8t-NEN2012
435					EA	L80x8	S355 t<=40	M20-8.8t-NEN2012
436					EA	L60x6	S355 t<=40	M20-8.8t-NEN2012
BR1					EA	L100x10	S355 t<=40	M24-8.8t-NEN2012



Overview

Notes and legend:

- New redundants according to drawing
- Size for new redundants is 50x50x5
- Other changes according to the table
- All changes are symmetrical unless otherwise indicated
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

New bracing/ insulators (red line)
Profile exchanged (blue line)
New redundant (green line)
Bolt exchanged (red dot)

00	18-8-2020	Version 1.0

DNV·GL

Projectname: Mastconstructies KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-030

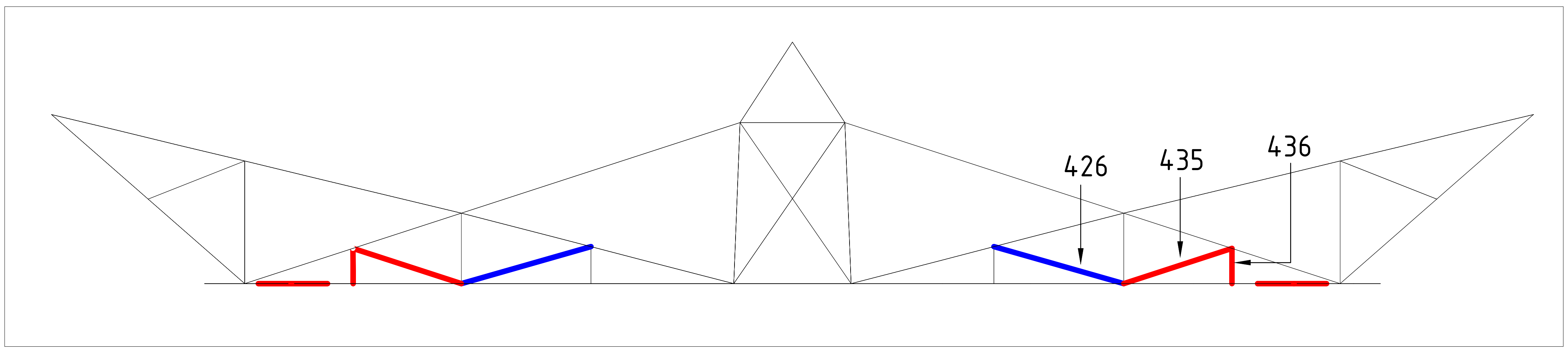
Design state: FINAL
Scale: -
Units: m
Drawn by: MuK 18-8-20
Checked by: TBR 19-8-20
Approved by: JHu 20-8-20
Project no: 10166260
Company: TenneT

Description: Modifications overview for mast type HC+0 Mast 54 page 1 of 2

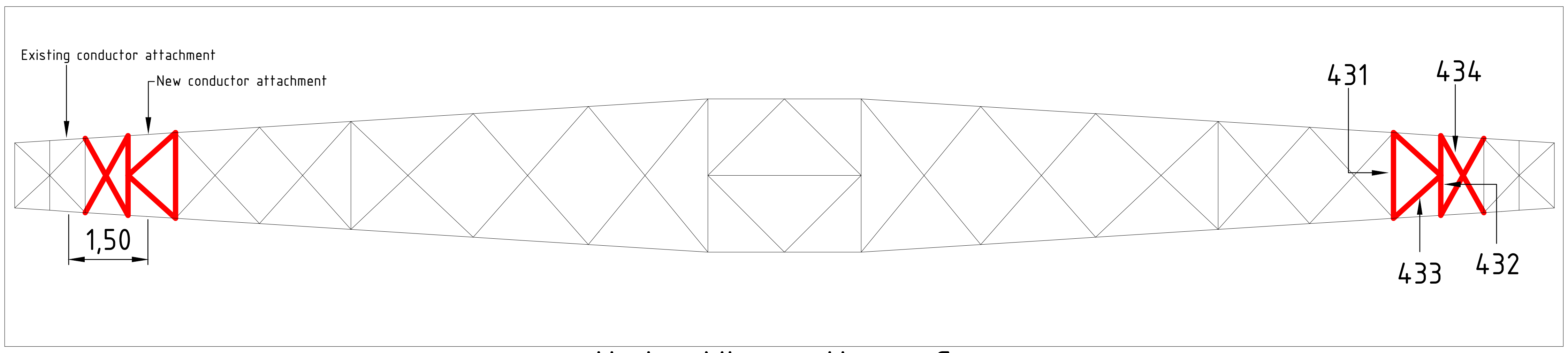
Revision: 00

Format: A2

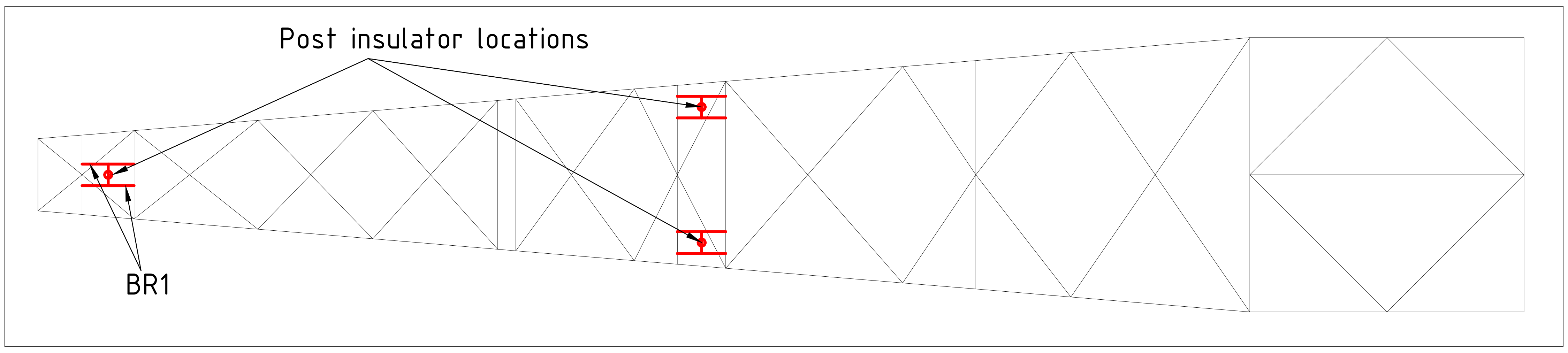
DNV GL Energy & Sustainability, Utrechtseweg 310, 6812 AR Arnhem, tel: +31 26 3 56 91 11, www.dnvgl.com



Front View - Upper Crossarm



Under View - Upper Crossarm



View on Arrow A

Notes and legend:

- New redundants according to drawing
- Size for new redundants is 50x50x5
- Other changes according to the table
- All changes are symmetrical unless indicated otherwise
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

New bracing/ insulators
Profile exchanged
New redundant
Bolt exchanged

00	18-8-2020	Version 1.0

DNV·GL

Projectname: Mastconstructies KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-030

Design state: FINAL		Scale:	-
Drawn by: MuK	18-8-20	Units:	m
Checked by: TBR	19-8-20	Project no:	10166260
Approved by: JHu	20-8-20	Company:	TenneT

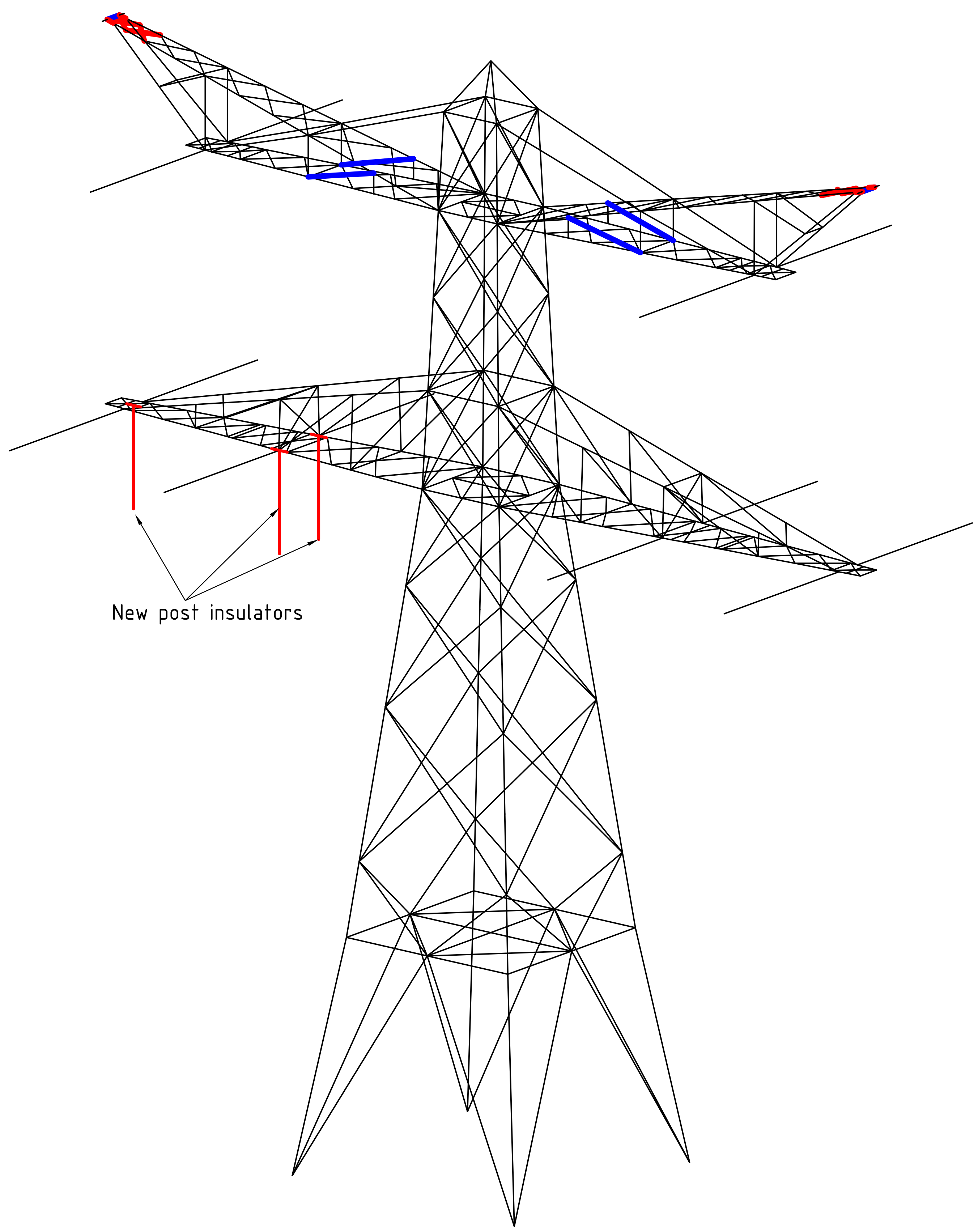
Description: Modifications overview for mast type HC+0 Mast 54 page 2 of 2

Revision: 00

Format: A2

DNV GL Energy & Sustainability, Utrechtseweg 310, 6812 AR Arnhem, tel: +31 26 3 56 91 11, www.dnvgl.com

	Initial Profiles and Bolts				Final Profiles and Bolts			
Group label	Profile type (ini)	Profile size (ini)	Steel quality (ini)	Bolt size and quality (ini)	Profile type (new)	Profile size (new)	Steel quality (new)	Bolt size and quality (new)
426	EA	L50x5	S235 t<=40	M16-5.6t-NEN2012	EA	L50x7	S355 t<=40	M16-8.8t-NEN2012
429	UNP	UNP 160	S235 t<=40	M16-5.6t-NEN2012	UNP	UNP 160	S355 t<=40	M16-8.8t-NEN2012
432					EA	L60x6	S355 t<=40	M20-8.8t-NEN2012
431					EA	L60x6	S355 t<=40	M20-8.8t-NEN2012
116					UNP	UNP 160	S355 t<=40	M24-8.8t-NEN2012



Overview

Notes and legend:

- New redundants according to drawing
- Size for new redundants is 50x50x5
- Other changes according to the table
- All changes are symmetrical unless otherwise indicated
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

New bracing/ insulators (red line)
Profile exchanged (blue line)
New redundant (green line)
Bolt exchanged (red dot)

01	28-04-2021	Dimension added
00	18-08-2020	Version 1.0

DNV·GL

Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

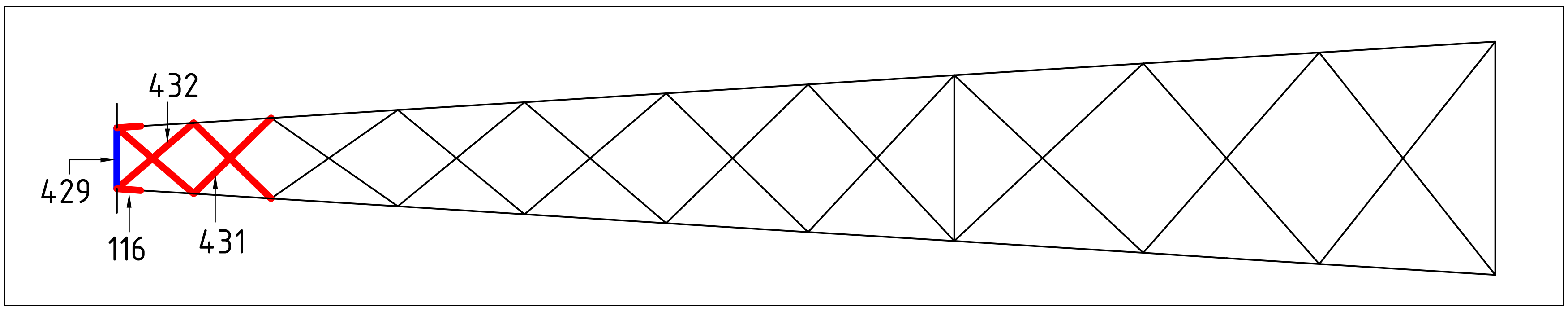
Drawing no.: 10166260-031

Design state: FINAL		Scale: -		
Drawn by: KCh	28-04-2021	Units: m		
Checked by: TBR	28-04-2021	Project no: 10166260		
Approved by: JHu	28-04-2021	Company: TenneT		

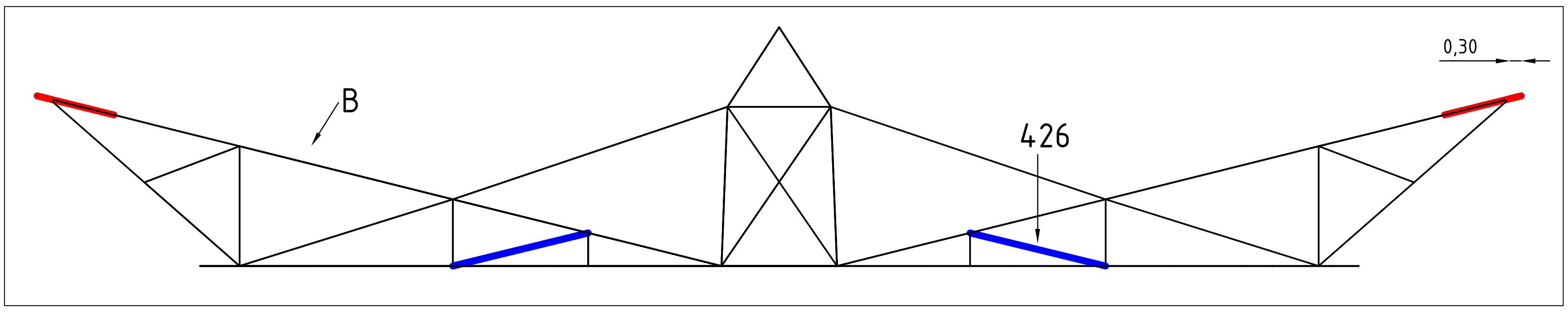
Description: Modifications overview for mast type HC+0 (mast 83) page 1 of 3

Revision: 01

Format: A2



View on Arrow B



Front View - Upper Crossarm

Notes and legend:

- **New redundants according to drawing**
- **Size for new redundants is 50x50x5**
- **Other changes according to the table**
- **All changes are symmetrical unless otherwise indicated**
- **Material quality t ≤ 16mm S355J0**
- **Material quality t > 16mm S355J2**
- **Bolt quality 8.8 rolled**

New bracing/ insulators
Profile exchanged
New redundant
Bolt exchanged

01	28-04-2021	Dimension added
00	18-08-2020	Version 1.0

DNV·GL

Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-031

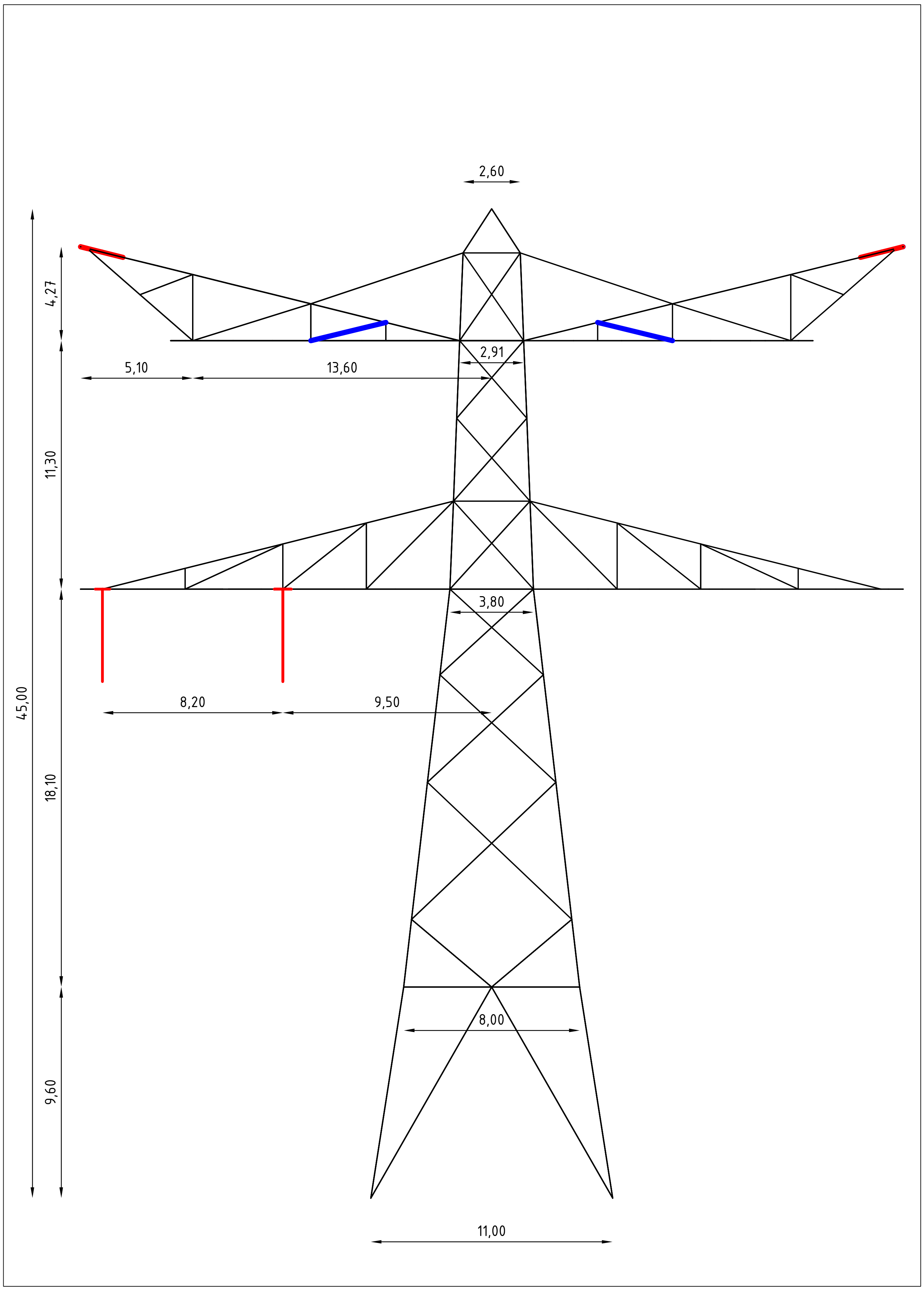
Design state: FINAL		Scale: -		
Drawn by: KCh	28-04-2021	Units: m		
Checked by: TBR	28-04-2021	Project no: 10166260		
Approved by: JHu	28-04-2021	Company: TenneT		

Description: Modifications overview for mast type HC+0 (mast 83) page 2 of 3

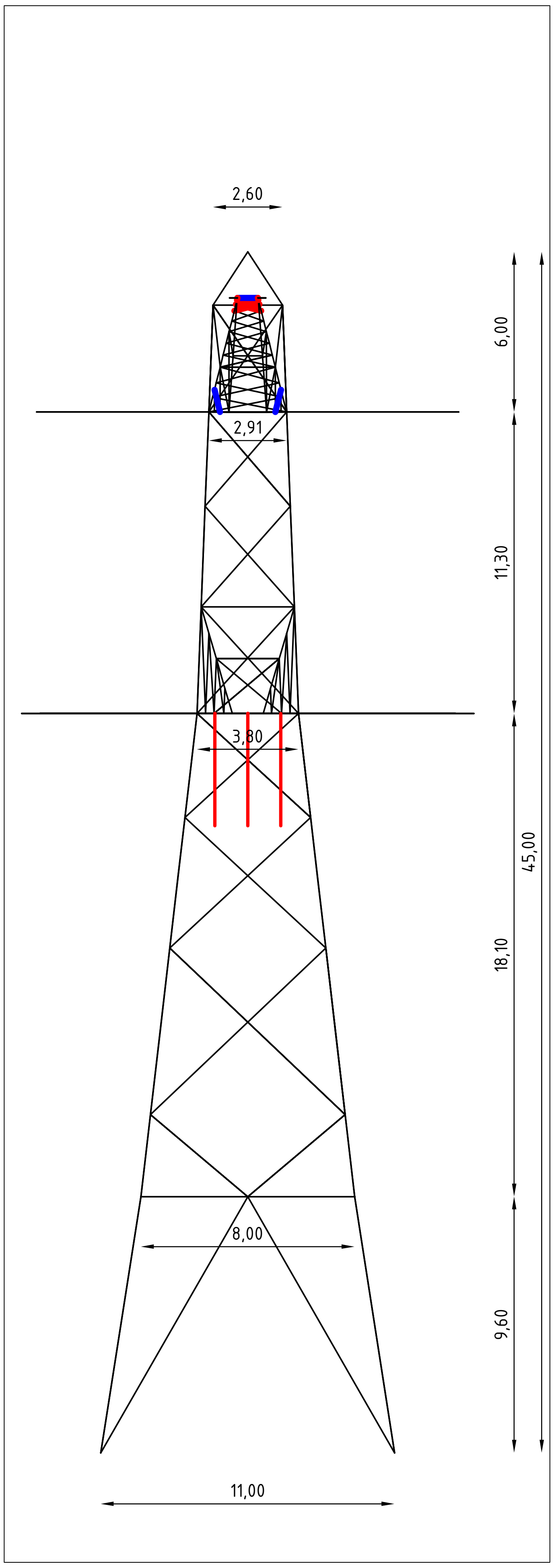
Revision: 01

Format: A2

DNV GL Energy & Sustainability, Utrechtseweg 310, 6812 AR Arnhem, tel: +31 26 3 56 91 11, www.dnvgl.com



Front View



Side View

Notes and legend:

- **New redundants according to drawing**
- **Size for new redundants is 50x50x5**
- **Other changes according to the table**
- **All changes are symmetrical unless otherwise indicated**
- **Material quality t ≤ 16mm S355J0**
- **Material quality t > 16mm S355J2**
- **Bolt quality 8.8 rolled**

New bracing/ insulators (red)
Profile exchanged (blue)
New redundant (green)
Bolt exchanged (red dot)

01	28-04-2021	Dimension added
00	18-08-2020	Version 1.0

DNV·GL

Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-031

Design state: FINAL		Scale: -		
Drawn by: KCh	28-04-2021	Units: m		
Checked by: TBR	28-04-2021	Project no: 10166260		
Approved by: JHu	28-04-2021	Company: TenneT		

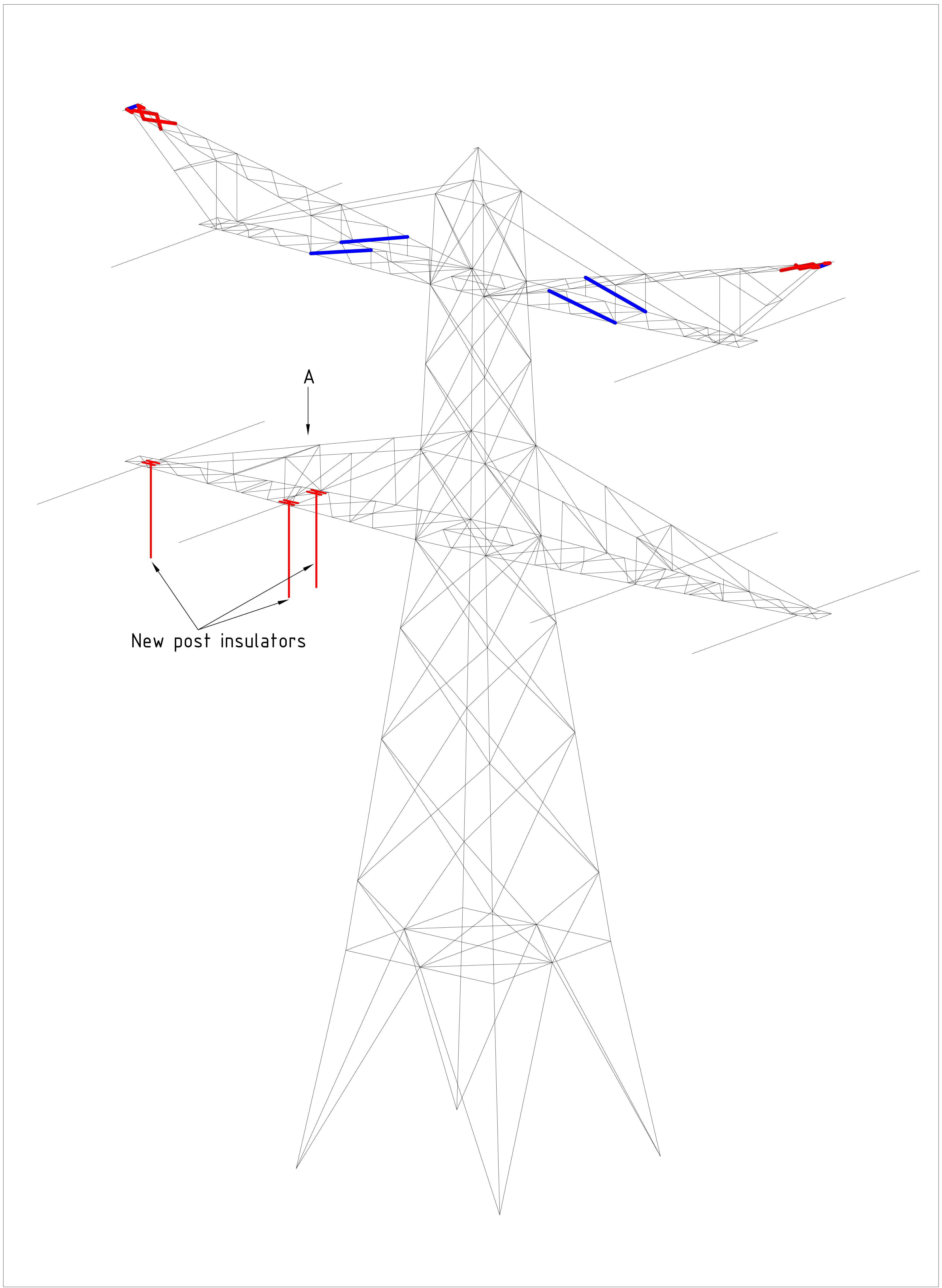
Description: Modifications overview for mast type HC+0 (mast 83) page 3 of 3

Revision: 01

Format: A2

DNV GL Energy & Sustainability, Utrechtseweg 310, 6812 AR Arnhem, tel: +31 26 3 56 91 11, www.dnvgl.com

Initial Profiles and Bolts					Final Profiles and Bolts			
Group label	Profile type (ini)	Profile size (ini)	Steel quality (ini)	Bolt size and quality (ini)	Profile type (new)	Profile size (new)	Steel quality (new)	Bolt size and quality (new)
426	EA	L50x5	S235 t<=40	M16-5.6t-NEN2012	EA	L50x6	S355 t<=40	M16-8.8t-NEN2012
429	UNP	UNP 160	S235 t<=40	M16-5.6t-NEN2012	UNP	UNP 160	S355 t<=40	M16-8.8t-NEN2012
432					EA	L60x6	S355 t<=40	M20-8.8t-NEN2012
431					EA	L60x6	S355 t<=40	M20-8.8t-NEN2012
116					UNP	UNP 160	S355 t<=40	M24-8.8t-NEN2012
BR1					EA	L100x10	S355 t<=40	M24-8.8t-NEN2012



Overview

Notes and legend:

- New redundants according to drawing
- Size for new redundants is 50x50x5
- Other changes according to the table
- All changes are symmetrical unless otherwise indicated
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

New bracing/ insulators (red)
Profile exchanged (blue)
New redundant (green)
Bolt exchanged (red dot)

00	18-08-2020	Version 1.0

DNV·GL

Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-032

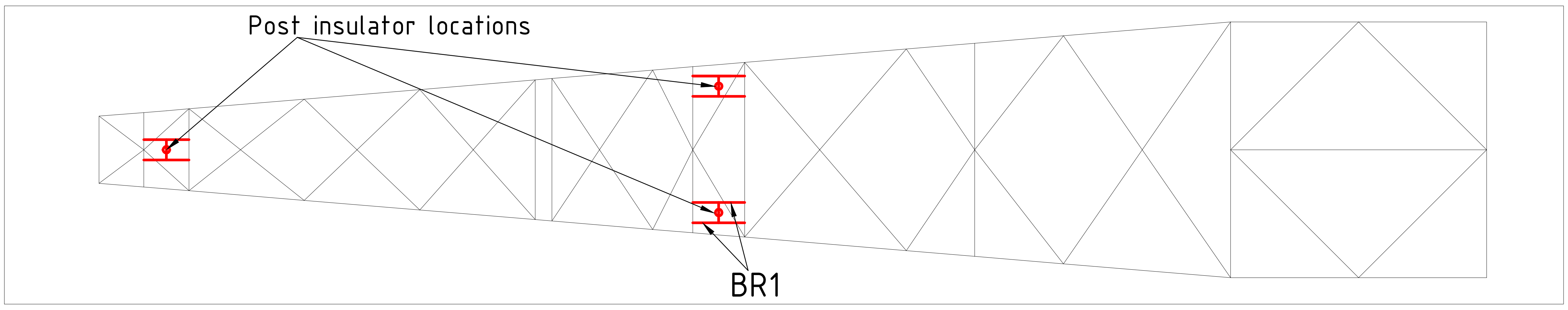
Design state: FINAL		Scale: -		
Drawn by: MuK	18-08-2020	Units: m		
Checked by: TBR	19-08-2020	Project no: 10166260		
Approved by: JHu	20-08-2020	Company: TenneT		

Description: Modifications overview for mast type HC+0T (mast 69) page 1 of 2

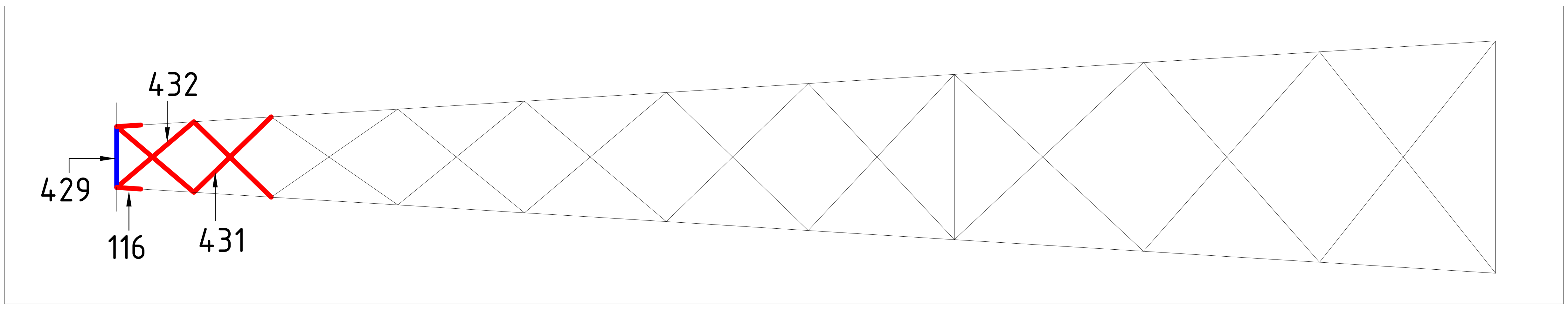
Revision: 00

Format: A2

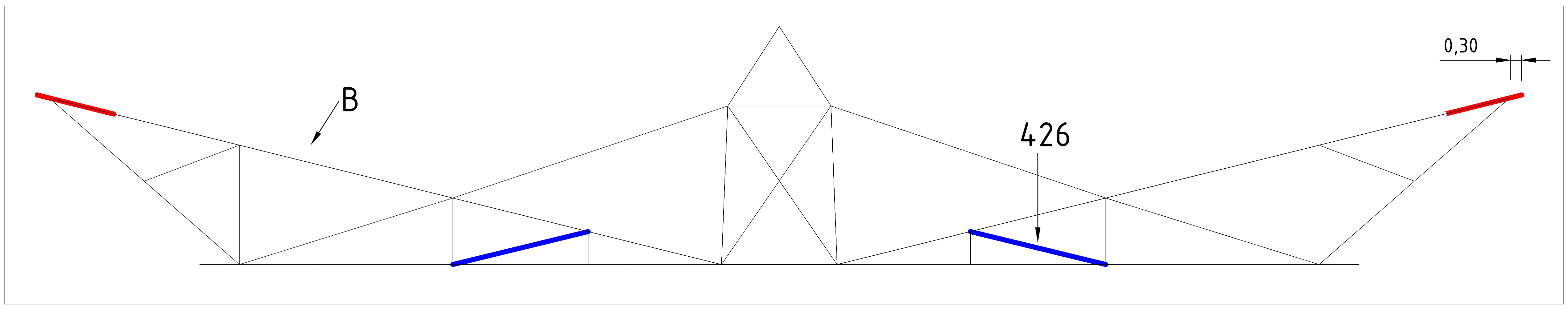
DNV GL Energy & Sustainability, Utrechtseweg 310, 6812 AR Arnhem, tel: +31 26 3 56 91 11, www.dnvgl.com



View on Arrow A



View on Arrow B



Front View - Upper Crossarm

Notes and legend:

- New redundants according to drawing
- Size for new redundants is 50x50x5
- Other changes according to the table
- All changes are symmetrical unless otherwise indicated
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

New bracing/ insulators
Profile exchanged
New redundant
Bolt exchanged

00	18-08-2020	Version 1.0

DNV·GL

Projectname: Mast constructions KIJ - GT 380 kV					
Third angle projection:		Drawing no.: 10166260-032			
Design state: FINAL		Scale: -	Description: Modifications overview for mast type HC+OT (mast 69) page 2 of 2	Revision: 00	
Drawn by: MuK	18-08-2020	Units: m			
Checked by: TBR	19-08-2020	Project no: 10166260		Format: A2	
Approved by: JHu	20-08-2020	Company: TenneT			

DNV GL Energy & Sustainability, Utrechtseweg 310, 6812 AR Arnhem, tel: +31 26 3 56 91 11, www.dnvgl.com

APPENDIX F REPORT AXISVM CROSS ARM

AXISVM ANALYSIS OF THE HC+0 UPPER CROSSARM

1 INTRODUCTION

Based on the results of the E-study, changes are required in the positions of the conductor and earthwire attachment points on the upper crossarm of the HC+0. The new configuration of the crossarm was analysed in AxisVM to determine if the proposed bracing arrangements would provide adequate structural support. The following masts on the KIJ-GT line were analysed:

- Mast 15
- Mast 54
- Mast 83
- Mast 69 (telecom mast)

The crossarm was analysed in isolation as the loads resulting from the changes in attachment positions are only expected to have localised effects. The analysis focuses on the loads in the top and bottom main chords and the effectiveness of additional members in accordance with Eurocode 3 is assessed. Figure 1 depicts the existing geometry of the HC+0 upper crossarm. The insulator ID's are shown in the figure.

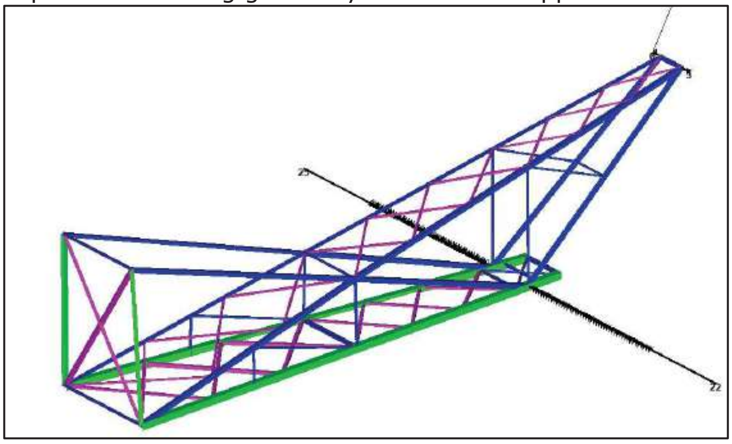


Figure 1 Existing upper crossarm of the HC+0 tower

2 GEOMETRY

To facilitate the movement of the insulator attachment, additional bracing members were used to support the bottom chord as well as vertical and diagonal bracing which connects the top and bottom chords. To enable the movement of the earthwire attachment, additional crossing diagonals were added to the top face of the crossarm and a UNP member was used to shift the earthwire attachment horizontally by 300 mm. The new geometry together with the cross-section properties are illustrated in Figure 2.

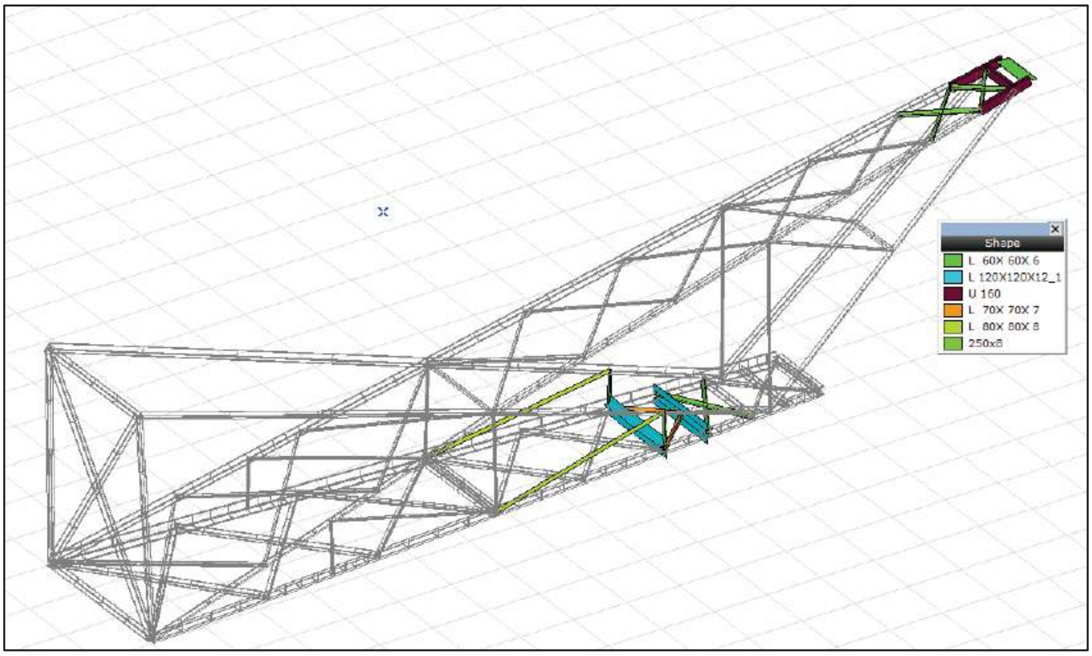


Figure 2 Cross arm with repositioned insulators

2.1 Supports

The crossarm of the tower is analysed in isolation in this study. This approach is based on the assumption that the change in insulator position will not have a global effect and only the new members required to facilitate repositioning should be checked for efficiency. The crossarm is modelled and its connections with leg members are constrained (supported). The node connections of the bottom chord to the leg members are modelled as pinned connections i.e. restrained in translation in x, y and z directions. The nodes connecting the top chord with the leg member have been constrained only for horizontal translation. Figure 3 shows the support conditions imposed on the crossarm in AxisVM.

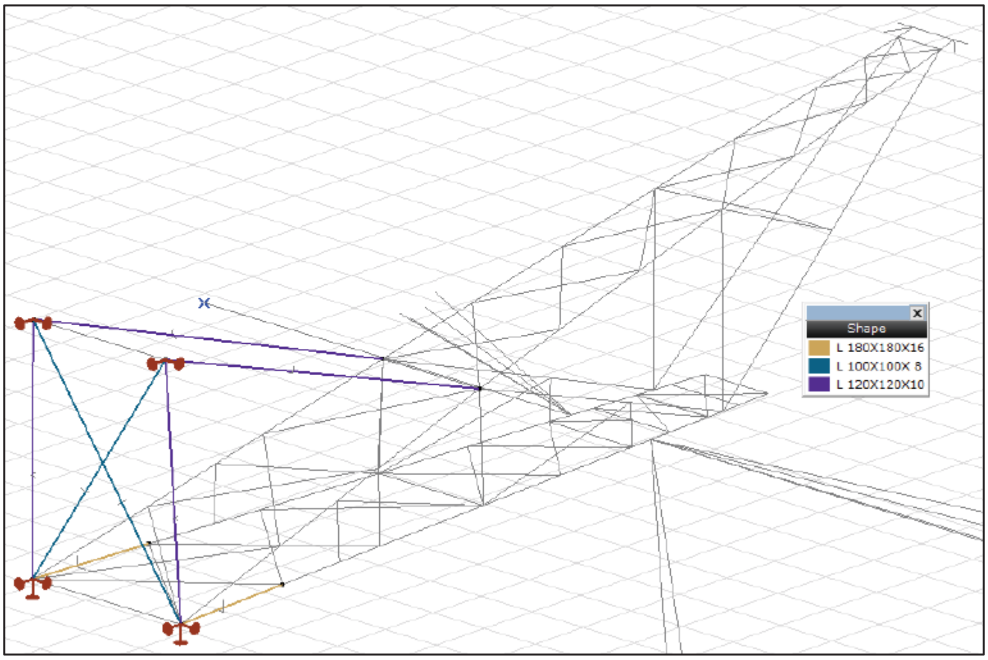
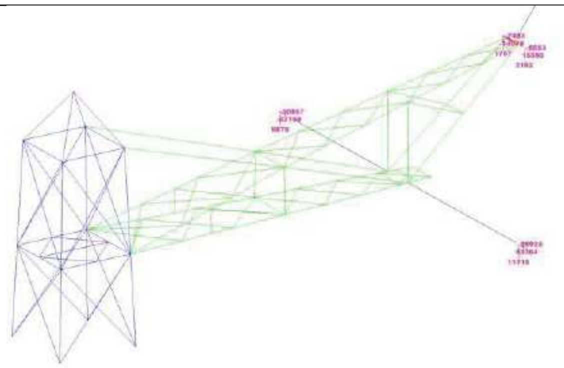
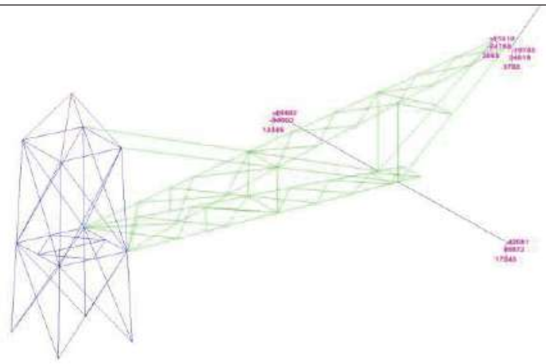
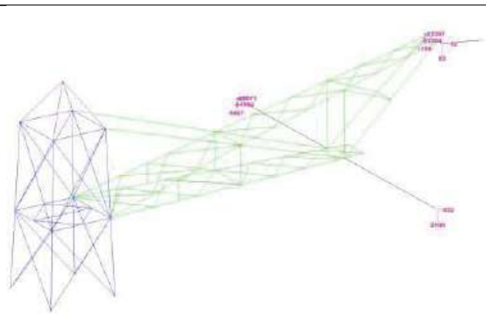
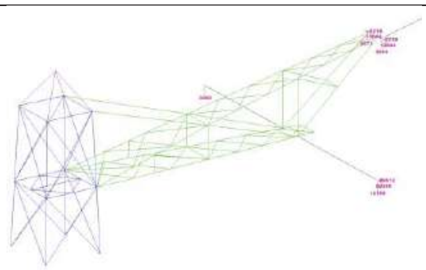


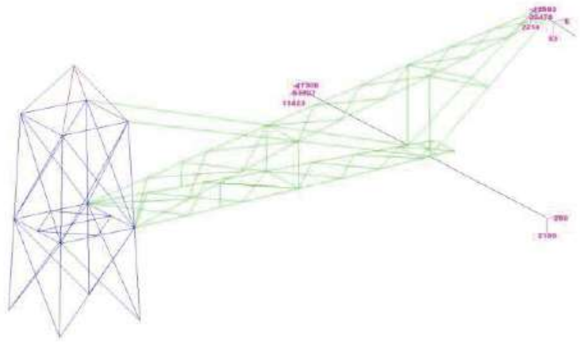
Figure 3 Support conditions for the cross arm.

3 LOADING

The most critical load cases were applied in Axis VM. The loads are in alignment with the loads applied in PLS Tower for the existing model. The naming convention of load cases in Axis VM is identical to that of the PLS Tower model. Furthermore, extra load cases were developed where the direction of horizontal loads are reversed. Load case 1 is based on the highest wind speed and dead weight of the crossarm. Load case 3 has loads from dead weight, wind and ice including relevant partial load factors. Load case 5a represents mechanical failure of the conductor.

Table 1 Details of load cases

Sr. No.	Load Case	Description	Load applied in PLS tower model
1	01 ULA 1a_0	Wind load: Critical for max horizontal load. The insulator swings in plane and is thus subjected to tension. Considering insulators cannot transer moments, the forces can be transferred and applied to the attachment nodes of the conductor by means of vector translation.	
2	13 ULA 3a	Ice + wind: This load case generates the peak vertical load.	
3	35 ULS 5a Ba 22	Failure of the conductor - 25	
4	49 SPLS1a 65.5 Ah All Cts	Failure of the conductor - 22 and 3	

Sr. No.	Load Case	Description	Load applied in PLS tower model
5	121 SPSL 3 65.5 Ah All Cts	Failure of the conductor - 22 and 6	

The conductor ID's are the same as the PLS tower model. The insulators have been modelled as 25 mm diameter bars. Self-weight of the rods has been included in the model.

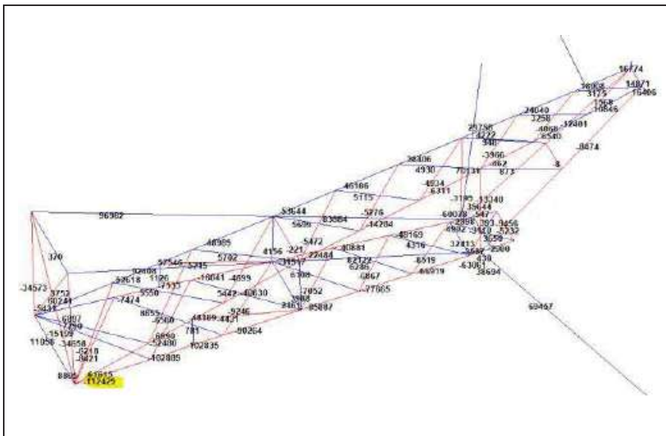
4 RESULTS

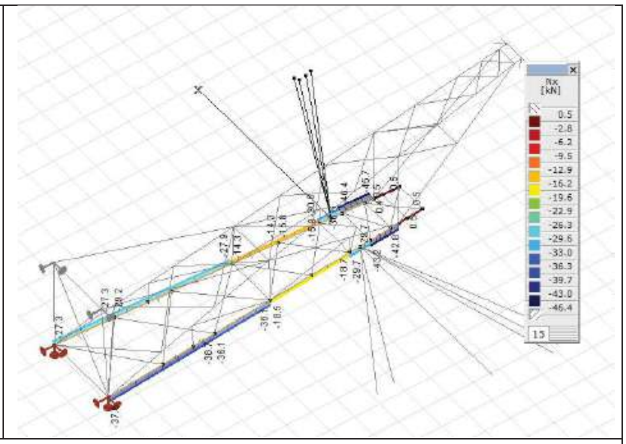
4.1 Comparison with PLS-TOWER

The existing model was analyzed in PLS Tower which is limited to analysing structures based on the axial forces in each member. Maximum compression occurs in the bottom chord which is also the most critical element in the structure. The axial force in the arms for the following load cases are displayed in Figure 4:

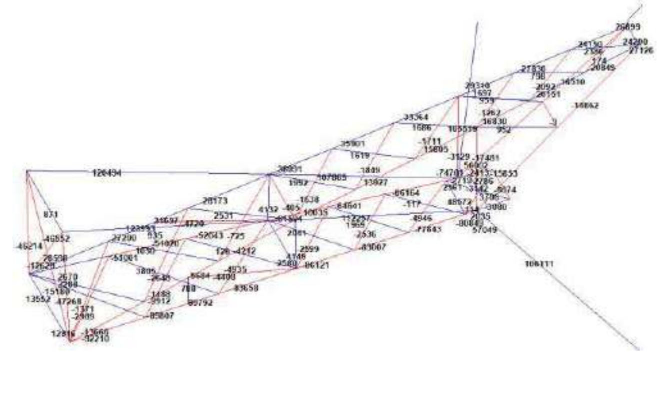
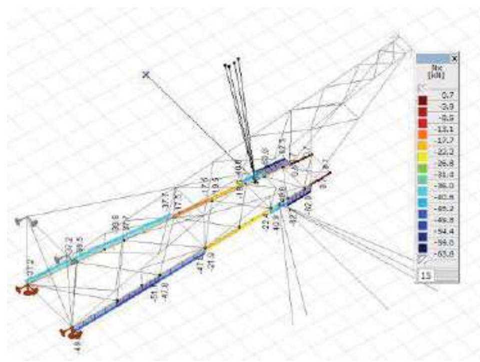
1. 01 ULA 1a_0
2. 13 ULA 3a,
3. 35 ULS 5a Ba 22,
4. SPLS1a 65.6 Ah All Cts
5. SPSL 3 65.5 Ah All Cts.

The compressive force has negative sign. The pictures on the left depict the existing situation from the PLS Tower model while the pictures right represent the axial force for the simulation in AxisVM.

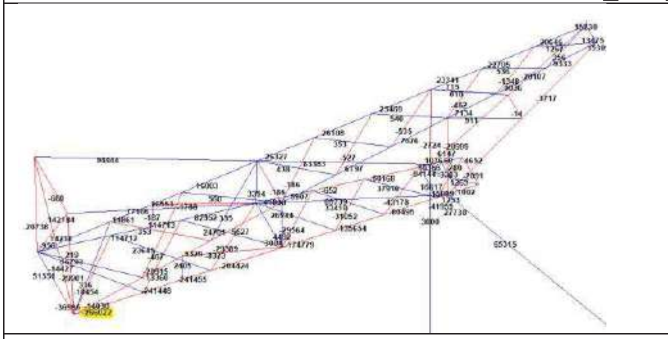
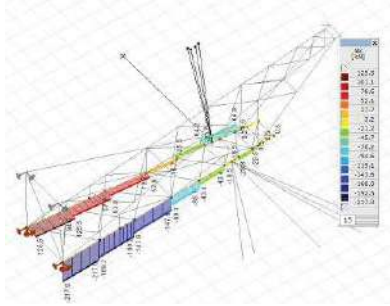




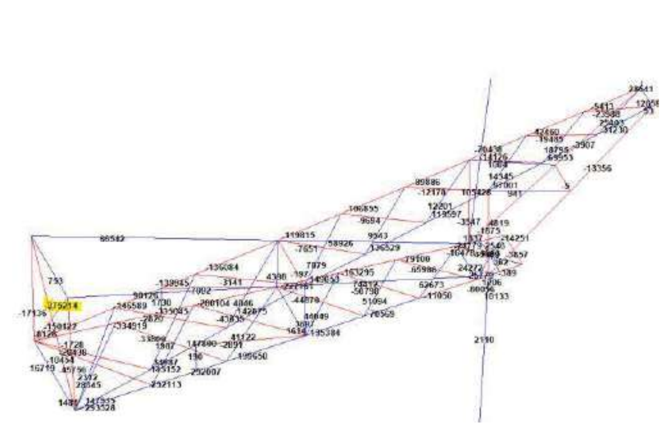
Load case – 01_ULA_1a_0 (max wind)

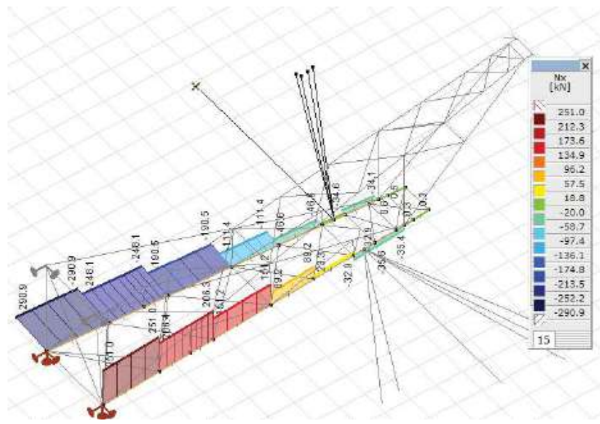
 

Load case - 13_ULA_3a (ice + wind)

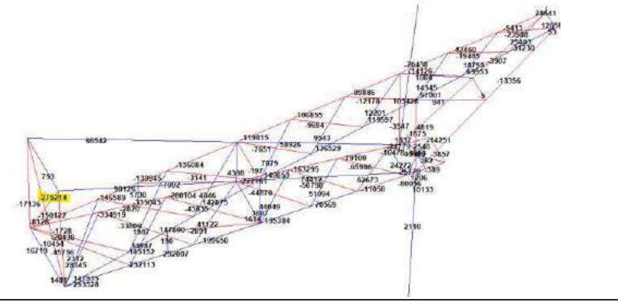
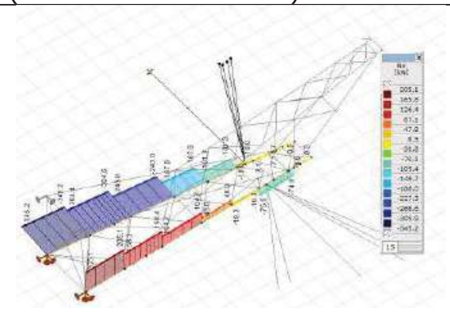
 

Load case – 35_ULS_5a_Ba_22 (Broken conductor - 22)_





Load case – 49_SPLS_1a_65,5_Ah All Cts (Broken conductor - 22)

Load case – 121_SPSL_3_65,5_Ah_All_Cts (Broken conductor - 25)

Figure 4 Axial forces generated by PLS Tower vs AxisVM

The forces in the bottom chord in the existing and new situation is tabulated in Table 2. The maximum force occurs in loads case 121_SPSL_3_65,5_Ah_All_Cts across the models and the critical force in the new scenario is 376 kN. The compressive force has reduced or are of the same magnitude from the existing situation.

Table 2 Comparison of compressive forces generated by PLS Tower vs AxisVM

Load Case	PLS tower force (kN)	AxisVM force (kN)
01_ULS_1a_0	112	30
13_ULA_3a	136	50
35_ULS_5a_Ba_22	266	278
49_SPLS_1a_65,5_Ah All Cts	375	290
121_SPSL_3_65,5_Ah_All_Cts	376	345

4.2 Member Analysis

The newly added as well as existing members in the tower are class 4 members as per Euro code classification.These members cannot be accurately analysed by Axis VM and so a stress-based approach is used. The stress in the members are shown in Figure 5 below. The maximum stress in newly added members, bottom chord and top chords are shown seperately in sub figures for clarity. The maximum stress acros the cross arm is 181 MPa which is lower than the yield stress of 235 MPa by a factor of approximately 1.3. This indicates that the crossarm is structurally sound.

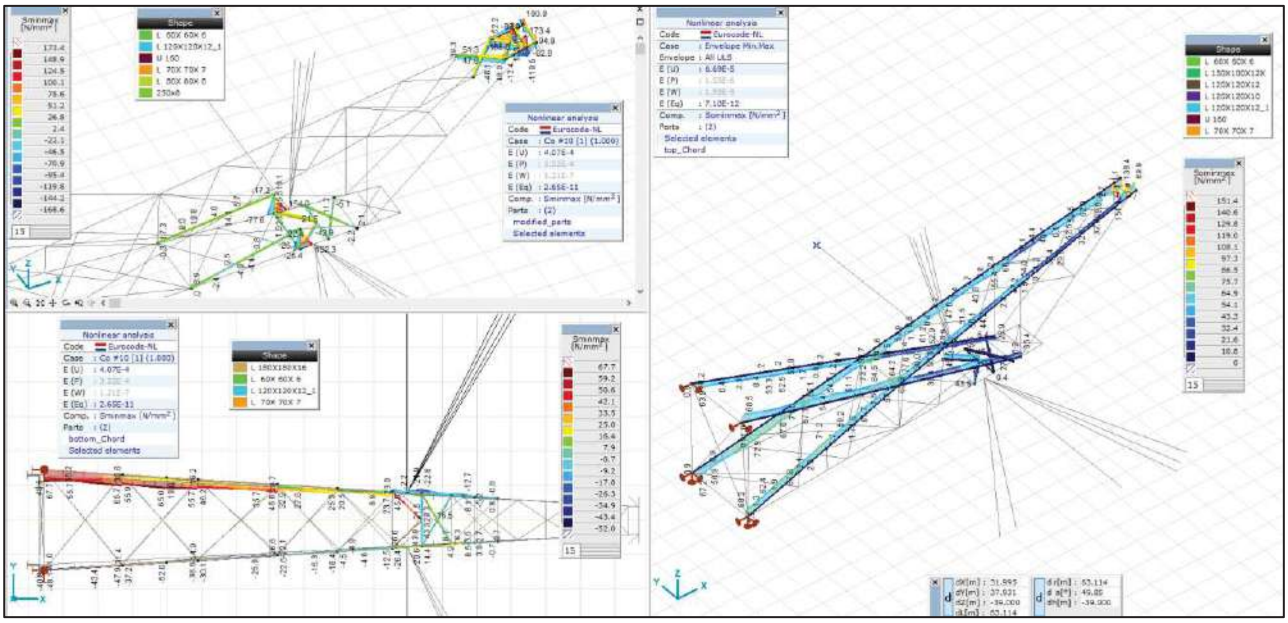


Figure 5 Stress of new members, top chord and bottom chord for ULS load case

5 CONCLUSION

It is evident that the maximum compressive force in the bottom chord has not increased when compared to the PLS TOWER analysis. The existing cross arm is therefore sufficient for the loads imposed by the repositioning of the insulators. This confirms the initial assumption of the studying the crossarm in isolation.

The new members are checked by comparing the stress from the analysis to their yield stress. Additional capacity of 30% is observed and is deemed sufficient for to cater for possible stress increases due to end conditions or other imperfections. Figure 6 shows the modification to the crossarm.

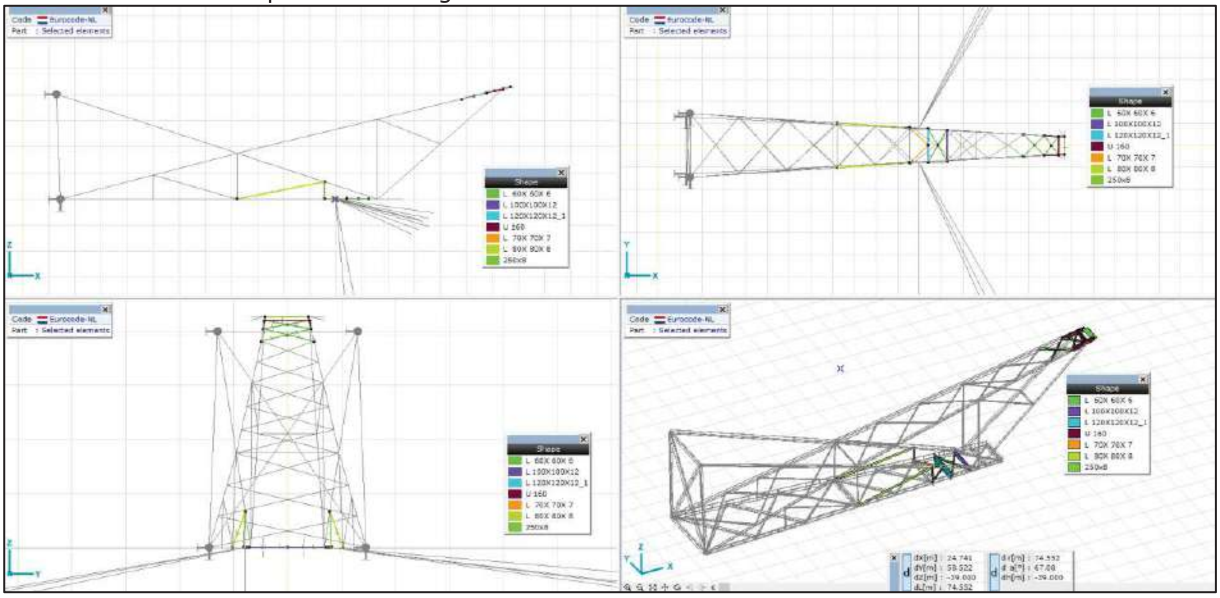


Figure 6 Overview of the HC+0 upper crossarm modification

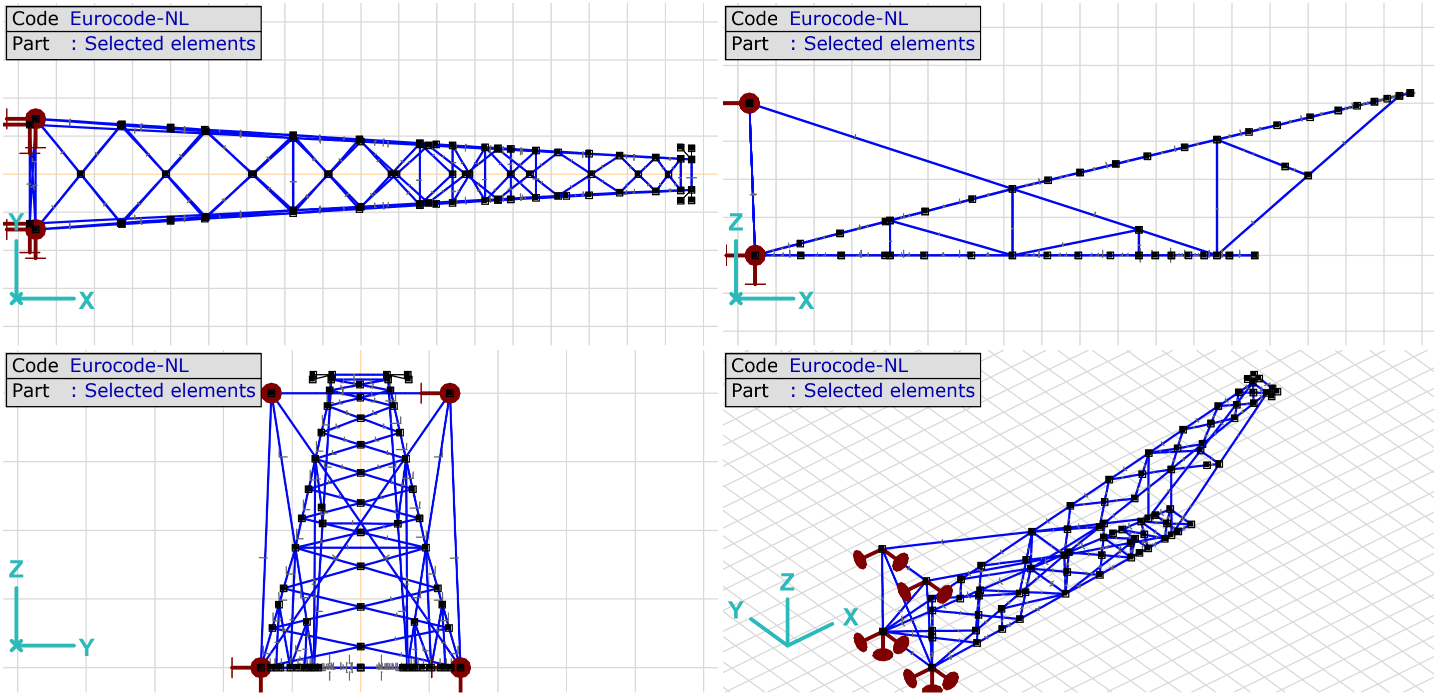
6 AXISVM OUTPUT

Project

Analysis by

AxisVM X5 R4a · Registered to DNV GL - Energy
HC+0-cross_arm_report.axs

Report



Model_views

Materials

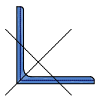
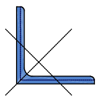
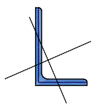
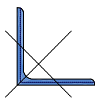
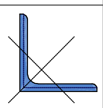
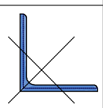
	Name	*Type*	*National design code*	*Material code*	*Model*	*E_x [N/mm^2]*	*E_y [N/mm^2]*	*ν*	*α_T [1/°C]*	*ρ [kg/m^3]*
1	S 235	Steel	Eurocode-NL	10025-2	Linear	210000	210000	0.30	1.2E-5	7850

	Name	*Material color*	*Contour color*	*Texture*	*P_1*	*P_2*	*P_3*
1	S 235			Steel	f_y[N/mm^2] = 235.00	f_u[N/mm^2] = 360.00	f_y^*[N/mm^2] = 215.00

	Name	*P_4*	*P_5*	*P_6*	*P_7*	*P_8*	*P_9*	*P_{10}*	*P_{11}*	*P_{12}*	*P_{13}*	*P_{14}*
1	S 235	f_u^*[N/mm^2] = 360.00										

Name: Material name; **Type:** Type of material; **Model:** Material model; **E_x:** Young's modulus of elasticity in local x direction; **E_y:** Young's modulus of elasticity in local y direction; **ν:** Poisson's ratio; **α_T:** Thermal expansion coefficient; **ρ:** Density; **Contour color:** Material outline color; **P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9, P_{10}, P_{11}, P_{12}, P_{13}, P_{14}:** Design parameter;

Cross-sections

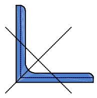
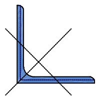
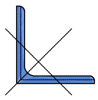
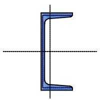
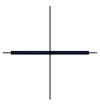
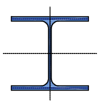
	Name	*Drawing*	*Process*	*Shape*	*h [mm]*	*b [mm]*	*tw [mm]*	*tf [mm]*	r_1 [mm]	r_2 [mm]	r_3 [mm]
1	L 180X180X16		Rolled	L	180.0	180.0	16.0	16.0	18.0	9.0	0
2	L 120X120X12		Rolled	L	120.0	120.0	12.0	12.0	13.0	6.5	0
3	L 150X100X12X		Rolled	L	150.0	100.0	12.0	12.0	13.0	6.5	0
4	L 100X100X 8		Rolled	L	100.0	100.0	8.0	8.0	12.0	6.0	0
5	L 50X 50X 5		Rolled	L	50.0	50.0	5.0	5.0	7.0	3.5	0
6	L 120X120X10		Rolled	L	120.0	120.0	10.0	10.0	13.0	6.5	0

	Name	*Ax* $[mm^2]$	*Ay* $[mm^2]$	*Az* $[mm^2]$	*Ix* $[mm^4]$	*Iy* $[mm^4]$	*Iz* $[mm^4]$	*Iyz* $[mm^4]$
1	L 180X180X16	5538.93	2403.86	2433.89	499973.8	1.7E+07	1.7E+07	−9905372.0
2	L 120X120X12	2754.22	1208.71	1219.23	139579.2	3676399.0	3676399.0	−2160249.0
3	L 150X100X12X	2874.22	968.08	1544.68	145589.2	6495756.0	2318462.0	−2245896.0
4	L 100X100X 8	1551.52	669.67	678.46	36218.9	1448264.0	1448264.0	−849655.4
5	L 50X 50X 5	480.28	210.38	213.29	4408.9	109629.1	109629.1	−64162.8
6	L 120X120X10	2318.22	1004.33	1014.85	82759.6	3129113.0	3129113.0	−1840138.0

	Name	I_1 $[mm^4]$	I_2 $[mm^4]$	α [°]	$I\omega$ $[mm^6]$	$W_{1,el,t}$ $[mm^3]$	$W_{1,el,b}$ $[mm^3]$	$W_{2,el,t}$ $[mm^3]$	$W_{2,el,b}$ $[mm^3]$
1	L 180X180X16	2.7E+07	6917778.0	45.00	1.1E+09	209999.1	209999.1	108387.8	97377.7
2	L 120X120X12	5836648.0	1516150.0	45.00	1.3E+08	68785.5	68785.5	35578.9	31565.4
3	L 150X100X12X	7474110.0	1340107.0	23.54	1.7E+08	73003.3	99555.1	25409.8	32155.0
4	L 100X100X 8	2297919.0	598608.2	45.00	2.3E+07	32497.5	32497.5	17014.9	15467.6
5	L 50X 50X 5	173791.9	45466.3	45.00	678722	4915.6	4915.6	2584.4	2290.7
6	L 120X120X10	4969251.0	1288975.0	45.00	7.9E+07	58563.2	58563.2	30420.2	27507.4

	Name	$W_{1,pl}$ $[mm^3]$	$W_{2,pl}$ $[mm^3]$	i_y [mm]	i_z [mm]	*Hy* [mm]	*Hz* [mm]	y_G [mm]	z_G [mm]	y_s [mm]	z_s [mm]	*S.p.*
1	L 180X180X16	331133.4	169336.0	55.1	55.1	180.0	180.0	50.2	50.2	−41.0	−41.0	4
2	L 120X120X12	109074.8	55859.7	36.5	36.5	120.0	120.0	34.0	34.0	−27.0	−27.0	4
3	L 150X100X12X	127637.8	51652.8	47.5	28.4	100.0	150.0	24.2	48.9	−17.8	−40.9	4
4	L 100X100X 8	51224.3	26412.7	30.6	30.6	100.0	100.0	27.4	27.4	−22.6	−22.6	4
5	L 50X 50X 5	7830.3	4045.4	15.1	15.1	50.0	50.0	14.0	14.0	−11.0	−11.0	4
6	L 120X120X10	92246.3	47331.9	36.7	36.7	120.0	120.0	33.1	33.1	−27.3	−27.3	4

Cross-sections

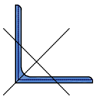
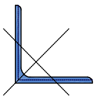
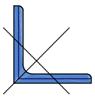
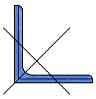
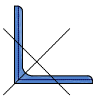
	Name	*Drawing*	*Process*	*Shape*	*h [mm]*	*b [mm]*	*tw [mm]*	*tf [mm]*	*r_1 [mm]*	*r_2 [mm]*	*r_3 [mm]*
7	L 50X 50X 6		Rolled	L	50.0	50.0	6.0	6.0	7.0	3.5	0
8	L 60X 60X 5		Rolled	L	60.0	60.0	5.0	5.0	8.0	4.0	0
9	L 60X 60X 6		Rolled	L	60.0	60.0	6.0	6.0	8.0	4.0	0
10	U 160		Rolled	U	160.0	65.0	7.5	10.5	10.5	5.5	0
11	250x8		Rolled	Rect.	8.0	250.0	0	0	0	0	0
12	HE 160 A		Rolled	I	152.0	160.0	6.0	9.0	15.0	0	0

	Name	*Ax [mm^2]*	*Ay [mm^2]*	*Az [mm^2]*	*Ix [mm^4]*	*Iy [mm^4]*	*Iz [mm^4]*	*Iyz [mm^4]*
7	L 50X 50X 6	569.28	253.93	256.85	7382.5	128392.8	128392.8	−75011.6
8	L 60X 60X 5	581.90	251.80	255.13	5401.4	193681.9	193681.9	−113374.7
9	L 60X 60X 6	690.90	302.80	306.64	9044.2	227898.9	227898.9	−133497.7
10	U 160	2401.46	779.16	1094.03	74997.1	9247535.0	850482.0	0
11	250x8	2000.00	1666.67	1666.67	41790.8	10666.7	1E+07	0
12	HE 160 A	3878.04	2636.55	888.57	121366.2	1.7E+07	6155809.0	0

	Name	*I_1 [mm^4]*	*I_2 [mm^4]*	*α [°]*	*Iω [mm^6]*	*$W_{1,el,t}$ [mm^3]*	*$W_{1,el,b}$ [mm^3]*	*$W_{2,el,t}$ [mm^3]*	*$W_{2,el,b}$ [mm^3]*
7	L 50X 50X 6	203404.4	53381.2	45.00	1127709	5753.1	5753.1	3014.6	2611.5
8	L 60X 60X 5	307056.6	80307.2	45.00	1215843	7237.4	7237.4	3812.7	3455.3
9	L 60X 60X 6	361396.6	94401.2	45.00	2037188	8518.2	8518.2	4463.6	3956.0
10	U 160	9247535.0	850482.0	0	3.2E+09	115594.2	115594.2	18249.1	46232.2
11	250x8	1E+07	10666.7	90.00	5.4E+07	83333.3	83333.3	2666.7	2666.7
12	HE 160 A	1.7E+07	6155809.0	0	3.1E+10	220173.4	220173.4	76947.6	76947.6

	Name	*$W_{1,pl}$ [mm^3]*	*$W_{2,pl}$ [mm^3]*	*i_y [mm]*	*i_z [mm]*	*Hy [mm]*	*Hz [mm]*	*y_G [mm]*	*z_G [mm]*	*y_s [mm]*	*z_s [mm]*	*S.p.*
7	L 50X 50X 6	9234.4	4760.1	15.0	15.0	50.0	50.0	14.5	14.5	−10.8	−10.8	4
8	L 60X 60X 5	11449.3	5927.0	18.2	18.2	60.0	60.0	16.4	16.4	−13.4	−13.4	4
9	L 60X 60X 6	13554.5	6989.1	18.2	18.2	60.0	60.0	16.9	16.9	−13.3	−13.3	4
10	U 160	137539.2	35145.4	62.1	18.8	65.0	160.0	18.4	80.0	−34.9	0	8
11	250x8	125000.0	4000.0	2.3	72.2	250.0	8.0	125.0	4.0	0	0	5
12	HE 160 A	245202.6	117640.1	65.7	39.8	160.0	152.0	80.0	76.0	0	0	9

Cross-sections

	Name	*Drawing*	*Process*	*Shape*	*h [mm]*	*b [mm]*	*tw [mm]*	*tf [mm]*	*r_1 [mm]*	*r_2 [mm]*	*r_3 [mm]*
13	L 90X 90X 7		Rolled	L	90.0	90.0	7.0	7.0	11.0	5.5	0
14	L 80X 80X 6		Rolled	L	80.0	80.0	6.0	6.0	10.0	5.0	0
15	L 100X100X12		Rolled	L	100.0	100.0	12.0	12.0	12.0	6.0	0
16	L 80X 80X 8		Rolled	L	80.0	80.0	8.0	8.0	10.0	5.0	0
17	L 70X 70X 7		Rolled	L	70.0	70.0	7.0	7.0	9.0	4.5	0

	Name	*Ax [mm^2]*	*Ay [mm^2]*	*Az [mm^2]*	*Ix [mm^4]*	*Iy [mm^4]*	*Iz [mm^4]*	*Iyz [mm^4]*
13	L 90X 90X 7	1224.04	527.22	534.59	22025.5	925370.1	925370.2	−542496.5
14	L 80X 80X 6	934.78	402.15	407.43	12473.9	558166.2	558166.2	−326876.9
15	L 100X100X12	2271.52	1013.59	1022.43	115069.0	2066722.0	2066722.0	−1209266.0
16	L 80X 80X 8	1226.78	537.99	544.05	28221.9	722397.8	722397.8	−423612.4
17	L 70X 70X 7	939.73	412.00	416.89	16632.0	422933.4	422933.4	−247895.0

	Name	*I_1 [mm^4]*	*I_2 [mm^4]*	*α [°]*	*Iω [mm^6]*	*$W_{1,el,t}$ [mm^3]*	*$W_{1,el,b}$ [mm^3]*	*$W_{2,el,t}$ [mm^3]*	*$W_{2,el,b}$ [mm^3]*
13	L 90X 90X 7	1467867.0	382873.6	45.00	1.1E+07	23065.3	23065.3	12103.1	11041.2
14	L 80X 80X 6	885043.1	231289.3	45.00	5085144	15645.5	15645.5	8233.3	7546.6
15	L 100X100X12	3275987.0	857455.8	45.00	7.3E+07	46329.5	46329.5	24048.5	20885.3
16	L 80X 80X 8	1146010.0	298785.4	45.00	1.2E+07	20258.8	20258.8	10570.7	9369.6
17	L 70X 70X 7	670828.4	175038.4	45.00	5155803	13552.8	13552.8	7084.6	6279.1

	Name	*$W_{1,pl}$ [mm^3]*	*$W_{2,pl}$ [mm^3]*	*i_y [mm]*	*i_z [mm]*	*Hy [mm]*	*Hz [mm]*	*y_G [mm]*	*z_G [mm]*	*y_s [mm]*	*z_s [mm]*	*S.p.*
13	L 90X 90X 7	36344.2	18768.7	27.5	27.5	90.0	90.0	24.5	24.5	−20.3	−20.3	4
14	L 80X 80X 6	24644.0	12753.5	24.4	24.4	80.0	80.0	21.7	21.7	−18.1	−18.1	4
15	L 100X100X12	74182.2	38079.2	30.2	30.2	100.0	100.0	29.0	29.0	−21.9	−21.9	4
16	L 80X 80X 8	32196.1	16562.3	24.3	24.3	80.0	80.0	22.5	22.5	−17.8	−17.8	4
17	L 70X 70X 7	21550.0	11096.7	21.2	21.2	70.0	70.0	19.7	19.7	−15.5	−15.5	4

Cross-sections

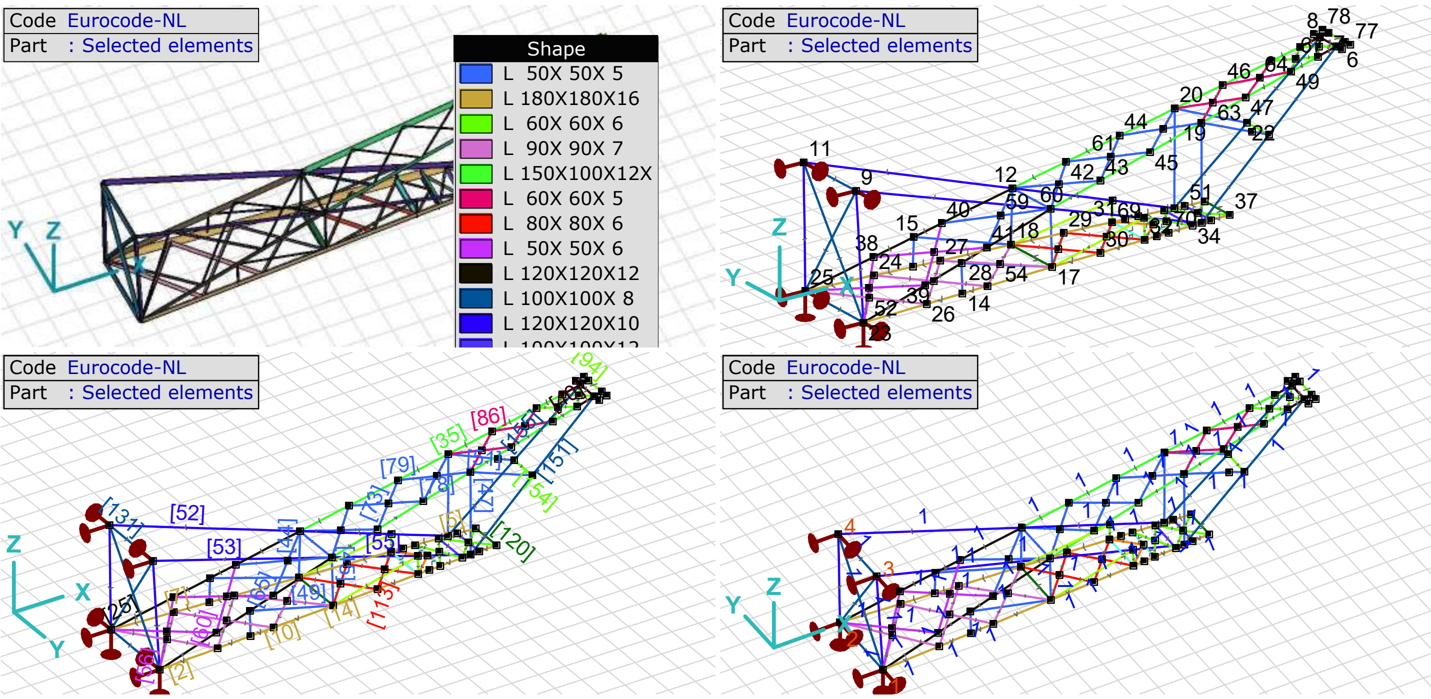
	Name	Drawing	Process	Shape	h [mm]	b [mm]	tw [mm]	tf [mm]	r_1 [mm]	r_2 [mm]	r_3 [mm]
18	L 120X120X12_1		Rolled	Custom	360.0	120.0	12.0	12.0	13.0	6.5	0

	Name	Ax [mm²]	Ay [mm²]	Az [mm²]	Ix [mm⁴]	Iy [mm⁴]	Iz [mm⁴]	Iyz [mm⁴]
18	L 120X120X12_1	5508.29	0	0	258822.2	5.6E+07	7353251.0	0

	Name	I_1 [mm⁴]	I_2 [mm⁴]	α [°]	Iω [mm⁶]	$W_{1,el,t}$ [mm³]	$W_{1,el,b}$ [mm³]	$W_{2,el,t}$ [mm³]	$W_{2,el,b}$ [mm³]
18	L 120X120X12_1	5.6E+07	7353251.0	0	2.1E+10	310993.1	310993.1	85468.5	216492.6

	Name	$W_{1,pl}$ [mm³]	$W_{2,pl}$ [mm³]	i_y [mm]	i_z [mm]	Hy [mm]	Hz [mm]	y_G [mm]	z_G [mm]	y_s [mm]	z_s [mm]	S.p.
18	L 120X120X12_1	517513.3	155560.4	100.8	36.5	120.0	360.0	34.0	180.0	11.6	0	4

Name: Cross-section name; **Process:** Manufacturing process; **h:** Cross-section height; **b:** Cross-section width; **tw:** Web thickness; **tf:** Flange thickness; r_1, r_2, r_3: Rounding radius;
Ax: Cross-section area; **Ay, Az:** Shear area; **Ix:** Torsional inertia; **Iy, Iz:** Flexural inertia; **Iyz:** Centrifugal inertia; I_1, I_2: Principal flexural inertia; **α:** Principal directions; **Iω:** Warping constant;
$W_{1,el,t}$, $W_{1,el,b}$, $W_{2,el,t}$, $W_{2,el,b}$: Elastic modulus; $W_{1,pl}$, $W_{2,pl}$: Plastic modulus; i_y, i_z: Radius of inertia; **Hy:** Dimension in local y direction; **Hz:** Dimension in local z direction;
y_G: y coordinate of the center of gravity; z_G: z coordinate of the center of gravity; y_s: y coordinate of the shear (torsion) center relative to the center of gravity;
z_s: z coordinate of the shear (torsion) center relative to the center of gravity; **S.p.:** Stress calculation points;



Model_nodes, beam_ID's and Materials

Nodes [Selected]

	X [m]	Y [m]	Z [m]	e_X	e_Y	e_Z	θ_X	θ_Y	θ_Z
1	13.600	−0.682	39.000	f	f	f	f	f	f
3	13.600	0.682	39.000	f	f	f	f	f	f

Nodes [Selected]

	X [m]	Y [m]	Z [m]	e_X	e_Y	e_Z	θ_X	θ_Y	θ_Z
5	18.691	−0.416	43.270	f	f	f	f	f	f
6	18.400	−0.700	43.200	f	f	f	f	f	f
7	18.691	0.384	43.270	f	f	f	f	f	f
8	18.400	0.700	43.200	f	f	f	f	f	f
9	1.300	−1.300	43.000	f	f	f	f	f	f
10	8.225	−0.952	40.748	f	f	f	f	f	f
11	1.300	1.300	43.000	f	f	f	f	f	f
12	8.225	0.952	40.748	f	f	f	f	f	f
13	5.002	−1.191	39.916	f	f	f	f	f	f
14	5.002	−1.229	39.000	f	f	f	f	f	f
15	5.002	1.191	39.916	f	f	f	f	f	f
16	5.002	1.229	39.000	f	f	f	f	f	f
17	8.224	−1.024	39.000	f	f	f	f	f	f
18	8.224	1.024	39.000	f	f	f	f	f	f
19	13.600	−0.660	42.043	f	f	f	f	f	f
20	13.600	0.660	42.043	f	f	f	f	f	f
21	16.000	−0.554	41.100	f	f	f	f	f	f
22	16.000	0.541	41.100	f	f	f	f	f	f
23	1.455	−1.455	39.000	f	f	f	f	f	f
24	3.723	1.311	39.000	f	f	f	f	f	f
25	1.455	1.455	39.000	f	f	f	f	f	f
26	3.723	−1.311	39.000	f	f	f	f	f	f
27	5.903	1.172	39.000	f	f	f	f	f	f
28	5.903	−1.172	39.000	f	f	f	f	f	f
29	9.958	0.914	39.000	f	f	f	f	f	f
30	9.958	−0.914	39.000	f	f	f	f	f	f
31	11.551	0.812	39.000	f	f	f	f	f	f
32	11.551	−0.812	39.000	f	f	f	f	f	f
33	13.265	0.703	39.000	f	f	f	f	f	f
34	13.265	−0.703	39.000	f	f	f	f	f	f
35	13.935	0	39.000	f	f	f	f	f	f
36	14.600	0.618	39.000	f	f	f	f	f	f
37	14.600	−0.618	39.000	f	f	f	f	f	f
38	3.689	1.289	39.577	f	f	f	f	f	f
39	3.689	−1.289	39.577	f	f	f	f	f	f
40	5.923	1.123	40.154	f	f	f	f	f	f
41	5.923	−1.123	40.154	f	f	f	f	f	f
42	9.999	0.856	41.175	f	f	f	f	f	f
43	9.999	−0.856	41.175	f	f	f	f	f	f
44	11.773	0.759	41.603	f	f	f	f	f	f
45	11.773	−0.759	41.603	f	f	f	f	f	f
46	15.184	0.574	42.425	f	f	f	f	f	f
47	15.184	−0.574	42.425	f	f	f	f	f	f
48	16.797	0.487	42.814	f	f	f	f	f	f
49	16.797	−0.487	42.814	f	f	f	f	f	f
50	13.935	−0.660	39.000	f	f	f	f	f	f
51	13.935	0.660	39.000	f	f	f	f	f	f
52	2.648	0	39.000	f	f	f	f	f	f
53	4.874	0	39.000	f	f	f	f	f	f
54	7.142	0	39.000	f	f	f	f	f	f
55	9.140	0	39.000	f	f	f	f	f	f
56	10.802	0	39.000	f	f	f	f	f	f
57	2.640	0	39.306	f	f	f	f	f	f
58	4.883	0	39.885	f	f	f	f	f	f
59	7.169	0	40.475	f	f	f	f	f	f
60	9.159	0	40.973	f	f	f	f	f	f
61	10.939	0	41.402	f	f	f	f	f	f
62	12.750	0	41.838	f	f	f	f	f	f
63	14.447	0	42.247	f	f	f	f	f	f
64	16.057	0	42.635	f	f	f	f	f	f

Nodes [Selected]

	X [m]	Y [m]	Z [m]	e_X	e_Y	e_Z	θ_X	θ_Y	θ_Z
65	17.744	−0.451	43.042	f	f	f	f	f	f
66	17.744	0.436	43.042	f	f	f	f	f	f
67	17.293	−0.004	42.933	f	f	f	f	f	f
68	11.549	−0.785	39.667	f	f	f	f	f	f
69	11.549	0.785	39.667	f	f	f	f	f	f
70	12.408	−0.758	39.000	f	f	f	f	f	f
71	12.408	0.758	39.000	f	f	f	f	f	f
72	12.408	0	39.000	f	f	f	f	f	f
73	12.852	0	39.000	f	f	f	f	f	f
74	18.400	−0.427	43.200	f	f	f	f	f	f
75	18.400	0.400	43.200	f	f	f	f	f	f
76	18.084	−0.011	43.124	f	f	f	f	f	f
77	18.691	−0.689	43.270	f	f	f	f	f	f
78	18.691	0.684	43.270	f	f	f	f	f	f
87	11.980	−0.785	39.000	f	f	f	f	f	f
88	11.980	0.785	39.000	f	f	f	f	f	f
121	15.400	−0.571	41.336	f	f	f	f	f	f

e_X: Nodal DOF (translation constraint X); **e_Y:** Nodal DOF (translation constraint Y); **e_Z:** Nodal DOF (translation constraint Z); **θ_X:** Nodal DOF (rotation constraint about X-Axis);
θ_Y: Nodal DOF (rotation constraint about Y-Axis); **θ_Z:** Nodal DOF (rotation constraint about Z-Axis);

Beams [Selected]

	Node i	Node j	Length	Local x	Material	Start cross-section	End cross-section	Ref_z	ER_{St}	ER_{End}
1	23	→ 26	2.273	i - j	S 235	1	1	Auto	.	.
2	24	← 25	2.273	j - i	S 235	1	1	R1	.	.
3	1	→ 50	0.336	i - j	S 235	1	1	Auto	.	.
4	3	→ 51	0.336	i - j	S 235	1	1	R1	.	.
5	37	← 50	0.666	j - i	S 235	1	1	Auto	.	.
6	36	← 51	0.666	j - i	S 235	1	1	R1	.	.
7	14	← 26	1.282	j - i	S 235	1	1	Auto	.	.
8	16	← 24	1.282	j - i	S 235	1	1	R1	.	.
9	14	→ 28	0.903	i - j	S 235	1	1	Auto	.	.
10	16	→ 27	0.903	i - j	S 235	1	1	R1	.	.
11	17	← 28	2.326	j - i	S 235	1	1	Auto	.	.
12	18	← 27	2.326	j - i	S 235	1	1	R1	.	.
13	17	→ 30	1.737	i - j	S 235	1	1	Auto	.	.
14	18	→ 29	1.737	i - j	S 235	1	1	R1	.	.
15	30	→ 32	1.596	i - j	S 235	1	1	Auto	.	.
16	29	→ 31	1.596	i - j	S 235	1	1	R1	.	.
17	32	→ 70	0.859	i - j	S 235	1	1	Auto	.	.
18	31	→ 71	0.859	i - j	S 235	1	1	R1	.	.
19	1	← 34	0.336	j - i	S 235	1	1	Auto	.	.
20	3	← 33	0.336	j - i	S 235	1	1	R1	.	.
21	13	← 39	1.360	j - i	S 235	2	2	Auto	.	.
22	15	← 38	1.360	j - i	S 235	2	2	R1	.	.
23	10	← 41	2.384	j - i	S 235	2	2	Auto	.	.
24	12	← 40	2.384	j - i	S 235	2	2	R1	.	.
25	23	→ 39	2.313	i - j	S 235	2	2	Auto	.	.
26	25	→ 38	2.313	i - j	S 235	2	2	R1	.	.
27	13	→ 41	0.954	i - j	S 235	2	2	Auto	.	.
28	15	→ 40	0.954	i - j	S 235	2	2	R1	.	.
29	10	→ 43	1.827	i - j	S 235	3	3	Auto	.	.
30	12	→ 42	1.827	i - j	S 235	3	3	R1	.	.
31	43	→ 45	1.827	i - j	S 235	3	3	Auto	.	.
32	42	→ 44	1.827	i - j	S 235	3	3	R1	.	.
33	19	← 45	1.882	j - i	S 235	3	3	Auto	.	.
34	20	← 44	1.882	j - i	S 235	3	3	R1	.	.
35	19	→ 47	1.632	i - j	S 235	3	3	Auto	.	.

Beams [Selected]

	Node i	*Node j*	*Length*	*Local x*	*Material*	*Start cross-section*	*End cross-section*	*Ref$_z$*	*ER$_{St}$*	*ER$_{End}$*
36	20	→ 46	1.632	i - j	S 235	3	3	R1	.	.
37	47	→ 49	1.662	i - j	S 235	3	3	Auto	.	.
38	46	→ 48	1.662	i - j	S 235	3	3	R1	.	.
39	5	← 65	0.975	j - i	S 235	10	10	Auto	.	.
40	7	← 66	0.976	j - i	S 235	10	10	R2	.	.
41	3	→ 22	3.192	i - j	S 235	4	4	R1	.	.
42	13	← 14	0.917	j - i	S 235	5	5	Auto	.	.
43	15	← 16	0.917	j - i	S 235	5	5	Auto	.	.
44	10	← 17	1.749	j - i	S 235	5	5	Auto	.	.
45	12	← 18	1.749	j - i	S 235	5	5	Auto	.	.
46	1	→ 19	3.043	i - j	S 235	5	5	Auto	.	.
47	3	→ 20	3.043	i - j	S 235	5	5	Auto	.	.
48	13	→ 17	3.354	i - j	S 235	5	5	Auto	.	.
49	15	→ 18	3.354	i - j	S 235	5	5	Auto	.	.
50	19	→ 121	1.936	i - j	S 235	5	5	Auto	.	.
51	20	→ 22	2.581	i - j	S 235	5	5	Auto	.	.
52	9	→ 10	7.290	i - j	S 235	6	6	Auto	.	.
53	11	→ 12	7.290	i - j	S 235	6	6	R1	.	.
54	1	← 10	5.659	j - i	S 235	6	6	Auto	.	.
55	3	← 12	5.659	j - i	S 235	6	6	R1	.	.
56	25	← 57	1.901	j - i	S 235	7	7	Auto	.	.
57	39	→ 57	1.684	i - j	S 235	7	7	Auto	.	.
58	23	→ 57	1.901	i - j	S 235	7	7	Auto	.	.
59	38	← 57	1.684	j - i	S 235	7	7	Auto	.	.
60	38	← 58	1.784	j - i	S 235	7	7	Auto	.	.
61	41	→ 58	1.554	i - j	S 235	7	7	Auto	.	.
62	39	→ 58	1.784	i - j	S 235	7	7	Auto	.	.
63	40	← 58	1.554	j - i	S 235	7	7	Auto	.	.
64	10	← 59	1.448	j - i	S 235	5	5	Auto	.	.
65	40	→ 59	1.708	i - j	S 235	5	5	Auto	.	.
66	12	← 59	1.448	j - i	S 235	5	5	Auto	.	.
67	41	→ 59	1.708	i - j	S 235	5	5	Auto	.	.
68	12	← 60	1.353	j - i	S 235	5	5	Auto	.	.
69	43	→ 60	1.216	i - j	S 235	5	5	Auto	.	.
70	10	→ 60	1.353	i - j	S 235	5	5	Auto	.	.
71	42	← 60	1.216	j - i	S 235	5	5	Auto	.	.
72	42	→ 61	1.292	i - j	S 235	5	5	Auto	.	.
73	45	← 61	1.145	j - i	S 235	5	5	Auto	.	.
74	43	→ 61	1.292	i - j	S 235	5	5	Auto	.	.
75	44	← 61	1.145	j - i	S 235	5	5	Auto	.	.
76	19	← 62	1.095	j - i	S 235	5	5	Auto	.	.
77	44	→ 62	1.260	i - j	S 235	5	5	Auto	.	.
78	20	← 62	1.095	j - i	S 235	5	5	Auto	.	.
79	45	→ 62	1.260	i - j	S 235	5	5	Auto	.	.
80	20	→ 63	1.093	i - j	S 235	8	8	Auto	.	.
81	47	← 63	0.951	j - i	S 235	8	8	Auto	.	.
82	19	→ 63	1.093	i - j	S 235	8	8	Auto	.	.
83	46	← 63	0.951	j - i	S 235	8	8	Auto	.	.
84	46	→ 64	1.065	i - j	S 235	8	8	Auto	.	.
85	49	← 64	0.904	j - i	S 235	8	8	Auto	.	.
86	47	→ 64	1.065	i - j	S 235	8	8	Auto	.	.
87	48	← 64	0.904	j - i	S 235	8	8	Auto	.	.
88	48	← 67	0.708	j - i	S 235	9	9	Auto	.	.
89	65	→ 67	0.645	i - j	S 235	9	9	Auto	.	.
90	49	→ 67	0.702	i - j	S 235	9	9	Auto	.	.
91	66	← 67	0.640	j - i	S 235	9	9	Auto	.	.
92	49	→ 65	0.975	i - j	S 235	3	3	Auto	.	.
93	48	→ 66	0.976	i - j	S 235	3	3	R1	.	.
94	5	→ 7	0.800	i - j	S 235	11	11	Auto	.	.

Beams [Selected]

	Node i	*Node j*	*Length*	*Local x*	*Material*	*Start cross-section*	*End cross-section*	Ref_z	ER_{St}	ER_{End}
95	10	→ 12	1.904	i - j	S 235	5	5	Auto	.	.
96	17	→ 18	2.048	i - j	S 235	12	12	Auto	.	.
97	25	← 52	1.882	j - i	S 235	13	13	Auto	.	.
98	26	→ 52	1.695	i - j	S 235	13	13	Auto	.	.
99	23	→ 52	1.882	i - j	S 235	13	13	Auto	.	.
100	24	← 52	1.695	j - i	S 235	13	13	Auto	.	.
101	24	← 53	1.745	j - i	S 235	13	13	Auto	.	.
102	28	→ 53	1.560	i - j	S 235	13	13	Auto	.	.
103	26	→ 53	1.745	i - j	S 235	13	13	Auto	.	.
104	27	← 53	1.560	j - i	S 235	13	13	Auto	.	.
105	17	← 54	1.490	j - i	S 235	13	13	Auto	.	.
106	27	→ 54	1.705	i - j	S 235	13	13	Auto	.	.
107	18	← 54	1.490	j - i	S 235	13	13	Auto	.	.
108	28	→ 54	1.705	i - j	S 235	13	13	Auto	.	.
109	18	← 55	1.374	j - i	S 235	14	14	Auto	.	.
110	30	→ 55	1.226	i - j	S 235	14	14	Auto	.	.
111	17	→ 55	1.374	i - j	S 235	14	14	Auto	.	.
112	29	← 55	1.226	j - i	S 235	14	14	Auto	.	.
113	29	← 56	1.244	j - i	S 235	14	14	Auto	.	.
114	32	→ 56	1.105	i - j	S 235	14	14	Auto	.	.
115	30	→ 56	1.244	i - j	S 235	14	14	Auto	.	.
116	31	← 56	1.105	j - i	S 235	14	14	Auto	.	.
117	33	← 34	1.406	j - i	S 235	15	15	Auto	.	.
118	35	← 50	0.660	j - i	S 235	15	15	Auto	.	.
119	35	→ 51	0.660	i - j	S 235	15	15	Auto	.	.
120	36	← 37	1.236	j - i	S 235	12	12	Auto	.	.
121	34	→ 35	0.971	i - j	S 235	9	9	Auto	.	.
122	33	← 35	0.971	j - i	S 235	9	9	Auto	.	.
123	35	→ 36	0.908	i - j	S 235	9	9	Auto	.	.
124	35	→ 37	0.908	i - j	S 235	9	9	Auto	.	.
125	32	→ 68	0.667	i - j	S 235	9	9	Auto	.	.
126	31	→ 69	0.667	i - j	S 235	9	9	Auto	.	.
127	18	→ 69	3.400	i - j	S 235	16	16	Auto	.	.
128	17	→ 68	3.400	i - j	S 235	16	16	Auto	.	.
129	9	← 23	4.006	j - i	S 235	6	6	Auto	.	.
130	11	← 25	4.006	j - i	S 235	6	6	Auto	.	.
131	9	→ 11	2.600	i - j	S 235	4	4	Auto	.	.
132	11	← 23	4.859	j - i	S 235	4	4	Auto	.	.
133	9	← 25	4.859	j - i	S 235	4	4	Auto	.	.
134	23	→ 25	2.910	i - j	S 235	4	4	Auto	.	.
135	70	→ 72	0.758	i - j	S 235	18	18	R2	.	.
136	71	← 72	0.758	j - i	S 235	18	18	R2	.	.
137	31	← 32	1.624	j - i	S 235	18	18	Auto	.	.
138	34	→ 73	0.815	i - j	S 235	9	9	Auto	.	.
139	71	← 73	0.878	j - i	S 235	9	9	Auto	.	.
140	33	← 73	0.815	j - i	S 235	9	9	Auto	.	.
141	70	→ 73	0.878	i - j	S 235	9	9	Auto	.	.
142	31	→ 72	1.181	i - j	S 235	17	17	Auto	.	.
143	32	→ 72	1.181	i - j	S 235	17	17	Auto	.	.
144	34	← 70	0.859	j - i	S 235	1	1	Auto	.	.
145	33	← 71	0.859	j - i	S 235	1	1	R1	.	.
146	66	← 76	0.567	j - i	S 235	9	9	Auto	.	.
147	74	→ 76	0.528	i - j	S 235	9	9	Auto	.	.
148	65	→ 76	0.562	i - j	S 235	9	9	Auto	.	.
149	75	← 76	0.524	j - i	S 235	9	9	Auto	.	.
150	74	→ 75	0.827	i - j	S 235	10	10	Auto	.	.
151	22	→ 75	3.192	i - j	S 235	4	4	R1	.	.
152	21	← 121	0.645	j - i	S 235	5	5	Auto	.	.
153	1	→ 21	3.192	i - j	S 235	4	4	Auto	.	.

Beams [Selected]

	Node i	*Node j*	*Length*	*Local x*	*Material*	*Start cross-section*	*End cross-section*	*Ref_z*	*ER_{St}*	*ER_{End}*
154	21	22	1.095	i - j	S 235	9	9	Auto	.	.
155	21	74	3.191	i - j	S 235	4	4	Auto	.	.

Node i: Node at i end; **Node j:** Node at j end; **Length:** Beam length; **Local x:** Local x direction; **Ref_z:** Reference for local z direction; **ER_{St}:** End releases at start point; **ER_{End}:** End releases at end point;

Nodal supports [Selected]

	Node	*X [m]*	*Y [m]*	*Z [m]*
1	23	1.455	−1.455	39.000
2	25	1.455	1.455	39.000
3	9	1.300	−1.300	43.000
4	11	1.300	1.300	43.000

	Node	*Type*	*$Name_x$*	*K_x [kN/m]*	*K_{xV} [kN/m]*	*$Name_y$*	*K_y [kN/m]*	*K_{yV} [kN/m]*	*$Name_z$*
1	23	Glob.	Rigid - Translational	1E+10	1E+10	Rigid - Translational	1E+10	1E+10	Rigid - Translational
2	25	Glob.	Rigid - Translational	1E+10	1E+10	Rigid - Translational	1E+10	1E+10	Rigid - Translational
3	9	Glob.	Rigid - Translational	1E+10	1E+10	Rigid - Translational	1E+10	1E+10	—
4	11	Glob.	Rigid - Translational	1E+10	1E+10	Rigid - Translational	1E+10	1E+10	—

	Node	*K_z [kN/m]*	*K_{zV} [kN/m]*	*$Name_{xx}$*	*K_{xx} [kNm/rad]*	*K_{xxV} [kNm/rad]*	*$Name_{yy}$*	*K_{yy} [kNm/rad]*	*K_{yyV} [kNm/rad]*	*$Name_{zz}$*	*K_{zz} [kNm/rad]*
1	23	1E+10	1E+10	—	–	–	—	–	–	—	–
2	25	1E+10	1E+10	—	–	–	—	–	–	—	–
3	9	–	–	—	–	–	—	–	–	—	–
4	11	–	–	—	–	–	—	–	–	—	–

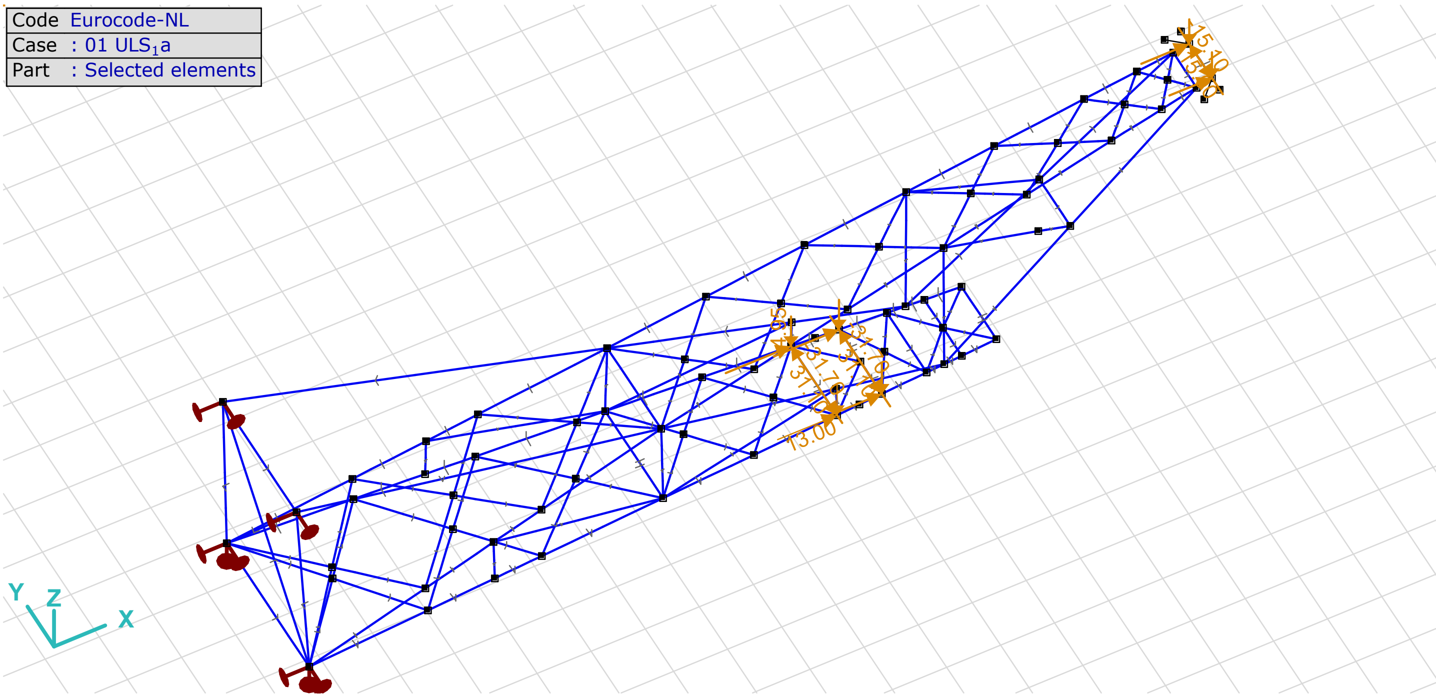
	Node	*K_{zzV} [kNm/rad]*
1	23	–
2	25	–
3	9	–
4	11	–

Node: Supported node; **Type:** Support type; **$Name_x$:** Name of the spring characteristics; **K_x:** Initial stiffness; **K_{xV}:** Vibration stiffness; **$Name_y$:** Name of the spring characteristics; **K_y:** Initial stiffness; **K_{yV}:** Vibration stiffness; **$Name_z$:** Name of the spring characteristics; **K_z:** Initial stiffness; **K_{zV}:** Vibration stiffness; **$Name_{xx}$:** Name of the spring characteristics; **K_{xx}:** Initial stiffness; **K_{xxV}:** Vibration stiffness; **$Name_{yy}$:** Name of the spring characteristics; **K_{yy}:** Initial stiffness; **K_{yyV}:** Vibration stiffness; **$Name_{zz}$:** Name of the spring characteristics; **K_{zz}:** Initial stiffness; **K_{zzV}:** Vibration stiffness;

01 ULS_1a: Nodal loads [Selected]

	Direction	*Fx [kN]*	*Fy [kN]*	*Fz [kN]*	*Mx [kNm]*	*My [kNm]*	*Mz [kNm]*
5	Global	5.10	−15.10	−2.20	0	0	0
7	Global	7.50	15.00	−1.80	0	0	0
31	Global	15.45	31.10	−4.95	0	0	0
32	Global	13.00	−31.70	−5.85	0	0	0
70	Global	13.00	−31.70	−5.85	0	0	0
71	Global	15.45	31.10	−4.95	0	0	0

Fx, Fy, Fz: Load force component; **Mx, My, Mz:** Load moment component;

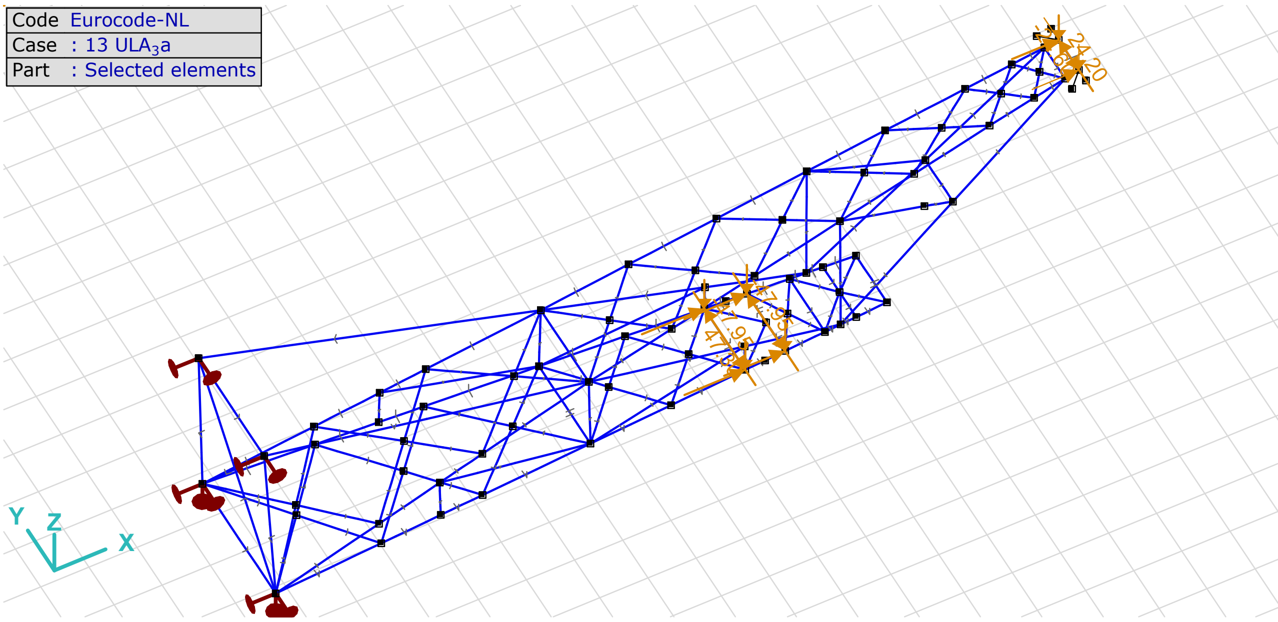


model_1, 01 ULS_1a

13 ULA_3a: Nodal loads [Selected]

	Direction	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
5	Global	10.70	−24.60	−3.80	0	0	0
7	Global	11.40	24.20	−3.10	0	0	0
31	Global	22.25	47.30	−7.20	0	0	0
32	Global	21.05	−47.95	−8.60	0	0	0
70	Global	21.05	−47.95	−8.60	0	0	0
71	Global	22.25	47.30	−7.20	0	0	0

Fx, Fy, Fz: Load force component; **Mx, My, Mz:** Load moment component;

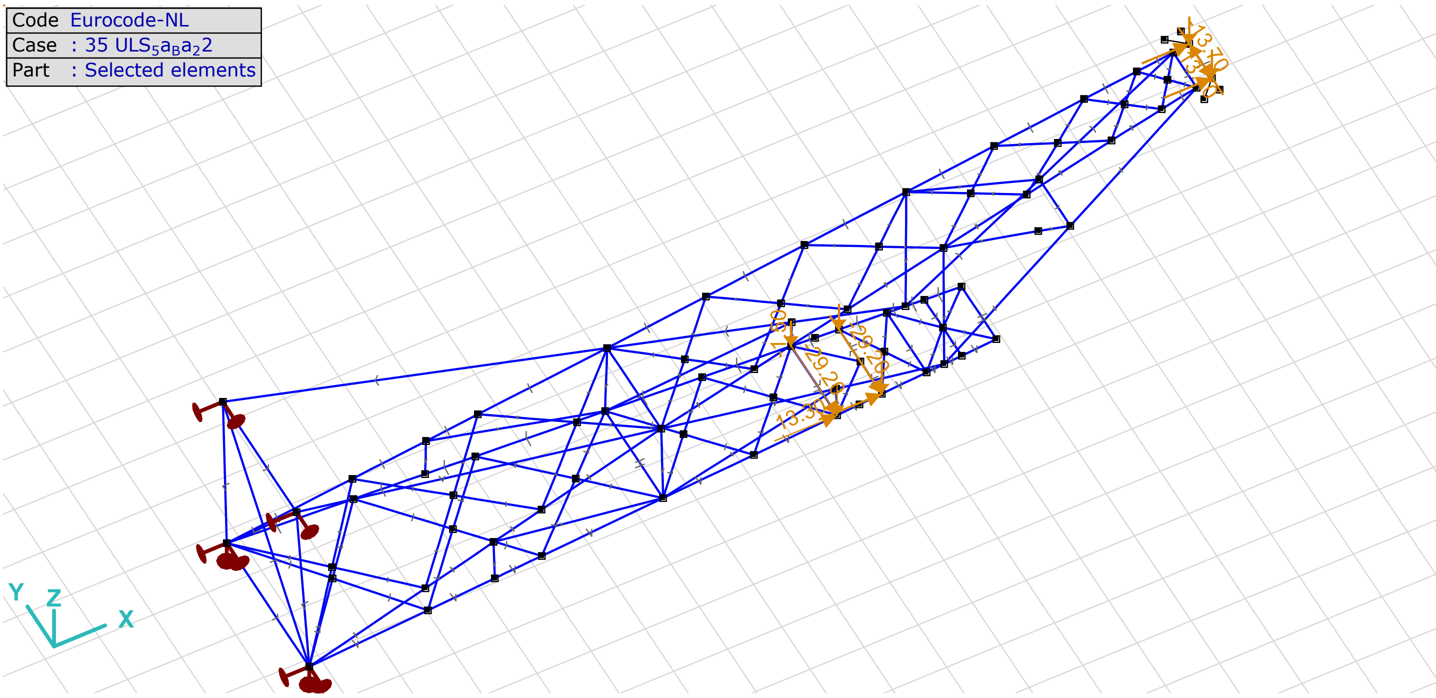


model_1, 13 ULA_3a

35 ULS_5a_Ba_22: Nodal loads [Selected]

	Direction	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
5	Global	6.20	−13.70	−3.10	0	0	0
7	Global	6.20	13.70	−2.70	0	0	0
31	Global	0	0	−1.50	0	0	0
32	Global	13.30	−29.20	−6.10	0	0	0
70	Global	13.30	−29.20	−6.10	0	0	0
71	Global	0	0	−1.50	0	0	0

Fx, Fy, Fz: Load force component; **Mx, My, Mz:** Load moment component;

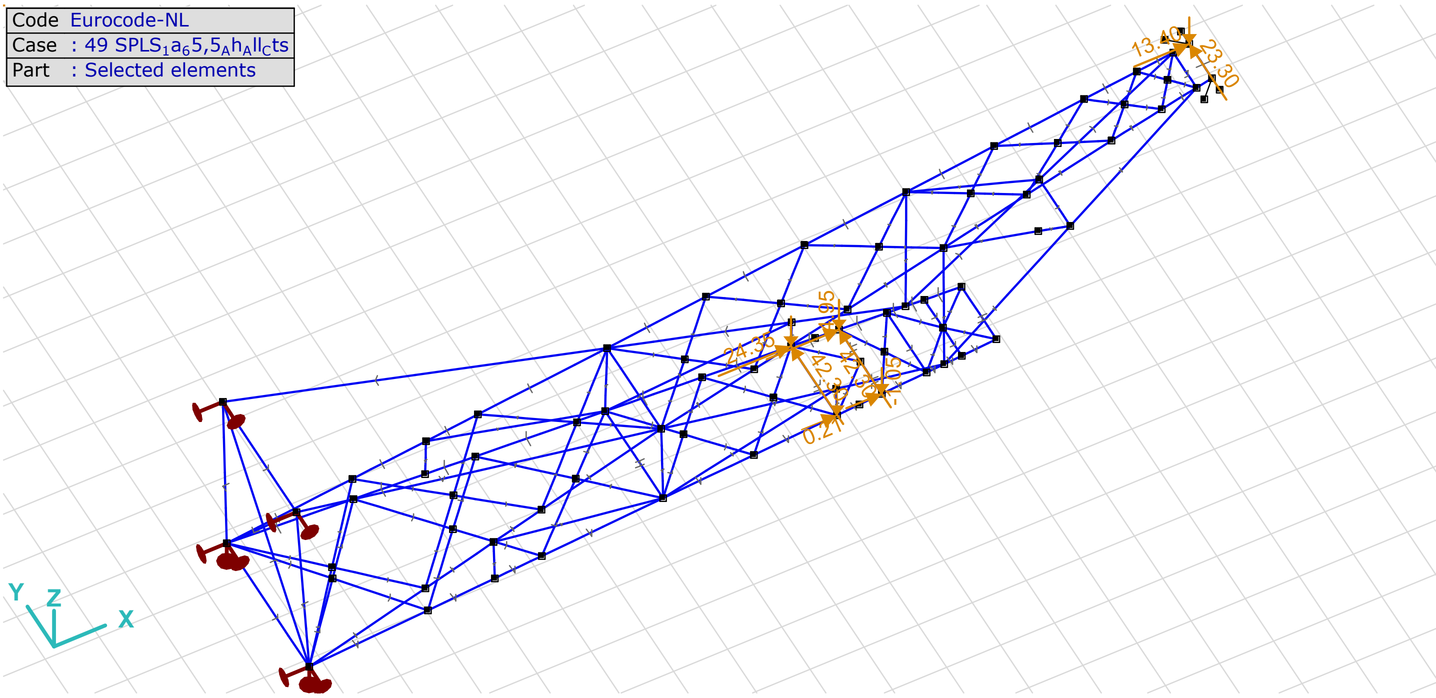


model_1, 35 ULS_5a_Ba_22

49 SPLS_1a_65,5_Ah_All_Cts: Nodal loads [Selected]

	Direction	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
7	Global	13.40	23.30	−1.80	0	0	0
31	Global	24.35	42.30	−4.95	0	0	0
32	Global	0.21	0	−1.05	0	0	0
70	Global	0.21	0	−1.05	0	0	0
71	Global	24.35	42.30	−4.95	0	0	0

Fx, Fy, Fz: Load force component; **Mx, My, Mz:** Load moment component;

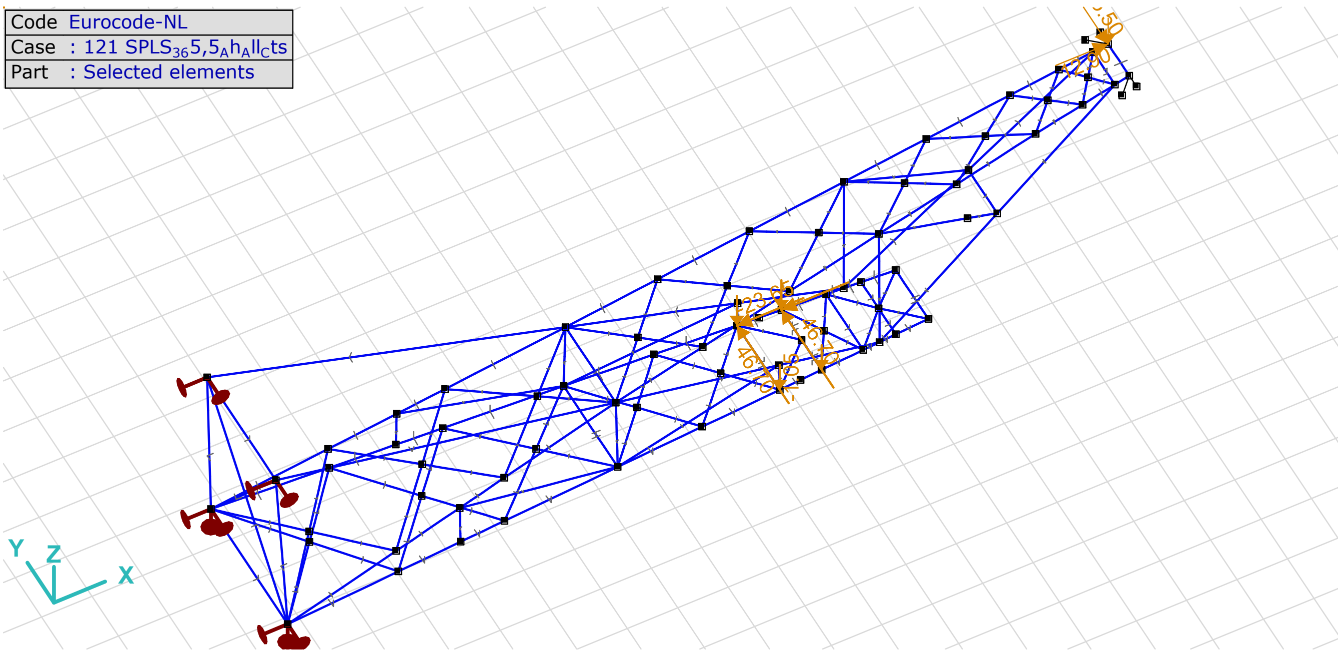


model_1, 49 SPLS_1a_65,5_Ah_All_Cts

121 SPLS_3_65,5_Ah_All_Cts: Nodal loads [Selected]

	Direction	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
7	Global	12.90	−25.50	−2.20	0	0	0
31	Global	−23.65	46.70	−5.75	0	0	0
32	Global	0	0	−1.05	0	0	0
70	Global	0	0	−1.05	0	0	0
71	Global	−23.65	46.70	−5.75	0	0	0

Fx, Fy, Fz: Load force component; **Mx, My, Mz:** Load moment component;



model_1, 121 SPLS_3_65,5_Ah_All_Cts

Weights per material [Selected]

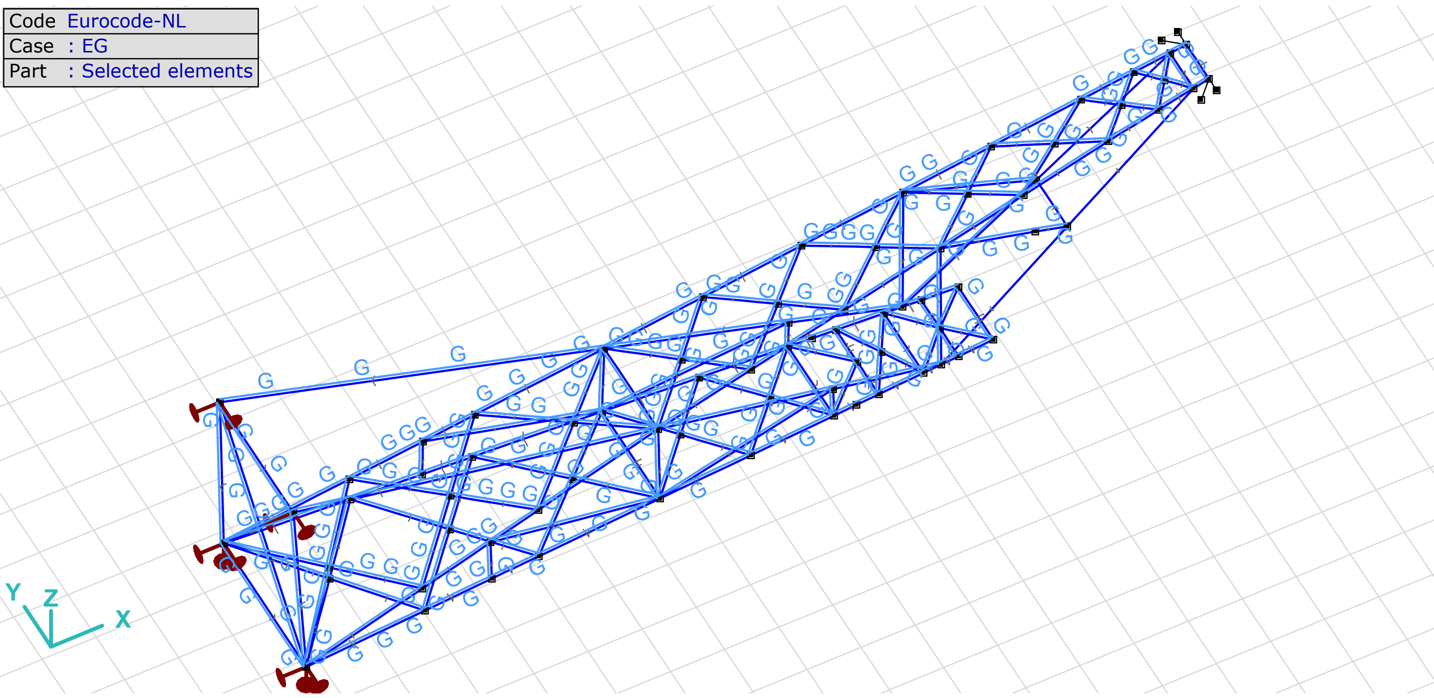
	Material name	*ρ [kg/m³]*	*Σ V [m³]*	*Σ G [kg]*
1	S 235	7850	0.497	3898.663
	Total		**0.497**	**3898.663**

ρ: Density; **Σ V:** Total volume; **Σ G:** Total mass;

Weights per cross-section [Selected]

	Cross-section	*Material name*	*Σ L [m]*	*Σ V [m³]*	*M [kg/m]*	*Σ G [kg]*	*Σ A_o [m²]*	*Σ A_i [m²]*
1	L 180X180X16	S 235	26.343	0.146	43.481	1145.420	18.560	0
2	L 120X120X12	S 235	14.020	0.039	21.621	303.125	6.573	0
3	L 150X100X12X	S 235	19.610	0.056	22.563	442.449	9.586	0
4	L 100X100X 8	S 235	27.996	0.043	12.179	340.981	10.910	0
5	L 50X 50X 5	S 235	46.225	0.022	3.770	174.278	8.967	0
6	L 120X120X10	S 235	33.910	0.079	18.198	617.088	15.898	0
7	L 50X 50X 6	S 235	13.846	0.008	4.469	61.876	2.686	0
8	L 60X 60X 5	S 235	8.027	0.005	4.568	36.666	1.871	0
9	L 60X 60X 6	S 235	14.451	0.010	5.424	78.374	3.369	0
10	U 160	S 235	2.777	0.007	18.851	52.355	1.513	0
11	250x8	S 235	0.800	0.002	15.700	12.560	0.413	0
12	HE 160 A	S 235	3.284	0.013	30.443	99.973	2.976	0
13	L 90X 90X 7	S 235	20.153	0.025	9.609	193.642	7.065	0
14	L 80X 80X 6	S 235	9.899	0.009	7.338	72.636	3.083	0
15	L 100X100X12	S 235	2.726	0.006	17.831	48.609	1.062	0
16	L 80X 80X 8	S 235	6.800	0.008	9.630	65.484	2.118	0
17	L 70X 70X 7	S 235	2.361	0.002	7.377	17.418	0.643	0
18	L 120X120X12_1	S 235	3.139	0.017	43.240	135.731	2.943	0
	Total			**0.497**		**3898.663**	**100.237**	**0**

Σ L: Total length; **Σ V:** Total volume; **M:** Mass per length; **Σ G:** Total mass; **Σ A_o:** Painting area (outside); **Σ A_i:** Painting area (inside);



model_1, EG

Custom load combinations by load cases

	Name	*Type*	*01 ULS_1a*	*13 ULA_3a*	*35 ULS_5a_Ba_22*	*49 SPLS_1a_65,5_Ah_All_Cts*
1	Co #1	ULS	1.00	0	0	0
2	Co #2	ULS	0	1.00	0	0
3	Co #3	ULS	0	0	1.00	0
4	Co #4	ULS	0	0	0	1.00
5	Co #5	ULS	0	0	0	0
6	Co #6	ULS	−1.00	0	0	0
7	Co #7	ULS	0	−1.00	0	0
8	Co #8	ULS	0	0	−1.00	0
9	Co #9	ULS	0	0	0	−1.00
10	Co #10	ULS	0	0	0	0

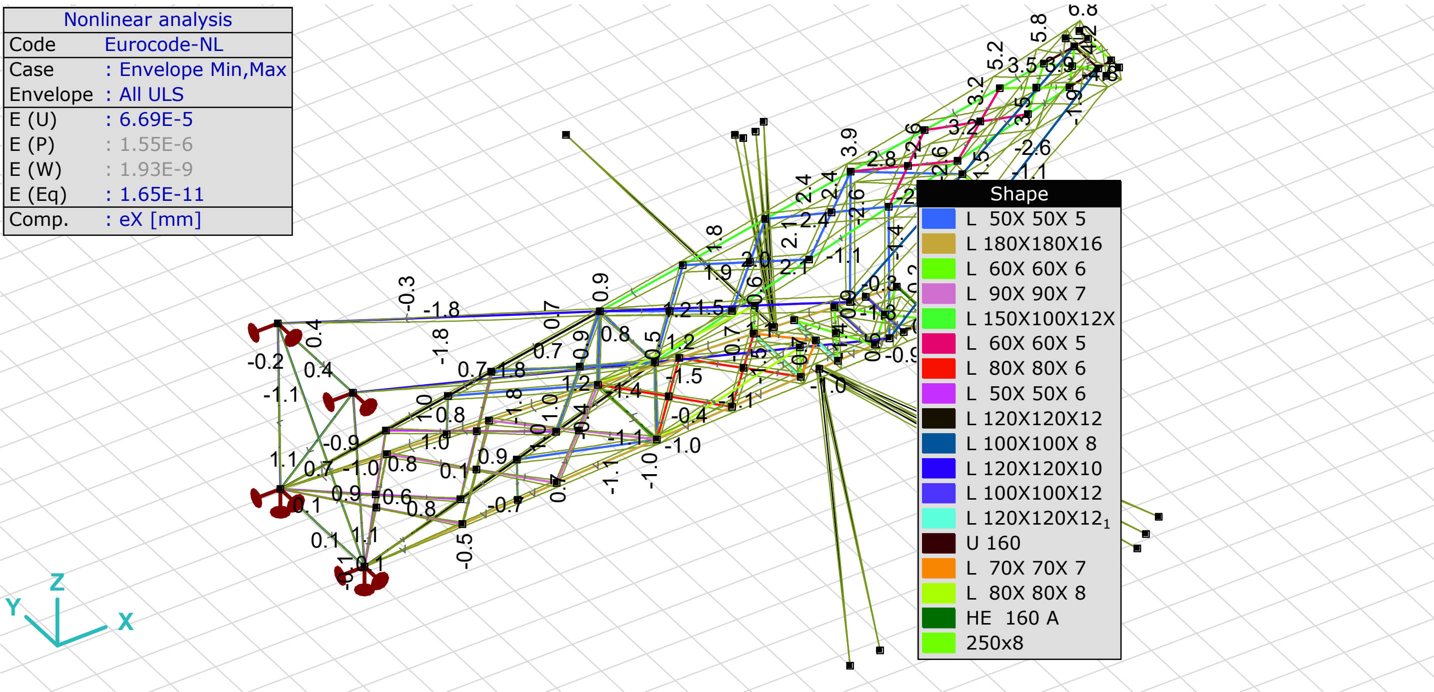
	121 SPLS_3_65,5_Ah_All_Cts	*EG*	*Comment*
1	0	1.10	
2	0	1.10	
3	0	1.10	
4	0	1.10	
5	1.00	1.10	
6	0	1.10	
7	0	1.10	
8	0	1.10	
9	0	1.10	
10	−1.00	1.10	

Name: Load combination name; **Type:** Load combination type; **01 ULS$_1$a, 13 ULA$_3$a, 35 ULS$_5$a$_B$a$_2$2, 49 SPLS$_1$a$_6$5,5$_A$h$_A$ll$_C$ts, 121 SPLS$_{36}$5,5$_A$h$_A$ll$_C$ts, EG:** Factor;

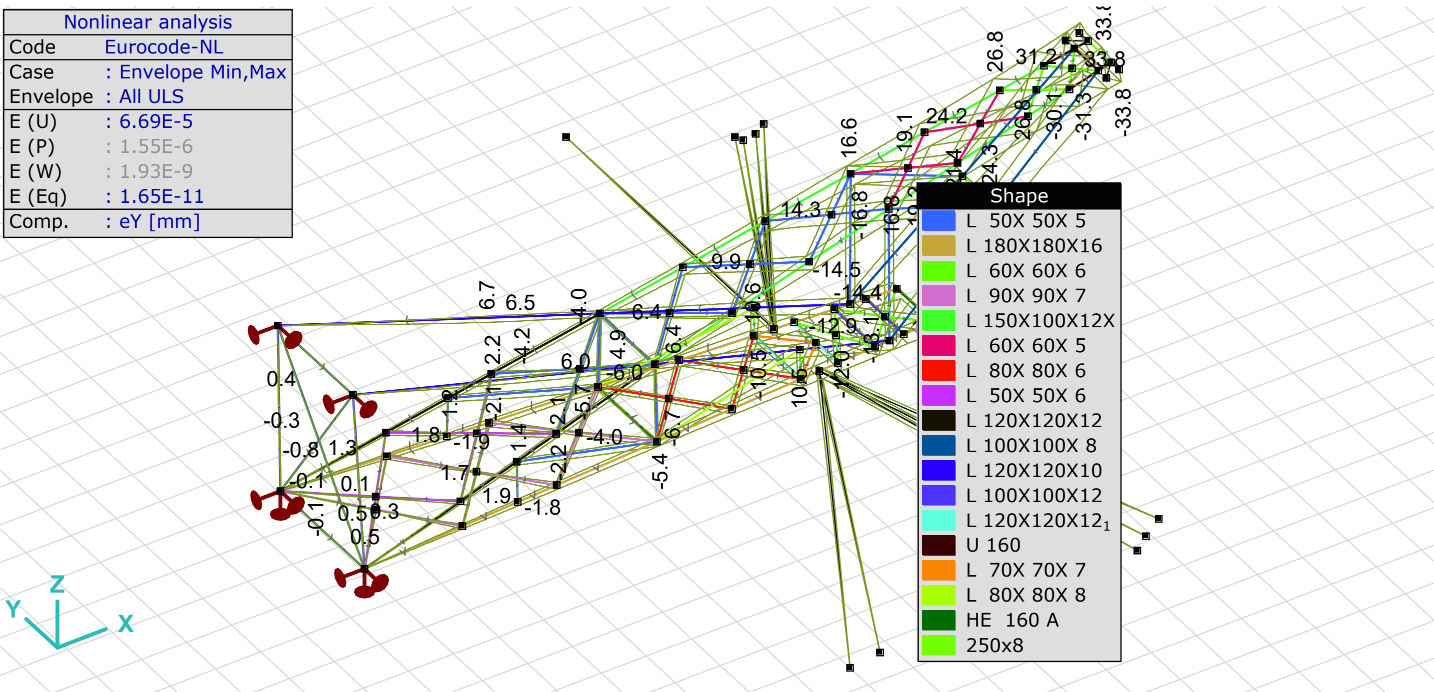
Nodal displacements [Nonlin., Envelope (All ULS)]

	C	*min. max.*	*Case*	*eX [mm]*	*eY [mm]*	*eZ [mm]*	*eR [mm]*	*fX [rad]*	*fY [rad]*	*fZ [rad]*	*fR [rad]*
Ext.											
7	eX	min	Co #10 [1] (1.000)	**−4.8**	31.2	12.6	34.0	0	0	0	0
7		max	Co #5 [1] (1.000)	**6.8**	−31.7	−22.6	39.5	0	0	0	0
7	eY	min	Co #9 [1] (1.000)	−0.2	**−33.8**	3.6	34.0	0	0	0	0
243		min	Co #9 [1] (1.000)	−0.6	**−33.8**	−0.2	33.8	0	0	0	0
244		min	Co #9 [1] (1.000)	−0.4	**−33.8**	1.1	33.8	0	0	0	0
5		max	Co #4 [1] (1.000)	2.7	**33.8**	−5.2	34.3	0	0	0	0
7		max	Co #4 [1] (1.000)	1.8	**33.7**	−12.1	35.9	0	0	0	0
242		max	Co #4 [1] (1.000)	2.5	**33.7**	−7.5	34.7	0	0	0	0
243		max	Co #4 [1] (1.000)	2.3	**33.8**	−8.7	34.9	0	0	0	0
244		max	Co #4 [1] (1.000)	2.0	**33.8**	−9.9	35.2	0	0	0	0
7	eZ	min	Co #5 [1] (1.000)	6.8	−31.7	**−22.6**	39.5	0	0	0	0
7		max	Co #10 [1] (1.000)	−4.8	31.2	**12.6**	34.0	0	0	0	0

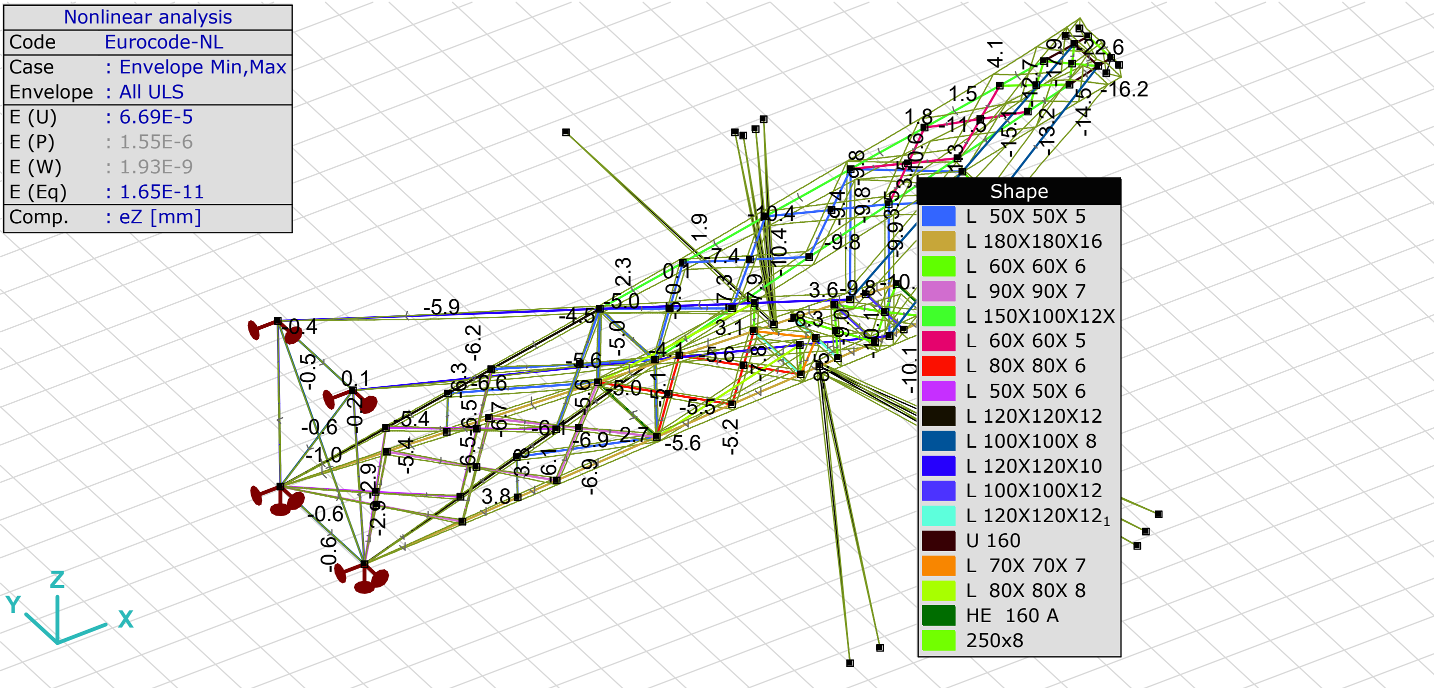
C: Extremal component; **min. max.:** Extreme type; **Case:** Load case of extreme; **eX:** Translation in X direction; **eY:** Translation in Y direction; **eZ:** Translation in Z direction; **eR:** Resultant translation; **fX:** Rotation in X direction; **fY:** Rotation in Y direction; **fZ:** Rotation in Z direction; **fR:** Resultant rotation;



[II], Nonlin., Envelope (All ULS), eX, Diagram

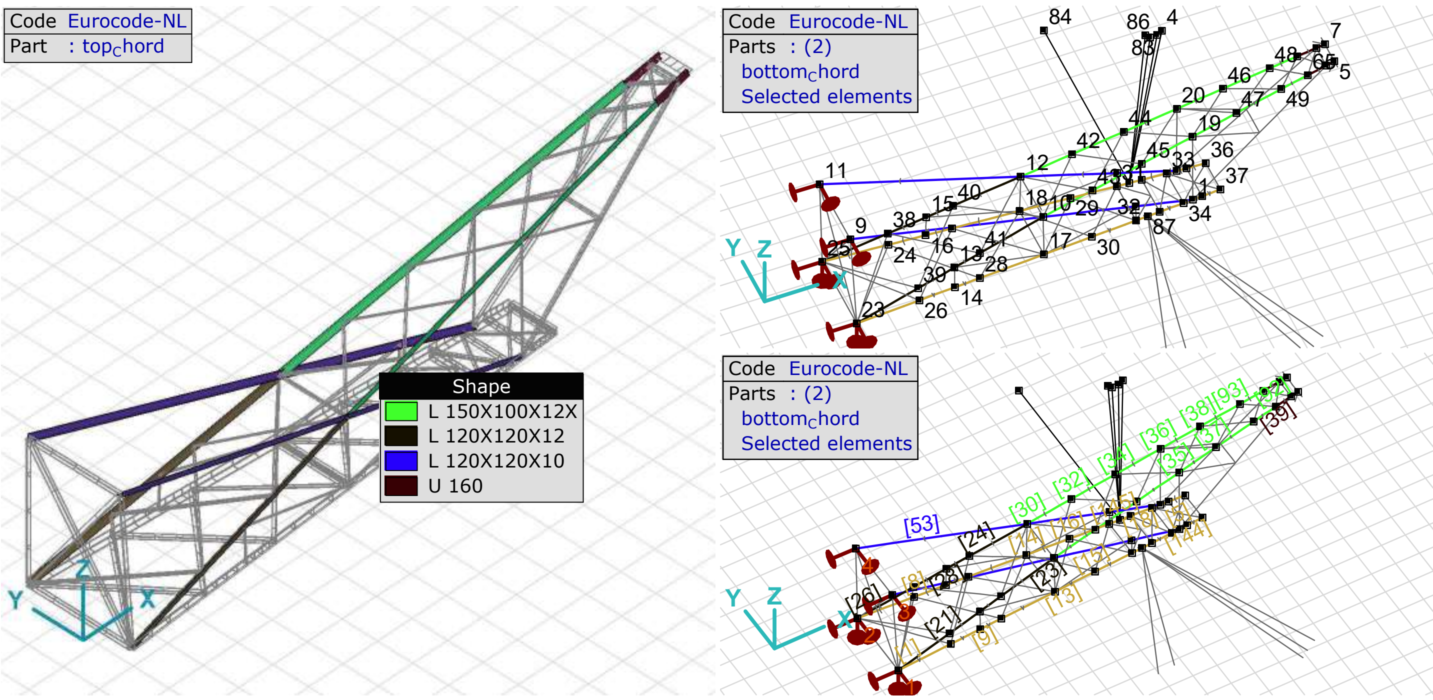


[II], Nonlin., Envelope (All ULS), eY, Diagram



[II], Nonlin., Envelope (All ULS), eZ, Diagram

top_chord



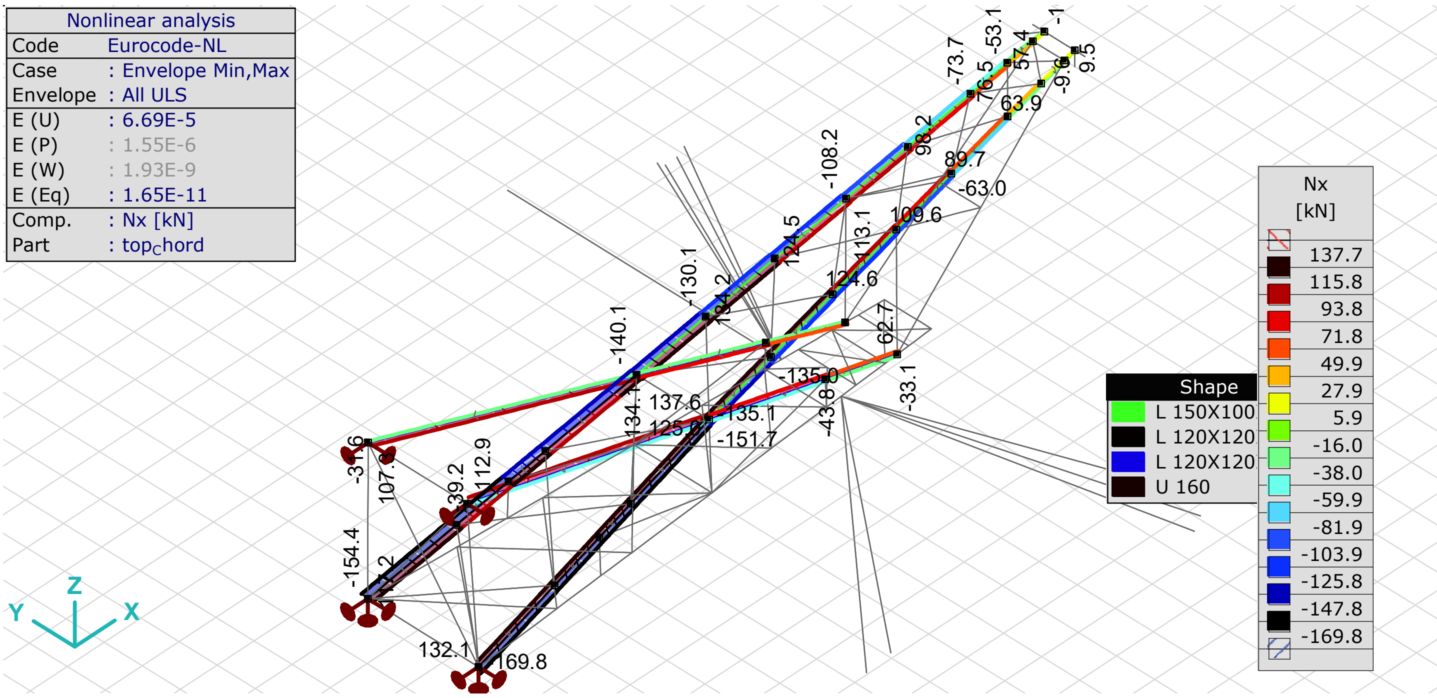
top_Chord

Beam internal forces [Nonlin., Envelope (All ULS), top_Chord]

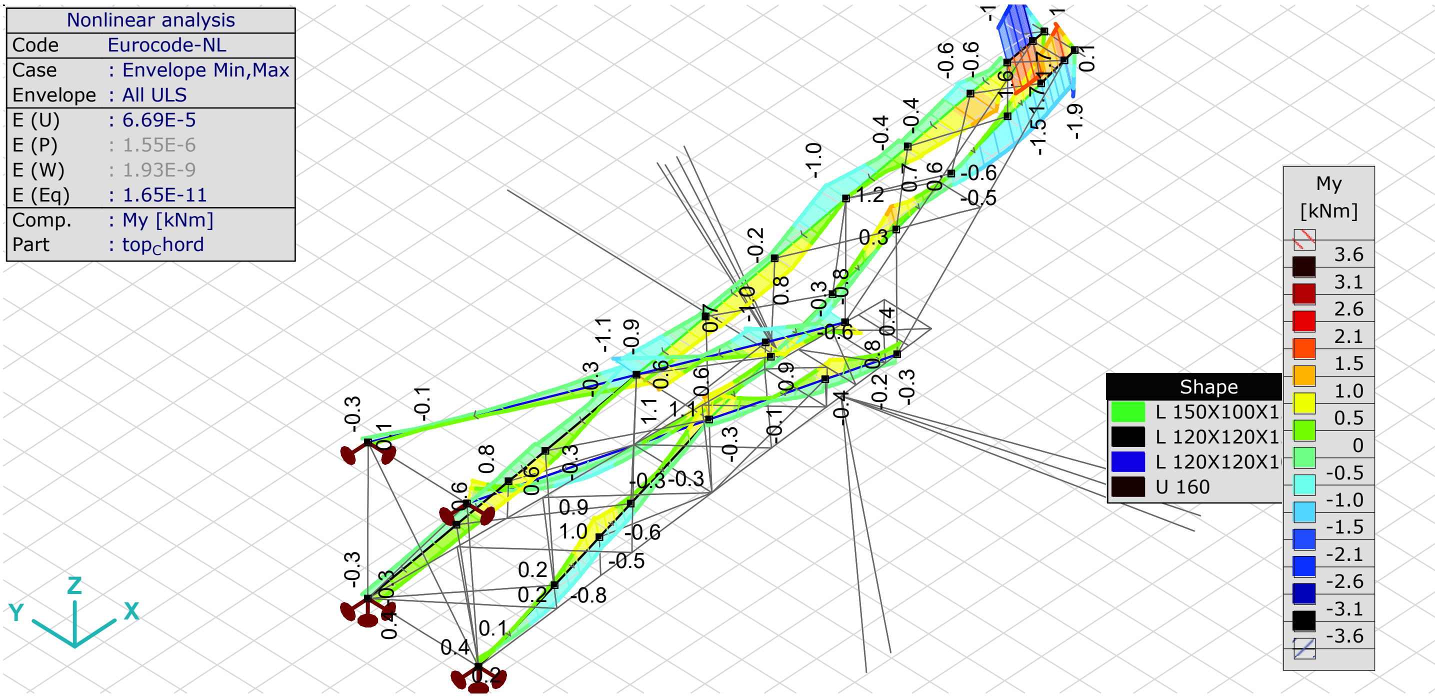
Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Nx [kN]	Vy [kN]	Vz [kN]
25	2	L 120X120X12	Nx	min	Co #9 [1] (1.000)	0	(23)	**−169.8**	0.1	−0.5
29	3	L 150X100X12X		max	Co #4 [1] (1.000)	1.827	(43)	**137.7**	0.1	−0.3
39	10	U 160	Vz	min	Co #2 [1] (1.000)	0.675	(74)	9.5	−0.5	**−6.3**
40	10	U 160		max	Co #5 [1] (1.000)	0.676	(75)	16.5	12.4	**6.3**
40	10	U 160	My	min	Co #5 [1] (1.000)	0.676	(75)	38.8	−3.1	−1.4
39	10	U 160		max	Co #2 [1] (1.000)	0.675	(74)	9.5	−0.5	−6.3
39	10	U 160	Mz	min	Co #9 [1] (1.000)	0.675	(74)	−3.4	−12.1	0.4
39	10	U 160		max	Co #4 [1] (1.000)	0.675	(74)	3.4	11.6	−0.6
40	10	U 160		max	Co #9 [1] (1.000)	0.676	(75)	−9.0	11.6	−4.5

Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Tx [kNm]	My [kNm]	Mz [kNm]
25	2	L 120X120X12	Nx	min	Co #9 [1] (1.000)	0	(23)	0	0.3	0
29	3	L 150X100X12X		max	Co #4 [1] (1.000)	1.827	(43)	0	0.1	0.1
39	10	U 160	Vz	min	Co #2 [1] (1.000)	0.675	(74)	0	1.9	−0.1
40	10	U 160		max	Co #5 [1] (1.000)	0.676	(75)	0.2	−1.9	2.3
40	10	U 160	My	min	Co #5 [1] (1.000)	0.676	(75)	−0.1	**−2.7**	1.7
39	10	U 160		max	Co #2 [1] (1.000)	0.675	(74)	0	**1.9**	−0.1
39	10	U 160	Mz	min	Co #9 [1] (1.000)	0.675	(74)	0.2	−0.1	**−2.4**
39	10	U 160		max	Co #4 [1] (1.000)	0.675	(74)	−0.2	0.2	**2.3**
40	10	U 160		max	Co #9 [1] (1.000)	0.676	(75)	0.2	1.3	**2.3**

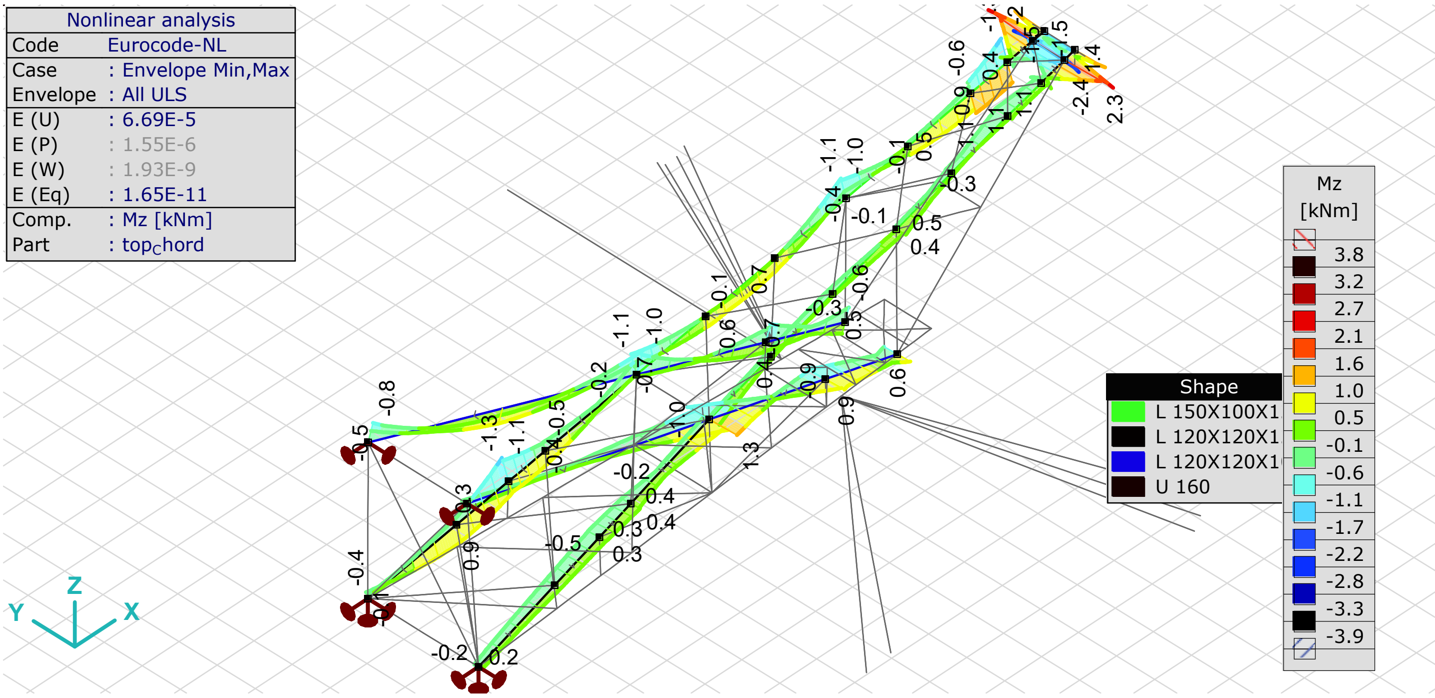
Sh.: Cross-section; **C:** Extremal component; **min. max.:** Extreme type; **Case:** Load case of extreme; **Loc.:** Cross-section local x position on the beam; **Nx:** Axial force; **Vy:** Shear force in local y direction; **Vz:** Shear force in local z direction; **Tx:** Torsional moment; **My:** Flexural moment about local y axis; **Mz:** Flexural moment about local z axis;



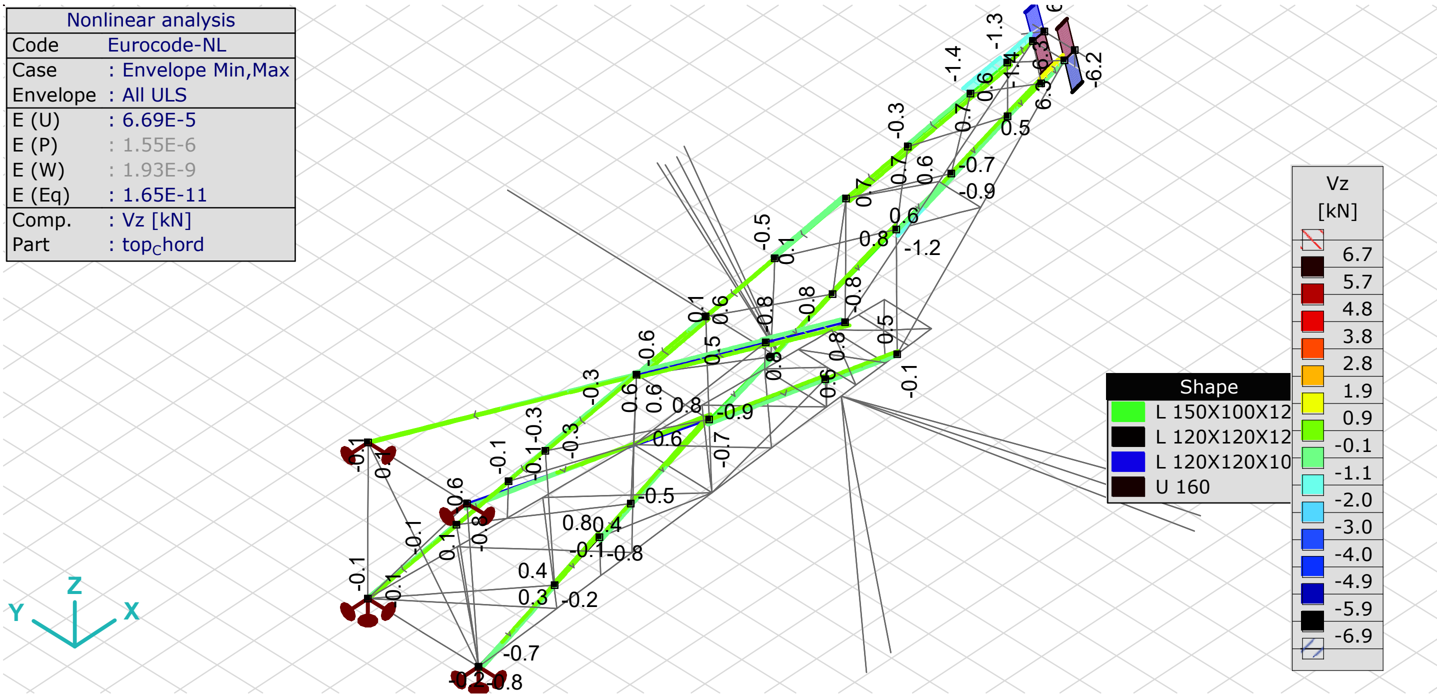
[II], > top_Chord, Nonlin., Envelope (All ULS), Nx, Filled diagram



[II], > top_Chord, Nonlin., Envelope (All ULS), My, Filled diagram



[II], > top_Chord, Nonlin., Envelope (All ULS), Mz, Filled diagram



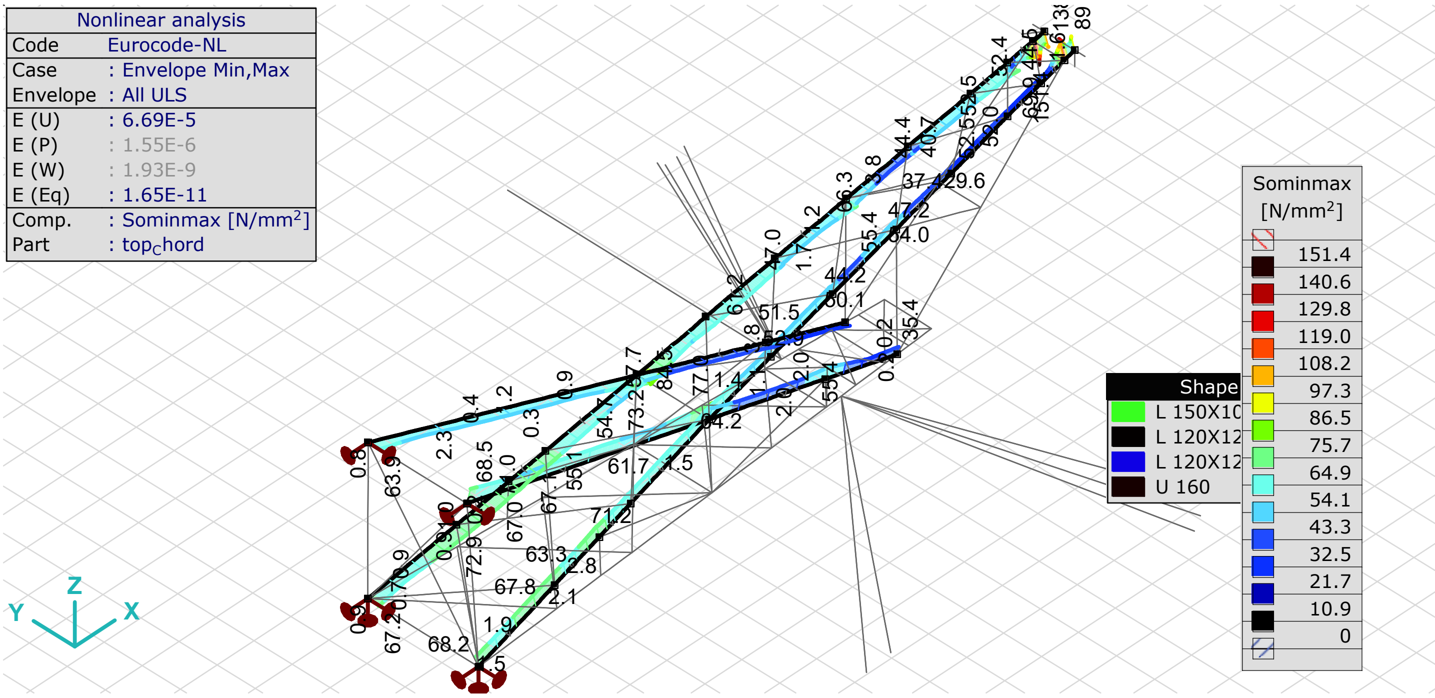
[II], > top_Chord, Nonlin., Envelope (All ULS), Vz, Filled diagram

Beam stresses [Nonlin., Envelope (All ULS), top_Chord]

Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Smin [N/mm^2]	Smax [N/mm^2]	Vmin [N/mm^2]	Vmax [N/mm^2]
40	10	U 160	Smin	min	Co #9 [1] (1.000)	0.676	(75)	**−142.8**	58.2	0	37.3
52	6	L 120X120X10		max	Co #2 [1] (1.000)	1.458		**48.2**	49.0	0	0.2
25	2	L 120X120X12	Smax	min	Co #9 [1] (1.000)	1.041		−64.3	**−60.2**	0	0.8
40	10	U 160		max	Co #4 [1] (1.000)	0.676	(75)	−59.1	**146.4**	0	36.5
54	6	L 120X120X10	Somin	min	Co #7 [1] (1.000)	5.335		−13.7	0	0	0.2
25	2	L 120X120X12		max	Co #9 [1] (1.000)	1.041		−64.3	−60.2	0	0.8
52	6	L 120X120X10	Somax	min	Co #8 [1] (1.000)	1.458		−0.9	0.1	0	0.4
40	10	U 160		max	Co #4 [1] (1.000)	0.676	(75)	−59.1	146.4	0	36.5

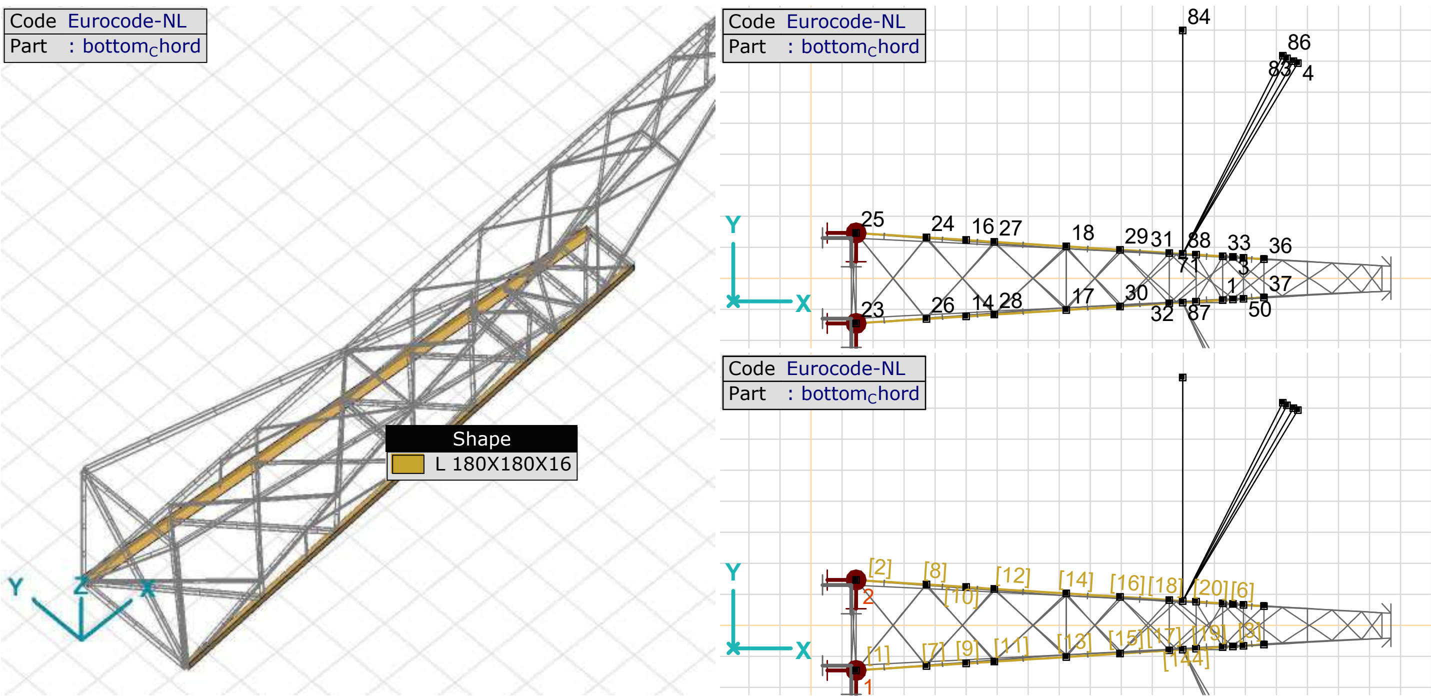
Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Somin [N/mm^2]	Somax [N/mm^2]	Vymean [N/mm^2]	Vzmean [N/mm^2]
40	10	U 160	Smin	min	Co #9 [1] (1.000)	0.676	(75)	3.7	148.5	4.8	−1.9
52	6	L 120X120X10		max	Co #2 [1] (1.000)	1.458		48.2	49.0	0	−0.1
25	2	L 120X120X12	Smax	min	Co #9 [1] (1.000)	1.041		60.2	64.3	0	−0.1
40	10	U 160		max	Co #4 [1] (1.000)	0.676	(75)	3.8	151.4	−5.1	1.8
54	6	L 120X120X10	Somin	min	Co #7 [1] (1.000)	5.335		**0**	13.7	0	0.1
25	2	L 120X120X12		max	Co #9 [1] (1.000)	1.041		**60.2**	64.3	0	−0.1
52	6	L 120X120X10	Somax	min	Co #8 [1] (1.000)	1.458		0.2	**0.9**	0	−0.2
40	10	U 160		max	Co #4 [1] (1.000)	0.676	(75)	3.8	**151.4**	−5.1	1.8

Sh.: Cross-section; **C:** Extremal component; **min. max.:** Extreme type; **Case:** Load case of extreme; **Loc.:** Cross-section local x position on the beam; **Smin:** Axial stress cross-Section minimum; **Smax:** Axial stress cross-Section maximum; **Vmin:** Shear stress cross-section minimum; **Vmax:** Shear stress cross-section maximum; **Somin:** Von Mises stress cross-section minimum; **Somax:** Von Mises stress cross-section maximum; **Vymean:** Shear stress in local y direction; **Vzmean:** Shear stress in local z direction;



[II], > top_Chord, Nonlin., Envelope (All ULS), Sominmax, Filled diagram

bottom_Chord



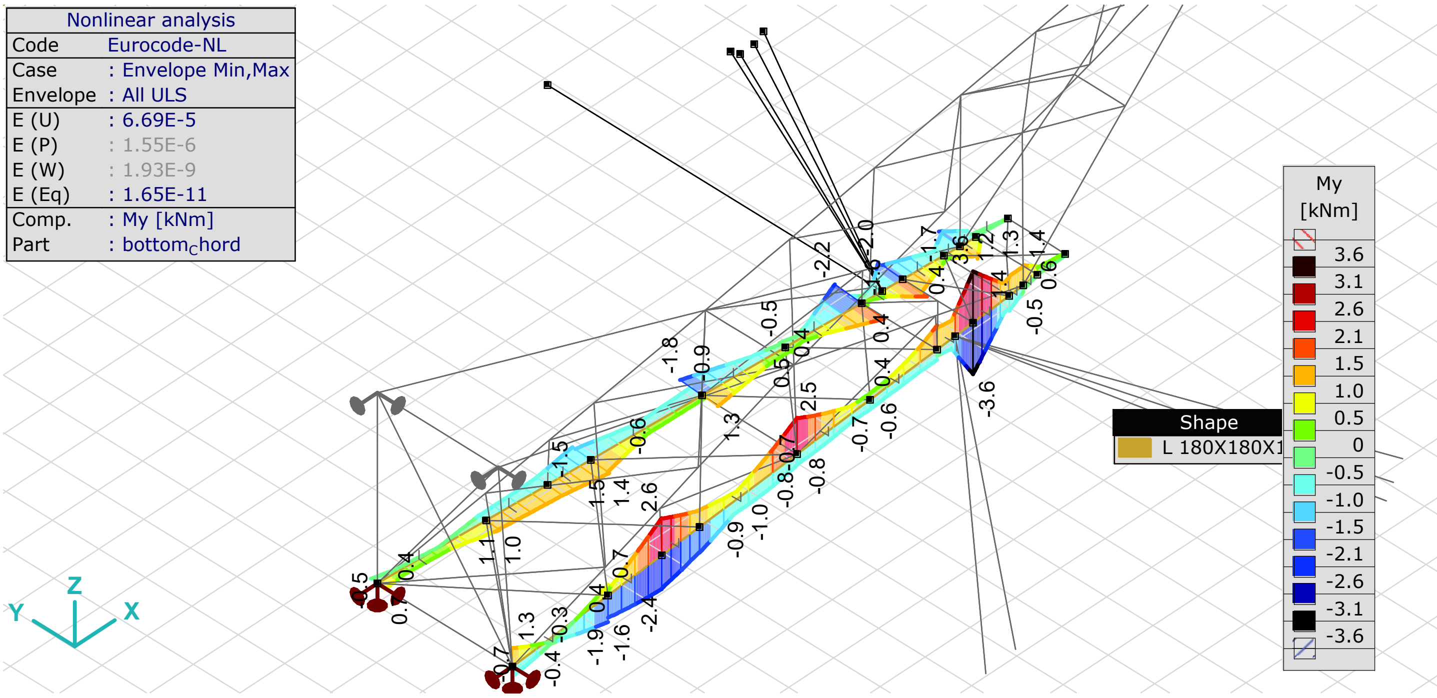
bottom_Chord,

Beam internal forces [Nonlin., Envelope (All ULS), bottom_Chord]

Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Nx [kN]	Vy [kN]	Vz [kN]
2	1	L 180X180X16	Nx	min	Co #5 [1] (1.000)	0	(25)	**−345.2**	0.6	−0.5
2	1	L 180X180X16		max	Co #10 [1] (1.000)	0	(25)	**307.2**	−2.3	0.7
17	1	L 180X180X16	Vz	min	Co #2 [1] (1.000)	0	(32)	−40.8	2.8	**−5.9**
17	1	L 180X180X16		max	Co #7 [1] (1.000)	0.859	(70)	8.0	−2.4	**4.7**
144	1	L 180X180X16	My	min	Co #2 [1] (1.000)	0	(70)	−62.7	−1.6	3.5
17	1	L 180X180X16		max	Co #7 [1] (1.000)	0.859	(70)	8.0	−2.4	4.7
8	1	L 180X180X16	Mz	min	Co #5 [1] (1.000)	1.282	(16)	−304.4	2.3	−0.3
8	1	L 180X180X16		max	Co #10 [1] (1.000)	1.282	(16)	264.4	−0.9	0.1

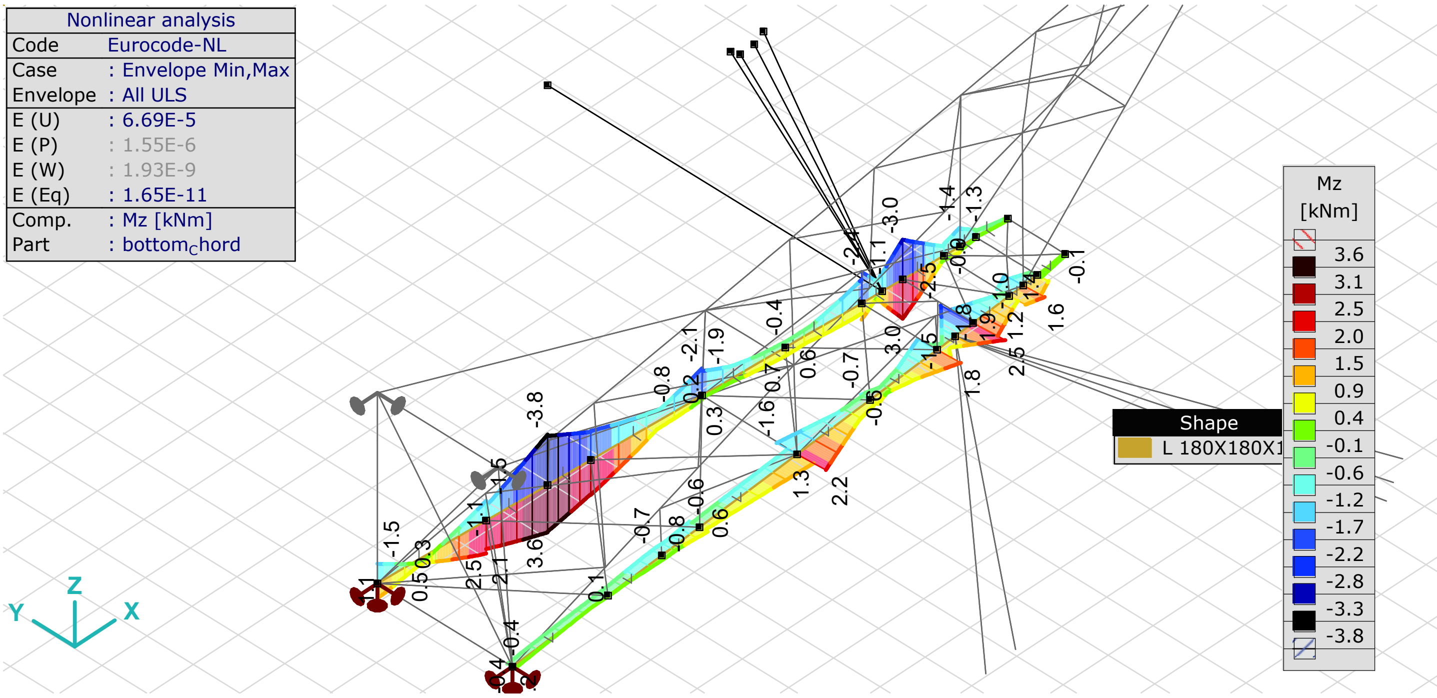
Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Tx [kNm]	My [kNm]	Mz [kNm]
2	1	L 180X180X16	Nx	min	Co #5 [1] (1.000)	0	(25)	0.1	0.7	1.1
2	1	L 180X180X16		max	Co #10 [1] (1.000)	0	(25)	−0.1	−0.5	−1.5
17	1	L 180X180X16	Vz	min	Co #2 [1] (1.000)	0	(32)	0	1.3	0.6
17	1	L 180X180X16		max	Co #7 [1] (1.000)	0.859	(70)	0	3.6	1.8
144	1	L 180X180X16	My	min	Co #2 [1] (1.000)	0	(70)	0	**−3.6**	−1.8
17	1	L 180X180X16		max	Co #7 [1] (1.000)	0.859	(70)	0	**3.6**	1.8
8	1	L 180X180X16	Mz	min	Co #5 [1] (1.000)	1.282	(16)	0	−0.9	**−3.8**
8	1	L 180X180X16		max	Co #10 [1] (1.000)	1.282	(16)	0	1.2	**3.6**

Sh.: Cross-section; **C:** Extremal component; **min. max.:** Extreme type; **Case:** Load case of extreme; **Loc.:** Cross-section local x position on the beam; **Nx:** Axial force; **Vy:** Shear force in local y direction; **Vz:** Shear force in local z direction; **Tx:** Torsional moment; **My:** Flexural moment about local y axis; **Mz:** Flexural moment about local z axis;



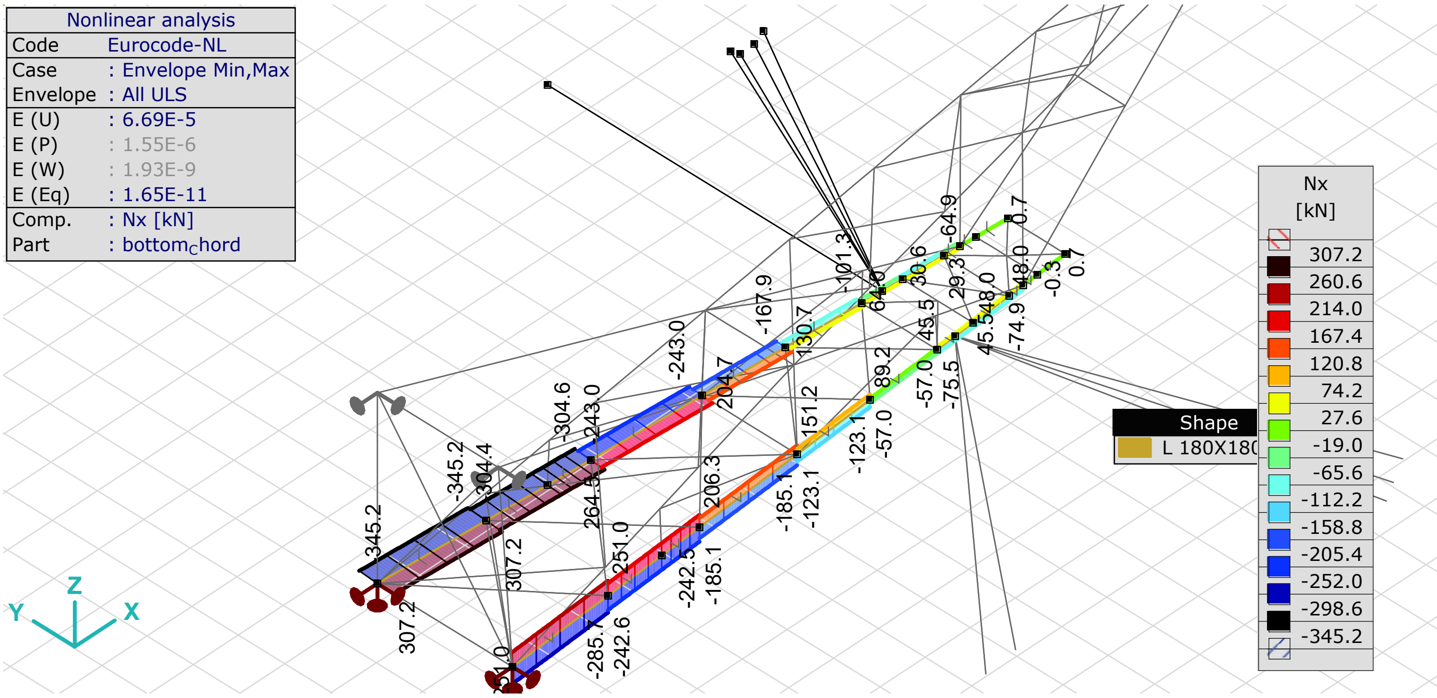
[II], > bottom_Chord, Nonlin., Envelope (All ULS), My, Filled diagram

Nonlinear analysis	
Code	Eurocode-NL
Case	: Envelope Min,Max
Envelope	: All ULS
E (U)	: 6.69E-5
E (P)	: 1.55E-6
E (W)	: 1.93E-9
E (Eq)	: 1.65E-11
Comp.	: Mz [kNm]
Part	: bottom$_c$hord



[II], > bottom_Chord, Nonlin., Envelope (All ULS), Mz, Filled diagram

Nonlinear analysis	
Code	Eurocode-NL
Case	: Envelope Min,Max
Envelope	: All ULS
E (U)	: 6.69E-5
E (P)	: 1.55E-6
E (W)	: 1.93E-9
E (Eq)	: 1.65E-11
Comp.	: Nx [kN]
Part	: bottom$_c$hord



[II], > bottom_Chord, Nonlin., Envelope (All ULS), Nx, Filled diagram

Beam stresses [Nonlin., Envelope (All ULS), bottom_Chord]

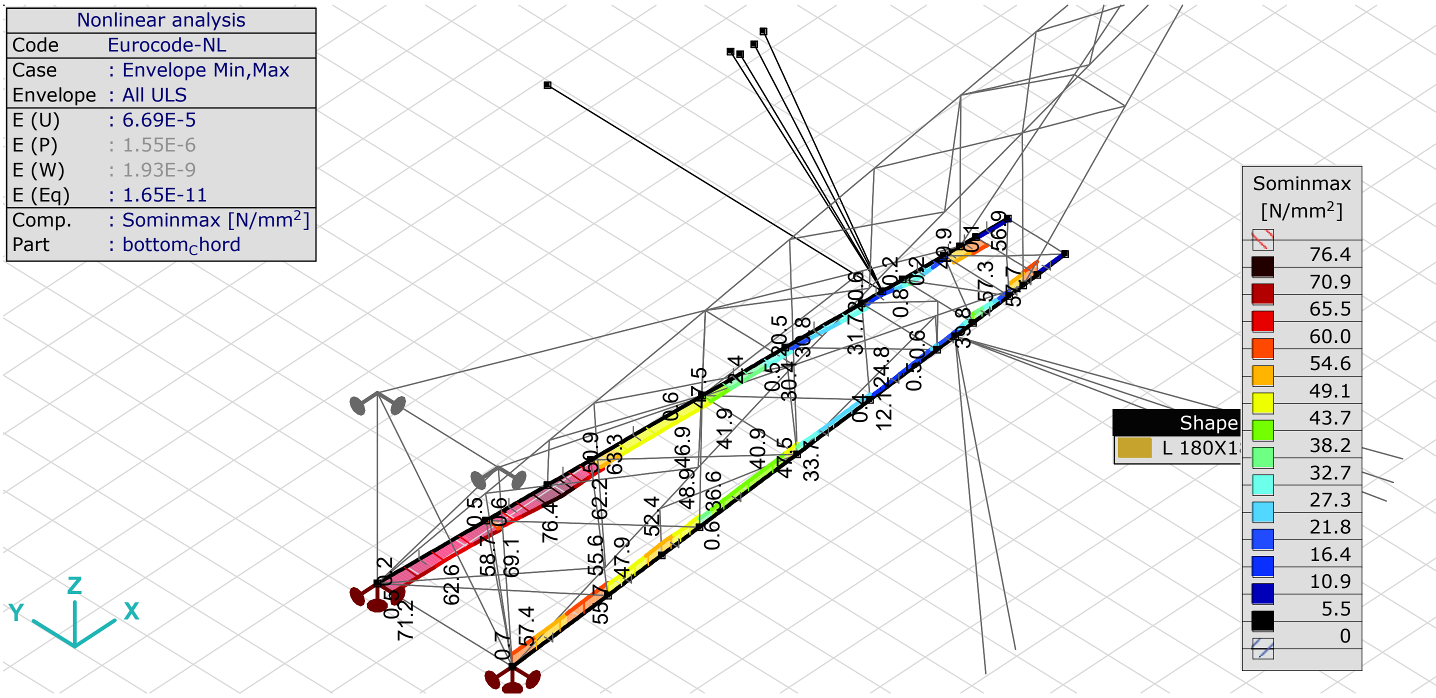
Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Smin [N/mm²]	Smax [N/mm²]
8	1	L 180X180X16	Smin	min	Co #5 [1] (1.000)	1.282	(16)	**−76.4**	−22.3
2	1	L 180X180X16		max	Co #10 [1] (1.000)	0.682		**55.2**	55.9
2	1	L 180X180X16	Smax	min	Co #5 [1] (1.000)	1.250		−62.5	**−62.2**
2	1	L 180X180X16		max	Co #10 [1] (1.000)	0	(25)	48.5	**67.7**
3	1	L 180X180X16	Somin	min	Co #4 [1] (1.000)	0	(1)	−4.1	7.3
2	1	L 180X180X16		max	Co #5 [1] (1.000)	1.250		−62.5	−62.2
5	1	L 180X180X16	Somax	min	Co #6 [1] (1.000)	0.666	(37)	−0.1	0
8	1	L 180X180X16		max	Co #5 [1] (1.000)	1.282	(16)	−76.4	−22.3

Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Vmin [N/mm²]	Vmax [N/mm²]
8	1	L 180X180X16	Smin	min	Co #5 [1] (1.000)	1.282	(16)	0	0.7
2	1	L 180X180X16		max	Co #10 [1] (1.000)	0.682		0	2.3
2	1	L 180X180X16	Smax	min	Co #5 [1] (1.000)	1.250		0	2.1
2	1	L 180X180X16		max	Co #10 [1] (1.000)	0	(25)	0	2.4
3	1	L 180X180X16	Somin	min	Co #4 [1] (1.000)	0	(1)	0	10.7
2	1	L 180X180X16		max	Co #5 [1] (1.000)	1.250		0	2.1
5	1	L 180X180X16	Somax	min	Co #6 [1] (1.000)	0.666	(37)	0	0.1
8	1	L 180X180X16		max	Co #5 [1] (1.000)	1.282	(16)	0	0.7

Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Somin [N/mm²]	Somax [N/mm²]
8	1	L 180X180X16	Smin	min	Co #5 [1] (1.000)	1.282	(16)	22.3	76.4
2	1	L 180X180X16		max	Co #10 [1] (1.000)	0.682		55.4	56.0
2	1	L 180X180X16	Smax	min	Co #5 [1] (1.000)	1.250		62.3	62.6
2	1	L 180X180X16		max	Co #10 [1] (1.000)	0	(25)	48.6	67.8
3	1	L 180X180X16	Somin	min	Co #4 [1] (1.000)	0	(1)	**0**	19.4
2	1	L 180X180X16		max	Co #5 [1] (1.000)	1.250		**62.3**	62.6
5	1	L 180X180X16	Somax	min	Co #6 [1] (1.000)	0.666	(37)	0	**0.2**
8	1	L 180X180X16		max	Co #5 [1] (1.000)	1.282	(16)	22.3	**76.4**

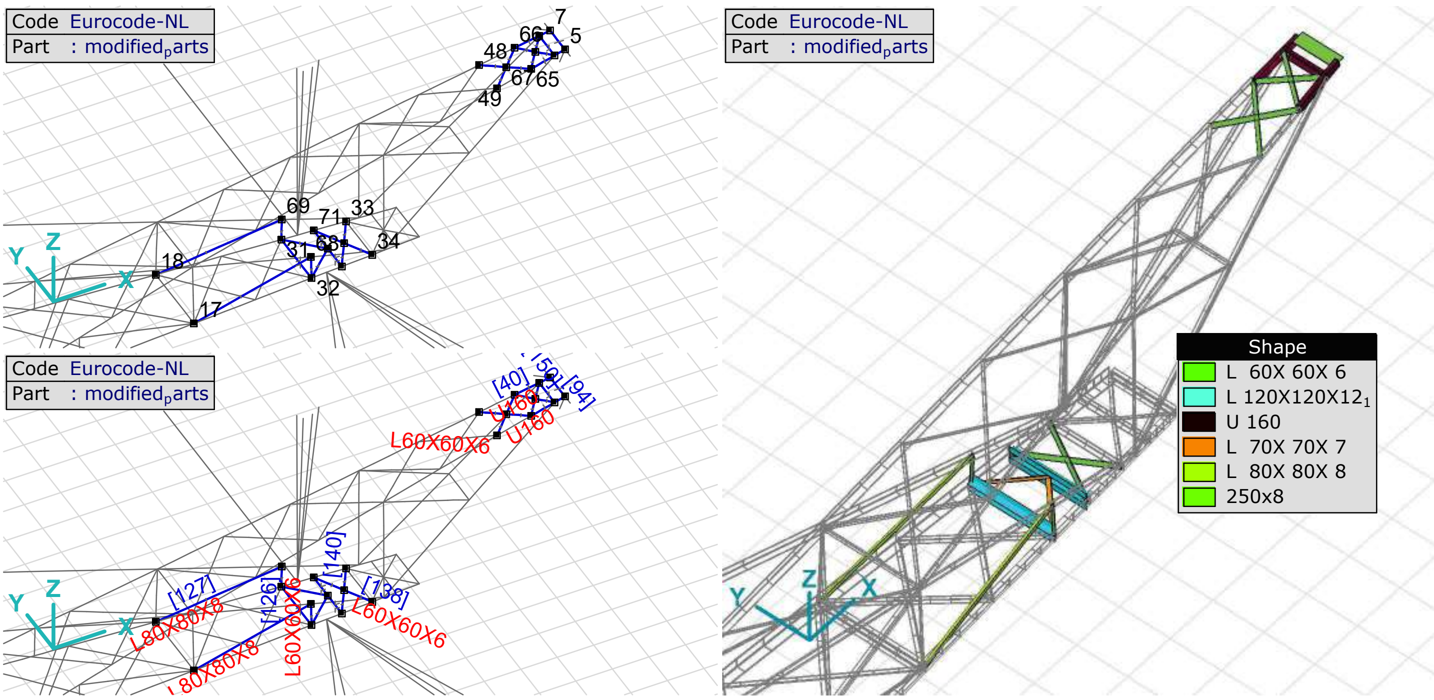
Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Vymean [N/mm²]	Vzmean [N/mm²]
8	1	L 180X180X16	Smin	min	Co #5 [1] (1.000)	1.282	(16)	0.4	−0.1
2	1	L 180X180X16		max	Co #10 [1] (1.000)	0.682		−0.3	0.1
2	1	L 180X180X16	Smax	min	Co #5 [1] (1.000)	1.250		0.2	−0.1
2	1	L 180X180X16		max	Co #10 [1] (1.000)	0	(25)	−0.4	0.1
3	1	L 180X180X16	Somin	min	Co #4 [1] (1.000)	0	(1)	−0.1	−0.3
2	1	L 180X180X16		max	Co #5 [1] (1.000)	1.250		0.2	−0.1
5	1	L 180X180X16	Somax	min	Co #6 [1] (1.000)	0.666	(37)	0	0
8	1	L 180X180X16		max	Co #5 [1] (1.000)	1.282	(16)	0.4	−0.1

Sh.: Cross-section; **C:** Extremal component; **min. max.:** Extreme type; **Case:** Load case of extreme; **Loc.:** Cross-section local x position on the beam; **Smin:** Axial stress cross-Section minimum; **Smax:** Axial stress cross-Section maximum; **Vmin:** Shear stress cross-section minimum; **Vmax:** Shear stress cross-section maximum; **Somin:** Von Mises stress cross-section minimum; **Somax:** Von Mises stress cross-section maximum; **Vymean:** Shear stress in local y direction; **Vzmean:** Shear stress in local z direction;



[II], > bottom_Chord, Nonlin., Envelope (All ULS), Sominmax, Filled diagram

modified_parts



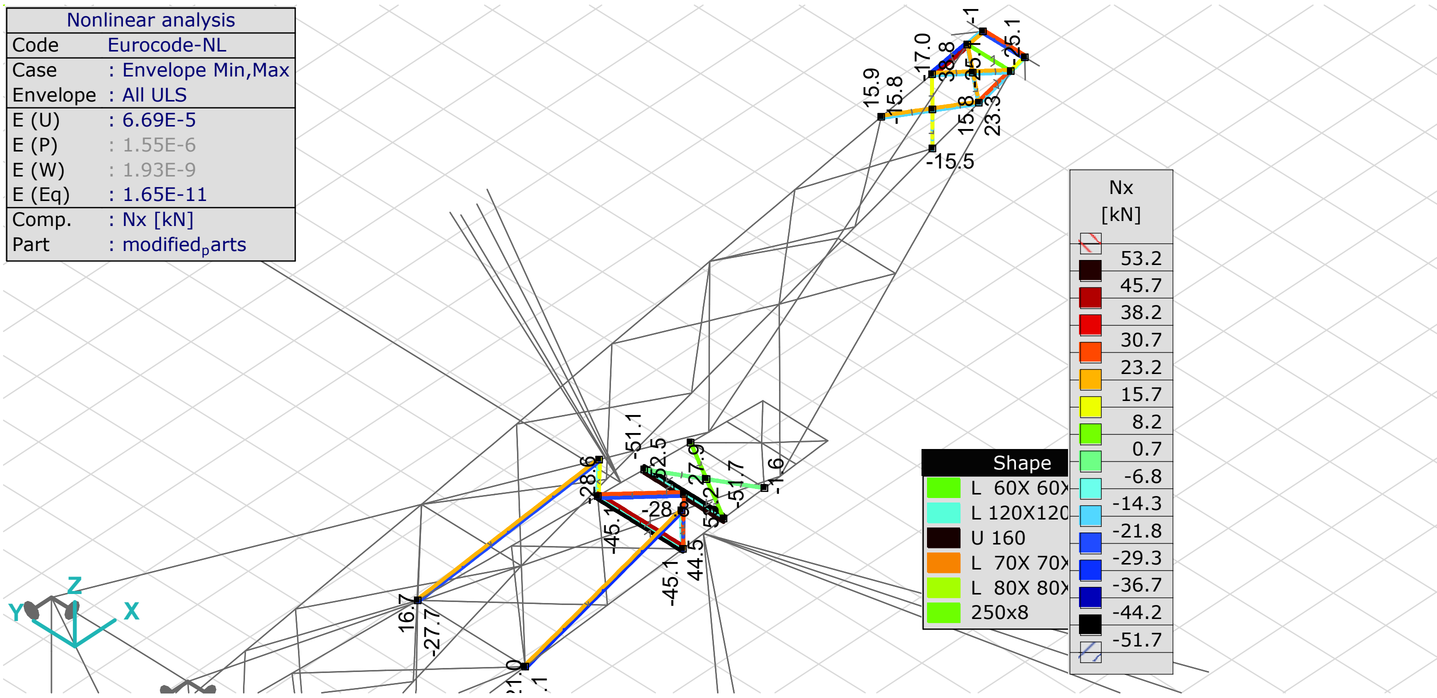
modified_parts, x 3

Beam internal forces [Nonlin., Envelope (All ULS), modified_parts]

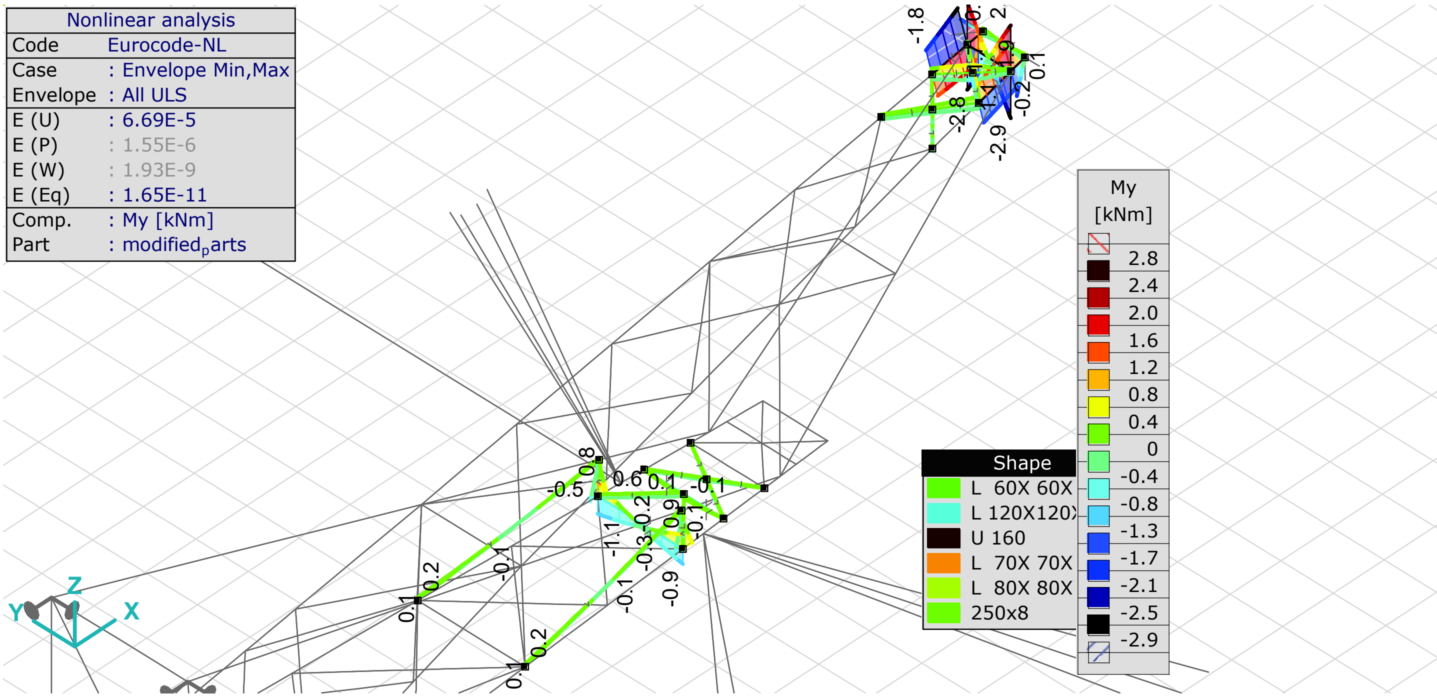
Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Nx [kN]	Vy [kN]	Vz [kN]
135	18	L 120X120X12_1	Nx	min	Co #7 [1] (1.000)	0.568	(469)	**−51.7**	0.4	0.1
135	18	L 120X120X12_1		max	Co #2 [1] (1.000)	0.568	(469)	**53.2**	0.2	0.1
150	10	U 160	Vz	min	Co #5 [1] (1.000)	0	(74)	−0.9	6.6	**−6.9**
150	10	U 160		max	Co #10 [1] (1.000)	0.827	(75)	1.1	−6.5	**6.7**
150	10	U 160	My	min	Co #10 [1] (1.000)	0	(74)	1.1	−6.5	6.6
150	10	U 160		max	Co #5 [1] (1.000)	0	(74)	−0.9	6.6	−6.9
150	10	U 160	Mz	min	Co #5 [1] (1.000)	0.827	(75)	−0.9	6.6	−6.7
150	10	U 160		max	Co #5 [1] (1.000)	0	(74)	−0.9	6.6	−6.9

Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Tx [kNm]	My [kNm]	Mz [kNm]
135	18	L 120X120X12_1	Nx	min	Co #7 [1] (1.000)	0.568	(469)	0	0.2	−0.1
135	18	L 120X120X12_1		max	Co #2 [1] (1.000)	0.568	(469)	0	0.1	0
150	10	U 160	Vz	min	Co #5 [1] (1.000)	0	(74)	0.1	2.8	2.7
150	10	U 160		max	Co #10 [1] (1.000)	0.827	(75)	−0.1	2.6	2.7
150	10	U 160	My	min	Co #10 [1] (1.000)	0	(74)	−0.1	**−2.9**	−2.7
150	10	U 160		max	Co #5 [1] (1.000)	0	(74)	0.1	**2.8**	2.7
150	10	U 160	Mz	min	Co #5 [1] (1.000)	0.827	(75)	0.1	−2.8	**−2.7**
150	10	U 160		max	Co #5 [1] (1.000)	0	(74)	0.1	2.8	**2.7**

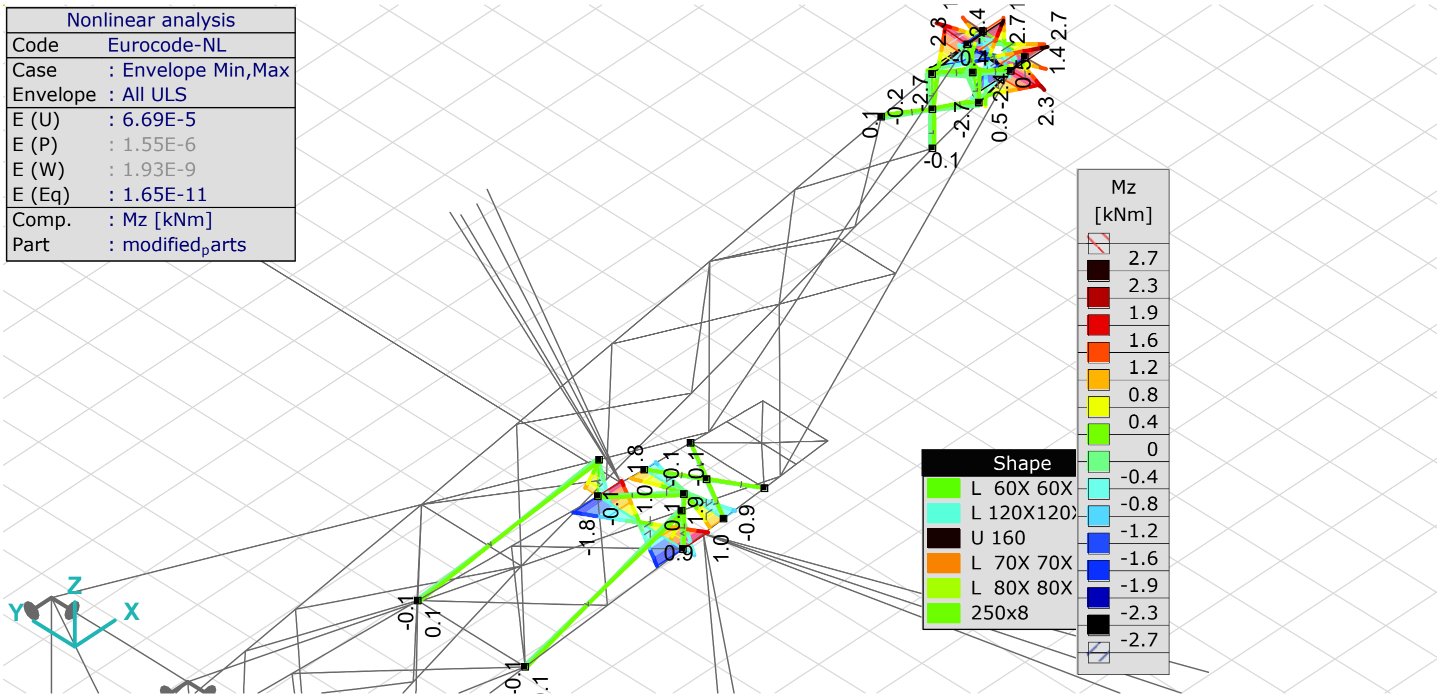
Sh.: Cross-section; **C:** Extremal component; **min. max.:** Extreme type; **Case:** Load case of extreme; **Loc.:** Cross-section local x position on the beam; **Nx:** Axial force; **Vy:** Shear force in local y direction; **Vz:** Shear force in local z direction; **Tx:** Torsional moment; **My:** Flexural moment about local y axis; **Mz:** Flexural moment about local z axis;



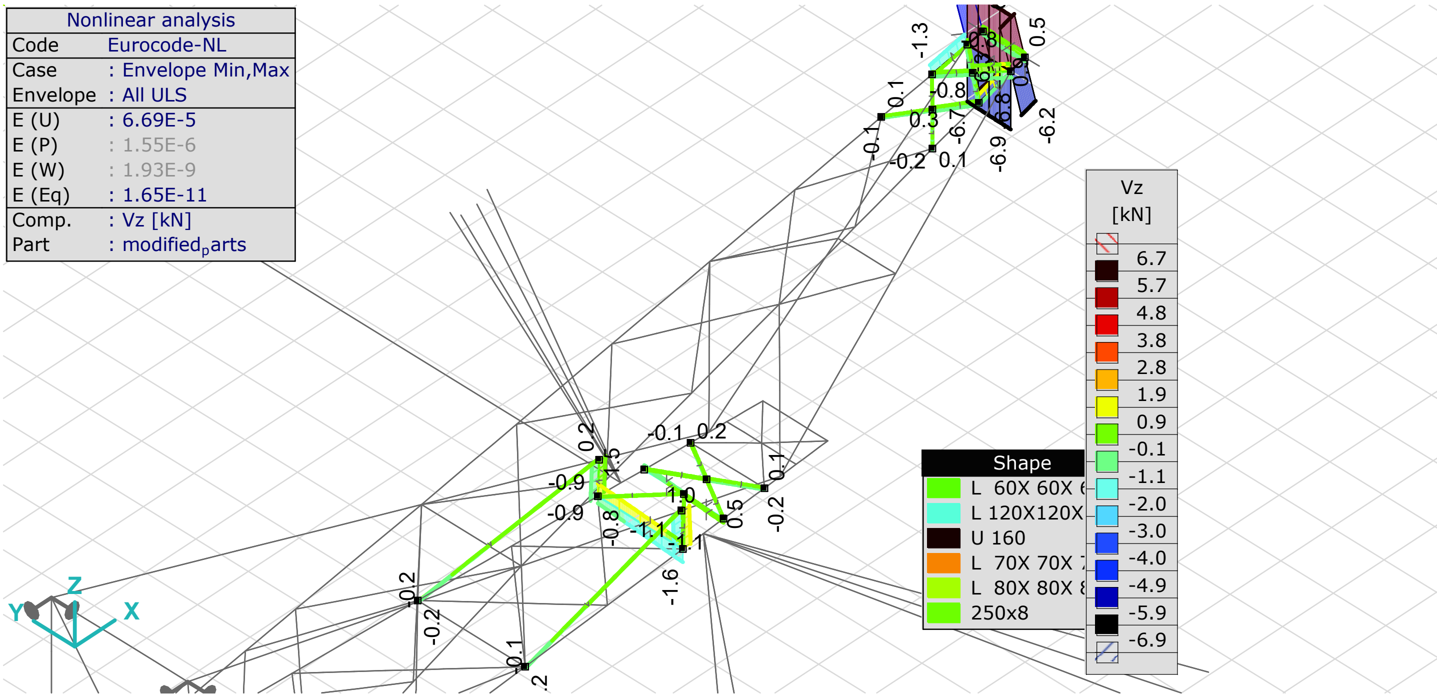
[II], > modified_parts, Nonlin., Envelope (All ULS), Nx, Filled diagram



[II], > modified_parts, Nonlin., Envelope (All ULS), My, Filled diagram



[II], > modified_parts, Nonlin., Envelope (All ULS), Mz, Filled diagram



[II], > modified_parts, Nonlin., Envelope (All ULS), Vz, Filled diagram

Beam stresses [Nonlin., Envelope (All ULS), modified_parts]

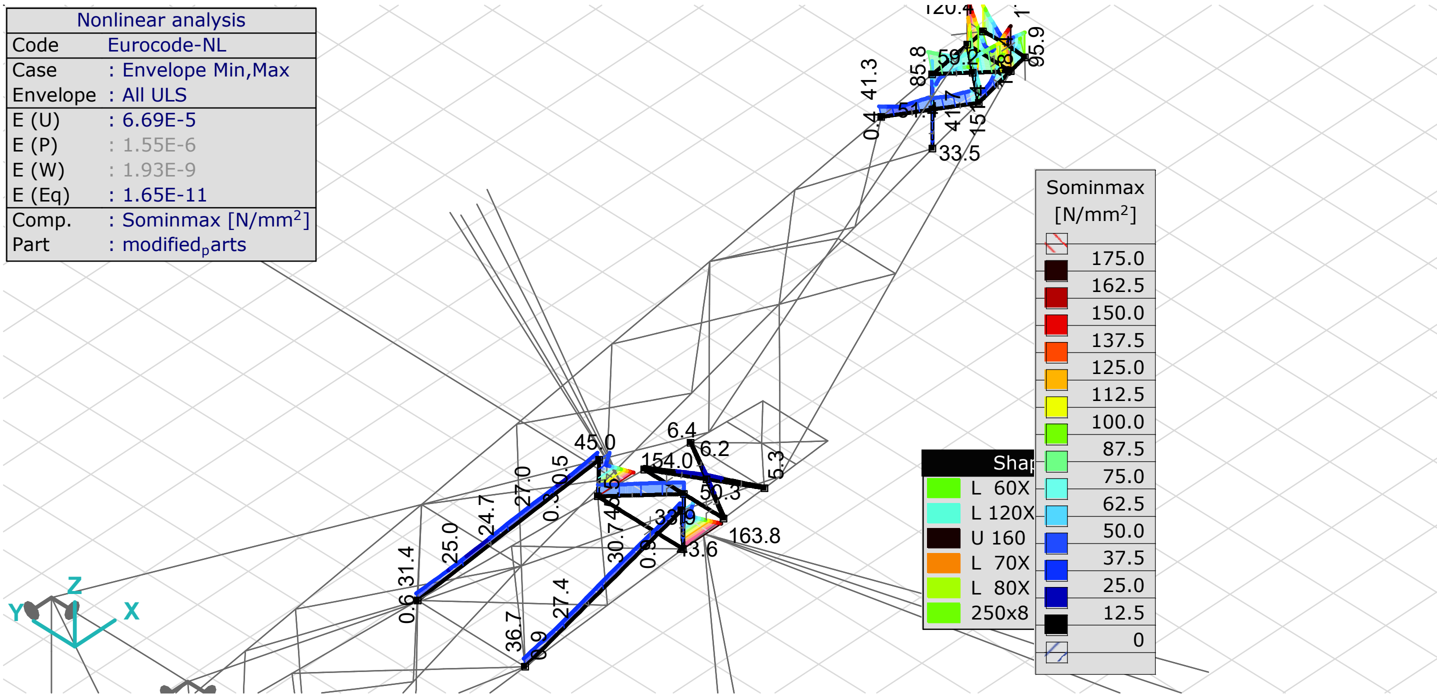
Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Smin [N/mm²]	Smax [N/mm²]
150	10	U 160	Smin	min	Co #5 [1] (1.000)	0	(74)	**−174.3**	83.2
143	17	L 70X 70X 7		max	Co #4 [1] (1.000)	0.295	(479)	**25.8**	36.6
143	17	L 70X 70X 7	Smax	min	Co #9 [1] (1.000)	0.089		−33.8	**−29.3**
150	10	U 160		max	Co #10 [1] (1.000)	0	(74)	−82.9	**173.4**
135	18	L 120X120X12_1	Somin	min	Co #1 [1] (1.000)	0	(70)	5.6	6.8
143	17	L 70X 70X 7		max	Co #9 [1] (1.000)	0.089		−33.8	−29.3
135	18	L 120X120X12_1	Somax	min	Co #1 [1] (1.000)	0	(70)	5.6	6.8
150	10	U 160		max	Co #5 [1] (1.000)	0	(74)	−174.3	83.2

Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Vmin [N/mm²]	Vmax [N/mm²]
150	10	U 160	Smin	min	Co #5 [1] (1.000)	0	(74)	0	19.7
143	17	L 70X 70X 7		max	Co #4 [1] (1.000)	0.295	(479)	0	0
143	17	L 70X 70X 7	Smax	min	Co #9 [1] (1.000)	0.089		0	0.2
150	10	U 160		max	Co #10 [1] (1.000)	0	(74)	0	19.8
135	18	L 120X120X12_1	Somin	min	Co #1 [1] (1.000)	0	(70)	0	0
143	17	L 70X 70X 7		max	Co #9 [1] (1.000)	0.089		0	0.2
135	18	L 120X120X12_1	Somax	min	Co #1 [1] (1.000)	0	(70)	0	0
150	10	U 160		max	Co #5 [1] (1.000)	0	(74)	0	19.7

Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Somin [N/mm²]	Somax [N/mm²]
150	10	U 160	Smin	min	Co #5 [1] (1.000)	0	(74)	0.4	175.0
143	17	L 70X 70X 7		max	Co #4 [1] (1.000)	0.295	(479)	25.8	36.6
143	17	L 70X 70X 7	Smax	min	Co #9 [1] (1.000)	0.089		29.3	33.8
150	10	U 160		max	Co #10 [1] (1.000)	0	(74)	0.5	174.2
135	18	L 120X120X12_1	Somin	min	Co #1 [1] (1.000)	0	(70)	**0**	0
143	17	L 70X 70X 7		max	Co #9 [1] (1.000)	0.089		**29.3**	33.8
135	18	L 120X120X12_1	Somax	min	Co #1 [1] (1.000)	0	(70)	0	**0**
150	10	U 160		max	Co #5 [1] (1.000)	0	(74)	0.4	**175.0**

Ext.	Sh.	Cross-section name	C	min. max.	Case	Loc. [m]	Node	Vymean [N/mm²]	Vzmean [N/mm²]
150	10	U 160	Smin	min	Co #5 [1] (1.000)	0	(74)	2.8	−2.9
143	17	L 70X 70X 7		max	Co #4 [1] (1.000)	0.295	(479)	0	0
143	17	L 70X 70X 7	Smax	min	Co #9 [1] (1.000)	0.089		0	−0.1
150	10	U 160		max	Co #10 [1] (1.000)	0	(74)	−2.7	2.7
135	18	L 120X120X12_1	Somin	min	Co #1 [1] (1.000)	0	(70)	0	0.1
143	17	L 70X 70X 7		max	Co #9 [1] (1.000)	0.089		0	−0.1
135	18	L 120X120X12_1	Somax	min	Co #1 [1] (1.000)	0	(70)	0	0.1
150	10	U 160		max	Co #5 [1] (1.000)	0	(74)	2.8	−2.9

Sh.: Cross-section; **C:** Extremal component; **min. max.:** Extreme type; **Case:** Load case of extreme; **Loc.:** Cross-section local x position on the beam; **Smin:** Axial stress cross-Section minimum; **Smax:** Axial stress cross-Section maximum; **Vmin:** Shear stress cross-section minimum; **Vmax:** Shear stress cross-section maximum; **Somin:** Von Mises stress cross-section minimum; **Somax:** Von Mises stress cross-section maximum; **Vymean:** Shear stress in local y direction; **Vzmean:** Shear stress in local z direction;



[II], > modified_parts, Nonlin., Envelope (All ULS), Sominmax, Filled diagram

OVER DNV GL

DNV GL is een wereldwijd bedrijf voor kwaliteitsborging en risicobeheer. Vanuit haar streven leven, bezit en het milieu te beschermen stelt DNV GL organisaties in staat de veiligheid en duurzaamheid van hun activiteiten te bevorderen. DNV GL biedt classificering en technische borging, naast software en onafhankelijk, deskundig advies voor de maritieme, de olie- en gasindustrie, energiecentrales en de duurzame energiesector. Daarnaast biedt het bedrijf certificeringsservices en datamanagement voor klanten in uiteenlopende sectoren. Onze medewerkers zijn actief in meer dan 100 landen over de hele wereld en streven ernaar klanten te helpen de wereld veiliger, slimmer en groener te maken.

APPENDIX E   DRAWINGS

Bijlage 14 Rapportage Mastconstructie S+0

“TOETSING EN HERONTWERP MASTEN EN FUNDATIES BBB380”

KIJ-GT380 – Rapportage mast S+0

TenneT TSO B.V.

Meridian doc. nr.: 002.589.40 0916488
Rapport nr.: 21-1102 Rev.0
Datum: 2021-07-06

Projectnaam:	"Toetsing en herontwerp masten en fundaties BBB380"	DNV GL - Energy
		Energy Advisory
Rapport titel:	KIJ-GT380 – Rapportage mast S+0	Postbus 9035
Klant:	TenneT TSO B.V.	6800 ET ARNHEM
Contactpersoon:	[redacted]	
Datum:	2021-07-06	
Project nr.:	10166260	[redacted]11
Organisatie unit:	TDT	[redacted]
Meridian doc.nr.:	002.589.40 0916488	
Rapport nr.:	21-1102 Rev.0	

Geschreven door: Beoordeeld door: Goedgekeurd door:

[redacted]

DNV GL Distributie:

☐ Onbeperkte distributie (intern en extern)
☐ Onbeperkte distributie binnen de DNV GL Groep
☐ Onbeperkte distributie binnen DNV GL Netherlands B.V.
☒ Geen distributie (vertrouwelijk)

Trefwoorden:

Versie	Datum	Reden voor uitgave	Auteur	Beoordeeld	Goedgekeurd
0	2021-07-06	Eerste uitgave	[redacted]		

DNV GL Netherlands B.V.

Inhoud

1 INLEIDING

1.1 Inleiding

Om in de toekomst meer elektriciteit te kunnen transporteren is het noodzakelijk om naast de nieuwbouw van verbindingen bestaande hoogspanningsverbindingen aan te passen zodat er een grotere transportcapaciteit mogelijk wordt gemaakt.

Om die reden is de opdrachtgever (OG) voornemens de bestaande 380 kV-koppelnetring op te waarderen. Het opwaarderen van de bestaande verbindingen valt onder het programma "Beter benutten bestaande 380 kV-ring" en omvat de volgende deelprojecten:

- Opwaardering 380 kV-verbinding Lelystad – Ens (LLS-ENS380)
- Opwaardering 380 kV-verbinding Diemen – Lelystad (DIM-LLS380)
- Opwaardering 380 kV-verbinding Rilland – Zandvliet (RLL-ZVL380)
- Opwaardering 380 kV-verbinding Krimpen aan den IJssel - Geertruidenberg (KIJ-GT380)
- Opwaardering 380 kV-verbinding Ens - Zwolle (ENS-ZL380)
- Opwaardering 380 kV-verbinding Maasbracht - Eindhoven (MBT-EHV380)

Om te komen tot een DO waarmee de werkzaamheden kunnen worden gestart is door TenneT aan DNV GL opdracht verstrekt voor de volgende onderdelen:

1. In eerste fase het opstellen en creëren van:

1.1 E-studie deel 1

1.2 Uitgangspuntenrapporten ten behoeve van de constructieve analyse van masten en fundaties

1.3 Sonderingmodellen

1.4 Fundatiemodellen

1.5 Mastmodellen

2. In tweede fase de uitvoering van de DO-fase bevattende:

2.1 Toetsing conform het uitgangspuntenrapport van de bestaande fundaties

2.2 Globale specificatie van benodigde fundatieversterkingen ten behoeve van aanbesteding

2.3 Toetsing conform het uitgangspuntenrapport van de bestaande masten

2.4 Globale specificatie van benodigde mastversterkingen ten behoeve van aanbesteding

2.5 E-studie deel 2

In deze studie wordt voor de lijn Krimpen aan den IJssel - Geertruidenberg de controle van de mastconstructie van masttype S+0 gerapporteerd.

Inhoudelijk is de Nederlandse versie van de rapportage ongewijzigd ten opzichte van de Engelse versie. Om deze reden zijn de bijlagen in dit rapport één op één overgenomen uit de Engelse versie. Hierdoor wijkt het revisienummer van de bijlagen af van het revisienummer van de rapportage.

1.2 Doelstelling en scope van dit rapport

Het doel van deze studie is om te bepalen of de in dit rapport beschreven bestaande mast geschikt is om te worden uitgerust met de ACCCZ-Warsaw geleider.

Nadat de wijzigingen zijn toegepast dient aantoonbaar geverifieerd te worden dat het systeem voldoet aan de vigerende eisen.

1.3 Relatie overige documenten

1.3.1 Verificatie & validatie plan

De door TenneT aangeleverde set met eisen is beoordeeld op relevantie en voor de relevante eisen is aangegeven in welk document wordt aangetoond dat er aan de eis wordt voldaan. De resultaten hiervan zijn opgenomen in het rapport "Verificatie & Validatieplan 380 kV verbinding Krimpen aan den IJssel - Geertruidenberg" [1].

1.3.2 E-studie deel 1

In de rapportage "KIJ-GT380 - E-studie deel 1" [2] is bepaald welke aanpassingen benodigd zijn om de ACCCZ Warsaw geleider toe te passen binnen de verbinding Krimpen aan den IJssel - Geertruidenberg. Uit de E-studie volgen geen zaken die relevant zijn voor de constructie van masttype S+0.

1.3.3 Uitgangspunten rapport

De uitgangspunten op basis waarvan de berekeningen in deze rapportage zijn uitgevoerd zijn opgenomen in het rapport "Uitgangspuntenrapport 380kV verbinding Krimpen aan den IJssel - Geertruidenberg" [3].

2 EISEN

In onderstaande Tabel 1 zijn de eisen opgenomen die binnen deze rapportage worden getoetst.

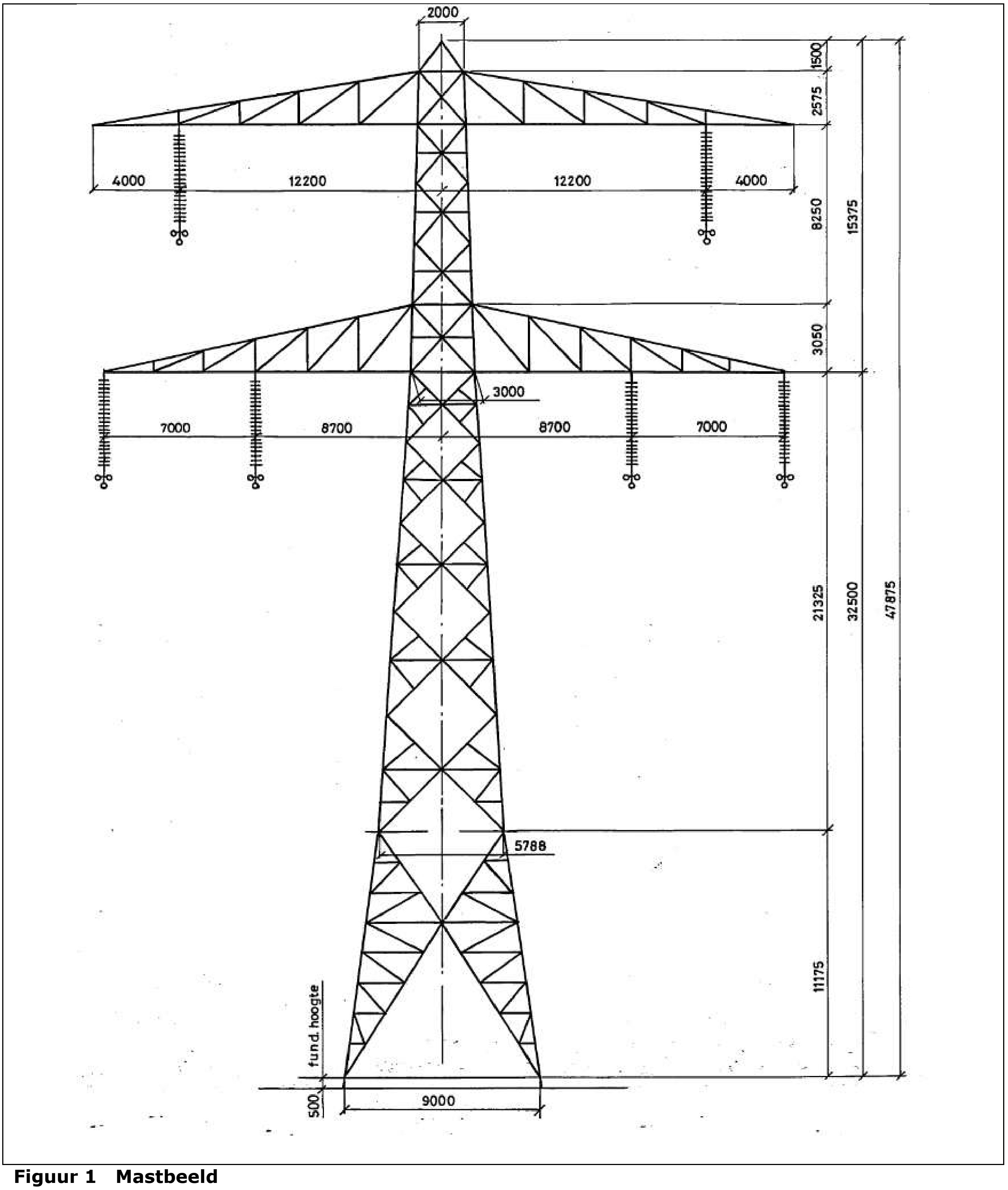
Tabel 1 Relevante eisen

Eis Id	Titel	Eis Tekst	Bewijsvoering
BO Eis: H2.7-6	Omgeving, beperkings factoren	Het ontwerp dient geverifieerd te worden op de uitvoerbaarheid.	Tabel 7
PVE.05.001 5.14	Masten	Aanwijzingen t.a.v. klimvoorziening en valbeveiliging: Huidige klimweg blijft gehandhaafd en zal voldoen aan de eisen zoals opgenomen in de NEN 1060:1964. Valbeveiliging is/zal worden uitgevoerd in het type "latch way". Indien staaldelen in de nabijheid (aangrenzend profiel) van de klimweg gewijzigd worden, dient geverifieerd te worden dat de klimvoorziening in overeenstemming is met de NEN 1060:1964.	Tabel 7

3 BEREKENINGEN

3.1 Mastbeeld

Het mastbeeld op basis van de Asset-data is weergegeven in Figuur 1.



Figuur 1 Mastbeeld

3.2 Mastenlijst

In deze rapportage wordt masttype S+0 getoetst. De berekening is uitgevoerd voor windgebied II en windgebied III. De wind en weight span van de verschillende masten zijn in Tabel 2 weergegeven. De maatgevende mastnummers zijn aangegeven. Bij zowel de masten in windgebied II als III is rekening gehouden met verhoogde windbelasting als gevolg van een hogere aangrenzende mast (hoger is een negatieve waarde).

Tabel 2 Mastnummers

Mastnummer	Masttype	Maatgevend mastnummer	Wind span (m)	Weight span (m)	Hoogteverschil
6	S+0 II	39	341	321	-5.7
7	S+0 II	39	337	337	-0.8
16	S+0 II	39	343	342	-1.1
17	S+0 II	39	388	390	0.2
18	S+0 II	39	393	394	0.0
19	S+0 II	39	390	391	-0.2
20	S+0 II	39	383	387	0.6
21	S+0 II	39	379	379	-0.5
22	S+0 II	39	382	383	0.1
23	S+0 II	39	372	373	-0.1
24	S+0 II	39	350	352	-0.5
26	S+0 II	39	366	347	-6.4
29	S+0 II	39	379	359	-5.8
30	S+0 II	39	379	380	-0.2
31	S+0 II	39	380	382	0.3
32	S+0 II	39	376	376	-0.1
33	S+0 II	39	381	382	-0.1
34	S+0 II	39	377	379	0.2
36	S+0 II	39	394	396	-0.3
39	S+0 II	39	399	400	-0.7
40	S+0 II	39	318	322	0.7
41	S+0 II	39	308	307	-0.5
42	S+0 II	39	388	370	-5.5
45	S+0 II	39	362	330	**-8.6**
55	S+0	65	399	400	-0.7
56	S+0	65	349	326	-5.2
59	S+0	65	399	336	-22.0
62	S+0	65	336	323	-3.2
64	S+0	65	399	388	-3.5
65	S+0	65	404	407	0.2
66	S+0	65	392	296	**-26.2**
70	S+0	65	280	194	-18.5
73	S+0	65	397	344	-15.3
74	S+0	65	399	401	0.0
75	S+0	65	399	402	-0.2
79	S+0	65	404	321	-24.0
82	S+0	65	395	389	-3.3

3.3 Uitgangspunten berekening

De berekening is uitgevoerd op basis van de uitgangspunten zoals opgenomen in het uitgangspuntenrapport [3]. Hierin is een volledig overzicht opgenomen van de belastingcombinaties en toegepaste belastingfactoren

Tabel 3 Uitgangspunten berekening

Algemeen	Norm Windgebied Terreincategorie Reductiefactor cdir	NEN-EN50341-2-15:2019 II/III II (onbebouwde omgeving) 1,00
Situatie initieel	Gevolgklasse Betrouwbaarheidsniveau Referentieperiode	CC2-0 Afkeur CC2-0 30 jaar
Situatie na aanpassingen	Gevolgklasse Betrouwbaarheidsniveau Referentieperiode	CC2 Verbouw 50 jaar

3.4 Proces stappen

Het proces van het bepalen van eventueel benodigde verstevigingen bestaat uit de volgende stappen:

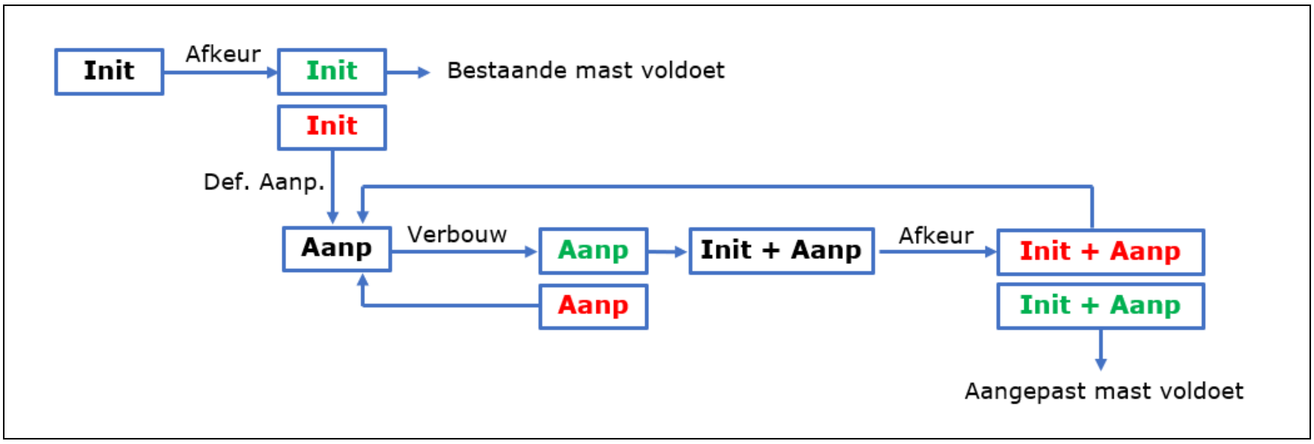
Stap 1: Toets bestaande (Init) mast op Afkeur

Stap 2: Definiëren benodigde aanpassingen indien initiële mast niet voldoet aan toets op Afkeur (Def. Aanp.)

Stap 3: Het toetsen van (alleen) de uitgewerkte aanpassingen (Aanp) op Verbouw

Stap 4: Het opnieuw toetsen van de complete mast inclusief aanpassingen (Initi + Aanp) op Afkeur

Het hierboven omschreven proces is in Figuur 2 weergegeven.



Figuur 2 Proces diagram

3.5 Geleiderbelastingen

De berekening is uitgevoerd met het geleiderbelastingprogramma van DNV GL. In Appendix A zijn de resultaten van de geleiderbelastingen samengevat.

3.6 Reacties op de fundering

De oplegreacties op de fundering worden ontleend aan de uitvoer van het geleiderbelastingenprogramma, zie ook Appendix A.

3.7 Modellering

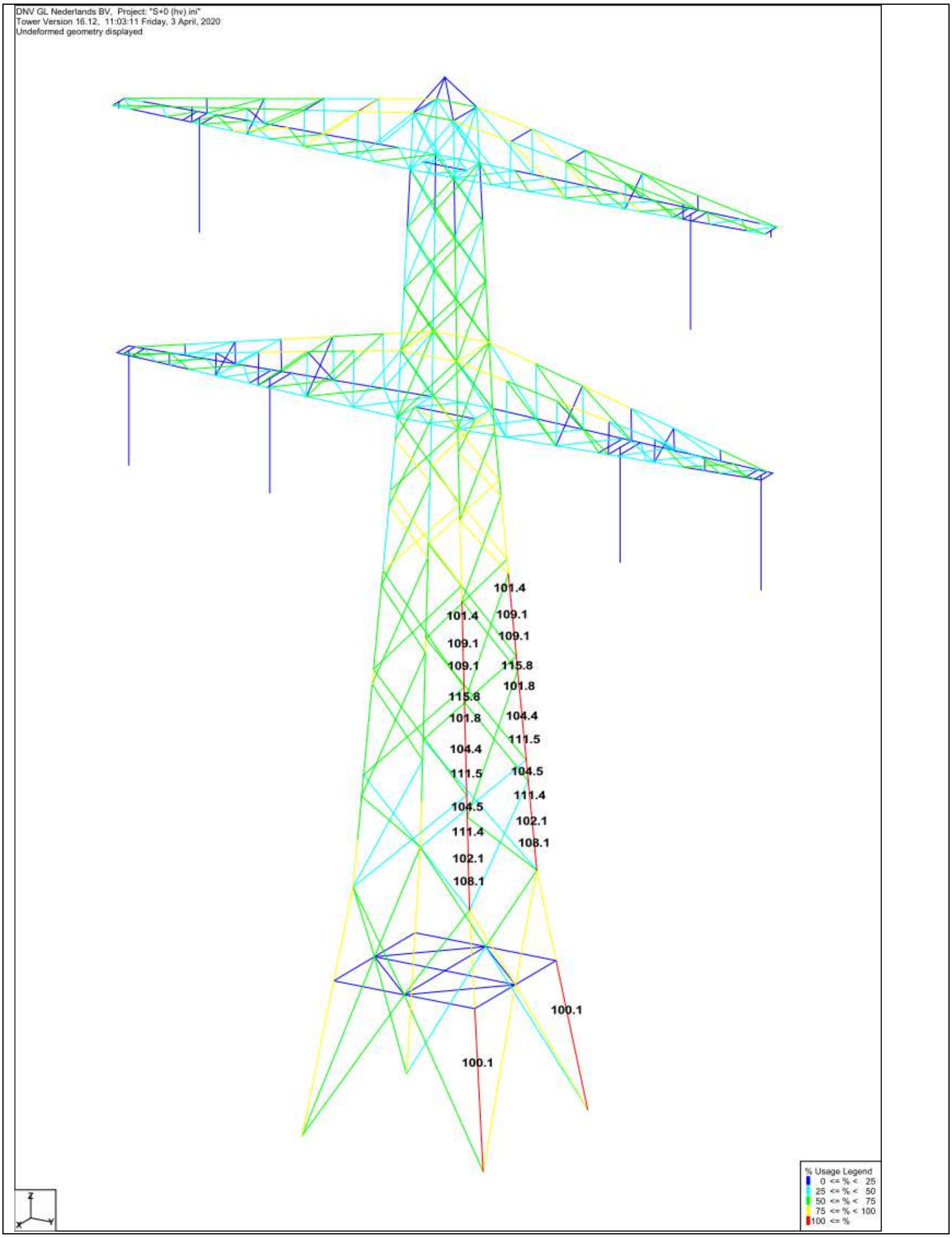
Op basis van de as-built tekeningen is de mast in PLS-TOWER ingevoerd. De hoofdelementen zijn gemodelleerd. Niet-dragende profielen als knikverkorters zijn weggelaten en worden separaat getoetst. De profielen inclusief de boutverbindingen zijn in PLS-TOWER ingevoerd en getoetst. Controle van de schetsplaten en andere detailverbindingen valt buiten de scope.

De geleiderbelastingen vanuit het geleiderbelastingenprogramma zijn als invoer voor de belastingen gebruikt.

Diagonalen in voor- en achtervlak respectievelijk de twee zijvlakken zijn samengenomen in een groep en de toetsing wordt per staafgroep uitgevoerd. Ingeval dat een element uit een groep is overbelast, geldt dit voor alle elementen uit de betreffende groep.

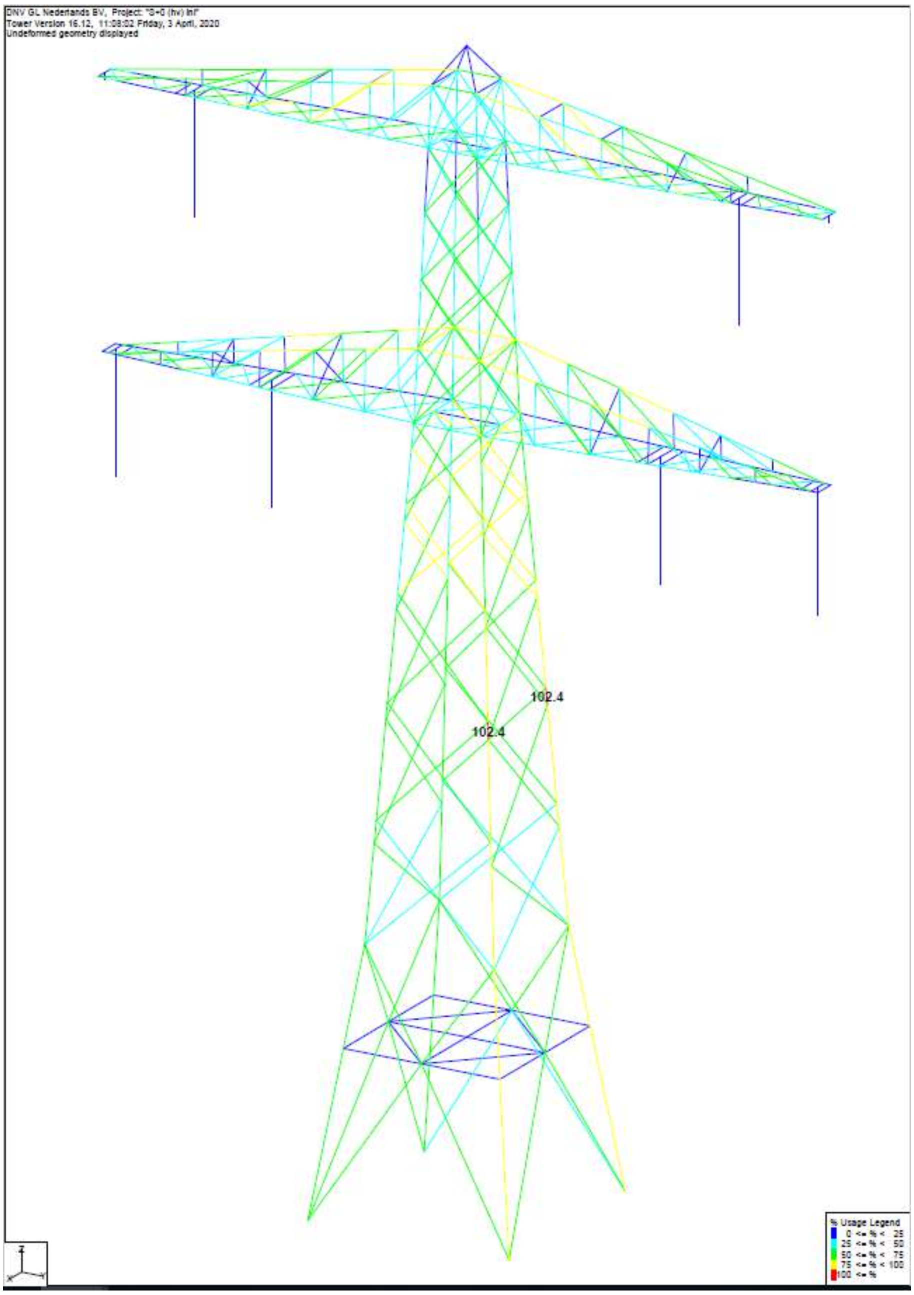
4 TOETSING MAST

Het resultaat van de controle van de mastconstructie type S+0 in windgebied II met belastingen op afkeurniveau is weergegeven in Figuur 3.



Figuur 3 Resultaat PLS-TOWER S+0 II (39)

Het resultaat van de controle van de mastconstructie type S+0 in windgebied III met belastingen op afkeurniveau is weergegeven in Figuur 4.



Figuur 4 Resultaat PLS-TOWER S+0 (65)

De resultaten van de controles van profielen, knikverkorters en ankers randstijl zijn opgenomen in Tabel 4.

Tabel 4 Samenvatting controle

Controle van	Beoordeling		Referentie
Profielen		**Voldoen niet**	Figuur 3
Knikverkorters		**Voldoen niet**	Appendix C
Ankers en voetplaat		**Voldoen niet**	Appendix D
Blokdeuvels	Voldoen		Appendix D

5 AANPASSINGEN

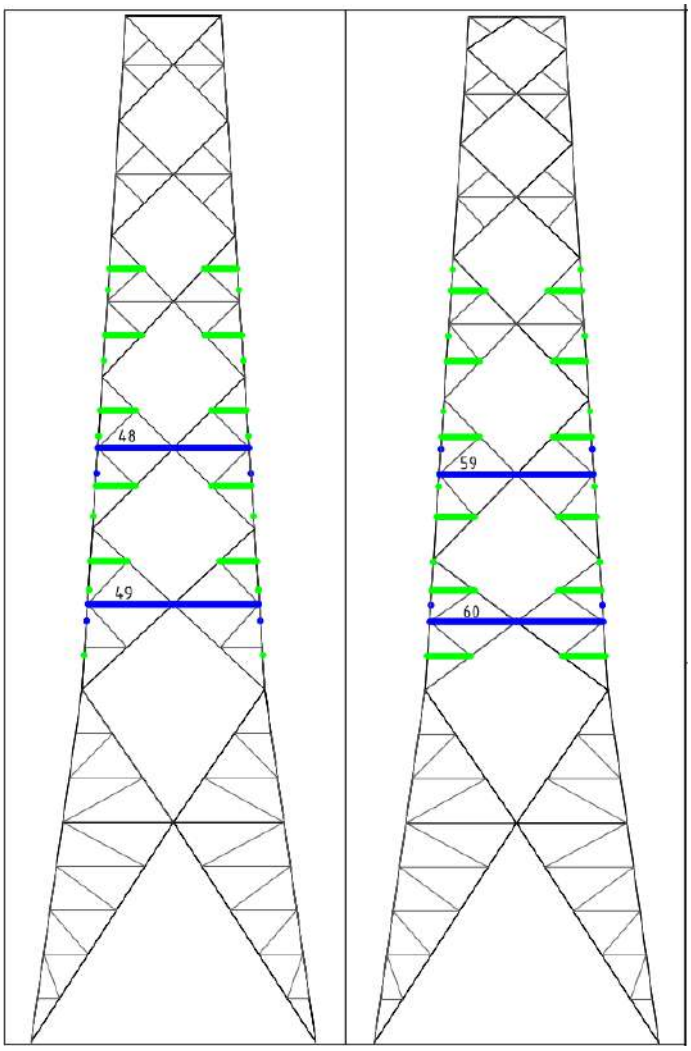
5.1 Inleiding

Een versterkingsvoorstel om de mast aan afkeurniveau te laten voldoen is uitgewerkt. Dit voorstel bevat de volgende maatregelen:

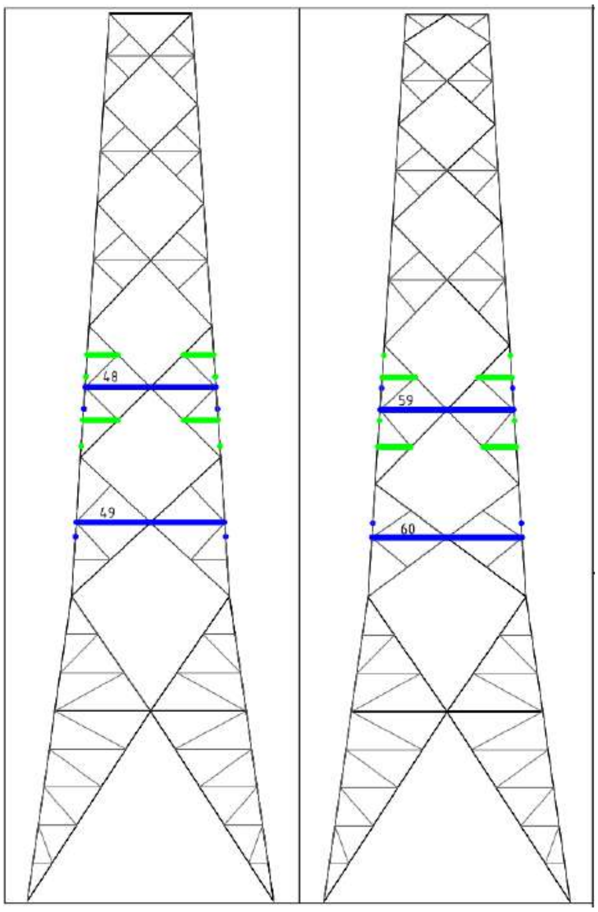
- Knikverkorters vervangen;
- Vervangen van een diagonaal in de bovenste traverse;
- Knikverkorters toevoegen;
- Bouten vervangen;
- Voetplaat verzwaren.

5.2 Aanpassingen

Voor berekening, zie Appendix C. Voor afmetingen profielen en bouten, zie Appendix E. De benodigde aanpassingen zijn weergegeven in Figuur 5 en Figuur 6.

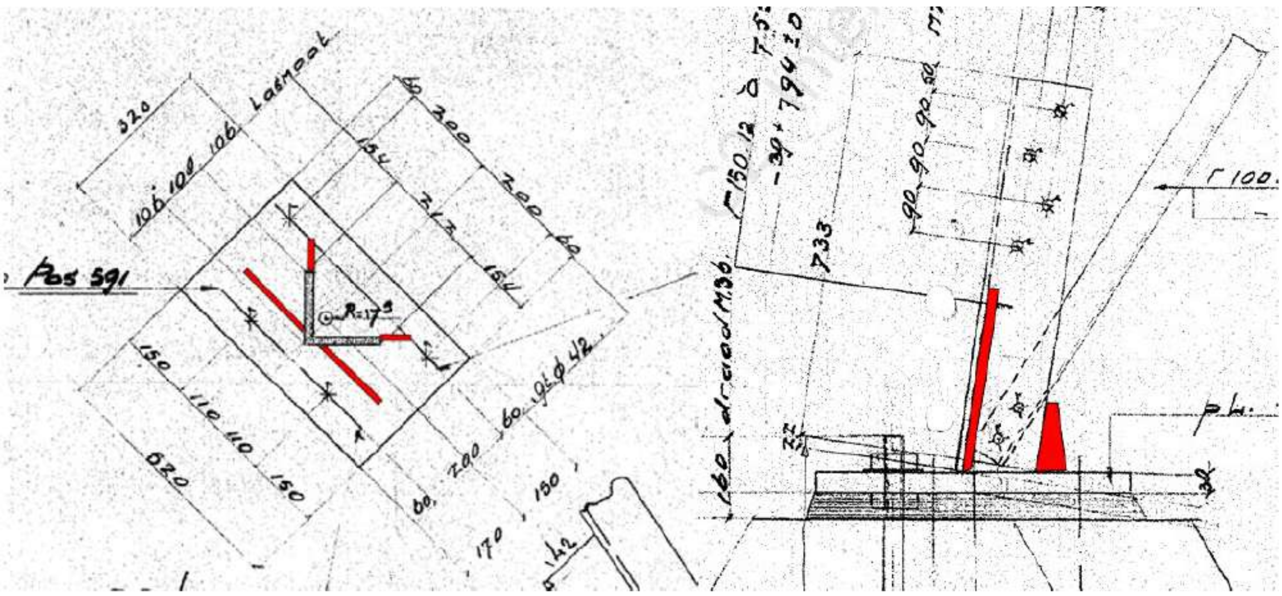


Figuur 5 Principe aanpassing/toevoeging knikverkorters voor S+0 II (39)



Figuur 6 Principe aanpassing/toevoeging knikverkorters voor S+0 (65)

De voetplaat voor S+0 (39) in windgebied II moet versterkt worden. Een aanpassingsvoorstel voor de voetplaat en ankers is de voetplaat versterken met in het werk aan te lassen verstijvingsplaten. Zie hiervoor Figuur 7. Voor de berekening van de ankerverbinding zie Appendix D.



Figuur 7 Principe van te versterken ankerplaat

Een overzicht van het nettogewicht van de profielen die nodig zijn voor de versterkingen/aanpassingen is voor mast 39 gegeven in Tabel 5 en voor mast 65 in Tabel 6. Het gewicht van eventueel benodigde schetsplaten is niet meegenomen.

Tabel 5 Gewichten S+0 II (39) van toegevoegde knikverkorters en uitgewisselde profielen

Staafgroep	Profiel	Materiaal	Bouten	Profiel nw.	Materiaal nw.	Bouten nw.	Maatregel	Aantal	Lengte (m)	Gewicht (kg)
49	L45.5	S235	M12-5.6	L55.6	S355	M12-8.8	Profiel uitgewisseld	4	2,64	53,3
48	L45.5	S235	M12-5.6	L50.5	S355	M12-8.8	Profiel uitgewisseld	4	2,32	35,6
60	L45.5	S235	M12-5.6	L55.6	S355	M12-8.8	Profiel uitgewisseld	4	2,67	53,9
59	L45.5	S235	M12-5.6	L50.5	S355	M12-8.8	Profiel uitgewisseld	4	2,37	36,4
5000				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,22	18,7
5001				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,32	20,3
5002				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,17	18,0
5005				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,43	22,0
5006				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,43	22,0
5007				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,27	19,5
5008				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,27	19,5
5003				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,22	18,7
5004				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,1	16,9
5009				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,12	17,2
5010				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,12	17,2
										389,2

Tabel 6 Gewichten S+0 (65) van toegevoegde knikverkorters en uitgewisselde profielen

Staafgroep	Profiel	Materiaal	Bouten	Profiel nw.	Materiaal nw.	Bouten nw.	Maatregel	Aantal	Lengte (m)	Gewicht (kg)
49	L45.5	S235	M12-5.6	L55.6	S355	M12-8.8	Profiel uitgewisseld	4	2,64	53,3
48	L45.5	S235	M12-5.6	L50.5	S355	M12-8.8	Profiel uitgewisseld	4	2,32	35,6
60	L45.5	S235	M12-5.6	L55.6	S355	M12-8.8	Profiel uitgewisseld	4	2,67	53,9
59	L45.5	S235	M12-5.6	L50.5	S355	M12-8.8	Profiel uitgewisseld	4	2,37	36,4
5001				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,32	20,3
5002				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,17	18,0
5007				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,27	19,5
5008				L50.5	S355	M16-8.8	Profielen toegevoegd	4	1,27	19,5
										256,5

5.3 Eisen verificatie

De verificatie van de van toepassing zijnde eisen is uitgevoerd in onderstaande Tabel 7.

Tabel 7 Verificatie eisen

Eis Id	Eis Tekst	Ja	Nee	N.v.t.	toelichting
BO Eis: H2.7-6	Aanpassingen uitvoerbaar?	X			De toe te voegen staalonderdelen zijn met geboute verbindingen te bevestigen. Dit is een bewezen methode. De verstijving van de voetplaat vereist in het werk lassen. Vanwege de locatie op de grond is dit uitvoerbaar en een bewezen oplossing.
PVE.05.001 5.14	Staaldelen in nabijheid van klimweg gewijzigd?	X			De wijzigingen in de nabijheid van de klimweg (knikverkorters) zijn in te passen zonder negatieve invloed op de begaanbaarheid.
	klimvoorziening nog in overeenstemming is met de NEN 1060:1964?			X	Geen wijzigingen

6 REFERENTIES

[1] „002.589.40 0817486 - 20-0473 - Verificatie & validatieplan 380kV verbinding Krimpen aan de IJssel - Geertruidenberg".

[2] „002.589.40 0808624 - 20-0472 - E-studie deel 1 380kV verbinding Krimpen aan de IJssel - Geertruidenberg".

[3] „002.589.40 0808629 - 20-0345 - Uitgangspuntenrapport 380kV verbinding Krimpen aan de IJssel - Geertruidenberg".

APPENDIX A CONDUCTOR LOADS

Content

ISSUE	DATE	REVISION	CHK'D	APP'D
0.0	2020-11-26			

Data

Norm	NEN-EN50341-2-15:2019
Initial	
Consequence class	CC2-0
Reliability level	Afkeur
Reference period	30 jaar
After adjustment	
Consequence class	CC2
Reliability level	Verbouw
Reference period	50 jaar
Wind zone	II
Wind speed	27 m/s
Terrain categorie	II
Reduction factor C_{dir}	1,00
Ice region	B
Tower type	Steunmast
Tower height	48 m
Max. Span	402 m
Line angle	180°
Catenary	1400 m
Wind span	400 m
EDS Weight span	399 m
Min. Weight span	396 m
Max. Weight span	399 m

Client: TenneT Taking power further

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Title:

Berekening masttype S+0 II

JOB No.	-	DATE	-
DRAWN	-	CHKD	-
DESIGN	-	APPD	-

Document name:

KIJ-GT_S+0 II_39_Report.pdf

Project number:

Project client number:

0.0

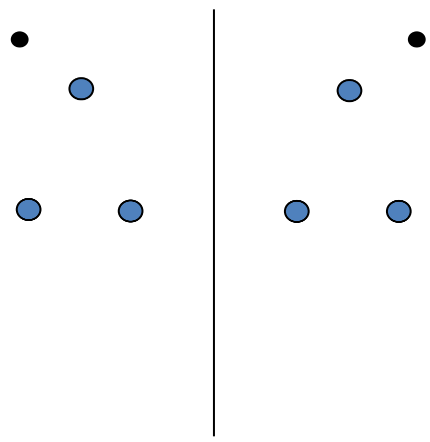
Project: KIJ-GT
Tower: S+0 II
Number: 39

Conductor loads

Auteur: TBR
Versie: v11.3

General

Description	S+0 II
Tower type	Steunmast
Number of circuits	2
Configuration	2-circuit-donau
Number of earth wires	2



Configuratie geleiders

Starting points

Norm	NEN-EN50341-2-15:2019
Consequence class	CC2-0
Reliability level initial	Afkeur CC2-0
Reference period intial	30 jaar
Consequence class modified	CC2
Reliability level modified	Verbouw
Reference period modified	50 jaar
Wind zone	II
Wind speed	27,0 m/s
Terrain category	II
Reduction factor c_{dir}	1,00
Ice region phase conductor	B
Ice region earth conductor	B

Conductors back

Description	Voltage	Conductor Back	Bundle Ba	Ice region	Additional weight	Additional diameter	Catenary P_{back}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Conductors ahead

Description	Voltage	Conductor Ahead	Bundle Ah	Ice region	Additional weight	Additional diameter	Catenary P_{ahead}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Insulators *(1)*

Description	Suspension	Weight [kN]	Length [m]	Wind area [m^2]
Circuit 1	Halfverankering	2,00	4,30	1,00
Circuit 2	Halfverankering	2,00	4,30	1,00
Bliksemdraad 1	Vast (Bliksemdraad)	0,10	0,50	0,05
Bliksemdraad 2	Vast (Bliksemdraad)	0,10	0,50	0,05

1. Properties apply to the entire isolator set

Suspension height and position in mast

Circuits	Designation	Number	Suspension height	Attach point	Position in tower (3) Horizontal distance
Circuit 1	10	380ct1f1	28,2 m	32,5 m	15,7 m
Circuit 1	11	380ct1f2	28,2 m	32,5 m	8,7 m
Circuit 1	12	380ct1f3	39,5 m	43,8 m	12,2 m
Circuit 2	20	380ct2f1	28,2 m	32,5 m	-8,7 m
Circuit 2	21	380ct2f2	28,2 m	32,5 m	-15,7 m
Circuit 2	22	380ct2f3	39,5 m	43,8 m	-12,2 m
Bliksemdraad 1	1	bl1	43,3 m	43,8 m	16,2 m
Bliksemdraad 2	3	bl2	43,3 m	43,8 m	-16,2 m

1. Positive = adjacent mast higher
2. Positive = in direction of rotation coordinate system x => y

Project: KIJ-GT
Tower: S+0 II
Number: 39

Height adjustment adjacent masts (wind and weight span adjustment)

	Back	Ahead	
Height increase for wind pressure	0,0 m	9,0 m	(positive: higher)
Height decrease for vertical load	0,0 m	0,0 m	(negative: decrease, more weight span)

Decrease: Niet in 0,9EG-combinaties

Height difference adjacent tower and change of direction with respect to Line direction

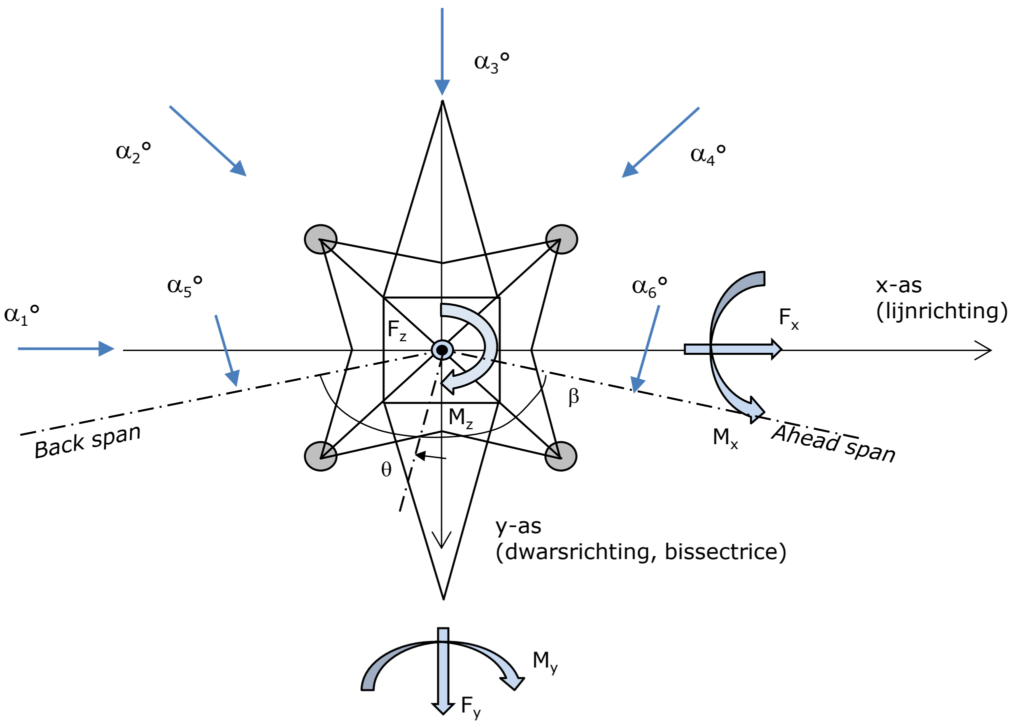
			Hoogteverschil		Richtingsverandering	
Circuits	Aanduiding	Nummer	Δh_back	Δh_ahead	Δy_back	Δy_ahead
Circuit 1	10	380ct1f1	-0,4	0,4 m	0,0	0,0 m
Circuit 1	11	380ct1f2	-0,4	0,4 m	0,0	0,0 m
Circuit 1	12	380ct1f3	-0,4	0,4 m	0,0	0,0 m
Circuit 2	20	380ct2f1	-0,4	0,4 m	0,0	0,0 m
Circuit 2	21	380ct2f2	-0,4	0,4 m	0,0	0,0 m
Circuit 2	22	380ct2f3	-0,4	0,4 m	0,0	0,0 m
Bliksemdraad 1	1	bl1	0,0	0,4 m	0,0	0,0 m
Bliksemdraad 2	3	bl2	0,0	0,4 m	0,0	0,0 m

Line and tower data

		Back	Ahead
		402,0	397,0 m
Ruling span $\sqrt{(\Sigma L^3/\Sigma L)}$		366,3	366,3 m
Line angle	β	180 °	
Tower orientation with respect to bis	θ	0 °	
Section length		3403	3403 m
Height bottom of tower to ground level		0,5 m	
Wind directions considered	α_1	0 °	
Wind directions according to:	α_2	45 °	
Geleiderbelastingen	α_3	90 °	
	α_4	135 °	
	α_5	- °	
	α_6	- °	

Wind directions apply to the main direction of mast construction, not to the bisector.

Windrichtingen en positieve richtingen belastingen



Considered number of wind directions	
1a	4
3	4
4	1
6	1
Overig	1

Project: KIJ-GT
Tower: S+0 II
Number: 39

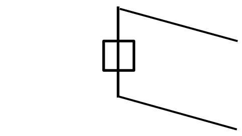
Absence of conductors

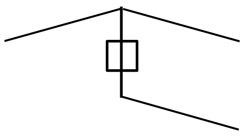
		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	380ct1f1	1	0	1	0	0,8	0
Circuit 1	380ct1f2	1	0	1	0	0,8	0
Circuit 1	380ct1f3	1	0	1	0	0,8	0
Circuit 2	380ct2f1	0	1	1	0	0,8	0
Circuit 2	380ct2f2	0	1	1	0	0,8	0
Circuit 2	380ct2f3	0	1	1	0	0,8	0
Bliksemdraad 1	bl1	1	0	1	0	1	0
Bliksemdraad 2	bl2	0	1	1	0	1	0

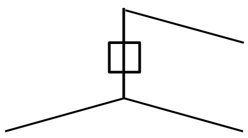
Load situations SPLS

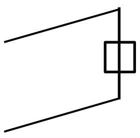
Considered situations SPLS: SPLS for suspension tower not applicable

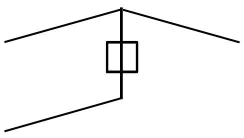
Principle of load situations:

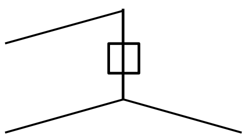

1. Ba All cts


2. Ba ct1


3. Ba ct2


4. Ah All cts

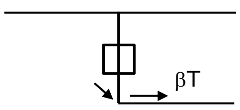

5. Ah ct1


6. Ah ct2

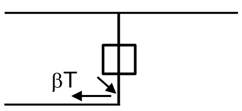
Load situation 5a. Conductor failure

Considered situations conductor failure 5a: 1, design assumption is symmetry back and ahead

Principle of load situations:



1. Ba



2. Ah

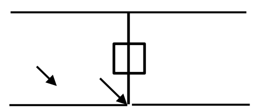
Load situations LC6. Construction and maintenance
Under 6a, the load due to the presence of a line verhicle or line bicycle in combination with point load on the traverse is assesed.
Combination 6b does not contain any loads in conductor or on traverse. This combination has been added to be able to combine with separate control platforms, etc. The situations are applied in ULS and in every SPLS situation (in case of angle tower).

3,0 kN	2,0 kN
1,0 kN	1,0 kN

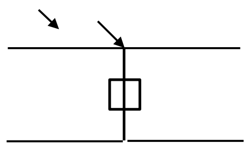
Considered situations construction and maintenance 6a: 1 up to 4, all possible situations

Presence line vehicle: Circuit, load present in all conductors of a circuit

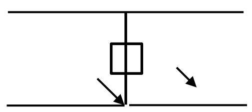
Principle of load situations:



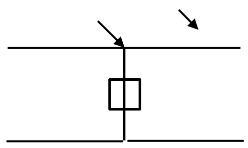
1. Ba Ct1



2. Ba Ct2



3. Ah Ct1



4. Ah Ct2

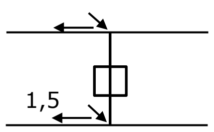
Load situations 8. Galloping as a static load

Conductor		
Suspension tower phase	0,866 W	1,5 W
Suspension tower earth	1,5 EDS	1,5 W
Strain tower phase and earth	1,5 EDS	1,5 W

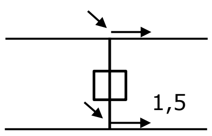
Considered situations galloping 8: None (existing structure)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principle of load situations:



1. Ba



2. Ah

Load combination 8. Galloping as a dynamic load
Only applies to tension towers
Load consists of EDS tensile load in one of the conductors on one side of the tower
Can be converted by user to fatigue spectrum via the load spectrum of table 4.11 / NL.1

Project: KIJ-GT
Tower: S+0 II
Number: 39

Tower structure

Properties

Tower type	Steunmast		
Tower designation	S+0 II		
Base plate w.r.t. ground level	0,5	m	
Tower height w.r.t. base plate	48,0	m	
Tower self weight	205,0	kN	

Width and slope at foundation	x-ri.	y-ri.	
Leg spread	9,00	9,00	m
Inclination of main leg	0,144	0,144	-
Horizontal force factor	1,4	1,4	-

Calculation Wind load

Dynamic factor G_T	1,00 *(Masthoogte < 60 m)*
Wind load diagonally to tower body proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Wind load diagonally on traverse proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Magnification factor diagonal wind to tower body	(1+0,2sin^2(2phi))
Magnification factor diagonal wind to cross arm	(1+0,2sin^2(2phi))
Magnification factor wind parallel to perpendicular to cross a	0,4

Properties mast sections line direction (front view, yz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	11,18	9,00	5,79	11,18	0,144	82,68	8,38	0,10	3,40
Middenstuk 1	21,06	5,79	4,50	9,88	0,065	50,83	6,38	0,13	3,28
Middenstuk 2	32,50	4,50	3,00	11,44	0,066	42,90	7,13	0,17	3,08
Bovenstuk 1	38,40	3,00	2,58	5,90	0,036	16,46	4,17	0,25	2,71
Bovenstuk 2	46,40	2,58	2,00	8,00	0,036	18,32	4,61	0,25	2,72
Topstuk	47,88	2,00		1,48		1,48	0,38	0,26	2,70
Ondertraverse	32,50	15,70		2,90		22,77	4,29	0,19	2,98
Boventraverse	43,80	16,20		2,50		20,25	4,17	0,21	2,90

Properties tower sections transverse direction (side view, xz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	11,18	9,00	5,79	11,18	0,144	82,68	8,38	0,10	3,40
Middenstuk 1	21,06	5,79	4,50	9,88	0,065	50,83	6,38	0,13	3,28
Middenstuk 2	32,50	4,50	3,00	11,44	0,066	42,90	7,13	0,17	3,08
Bovenstuk 1	38,40	3,00	2,58	5,90	0,036	16,46	4,17	0,25	2,71
Bovenstuk 2	46,40	2,58	2,00	8,00	0,036	18,32	4,61	0,25	2,72
Topstuk	47,88	2,00		1,48		1,48	0,38	0,26	2,70
Ondertraverse	32,50	15,70		2,90		22,77	4,29	0,19	2,98
Boventraverse	43,80	16,20		2,50		20,25	4,17	0,21	2,90

Note: Surface transverse direction is reduced in calculation.

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Project: KIJ-GT
Tower: S+0 II
Number: 39

Wind surface feeders telecom installations

Part	A (m^2/m)	Δh	A_1
Broekstuk 1			
Middenstuk 1			
Middenstuk 2			
Bovenstuk 1			
Bovenstuk 2			

Input antennas

Description	A (m^2)	h (m)	C_f (m)
Antenne top			
Antenne o.t.			

Tower section loads longitudinal (x-direction) per wind direction

Description	p_w	F_{x1}	F_{x2}	F_{x3}	F_{x4}	h_{ef}	M_{y1}	M_{y2}	M_{y3}	M_{y4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,85	24,3	20,6	0,0	-20,6	5,6	135,6	115,0	0,0	-115,0
Middenstuk 1	1,00	20,9	17,7	0,0	-17,7	16,1	336,1	285,2	0,0	-285,2
Middenstuk 2	1,16	25,5	21,7	0,0	-21,7	26,8	684,0	580,4	0,0	-580,4
Bovenstuk 1	1,26	14,2	12,1	0,0	-12,1	35,5	503,8	427,4	0,0	-427,4
Bovenstuk 2	1,32	16,5	14,0	0,0	-14,0	42,4	701,0	594,8	0,0	-594,8
Topstuk	1,36	1,4	1,2	0,0	-1,2	47,1	65,6	55,6	0,0	-55,6
Ondertraverse	1,24	31,7	18,8	0,0	-18,8	33,5	1059,7	629,4	0,0	-629,4
Boventraverse	1,34	32,4	19,3	0,0	-19,3	44,6	1447,3	859,7	0,0	-859,7
Totaal		166,9	125,3	0,0	-125,3		4933,0	3547,6	0,0	-3547,6

Tower section loads longitudinal (y-direction) per wind direction

Description	p_w	F_{y1}	F_{y2}	F_{y3}	F_{x4}	h_{ef}	M_{x1}	M_{x2}	M_{x3}	M_{x4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,85	0,0	20,6	24,3	20,6	5,6	0,0	115,0	135,6	115,0
Middenstuk 1	1,00	0,0	17,7	20,9	17,7	16,1	0,0	285,2	336,1	285,2
Middenstuk 2	1,16	0,0	21,7	25,5	21,7	26,8	0,0	580,4	684,0	580,4
Bovenstuk 1	1,26	0,0	12,1	14,2	12,1	35,5	0,0	427,4	503,8	427,4
Bovenstuk 2	1,32	0,0	14,0	16,5	14,0	42,4	0,0	594,8	701,0	594,8
Topstuk	1,36	0,0	1,2	1,4	1,2	47,1	0,0	55,6	65,6	55,6
Ondertraverse	1,24	0,0	18,8	12,7	18,8	33,5	0,0	629,4	423,9	629,4
Boventraverse	1,34	0,0	19,3	13,0	19,3	44,6	0,0	859,7	578,9	859,7
Total		0,0	125,3	128,4	125,3		0,0	3547,6	3428,8	3547,6

Resulting loads from mast construction incl. Antenna without conductors level foundation (char. Value)

Load / wind direction	F_x	F_y	F_z	M_x	M_y	M_z
	[kN]	[kN]	[kN]	[kNm]	[kNm]	[kNm]
Permanente belasting	0	0	205	0	0	0
Windrichting 0°	167	0	0	0	4933	0
Windrichting 45°	125	125	0	3548	3548	0
Windrichting 90°	0	128	0	3429	0	0
Windrichting 135°	-125	125	0	3548	-3548	0

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Project: KIJ-GT
Tower: S+0 II
Number: 39

Intermediate results for conductor loads

Conductors back

Circuit	Geleider	Diameter [mm]	A [mm²]	G [N/m]	E [N/mm²]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Conductors ahead

Circuit	Geleider	Diameter [mm]	A [mm²]	G [N/m]	E [N/mm²]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Vertical load back

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Vertical load ahead

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	[N/m]	[N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Insulators

Conductor	$G_{isolator}$ [kN]	Number -	$F_{v,iso}$ [kN]	Length [m]	Wind surf. [m²]	Wind heigth [m]	Pressure [kN/m²]	Drag factor [-]	$F_{h,iso}$ [kN]
380ct1f1	2,00	1	2	4,3	1,0	30,85	1,21	1,2	1,45
380ct1f2	2,00	1	2	4,3	1,0	30,85	1,21	1,2	1,45
380ct1f3	2,00	1	2	4,3	1,0	42,15	1,32	1,2	1,58
380ct2f1	2,00	1	2	4,3	1,0	30,85	1,21	1,2	1,45
380ct2f2	2,00	1	2	4,3	1,0	30,85	1,21	1,2	1,45
380ct2f3	2,00	1	2	4,3	1,0	42,15	1,32	1,2	1,58
bl1	0,10	1	0,1	0,5	0,1	44,05	1,33	1,2	0,08
bl2	0,10	1	0,1	0,5	0,1	44,05	1,33	1,2	0,08

Project: KIJ-GT
Tower: S+0 II
Number: 39

Wind load back

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	18,9	1,05	0,54	0,47	1,08	28,25	52,0	44,9	46,9	95,7	82,6
380ct1f2	18,9	1,05	0,54	0,47	1,08	28,25	52,0	44,9	46,9	95,7	82,6
380ct1f3	30,2	1,20	0,58	0,50	1,04	28,25	61,4	52,9	46,9	117,4	101,1
380ct2f1	18,9	1,05	0,54	0,47	1,08	28,25	52,0	44,9	46,9	95,7	82,6
380ct2f2	18,9	1,05	0,54	0,47	1,08	28,25	52,0	44,9	46,9	95,7	82,6
380ct2f3	30,2	1,20	0,58	0,50	1,04	28,25	61,4	52,9	46,9	117,4	101,1
bl1	34,8	1,25	0,59	0,51	1,16	22,24	19,1	16,4	41,5	36,7	31,6
bl2	34,8	1,25	0,59	0,51	1,16	22,13	19,0	16,3	41,4	36,7	31,5

Wind load ahead

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	24,0	1,13	0,56	0,48	1,06	28,25	56,8	48,9	46,9	106,5	91,8
380ct1f2	24,0	1,13	0,56	0,48	1,06	28,25	56,8	48,9	46,9	106,5	91,8
380ct1f3	35,3	1,26	0,59	0,51	1,03	28,25	64,7	55,6	46,9	125,3	107,8
380ct2f1	24,0	1,13	0,56	0,48	1,06	28,25	56,8	48,9	46,9	106,5	91,8
380ct2f2	24,0	1,13	0,56	0,48	1,06	28,25	56,8	48,9	46,9	106,5	91,8
380ct2f3	35,3	1,26	0,59	0,51	1,03	28,25	64,7	55,6	46,9	125,3	107,8
bl1	39,7	1,30	0,60	0,52	1,15	22,24	20,0	17,1	41,5	38,8	33,3
bl2	39,7	1,30	0,60	0,52	1,16	22,13	19,9	17,1	41,4	38,7	33,3

Project: KIJ-GT
Tower: S+0 II
Number: 39

Auteur: TBR
Versie: v11.3

Conductor loads

Starting points

Consequence class	Afkeur CC2-0
Reference period	30 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,05	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,12	0,00	0,0
ULS 3	Wind+ice	-5°	1,05	1,05	0,00	0,34	0,97	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,05	0,00	0,34	0,97	0,0
ULS 4	Cold+wind	-20°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,05	0,00	0,22	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,05	1,05	1,20	0,22	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 7	Permanent	10°	1,15	1,15	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,05	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,05	1,05	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,05	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,05	1,05	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,05	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,05	1,05	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,05	1,05	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	0,94	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,28	0,88	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	4
Number of load combinations for ULS	36
Number of load combinations for SPLS	0
Number of load combinations for SLS	11
Number of concentrated loads	376

Project: KIJ-GT
Tower: S+0 II
Number: 39

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-29,9	29,9	4,3	4,5	5,4	5,3
bl2	-30,2	30,2	4,3	4,5	5,4	5,3
380ct1f1	-110,9	110,9	12,6	13,5	16,4	16,0
380ct1f2	-110,9	110,9	12,6	13,5	16,4	16,0
380ct1f3	-113,5	113,5	14,8	15,3	16,4	16,0
380ct2f1	-110,9	110,9	12,6	13,5	16,4	16,0
380ct2f2	-110,9	110,9	12,6	13,5	16,4	16,0
380ct2f3	-113,5	113,5	14,8	15,3	16,4	16,0

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	396,8	397,7	398,0
bl2	396,8	397,7	398,0
380ct1f1	399,1	399,2	399,2
380ct1f2	399,1	399,2	399,2
380ct1f3	399,1	399,2	399,2
380ct2f1	399,1	399,2	399,2
380ct2f2	399,1	399,2	399,2
380ct2f3	399,1	399,2	399,2

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	398,0	398,0
bl2	398,0	398,0
380ct1f1	399,2	399,2
380ct1f2	399,2	399,2
380ct1f3	399,2	399,2
380ct2f1	399,2	399,2
380ct2f2	399,2	399,2
380ct2f3	399,2	399,2

Envelop of weight span over all combinations (incl. 0,9 combinations) For all conductors		Wind / Weight span ratio
Max. weight span	399,2 m	0,999 -
Min. weight span	396,2 m	0,992 -

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Project: KIJ-GT
Tower: S+0 II
Number: 39

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	15,0	8,8	8,1	-31,7	31,7
bl2	15,0	8,8	8,1	-31,8	31,8
380ct1f1	51,3	26,0	32,4	-110,2	111,6
380ct1f2	51,3	26,0	32,4	-110,2	111,6
380ct1f3	51,3	30,1	32,4	-113,0	114,1
380ct2f1	51,3	26,0	32,4	-110,2	111,6
380ct2f2	51,3	26,0	32,4	-110,2	111,6
380ct2f3	51,3	30,1	32,4	-113,0	114,1

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	0,0	0,0	4,1	-15,0	15,0
bl2	0,0	0,0	4,1	-15,0	15,0
380ct1f1	0,0	0,0	20,3	-64,2	64,2
380ct1f2	0,0	0,0	20,3	-64,2	64,2
380ct1f3	0,0	0,0	20,3	-64,2	64,2
380ct2f1	0,0	0,0	20,3	-64,2	64,2
380ct2f2	0,0	0,0	20,3	-64,2	64,2
380ct2f3	0,0	0,0	20,3	-64,2	64,2

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	2,1	2,0
	bl2	2,1	2,0
	380ct1f1	10,3	10,0
	380ct1f2	10,3	10,0
	380ct1f3	10,3	10,0
	380ct2f1	10,3	10,0
	380ct2f2	10,3	10,0
	380ct2f3	10,3	10,0

Project: KIJ-GT
Tower: S+0 II
Number: 39

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		0	182	136	6796	0	0
ULS 1a_0,9_90		0	182	136	6796	0	0
ULS 3_90		0	100	209	3760	0	0
ULS 3_0,9_90		0	100	209	3760	0	0
SLS 7		0	0	130	0	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

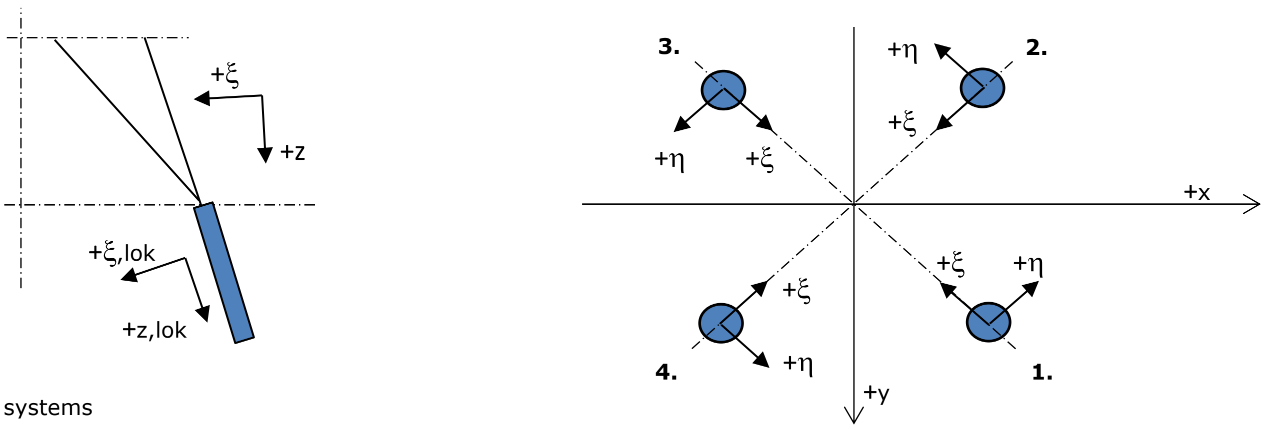
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	326	352	10650	0	0
ULS 3_90	0	144	424	4916	0	0
SLS 7	0	0	335	0	0	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	326	352	**10650**	0	0
ULS 1a_0	190	0	352	0	**5645**	0
ULS 5a Ba 10	51	0	334	-145	1669	**806**
ULS 1a_45	143	234	352	**7463**	**4058**	0

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_45	137	121	**728**	11	-183	-35	743
2	ULS 1a_0	65	-81	**402**	11	-103	-22	410
3	ULS 7	-19	-19	**96**	0	-27	-8	98
4	ULS 1a_135	-137	121	**728**	-11	-183	-35	743

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	0	0	0	0
2	ULS 1a_0,9_0,9_135	-104	89	**-565**	11	136	21	-576
3	ULS 1a_0,9_0,9_45	104	89	**-565**	-11	136	21	-576
4	ULS 1a_0,9_0,9_0	32	-48	**-238**	-11	57	8	-243

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 5a Ba 10	50	13	168	**26**	-45	-11	171
2	ULS 5a Ba 10	9	-58	184	**35**	-47	-10	188
3	ULS 5a Ba 10	-28	24	-1	**37**	-3	-3	-1
4	ULS 5a Ba 10	20	21	-17	**29**	0	-4	-18

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	ULS 5a Ba 21	9	58	184	**-35**	-47	-10	188
2	ULS 5a Ba 21	50	-13	168	**-26**	-45	-11	171
3	ULS 5a Ba 21	20	-21	-17	**-29**	0	-4	-18
4	ULS 5a Ba 21	-28	-24	-1	**-37**	-3	-3	-1

Project: KIJ-GT
Tower: S+0 II
Number: 39

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	**0**	0	0	0
2	ULS 1a_0,9_0,9_135	-104	89	**-565**	**11**	136	21	-576
3	ULS 1a_0,9_0,9_45	104	89	**-565**	**-11**	136	21	-576
4	ULS 1a_0,9_0,9_0	32	-48	**-238**	**-11**	57	8	-243

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	17	17	84	0	-24	-7	85
2	SLS 7	17	-17	84	0	-24	-7	85
3	SLS 7	-17	-17	84	0	-24	-7	85
4	SLS 7	-17	17	84	0	-24	-7	85

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_45	137	121	**728**	11	-183	-35	743
Max. tension	ULS 1a_0,9_0,9_45	104	89	**-565**	-11	136	21	-576
Max. pos. torsie	ULS 5a Ba 10	-28	24	-1	**37**	-3	-3	-1
Max. neg. torsie	ULS 5a Ba 21	-28	-24	-1	**-37**	-3	-3	-1
Comb. tension+torsie	ULS 1a_0,9_0,9_45	104	89	**-565**	**-11**	136	21	-576

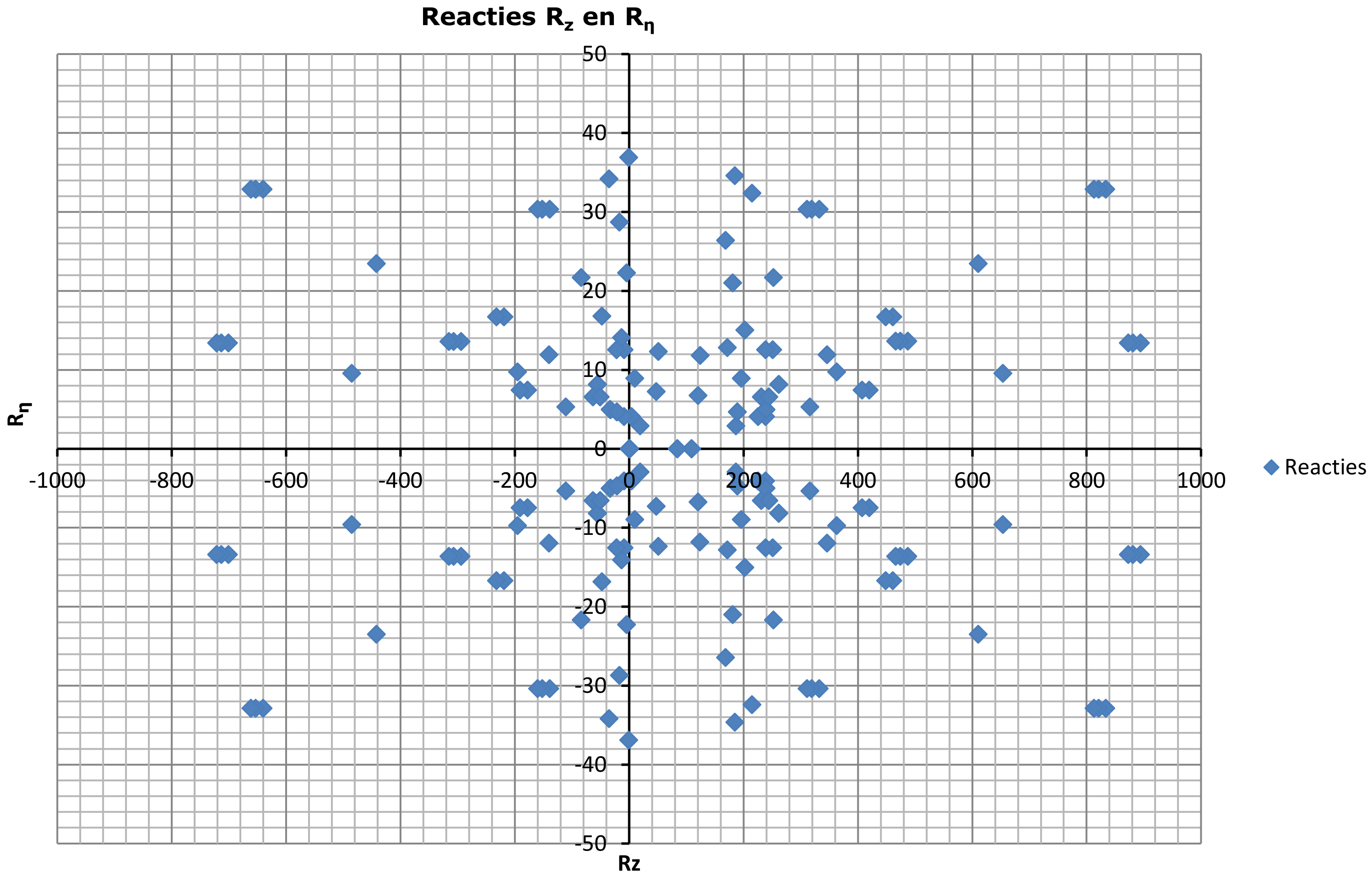
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	17	17	**84**	0	-24	-7	85
2	SLS 1a_135	-83	70	**-453**	9	108	16	-463
3	SLS 1a_45	83	70	**-453**	-9	108	16	-463
4	SLS 1a_0	23	-36	**-179**	-9	42	5	-183

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_45	117	104	**621**	9	-156	-30	634
2	SLS 1a_0	57	-70	**347**	9	-89	-19	354
3	SLS 7	-17	-17	**84**	0	-24	-7	85
4	SLS 1a_135	-117	104	**621**	-9	-156	-30	634

Project: KIJ-GT
Tower: S+0 II
Number: 39



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Project: KIJ-GT
Tower: S+0 II
Number: 39

Conductor loads		Auteur:	TBR
		Versie:	v11.3

Starting points

Consequence class Verbouw CC2
Reference period 50 jaar

ULS	(strength)	**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,15	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,40	0,00	0,0
ULS 3	Wind+ice	-5°	1,15	1,15	0,00	0,42	1,30	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,15	0,00	0,42	1,30	0,0
ULS 4	Cold+wind	-20°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,15	0,00	0,28	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,15	1,15	1,30	0,28	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 7	Permanent	10°	1,30	1,30	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS	(strength, for angle towers: absence of conductors)			γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,15	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,15	1,15	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,15	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,15	1,15	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,15	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,15	1,15	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,15	1,15	0,0	0,24	0,0	0,0
SLS	(deformations, fatigue, EDS)							
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	1,00	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,30	1,00	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	4
Number of load combinations for ULS	36
Number of load combinations for SPLS	0
Number of load combinations for SLS	11
Number of concentrated loads	376

Project: KIJ-GT
Tower: S+0 II
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Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-34,9	34,9	5,4	5,6	5,9	5,8
bl2	-35,2	35,2	5,4	5,6	5,9	5,8
380ct1f1	-128,9	128,9	15,6	16,8	19,3	18,9
380ct1f2	-128,9	128,9	15,6	16,8	19,3	18,9
380ct1f3	-132,2	132,2	18,4	19,1	19,3	18,9
380ct2f1	-128,9	128,9	15,6	16,8	19,3	18,9
380ct2f2	-128,9	128,9	15,6	16,8	19,3	18,9
380ct2f3	-132,2	132,2	18,4	19,1	19,3	18,9

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	396,7	397,7	398,0
bl2	396,7	397,6	398,0
380ct1f1	399,1	399,2	399,2
380ct1f2	399,1	399,2	399,2
380ct1f3	399,1	399,2	399,2
380ct2f1	399,1	399,2	399,2
380ct2f2	399,1	399,2	399,2
380ct2f3	399,1	399,2	399,2

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	398,0	398,1
bl2	398,0	398,1
380ct1f1	399,2	399,2
380ct1f2	399,2	399,2
380ct1f3	399,2	399,2
380ct2f1	399,2	399,2
380ct2f2	399,2	399,2
380ct2f3	399,2	399,2

Envelop of weight span over all combinations (incl. 0,9 combinations) For all conductors		Wind / Weight span ratio
Max. weight span	399,2 m	0,999 -
Min. weight span	395,7 m	0,990 -

Project: KIJ-GT
Tower: S+0 II
Number: 39

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	15,0	11,0	9,0	-34,7	35,1
bl2	15,0	11,0	9,0	-35,0	35,4
380ct1f1	51,3	32,4	38,2	-128,1	129,7
380ct1f2	51,3	32,4	38,2	-128,1	129,7
380ct1f3	51,3	37,5	38,2	-131,5	132,9
380ct2f1	51,3	32,4	38,2	-128,1	129,7
380ct2f2	51,3	32,4	38,2	-128,1	129,7
380ct2f3	51,3	37,5	38,2	-131,5	132,9

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	0,0	0,0	4,1	-15,0	15,0
bl2	0,0	0,0	4,1	-15,0	15,0
380ct1f1	0,0	0,0	20,3	-64,2	64,2
380ct1f2	0,0	0,0	20,3	-64,2	64,2
380ct1f3	0,0	0,0	20,3	-64,2	64,2
380ct2f1	0,0	0,0	20,3	-64,2	64,2
380ct2f2	0,0	0,0	20,3	-64,2	64,2
380ct2f3	0,0	0,0	20,3	-64,2	64,2

1 **Control uplift SLS-wind**

Combinatie	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	2,1	2,0
	bl2	2,1	2,0
	380ct1f1	10,3	10,0
	380ct1f2	10,3	10,0
	380ct1f3	10,3	10,0
	380ct2f1	10,3	10,0
	380ct2f2	10,3	10,0
	380ct2f3	10,3	10,0

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Project: KIJ-GT
Tower: S+0 II
Number: 39

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		0	227	149	8464	0	0
ULS 1a_0,9_90		0	227	149	8464	0	0
ULS 3_90		0	125	247	4684	0	0
ULS 3_0,9_90		0	125	247	4684	0	0
SLS 7		0	0	130	0	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

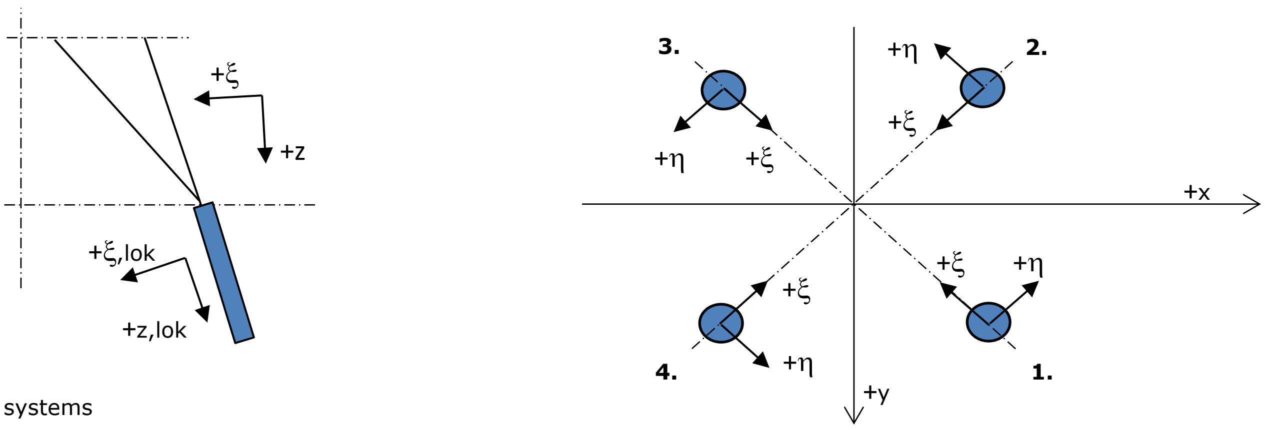
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	406	385	13264	0	0
ULS 3_90	0	179	483	6124	0	0
SLS 7	0	0	335	0	0	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	406	385	**13264**	0	0
ULS 1a_0	237	0	385	0	**7031**	0
ULS 5a Ba 10	51	0	334	-145	1669	**806**
ULS 1a_45	178	291	385	**9296**	**5055**	0

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_45	168	149	**894**	13	-224	-42	912
2	ULS 1a_0	79	-98	**487**	14	-125	-26	497
3	ULS 7	-22	-22	**109**	0	-31	-9	111
4	ULS 1a_135	-168	149	**894**	-13	-224	-42	912

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	0	0	0	0
2	ULS 1a_0,9_0,9_135	-133	114	**-722**	13	175	28	-737
3	ULS 1a_0,9_0,9_45	133	114	**-722**	-13	175	28	-737
4	ULS 1a_0,9_0,9_0	44	-63	**-315**	-14	76	12	-322

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_90	167	121	833	**33**	-204	-35	850
2	ULS 5a Ba 10	9	-58	184	**35**	-47	-10	188
3	ULS 5a Ba 10	-28	24	-1	**37**	-3	-3	-1
4	ULS 5a Ba 10	20	21	-17	**29**	0	-4	-18

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	ULS 5a Ba 21	9	58	184	**-35**	-47	-10	188
2	ULS 5a Ba 21	50	-13	168	**-26**	-45	-11	171
3	ULS 1a_90	129	82	-641	**-33**	149	19	-654
4	ULS 5a Ba 21	-28	-24	-1	**-37**	-3	-3	-1

Project: KIJ-GT
Tower: S+0 II
Number: 39

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	**0**	0	0	0
2	ULS 1a_0,9_0,9_135	-133	114	**-722**	**13**	175	28	-737
3	ULS 1a_0,9_0,9_45	133	114	**-722**	**-13**	175	28	-737
4	ULS 1a_0,9_0,9_0	44	-63	**-315**	**-14**	76	12	-322

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	17	17	84	0	-24	-7	85
2	SLS 7	17	-17	84	0	-24	-7	85
3	SLS 7	-17	-17	84	0	-24	-7	85
4	SLS 7	-17	17	84	0	-24	-7	85

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_45	168	149	**894**	13	-224	-42	912
Max. tension	ULS 1a_0,9_0,9_45	133	114	**-722**	-13	175	28	-737
Max. pos. torsie	ULS 5a Ba 10	-28	24	-1	**37**	-3	-3	-1
Max. neg. torsie	ULS 5a Ba 21	-28	-24	-1	**-37**	-3	-3	-1
Comb. tension+torsie	ULS 1a_0,9_0,9_45	133	114	**-722**	**-13**	175	28	-737

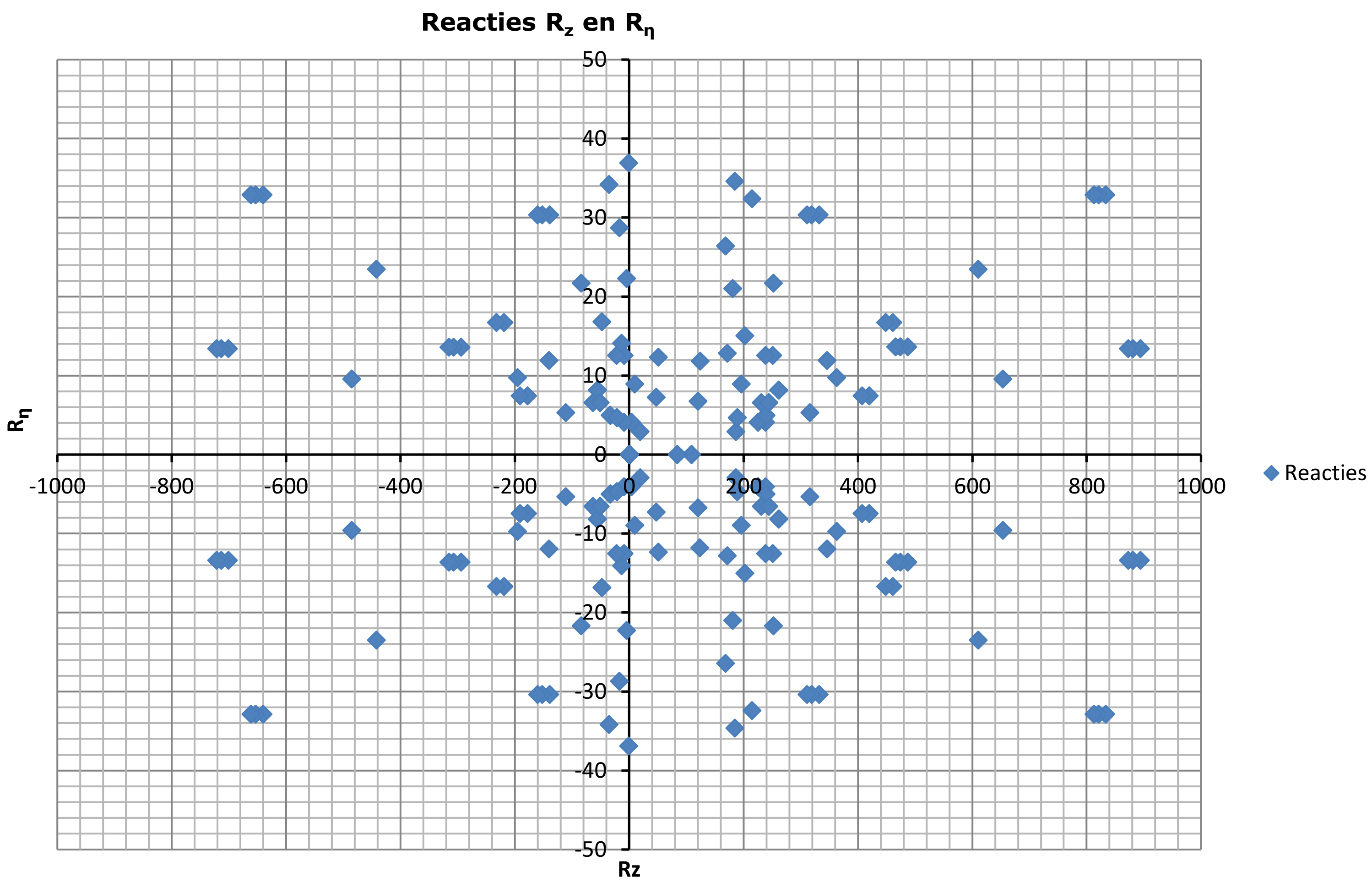
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	17	17	**84**	0	-24	-7	85
2	SLS 1a_135	-89	76	**-486**	10	116	18	-496
3	SLS 1a_45	89	76	**-486**	-10	116	18	-496
4	SLS 1a_0	25	-39	**-195**	-10	46	6	-199

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_45	123	109	**653**	10	-164	-31	667
2	SLS 1a_0	59	-73	**363**	10	-93	-20	370
3	SLS 7	-17	-17	**84**	0	-24	-7	85
4	SLS 1a_135	-123	109	**653**	-10	-164	-31	667

Project: KIJ-GT
Tower: S+0 II
Number: 39



Content

ISSUE	DATE	REVISION	CHK'D	APP'D
0.0	2020-11-26			

Data

Norm	NEN-EN50341-2-15:2019
Initial	
Consequence class	CC2-0
Reliability level	Afkeur
Reference period	30 jaar
After adjustment	
Consequence class	CC2
Reliability level	Verbouw
Reference period	50 jaar
Wind zone	III
Wind speed	24,5 m/s
Terrain categorie	II
Reduction factor C_{dir}	1,00
Ice region	B
Tower type	Steunmast
Tower height	48 m
Max. Span	410 m
Line angle	180°
Catenary	1400 m
Wind span	405 m
EDS Weight span	405 m
Min. Weight span	404 m
Max. Weight span	406 m

Client: TenneT Taking power further

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Title:

Berekening masttype S+0

JOB No.	-	DATE	-
DRAWN	-	CHKD	-
DESIGN	-	APPD	-

Document name:

KIJ-GT_S+0_65_Report.pdf

Project number:

Project client number:

0.0

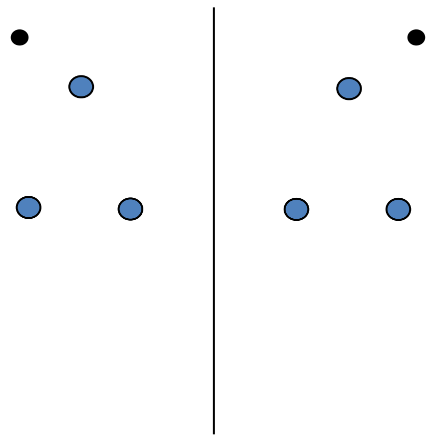
Project: KIJ-GT
Tower: S+0
Number: 65

Conductor loads

Auteur: TBR
Versie: v11.3

General

Description	S+0
Tower type	Steunmast
Number of circuits	2
Configuration	2-circuit-donau
Number of earth wires	2



Configuratie geleiders

Starting points

Norm	NEN-EN50341-2-15:2019
Consequence class	CC2-0
Reliability level initial	Afkeur CC2-0
Reference period intial	30 jaar
Consequence class modified	CC2
Reliability level modified	Verbouw
Reference period modified	50 jaar
Wind zone	III
Wind speed	24,5 m/s
Terrain category	II
Reduction factor c_{dir}	1,00
Ice region phase conductor	B
Ice region earth conductor	B

Conductors back

Description	Voltage	Conductor Back	Bundle Ba	Ice region	Additional weight	Additional diameter	Catenary P_{back}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Conductors ahead

Description	Voltage	Conductor Ahead	Bundle Ah	Ice region	Additional weight	Additional diameter	Catenary P_{ahead}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Insulators *(1)*

Description	Suspension	Weight [kN]	Length [m]	Wind area [m^2]
Circuit 1	Halfverankering	2,00	4,30	1,00
Circuit 2	Halfverankering	2,00	4,30	1,00
Bliksemdraad 1	Vast (Bliksemdraad)	0,10	0,50	0,05
Bliksemdraad 2	Vast (Bliksemdraad)	0,10	0,50	0,05

1. *Properties apply to the entire isolator set*

Suspension height and position in mast

Circuits	Designation	Number	Suspension height	Attach point	Position in tower (3) Horizontal distance
Circuit 1	10	380ct1f1	28,2 m	32,5 m	15,7 m
Circuit 1	11	380ct1f2	28,2 m	32,5 m	8,7 m
Circuit 1	12	380ct1f3	39,5 m	43,8 m	12,2 m
Circuit 2	20	380ct2f1	28,2 m	32,5 m	-8,7 m
Circuit 2	21	380ct2f2	28,2 m	32,5 m	-15,7 m
Circuit 2	22	380ct2f3	39,5 m	43,8 m	-12,2 m
Bliksemdraad 1	1	bl1	43,3 m	43,8 m	16,2 m
Bliksemdraad 2	3	bl2	43,3 m	43,8 m	-16,2 m

1. *Positive = adjacent mast higher*
2. *Positive = in direction of rotation coordinate system x => y*

Project: KIJ-GT
Tower: S+0
Number: 65

Height adjustment adjacent masts (wind and weight span adjustment)

	Back		Ahead		
Height increase for wind pressure	0,0	m	26,0	m	(positive: higher)
Height decrease for vertical load	0,0	m	0,0	m	(negative: decrease, more weight span)

Decrease: Niet in 0,9EG-combinaties

Height difference adjacent tower and change of direction with respect to Line direction

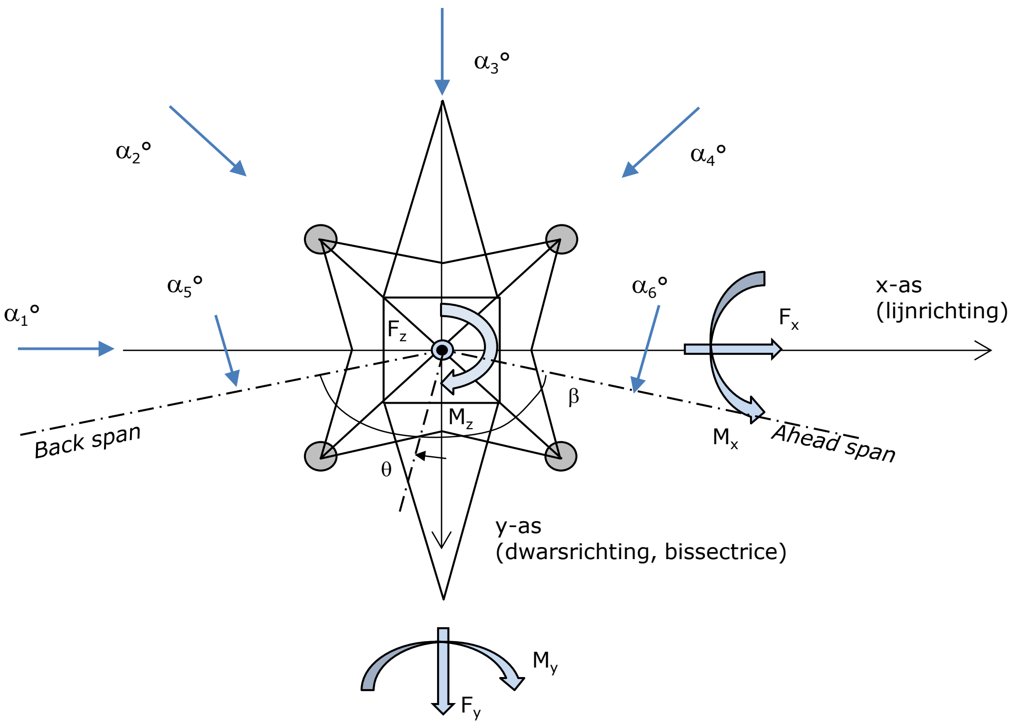
			Hoogteverschil		Richtingsverandering	
Circuits	Aanduiding	Nummer	Δh_back	Δh_ahead	Δy_back	Δy_ahead
Circuit 1	10	380ct1f1	-0,2	0,3 m	0,0	0,0 m
Circuit 1	11	380ct1f2	-0,2	0,2 m	0,0	0,0 m
Circuit 1	12	380ct1f3	-0,2	0,1 m	0,0	0,0 m
Circuit 2	20	380ct2f1	-0,2	0,2 m	0,0	0,0 m
Circuit 2	21	380ct2f2	-0,2	0,3 m	0,0	0,0 m
Circuit 2	22	380ct2f3	-0,2	0,1 m	0,0	0,0 m
Bliksemdraad 1	1	bl1	-0,2	0,0 m	0,0	0,0 m
Bliksemdraad 2	3	bl2	-0,2	0,0 m	0,0	0,0 m

Line and tower data

		Back	Ahead
		410,0	399,0 m
Ruling span $\sqrt{(\Sigma L^3/\Sigma L)}$		390,6	390,6 m
Line angle	β	180 °	
Tower orientation with respect to bis	θ	0 °	
Section length		2681	2681 m
Height bottom of tower to ground level		0,5 m	
Wind directions considered	α_1	0 °	
Wind directions according to:	α_2	45 °	
Geleiderbelastingen	α_3	90 °	
	α_4	135 °	
	α_5	- °	
	α_6	- °	

Wind directions apply to the main direction of mast construction, not to the bisector.

Windrichtingen en positieve richtingen belastingen



Considered number of wind directions	
1a	4
3	4
4	1
6	1
Overig	1

Project: KIJ-GT
Tower: S+0
Number: 65

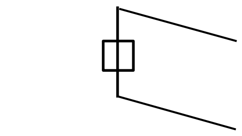
Absence of conductors

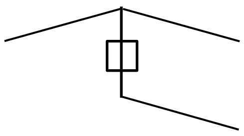
		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	380ct1f1	1	0	1	0	0,8	0
Circuit 1	380ct1f2	1	0	1	0	0,8	0
Circuit 1	380ct1f3	1	0	1	0	0,8	0
Circuit 2	380ct2f1	0	1	1	0	0,8	0
Circuit 2	380ct2f2	0	1	1	0	0,8	0
Circuit 2	380ct2f3	0	1	1	0	0,8	0
Bliksemdraad 1	bl1	1	0	1	0	1	0
Bliksemdraad 2	bl2	0	1	1	0	1	0

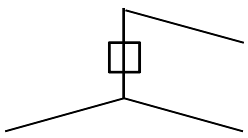
Load situations SPLS

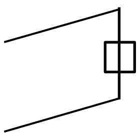
Considered situations SPLS: SPLS for suspension tower not applicable

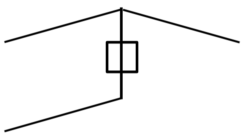
Principle of load situations:

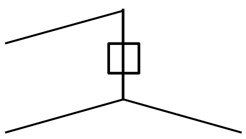

1. Ba All cts


2. Ba ct1


3. Ba ct2


4. Ah All cts

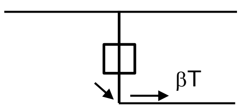

5. Ah ct1


6. Ah ct2

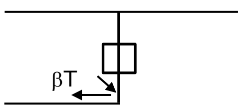
Load situation 5a. Conductor failure

Considered situations conductor failure 5a: 1, design assumption is symmetry back and ahead

Principle of load situations:



1. Ba



2. Ah

Project: KIJ-GT
Tower: S+0
Number: 65

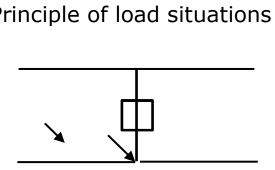
Load situations LC6. Construction and maintenance
Under 6a, the load due to the presence of a line verhicle or line bicycle in combination with point load on the traverse is assesed.
Combination 6b does not contain any loads in conductor or on traverse. This combination has been added to be able to combine with separate control platforms, etc. The situations are applied in ULS and in every SPLS situation (in case of angle tower).

3,0 kN	2,0 kN
1,0 kN	1,0 kN

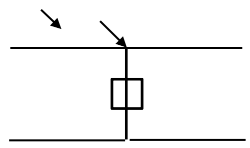
Considered situations construction and maintenance 6a: 1 up to 4, all possible situations

Presence line vehicle: Circuit, load present in all conductors of a circuit

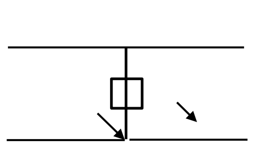
Principle of load situations:



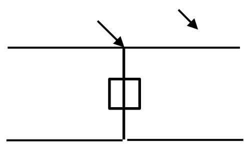
1. Ba Ct1



2. Ba Ct2



3. Ah Ct1



4. Ah Ct2

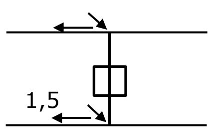
Load situations 8. Galloping as a static load

Conductor		
Suspension tower phase	0,866 W	1,5 W
Suspension tower earth	1,5 EDS	1,5 W
Strain tower phase and earth	1,5 EDS	1,5 W

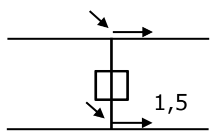
Considered situations galloping 8: None (existing structure)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principle of load situations:



1. Ba



2. Ah

Load combination 8. Galloping as a dynamic load
Only applies to tension towers
Load consists of EDS tensile load in one of the conductors on one side of the tower
Can be converted by user to fatigue spectrum via the load spectrum of table 4.11 / NL.1

Project: KIJ-GT
Tower: S+0
Number: 65

Tower structure

Properties

Tower type	Steunmast		
Tower designation	S+0		
Base plate w.r.t. ground level	0,5	m	
Tower height w.r.t. base plate	48,0	m	
Tower self weight	205,0	kN	
Width and slope at foundation	x-ri.	y-ri.	
Leg spread	9,00	9,00	m
Inclination of main leg	0,144	0,144	-
Horizontal force factor	1,4	1,4	-

Calculation Wind load

Dynamic factor G_T	1,00 *(Masthoogte < 60 m)*
Wind load diagonally to tower body proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Wind load diagonally on traverse proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Magnification factor diagonal wind to tower body	(1+0,2sin^2(2phi))
Magnification factor diagonal wind to cross arm	(1+0,2sin^2(2phi))
Magnification factor wind parallel to perpendicular to cross a	0,4

Properties mast sections line direction (front view, yz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	11,18	9,00	5,79	11,18	0,144	82,68	8,38	0,10	3,40
Middenstuk 1	21,06	5,79	4,50	9,88	0,065	50,83	6,38	0,13	3,28
Middenstuk 2	32,50	4,50	3,00	11,44	0,066	42,90	7,13	0,17	3,08
Bovenstuk 1	38,40	3,00	2,58	5,90	0,036	16,46	4,17	0,25	2,71
Bovenstuk 2	46,40	2,58	2,00	8,00	0,036	18,32	4,61	0,25	2,72
Topstuk	47,88	2,00		1,48		1,48	0,38	0,26	2,70
Ondertraverse	32,50	15,70		2,90		22,77	4,29	0,19	2,98
Boventraverse	43,80	16,20		2,50		20,25	4,17	0,21	2,90

Properties tower sections transverse direction (side view, xz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	11,18	9,00	5,79	11,18	0,144	82,68	8,38	0,10	3,40
Middenstuk 1	21,06	5,79	4,50	9,88	0,065	50,83	6,38	0,13	3,28
Middenstuk 2	32,50	4,50	3,00	11,44	0,066	42,90	7,13	0,17	3,08
Bovenstuk 1	38,40	3,00	2,58	5,90	0,036	16,46	4,17	0,25	2,71
Bovenstuk 2	46,40	2,58	2,00	8,00	0,036	18,32	4,61	0,25	2,72
Topstuk	47,88	2,00		1,48		1,48	0,38	0,26	2,70
Ondertraverse	32,50	15,70		2,90		22,77	4,29	0,19	2,98
Boventraverse	43,80	16,20		2,50		20,25	4,17	0,21	2,90

Note: Surface transverse direction is reduced in calculation.

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Project: KIJ-GT
Tower: S+0
Number: 65

Wind surface feeders telecom installations

Part	A (m^2/m)	Δh	A_1
Broekstuk 1			
Middenstuk 1			
Middenstuk 2			
Bovenstuk 1			
Bovenstuk 2			

Input antennas

Description	A (m^2)	h (m)	C_f (m)
Antenne top			
Antenne o.t.			

Tower section loads longitudinal (x-direction) per wind direction

Description	p_w	F_{x1}	F_{x2}	F_{x3}	F_{x4}	h_{ef}	M_{y1}	M_{y2}	M_{y3}	M_{y4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,70	20,0	16,9	0,0	-16,9	5,6	111,6	94,7	0,0	-94,7
Middenstuk 1	0,82	17,2	14,6	0,0	-14,6	16,1	276,7	234,8	0,0	-234,8
Middenstuk 2	0,96	21,0	17,8	0,0	-17,8	26,8	563,2	477,9	0,0	-477,9
Bovenstuk 1	1,04	11,7	9,9	0,0	-9,9	35,5	414,8	352,0	0,0	-352,0
Bovenstuk 2	1,09	13,6	11,6	0,0	-11,6	42,4	577,2	489,7	0,0	-489,7
Topstuk	1,12	1,1	1,0	0,0	-1,0	47,1	54,0	45,8	0,0	-45,8
Ondertraverse	1,02	26,1	15,5	0,0	-15,5	33,5	872,5	518,3	0,0	-518,3
Boventraverse	1,10	26,7	15,9	0,0	-15,9	44,6	1191,7	707,8	0,0	-707,8
Totaal		137,4	103,2	0,0	-103,2		4061,8	2921,0	0,0	-2921,0

Tower section loads longitudinal (y-direction) per wind direction

Description	p_w	F_{y1}	F_{y2}	F_{y3}	F_{x4}	h_{ef}	M_{x1}	M_{x2}	M_{x3}	M_{x4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,70	0,0	16,9	20,0	16,9	5,6	0,0	94,7	111,6	94,7
Middenstuk 1	0,82	0,0	14,6	17,2	14,6	16,1	0,0	234,8	276,7	234,8
Middenstuk 2	0,96	0,0	17,8	21,0	17,8	26,8	0,0	477,9	563,2	477,9
Bovenstuk 1	1,04	0,0	9,9	11,7	9,9	35,5	0,0	352,0	414,8	352,0
Bovenstuk 2	1,09	0,0	11,6	13,6	11,6	42,4	0,0	489,7	577,2	489,7
Topstuk	1,12	0,0	1,0	1,1	1,0	47,1	0,0	45,8	54,0	45,8
Ondertraverse	1,02	0,0	15,5	10,4	15,5	33,5	0,0	518,3	349,0	518,3
Boventraverse	1,10	0,0	15,9	10,7	15,9	44,6	0,0	707,8	476,7	707,8
Total		0,0	103,2	105,7	103,2		0,0	2921,0	2823,2	2921,0

Resulting loads from mast construction incl. Antenna without conductors level foundation (char. Value)

Load / wind direction	F_x	F_y	F_z	M_x	M_y	M_z
	[kN]	[kN]	[kN]	[kNm]	[kNm]	[kNm]
Permanente belasting	0	0	205	0	0	0
Windrichting 0°	137	0	0	0	4062	0
Windrichting 45°	103	103	0	2921	2921	0
Windrichting 90°	0	106	0	2823	0	0
Windrichting 135°	-103	103	0	2921	-2921	0

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Project: KIJ-GT
Tower: S+0
Number: 65

Intermediate results for conductor loads

Conductors back

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Conductors ahead

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Vertical load back

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Vertical load ahead

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	[N/m]	[N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Insulators

Conductor	$G_{isolator}$ [kN]	Number -	$F_{v,iso}$ [kN]	Length [m]	Wind surf. [m^2]	Wind heigth [m]	Pressure [kN/m^2]	Drag factor [-]	$F_{h,iso}$ [kN]
380ct1f1	2,00	1	2	4,3	1,0	30,85	1,00	1,2	1,20
380ct1f2	2,00	1	2	4,3	1,0	30,85	1,00	1,2	1,20
380ct1f3	2,00	1	2	4,3	1,0	42,15	1,09	1,2	1,30
380ct2f1	2,00	1	2	4,3	1,0	30,85	1,00	1,2	1,20
380ct2f2	2,00	1	2	4,3	1,0	30,85	1,00	1,2	1,20
380ct2f3	2,00	1	2	4,3	1,0	42,15	1,09	1,2	1,30
bl1	0,10	1	0,1	0,5	0,1	44,05	1,10	1,2	0,07
bl2	0,10	1	0,1	0,5	0,1	44,05	1,10	1,2	0,07

Project: KIJ-GT
Tower: S+0
Number: 65

Wind load back

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	18,6	0,86	0,54	0,47	1,14	28,25	44,5	39,2	46,9	78,1	68,8
380ct1f2	18,6	0,86	0,54	0,47	1,14	28,25	44,5	39,2	46,9	78,1	68,8
380ct1f3	29,9	0,99	0,58	0,51	1,10	28,25	53,0	46,6	46,9	96,1	84,5
380ct2f1	18,6	0,86	0,54	0,47	1,14	28,25	44,5	39,2	46,9	78,1	68,8
380ct2f2	18,6	0,86	0,54	0,47	1,14	28,25	44,5	39,2	46,9	78,1	68,8
380ct2f3	29,9	0,99	0,58	0,51	1,10	28,25	53,0	46,6	46,9	96,1	84,5
bl1	34,3	1,03	0,59	0,52	1,20	22,24	16,1	14,1	41,5	30,0	26,4
bl2	34,3	1,03	0,59	0,52	1,20	22,13	16,0	14,1	41,4	30,0	26,3

Wind load ahead

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	32,3	1,01	0,58	0,51	1,09	28,25	54,5	47,9	46,9	99,3	87,4
380ct1f2	32,3	1,01	0,58	0,51	1,09	28,25	54,5	47,9	46,9	99,3	87,3
380ct1f3	43,6	1,10	0,61	0,53	1,07	28,25	60,2	52,8	46,9	112,1	98,4
380ct2f1	32,3	1,01	0,58	0,51	1,09	28,25	54,5	47,9	46,9	99,3	87,3
380ct2f2	32,3	1,01	0,58	0,51	1,09	28,25	54,5	47,9	46,9	99,3	87,4
380ct2f3	43,6	1,10	0,61	0,53	1,07	28,25	60,2	52,8	46,9	112,1	98,4
bl1	48,0	1,12	0,61	0,54	1,19	22,24	18,2	16,0	41,5	34,3	30,1
bl2	48,0	1,12	0,61	0,54	1,19	22,13	18,1	15,9	41,4	34,3	30,1

Project: KIJ-GT
Tower: S+0
Number: 65

Auteur: TBR
Versie: v11.3

Conductor loads

Starting points

Consequence class	Afkeur CC2-0
Reference period	30 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,05	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,12	0,00	0,0
ULS 3	Wind+ice	-5°	1,05	1,05	0,00	0,34	0,97	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,05	0,00	0,34	0,97	0,0
ULS 4	Cold+wind	-20°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,05	0,00	0,22	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,05	1,05	1,20	0,22	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 7	Permanent	10°	1,15	1,15	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,05	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,05	1,05	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,05	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,05	1,05	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,05	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,05	1,05	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,05	1,05	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	0,94	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,28	0,88	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	4
Number of load combinations for ULS	36
Number of load combinations for SPLS	0
Number of load combinations for SLS	11
Number of concentrated loads	376

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Project: KIJ-GT
Tower: S+0
Number: 65

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

	Fx_ba	Fx_ah	Fy_ba	Fy_ah	Fz_ba	Fz_ah
Geleider	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
bl1	-29,3	29,3	3,7	4,1	5,3	5,2
bl2	-29,5	29,5	3,7	4,1	5,3	5,2
380ct1f1	-109,9	109,9	10,9	12,8	16,7	16,1
380ct1f2	-109,9	109,9	10,9	12,8	16,7	16,1
380ct1f3	-111,8	111,8	12,9	14,1	16,7	16,1
380ct2f1	-109,9	109,9	10,9	12,8	16,7	16,1
380ct2f2	-109,9	109,9	10,9	12,8	16,7	16,1
380ct2f3	-111,8	111,8	12,9	14,1	16,7	16,1

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	405,3	405,4	405,3
bl2	405,3	405,4	405,3
380ct1f1	404,3	404,4	404,4
380ct1f2	404,8	404,8	404,8
380ct1f3	405,0	405,0	405,0
380ct2f1	404,8	404,8	404,8
380ct2f2	404,3	404,4	404,4
380ct2f3	405,0	405,0	405,0

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	405,8	405,3
bl2	405,8	405,3
380ct1f1	404,4	404,4
380ct1f2	404,8	404,8
380ct1f3	405,1	405,0
380ct2f1	404,8	404,8
380ct2f2	404,4	404,4
380ct2f3	405,1	405,0

Envelop of weight span over all combinations (incl. 0,9 combinations)		
For all conductors		Wind / Weight span ratio
Max. weight span	406,0 m	1,004 -
Min. weight span	404,3 m	0,999 -

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Project: KIJ-GT
Tower: S+0
Number: 65

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	15,0	7,8	8,1	-31,1	31,1
bl2	15,0	7,8	8,1	-31,2	31,2
380ct1f1	51,3	23,7	32,8	-108,7	111,1
380ct1f2	51,3	23,7	32,8	-108,7	111,1
380ct1f3	51,3	27,0	32,8	-110,7	112,8
380ct2f1	51,3	23,7	32,8	-108,7	111,1
380ct2f2	51,3	23,7	32,8	-108,7	111,1
380ct2f3	51,3	27,0	32,8	-110,7	112,8

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	0,0	0,0	4,2	-15,0	15,0
bl2	0,0	0,0	4,2	-15,0	15,0
380ct1f1	0,0	0,0	20,5	-64,2	64,2
380ct1f2	0,0	0,0	20,6	-64,2	64,2
380ct1f3	0,0	0,0	20,6	-64,2	64,2
380ct2f1	0,0	0,0	20,6	-64,2	64,2
380ct2f2	0,0	0,0	20,5	-64,2	64,2
380ct2f3	0,0	0,0	20,6	-64,2	64,2

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	2,1	2,0
	bl2	2,1	2,0
	380ct1f1	10,4	10,1
	380ct1f2	10,4	10,1
	380ct1f3	10,4	10,1
	380ct2f1	10,4	10,1
	380ct2f2	10,4	10,1
	380ct2f3	10,4	10,1

Project: KIJ-GT
Tower: S+0
Number: 65

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		0	164	138	6124	0	0
ULS 1a_0,9_90		0	164	138	6124	0	0
ULS 3_90		0	87	212	3268	0	0
ULS 3_0,9_90		0	87	212	3268	0	0
SLS 7		0	0	132	0	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

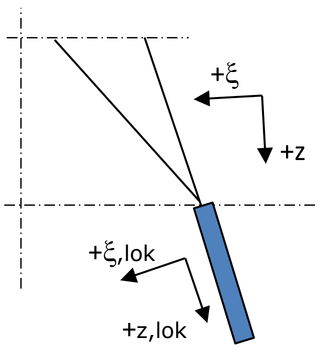
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	282	353	9277	0	0
ULS 3_90	0	123	427	4214	0	0
SLS 7	0	0	337	0	0	0

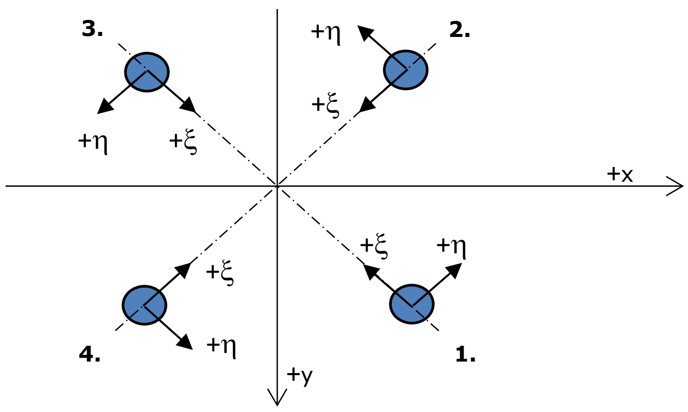
Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	282	353	**9277**	0	0
ULS 1a_0,9_0,9_0	156	0	303	0	**4618**	0
ULS 5a Ba 10	51	0	335	-148	1669	**806**
ULS 1a_45	117	199	353	**6388**	**3320**	0

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg





Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_45	118	105	**628**	10	-158	-30	640
2	ULS 1a_0	57	-69	**345**	9	-89	-19	352
3	ULS 7	-19	-19	**97**	0	-28	-8	99
4	ULS 1a_135	-118	105	**628**	-10	-158	-30	640

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	0	0	0	0
2	ULS 1a_0,9_0,9_135	-85	72	**-464**	10	111	17	-473
3	ULS 1a_0,9_0,9_45	85	72	**-464**	-10	111	17	-473
4	ULS 1a_0,9_0,9_0	24	-36	**-181**	-9	42	6	-184

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 5a Ba 10	50	13	168	**26**	-45	-11	172
2	ULS 5a Ba 10	9	-58	185	**35**	-47	-10	188
3	ULS 5a Ba 10	-28	24	-1	**37**	-3	-3	-1
4	ULS 5a Ba 10	20	21	-17	**29**	0	-4	-17

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	ULS 5a Ba 21	9	58	185	**-35**	-47	-10	188
2	ULS 5a Ba 21	50	-13	168	**-26**	-45	-11	172
3	ULS 5a Ba 21	20	-21	-17	**-29**	0	-4	-17
4	ULS 5a Ba 21	-28	-24	-1	**-37**	-3	-3	-1

Project: KIJ-GT
Tower: S+0
Number: 65

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	**0**	0	0	0
2	ULS 1a_0,9_0,9_90	-88	55	**-440**	**23**	102	12	-449
3	ULS 1a_0,9_0,9_90	88	55	**-440**	**-23**	102	12	-449
4	ULS 1a_0,9_0,9_0	24	-36	**-181**	**-9**	42	6	-184

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	17	17	84	0	-24	-7	86
2	SLS 7	17	-17	84	0	-24	-7	86
3	SLS 7	-17	-17	84	0	-24	-7	86
4	SLS 7	-17	17	84	0	-24	-7	86

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_45	118	105	**628**	10	-158	-30	640
Max. tension	ULS 1a_0,9_0,9_45	85	72	**-464**	-10	111	17	-473
Max. pos. torsie	ULS 5a Ba 10	-28	24	-1	**37**	-3	-3	-1
Max. neg. torsie	ULS 5a Ba 21	-28	-24	-1	**-37**	-3	-3	-1
Comb. tension+torsie	ULS 1a_0,9_0,9_90	-88	55	**-440**	**23**	102	12	-449

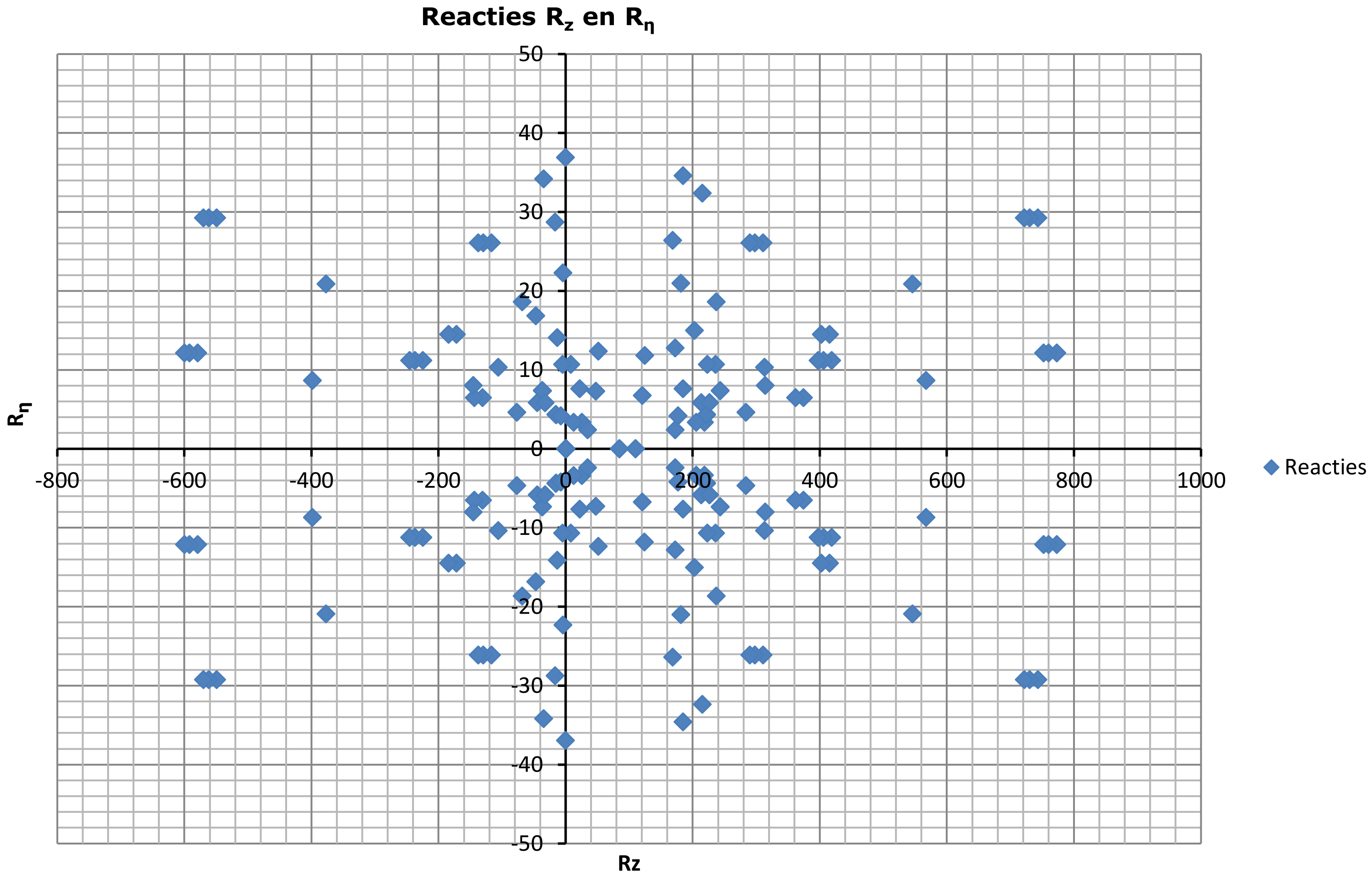
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	17	17	**84**	0	-24	-7	86
2	SLS 1a_135	-68	56	**-371**	8	88	13	-379
3	SLS 1a_45	68	56	**-371**	-8	88	13	-379
4	SLS 1a_0	16	-27	**-133**	-8	30	3	-135

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_45	102	90	**540**	8	-136	-26	551
2	SLS 1a_0	50	-60	**301**	8	-78	-17	307
3	SLS 7	-17	-17	**84**	0	-24	-7	86
4	SLS 1a_135	-102	90	**540**	-8	-136	-26	551

Project: KIJ-GT
Tower: S+0
Number: 65



Project: KIJ-GT
Tower: S+0
Number: 65

Auteur: TBR
Versie: v11.3

Conductor loads

Starting points

Consequence class: Verbouw CC2
Reference period: 50 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,15	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,40	0,00	0,0
ULS 3	Wind+ice	-5°	1,15	1,15	0,00	0,42	1,30	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,15	0,00	0,42	1,30	0,0
ULS 4	Cold+wind	-20°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,15	0,00	0,28	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,15	1,15	1,30	0,28	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 7	Permanent	10°	1,30	1,30	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,15	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,15	1,15	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,15	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,15	1,15	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,15	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,15	1,15	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,15	1,15	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	1,00	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,30	1,00	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	4
Number of load combinations for ULS	36
Number of load combinations for SPLS	0
Number of load combinations for SLS	11
Number of concentrated loads	376

Project: KIJ-GT
Tower: S+0
Number: 65

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-34,3	34,3	4,7	5,1	5,8	5,7
bl2	-34,6	34,6	4,6	5,1	5,8	5,7
380ct1f1	-128,1	128,1	13,6	16,1	19,7	19,0
380ct1f2	-128,1	128,1	13,6	16,1	19,7	19,0
380ct1f3	-130,4	130,4	16,1	17,7	19,7	19,1
380ct2f1	-128,1	128,1	13,6	16,1	19,7	19,0
380ct2f2	-128,1	128,1	13,6	16,1	19,7	19,0
380ct2f3	-130,4	130,4	16,1	17,7	19,7	19,1

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	405,3	405,4	405,3
bl2	405,3	405,4	405,3
380ct1f1	404,3	404,4	404,4
380ct1f2	404,8	404,8	404,8
380ct1f3	405,0	405,0	405,0
380ct2f1	404,8	404,8	404,8
380ct2f2	404,3	404,4	404,4
380ct2f3	405,0	405,0	405,0

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	405,9	405,3
bl2	405,9	405,3
380ct1f1	404,4	404,4
380ct1f2	404,8	404,7
380ct1f3	405,2	405,0
380ct2f1	404,8	404,7
380ct2f2	404,4	404,4
380ct2f3	405,2	405,0

Envelop of weight span over all combinations (incl. 0,9 combinations)

For all conductors		Wind / Weight span ratio
Max. weight span	406,2 m	1,004 -
Min. weight span	404,2 m	0,999 -

Project: KIJ-GT
Tower: S+0
Number: 65

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	15,0	9,8	9,2	-33,9	34,7
bl2	15,0	9,8	9,2	-34,2	35,0
380ct1f1	51,3	29,7	38,7	-126,5	129,6
380ct1f2	51,3	29,7	38,7	-126,5	129,6
380ct1f3	51,3	33,8	38,7	-129,1	131,7
380ct2f1	51,3	29,7	38,7	-126,5	129,6
380ct2f2	51,3	29,7	38,7	-126,5	129,6
380ct2f3	51,3	33,8	38,7	-129,1	131,7

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	0,0	0,0	4,2	-15,0	15,0
bl2	0,0	0,0	4,2	-15,0	15,0
380ct1f1	0,0	0,0	20,5	-64,2	64,2
380ct1f2	0,0	0,0	20,6	-64,2	64,2
380ct1f3	0,0	0,0	20,6	-64,2	64,2
380ct2f1	0,0	0,0	20,6	-64,2	64,2
380ct2f2	0,0	0,0	20,5	-64,2	64,2
380ct2f3	0,0	0,0	20,6	-64,2	64,2

1 **Control uplift SLS-wind**

Combinatie	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	2,1	2,0
	bl2	2,1	2,0
	380ct1f1	10,4	10,1
	380ct1f2	10,4	10,1
	380ct1f3	10,4	10,1
	380ct2f1	10,4	10,1
	380ct2f2	10,4	10,1
	380ct2f3	10,4	10,1

Project: KIJ-GT
Tower: S+0
Number: 65

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		0	206	151	7678	0	0
ULS 1a_0,9_90		0	206	151	7678	0	0
ULS 3_90		0	110	251	4097	0	0
ULS 3_0,9_90		0	110	251	4097	0	0
SLS 7		0	0	132	0	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

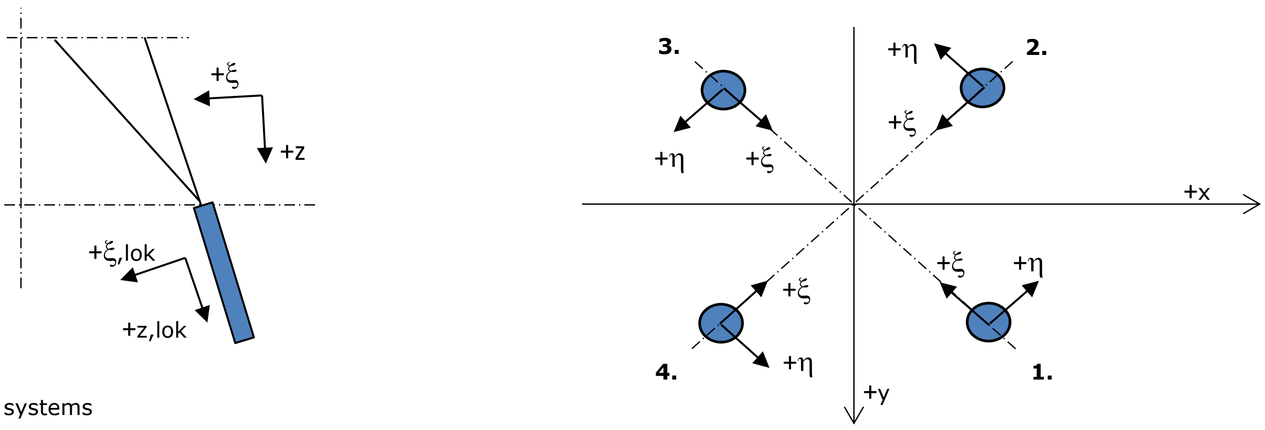
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	354	387	11630	0	0
ULS 3_90	0	154	486	5283	0	0
SLS 7	0	0	337	0	0	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	354	387	**11630**	0	0
ULS 1a_0	195	0	387	0	**5789**	0
ULS 5a Ba 10	51	0	335	-148	1669	**806**
ULS 1a_45	146	250	387	**8008**	**4162**	0

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_45	145	128	**773**	12	-194	-37	789
2	ULS 1a_0	68	-84	**418**	11	-108	-23	427
3	ULS 7	-22	-22	**109**	0	-31	-9	112
4	ULS 1a_135	-145	128	**773**	-12	-194	-37	789

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	0	0	0	0
2	ULS 1a_0,9_0,9_135	-111	94	**-600**	12	145	23	-613
3	ULS 1a_0,9_0,9_45	111	94	**-600**	-12	145	23	-613
4	ULS 1a_0,9_0,9_0	34	-49	**-246**	-11	59	9	-251

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_90	149	108	743	**29**	-182	-31	758
2	ULS 5a Ba 10	9	-58	185	**35**	-47	-10	188
3	ULS 5a Ba 10	-28	24	-1	**37**	-3	-3	-1
4	ULS 5a Ba 10	20	21	-17	**29**	0	-4	-17

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	ULS 5a Ba 21	9	58	185	**-35**	-47	-10	188
2	ULS 5a Ba 21	50	-13	168	**-26**	-45	-11	172
3	ULS 1a_90	110	69	-549	**-29**	127	15	-561
4	ULS 5a Ba 21	-28	-24	-1	**-37**	-3	-3	-1

Project: KIJ-GT
Tower: S+0
Number: 65

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	**0**	0	0	0
2	ULS 1a_0,9_0,9_90	-115	73	**-570**	**29**	133	17	-582
3	ULS 1a_0,9_0,9_90	115	73	**-570**	**-29**	133	17	-582
4	ULS 1a_0,9_0,9_0	34	-49	**-246**	**-11**	59	9	-251

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	17	17	84	0	-24	-7	86
2	SLS 7	17	-17	84	0	-24	-7	86
3	SLS 7	-17	-17	84	0	-24	-7	86
4	SLS 7	-17	17	84	0	-24	-7	86

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_45	145	128	**773**	12	-194	-37	789
Max. tension	ULS 1a_0,9_0,9_45	111	94	**-600**	-12	145	23	-613
Max. pos. torsie	ULS 5a Ba 10	-28	24	-1	**37**	-3	-3	-1
Max. neg. torsie	ULS 5a Ba 21	-28	-24	-1	**-37**	-3	-3	-1
Comb. tension+torsie	ULS 1a_0,9_0,9_90	-115	73	**-570**	**29**	133	17	-582

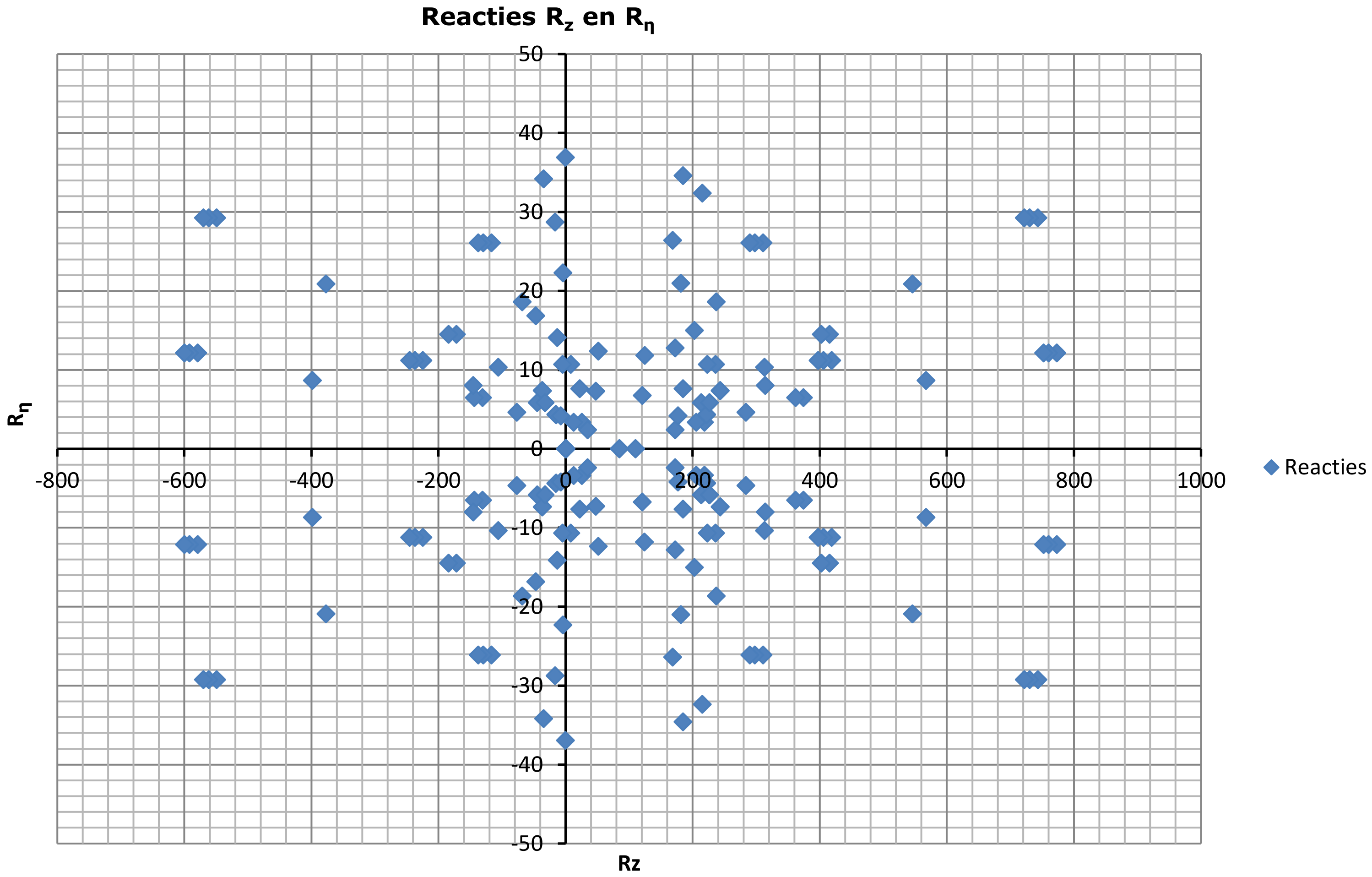
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	17	17	**84**	0	-24	-7	86
2	SLS 1a_135	-73	61	**-399**	9	95	14	-407
3	SLS 1a_45	73	61	**-399**	-9	95	14	-407
4	SLS 1a_0	18	-29	**-146**	-8	33	4	-149

Maximum compression load - SLS

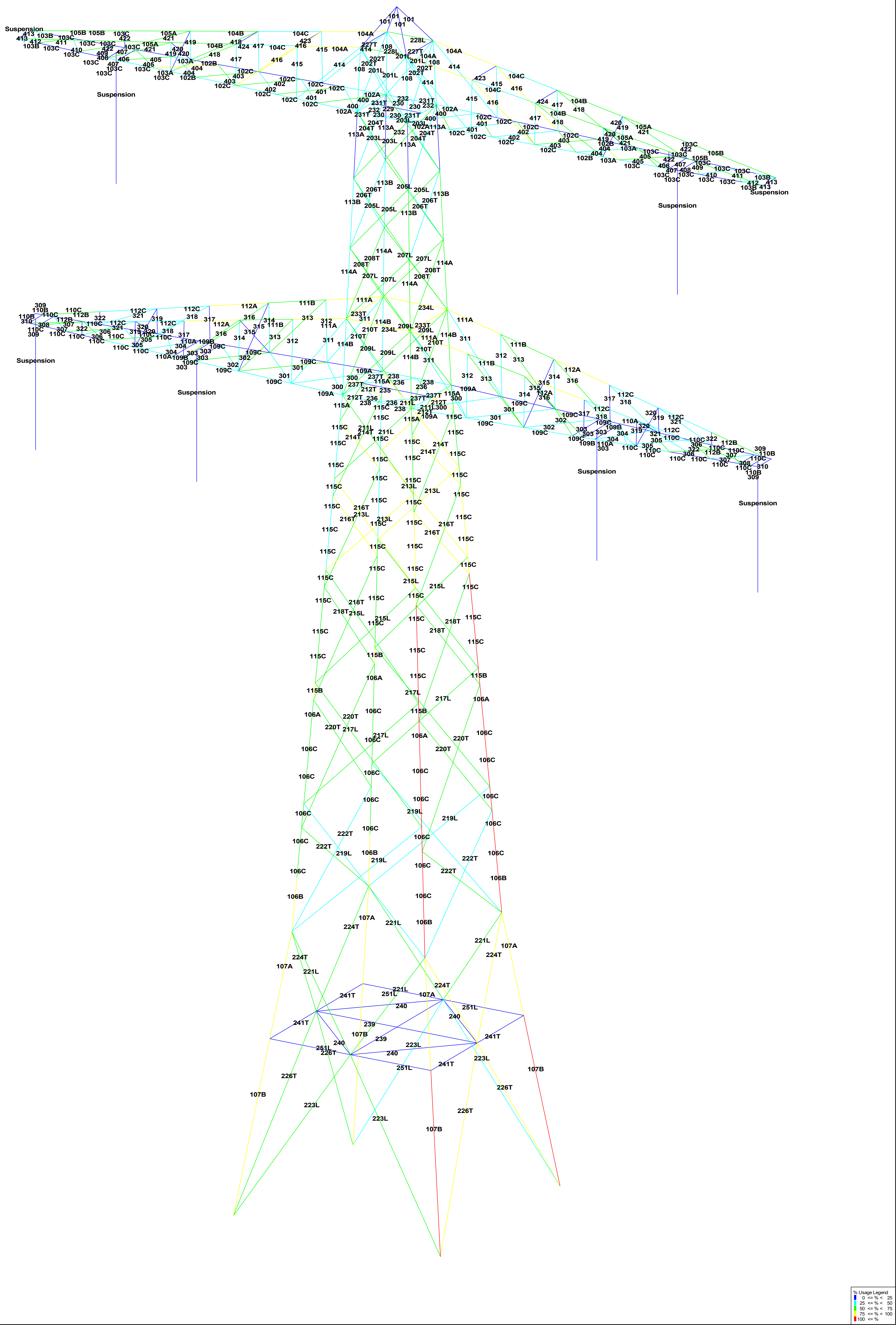
Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_45	107	95	**567**	9	-143	-27	579
2	SLS 1a_0	52	-63	**314**	8	-81	-17	320
3	SLS 7	-17	-17	**84**	0	-24	-7	86
4	SLS 1a_135	-107	95	**567**	-9	-143	-27	579

Project: KIJ-GT
Tower: S+0
Number: 65



APPENDIX B PLS-TOWER OUTPUT

DNV GL Nederlands BV, Project: "S+0 (hv) ini"
Tower Version 16.12, 11:01:51 Friday, 3 April, 2020
Undeformed geometry displayed



Assessment of groups for initial mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0
Mast 39

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compression)	Buckling	Shear (Comp)	aring (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)	Exceedance (Tens)
101		100x100x6	S235	2M16-5.6t	1.00	1.00	1.00	105	-7.8	ULS 5a Ba 12	142.1	75.4	103.7	0.10		7.7	ULS 5a Ba 12	144.1	75.4	76.8	0.10	
108		90x90x8	S235	5M16-5.6t	1.00	1.00	1.00	146	-41.7	ULS 5a Ba 22	112.9	188.4	345.6	0.37		0.0		285.6	188.4	298.7	0.00	
113A		90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	76	-61.0	ULS 1a_135	251.3	338.9	414.7	0.24		18.9	ULS 5a Ba 22	252.5	338.9	297.7	0.07	
114A		100x100x10	S235	4M24-5.6t	0.50	0.50	0.50	72	-182.9	ULS 1a_135	355.2	338.9	518.4	0.54		131.6	ULS 1a_0,9_0,9_135	362.9	338.9	443.1	0.39	
115A		150x150x10	S235	6M24-5.6t	1.77	1.37	1.14	39	-338.1	ULS 1a_135	643.5	508.3	777.6	0.67		224.5	ULS 1a_0,9_0,9_135	624.7	508.3	664.6	0.44	
106A		150x150x12	S235	8M24-5.6t	1.66	1.73	1.38	76	-639.6	ULS 1a_135	628.6	677.8	1244.2	1.02	knik	500.2	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.74	
106C		150x150x12	S235		1.81	1.89	1.51	87	-641.2	ULS 1a_135	575.2	0.0	0.0	1.11	knik	588.6	ULS 1a_0,9_0,9_135	817.8	0.0	0.0	0.72	
107A		150x150x12	S235	8M24-5.6t	0.33	0.33	0.33	49	-675.9	ULS 1a_135	735.4	677.8	1244.2	1.00		551.1	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.81	
201L		70x70x7	S235	1M24-5.6t	0.52	0.52	0.52	127	-24.3	ULS 5a Ba 22	75.8	84.7	90.7	0.32		18.0	ULS 5a Ba 22	88.7	84.7	64.2	0.28	
202T		50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	178	-10.7	ULS 5a Ba 22	25.7	37.7	43.2	0.42		5.5	ULS 5a Ba 22	37.4	37.7	22.0	0.25	
203L		100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	93	-108.6	ULS 5a Ba 12	207.7	169.4	207.4	0.64		116.7	ULS 5a Ba 22	181.4	169.4	177.2	0.69	
204T		100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	93	-123.1	ULS 5a Ba 12	256.2	254.2	388.8	0.48		122.1	ULS 5a Ba 22	261.1	254.2	332.3	0.48	
205L		100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	99	-105.5	ULS 5a Ba 22	198.3	169.4	207.4	0.62		97.2	ULS 5a Ba 12	181.4	169.4	177.2	0.57	
206T		100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	99	-109.8	ULS 5a Ba 22	244.6	254.2	388.8	0.45		110.5	ULS 5a Ba 12	261.1	254.2	332.3	0.43	
207L		100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	103	-86.9	ULS 5a Ba 12	190.8	169.4	207.4	0.51		94.4	ULS 5a Ba 22	181.4	169.4	177.2	0.56	
208T		100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	104	-99.2	ULS 5a Ba 12	235.3	169.4	259.2	0.59		97.9	ULS 5a Ba 22	224.3	169.4	221.5	0.58	
209L		100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	112	-94.6	ULS 5a Ba 12	177.9	169.4	207.4	0.56		95.0	ULS 5a Ba 22	181.4	169.4	177.2	0.56	
210T		100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	112	-101.1	ULS 5a Ba 12	219.3	169.4	259.2	0.60		80.3	ULS 5a Ba 22	224.3	169.4	221.5	0.47	
211L		100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	76	-94.7	ULS 5a Ba 21	197.1	169.4	207.4	0.56		89.1	ULS 5a Ba 21	125.9	169.4	116.0	0.77	
212T		100x75x9	S235	2M24-5.6t	1.00	0.55	0.55	65	-96.1	ULS 5a Ba 10	245.9	169.4	233.3	0.57		93.0	ULS 5a Ba 10	121.3	169.4	130.6	0.77	
213L		100x75x7	S235	2M24-5.6t	0.52	0.25	0.25	85	-77.5	ULS 5a Ba 21	161.2	169.4	181.4	0.48		81.2	ULS 5a Ba 21	98.2	169.4	101.5	0.83	
214T		100x75x9	S235	2M24-5.6t	0.52	0.25	0.25	74	-96.3	ULS 5a Ba 10	221.2	169.4	233.3	0.57		99.3	ULS 5a Ba 10	119.9	169.4	130.6	0.83	
215L		100x75x7	S235	2M24-5.6t	0.52	0.25	0.25	101	-73.9	ULS 5a Ba 21	141.1	169.4	181.4	0.52		69.9	ULS 5a Ba 21	100.4	169.4	101.5	0.70	
216T		100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	86	-90.6	ULS 5a Ba 10	182.6	169.4	207.4	0.53		87.2	ULS 5a Ba 21	110.7	169.4	116.0	0.79	
217L		100x75x7	S235	2M20-5.6t	0.52	0.25	0.25	112	-59.4	ULS 5a Ba 21	129.0	117.6	151.2	0.50		62.0	ULS 5a Ba 21	115.4	117.6	106.9	0.58	
218T		100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	102	-80.2	ULS 5a Ba 21	159.3	169.4	207.4	0.50		82.9	ULS 5a Ba 10	113.2	169.4	116.0	0.73	
219L		100x75x8	S235	2M20-5.6t	0.52	0.25	0.25	123	-53.2	ULS 5a Ba 21	133.9	117.6	172.8	0.45		50.2	ULS 5a Ba 21	128.6	117.6	104.7	0.48	
220T		100x75x9	S235	2M20-5.6t	0.52	0.25	0.25	117	-72.5	ULS 5a Ba 10	155.5	117.6	194.4	0.62		69.1	ULS 5a Ba 21	146.1	117.6	137.5	0.59	
221L		130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	124	-68.7	ULS 5a Ba 10	147.8	117.6	172.8	0.58		57.1	ULS 5a Ba 21	113.0	117.6	136.1	0.51	
222T		100x75x7	S235	2M20-5.6t	0.52	0.25	0.25	113	-53.4	ULS 5a Ba 21	127.3	117.6	151.2	0.45		55.7	ULS 5a Ba 10	107.3	117.6	91.6	0.61	
223L		100x75x7	S235	2M20-5.6t	0.33	0.20	0.20	105	-71.7	ULS 5a Ba 10	144.3	117.6	151.2	0.61		57.6	ULS 5a Ba 21	119.5	117.6	122.2	0.49	
224T		130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	124	-91.6	ULS 1a_90	147.8	117.6	172.8	0.78		80.3	ULS 1a_0,9_0,9_90	113.0	117.6	136.1	0.71	
226T		100x75x7	S235	2M20-5.6t	0.33	0.20	0.20	105	-91.4	ULS 1a_90	144.3	117.6	151.2	0.78		77.6	ULS 1a_0,9_0,9_90	119.5	117.6	122.2	0.66	
227T		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	206	-2.1	ULS 6a_90 Ba Ct2	21.0	37.7	43.2	0.10		0.0	ULS 5a Ba 22	37.4	37.7	22.0	0.00	
228L		80x80x8	S235	4M20-5.6t	1.00	1.00	1.00	128	0.0		122.6	235.2	345.6	0.00		119.6	ULS 3_0	168.3	235.2	244.4	0.71	
229		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	225	-0.3	ULS 3_0	18.5	37.7	43.2	0.01		0.0		37.4	37.7	25.7	0.00	
230		80x80x8	S235	2M24-5.6t	1.00	1.00	1.00	99	-76.2	ULS 5a Ba 12	156.9	169.4	207.4	0.49		76.1	ULS 5a Ba 12	206.0	169.4	159.5	0.48	
231T		100x75x7	S235	3M24-5.6t	2.00	1.00	1.00	69	-48.9	ULS 5a Ba 22	182.6	254.2	272.2	0.27		64.4	ULS 5a Ba 22	214.1	254.2	217.6	0.30	
232		150x100x12	S235	8M24-5.6t	2.00	1.00	1.00	51	-249.6	ULS 5a Ba 22	512.4	677.8	1244.2	0.49		94.2	ULS 5a Ba 22	582.2	677.8	755.0	0.16	
233T		70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	203	-34.0	ULS 1a_0,9_0,9_90	36.2	58.8	64.8	0.94		45.1	ULS 1a_90	82.9	58.8	52.4	0.86	
234L		80x80x8	S235	3M24-5.6t	1.00	1.00	1.00	178	0.0		82.2	254.2	311.0	0.00		147.7	ULS 3_0	169.8	254.2	239.3	0.87	
235		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	309	-0.6	ULS 3_90	11.3	37.7	43.2	0.05		0.0		37.4	37.7	22.0	0.00	
236		100x100x8	S235	2M24-5.6t	1.00	1.00	1.00	108	-75.6	ULS 5a Ba 10	182.9	169.4	207.4	0.45		75.8	ULS 5a Ba 10	208.1	169.4	177.2	0.45	
237T		100x75x7	S235	4M24-5.6t	1.00	1.00	1.00	94	-42.6	ULS 5a Ba 22	157.6	338.9	362.9	0.27		69.2	ULS 5a Ba 12	214.1	338.9	290.1	0.32	
238		150x100x14	S235	11M24-5.6t	2.00	1.00	1.00	70	-249.3	ULS 5a Ba 10	526.8	931.9	1995.8	0.47		72.0	ULS 5a Ba 10	666.7	931.9	1211.2	0.11	
239		100x50x6	S235	1M16-5.6t	0.50	0.50	0.50	327	-0.4	ULS 1a_90	18.6	37.7	51.8	0.02		0.0		55.3	37.7	28.0	0.00	
240		60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	272	-1.4	ULS 1a_90	14.1	37.7	43.2	0.10		2.8	ULS 1a_0,9_0,9_135	60.5	37.7	26.7	0.10	
241T		70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	255	-3.4	ULS 1a_135	28.9	37.7	51.8	0.12		1.2	ULS 1a_0,9_0,9_0	89.9	37.7	38.4	0.03	
251L		70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	255	-3.6	ULS 1a_90	28.9	37.7	51.8	0.12		0.9	ULS 1a_0,9_135	89.9	37.7	38.4	0.02	
113B		90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	79	-129.7	ULS 1a_135	245.5	338.9	414.7	0.53		81.7	ULS 1a_0,9_0,9_135	252.5	338.9	354.5	0.32	
114B		100x100x10	S235	6M24-5.6t	0.50	0.50	0.50	78	-218.9	ULS 1a_135	340.4	508.3	777.6	0.64		131.5	ULS 1a_0,9_0,9_135	362.9	508.3	651.3	0.36	
115B		150x150x10	S235	8M24-5.6t	4.00	4.23	3.33	76	-613.7	ULS 1a_135	530.0	677.8	1036.8	1.16	knik	472.5	ULS 1a_0,9_0,9_90	624.7	677.8	886.2	0.76	
115C		150x150x10	S235		1.70	1.70	1.42	80	-561.8	ULS 1a_135	514.8	0.0	0.0	1.09	knik	427.6	ULS 1a_0,9_0,9_135	688.6	0.0	0.0	0.62	
106B		150x150x12	S235	8M24-5.6t	0.76	1.28	0.63	60	-732.7	ULS 1a_135	696.2	677.8	1244.2	1.08	knik, afschuiving	587.4	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.87	
107B		150x150x12	S235	8M24-5.6t	0.20	0.20	0.20	48	-678.7	ULS 1a_135	736.7	677.8	1244.2	1.00	afschuiving	548.4	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.81	
102A		150x150x12	S235	8M24-5.6t	1.00	1.50	1.00	61	-303.0	ULS 5a Ba 12	689.3	677.8	1244.2	0.45		171.8	ULS 5a Ba 22	740.3	677.8	755.0	0.25	
102B		150x150x12	S235	6M24-5.6t	2.52	1.61	1.00	63	-143.2	ULS 5a Ba 12	682.7	508.3	933.1	0.28		36.7	ULS 5a Ba 22	740.3	508.3	797.5	0.07	
102C		150x150x12	S235		3.01	2.00	1.00	59	-274.7	ULS 5a Ba 12	698.8	0.0	0.0	0.39		148.9	ULS 5a Ba 22	817.8	0.0	0.0	0.18	
103A		120x120x8	S235	6M24-5.6t	2.64	4.00	1.00	76	-132.5	ULS 5a Ba 12	340.1	508.3	622.1	0.39		47.5	ULS 5a Ba 22	379.5	508.3	531.7	0.13	
103B		120x120x8	S235	2M16-5.6t	2.00	4.44	2.00	108	-31.4	ULS 3_90	249.9	75.4	138.2	0.42		0.0		316.6	75.4	138.2	0.00	
103C		120x120x8	S235		1.71	1.00	1.00	76	-95.0	ULS 5a Ba 1	340.3	0.0	0.0	0.28		21.3	ULS 5a Ba 1	441.8	0.0	0.0	0.05	
104A		100x65x7*	S235	4M20-5.6t	1.00	1.00	1.00	202	0.0		63.1	235.2	302.4	0.00		111.1	ULS 3_0	115.2	235.2	207.0	0.96	
104B		100x65x7*	S235	3M20-5.6t	1.00	1.00	1.00	209	0.0		60.1	176.4	226.8	0.00		77.0	ULS 3_0	137.8	176.4	155.3	0.56	
104C		100x65x7*	S235		1.00	1.00	1.00	194	0.0		66.4	0.0	0.0	0.00		98.0	ULS 3_0	263.2	0.0	0.0	0.37	
105A		60x60x5	S235	2M16-5.6t	1.00	2.43	1.00	380	0.0		11.8	75.4	86.4	0.00		30.8	ULS 6a_90 Ba Ct1	98.8	75.4	56.0	0.55	
105B		60x60x5	S235	2M16-5.6t	1.00	1.70	1.00	379	0.0		11.8	75.4	86.4	0.00		30.9	ULS 6a_90 Ba Ct1	65.9	75.4	56.0	0.55	
415		60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	180	-8.6	ULS 3_0	30.7	37.7	43.2	0.28		0.0		60.5	37.7	26.7	0.00	
417		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	170	-9.5	ULS 3_0	27.4	37.7	43.2	0.35		0.0		37.4	37.7	18.4	0.00	
419		75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	107	-11.8	ULS 3_0	55.1	37.7	43.2	0.31		0.0		37.4	37.7	22.0	0.00	
422		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	70	-0.5	ULS 6a_90 Ba Ct1	58.8	37.7	43.2	0.01		0.0		37.4	37.7	18.4	0.00	
414		60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	325	0.0		12.6	37.7	43.2	0.00		13.7	ULS 3_0	60.5	37.7	32.0	0.43	
416		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	353	0.0		9.1	37.7	43.2	0.00		16.9	ULS 3_0	37.4	37.7	22.0	0.77	
418		50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	344	0.0		11.9	75.4	86.4	0.00		25.9	ULS 3_0	56.2	75.4	44.1	0.59	
421		60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	259	0.0		26.8	117.6	129.6	0.00		50.0	ULS 3_0	77.4	117.6	88.7	0.65	
420		45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	111	-1.5	ULS 1a_0,9_0,9_0	39.6	20.2	32.4	0.08		1.4	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.07	
400		60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	124	-20.9	ULS 5a Ba 22	48.1	58.8	54.0	0.43		19.4	ULS 5a Ba 12	54.7	58.8	37.0	0.52	
401		60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	119	-23.1	ULS 5a Ba 12	50.2	58.8	54.0	0.46		23.8	ULS 5a Ba 22	54.7	58.8	37.0	0.64	
402		60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	114	-25.9	ULS 5a Ba 22	52.1	58.8	54.0	0.50		25.5	ULS 5a Ba 12	54.7	58.8	37.0	0.69	
403		60x60x6	S235	1M20-5.6t	0.52	0.52	0.52	108	-29.6	ULS 5a Ba 12	65.2	58.8	64.8	0.50		28.8	ULS 5a Ba 22	65.7	58.8	44.4	0.65	
404		70x70x6	S235	1M24-5.6t	0.53	0.53	0.53	93	-32.0	ULS 5a Ba 22	86.5	84.7	77.8	0.41		34.1	ULS 5a Ba 12	76.0	84.7	44.0	0.78	
405		75x50x7	S235	1M24-5.6t	0.53	0.53	0.53	107	-41.9	ULS 5a Ba 12	76.2	84.7	90.7	0.55		38.4	ULS 5a Ba 22	98.8	84.7	58.0	0.66	
409		55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	142	-5.0	ULS 1a_135	37.9	37.7	43.2	0.13		16.3	ULS 5a Ba 1	53.3	37.7	32.0	0.51	
410		55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	140	-16.7	ULS 5a Ba 1	38.5	37.7	43.2	0.44		4.0	ULS 1a_135	53.3	37.7	32.0	0.12	
411		55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	135	-2.9	ULS 1a_135	40.2	37.7	43.2	0.08		17.1	ULS 5a Ba 1	53.3	37.7	32.0	0.53	
412		55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	129	-17.7	ULS 5a Ba 1	42.0	37.7	43.2	0.47		2.3	ULS 1a_0,9_0,9_135	53.3	37.7	32.0	0.07	
406		HEB160	S235		1.00	1.00	1.00	33	-2.1	ULS 1a_0,9_0,9_90	991.1	0.0	0.0	0.00		5.9	ULS 1a_90	1276.1	0.0	0.0	0.00	
407		HEB160	S235		2.00	2.00	2.00	32	-26.4	ULS 5a Ba 12	994.8	0.0	0.0	0.03		25.1	ULS 5a Ba 22	1276.1	0.0	0.0	0.02	

Assessment of groups for initial mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0
Mast 39

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compression)	Buckling	Shear (Comp)	aring (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)	Exceedance (Tens)
408		HEB160	S235		1.00	1.00	1.00	32	**-7.0**	ULS 5a Ba 1	998.4	0.0	0.0	0.01		**3.9**	ULS 1a_135	1276.1	0.0	0.0	0.00	
413		HEB160	S235	2M16-5.6t	2.00	2.00	2.00	25	**-1.3**	ULS 1a_0,9_0,9_135	1067.2	75.4	138.2	0.02		**14.2**	ULS 5a Ba 1	1296.6	75.4	124.6	0.19	
423		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	187	**0.0**	ULS 1a_45	24.0	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00	
424		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	169	**0.0**	ULS 3_90	27.5	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00	
111A		80x80x8	S235	3M24-5.6t	1.00	2.00	1.00	203	**0.0**		65.4	254.2	311.0	0.00		**135.9**	ULS 3_45	160.8	254.2	259.0	0.85	
111B		80x80x8	S235	3M20-5.6t	1.00	2.00	1.00	202	**0.0**		65.8	176.4	259.2	0.00		**120.2**	ULS 3_0	168.3	176.4	209.5	0.71	
112A		70x70x7	S235	3M20-5.6t	1.00	1.88	1.00	227	**0.0**		42.7	176.4	226.8	0.00		**95.3**	ULS 3_0	125.5	176.4	155.3	0.76	
112B		70x70x7	S235	3M20-5.6t	1.00	2.00	1.00	232	**0.0**		41.4	176.4	226.8	0.00		**83.5**	ULS 3_0	125.5	176.4	155.3	0.67	
112C		70x70x7	S235		1.00	2.14	1.00	227	**0.0**		42.7	0.0	0.0	0.00		**91.4**	ULS 3_0	220.9	0.0	0.0	0.41	
110A		120x120x11	S235	6M24-5.6t	1.64	1.00	1.00	60	**-191.0**	ULS 5a Ba 21	508.6	508.3	855.4	0.38		**104.3**	ULS 5a Ba 21	513.2	508.3	731.1	0.21	
110B		120x120x11	S235		1.00	1.00	1.00	13	**-0.4**	ULS 1a_0,9_0,9_90	599.7	0.0	0.0	0.00		**0.4**	ULS 1a_90	599.7	0.0	0.0	0.00	
110C		120x120x11	S235		1.71	1.29	1.00	66	**-158.8**	ULS 5a Ba 21	492.8	0.0	0.0	0.32		**80.8**	ULS 5a Ba 10	599.7	0.0	0.0	0.13	
109A		150x100x14	S235	11M24-5.6t	1.00	0.52	0.52	56	**-302.5**	ULS 5a Ba 10	673.7	931.9	1995.8	0.45		**142.6**	ULS 5a Ba 21	666.7	931.9	1211.2	0.21	
109B		150x100x14	S235	6M24-5.6t	4.78	1.00	1.00	47	**-206.2**	ULS 5a Ba 10	703.8	508.3	1088.6	0.41		**119.3**	ULS 5a Ba 21	666.7	508.3	930.5	0.23	
109C		150x100x14	S235		1.00	0.52	0.52	58	**-277.9**	ULS 5a Ba 21	665.2	0.0	0.0	0.42		**131.2**	ULS 5a Ba 10	775.5	0.0	0.0	0.17	
312		70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	185	**-14.3**	ULS 3_135	41.1	58.8	64.8	0.35		**0.0**		82.9	58.8	39.3	0.00	
314		70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	148	**-15.5**	ULS 3_0	54.9	58.8	64.8	0.28		**0.0**		82.9	58.8	39.3	0.00	
317		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	154	**-2.9**	ULS 1a_0	31.0	37.7	43.2	0.09		**0.0**		37.4	37.7	18.4	0.00	
319		75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-2.6**	ULS 1a_0	59.5	37.7	43.2	0.07		**0.0**		37.4	37.7	18.4	0.00	
322		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	53	**-1.1**	ULS 3_90	63.5	37.7	43.2	0.03		**0.0**		37.4	37.7	18.4	0.00	
311		60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	332	**0.0**		12.1	58.8	54.0	0.00		**17.4**	ULS 3_45	54.7	58.8	37.0	0.47	
313		60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	298	**0.0**		14.4	58.8	54.0	0.00		**23.7**	ULS 3_135	54.7	58.8	37.0	0.64	
316		50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	332	**0.0**		12.6	75.4	86.4	0.00		**31.7**	ULS 3_135	52.4	75.4	44.1	0.72	
318		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	274	**0.0**		13.7	37.7	43.2	0.00		**6.4**	ULS 5a Ba 10	37.4	37.7	22.0	0.29	
321		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	269	**0.0**		14.1	37.7	43.2	0.00		**8.9**	ULS 3_0	37.4	37.7	22.0	0.40	
315		45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	180	**-1.3**	ULS 1a_0	22.7	20.2	32.4	0.06		**1.1**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.06	
320		45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	115	**-1.1**	ULS 1a_0	38.2	20.2	32.4	0.05		**1.0**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.05	
300		70x70x7	S235	1M20-5.6t	0.53	0.53	0.53	142	**-24.3**	ULS 5a Ba 20	66.6	58.8	75.6	0.41		**22.2**	ULS 5a Ba 11	96.8	58.8	53.5	0.41	
301		70x70x7	S235	1M20-5.6t	0.54	0.54	0.54	138	**-27.0**	ULS 5a Ba 11	69.0	58.8	75.6	0.46		**29.8**	ULS 5a Ba 20	96.8	58.8	53.5	0.56	
302		70x70x7	S235	1M24-5.6t	0.54	0.54	0.54	119	**-33.6**	ULS 5a Ba 20	80.7	84.7	90.7	0.42		**30.2**	ULS 5a Ba 11	88.7	84.7	44.9	0.67	
304		60x60x5	S235	1M20-5.6t	0.53	0.53	0.53	104	**-18.0**	ULS 5a Ba 21	57.0	58.8	54.0	0.33		**17.6**	ULS 5a Ba 21	54.7	58.8	37.0	0.48	
305		60x60x5	S235	1M20-5.6t	0.54	0.54	0.54	112	**-24.9**	ULS 5a Ba 10	52.9	58.8	54.0	0.47		**24.7**	ULS 5a Ba 10	54.7	58.8	37.0	0.67	
306		75x50x5	S235	1M24-5.6t	0.55	0.55	0.55	112	**-29.5**	ULS 5a Ba 10	53.3	84.7	64.8	0.55		**29.9**	ULS 5a Ba 10	70.6	84.7	41.4	0.72	
307		75x50x7	S235	1M24-5.6t	0.54	0.54	0.54	87	**-37.7**	ULS 5a Ba 21	86.9	84.7	90.7	0.45		**36.4**	ULS 5a Ba 21	98.8	84.7	58.0	0.63	
303		HEB160	S235		2.00	2.00	2.00	50	**-26.0**	ULS 5a Ba 20	918.5	0.0	0.0	0.03		**25.4**	ULS 5a Ba 11	1276.1	0.0	0.0	0.02	
308		HEB160	S235		1.00	1.00	1.00	27	**-1.0**	ULS 1a_0,9_0,9_90	1015.5	0.0	0.0	0.00		**3.8**	ULS 1a_90	1276.1	0.0	0.0	0.00	
309		HEB160	S235		2.00	2.00	2.00	26	**-26.7**	ULS 5a Ba 10	1021.6	0.0	0.0	0.03		**24.9**	ULS 5a Ba 21	1276.1	0.0	0.0	0.02	
310		HEB160	S235		1.00	1.00	1.00	25	**-3.3**	ULS 1a_0,9_0,9_90	1025.6	0.0	0.0	0.00		**3.3**	ULS 1a_90	1276.1	0.0	0.0	0.00	

Assessment of groups for strengthened mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0
Mast 39

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compres	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)
101	0	100x100x6	S235	2M16-5.6t	1.00	1.00	1.00	105	-7.8	ULS 5a Ba 12	142.1	75.4	103.7	0.10		7.7	ULS 5a Ba 12	144.1	75.4	76.8	0.10
108	0	90x90x8	S235	5M16-5.6t	1.00	1.00	1.00	146	-41.7	ULS 5a Ba 22	112.9	188.4	345.6	0.37		0.0		285.6	188.4	298.7	0.00
113A	0	90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	76	-61.0	ULS 1a_135	251.3	338.9	414.7	0.24		18.9	ULS 5a Ba 22	252.5	338.9	297.7	0.07
114A	0	100x100x10	S235	4M24-5.6t	0.50	0.50	0.50	72	-182.9	ULS 1a_135	355.2	338.9	518.4	0.54		131.6	ULS 1a_0,9_0,9_135	362.9	338.9	443.1	0.39
115A	0	150x150x10	S235	6M24-5.6t	1.77	1.37	1.14	39	-338.1	ULS 1a_135	643.5	508.3	777.6	0.67		224.5	ULS 1a_0,9_0,9_135	624.7	508.3	664.6	0.44
106A	0	150x150x12	S235	8M24-5.6t	**0.97**	**0.97**	**0.62**	34	-639.6	ULS 1a_135	780.4	677.8	1244.2	0.94		500.2	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.74
106C	0	150x150x12	S235		**3.06**	**3.06**	**1.96**	35	-731.8	ULS 1a_135	776.6	0.0	0.0	0.94		588.6	ULS 1a_0,9_0,9_135	817.8	0.0	0.0	0.72
107A	0	150x150x12	S235	8M24-5.6t	0.33	0.33	0.33	49	-675.9	ULS 1a_135	735.4	677.8	1244.2	1.00		551.1	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.81
201L	0	70x70x7	S235	1M24-5.6t	0.52	0.52	0.52	127	-24.3	ULS 5a Ba 22	75.8	84.7	90.7	0.32		18.0	ULS 5a Ba 22	88.7	84.7	64.2	0.28
202T	0	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	178	-10.7	ULS 5a Ba 22	25.7	37.7	43.2	0.42		5.5	ULS 5a Ba 22	37.4	37.7	22.0	0.25
203L	0	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	93	-108.6	ULS 5a Ba 12	207.7	169.4	207.4	0.64		116.7	ULS 5a Ba 22	181.4	169.4	177.2	0.69
204T	0	100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	93	-123.1	ULS 5a Ba 12	256.2	254.2	388.8	0.48		122.1	ULS 5a Ba 22	261.1	254.2	332.3	0.48
205L	0	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	99	-105.5	ULS 5a Ba 22	198.3	169.4	207.4	0.62		97.2	ULS 5a Ba 12	181.4	169.4	177.2	0.57
206T	0	100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	99	-109.8	ULS 5a Ba 22	244.6	254.2	388.8	0.45		110.5	ULS 5a Ba 12	261.1	254.2	332.3	0.43
207L	0	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	103	-86.9	ULS 5a Ba 12	190.8	169.4	207.4	0.51		94.4	ULS 5a Ba 22	181.4	169.4	177.2	0.56
208T	0	100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	104	-99.2	ULS 5a Ba 12	235.3	169.4	259.2	0.59		97.9	ULS 5a Ba 22	224.3	169.4	221.5	0.58
209L	0	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	112	-94.6	ULS 5a Ba 12	177.9	169.4	207.4	0.56		95.0	ULS 5a Ba 22	181.4	169.4	177.2	0.56
210T	0	100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	112	-101.1	ULS 5a Ba 12	219.3	169.4	259.2	0.60		80.3	ULS 5a Ba 22	224.3	169.4	221.5	0.47
211L	0	100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	76	-94.7	ULS 5a Ba 21	197.1	169.4	207.4	0.56		89.1	ULS 5a Ba 21	125.9	169.4	116.0	0.77
212T	0	100x75x9	S235	2M24-5.6t	1.00	0.55	0.55	65	-96.1	ULS 5a Ba 10	245.9	169.4	233.3	0.57		93.0	ULS 5a Ba 10	121.3	169.4	130.6	0.77
213L	0	100x75x7	S235	2M24-5.6t	0.52	0.25	0.25	85	-77.5	ULS 5a Ba 21	161.2	169.4	181.4	0.48		81.2	ULS 5a Ba 21	98.2	169.4	101.5	0.83
214T	0	100x75x9	S235	2M24-5.6t	0.52	0.25	0.25	74	-96.3	ULS 5a Ba 10	221.2	169.4	233.3	0.57		99.3	ULS 5a Ba 10	119.9	169.4	130.6	0.83
215L	0	100x75x7	S235	2M24-5.6t	0.52	0.25	0.25	101	-73.9	ULS 5a Ba 21	141.1	169.4	181.4	0.52		69.9	ULS 5a Ba 21	100.4	169.4	101.5	0.70
216T	0	100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	86	-90.6	ULS 5a Ba 10	182.6	169.4	207.4	0.53		87.2	ULS 5a Ba 21	110.7	169.4	116.0	0.79
217L	0	100x75x7	S235	2M20-5.6t	0.52	0.25	0.25	112	-59.4	ULS 5a Ba 21	129.0	117.6	151.2	0.50		62.0	ULS 5a Ba 21	115.4	117.6	106.9	0.58
218T	0	100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	102	-80.2	ULS 5a Ba 21	159.3	169.4	207.4	0.50		82.9	ULS 5a Ba 10	113.2	169.4	116.0	0.73
219L	0	100x75x8	S235	2M20-5.6t	0.52	0.25	0.25	123	-53.2	ULS 5a Ba 21	133.9	117.6	172.8	0.45		50.2	ULS 5a Ba 21	128.6	117.6	104.7	0.48
220T	0	100x75x9	S235	2M20-5.6t	0.52	0.25	0.25	117	-72.5	ULS 5a Ba 10	155.5	117.6	194.4	0.62		69.1	ULS 5a Ba 21	146.1	117.6	137.5	0.59
221L	0	130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	124	-68.7	ULS 5a Ba 10	147.8	117.6	172.8	0.58		57.1	ULS 5a Ba 21	113.0	117.6	136.1	0.51
222T	0	100x75x7	S235	2M20-5.6t	0.52	0.25	0.25	113	-53.4	ULS 5a Ba 21	127.3	117.6	151.2	0.45		55.7	ULS 5a Ba 10	107.3	117.6	91.6	0.61
223L	0	100x75x7	S235	2M20-5.6t	0.33	0.20	0.20	105	-71.7	ULS 5a Ba 10	144.3	117.6	151.2	0.61		57.6	ULS 5a Ba 21	119.5	117.6	122.2	0.49
224T	0	130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	124	-91.6	ULS 1a_90	147.8	117.6	172.8	0.78		80.3	ULS 1a_0,9_0,9_90	113.0	117.6	136.1	0.71
226T	0	100x75x7	S235	2M20-5.6t	0.33	0.20	0.20	105	-91.4	ULS 1a_90	144.3	117.6	151.2	0.78		77.6	ULS 1a_0,9_0,9_90	119.5	117.6	122.2	0.66
227T	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	206	-2.1	ULS 6a_90 Ba Ct2	21.0	37.7	43.2	0.10		0.0	ULS 5a Ba 22	37.4	37.7	22.0	0.00
228L	0	80x80x8	S235	4M20-5.6t	1.00	1.00	1.00	128	0.0		122.6	235.2	345.6	0.00		119.6	ULS 3_0	168.3	235.2	244.4	0.71
229	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	225	-0.3	ULS 3_0	18.5	37.7	43.2	0.01		0.0		37.4	37.7	25.7	0.00
230	0	80x80x8	S235	2M24-5.6t	1.00	1.00	1.00	99	-76.2	ULS 5a Ba 12	156.9	169.4	207.4	0.49		76.1	ULS 5a Ba 12	206.0	169.4	159.5	0.48
231T	0	100x75x7	S235	3M24-5.6t	2.00	1.00	1.00	69	-48.9	ULS 5a Ba 22	182.6	254.2	272.2	0.27		64.4	ULS 5a Ba 22	214.1	254.2	217.6	0.30
232	0	150x100x12	S235	8M24-5.6t	2.00	1.00	1.00	51	-249.6	ULS 5a Ba 22	512.4	677.8	1244.2	0.49		94.2	ULS 5a Ba 22	582.2	677.8	755.0	0.16
233T	0	70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	203	-34.0	ULS 1a_0,9_0,9_90	36.2	58.8	64.8	0.94		45.1	ULS 1a_90	82.9	58.8	52.4	0.86
234L	0	80x80x8	S235	3M24-5.6t	1.00	1.00	1.00	178	0.0		82.2	254.2	311.0	0.00		147.7	ULS 3_0	169.8	254.2	239.3	0.87
235	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	309	-0.6	ULS 3_90	11.3	37.7	43.2	0.05		0.0		37.4	37.7	22.0	0.00
236	0	100x100x8	S235	2M24-5.6t	1.00	1.00	1.00	108	-75.6	ULS 5a Ba 10	182.9	169.4	207.4	0.45		75.8	ULS 5a Ba 10	208.1	169.4	177.2	0.45
237T	0	100x75x7	S235	4M24-5.6t	1.00	1.00	1.00	94	-42.6	ULS 5a Ba 22	157.6	338.9	362.9	0.27		69.2	ULS 5a Ba 12	214.1	338.9	290.1	0.32
238	0	150x100x14	S235	11M24-5.6t	2.00	1.00	1.00	70	-249.3	ULS 5a Ba 10	526.8	931.9	1995.8	0.47		72.0	ULS 5a Ba 10	666.7	931.9	1211.2	0.11
239	0	100x50x6	S235	1M16-5.6t	0.50	0.50	0.50	327	-0.4	ULS 1a_90	18.6	37.7	51.8	0.02		0.0		55.3	37.7	28.0	0.00
240	0	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	272	-1.4	ULS 1a_90	14.1	37.7	43.2	0.10		2.8	ULS 1a_0,9_0,9_135	60.5	37.7	26.7	0.10
241T	0	70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	255	-3.4	ULS 1a_135	28.9	37.7	51.8	0.12		1.2	ULS 1a_0,9_0,9_0	89.9	37.7	38.4	0.03
251L	0	70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	255	-3.6	ULS 1a_90	28.9	37.7	51.8	0.12		0.9	ULS 1a_0,9_135	89.9	37.7	38.4	0.02
113B	0	90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	79	-129.7	ULS 1a_135	245.5	338.9	414.7	0.53		81.7	ULS 1a_0,9_0,9_135	252.5	338.9	354.5	0.32
114B	0	100x100x10	S235	6M24-5.6t	0.50	0.50	0.50	78	-218.9	ULS 1a_135	340.4	508.3	777.6	0.64		131.5	ULS 1a_0,9_0,9_135	362.9	508.3	651.3	0.36
115B	0	150x150x10	S235	8M24-5.6t	**1.87**	**1.87**	**1.20**	27	-613.7	ULS 1a_135	673.5	677.8	1036.8	0.91		472.5	ULS 1a_0,9_0,9_90	624.7	677.8	886.2	0.76
115C	0	150x150x10	S235		**1.19**	**1.19**	**0.77**	43	-561.8	ULS 1a_135	633.8	0.0	0.0	0.89		427.6	ULS 1a_0,9_0,9_135	688.6	0.0	0.0	0.62
106B	0	150x150x12	S235	**8M24-8.8t**	0.76	**0.76**	**0.49**	36	-732.7	ULS 1a_135	776.0	1084.4	1244.2	0.94		587.4	ULS 1a_0,9_0,9_135	740.3	1084.4	1063.4	0.79
107B	0	150x150x12	S235	**8M24-8.8t**	0.20	0.20	0.20	48	-678.7	ULS 1a_135	736.7	1084.4	1244.2	0.92		548.4	ULS 1a_0,9_0,9_135	740.3	1084.4	1063.4	0.74
102A	0	150x150x12	S235	8M24-5.6t	1.00	1.50	1.00	61	-303.0	ULS 5a Ba 12	689.3	677.8	1244.2	0.45		171.8	ULS 5a Ba 22	740.3	677.8	755.0	0.25
102B	0	150x150x12	S235	6M24-5.6t	2.52	1.61	1.00	63	-143.2	ULS 5a Ba 12	682.7	508.3	933.1	0.28		36.7	ULS 5a Ba 22	740.3	508.3	797.5	0.07
102C	0	150x150x12	S235		3.01	2.00	1.00	59	-274.7	ULS 5a Ba 12	698.8	0.0	0.0	0.39		148.9	ULS 5a Ba 22	817.8	0.0	0.0	0.18
103A	0	120x120x8	S235	6M24-5.6t	2.64	4.00	1.00	76	-132.5	ULS 5a Ba 12	340.1	508.3	622.1	0.39		47.5	ULS 5a Ba 22	379.5	508.3	531.7	0.13
103B	0	120x120x8	S235	2M16-5.6t	2.00	4.44	2.00	108	-31.4	ULS 3_90	249.9	75.4	138.2	0.42		0.0		316.6	75.4	138.2	0.00
103C	0	120x120x8	S235		1.71	1.00	1.00	76	-95.0	ULS 5a Ba 1	340.3	0.0	0.0	0.28		21.3	ULS 5a Ba 1	441.8	0.0	0.0	0.05
104A	0	100x65x7*	S235	4M20-5.6t	1.00	1.00	1.00	202	0.0		63.1	235.2	302.4	0.00		111.1	ULS 3_0	115.2	235.2	207.0	0.96
104B	0	100x65x7*	S235	3M20-5.6t	1.00	1.00	1.00	209	0.0		60.1	176.4	226.8	0.00		77.0	ULS 3_0	137.8	176.4	155.3	0.56
104C	0	100x65x7*	S235		1.00	1.00	1.00	194	0.0		66.4	0.0	0.0	0.00		98.0	ULS 3_0	263.2	0.0	0.0	0.37
105A	0	60x60x5	S235	2M16-5.6t	1.00	2.43	1.00	380	0.0		11.8	75.4	86.4	0.00		30.8	ULS 6a_90 Ba Ct1	98.8	75.4	56.0	0.55
105B	0	60x60x5	S235	2M16-5.6t	1.00	1.70	1.00	379	0.0		11.8	75.4	86.4	0.00		30.9	ULS 6a_90 Ba Ct1	65.9	75.4	56.0	0.55
415	0	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	180	-8.6	ULS 3_0	30.7	37.7	43.2	0.28		0.0		60.5	37.7	26.7	0.00
417	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	170	-9.5	ULS 3_0	27.4	37.7	43.2	0.35		0.0		37.4	37.7	18.4	0.00
419	0	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	107	-11.8	ULS 3_0	55.1	37.7	43.2	0.31		0.0		37.4	37.7	22.0	0.00
422	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	70	-0.5	ULS 6a_90 Ba Ct1	58.8	37.7	43.2	0.01		0.0		37.4	37.7	18.4	0.00
414	0	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	325	0.0		12.6	37.7	43.2	0.00		13.7	ULS 3_0	60.5	37.7	32.0	0.43
416	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	353	0.0		9.1	37.7	43.2	0.00		16.9	ULS 3_0	37.4	37.7	22.0	0.77
418	0	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	344	0.0		11.9	75.4	86.4	0.00		25.9	ULS 3_0	56.2	75.4	44.1	0.59
421	0	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	259	0.0		26.8	117.6	129.6	0.00		50.0	ULS 3_0	77.4	117.6	88.7	0.65
420	0	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	111	-1.5	ULS 1a_0,9_0,9_0	39.6	20.2	32.4	0.08		1.4	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.07
400	0	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	124	-20.9	ULS 5a Ba 22	48.1	58.8	54.0	0.43		19.4	ULS 5a Ba 12	54.7	58.8	37.0	0.52
401	0	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	119	-23.1	ULS 5a Ba 12	50.2	58.8	54.0	0.46		23.8	ULS 5a Ba 22	54.7	58.8	37.0	0.64
402	0	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	114	-25.9	ULS 5a Ba 22	52.1	58.8	54.0	0.50		25.5	ULS 5a Ba 12	54.7	58.8	37.0	0.69
403	0	60x60x6	S235	1M20-5.6t	0.52	0.52	0.52	108	-29.6	ULS 5a Ba 12	65.2	58.8	64.8	0.50		28.8	ULS 5a Ba 22	65.7	58.8	44.4	0.65
404	0	70x70x6	S235	1M24-5.6t	0.53	0.53	0.53	93	-32.0	ULS 5a Ba 22	86.5	84.7	77.8	0.41		34.1	ULS 5a Ba 12	76.0	84.7	44.0	0.78
405	0	75x50x7	S235	1M24-5.6t	0.53	0.53	0.53	107	-41.9	ULS 5a Ba 12	76.2	84.7	90.7	0.55		38.4	ULS 5a Ba 22	98.8	84.7	58.0	0.66

Assessment of groups for strenghtened mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0
Mast 39

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compres	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)
409	0	55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	142	**-5.0**	ULS 1a_135	37.9	37.7	43.2	0.13		**16.3**	ULS 5a Ba 1	53.3	37.7	32.0	0.51
410	0	55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	140	**-16.7**	ULS 5a Ba 1	38.5	37.7	43.2	0.44		**4.0**	ULS 1a_135	53.3	37.7	32.0	0.12
411	0	55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	135	**-2.9**	ULS 1a_135	40.2	37.7	43.2	0.08		**17.1**	ULS 5a Ba 1	53.3	37.7	32.0	0.53
412	0	55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	129	**-17.7**	ULS 5a Ba 1	42.0	37.7	43.2	0.47		**2.3**	ULS 1a_0,9_0,9_135	53.3	37.7	32.0	0.07
406	0	HEB160	S235		1.00	1.00	1.00	33	**-2.1**	ULS 1a_0,9_0,9_90	991.1	0.0	0.0	0.00		**5.9**	ULS 1a_90	1276.1	0.0	0.0	0.00
407	0	HEB160	S235		2.00	2.00	2.00	32	**-26.4**	ULS 5a Ba 12	994.8	0.0	0.0	0.03		**25.1**	ULS 5a Ba 22	1276.1	0.0	0.0	0.02
408	0	HEB160	S235		1.00	1.00	1.00	32	**-7.0**	ULS 5a Ba 1	998.4	0.0	0.0	0.01		**3.9**	ULS 1a_135	1276.1	0.0	0.0	0.00
413	0	HEB160	S235	2M16-5.6t	2.00	2.00	2.00	25	**-1.3**	ULS 1a_0,9_0,9_135	1067.2	75.4	138.2	0.02		**14.2**	ULS 5a Ba 1	1296.6	75.4	124.6	0.19
423	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	187	**0.0**	ULS 1a_45	24.0	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00
424	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	169	**0.0**	ULS 3_90	27.5	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00
111A	0	80x80x8	S235	3M24-5.6t	1.00	2.00	1.00	203	**0.0**		65.4	254.2	311.0	0.00		**135.9**	ULS 3_45	160.8	254.2	259.0	0.85
111B	0	80x80x8	S235	3M20-5.6t	1.00	2.00	1.00	202	**0.0**		65.8	176.4	259.2	0.00		**120.2**	ULS 3_0	168.3	176.4	209.5	0.71
112A	0	70x70x7	S235	3M20-5.6t	1.00	1.88	1.00	227	**0.0**		42.7	176.4	226.8	0.00		**95.3**	ULS 3_0	125.5	176.4	155.3	0.76
112B	0	70x70x7	S235	3M20-5.6t	1.00	2.00	1.00	232	**0.0**		41.4	176.4	226.8	0.00		**83.5**	ULS 3_0	125.5	176.4	155.3	0.67
112C	0	70x70x7	S235		1.00	2.14	1.00	227	**0.0**		42.7	0.0	0.0	0.00		**91.4**	ULS 3_0	220.9	0.0	0.0	0.41
110A	0	120x120x11	S235	6M24-5.6t	1.64	1.00	1.00	60	**-191.0**	ULS 5a Ba 21	508.6	508.3	855.4	0.38		**104.3**	ULS 5a Ba 21	513.2	508.3	731.1	0.21
110B	0	120x120x11	S235		1.00	1.00	1.00	13	**-0.4**	ULS 1a_0,9_0,9_90	599.7	0.0	0.0	0.00		**0.4**	ULS 1a_90	599.7	0.0	0.0	0.00
110C	0	120x120x11	S235		1.71	1.29	1.00	66	**-158.8**	ULS 5a Ba 21	492.8	0.0	0.0	0.32		**80.8**	ULS 5a Ba 10	599.7	0.0	0.0	0.13
109A	0	150x100x14	S235	11M24-5.6t	1.00	0.52	0.52	56	**-302.5**	ULS 5a Ba 10	673.7	931.9	1995.8	0.45		**142.6**	ULS 5a Ba 21	666.7	931.9	1211.2	0.21
109B	0	150x100x14	S235	6M24-5.6t	4.78	1.00	1.00	47	**-206.2**	ULS 5a Ba 10	703.8	508.3	1088.6	0.41		**119.3**	ULS 5a Ba 21	666.7	508.3	930.5	0.23
109C	0	150x100x14	S235		1.00	0.52	0.52	58	**-277.9**	ULS 5a Ba 21	665.2	0.0	0.0	0.42		**131.2**	ULS 5a Ba 10	775.5	0.0	0.0	0.17
312	0	70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	185	**-14.3**	ULS 3_135	41.1	58.8	64.8	0.35		**0.0**		82.9	58.8	39.3	0.00
314	0	70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	148	**-15.5**	ULS 3_0	54.9	58.8	64.8	0.28		**0.0**		82.9	58.8	39.3	0.00
317	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	154	**-2.9**	ULS 1a_0	31.0	37.7	43.2	0.09		**0.0**		37.4	37.7	18.4	0.00
319	0	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-2.6**	ULS 1a_0	59.5	37.7	43.2	0.07		**0.0**		37.4	37.7	18.4	0.00
322	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	53	**-1.1**	ULS 3_90	63.5	37.7	43.2	0.03		**0.0**		37.4	37.7	18.4	0.00
311	0	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	332	**0.0**		12.1	58.8	54.0	0.00		**17.4**	ULS 3_45	54.7	58.8	37.0	0.47
313	0	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	298	**0.0**		14.4	58.8	54.0	0.00		**23.7**	ULS 3_135	54.7	58.8	37.0	0.64
316	0	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	332	**0.0**		12.6	75.4	86.4	0.00		**31.7**	ULS 3_135	52.4	75.4	44.1	0.72
318	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	274	**0.0**		13.7	37.7	43.2	0.00		**6.4**	ULS 5a Ba 10	37.4	37.7	22.0	0.29
321	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	269	**0.0**		14.1	37.7	43.2	0.00		**8.9**	ULS 3_0	37.4	37.7	22.0	0.40
315	0	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	180	**-1.3**	ULS 1a_0	22.7	20.2	32.4	0.06		**1.1**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.06
320	0	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	115	**-1.1**	ULS 1a_0	38.2	20.2	32.4	0.05		**1.0**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.05
300	0	70x70x7	S235	1M20-5.6t	0.53	0.53	0.53	142	**-24.3**	ULS 5a Ba 20	66.6	58.8	75.6	0.41		**22.2**	ULS 5a Ba 11	96.8	58.8	53.5	0.41
301	0	70x70x7	S235	1M20-5.6t	0.54	0.54	0.54	138	**-27.0**	ULS 5a Ba 11	69.0	58.8	75.6	0.46		**29.8**	ULS 5a Ba 20	96.8	58.8	53.5	0.56
302	0	70x70x7	S235	1M24-5.6t	0.54	0.54	0.54	119	**-33.6**	ULS 5a Ba 20	80.7	84.7	90.7	0.42		**30.2**	ULS 5a Ba 11	88.7	84.7	44.9	0.67
304	0	60x60x5	S235	1M20-5.6t	0.53	0.53	0.53	104	**-18.0**	ULS 5a Ba 21	57.0	58.8	54.0	0.33		**17.6**	ULS 5a Ba 21	54.7	58.8	37.0	0.48
305	0	60x60x5	S235	1M20-5.6t	0.54	0.54	0.54	112	**-24.9**	ULS 5a Ba 10	52.9	58.8	54.0	0.47		**24.7**	ULS 5a Ba 10	54.7	58.8	37.0	0.67
306	0	75x50x5	S235	1M24-5.6t	0.55	0.55	0.55	112	**-29.5**	ULS 5a Ba 10	53.3	84.7	64.8	0.55		**29.9**	ULS 5a Ba 10	70.6	84.7	41.4	0.72
307	0	75x50x7	S235	1M24-5.6t	0.54	0.54	0.54	87	**-37.7**	ULS 5a Ba 21	86.9	84.7	90.7	0.45		**36.4**	ULS 5a Ba 21	98.8	84.7	58.0	0.63
303	0	HEB160	S235		2.00	2.00	2.00	50	**-26.0**	ULS 5a Ba 20	918.5	0.0	0.0	0.03		**25.4**	ULS 5a Ba 11	1276.1	0.0	0.0	0.02
308	0	HEB160	S235		1.00	1.00	1.00	27	**-1.0**	ULS 1a_0,9_0,9_90	1015.5	0.0	0.0	0.00		**3.8**	ULS 1a_90	1276.1	0.0	0.0	0.00
309	0	HEB160	S235		2.00	2.00	2.00	26	**-26.7**	ULS 5a Ba 10	1021.6	0.0	0.0	0.03		**24.9**	ULS 5a Ba 21	1276.1	0.0	0.0	0.02
310	0	HEB160	S235		1.00	1.00	1.00	25	**-3.3**	ULS 1a_0,9_0,9_90	1025.6	0.0	0.0	0.00		**3.3**	ULS 1a_90	1276.1	0.0	0.0	0.00
40	40	**75x50x5**	S235	1M16-5.6c	1.00	1.00	1.00	230	**0.0**		22.4	37.7	43.2	0.00		**0.8**	0.764	ULS 30yr 1a \	146.9	18.4	0.04
903	903	**80x80x8**	S235	1M20-5.6c	1.00	1.00	1.00	201	**-0.1**	ULS 30yr 1a W ZII WR	55.6	58.8	86.4	0.00		**0.0**	0.03	ULS 30yr 1a \	303.6	69.8	0.00
1052	1052	**180x180x16#**	S235	12M24-5.6c	2.00	1.00	1.00	73	**-260.5**	ULS 30yr 5a Trsnl ZII E	1023.5	991.2	2488.3	0.26		**31.0**	30.955	ULS 30yr 5a T	1328.1	2126.8	0.03
20	20	**100x100x8**	S235	2M24-5.6c	2.00	1.00	1.00	131	**-33.7**	ULS 30yr 5a Trsnl ZII E	143.1	169.4	207.4	0.24		**64.1**	64.138	ULS 30yr 5a T	181.4	172.2	0.38
1053	1053	**120x120x8**	S235	2M24-5.6c	1.00	1.00	1.00	119	**-65.9**	ULS 30yr 5a Trsnl ZII E	162.3	169.4	207.4	0.41		**65.7**	65.686	ULS 30yr 5a T	226.0	177.2	0.39
496	496	**50x50x5**	S235	1M16-5.6c	1.00	1.00	1.00	324	**0.0**		10.4	37.7	43.2	0.00		**3.4**	3.436	ULS 30yr 1a \	37.4	18.4	0.19
487	0	**0**	S	1M16-5.6c	0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
497	0	**0**	S	1M16-5.6c	0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
486	0	**0**	S	1M16-5.6c	0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
485	485	**50x50x5**	S235	1M16-5.6c	1.00	1.00	1.00	137	**-0.4**	ULS 30yr 1a W ZII WLI	35.4	37.7	43.2	0.01		**0.1**	0.08	ULS 30yr 1a \	112.3	22.0	0.00
484	484	**50x50x5**	S235	1M16-5.6c	1.00	1.00	1.00	110	**0.0**		44.7	37.7	43.2	0.00		**0.1**	0.126	ULS 30yr 3 W	112.3	22.0	0.01
495	495	**70x70x7**	S235	1M16-5.6c	0.50	1.00	0.50	215	**0.0**		31.6	37.7	60.5	0.00		**0.0**		10°C,T Global	104.8	44.8	0.00
490/91	490/91	**50x50x5**	S235	1M16-5.6c	1.00	1.50	1.00	201	**-2.4**	ULS 30yr 1a W ZII WR	18.5	37.7	43.2	0.13		**3.6**	3.616	ULS 30yr 5a T	112.3	22.0	0.16
494	494	**70x70x7**	S355	2M16-8.8c	0.50	1.00	0.50	171	**-13.7**	ULS 30yr 3 W + I ZII V	49.1	120.6	164.6	0.28		**0.0**		0.0	138.3	106.8	0.00
493	493	**55x55x6**	S235	1M16-5.6c	1.00	1.00	1.00	343	**-8.2**	ULS 30yr 1a W ZII WR_	12.4	37.7	51.8	0.66		**0.0**		0.0	55.3	33.6	0.00
492	492	**50x50x5**	S235	1M16-5.6c	1.00	1.00	1.00	101	**0.0**		48.3	37.7	43.2	0.00		**2.4**	2.372	ULS 30yr 1a \	37.4	22.0	0.11
1500	1500	**200x100x10**	S235	1M20-5.6c	1.00	0.50	0.50	277	**-1.0**	ULS 30yr 1a W ZII WL_	94.1	58.8	108.0	0.02		**0.0**		0.0	224.6	87.3	0.00
1441	1441	**L250.22 + L2(**	S235		1.00	1.00	1.00	46	**-3201.6**	ULS 30yr 1a W ZII WR_	3796.1	0.0	0.0	0.84		**2766.0**	2766.034	ULS 30yr 1a \	4419.4	3421.4	0.86
1443	1443	**150x100x10**	S235	1M24-5.6c	1.00	0.51	0.51	128	**-80.6**	ULS 30yr 1a W ZII WL_	168.5	84.7	129.6	0.95		**77.9**	77.885	ULS 30yr 1a \	213.1	110.8	0.92
1443-1	1443-1	**150x100x10**	S235	1M24-8.8c	1.00	0.51	0.51	148	**-100.5**	ULS 30yr 1a W ZII WL_	146.0	135.6	129.6	0.78		**88.4**	88.369	ULS 30yr 1a \	213.1	110.8	0.80
1445T	1445T	**120x80x10**	S355	2M24-8.8c	0.53	0.25	0.25	90	**-206.0**	ULS 30yr 1a W ZII WR	327.1	271.1	352.8	0.76		**199.0**	198.963	ULS 30yr 1a \	230.5	301.5	0.86
1445L	1445L	**120x80x8**	S235	2M24-5.6c	0.53	0.25	0.25	90	**-121.3**	ULS 30yr 1a W ZII WL_	209.3	169.4	207.4	0.72		**122.3**	122.327	ULS 30yr 1a \	138.1	172.2	0.89
1501	1501	**75x75x7#**	S235		1.00	1.00	1.00	340	**0.0**	ULS 30yr 1a W ZII 0.9	20.5	0.0	0.0	0.00		**0.0**	0.037	ULS 30yr 1a \	239.7	0.0	0.00
1502	1502	**60x60x6**	S235	1M20-5.6c	1.00	1.00	1.00	259	**0.0**		21.4	58.8	64.8	0.00		**1.4**	1.379	ULS 30yr 3 W	65.7	33.3	0.04
1503	1503	**100x100x8**	S235	1M20-5.6c	1.00	1.00	1.00	327	**-5.8**	ULS 30yr 1a W ZII WR_	33.2	58.8	86.4	0.17		**7.1**	7.126	ULS 30yr 1a \	179.7	69.8	0.12
1504	1504	**90x90x8**	S235	1M20-5.6c	1.00	1.00	1.00	258	**-15.1**	ULS 30yr 1a W ZII 0.9	43.5	58.8	86.4	0.35		**12.6**	12.608	ULS 30yr 1a \	156.7	69.8	0.21
1505	1505	**130x65x8**	S235	1M20-5.6c	0.50	0.50	0.50	329	**-0.3**	ULS 30yr 1a W ZII WLI	32.1	58.8	86.4	0.01		**0.0**		0.0	99.1	68.0	0.00
1442	1442	**150x100x10**	S235	1M24-5.6c	1.00	0.51	0.51	142	**-74.4**	ULS 30yr 1a W ZII 0.9	152.2	84.7	129.6	0.88		**80.4**	80.35	ULS 30yr 1a \	213.1	110.8	0.95
1442-1	1442-1	**150x100x10**	S235	1M24-8.8c	1.00	0.51	0.51	162	**-98.1**	ULS 30yr 1a W ZII WLI	132.7	135.6	129.6	0.76		**95.0**	95.029	ULS 30yr 1a \	213.1	110.8	0.86
1506	1506	**110x110x10**	S235	1M20-5.6c	1.00	1.00	1.00	341	**-5.7**	ULS 30yr 1a W ZII WR_	42.3	58.8	108.0	0.13		**7.2**	7.217	ULS 30yr 1a \	224.6	87.3	0.12
1507	1507	**150x100x10**	S235	1M20-5.6c	0.50	0.50	0.50	241	**-0.4**	ULS 30yr 1a W ZII WL_	84.3	58.8	108.0	0.01		**0.0**		0.0	224.6	87.3	0.00
fict01	fict01	**0.1x0.1x0.01**	S235		1.00	1.00	1.00	9,768	**0.0**	ULS 30yr 1a W ZII 0.9	0.0	0.0	0.0	0.00		**0.0**	0.03	ULS 30yr 1a \	0.0	0.0	0.00
1508	1508	**55x55x6**	S355	1M16-8.8c	1.00	1.00	1.00	236	**-4.0**	ULS 30yr 1a W ZII WR_	24.7	60.3	70.6	0.16		**1.7**	1.711	ULS 30yr 1a \	75.3	45.8	0.04
1509	1509	**70x70x7**	S355	1M16-8.8c	1.00	1.00	1.00	177	**-6.8**	ULS 30yr 1a W ZII 0.9	71.9	60.3	82.3	0.11		**9.2**	9.172	ULS 30yr 1a \	142.7	61.0	0.15
1420	1420	**110x110x10**	S355	1M24-8.8c	1.00	1.00	1.00	246	**-9.4**	ULS 30yr 1a W ZII WR_	77.8	135.6	176.4	0.12		**7.0**	6.989	ULS 30yr 1a \	329.3	150.8	0.05

Assessment of groups for strengthened mast (verbouw level)

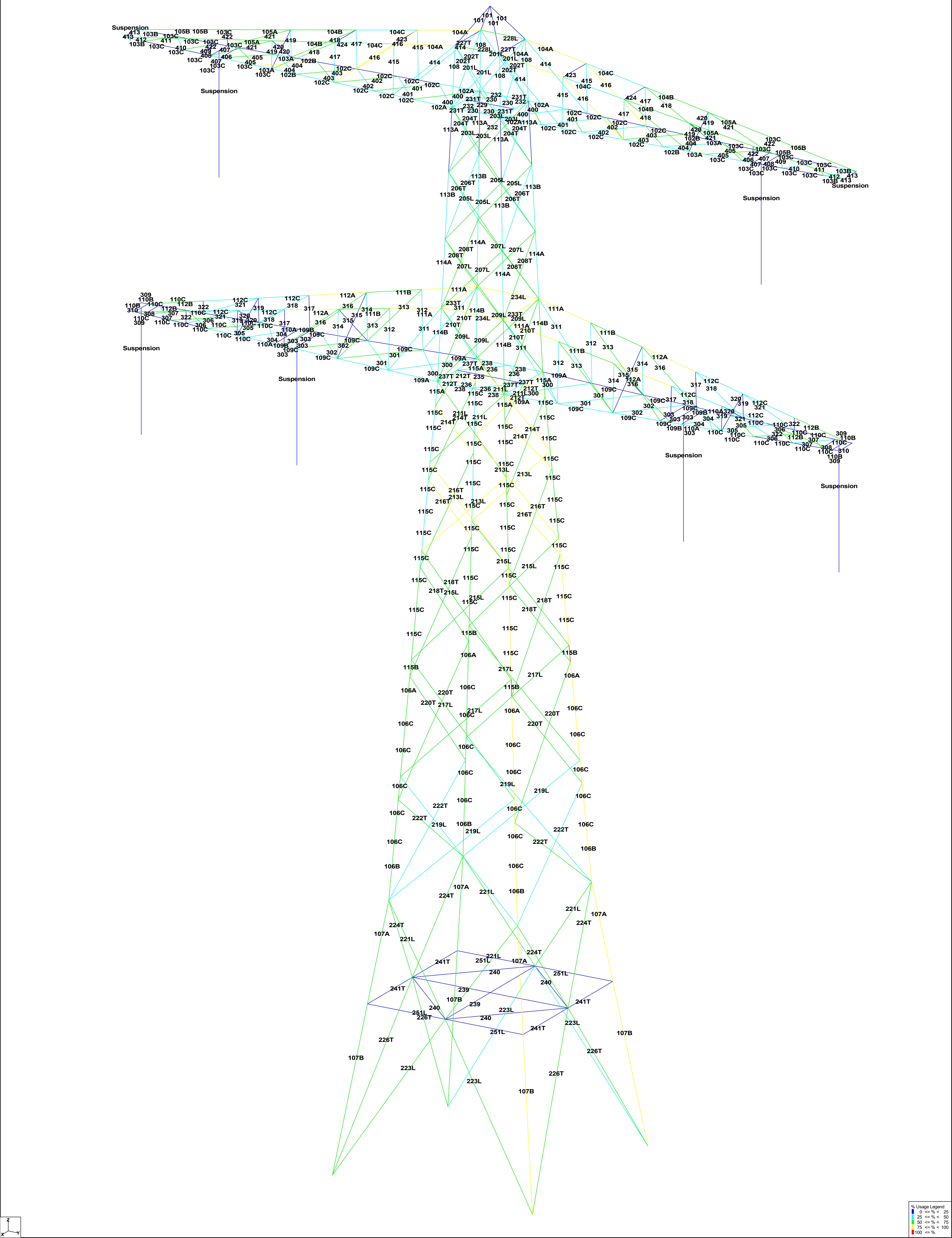
Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0
Mast 39

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compres	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)
106A		150x150x12	S235	8M24-5.6t	**0.97**	**0.97**	**0.62**	34	**-769.0**	ULS 1a_135	780.4	677.8	1244.2	1.13		**625.4**	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.92
106C		150x150x12	S235		**3.06**	**3.06**	**1.96**	35	**-881.0**	ULS 1a_135	776.6	0.0	0.0	1.13		**734.5**	ULS 1a_0,9_0,9_135	817.8	0.0	0.0	0.90
115B		150x150x10	S235	8M24-5.6t	**1.87**	**1.87**	**1.20**	27	**-736.1**	ULS 1a_135	673.5	677.8	1036.8	1.09		**590.5**	ULS 1a_0,9_0,9_135	624.7	677.8	886.2	0.95
115C		150x150x10	S235		**1.19**	**1.19**	**0.77**	43	**-674.7**	ULS 1a_135	633.8	0.0	0.0	1.06		**535.8**	ULS 1a_0,9_0,9_135	688.6	0.0	0.0	0.78
106B		150x150x12	S235	**8M24-8.8t**	0.76	**0.76**	**0.49**	36	**-881.9**	ULS 1a_135	776.0	1084.4	1244.2	1.14	(1)	**733.4**	ULS 1a_0,9_0,9_135	740.3	1084.4	1063.4	0.99
107B		150x150x12	S235	**8M24-8.8t**	0.20	0.20	0.20	48	**-818.9**	ULS 1a_135	736.7	1084.4	1244.2	1.11	(1)	**683.9**	ULS 1a_0,9_0,9_135	740.3	1084.4	1063.4	0.92

(1) Redundants (knikverkorters) have been added to groups 106A, 106B, 106C, 115B and 115C. The redundants are checked separately in Appendix C.
The exceeding of compression strength is not relevant, since the main leg itself does not need to be checked for verbouw level.

DNV GL Nederlands BV, Project: "S+0 (hv) ini"
Tower Version 16.12, 09:44:39 Wednesday, 1 April, 2020
Undeformed geometry displayed



Assessment of groups for initial mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0
Mast 65

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compression)	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)	Exceedance (Tens)
101		100x100x6	S235	2M16-5.6t	1.00	1.00	1.00	105	**-7.8**	ULS 5a Ba 12	142.1	75.4	103.7	0.10		**7.7**	ULS 5a Ba 12	144.1	75.4	76.8	0.10	
108		90x90x8	S235	5M16-5.6t	1.00	1.00	1.00	146	**-42.1**	ULS 5a Ba 22	112.9	188.4	345.6	0.37		**0.0**		285.6	188.4	298.7	0.00	
113A		90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	76	**-55.3**	ULS 1a_135	251.3	338.9	414.7	0.22		**19.2**	ULS 5a Ba 22	252.5	338.9	297.7	0.08	
114A		100x100x10	S235	4M24-5.6t	0.50	0.50	0.50	72	**-158.7**	ULS 1a_135	355.2	338.9	518.4	0.47		**106.7**	ULS 1a_0,9_0,9_135	362.9	338.9	443.1	0.31	
115A		150x150x10	S235	6M24-5.6t	1.77	1.37	1.14	39	**-297.9**	ULS 1a_90	643.5	508.3	777.6	0.59		**183.4**	ULS 1a_0,9_0,9_90	624.7	508.3	664.6	0.36	
106A		150x150x12	S235	8M24-5.6t	1.66	1.73	1.38	76	**-551.3**	ULS 1a_135	628.6	677.8	1244.2	0.88		**411.7**	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.61	
106C		150x150x12	S235		1.81	1.89	1.51	87	**-552.9**	ULS 1a_135	575.2	0.0	0.0	0.96		**485.4**	ULS 1a_0,9_0,9_135	817.8	0.0	0.0	0.59	
107A		150x150x12	S235	8M24-5.6t	0.33	0.33	0.33	49	**-580.0**	ULS 1a_135	735.4	677.8	1244.2	0.86		**454.9**	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.67	
201L		70x70x7	S235	1M24-5.6t	0.52	0.52	0.52	127	**-24.6**	ULS 5a Ba 22	75.8	84.7	90.7	0.32		**18.3**	ULS 5a Ba 22	88.7	84.7	64.2	0.28	
202T		50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	178	**-10.7**	ULS 5a Ba 22	25.7	37.7	43.2	0.42		**5.5**	ULS 5a Ba 22	37.4	37.7	22.0	0.25	
203L		100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	93	**-108.6**	ULS 5a Ba 12	207.7	169.4	207.4	0.64		**116.7**	ULS 5a Ba 22	181.4	169.4	177.2	0.69	
204T		100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	93	**-123.1**	ULS 5a Ba 12	256.2	254.2	388.8	0.48		**122.1**	ULS 5a Ba 22	261.1	254.2	332.3	0.48	
205L		100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	99	**-105.6**	ULS 5a Ba 22	198.3	169.4	207.4	0.62		**97.2**	ULS 5a Ba 12	181.4	169.4	177.2	0.57	
206T		100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	99	**-109.9**	ULS 5a Ba 22	244.6	254.2	388.8	0.45		**110.5**	ULS 5a Ba 12	261.1	254.2	332.3	0.43	
207L		100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	103	**-86.9**	ULS 5a Ba 12	190.8	169.4	207.4	0.51		**94.4**	ULS 5a Ba 22	181.4	169.4	177.2	0.56	
208T		100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	104	**-99.2**	ULS 5a Ba 12	235.3	169.4	259.2	0.59		**98.0**	ULS 5a Ba 22	224.3	169.4	221.5	0.58	
209L		100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	112	**-94.6**	ULS 5a Ba 12	177.9	169.4	207.4	0.56		**95.0**	ULS 5a Ba 22	181.4	169.4	177.2	0.56	
210T		100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	112	**-101.1**	ULS 5a Ba 12	219.3	169.4	259.2	0.60		**80.3**	ULS 5a Ba 22	224.3	169.4	221.5	0.47	
211L		100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	76	**-94.8**	ULS 5a Ba 21	197.1	169.4	207.4	0.56		**89.1**	ULS 5a Ba 21	125.9	169.4	116.0	0.77	
212T		100x75x9	S235	2M24-5.6t	1.00	0.55	0.55	65	**-96.1**	ULS 5a Ba 10	245.9	169.4	233.3	0.57		**93.0**	ULS 5a Ba 10	121.3	169.4	130.6	0.77	
213L		100x75x7	S235	2M24-5.6t	0.52	0.25	0.25	85	**-77.5**	ULS 5a Ba 21	161.2	169.4	181.4	0.48		**81.3**	ULS 5a Ba 21	98.2	169.4	101.5	0.83	
214T		100x75x9	S235	2M24-5.6t	0.52	0.25	0.25	74	**-96.3**	ULS 5a Ba 10	221.2	169.4	233.3	0.57		**99.3**	ULS 5a Ba 10	119.9	169.4	130.6	0.83	
215L		100x75x7	S235	2M24-5.6t	0.52	0.25	0.25	101	**-74.0**	ULS 5a Ba 21	141.1	169.4	181.4	0.52		**69.9**	ULS 5a Ba 21	100.4	169.4	101.5	0.70	
216T		100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	86	**-90.6**	ULS 5a Ba 10	182.6	169.4	207.4	0.53		**87.2**	ULS 5a Ba 21	110.7	169.4	116.0	0.79	
217L		100x75x7	S235	2M20-5.6t	0.52	0.25	0.25	112	**-59.4**	ULS 5a Ba 21	129.0	117.6	151.2	0.51		**62.0**	ULS 5a Ba 21	115.4	117.6	106.9	0.58	
218T		100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	102	**-80.2**	ULS 5a Ba 21	159.3	169.4	207.4	0.50		**82.9**	ULS 5a Ba 10	113.2	169.4	116.0	0.73	
219L		100x75x8	S235	2M20-5.6t	0.52	0.25	0.25	123	**-53.2**	ULS 5a Ba 21	133.9	117.6	172.8	0.45		**50.2**	ULS 5a Ba 21	128.6	117.6	104.7	0.48	
220T		100x75x9	S235	2M20-5.6t	0.52	0.25	0.25	117	**-72.5**	ULS 5a Ba 10	155.5	117.6	194.4	0.62		**69.1**	ULS 5a Ba 21	146.1	117.6	137.5	0.59	
221L		130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	124	**-68.6**	ULS 5a Ba 10	147.8	117.6	172.8	0.58		**57.1**	ULS 5a Ba 21	113.0	117.6	136.1	0.51	
222T		100x75x7	S235	2M20-5.6t	0.52	0.25	0.25	113	**-53.4**	ULS 5a Ba 21	127.3	117.6	151.2	0.45		**55.7**	ULS 5a Ba 10	107.3	117.6	91.6	0.61	
223L		100x75x7	S235	2M20-5.6t	0.33	0.20	0.20	105	**-71.7**	ULS 5a Ba 10	144.3	117.6	151.2	0.61		**57.6**	ULS 5a Ba 21	119.5	117.6	122.2	0.49	
224T		130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	124	**-82.1**	ULS 1a_90	147.8	117.6	172.8	0.70		**68.3**	ULS 1a_0,9_0,9_90	113.0	117.6	136.1	0.60	
226T		100x75x7	S235	2M20-5.6t	0.33	0.20	0.20	105	**-82.1**	ULS 1a_90	144.3	117.6	151.2	0.70		**65.7**	ULS 1a_0,9_0,9_90	119.5	117.6	122.2	0.56	
227T		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	206	**-2.1**	ULS 6a_90 Ba Ct2	21.0	37.7	43.2	0.10		**0.1**	ULS 5a Ba 22	37.4	37.7	22.0	0.00	
228L		80x80x8	S235	4M20-5.6t	1.00	1.00	1.00	128	**0.0**		122.6	235.2	345.6	0.00		**120.7**	ULS 3_0	168.3	235.2	244.4	0.72	
229		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	225	**-0.3**	ULS 3_0	18.5	37.7	43.2	0.02		**0.0**		37.4	37.7	25.7	0.00	
230		80x80x8	S235	2M24-5.6t	1.00	1.00	1.00	99	**-76.2**	ULS 5a Ba 12	156.9	169.4	207.4	0.49		**76.1**	ULS 5a Ba 12	206.0	169.4	159.5	0.48	
231T		100x75x7	S235	3M24-5.6t	2.00	1.00	1.00	69	**-48.9**	ULS 5a Ba 22	182.6	254.2	272.2	0.27		**64.5**	ULS 5a Ba 22	214.1	254.2	217.6	0.30	
232		150x100x12	S235	8M24-5.6t	2.00	1.00	1.00	51	**-250.2**	ULS 5a Ba 22	512.4	677.8	1244.2	0.49		**93.6**	ULS 5a Ba 22	582.2	677.8	755.0	0.16	
233T		70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	203	**-28.8**	ULS 1a_0,9_0,9_90	36.2	58.8	64.8	0.80		**39.9**	ULS 1a_90	82.9	58.8	52.4	0.76	
234L		80x80x8	S235	3M24-5.6t	1.00	1.00	1.00	178	**0.0**		82.2	254.2	311.0	0.00		**147.6**	ULS 3_0	169.8	254.2	239.3	0.87	
235		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	309	**-0.6**	ULS 3_90	11.3	37.7	43.2	0.05		**0.0**		37.4	37.7	22.0	0.00	
236		100x100x8	S235	2M24-5.6t	1.00	1.00	1.00	108	**-75.6**	ULS 5a Ba 10	182.9	169.4	207.4	0.45		**75.8**	ULS 5a Ba 10	208.1	169.4	177.2	0.45	
237T		100x75x7	S235	4M24-5.6t	1.00	1.00	1.00	94	**-42.5**	ULS 5a Ba 22	157.6	338.9	362.9	0.27		**69.2**	ULS 5a Ba 12	214.1	338.9	290.1	0.32	
238		150x100x14	S235	11M24-5.6t	2.00	1.00	1.00	70	**-249.9**	ULS 5a Ba 10	526.8	931.9	1995.8	0.47		**71.3**	ULS 5a Ba 10	666.7	931.9	1211.2	0.11	
239		100x50x6	S235	1M16-5.6t	0.50	0.50	0.50	327	**-0.4**	ULS 1a_90	18.6	37.7	51.8	0.02		**0.0**		55.3	37.7	28.0	0.00	
240		60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	272	**-1.2**	ULS 1a_45	14.1	37.7	43.2	0.08		**2.1**	ULS 1a_0,9_0,9_135	60.5	37.7	26.7	0.08	
241T		70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	255	**-2.7**	ULS 1a_135	28.9	37.7	51.8	0.09		**1.0**	ULS 1a_0,9_0,9_0	89.9	37.7	38.4	0.03	
251L		70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	255	**-2.9**	ULS 1a_90	28.9	37.7	51.8	0.10		**0.7**	ULS 1a_0,9_135	89.9	37.7	38.4	0.02	
113B		90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	79	**-113.5**	ULS 1a_135	245.5	338.9	414.7	0.46		**64.9**	ULS 1a_0,9_0,9_135	252.5	338.9	354.5	0.26	
114B		100x100x10	S235	6M24-5.6t	0.50	0.50	0.50	78	**-192.3**	ULS 1a_135	340.4	508.3	777.6	0.56		**103.6**	ULS 1a_0,9_0,9_135	362.9	508.3	651.3	0.29	
115B		150x150x10	S235	8M24-5.6t	4.00	4.23	3.33	76	**-542.7**	ULS 1a_90	530.0	677.8	1036.8	1.02	knik	**403.7**	ULS 1a_0,9_0,9_90	624.7	677.8	886.2	0.65	
115C		150x150x10	S235		1.70	1.70	1.42	80	**-485.2**	ULS 1a_135	514.8	0.0	0.0	0.94		**351.1**	ULS 1a_0,9_0,9_135	688.6	0.0	0.0	0.51	
106B		150x150x12	S235	8M24-5.6t	0.76	1.28	0.63	60	**-630.6**	ULS 1a_135	696.2	677.8	1244.2	0.93		**484.2**	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.71	
107B		150x150x12	S235	8M24-5.6t	0.20	0.20	0.20	48	**-582.6**	ULS 1a_135	736.7	677.8	1244.2	0.86		**452.3**	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.67	
102A		150x150x12	S235	8M24-5.6t	1.00	1.50	1.00	61	**-303.4**	ULS 5a Ba 12	689.3	677.8	1244.2	0.45		**171.4**	ULS 5a Ba 22	740.3	677.8	755.0	0.25	
102B		150x150x12	S235	6M24-5.6t	2.52	1.61	1.00	63	**-143.6**	ULS 5a Ba 12	682.7	508.3	933.1	0.28		**36.3**	ULS 5a Ba 22	740.3	508.3	797.5	0.07	
102C		150x150x12	S235		3.01	2.00	1.00	59	**-275.1**	ULS 5a Ba 12	698.8	0.0	0.0	0.39		**148.5**	ULS 5a Ba 22	817.8	0.0	0.0	0.18	
103A		120x120x8	S235	6M24-5.6t	2.64	4.00	1.00	76	**-132.8**	ULS 5a Ba 12	340.1	508.3	622.1	0.39		**47.2**	ULS 5a Ba 22	379.5	508.3	531.7	0.12	
103B		120x120x8	S235	2M16-5.6t	2.00	4.44	2.00	108	**-31.4**	ULS 3_90	249.9	75.4	138.2	0.42		**0.0**		316.6	75.4	138.2	0.00	
103C		120x120x8	S235		1.71	1.00	1.00	76	**-95.4**	ULS 5a Ba 1	340.3	0.0	0.0	0.28		**21.2**	ULS 5a Ba 1	441.8	0.0	0.0	0.05	
104A		100x65x7*	S235	4M20-5.6t	1.00	1.00	1.00	202	**0.0**		63.1	235.2	302.4	0.00		**112.3**	ULS 3_0	115.2	235.2	207.0	0.98	
104B		100x65x7*	S235	3M20-5.6t	1.00	1.00	1.00	209	**0.0**		60.1	176.4	226.8	0.00		**77.7**	ULS 3_0	137.8	176.4	155.3	0.56	
104C		100x65x7*	S235		1.00	1.00	1.00	194	**0.0**		66.4	0.0	0.0	0.00		**99.2**	ULS 3_0	263.2	0.0	0.0	0.38	
105A		60x60x5	S235	2M16-5.6t	1.00	2.43	1.00	380	**0.0**		11.8	75.4	86.4	0.00		**30.8**	ULS 6a_90 Ba Ct1	98.8	75.4	56.0	0.55	
105B		60x60x5	S235	2M16-5.6t	1.00	1.70	1.00	379	**0.0**		11.8	75.4	86.4	0.00		**30.8**	ULS 6a_90 Ba Ct1	65.9	75.4	56.0	0.55	
415		60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**-8.7**	ULS 3_0	30.7	37.7	43.2	0.28		**0.0**		60.5	37.7	26.7	0.00	
417		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	170	**-9.5**	ULS 3_0	27.4	37.7	43.2	0.35		**0.0**		37.4	37.7	18.4	0.00	
419		75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	107	**-11.9**	ULS 3_0	55.1	37.7	43.2	0.32		**0.0**		37.4	37.7	22.0	0.00	
422		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	70	**-0.5**	ULS 6a_90 Ba Ct1	58.8	37.7	43.2	0.01		**0.0**		37.4	37.7	18.4	0.00	
414		60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	325	**0.0**		12.6	37.7	43.2	0.00		**13.7**	ULS 3_0	60.5	37.7	32.0	0.43	
416		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	353	**0.0**		9.1	37.7	43.2	0.00		**16.9**	ULS 3_0	37.4	37.7	22.0	0.77	
418		50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	344	**0.0**		11.9	75.4	86.4	0.00		**26.0**	ULS 3_0	56.2	75.4	44.1	0.59	
421		60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	259	**0.0**		26.8	117.6	129.6	0.00		**50.5**	ULS 3_135	77.4	117.6	88.7	0.65	
420		45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	111	**-1.2**	ULS 1a_0,9_0,9_0	39.6	20.2	32.4	0.06		**1.2**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.06	
400		60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	124	**-20.9**	ULS 5a Ba 22	48.1	58.8	54.0	0.43		**19.4**	ULS 5a Ba 12	54.7	58.8	37.0	0.52	
401		60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	119	**-23.1**	ULS 5a Ba 12	50.2	58.8	54.0	0.46		**23.8**	ULS 5a Ba 22	54.7	58.8	37.0	0.64	
402		60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	114	**-25.9**	ULS 5a Ba 22	52.1	58.8	54.0	0.50		**25.5**	ULS 5a Ba 12	54.7	58.8	37.0	0.69	
403		60x60x6	S235	1M20-5.6t	0.52	0.52	0.52	108	**-29.6**	ULS 5a Ba 12	65.2	58.8	64.8	0.50		**28.8**	ULS 5a Ba 22	65.7	58.8	44.4	0.65	
404		70x70x6	S235	1M24-5.6t	0.53	0.53	0.53	93	**-32.0**	ULS 5a Ba 22	86.5	84.7	77.8	0.41		**34.1**	ULS 5a Ba 12	76.0	84.7	44.0	0.78	
405		75x50x7	S235	1M24-5.6t	0.53	0.53	0.53	107	**-41.9**	ULS 5a Ba 12	76.2	84.7	90.7	0.55		**38.4**	ULS 5a Ba 22	98.8	84.7	58.0	0.66	
409		55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	142	**-4.1**	ULS 1a_135	37.9	37.7	43.2	0.11		**16.3**	ULS 5a Ba 1	53.3	37.7	32.0	0.51	
410		55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	140	**-16.7**	ULS 5a Ba 1	38.5	37.7	43.2	0.44		**3.2**	ULS 1a_135	53.3	37.7	32.0	0.10	
411		55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	135	**-2.3**	ULS 1a_135	40.2	37.7	43.2	0.06		**17.1**	ULS 5a Ba 1	53.3	37.7	32.0	0.53	
412		55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	129	**-17.7**	ULS 5a Ba 1	42.0	37.7	43.2	0.47		**1.8**	ULS 1a_0,9_0,9_135	53.3	37.7	32.0	0.06	
406		HEB160	S235		1.00	1.00	1.00	33	**-1.6**	ULS 1a_0,9_0,9_90	991.1	0.0	0.0	0.00		**5.6**	ULS 1a_90	1276.1	0.0	0.0	0.00	
407		HEB160	S235		2.00	2.00	2.00	32	**-26.4**	ULS 5a Ba 12	994.8	0.0	0.0	0.03		**25.1**	ULS 5a Ba 22	1276.1	0.0	0.0	0.02	

Assessment of groups for initial mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0
Mast 65

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compression)	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)	Exceedance (Tens)
408		HEB160	S235		1.00	1.00	1.00	32	**-7.0**	ULS 5a Ba 1	998.4	0.0	0.0	0.01		**3.4**	ULS 1a_135	1276.1	0.0	0.0	0.00	
413		HEB160	S235	2M16-5.6t	2.00	2.00	2.00	25	**-1.0**	ULS 1a_0,9_0,9_135	1067.2	75.4	138.2	0.01		**14.2**	ULS 5a Ba 1	1296.6	75.4	124.6	0.19	
423		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	187	**0.0**	ULS 1a_45	24.0	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00	
424		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	169	**0.0**	ULS 3_90	27.5	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00	
111A		80x80x8	S235	3M24-5.6t	1.00	2.00	1.00	203	**0.0**		65.4	254.2	311.0	0.00		**137.2**	ULS 3_45	160.8	254.2	259.0	0.85	
111B		80x80x8	S235	3M20-5.6t	1.00	2.00	1.00	202	**0.0**		65.8	176.4	259.2	0.00		**121.3**	ULS 3_0	168.3	176.4	209.5	0.72	
112A		70x70x7	S235	3M20-5.6t	1.00	1.88	1.00	227	**0.0**		42.7	176.4	226.8	0.00		**96.1**	ULS 3_0	125.5	176.4	155.3	0.77	
112B		70x70x7	S235	3M20-5.6t	1.00	2.00	1.00	232	**0.0**		41.4	176.4	226.8	0.00		**84.2**	ULS 3_0	125.5	176.4	155.3	0.67	
112C		70x70x7	S235		1.00	2.14	1.00	227	**0.0**		42.7	0.0	0.0	0.00		**92.2**	ULS 3_0	220.9	0.0	0.0	0.42	
110A		120x120x11	S235	6M24-5.6t	1.64	1.00	1.00	60	**-191.2**	ULS 5a Ba 21	508.6	508.3	855.4	0.38		**104.2**	ULS 5a Ba 21	513.2	508.3	731.1	0.20	
110B		120x120x11	S235		1.00	1.00	1.00	13	**-0.4**	ULS 1a_0,9_0,9_90	599.7	0.0	0.0	0.00		**0.4**	ULS 1a_90	599.7	0.0	0.0	0.00	
110C		120x120x11	S235		1.71	1.29	1.00	66	**-159.0**	ULS 5a Ba 21	492.8	0.0	0.0	0.32		**80.6**	ULS 5a Ba 10	599.7	0.0	0.0	0.13	
109A		150x100x14	S235	11M24-5.6t	1.00	0.52	0.52	56	**-302.9**	ULS 5a Ba 10	673.7	931.9	1995.8	0.45		**142.1**	ULS 5a Ba 21	666.7	931.9	1211.2	0.21	
109B		150x100x14	S235	6M24-5.6t	4.78	1.00	1.00	47	**-206.4**	ULS 5a Ba 10	703.8	508.3	1088.6	0.41		**119.1**	ULS 5a Ba 21	666.7	508.3	930.5	0.23	
109C		150x100x14	S235		1.00	0.52	0.52	58	**-278.3**	ULS 5a Ba 21	665.2	0.0	0.0	0.42		**130.8**	ULS 5a Ba 10	775.5	0.0	0.0	0.17	
312		70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	185	**-14.3**	ULS 3_135	41.1	58.8	64.8	0.35		**0.0**		82.9	58.8	39.3	0.00	
314		70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	148	**-15.6**	ULS 3_0	54.9	58.8	64.8	0.28		**0.0**		82.9	58.8	39.3	0.00	
317		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	154	**-2.9**	ULS 5a Ba 10	31.0	37.7	43.2	0.09		**0.0**		37.4	37.7	18.4	0.00	
319		75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-2.5**	ULS 1a_0	59.5	37.7	43.2	0.07		**0.0**		37.4	37.7	18.4	0.00	
322		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	53	**-1.1**	ULS 3_90	63.5	37.7	43.2	0.03		**0.0**		37.4	37.7	18.4	0.00	
311		60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	332	**0.0**		12.1	58.8	54.0	0.00		**17.5**	ULS 3_45	54.7	58.8	37.0	0.47	
313		60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	298	**0.0**		14.4	58.8	54.0	0.00		**23.8**	ULS 3_135	54.7	58.8	37.0	0.64	
316		50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	332	**0.0**		12.6	75.4	86.4	0.00		**32.0**	ULS 3_135	52.4	75.4	44.1	0.73	
318		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	274	**0.0**		13.7	37.7	43.2	0.00		**6.4**	ULS 5a Ba 10	37.4	37.7	22.0	0.29	
321		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	269	**0.0**		14.1	37.7	43.2	0.00		**8.9**	ULS 3_0	37.4	37.7	22.0	0.40	
315		45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	180	**-1.0**	ULS 1a_0	22.7	20.2	32.4	0.05		**0.9**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.05	
320		45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	115	**-0.9**	ULS 1a_0	38.2	20.2	32.4	0.04		**0.8**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.04	
300		70x70x7	S235	1M20-5.6t	0.53	0.53	0.53	142	**-24.3**	ULS 5a Ba 20	66.6	58.8	75.6	0.41		**22.2**	ULS 5a Ba 11	96.8	58.8	53.5	0.41	
301		70x70x7	S235	1M20-5.6t	0.54	0.54	0.54	138	**-27.0**	ULS 5a Ba 11	69.0	58.8	75.6	0.46		**29.8**	ULS 5a Ba 20	96.8	58.8	53.5	0.56	
302		70x70x7	S235	1M24-5.6t	0.54	0.54	0.54	119	**-33.6**	ULS 5a Ba 20	80.7	84.7	90.7	0.42		**30.1**	ULS 5a Ba 11	88.7	84.7	44.9	0.67	
304		60x60x5	S235	1M20-5.6t	0.53	0.53	0.53	104	**-18.0**	ULS 5a Ba 21	57.0	58.8	54.0	0.33		**17.6**	ULS 5a Ba 21	54.7	58.8	37.0	0.48	
305		60x60x5	S235	1M20-5.6t	0.54	0.54	0.54	112	**-24.9**	ULS 5a Ba 10	52.9	58.8	54.0	0.47		**24.7**	ULS 5a Ba 10	54.7	58.8	37.0	0.67	
306		75x50x5	S235	1M24-5.6t	0.55	0.55	0.55	112	**-29.5**	ULS 5a Ba 10	53.3	84.7	64.8	0.55		**29.9**	ULS 5a Ba 10	70.6	84.7	41.4	0.72	
307		75x50x7	S235	1M24-5.6t	0.54	0.54	0.54	87	**-37.7**	ULS 5a Ba 21	86.9	84.7	90.7	0.45		**36.4**	ULS 5a Ba 21	98.8	84.7	58.0	0.63	
303		HEB160	S235		2.00	2.00	2.00	50	**-26.0**	ULS 5a Ba 20	918.5	0.0	0.0	0.03		**25.4**	ULS 5a Ba 11	1276.1	0.0	0.0	0.02	
308		HEB160	S235		1.00	1.00	1.00	27	**-0.8**	ULS 1a_0,9_0,9_90	1015.5	0.0	0.0	0.00		**3.6**	ULS 1a_90	1276.1	0.0	0.0	0.00	
309		HEB160	S235		2.00	2.00	2.00	26	**-26.7**	ULS 5a Ba 10	1021.6	0.0	0.0	0.03		**24.9**	ULS 5a Ba 21	1276.1	0.0	0.0	0.02	
310		HEB160	S235		1.00	1.00	1.00	25	**-3.0**	ULS 1a_0,9_0,9_90	1025.6	0.0	0.0	0.00		**3.0**	ULS 1a_90	1276.1	0.0	0.0	0.00	

Assessment of groups for strengthened mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0
Mast 65

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compres	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)
101	0	100x100x6	S235	2M16-5.6t	1.00	1.00	1.00	105	-7.8	ULS 5a Ba 12	142.1	75.4	103.7	0.10		7.7	ULS 5a Ba 12	144.1	75.4	76.8	0.10
108	0	90x90x8	S235	5M16-5.6t	1.00	1.00	1.00	146	-42.1	ULS 5a Ba 22	112.9	188.4	345.6	0.37		0.0		285.6	188.4	298.7	0.00
113A	0	90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	76	-55.3	ULS 1a_135	251.3	338.9	414.7	0.22		19.2	ULS 5a Ba 22	252.5	338.9	297.7	0.08
114A	0	100x100x10	S235	4M24-5.6t	0.50	0.50	0.50	72	-158.7	ULS 1a_135	355.2	338.9	518.4	0.47		106.7	ULS 1a_0,9_0,9_135	362.9	338.9	443.1	0.31
115A	0	150x150x10	S235	6M24-5.6t	1.77	1.37	1.14	39	-297.9	ULS 1a_90	643.5	508.3	777.6	0.59		183.4	ULS 1a_0,9_0,9_90	624.7	508.3	664.6	0.36
106A	0	150x150x12	S235	8M24-5.6t	0.97	0.97	0.62	34	-551.3	ULS 1a_135	780.4	677.8	1244.2	0.81		411.7	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.61
106C	0	150x150x12	S235		1.97	1.62	1.39	70	-628.9	ULS 1a_135	656.3	0.0	0.0	0.96		485.4	ULS 1a_0,9_0,9_135	817.8	0.0	0.0	0.59
107A	0	150x150x12	S235	8M24-5.6t	0.33	0.33	0.33	49	-580.0	ULS 1a_135	735.4	677.8	1244.2	0.86		454.9	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.67
201L	0	70x70x7	S235	1M24-5.6t	0.52	0.52	0.52	127	-24.6	ULS 5a Ba 22	75.8	84.7	90.7	0.32		18.3	ULS 5a Ba 22	88.7	84.7	64.2	0.28
202T	0	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	178	-10.7	ULS 5a Ba 22	25.7	37.7	43.2	0.42		5.5	ULS 5a Ba 22	37.4	37.7	22.0	0.25
203L	0	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	93	-108.6	ULS 5a Ba 12	207.7	169.4	207.4	0.64		116.7	ULS 5a Ba 22	181.4	169.4	177.2	0.69
204T	0	100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	93	-123.1	ULS 5a Ba 12	256.2	254.2	388.8	0.48		122.1	ULS 5a Ba 22	261.1	254.2	332.3	0.48
205L	0	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	99	-105.6	ULS 5a Ba 22	198.3	169.4	207.4	0.62		97.2	ULS 5a Ba 12	181.4	169.4	177.2	0.57
206T	0	100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	99	-109.9	ULS 5a Ba 22	244.6	254.2	388.8	0.45		110.5	ULS 5a Ba 12	261.1	254.2	332.3	0.43
207L	0	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	103	-86.9	ULS 5a Ba 12	190.8	169.4	207.4	0.51		94.4	ULS 5a Ba 22	181.4	169.4	177.2	0.56
208T	0	100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	104	-99.2	ULS 5a Ba 12	235.3	169.4	259.2	0.59		98.0	ULS 5a Ba 22	224.3	169.4	221.5	0.58
209L	0	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	112	-94.6	ULS 5a Ba 12	177.9	169.4	207.4	0.56		95.0	ULS 5a Ba 22	181.4	169.4	177.2	0.56
210T	0	100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	112	-101.1	ULS 5a Ba 12	219.3	169.4	259.2	0.60		80.3	ULS 5a Ba 22	224.3	169.4	221.5	0.47
211L	0	100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	76	-94.8	ULS 5a Ba 21	197.1	169.4	207.4	0.56		89.1	ULS 5a Ba 21	125.9	169.4	116.0	0.77
212T	0	100x75x9	S235	2M24-5.6t	1.00	0.55	0.55	65	-96.1	ULS 5a Ba 10	245.9	169.4	233.3	0.57		93.0	ULS 5a Ba 10	121.3	169.4	130.6	0.77
213L	0	100x75x7	S235	2M24-5.6t	0.52	0.25	0.25	85	-77.5	ULS 5a Ba 21	161.2	169.4	181.4	0.48		81.3	ULS 5a Ba 21	98.2	169.4	101.5	0.83
214T	0	100x75x9	S235	2M24-5.6t	0.52	0.25	0.25	74	-96.3	ULS 5a Ba 10	221.2	169.4	233.3	0.57		99.3	ULS 5a Ba 10	119.9	169.4	130.6	0.83
215L	0	100x75x7	S235	2M24-5.6t	0.52	0.25	0.25	101	-74.0	ULS 5a Ba 21	141.1	169.4	181.4	0.52		69.9	ULS 5a Ba 21	100.4	169.4	101.5	0.70
216T	0	100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	86	-90.6	ULS 5a Ba 10	182.6	169.4	207.4	0.53		87.2	ULS 5a Ba 21	110.7	169.4	116.0	0.79
217L	0	100x75x7	S235	2M20-5.6t	0.52	0.25	0.25	112	-59.4	ULS 5a Ba 21	129.0	117.6	151.2	0.51		62.0	ULS 5a Ba 21	115.4	117.6	106.9	0.58
218T	0	100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	102	-80.2	ULS 5a Ba 21	159.3	169.4	207.4	0.50		82.9	ULS 5a Ba 10	113.2	169.4	116.0	0.73
219L	0	100x75x8	S235	2M20-5.6t	0.52	0.25	0.25	123	-53.2	ULS 5a Ba 21	133.9	117.6	172.8	0.45		50.2	ULS 5a Ba 21	128.6	117.6	104.7	0.48
220T	0	100x75x9	S235	2M20-5.6t	0.52	0.25	0.25	117	-72.5	ULS 5a Ba 10	155.5	117.6	194.4	0.62		69.1	ULS 5a Ba 21	146.1	117.6	137.5	0.59
221L	0	130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	124	-68.6	ULS 5a Ba 10	147.8	117.6	172.8	0.58		57.1	ULS 5a Ba 21	113.0	117.6	136.1	0.51
222T	0	100x75x7	S235	2M20-5.6t	0.52	0.25	0.25	113	-53.4	ULS 5a Ba 21	127.3	117.6	151.2	0.45		55.7	ULS 5a Ba 10	107.3	117.6	91.6	0.61
223L	0	100x75x7	S235	2M20-5.6t	0.33	0.20	0.20	105	-71.7	ULS 5a Ba 10	144.3	117.6	151.2	0.61		57.6	ULS 5a Ba 21	119.5	117.6	122.2	0.49
224T	0	130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	124	-82.1	ULS 1a_90	147.8	117.6	172.8	0.70		68.3	ULS 1a_0,9_0,9_90	113.0	117.6	136.1	0.60
226T	0	100x75x7	S235	2M20-5.6t	0.33	0.20	0.20	105	-82.1	ULS 1a_90	144.3	117.6	151.2	0.70		65.7	ULS 1a_0,9_0,9_90	119.5	117.6	122.2	0.56
227T	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	206	-2.1	ULS 6a_90 Ba Ct2	21.0	37.7	43.2	0.10		0.1	ULS 5a Ba 22	37.4	37.7	22.0	0.00
228L	0	80x80x8	S235	4M20-5.6t	1.00	1.00	1.00	128	0.0		122.6	235.2	345.6	0.00		120.7	ULS 3_0	168.3	235.2	244.4	0.72
229	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	225	-0.3	ULS 3_0	18.5	37.7	43.2	0.02		0.0		37.4	37.7	25.7	0.00
230	0	80x80x8	S235	2M24-5.6t	1.00	1.00	1.00	99	-76.2	ULS 5a Ba 12	156.9	169.4	207.4	0.49		76.1	ULS 5a Ba 12	206.0	169.4	159.5	0.48
231T	0	100x75x7	S235	3M24-5.6t	2.00	1.00	1.00	69	-48.9	ULS 5a Ba 22	182.6	254.2	272.2	0.27		64.5	ULS 5a Ba 22	214.1	254.2	217.6	0.30
232	0	150x100x12	S235	8M24-5.6t	2.00	1.00	1.00	51	-250.2	ULS 5a Ba 22	512.4	677.8	1244.2	0.49		93.6	ULS 5a Ba 22	582.2	677.8	755.0	0.16
233T	0	70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	203	-28.8	ULS 1a_0,9_0,9_90	36.2	58.8	64.8	0.80		39.9	ULS 1a_90	82.9	58.8	52.4	0.76
234L	0	80x80x8	S235	3M24-5.6t	1.00	1.00	1.00	178	0.0		82.2	254.2	311.0	0.00		147.6	ULS 3_0	169.8	254.2	239.3	0.87
235	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	309	-0.6	ULS 3_90	11.3	37.7	43.2	0.05		0.0		37.4	37.7	22.0	0.00
236	0	100x100x8	S235	2M24-5.6t	1.00	1.00	1.00	108	-75.6	ULS 5a Ba 10	182.9	169.4	207.4	0.45		75.8	ULS 5a Ba 10	208.1	169.4	177.2	0.45
237T	0	100x75x7	S235	4M24-5.6t	1.00	1.00	1.00	94	-42.5	ULS 5a Ba 22	157.6	338.9	362.9	0.27		69.2	ULS 5a Ba 12	214.1	338.9	290.1	0.32
238	0	150x100x14	S235	11M24-5.6t	2.00	1.00	1.00	70	-249.9	ULS 5a Ba 10	526.8	931.9	1995.8	0.47		71.3	ULS 5a Ba 10	666.7	931.9	1211.2	0.11
239	0	100x50x6	S235	1M16-5.6t	0.50	0.50	0.50	327	-0.4	ULS 1a_90	18.6	37.7	51.8	0.02		0.0		55.3	37.7	28.0	0.00
240	0	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	272	-1.2	ULS 1a_45	14.1	37.7	43.2	0.08		2.1	ULS 1a_0,9_0,9_135	60.5	37.7	26.7	0.08
241T	0	70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	255	-2.7	ULS 1a_135	28.9	37.7	51.8	0.09		1.0	ULS 1a_0,9_0,9_0	89.9	37.7	38.4	0.03
251L	0	70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	255	-2.9	ULS 1a_90	28.9	37.7	51.8	0.10		0.7	ULS 1a_0,9_135	89.9	37.7	38.4	0.02
113B	0	90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	79	-113.5	ULS 1a_135	245.5	338.9	414.7	0.46		64.9	ULS 1a_0,9_0,9_135	252.5	338.9	354.5	0.26
114B	0	100x100x10	S235	6M24-5.6t	0.50	0.50	0.50	78	-192.3	ULS 1a_135	340.4	508.3	777.6	0.56		103.6	ULS 1a_0,9_0,9_135	362.9	508.3	651.3	0.29
115B	0	150x150x10	S235	8M24-5.6t	1.87	1.87	1.20	27	-542.7	ULS 1a_90	673.5	677.8	1036.8	0.81		403.7	ULS 1a_0,9_0,9_90	624.7	677.8	886.2	0.65
115C	0	150x150x10	S235		1.70	1.70	1.42	80	-485.2	ULS 1a_135	514.8	0.0	0.0	0.94		351.1	ULS 1a_0,9_0,9_135	688.6	0.0	0.0	0.51
106B	0	150x150x12	S235	8M24-5.6t	0.76	1.28	0.63	60	-630.6	ULS 1a_135	696.2	677.8	1244.2	0.93		484.2	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.71
107B	0	150x150x12	S235	8M24-5.6t	0.20	0.20	0.20	48	-582.6	ULS 1a_135	736.7	677.8	1244.2	0.86		452.3	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.67
102A	0	150x150x12	S235	8M24-5.6t	1.00	1.50	1.00	61	-303.4	ULS 5a Ba 12	689.3	677.8	1244.2	0.45		171.4	ULS 5a Ba 22	740.3	677.8	755.0	0.25
102B	0	150x150x12	S235	6M24-5.6t	2.52	1.61	1.00	63	-143.6	ULS 5a Ba 12	682.7	508.3	933.1	0.28		36.3	ULS 5a Ba 22	740.3	508.3	797.5	0.07
102C	0	150x150x12	S235		3.01	2.00	1.00	59	-275.1	ULS 5a Ba 12	698.8	0.0	0.0	0.39		148.5	ULS 5a Ba 22	817.8	0.0	0.0	0.18
103A	0	120x120x8	S235	6M24-5.6t	2.64	4.00	1.00	76	-132.8	ULS 5a Ba 12	340.1	508.3	622.1	0.39		47.2	ULS 5a Ba 22	379.5	508.3	531.7	0.12
103B	0	120x120x8	S235	2M16-5.6t	2.00	4.44	2.00	108	-31.4	ULS 3_90	249.9	75.4	138.2	0.42		0.0		316.6	75.4	138.2	0.00
103C	0	120x120x8	S235		1.71	1.00	1.00	76	-95.4	ULS 5a Ba 1	340.3	0.0	0.0	0.28		21.2	ULS 5a Ba 1	441.8	0.0	0.0	0.05
104A	0	100x65x7*	S235	4M20-5.6t	1.00	1.00	1.00	202	0.0		63.1	235.2	302.4	0.00		112.3	ULS 3_0	115.2	235.2	207.0	0.98
104B	0	100x65x7*	S235	3M20-5.6t	1.00	1.00	1.00	209	0.0		60.1	176.4	226.8	0.00		77.7	ULS 3_0	137.8	176.4	155.3	0.56
104C	0	100x65x7*	S235		1.00	1.00	1.00	194	0.0		66.4	0.0	0.0	0.00		99.2	ULS 3_0	263.2	0.0	0.0	0.38
105A	0	60x60x5	S235	2M16-5.6t	1.00	2.43	1.00	380	0.0		11.8	75.4	86.4	0.00		30.8	ULS 6a_90 Ba Ct1	98.8	75.4	56.0	0.55
105B	0	60x60x5	S235	2M16-5.6t	1.00	1.70	1.00	379	0.0		11.8	75.4	86.4	0.00		30.8	ULS 6a_90 Ba Ct1	65.9	75.4	56.0	0.55
415	0	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	180	-8.7	ULS 3_0	30.7	37.7	43.2	0.28		0.0		60.5	37.7	26.7	0.00
417	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	170	-9.5	ULS 3_0	27.4	37.7	43.2	0.35		0.0		37.4	37.7	18.4	0.00
419	0	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	107	-11.9	ULS 3_0	55.1	37.7	43.2	0.32		0.0		37.4	37.7	22.0	0.00
422	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	70	-0.5	ULS 6a_90 Ba Ct1	58.8	37.7	43.2	0.01		0.0		37.4	37.7	18.4	0.00
414	0	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	325	0.0		12.6	37.7	43.2	0.00		13.7	ULS 3_0	60.5	37.7	32.0	0.43
416	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	353	0.0		9.1	37.7	43.2	0.00		16.9	ULS 3_0	37.4	37.7	22.0	0.77
418	0	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	344	0.0		11.9	75.4	86.4	0.00		26.0	ULS 3_0	56.2	75.4	44.1	0.59
421	0	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	259	0.0		26.8	117.6	129.6	0.00		50.5	ULS 3_135	77.4	117.6	88.7	0.65
420	0	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	111	-1.2	ULS 1a_0,9_0,9_0	39.6	20.2	32.4	0.06		1.2	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.06
400	0	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	124	-20.9	ULS 5a Ba 22	48.1	58.8	54.0	0.43		19.4	ULS 5a Ba 12	54.7	58.8	37.0	0.52
401	0	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	119	-23.1	ULS 5a Ba 12	50.2	58.8	54.0	0.46		23.8	ULS 5a Ba 22	54.7	58.8	37.0	0.64
402	0	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	114	-25.9	ULS 5a Ba 22	52.1	58.8	54.0	0.50		25.5	ULS 5a Ba 12	54.7	58.8	37.0	0.69
403	0	60x60x6	S235	1M20-5.6t	0.52	0.52	0.52	108	-29.6	ULS 5a Ba 12	65.2	58.8	64.8	0.50		28.8	ULS 5a Ba 22	65.7	58.8	44.4	0.65
404	0	70x70x6	S235	1M24-5.6t	0.53	0.53	0.53	93	-32.0	ULS 5a Ba 22	86.5	84.7	77.8	0.41		34.1	ULS 5a Ba 12	76.0	84.7	44.0	0.78
405	0	75x50x7	S235	1M24-5.6t	0.53	0.53	0.53	107	-41.9	ULS 5a Ba 12	76.2	84.7	90.7	0.55		38.4	ULS 5a Ba 22	98.8	84.7	58.0	0.66

DNV·GL

Assessment of groups for strengthened mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0
Mast 65

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compres	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)
409	0	55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	142	**-4.1**	ULS 1a_135	37.9	37.7	43.2	0.11		**16.3**	ULS 5a Ba 1	53.3	37.7	32.0	0.51
410	0	55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	140	**-16.7**	ULS 5a Ba 1	38.5	37.7	43.2	0.44		**3.2**	ULS 1a_135	53.3	37.7	32.0	0.10
411	0	55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	135	**-2.3**	ULS 1a_135	40.2	37.7	43.2	0.06		**17.1**	ULS 5a Ba 1	53.3	37.7	32.0	0.53
412	0	55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	129	**-17.7**	ULS 5a Ba 1	42.0	37.7	43.2	0.47		**1.8**	ULS 1a_0,9_0,9_135	53.3	37.7	32.0	0.06
406	0	HEB160	S235		1.00	1.00	1.00	33	**-1.6**	ULS 1a_0,9_0,9_90	991.1	0.0	0.0	0.00		**5.6**	ULS 1a_90	1276.1	0.0	0.0	0.00
407	0	HEB160	S235		2.00	2.00	2.00	32	**-26.4**	ULS 5a Ba 12	994.8	0.0	0.0	0.03		**25.1**	ULS 5a Ba 22	1276.1	0.0	0.0	0.02
408	0	HEB160	S235		1.00	1.00	1.00	32	**-7.0**	ULS 5a Ba 1	998.4	0.0	0.0	0.01		**3.4**	ULS 1a_135	1276.1	0.0	0.0	0.00
413	0	HEB160	S235	2M16-5.6t	2.00	2.00	2.00	25	**-1.0**	ULS 1a_0,9_0,9_135	1067.2	75.4	138.2	0.01		**14.2**	ULS 5a Ba 1	1296.6	75.4	124.6	0.19
423	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	187	**0.0**	ULS 1a_45	24.0	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00
424	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	169	**0.0**	ULS 3_90	27.5	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00
111A	0	80x80x8	S235	3M24-5.6t	1.00	2.00	1.00	203	**0.0**		65.4	254.2	311.0	0.00		**137.2**	ULS 3_45	160.8	254.2	259.0	0.85
111B	0	80x80x8	S235	3M20-5.6t	1.00	2.00	1.00	202	**0.0**		65.8	176.4	259.2	0.00		**121.3**	ULS 3_0	168.3	176.4	209.5	0.72
112A	0	70x70x7	S235	3M20-5.6t	1.00	1.88	1.00	227	**0.0**		42.7	176.4	226.8	0.00		**96.1**	ULS 3_0	125.5	176.4	155.3	0.77
112B	0	70x70x7	S235	3M20-5.6t	1.00	2.00	1.00	232	**0.0**		41.4	176.4	226.8	0.00		**84.2**	ULS 3_0	125.5	176.4	155.3	0.67
112C	0	70x70x7	S235		1.00	2.14	1.00	227	**0.0**		42.7	0.0	0.0	0.00		**92.2**	ULS 3_0	220.9	0.0	0.0	0.42
110A	0	120x120x11	S235	6M24-5.6t	1.64	1.00	1.00	60	**-191.2**	ULS 5a Ba 21	508.6	508.3	855.4	0.38		**104.2**	ULS 5a Ba 21	513.2	508.3	731.1	0.20
110B	0	120x120x11	S235		1.00	1.00	1.00	13	**-0.4**	ULS 1a_0,9_0,9_90	599.7	0.0	0.0	0.00		**0.4**	ULS 1a_90	599.7	0.0	0.0	0.00
110C	0	120x120x11	S235		1.71	1.29	1.00	66	**-159.0**	ULS 5a Ba 21	492.8	0.0	0.0	0.32		**80.6**	ULS 5a Ba 10	599.7	0.0	0.0	0.13
109A	0	150x100x14	S235	11M24-5.6t	1.00	0.52	0.52	56	**-302.9**	ULS 5a Ba 10	673.7	931.9	1995.8	0.45		**142.1**	ULS 5a Ba 21	666.7	931.9	1211.2	0.21
109B	0	150x100x14	S235	6M24-5.6t	4.78	1.00	1.00	47	**-206.4**	ULS 5a Ba 10	703.8	508.3	1088.6	0.41		**119.1**	ULS 5a Ba 21	666.7	508.3	930.5	0.23
109C	0	150x100x14	S235		1.00	0.52	0.52	58	**-278.3**	ULS 5a Ba 21	665.2	0.0	0.0	0.42		**130.8**	ULS 5a Ba 10	775.5	0.0	0.0	0.17
312	0	70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	185	**-14.3**	ULS 3_135	41.1	58.8	64.8	0.35		**0.0**		82.9	58.8	39.3	0.00
314	0	70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	148	**-15.6**	ULS 3_0	54.9	58.8	64.8	0.28		**0.0**		82.9	58.8	39.3	0.00
317	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	154	**-2.9**	ULS 5a Ba 10	31.0	37.7	43.2	0.09		**0.0**		37.4	37.7	18.4	0.00
319	0	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-2.5**	ULS 1a_0	59.5	37.7	43.2	0.07		**0.0**		37.4	37.7	18.4	0.00
322	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	53	**-1.1**	ULS 3_90	63.5	37.7	43.2	0.03		**0.0**		37.4	37.7	18.4	0.00
311	0	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	332	**0.0**		12.1	58.8	54.0	0.00		**17.5**	ULS 3_45	54.7	58.8	37.0	0.47
313	0	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	298	**0.0**		14.4	58.8	54.0	0.00		**23.8**	ULS 3_135	54.7	58.8	37.0	0.64
316	0	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	332	**0.0**		12.6	75.4	86.4	0.00		**32.0**	ULS 3_135	52.4	75.4	44.1	0.73
318	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	274	**0.0**		13.7	37.7	43.2	0.00		**6.4**	ULS 5a Ba 10	37.4	37.7	22.0	0.29
321	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	269	**0.0**		14.1	37.7	43.2	0.00		**8.9**	ULS 3_0	37.4	37.7	22.0	0.40
315	0	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	180	**-1.0**	ULS 1a_0	22.7	20.2	32.4	0.05		**0.9**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.05
320	0	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	115	**-0.9**	ULS 1a_0	38.2	20.2	32.4	0.04		**0.8**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.04
300	0	70x70x7	S235	1M20-5.6t	0.53	0.53	0.53	142	**-24.3**	ULS 5a Ba 20	66.6	58.8	75.6	0.41		**22.2**	ULS 5a Ba 11	96.8	58.8	53.5	0.41
301	0	70x70x7	S235	1M20-5.6t	0.54	0.54	0.54	138	**-27.0**	ULS 5a Ba 11	69.0	58.8	75.6	0.46		**29.8**	ULS 5a Ba 20	96.8	58.8	53.5	0.56
302	0	70x70x7	S235	1M24-5.6t	0.54	0.54	0.54	119	**-33.6**	ULS 5a Ba 20	80.7	84.7	90.7	0.42		**30.1**	ULS 5a Ba 11	88.7	84.7	44.9	0.67
304	0	60x60x5	S235	1M20-5.6t	0.53	0.53	0.53	104	**-18.0**	ULS 5a Ba 21	57.0	58.8	54.0	0.33		**17.6**	ULS 5a Ba 21	54.7	58.8	37.0	0.48
305	0	60x60x5	S235	1M20-5.6t	0.54	0.54	0.54	112	**-24.9**	ULS 5a Ba 10	52.9	58.8	54.0	0.47		**24.7**	ULS 5a Ba 10	54.7	58.8	37.0	0.67
306	0	75x50x5	S235	1M24-5.6t	0.55	0.55	0.55	112	**-29.5**	ULS 5a Ba 10	53.3	84.7	64.8	0.55		**29.9**	ULS 5a Ba 10	70.6	84.7	41.4	0.72
307	0	75x50x7	S235	1M24-5.6t	0.54	0.54	0.54	87	**-37.7**	ULS 5a Ba 21	86.9	84.7	90.7	0.45		**36.4**	ULS 5a Ba 21	98.8	84.7	58.0	0.63
303	0	HEB160	S235		2.00	2.00	2.00	50	**-26.0**	ULS 5a Ba 20	918.5	0.0	0.0	0.03		**25.4**	ULS 5a Ba 11	1276.1	0.0	0.0	0.02
308	0	HEB160	S235		1.00	1.00	1.00	27	**-0.8**	ULS 1a_0,9_0,9_90	1015.5	0.0	0.0	0.00		**3.6**	ULS 1a_90	1276.1	0.0	0.0	0.00
309	0	HEB160	S235		2.00	2.00	2.00	26	**-26.7**	ULS 5a Ba 10	1021.6	0.0	0.0	0.03		**24.9**	ULS 5a Ba 21	1276.1	0.0	0.0	0.02
310	0	HEB160	S235		1.00	1.00	1.00	25	**-3.0**	ULS 1a_0,9_0,9_90	1025.6	0.0	0.0	0.00		**3.0**	ULS 1a_90	1276.1	0.0	0.0	0.00

DNV·GL

Assessment of groups for strengthened mast (verbouw level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0
Mast 65

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compres	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)
106A		150x150x12	S235	8M24-5.6t	**0.97**	**0.97**	**0.62**	34	**-679.9**	ULS 1a_135	780.4	677.8	1244.2	1.00		**531.9**	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.78
106C		150x150x12	S235		**1.97**	**1.62**	**1.39**	70	**-776.3**	ULS 1a_135	656.3	0.0	0.0	1.18		**625.4**	ULS 1a_0,9_0,9_135	817.8	0.0	0.0	0.76
115B		150x150x10	S235	8M24-5.6t	**1.87**	**1.87**	**1.20**	27	**-669.0**	ULS 1a_90	673.5	677.8	1036.8	0.99		**522.9**	ULS 1a_0,9_0,9_90	624.7	677.8	886.2	0.84

Redundants (knikverkorters) have been added to groups 106A, 106C and 115B. The redundants are checked separately in Appendix C.
The exceeding of compression strength is not relevant, since the main leg itself does not need to be checked for verbouw level.

APPENDIX C REDUNDANT MEMBERS CHECK

Knikverkorters initial construction (afkeur)

Date: 2020-12-01
Author: Muhammed Khan
Version: 1.8

KIJ-GT
S+0
39

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Net Section Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type
14	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	0.59	0	68	**7.4**	**0.15**	53.2	20.2	27.7	38.9	0.57	0.37	
3020	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.47	75	169	**7.4**	**0.00**	24.7	20.2	27.7	38.9	0.57	0.37	
3012	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.29	0	148	**7.4**	**0.32**	29.1	20.2	27.7	38.9	0.57	0.56	
19	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.78	53	204	**7.4**	**0.00**	19.0	20.2	27.7	38.9	0.57	0.39	
11	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.99	0	229	**7.4**	**0.50**	16.2	20.2	27.7	38.9	0.57	0.87	
33	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	2.28	38	262	**7.4**	**0.00**	13.1	20.2	27.7	38.9	0.57	0.56	
10	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.69	0	276	**7.4**	**0.67**	13.5	20.2	27.7	44.6	0.72	0.94	
17	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.86	30	294	**7.4**	**0.62**	12.2	20.2	27.7	44.6	0.72	0.86	
16	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.75	29	283	**7.4**	**0.60**	13.0	20.2	27.7	44.6	0.72	0.84	
8	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.22	0	228	**7.4**	**0.56**	18.1	20.2	27.7	44.6	0.72	0.77	
15	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.89	48	217	**7.4**	**0.00**	17.4	20.2	27.7	38.9	0.57	0.42	
7	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.06	0	122	**7.4**	**0.27**	36.2	20.2	27.7	38.9	0.57	0.46	
26	Pootverband	Enkele staaf	L45.5	S235	M12	5.6	1.57	0	180	**1.5**	**0.39**	22.6	20.2	27.7	38.9	0.57	0.69	
24	Pootverband	Enkele staaf	L45.5	S235	M12	5.6	2.77	75	318	**1.5**	**0.00**	9.7	20.2	27.7	38.9	0.57	0.15	
25	Pootverband	Kniksteun en verticale steun	L45.5	S235	M12	5.6	3.21	0	238	**1.5**	**0.40**	12.6	20.2	27.7	38.9	0.42	0.98	
23	Pootverband	Enkele staaf	L50.5	S235	M12	5.6	3.00	59	308	**1.5**	**0.00**	11.3	20.2	27.7	44.6	0.72	0.13	
28	Tussenschot	Kniksteun en verticale steun	L60.5	S235	M12	5.6	4.83	0	264	**0.3**	**0.60**	14.8	20.2	27.7	67.7	0.81	0.78	
27	Tussenschot	Kruisende staaf halverwege	L100.50.6	S235	M12	5.6	7.00	0	329	**0.3**	**0.88**	18.5	20.2	33.2	53.6	3.24	0.27	
50	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.24	0	142	**7.2**	**0.31**	30.5	20.2	27.7	38.9	0.57	0.54	
47	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.83	49	210	**7.2**	**0.00**	18.3	20.2	27.7	38.9	0.57	0.39	
49	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.64	0	303	**7.2**	**0.66**	10.4	20.2	27.7	38.9	0.57	1.15	Bending
46	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.79	40	205	**7.2**	**0.00**	18.9	20.2	27.7	38.9	0.57	0.38	
45	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.66	51	191	**7.2**	**0.00**	21.0	20.2	27.7	38.9	0.57	0.36	
48	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.32	0	266	**7.2**	**0.58**	12.8	20.2	27.7	38.9	0.57	1.01	Bending
44	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.60	41	184	**7.2**	0.30	22.1	20.2	27.7	38.9	0.57	0.53	
270	1e tussenstul	Kruisende staaf halverwege	L100.50.6	S235	M12	5.6	7.00	0	329	**7.2**	0.88	18.5	20.2	33.2	53.6	3.24	0.39	
58	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.67	43	192	**7.2**	0.31	20.8	20.2	27.7	38.9	0.57	0.53	
60	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.67	0	307	**7.2**	0.67	10.2	20.2	27.7	38.9	0.57	1.17	Bending
57	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.67	35	192	**7.2**	0.34	20.8	20.2	27.7	38.9	0.57	0.60	
56	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.71	51	196	**7.2**	0.27	20.1	20.2	27.7	38.9	0.57	0.47	
59	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.37	0	272	**7.2**	0.59	12.4	20.2	27.7	38.9	0.57	1.04	Bending
55	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.65	42	190	**7.2**	0.31	21.1	20.2	27.7	38.9	0.57	0.54	
80	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.49	52	171	**6.4**	0.23	24.3	20.2	27.7	38.9	0.57	0.40	
83	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.02	0	232	**6.4**	0.51	15.8	20.2	27.7	38.9	0.57	0.88	
79	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.42	42	163	**6.4**	0.26	25.8	20.2	27.7	38.9	0.57	0.46	
78	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.25	51	144	**6.4**	0.20	30.2	20.2	27.7	38.9	0.57	0.35	
82	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.76	0	202	**6.4**	0.44	19.3	20.2	27.7	38.9	0.57	0.77	
77	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.19	41	137	**6.4**	0.22	32.0	20.2	27.7	38.9	0.57	0.39	
76	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.13	53	130	**6.4**	0.17	33.9	20.2	27.7	38.9	0.57	0.32	
81	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.53	0	176	**6.4**	0.38	23.4	20.2	27.7	38.9	0.57	0.67	
75	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.06	43	122	**6.4**	0.19	36.2	20.2	27.7	38.9	0.57	0.34	
96	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.50	52	172	**6.4**	0.23	24.0	20.2	27.7	38.9	0.57	0.40	
99	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.06	0	237	**6.4**	**0.52**	15.3	20.2	27.7	38.9	0.57	0.90	
95	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.43	42	164	**6.4**	**0.00**	25.6	20.2	27.7	38.9	0.57	0.32	
94	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.26	50	145	**6.4**	**0.00**	29.9	20.2	27.7	38.9	0.57	0.32	
98	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.80	0	207	**6.4**	**0.45**	18.7	20.2	27.7	38.9	0.57	0.79	
93	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.21	40	139	**6.4**	**0.00**	31.4	20.2	27.7	38.9	0.57	0.32	
92	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.05	46	120	**6.4**	**0.00**	36.8	20.2	27.7	38.9	0.57	0.32	
97	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.60	0	183	**6.4**	**0.40**	22.1	20.2	27.7	38.9	0.57	0.70	
91	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.01	37	116	**6.4**	**0.00**	38.0	20.2	27.7	38.9	0.57	0.32	
90	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	0.96	42	110	**6.4**	**0.00**	39.9	20.2	27.7	38.9	0.57	0.32	

Knikverkorters adjusted construction (verbouw)

Date: 2020-12-01
Author: Muhammed Khan
Version: 1.8

KIJ-GT

S+0
39

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness (-)	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Block Tearing Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type	Mitigation
49	1e tussenstul	Enkele staaf	**L55.6**	**S355**	M12	**8.8**	2.64	0	246	**7.2**	**0.86**	23.1	32.3	45.2	134.1	1.56	0.55		Profile exchanged
48	1e tussenstul	Enkele staaf	**L50.5**	**S355**	M12	**8.8**	2.32	0	238	**7.2**	**0.75**	18.6	32.3	37.7	92.1	1.08	0.70		Profile exchanged
60	1e tussenstul	Enkele staaf	**L55.6**	**S355**	M12	**8.8**	2.67	0	249	**7.2**	**0.87**	22.7	32.3	45.2	134.1	1.56	0.56		Profile exchanged
59	1e tussenstul	Enkele staaf	**L50.5**	**S355**	M12	**8.8**	2.37	0	244	**7.2**	**0.8**	18.0	32.3	37.7	92.1	1.1	0.71		Profile exchanged
5000	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.22	0	125	**7.2**	**0.4**	46.7	60.3	43.6	51.0	1.1	0.37		Profile added
5001	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.32	0	136	**7.2**	**0.43**	42.3	60.3	43.6	51.0	1.08	0.40		Profile added
5002	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.17	0	120	**7.2**	**0.38**	49.2	60.3	43.6	51.0	1.08	0.35		Profile added
5005	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.43	0	147	**7.2**	**0.46**	38.1	60.3	43.6	51.0	1.08	0.43		Profile added
5006	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.43	0	147	**7.2**	**0.46**	38.1	60.3	43.6	51.0	1.08	0.43		Profile added
5007	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.27	0	130	**7.2**	**0.41**	44.4	60.3	43.6	51.0	1.08	0.38		Profile added
5008	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.27	0	130	**7.2**	**0.41**	44.4	60.3	43.6	51.0	1.08	0.38		Profile added
5003	2e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.22	0	125	**6.4**	**0.40**	46.7	60.3	43.6	51.0	1.08	0.37		Profile added
5004	2e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.10	0	113	**6.4**	**0.36**	52.9	60.3	43.6	51.0	1.08	0.33		Profile added
5009	2e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.12	0	115	**6.4**	**0.36**	51.8	60.3	43.6	51.0	1.08	0.34		Profile added
5010	2e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.12	0	115	**6.4**	0.36	51.8	60.3	43.6	51.0	1.08	0.34		Profile added

Comment

1) Pos numbers 5000 to 5010 are new added redundants

DNV·GL

Knikverkorters initial construction (afkeur)

Date: 2020-12-01
Author: Muhammed Khan
Version: 1.8

KIJ-GT
S+0
65

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Net Section Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type
14	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	0.59	0	68	**7.4**	**0.15**	53.2	20.2	27.7	38.9	0.57	0.37	
3020	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.47	75	169	**7.4**	**0.00**	24.7	20.2	27.7	38.9	0.57	0.37	
3012	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.29	0	148	**7.4**	**0.32**	29.1	20.2	27.7	38.9	0.57	0.56	
19	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.78	53	204	**7.4**	**0.00**	19.0	20.2	27.7	38.9	0.57	0.39	
11	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.99	0	229	**7.4**	**0.50**	16.2	20.2	27.7	38.9	0.57	0.87	
33	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	2.28	38	262	**7.4**	**0.00**	13.1	20.2	27.7	38.9	0.57	0.56	
10	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.69	0	276	**7.4**	**0.67**	13.5	20.2	27.7	44.6	0.72	0.94	
17	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.86	30	294	**7.4**	**0.62**	12.2	20.2	27.7	44.6	0.72	0.86	
16	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.75	29	283	**7.4**	**0.60**	13.0	20.2	27.7	44.6	0.72	0.84	
8	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.22	0	228	**7.4**	**0.56**	18.1	20.2	27.7	44.6	0.72	0.77	
15	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.89	48	217	**7.4**	**0.00**	17.4	20.2	27.7	38.9	0.57	0.42	
7	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.06	0	122	**7.4**	**0.27**	36.2	20.2	27.7	38.9	0.57	0.46	
26	Pootverband	Enkele staaf	L45.5	S235	M12	5.6	1.57	0	180	**1.5**	**0.39**	22.6	20.2	27.7	38.9	0.57	0.69	
24	Pootverband	Enkele staaf	L45.5	S235	M12	5.6	2.77	75	318	**1.5**	**0.00**	9.7	20.2	27.7	38.9	0.57	0.15	
25	Pootverband	Kniksteun en verticale steun	L45.5	S235	M12	5.6	3.21	0	238	**1.5**	**0.40**	12.6	20.2	27.7	38.9	0.42	0.98	
23	Pootverband	Enkele staaf	L50.5	S235	M12	5.6	3.00	59	308	**1.5**	**0.00**	11.3	20.2	27.7	44.6	0.72	0.13	
28	Tussenschot	Kniksteun en verticale steun	L60.5	S235	M12	5.6	4.83	0	264	**0.3**	**0.60**	14.8	20.2	27.7	67.7	0.81	0.78	
27	Tussenschot	Kruisende staaf halverwege	L100.50.6	S235	M12	5.6	7.00	0	329	**0.3**	**0.88**	18.5	20.2	33.2	53.6	3.24	0.27	
50	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.24	0	142	**7.2**	**0.31**	30.5	20.2	27.7	38.9	0.57	0.54	
47	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.83	49	210	**7.2**	**0.00**	18.3	20.2	27.7	38.9	0.57	0.39	
49	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.64	0	303	**7.2**	**0.66**	10.4	20.2	27.7	38.9	0.57	1.15	Bending
46	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.79	40	205	**7.2**	**0.00**	18.9	20.2	27.7	38.9	0.57	0.38	
45	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.66	51	191	**7.2**	**0.00**	21.0	20.2	27.7	38.9	0.57	0.36	
48	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.32	0	266	**7.2**	**0.58**	12.8	20.2	27.7	38.9	0.57	1.01	Bending
44	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.60	41	184	**7.2**	0.30	22.1	20.2	27.7	38.9	0.57	0.53	
270	1e tussenstul	Kruisende staaf halverwege	L100.50.6	S235	M12	5.6	7.00	0	329	**7.2**	0.88	18.5	20.2	33.2	53.6	3.24	0.39	
58	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.67	43	192	**7.2**	0.31	20.8	20.2	27.7	38.9	0.57	0.53	
60	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.67	0	307	**7.2**	0.67	10.2	20.2	27.7	38.9	0.57	1.17	Bending
57	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.67	35	192	**7.2**	0.34	20.8	20.2	27.7	38.9	0.57	0.60	
56	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.71	51	196	**7.2**	0.27	20.1	20.2	27.7	38.9	0.57	0.47	
59	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.37	0	272	**7.2**	0.59	12.4	20.2	27.7	38.9	0.57	1.04	Bending
55	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.65	42	190	**7.2**	0.31	21.1	20.2	27.7	38.9	0.57	0.54	
80	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.49	52	171	**6.4**	0.23	24.3	20.2	27.7	38.9	0.57	0.40	
83	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.02	0	232	**6.4**	0.51	15.8	20.2	27.7	38.9	0.57	0.88	
79	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.42	42	163	**6.4**	0.26	25.8	20.2	27.7	38.9	0.57	0.46	
78	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.25	51	144	**6.4**	0.20	30.2	20.2	27.7	38.9	0.57	0.35	
82	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.76	0	202	**6.4**	0.44	19.3	20.2	27.7	38.9	0.57	0.77	
77	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.19	41	137	**6.4**	0.22	32.0	20.2	27.7	38.9	0.57	0.39	
76	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.13	53	130	**6.4**	0.17	33.9	20.2	27.7	38.9	0.57	0.32	
81	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.53	0	176	**6.4**	0.38	23.4	20.2	27.7	38.9	0.57	0.67	
75	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.06	43	122	**6.4**	0.19	36.2	20.2	27.7	38.9	0.57	0.34	
96	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.50	52	172	**6.4**	0.23	24.0	20.2	27.7	38.9	0.57	0.40	
99	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.06	0	237	**6.4**	**0.52**	15.3	20.2	27.7	38.9	0.57	0.90	
95	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.43	42	164	**6.4**	**0.00**	25.6	20.2	27.7	38.9	0.57	0.32	
94	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.26	50	145	**6.4**	**0.00**	29.9	20.2	27.7	38.9	0.57	0.32	
98	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.80	0	207	**6.4**	**0.45**	18.7	20.2	27.7	38.9	0.57	0.79	
93	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.21	40	139	**6.4**	**0.00**	31.4	20.2	27.7	38.9	0.57	0.32	
92	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.05	46	120	**6.4**	**0.00**	36.8	20.2	27.7	38.9	0.57	0.32	
97	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.60	0	183	**6.4**	**0.40**	22.1	20.2	27.7	38.9	0.57	0.70	
91	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.01	37	116	**6.4**	**0.00**	38.0	20.2	27.7	38.9	0.57	0.32	
90	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	0.96	42	110	**6.4**	**0.00**	39.9	20.2	27.7	38.9	0.57	0.32	

DNV·GL

Knikverkorters adjusted construction (verbouw)

Date: 2020-12-01
Author: Muhammed Khan
Version: 1.8

KIJ-GT

S+0
65

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness (-)	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Block Tearing Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type	Mitigation
49	1e tussenstul	Enkele staaf	**L55.6**	**S355**	M12	**8.8**	2.64	0	246	**7.2**	**0.86**	23.1	32.3	45.2	134.1	1.56	0.55		Profile exchanged
48	1e tussenstul	Enkele staaf	**L50.5**	**S355**	M12	**8.8**	2.32	0	238	**7.2**	**0.75**	18.6	32.3	37.7	92.1	1.08	0.70		Profile exchanged
60	1e tussenstul	Enkele staaf	**L55.6**	**S355**	M12	**8.8**	2.67	0	249	**7.2**	**0.87**	22.7	32.3	45.2	134.1	1.56	0.56		Profile exchanged
59	1e tussenstul	Enkele staaf	**L50.5**	**S355**	M12	**8.8**	2.37	0	244	**7.2**	**0.8**	18.0	32.3	37.7	92.1	1.1	0.71		Profile exchanged
5001	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.32	0	136	**7.2**	**0.43**	42.3	60.3	43.6	51.0	1.08	0.40		Profile added
5002	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.17	0	120	**7.2**	**0.38**	49.2	60.3	43.6	51.0	1.08	0.35		Profile added
5007	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.27	0	130	**7.2**	**0.41**	44.4	60.3	43.6	51.0	1.08	0.38		Profile added
5008	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.27	0	130	**7.2**	**0.41**	44.4	60.3	43.6	51.0	1.08	0.38		Profile added

Comment

1) Pos numbers 5001, 5002, 5007 and 5008 are new added redundants

APPENDIX D ANCHOR CHECKS AND SHEAR BLOCKS

ANCHORS AND SHEAR BLOCKS S+0

The towers in wind zone II are connected via anchor rods, the towers in wind zone III with an inserted leg member into the pile, force transfer is though shear blocks.

Anchors

The tower legs are connected to the foundation with a foot plate 320x520x38 mm and four anchor rods with diameter 38 mm. The thickness and dimensions have been verified by field investigation[1].

The anchor rods are connected to a horizontal rod "schieter" which allows for distribution of the tensile force to the concrete.

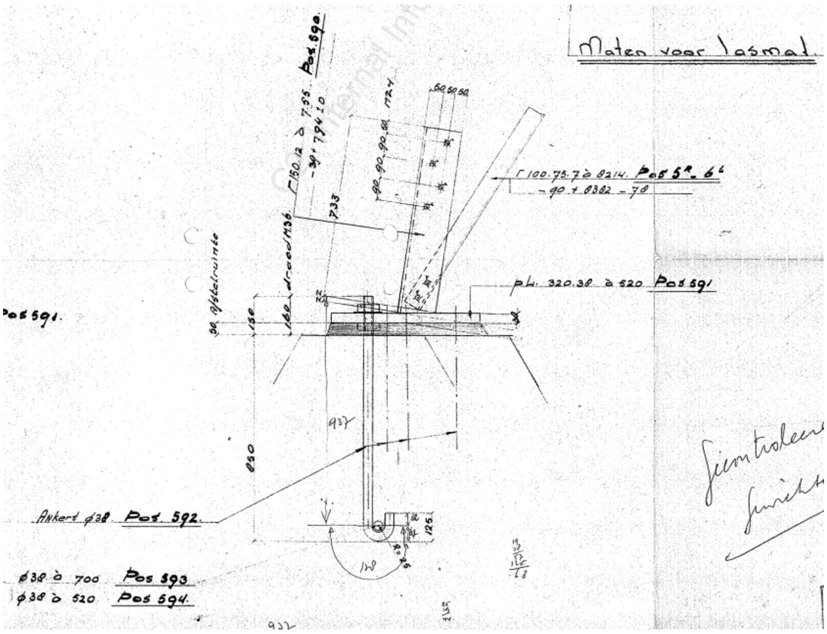


Figure 1 Anchor detail

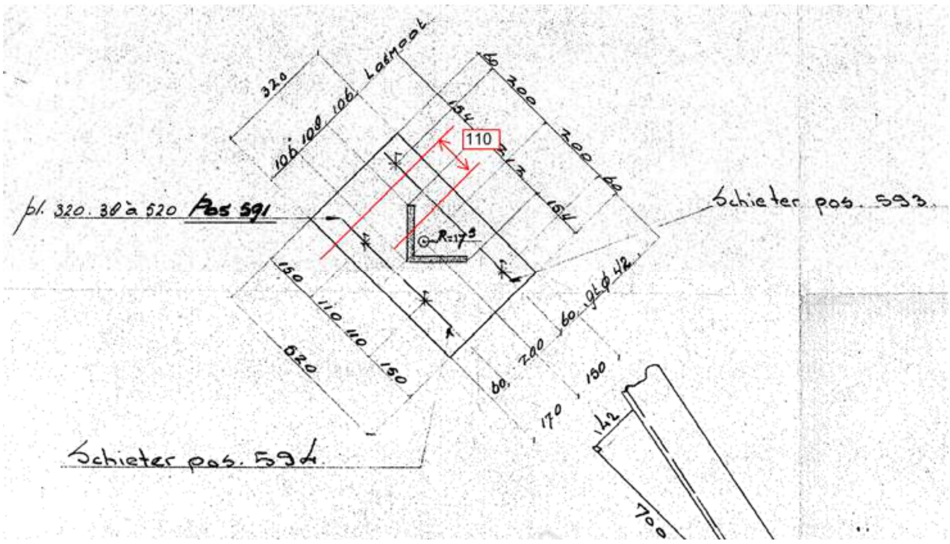


Figure 2 Foot plate with schematisation of effective width and leverage arm

[1] Rapport Bejan Bouw en Betontechniek d.d. 4-11-2020; 200152A-003 Krimpen aan den IJssel - Geertruidenberg v1.0.pdf

Loads

The loads coming from the tower are based on S+0 structure number 39 in wind zone II and can be seen in Table 1.

Table 1 Foundation loads wind zone II for tower 39

Omhullenden ongeacht stijl

Belasting	Combinatie	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. druk	ULS 1a_45	137	121	**728**	11	-183	-35	743
Max. trek	ULS 1a_0,9_0,9_45	104	89	**-565**	-11	136	21	-576
Max. pos. torsie	ULS 5a Ba 10	-28	24	-1	**37**	-3	-3	-1
Max. neg. torsie	ULS 5a Ba 21	-28	-24	-1	**-37**	-3	-3	-1
Comb. trek+torsie	ULS 1a_0,9_0,9_45	104	89	**-565**	**-11**	136	21	-576

Foot plate and anchors

The strength of the foot plate will be determined with the eccentricity of 110 mm shown in Figure 2. The effective width is equal to half of the foot plate, 160 mm.

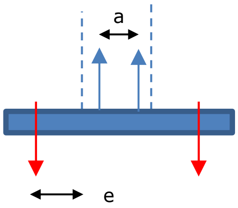


Figure 3 Scheme for check of foot plate

e: 110 mm

In the spreadsheet the anchor bolts and foot plate have been checked. The concrete strength is assumed to be equal or more than C20/25. This assumption is higher than what would be derived for old designation K225 but has been verified with concrete cylinder tests. Refer to aforementioned investigation. The foot plate is embedded in concrete. The anchor bolts will not be loaded by bending.

Check

See output of spreadsheet: the anchor fulfills the requirement, but the foot plate has insufficient capacity:

Tower 39: U.C. = 141 / 123 = 1,14 ≥ 1,00 Not ok

The foot plate needs to be strengthened. This can be done with additional vertical stiffeners that will be positioned to the tower leg. See Figure 4.

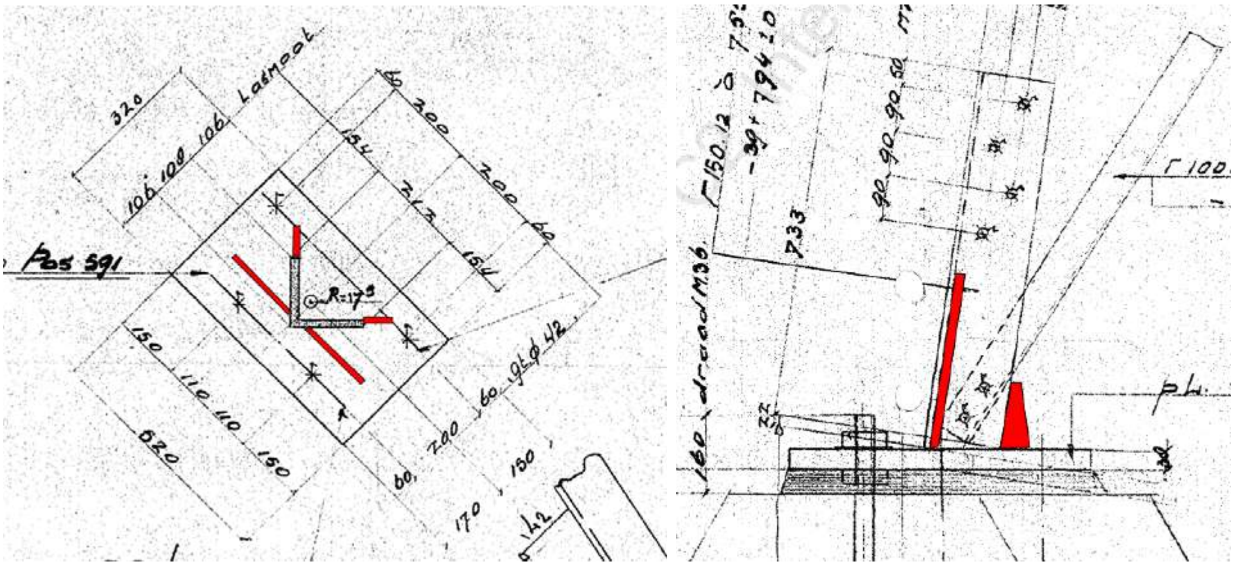


Figure 4 Stiffeners

For the detail-engineering the loads for tower 35 for verbouw load should be used.

Shear blocks

Tower 65 is the governing tower location for the check of the connection to the foundation. Loads to be used in direction of main leg ($R_{z,lok}$).

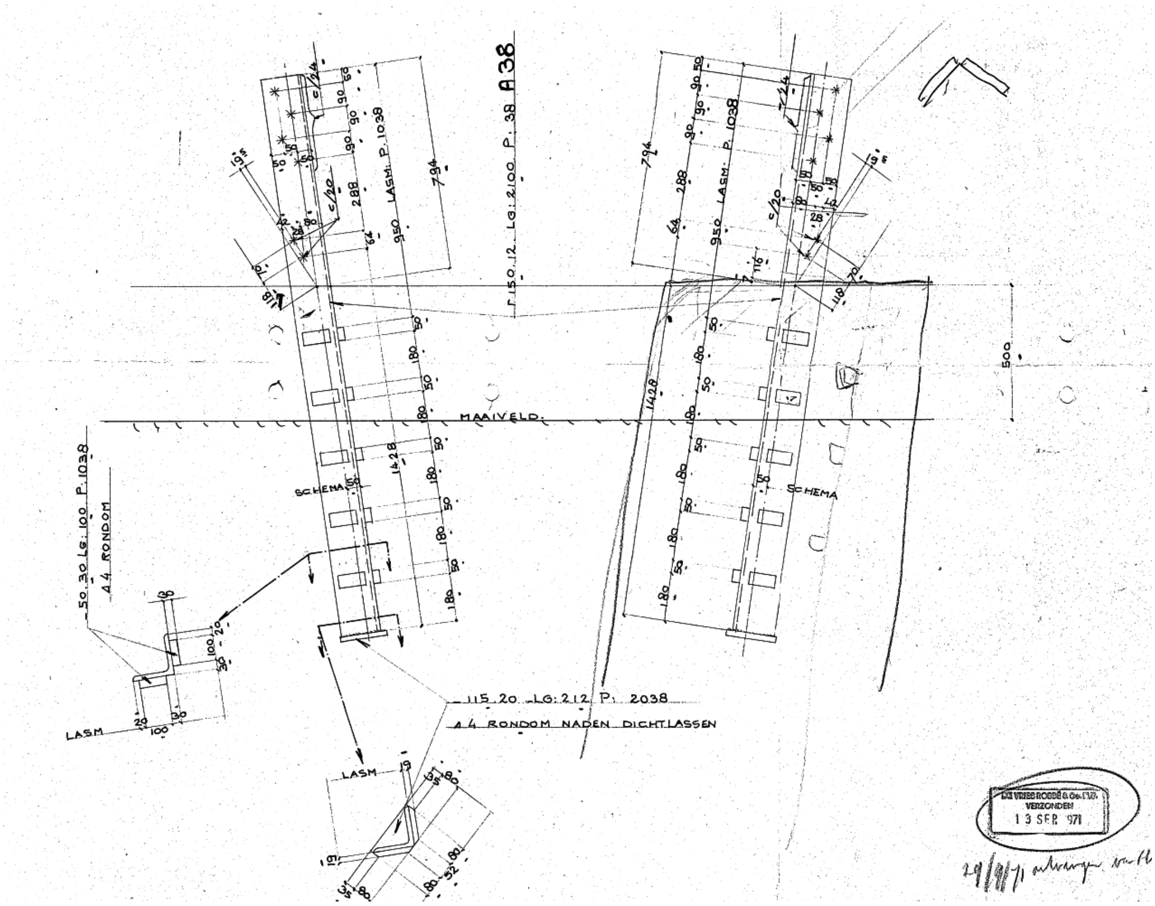


Figure 5 Shear blocks S+0

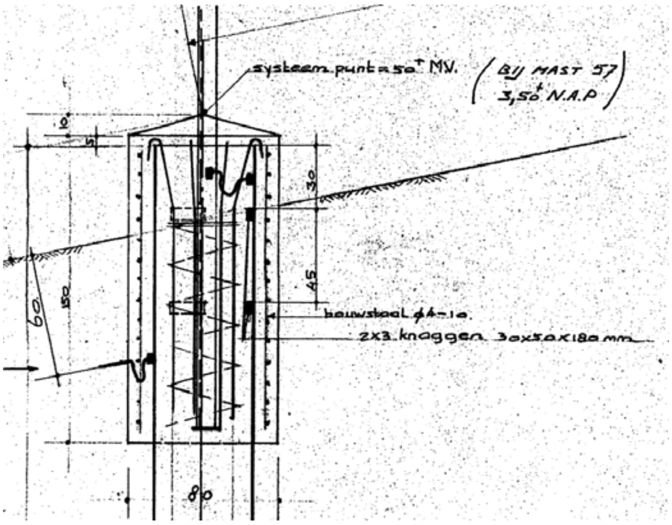


Figure 6 Pile shear blocks

Loads

The loads for wind zone III for tower 65 are tabulated in Table 2.

Table 2 Foundation loads wind zone III for tower 65

Omhullenden ongeacht stijl

Belasting	Combinatie	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. druk	ULS 1a_45	118	105	**628**	10	-158	-30	640
Max. trek	ULS 1a_0,9_0,9_45	85	72	**-464**	-10	111	17	-473
Max. pos. torsie	ULS 5a Ba 10	-28	24	-1	**37**	-3	-3	-1
Max. neg. torsie	ULS 5a Ba 21	-28	-24	-1	**-37**	-3	-3	-1
Comb. trek+torsie	ULS 1a_0,9_0,9_90	-88	55	**-440**	**23**	102	12	-449

Check

With the spreadsheet the shear blocks have been checked. As with the footplate and anchors check the concrete strength is assumed to be equal or more than C20/25. This assumption is higher than what would be derived for old designation K225 but has been verified with concrete cylinder tests. Refer to aforementioned investigation report.

The conclusion is that the shear blocks on the tower leg and pile have sufficient capacity.

Compression U.C. = 0,80 ≤ 1,00 OK

Tension U.C. = 0,79 ≤ 1,00 OK

DNV·GL

Project: Krimpen - Geertruidenberg 380

Date: 30-11-2020
Version: 2.6

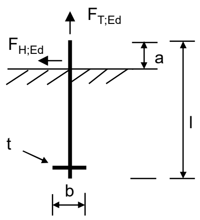
Anchors

NEN-EN 1992-1-1 and 1993-1-8 with NA
CUR-BmS 10

Subject: **S+0 II**	***Checks:***		
	Anchor bolt to tension	1,14	***not OK***
	Anchor bolt to shear	0,41	***OK***
	Dowel ("schieter")	0,90	***OK***

Inputs

Anchor diameter		**M38**	
Achor quality		**4.6**	
Thread		Cut	
Anchor length	l =	900	mm
Anchor length above concrete	a =	110	mm



Load on anchor group

T: the external tension force on the anchor group

Tension force	T =	**565**	kN
Shear force	$F_{H,Ed}$ =	**136**	kN
Number of anchors for tension		4	
Number of anchors for shear		4	
$F_{T;Ed} = T / n =$		141,3	kN
$F_{v;Ed} = F_{H,Ed} / n =$		34,0	kN

Anchor properties

$d_b =$	38,00	mm
$A_{b;s} =$	910	mm^2
$f_{yb} =$	240	N/mm^2
$f_{ub} =$	400	
γ_{Mb}	1,25	-
$\alpha_{red;2}$	0,85	-
$\alpha_b = 0{,}44 - 0{,}0003 f_{yb} =$	0,37	-

Capacity per anchor

$F_{T;Rd} = 0{,}9\alpha_{red;2} f_{ub} A_s / g_{M2} =$	**200,6**	kN
$F_{v;Rd} = \alpha_b f_{ub} A_s / g_{Mb} =$	**82,0**	kN

Foot plate

$F_{t,Rd}$: the tensile force in the anchors when yielding of foot plate is reached.

Steel material		**S235**	
Thickness	t =	38	mm
Width	b_{ef} =	160	mm
Leverage arm	m =	110	mm
$M_{pl,Rd} = 1/4 b_{ef} t_p^2 f_{yd} =$		13,6	kNm
$F_{t,Rd} = M_{pl,Rd} / m =$		123,4	kN

Check of dowel ("schieter")

$$\frac{\sigma_b'}{f_{cd}} = \frac{25{,}6}{40{,}0} = 0{,}64 \quad \textbf{OK}$$

$$\frac{F_{T,Ed}}{F_{v;Rd}} = \frac{141}{157} = 0{,}90 \quad \textbf{OK}$$

Capacity of concrete

Concrete strength	**C20/25**	
$f_{ck} =$	20	N/mm^2
$k_b =$	3	-
$\gamma_{Mc} =$	1,5	-
$f_{cd} = f_{ck} k_b / \gamma_{Mc} =$	40	MPa

Dowel

Diameter	$d_S =$	**38**	mm
Length	$b =$	**220**	mm
Spread	$c = t\sqrt{(f_{yd} / 3f_{jd})} =$	54	mm
Effective length	$b_{eff} = \min(b; d+2c)$	145	mm
Cross section	$A_S = \pi/4\, d_S^2 =$	1134	mm^2
Distributed load	$q = F_{T,Ed} / b_{eff} =$	971	kN/m
Concrete pressure	$\sigma_b' = q / d_S =$	25,6	MPa
Shear stress in dowel			
Load	$F_{T,Ed} =$	141	kN
Allowable	$F_{v,Rd} = f_{yd} / \sqrt{3} \times A_s =$	157	kN

Capacity of foot plate

$$\frac{F_{T,Ed}}{F_{t;Rd}} = \frac{141{,}3}{123{,}4} = 1{,}14 \quad \textbf{not OK}$$

Capacity of anchor for tension

$$\frac{F_{T,Ed}}{F_{T;Rd}} = \frac{141{,}3}{200{,}6} = 0{,}70 \quad \textbf{OK}$$

Check foot plate for tension

$$\frac{T}{n \times F_{t;Rd}} = \frac{565{,}0}{493{,}6} = 1{,}14 \quad \textbf{not OK}$$

Check anchor for shear

$$\frac{F_{v,Ed}}{F_{v;Rd}} = \frac{34{,}0}{82{,}0} = 0{,}41 \quad \textbf{OK}$$

DNV·GL

Project: KIJ-GT380
Mast: S+0

Shear blocks

NEN-EN 1993-1-1 en NEN-EN 1994-1-1

Datum: 2020-11-30
Auteur: TBR
Versie: 1.3

Load				**Results**			
Compression	$F_{Ed,druk}$	640	kN	Compression	U.C.	0,80	< 1,00 OK
Tension	$F_{Ed,trek}$	473	kN	Tension	U.C.	0,79	< 1,00 OK

Hoekstijl

Profile		**L150.12**	
Steel material		S235	
Cross section		3480	mm^2
Axial capacity	N_{pl}	818	kN
Width	b	150	mm
Thickness	t	12	mm
Length in concrete		1300	mm

Blokdeuvels randstijl

Width	b	50	mm
Thickness	h	30	mm
Length	L	100	mm
Welds	a	4	mm
c.t.c. separation	s	180	mm
Number for compr.	n	10	-
Number for tension	n	10	-

Foot plate

Thickness	t	20	mm
Ext. length	m	19	mm
Welds	a	5	mm

Pile

Name		Buispaal	
Diameter		525	mm
Thickness		10	mm
Cross section		16179	mm^2
Steel material		S235	
Capacity		3802	kN
Concrete strength		C20/25	

Shear blocks pile

Width	b	50	mm
Thickness	h	30	mm
Length	L	540	mm
Welds	a	5	mm
c.t.c. separation	s	450	mm
Number for compr.	n	2	-
Number for tension	n	2	-

Design value concrete strength

Material factor	γ_c	1,5	
Add. mat. factor	γ_m	1,25	-
f_{cd} =		10,7	N/mm^2

Steel tower stub

Yield strength	f_{yd} =	235	N/mm^2
Tensile strength	f_{ud} =	360	N/mm^2

Capacity shear blocks main leg

A_{f1} =	3000	mm^2
A_{f2} =	8512	mm^2
Slope	1:	5
$C_A = \sqrt{(A_{f2}/A_{f1})}$ =	1,68	
$f_{jd} = C_A \times f_{cd}$ =	18,0	N/mm^2
$F_{Rd,c} = n \times A_{f1} \times f_{jd}$ =	539	kN
$F_{Rd,t} = n \times A_{f1} \times f_{jd}$ =	539	kN

Capacity foot plate

k_d =	1,73	-
$f_{jd} = C_A \times f_{cd}$ =	18,5	N/mm^2
$c = t\sqrt{(f_{yd} / 3f_{jd})}$ =	42	mm
$m^* = \min(c,m)$ =	19	mm
Type foot plate	Diagonally cut	
Effective for	Compr. and tension	
$A_{p,trek}$ =	10510	mm^2
$F_{Rd} = A_{p,trek} \times f_{jd}$ =	194	kN
Welds foot plate	479	kN
$A_{p,druk}$ =	13990	mm^2
$F_{Rd} = A_{p,druk} \times f_{jd}$ =	258	kN

Capacity shear blocks pile

A_{f1} =	16200	mm^2
A_{f2} =	48600	mm^2
$C_A = \sqrt{(A_{f2}/A_{f1})}$ =	1,73	-
$f_{jd} = k_d \times f_{cd}$ =	18,5	N/mm^2
$F_{Rd,c} = n \times A_{f1} \times f_{jd}$ =	599	kN
$F_{Rd,t} = n \times A_{f1} \times f_{jd}$ =	599	kN

"Splitting" of pile

Spread of forces		45	°
Length force flow		1048	mm
Splitting force		226	kN/m
Yield strength wall	f_{yd} =	235	N/mm^2
Capacity tubular pile		4700	kN/m
U.C.		0,05	< 1,00 OK

Capacities

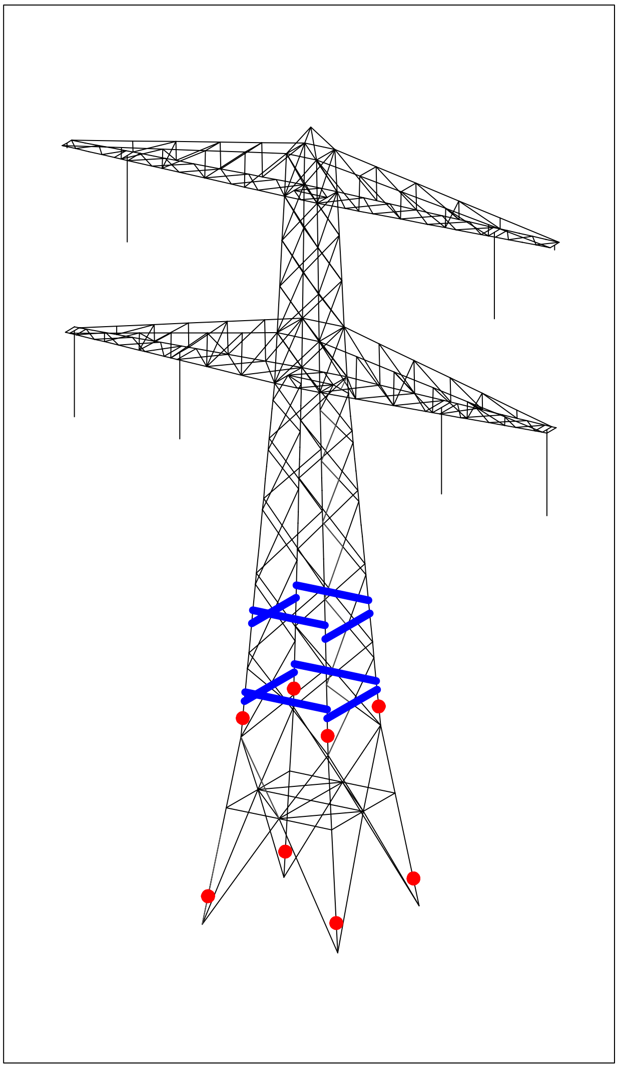
Main leg for tension	733	kN
Tubular pile for tension	599	kN
Main leg for compression	797	kN
Tubular pile for compression	857	kN

Check of welds

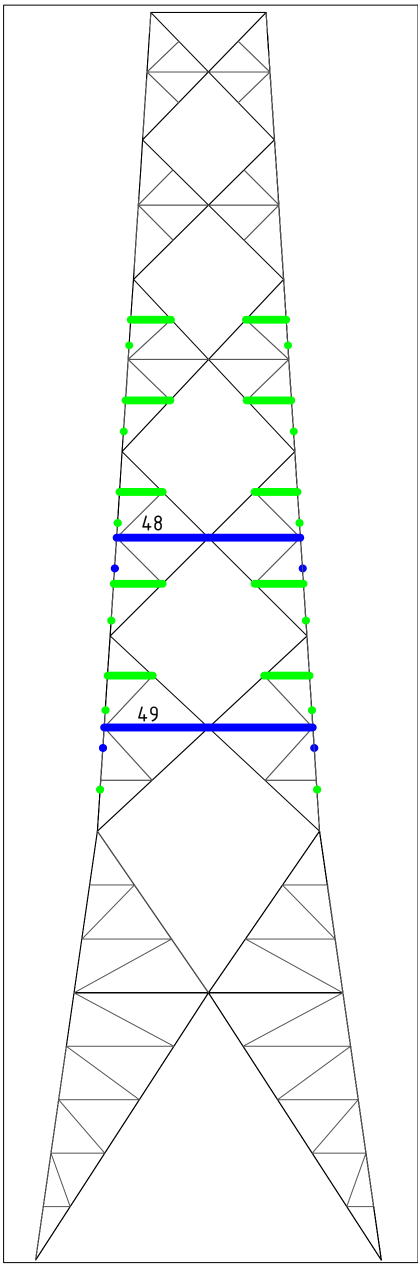
Shear block main leg	0,49	< 1,00 OK
Shear block pile	0,40	< 1,00 OK

APPENDIX E   DRAWINGS

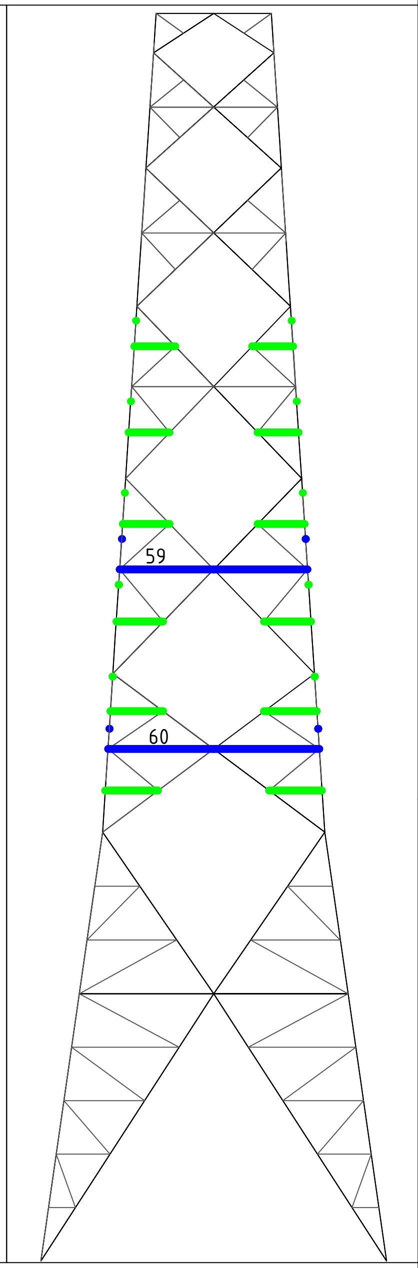
Initial Profiles and Bolts					Final Profiles and Bolts			
Group label	Profile type (ini)	Profile size (ini)	Steel quality (ini)	Bolt size and quality (ini)	Profile type (new)	Profile size (new)	Steel quality (new)	Bolt size and quality (new)
49	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L55x6	S355 t<=40	M12-8.8t-NEN2012
48	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L50x5	S355 t<=40	M12-8.8t-NEN2012
60	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L55x6	S355 t<=40	M12-8.8t-NEN2012
59	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L50x5	S355 t<=40	M12-8.8t-NEN2012



Overview



Front view



Side view

Notes and legend:

- New redundants according to drawing
- Size for new redundants is L50x50x5
- Other changes according to the table
- All changes are symmetrical unless otherwise indicated
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

Profile exchanged
New redundant
Bolt exchanged

01	24-11-2020	Version 2.0 - Profile exchange added
00	31-3-2020	Version 1.0

DNV·GL

Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-001

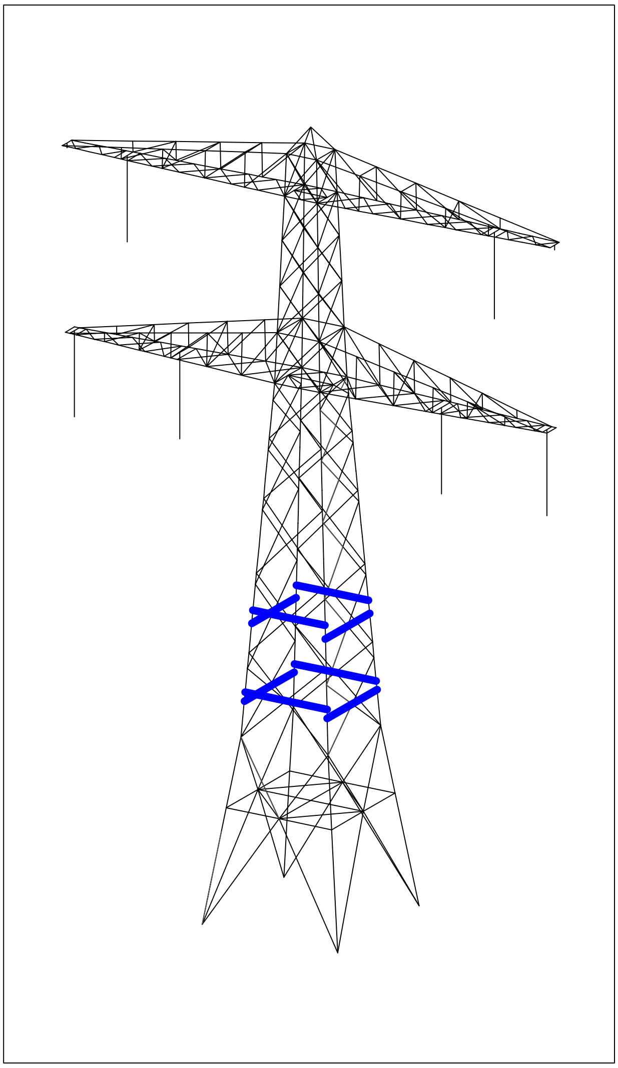
Design state: FINAL		Scale: -		
Drawn by: MuK	24-11-2020	Units: m		
Checked by: TBR	24-11-2020	Project no: 10166260		
Approved by: JHu	24-11-2020	Company: TenneT		

Description: Modifications overview for mast type S+0 Mast 39

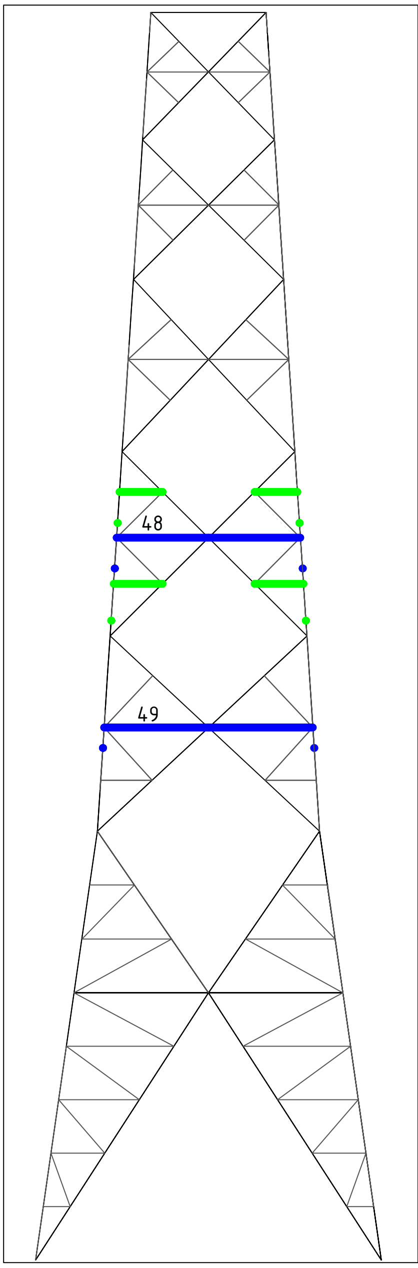
Revision: 01

Format: A2

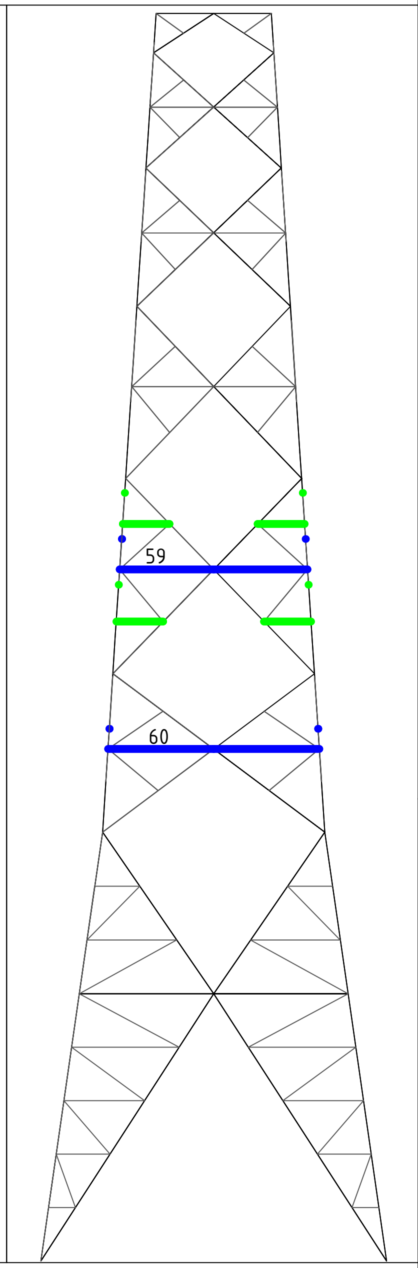
Initial Profiles and Bolts					Final Profiles and Bolts			
Group label	Profile type (ini)	Profile size (ini)	Steel quality (ini)	Bolt size and quality (ini)	Profile type (new)	Profile size (new)	Steel quality (new)	Bolt size and quality (new)
49	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L55x6	S355 t<=40	M12-8.8t-NEN2012
48	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L50x5	S355 t<=40	M12-8.8t-NEN2012
60	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L55x6	S355 t<=40	M12-8.8t-NEN2012
59	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L50x5	S355 t<=40	M12-8.8t-NEN2012



Overview



Front view



Side view

Notes and legend:

- New redundants according to drawing
- Size for new redundants is L50x50x5
- Other changes according to the table
- All changes are symmetrical unless otherwise indicated
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

Profile exchanged
New redundant
Bolt exchanged

01	24-11-2020	Version 2.0 - Profile exchange added
00	31-3-2020	Version 1.0

DNV·GL

Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-002

Design state: FINAL | Scale: -

Drawn by: MuK 24-11-2020 | Units: m

Checked by: TBR 24-11-2020 | Project no: 10166260

Approved by: JHu 24-11-2020 | Company: TenneT

Description: Modifications overview for mast type S+0 Mast 65

Revision: 01

Format: A2

DNV GL Energy & Sustainability, Utrechtseweg 310, 6812 AR Arnhem, tel: +31 26 3 56 91 11, www.dnvgl.com

OVER DNV GL

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Bijlage 15 Rapportage Mastconstructie S+0 T

DNV·GL

“TOETSING EN HERONTWERP MASTEN EN FUNDATIES BBB380”

KIJ-GT380 – Rapportage mast S+0 T

TenneT TSO B.V.

Meridian doc. nr.: 002.589.40 0916512
Rapport nr.: 21-1099 Rev.0
Datum: 2021-07-05

Projectnaam:	"Toetsing en herontwerp masten en fundaties BBB380"	DNV GL - Energy Energy Advisory Postbus 9035 6800 ET ARNHEM
Rapport titel:	KIJ-GT380 – Rapportage mast S+0 T	
Klant:	TenneT TSO B.V.	
Contactpersoon:	[redacted]	
Datum:	2021-07-05	
Project nr.:	10166260	[redacted]
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Geschreven door: Beoordeeld door: Goedgekeurd door:

[redacted]

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☒ Geen distributie (vertrouwelijk)

Trefwoorden:

Versie	Datum	Reden voor uitgave	Auteur	Beoordeeld	Goedgekeurd
0	2021-07-05	Eerste uitgave	[redacted]		

DNV GL Netherlands B.V.

Inhoud

1 INLEIDING

1.1 Inleiding

Om in de toekomst meer elektriciteit te kunnen transporteren is het noodzakelijk om naast de nieuwbouw van verbindingen bestaande hoogspanningsverbindingen aan te passen zodat er een grotere transportcapaciteit mogelijk wordt gemaakt.

Om die reden is de opdrachtgever (OG) voornemens de bestaande 380 kV-koppelnetring op te waarderen. Het opwaarderen van de bestaande verbindingen valt onder het programma "Beter benutten bestaande 380 kV-ring" en omvat de volgende deelprojecten:

- Opwaardering 380 kV-verbinding Lelystad – Ens (LLS-ENS380)
- Opwaardering 380 kV-verbinding Diemen – Lelystad (DIM-LLS380)
- Opwaardering 380 kV-verbinding Rilland – Zandvliet (RLL-ZVL380)
- Opwaardering 380 kV-verbinding Krimpen aan den IJssel - Geertruidenberg (KIJ-GT380)
- Opwaardering 380 kV-verbinding Ens - Zwolle (ENS-ZL380)
- Opwaardering 380 kV-verbinding Maasbracht - Eindhoven (MBT-EHV380)

Om te komen tot een DO waarmee de werkzaamheden kunnen worden gestart is door TenneT aan DNV GL opdracht verstrekt voor de volgende onderdelen:

1. In eerste fase het opstellen en creëren van:

1.1 E-studie deel 1

1.2 Uitgangspuntenrapporten ten behoeve van de constructieve analyse van masten en fundaties

1.3 Sonderingmodellen

1.4 Fundatiemodellen

1.5 Mastmodellen

2. In tweede fase de uitvoering van de DO-fase bevattende:

2.1 Toetsing conform het uitgangspuntenrapport van de bestaande fundaties

2.2 Globale specificatie van benodigde fundatieversterkingen ten behoeve van aanbesteding

2.3 Toetsing conform het uitgangspuntenrapport van de bestaande masten

2.4 Globale specificatie van benodigde mastversterkingen ten behoeve van aanbesteding

2.5 E-studie deel 2

In deze studie wordt voor de lijn Krimpen aan den IJssel - Geertruidenberg de controle van de mastconstructie van masttype S+0 T gerapporteerd.

Inhoudelijk is de Nederlandse versie van de rapportage ongewijzigd ten opzichte van de Engelse versie. Om deze reden zijn de bijlagen in dit rapport één op één overgenomen uit de Engelse versie. Hierdoor wijkt het revisienummer van de bijlagen af van het revisienummer van de rapportage.

1.2 Doelstelling en scope van dit rapport

Het doel van deze studie is om te bepalen of de in dit rapport beschreven bestaande mast geschikt is om te worden uitgerust met de ACCCZ-Warsaw geleider.

Nadat de wijzigingen zijn toegepast dient aantoonbaar geverifieerd te worden dat het systeem voldoet aan de vigerende eisen.

1.3 Relatie overige documenten

1.3.1 Verificatie & validatie plan

De door TenneT aangeleverde set met eisen is beoordeeld op relevantie en voor de relevante eisen is aangegeven in welk document wordt aangetoond dat er aan de eis wordt voldaan. De resultaten hiervan zijn opgenomen in het rapport "Verificatie & Validatieplan 380 kV verbinding Krimpen aan den IJssel - Geertruidenberg" [1].

1.3.2 E-studie deel 1

In de rapportage "KIJ-GT380 - E-studie deel 1" [2] is bepaald welke aanpassingen benodigd zijn om de ACCCZ Warsaw geleider toe te passen binnen de verbinding Krimpen aan den IJssel - Geertruidenberg. Uit de E-studie volgen geen zaken die relevant zijn voor de constructie van masttype S+0 T.

1.3.3 Uitgangspunten rapport

De uitgangspunten op basis waarvan de berekeningen in deze rapportage zijn uitgevoerd zijn opgenomen in het rapport "Uitgangspuntenrapport 380kV verbinding Krimpen aan den IJssel - Geertruidenberg" [3]

2 EISEN

In onderstaande Tabel 1 zijn de eisen opgenomen die binnen deze rapportage worden getoetst.

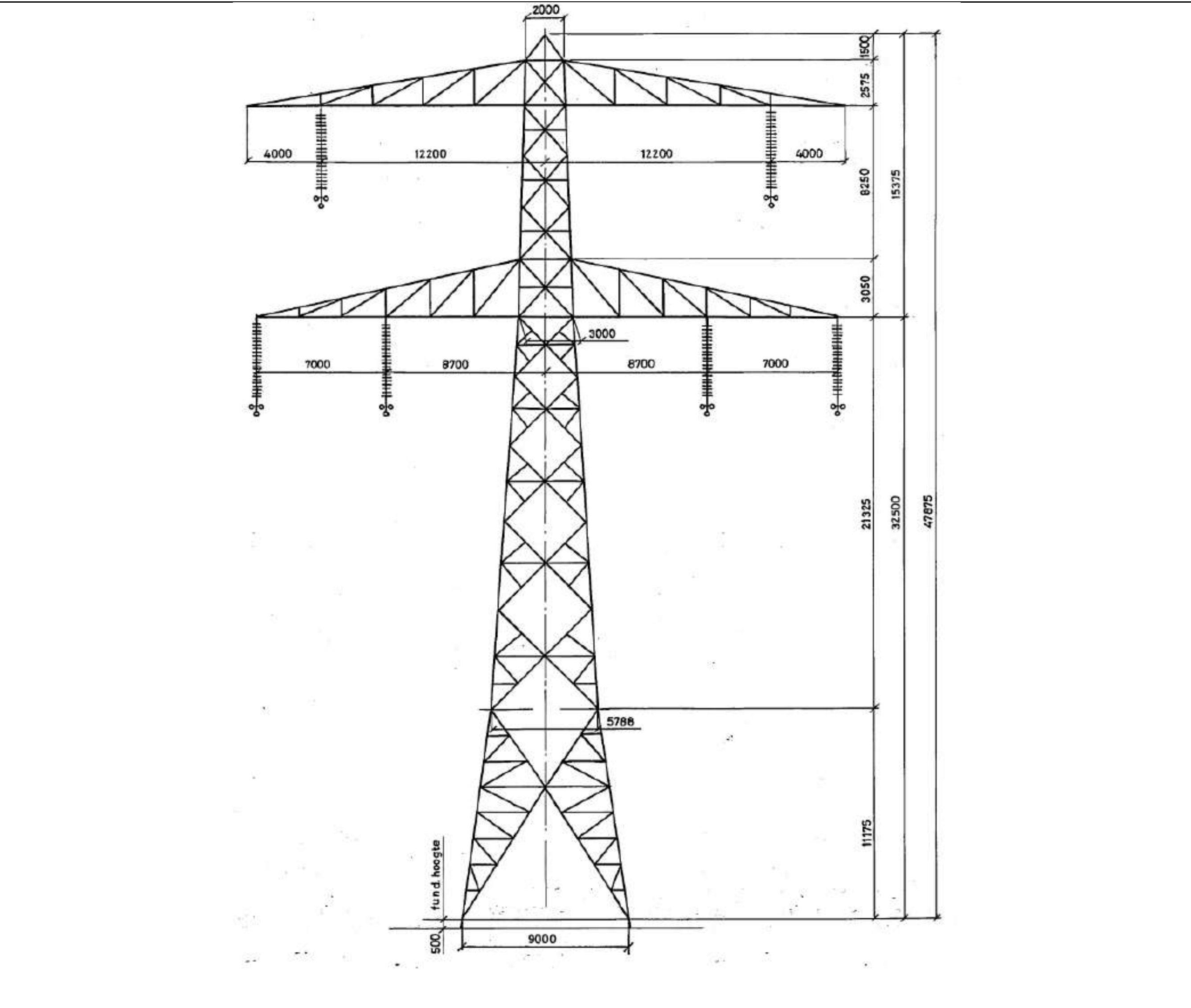
Tabel 1 Relevante eisen

Eis Id	Titel	Eis Tekst	Bewijsvoering
BO Eis: H2.7-6	Omgeving, beperkings factoren	Het ontwerp dient geverifieerd te worden op de uitvoerbaarheid.	Tabel 8
PVE.05.001 5.14	Masten	Aanwijzingen t.a.v. klimvoorziening en valbeveiliging: Huidige klimweg blijft gehandhaafd en zal voldoen aan de eisen zoals opgenomen in de NEN 1060:1977. Valbeveiliging is/zal worden uitgevoerd in het type "latch way". Indien staaldelen in de nabijheid (aangrenzend profiel) van de klimweg gewijzigd worden, dient geverifieerd te worden dat de klimvoorziening in overeenstemming is met de NEN 1060:1977.	Tabel 8

3 BEREKENINGEN

3.1 Mastbeeld

Het mastbeeld op basis van de Asset-data is weergegeven in Figuur 1.



Figuur 1 Mastbeeld

3.2 Mastenlijst

In deze rapportage wordt masttype S+0 T getoetst. In de verbinding KIJ-GT komt maar één mast voor van het type S+0 T (mast 35) en deze staat in wingebied II. De gegevens van de mast zijn in Tabel 2 weergegeven.

Tabel 2 Mastnummers

Mastnummer	Masttype	Maatgevend mastnummer	Wind span (m)	Weight span (m)	Hoogteverschil
35	S+0 II T	35	382	383	-0.1

3.3 Uitgangspunten berekening

De berekening is uitgevoerd op basis van de uitgangspunten zoals opgenomen in het uitgangspuntenrapport [3]. Hierin is een volledig overzicht opgenomen van de belastingcombinaties en toegepaste belastingfactoren

Tabel 3 Uitgangspunten berekening

Algemeen	Norm	NEN-EN50341-2-15:2019
	Windgebied	II
	Terreincategorie	II (onbebouwde omgeving)
	Reductiefactor cdir	1,00
Situatie initieel	Gevolgklasse	CC2-0
	Betrouwbaarheidsniveau	Afkeur CC2-0
	Referentieperiode	30 jaar
Situatie na aanpassingen	Gevolgklasse	CC2
	Betrouwbaarheidsniveau	Verbouw
	Referentieperiode	50 jaar

3.4 Proces stappen

Het proces van het bepalen van eventueel benodigde verstevigingen bestaat uit de volgende stappen:

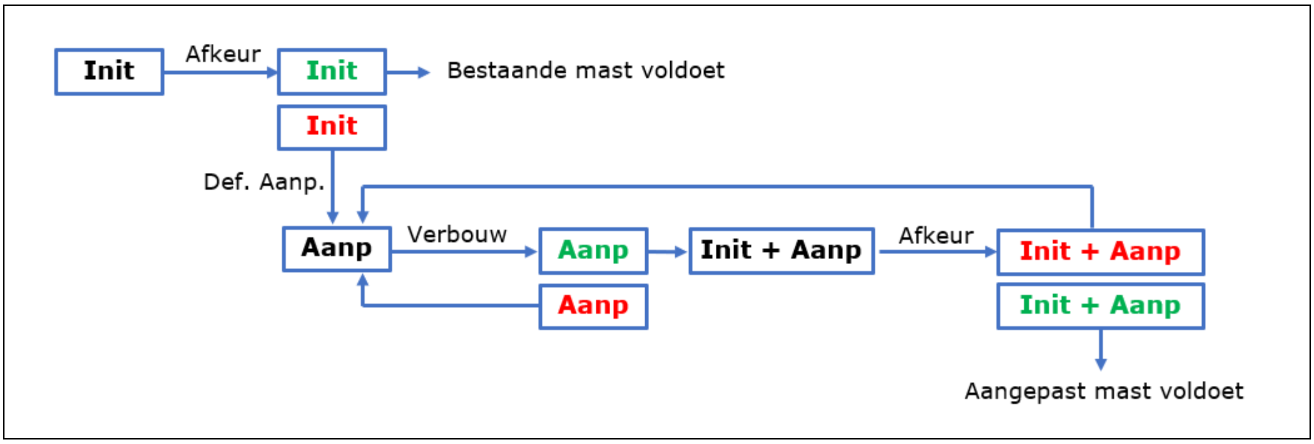
Stap 1: Toets bestaande (Init) mast op Afkeur

Stap 2: Definiëren benodigde aanpassingen indien initiële mast niet voldoet aan toets op Afkeur (Def. Aanp.)

Stap 3: Het toetsen van (alleen) de uitgewerkte aanpassingen (Aanp) op Verbouw

Stap 4: Het opnieuw toetsen van de complete mast inclusief aanpassingen (Initi + Aanp) op Afkeur

Het hierboven omschreven proces is in Figuur 2 weergegeven.



Figuur 2 Proces diagram

3.5 Geleiderbelastingen

De berekening is uitgevoerd met het geleiderbelastingenprogramma van DNV GL. In Appendix A zijn de resultaten van de geleiderbelastingen samengevat.

3.6 Telecomopstelling

De eigenschappen van de telecomopstelling zijn omschreven in het Uitgangspuntenrapport. De details zijn weergegeven in onderstaande tabellen.

Tabel 4 Details antenne mastlichaam - mast 35

Object	Aantal	$A_{frontaal}$/m [m²/m]	$A_{frontaal}$ [m²]	Massa [kg]
Kathrein 80020892	3		1,02	45
Radio 2217 3 st + 1 Power 6302	3		0,21	52
Radio 2212 RRU	3		0,14	20
FTTA-box	3		0,11	15
Schotel 300 mm	1		0,07	25
Hybride kabel (22mm) 3x	per m	0,07		4,5
Voeding KPN 3x1 13mm	per m	0,04		0,9
RG214-50 1x1	per m	0,01		0,2
Bevestigingsbuis 60.3 x 5 mm	6m		0,36	42
Bevestigingsbuis 60.3 x 5 m	6m		0,36	42
Totaal		0,085 m²/m	2,3 m²	255 kg

Het windoppervlak van de antenne op de top is vergroot naar 4,6m² gebaseerd op de DIM-LLS 5G-antennes.

Tabel 5 Details antenne top mast – mast 35

Object	Aantal	$A_{frontal}$/m [m²/m]	$A_{frontal}$ [m²]	Mass [kg]
Kathrein 80020892	3		1,02	45
Radio 2217 3 st + 1 Power 6302	3		0,21	52
Radio 2212 RRU	3		0,14	20
FTTA-box	3		0,11	15
Schotel 300 mm	1		0,07	25
Hybride kabel (22mm) 3x	per m	0,070	-	4.5
Voeding KPN 3x1 13mm	per m	0,040	-	0.9
RG214-50 1x1	per m	0,010	-	0.2
Bevestigingsbuis 60.3 x 5 mm	6m		0,36	42
Bevestiging UNP 120	6m		0,72	80
Bevestigingsbuis 168.3 x 16 mm	6m		1,01	480
Total		0,085 m²/m	4,6 m²	765 kg

3.7 Reacties op de fundering

De oplegreacties op de fundering worden ontleend aan de uitvoer van het geleiderbelastingenprogramma, zie ook Appendix A.

3.8 Modellering

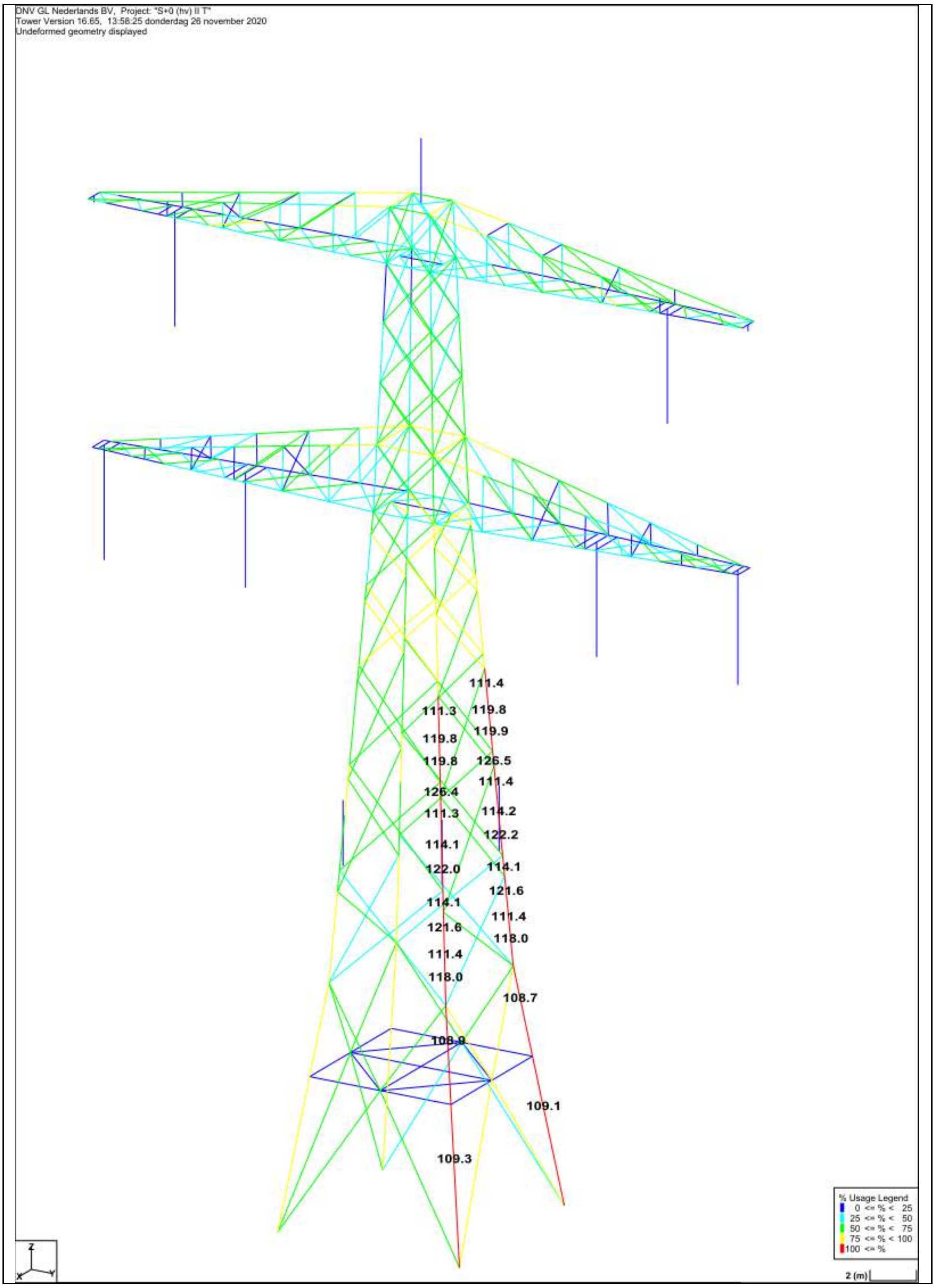
Op basis van de as-built tekeningen is de mast in PLS-TOWER ingevoerd. De hoofdelementen zijn gemodelleerd. Niet-dragende profielen als knikverkorters zijn weggelaten en worden separaat getoetst. De profielen inclusief de boutverbindingen zijn in PLS-TOWER ingevoerd en getoetst. Controle van de schetsplaten en andere detailverbindingen valt buiten de scope.

De geleiderbelastingen vanuit het geleiderbelastingenprogramma zijn als invoer voor de belastingen gebruikt.

Diagonalen in voor- en achtervlak respectievelijk de twee zijvlakken zijn samengenomen in een groep en de toetsing wordt per staafgroep uitgevoerd. Ingeval dat een element uit een groep is overbelast, geldt dit voor alle elementen uit de betreffende groep.

4 TOETSING MAST

Het resultaat van de controle van de mastconstructie type S+0 T met belastingen op afkeurniveau is weergegeven in onderstaande figuren.



Figuur 3 Resultaat PLS-TOWER S+0 T (35)

De resultaten van de controles van profielen, knikverkorters en ankers randstijl zijn opgenomen in Tabel 6.

Tabel 6 Samenvatting controle

Controle van	Beoordeling		Referentie
Profielen		**Voldoen niet**	Figuur 3
Knikverkorters		**Voldoen niet**	Appendix C
Ankers en voetplaat		**Voldoen niet**	Appendix D

5 AANPASSINGEN

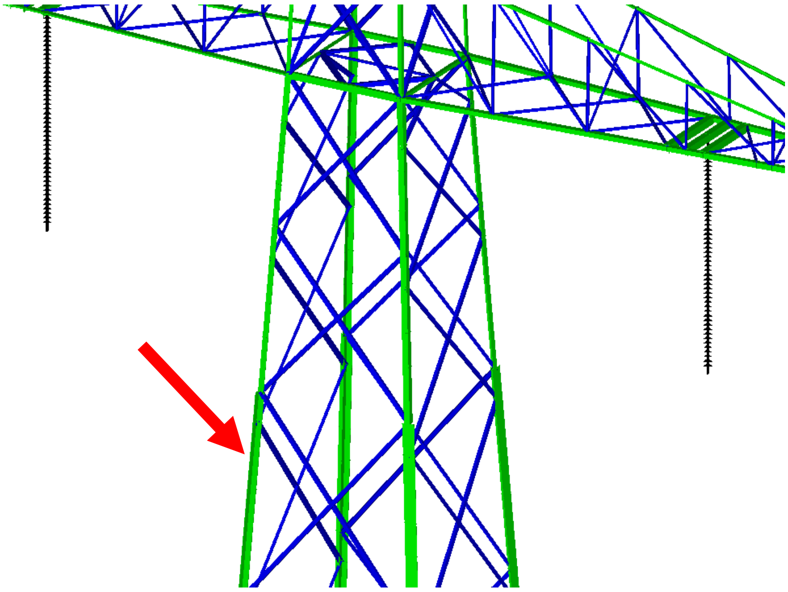
5.1 Inleiding

Een versterkingsvoorstel om de mast aan afkeurniveau te laten voldoen en nieuwe onderdelen aan verbouwniveau is uitgewerkt. Dit voorstel bevat de volgende maatregelen:

- Vervangen van knikverkorters;
- Toevoegen van knikverkorters;
- Vervanging van bouten;
- Versterking van voetplaat;
- Versterking van de randstijl door deze te voorzien van een extra hoefprofiel, zie Figuur 5. De nieuwe profielen moeten worden voorzien van stapbouten.

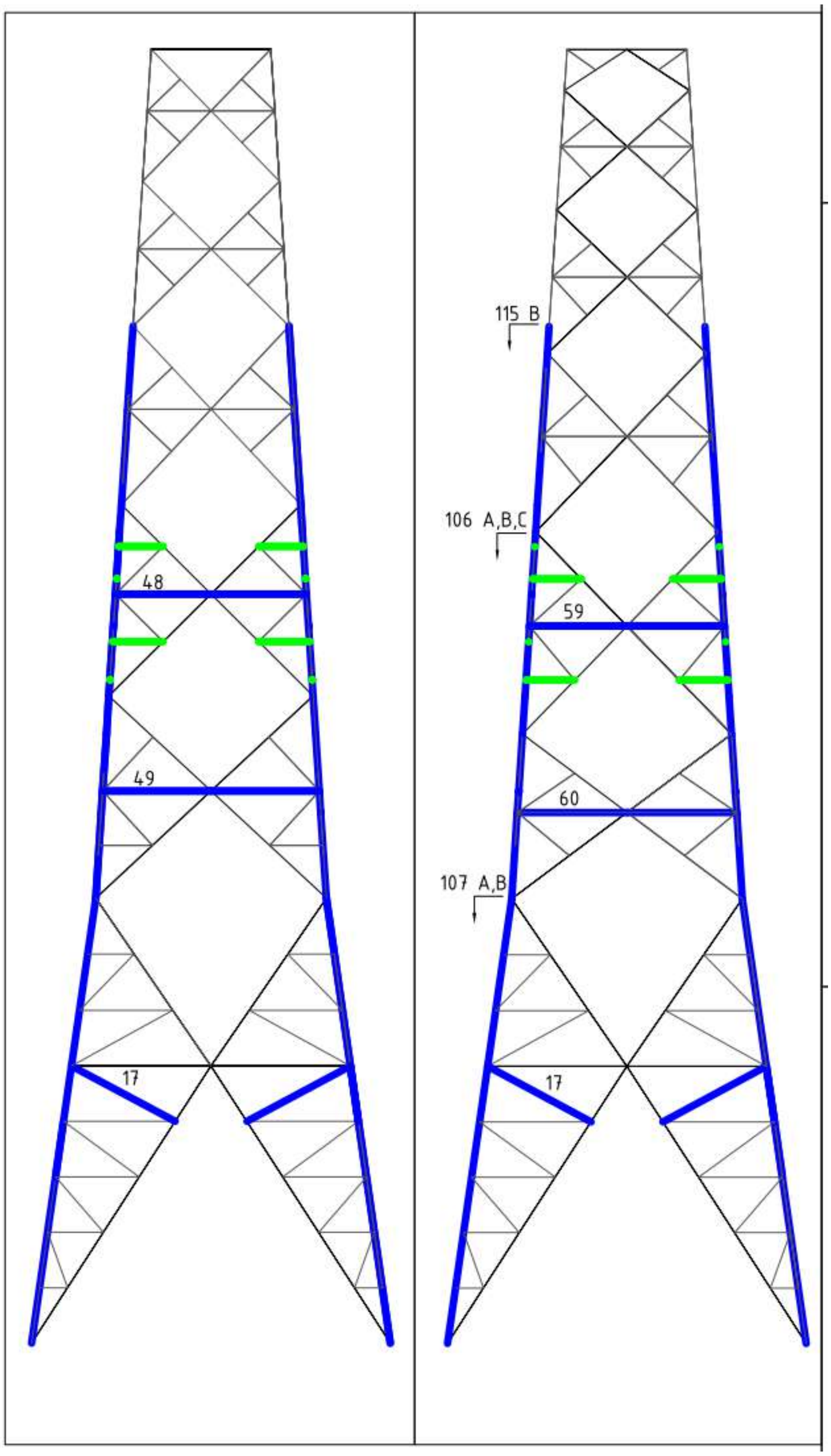
5.2 Aanpassingen

Voor afmetingen profielen en bouten, zie Appendix E. Een gedeelte is weergegeven in Figuur 4.

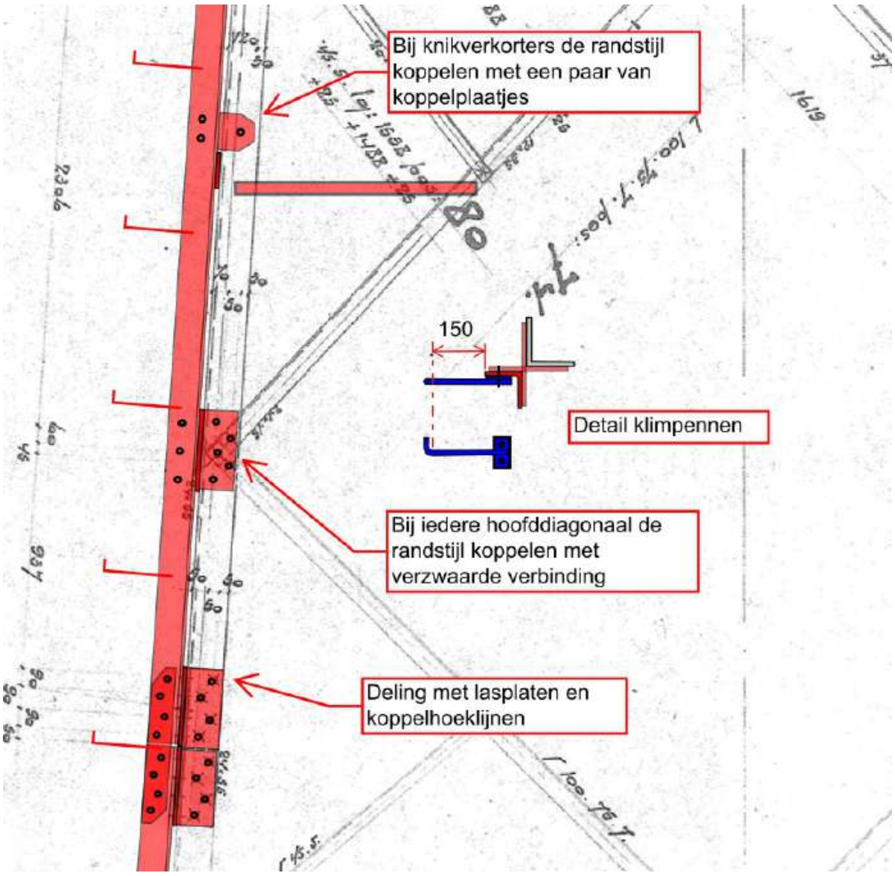


Figuur 4 Versterking randstijlen

Mocht de onderste antenne worden verwijderd, zijn de voorgestelde versterkingen van de randstijlen nog steeds nodig.

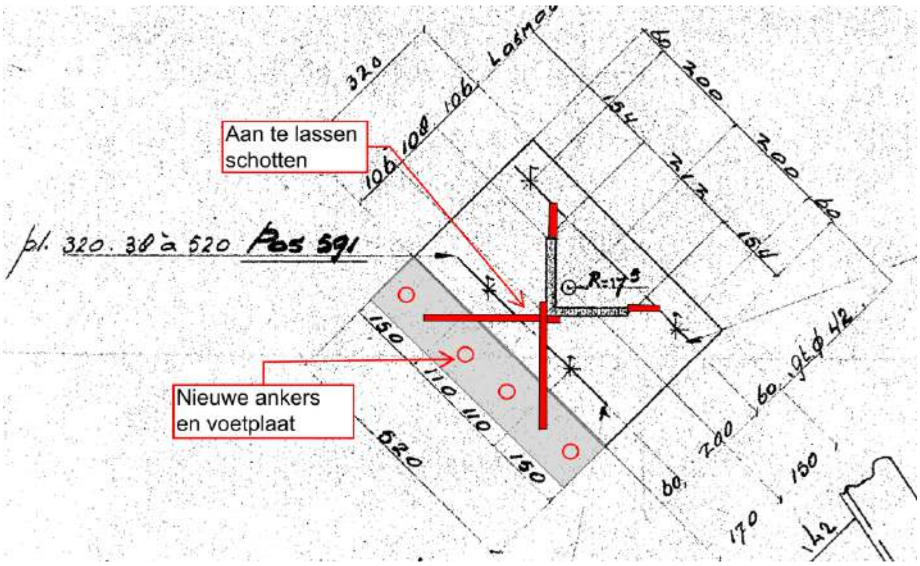


Figuur 5 Aanpassing (blauw) aan en toevoeging (groen) van knikverkorters

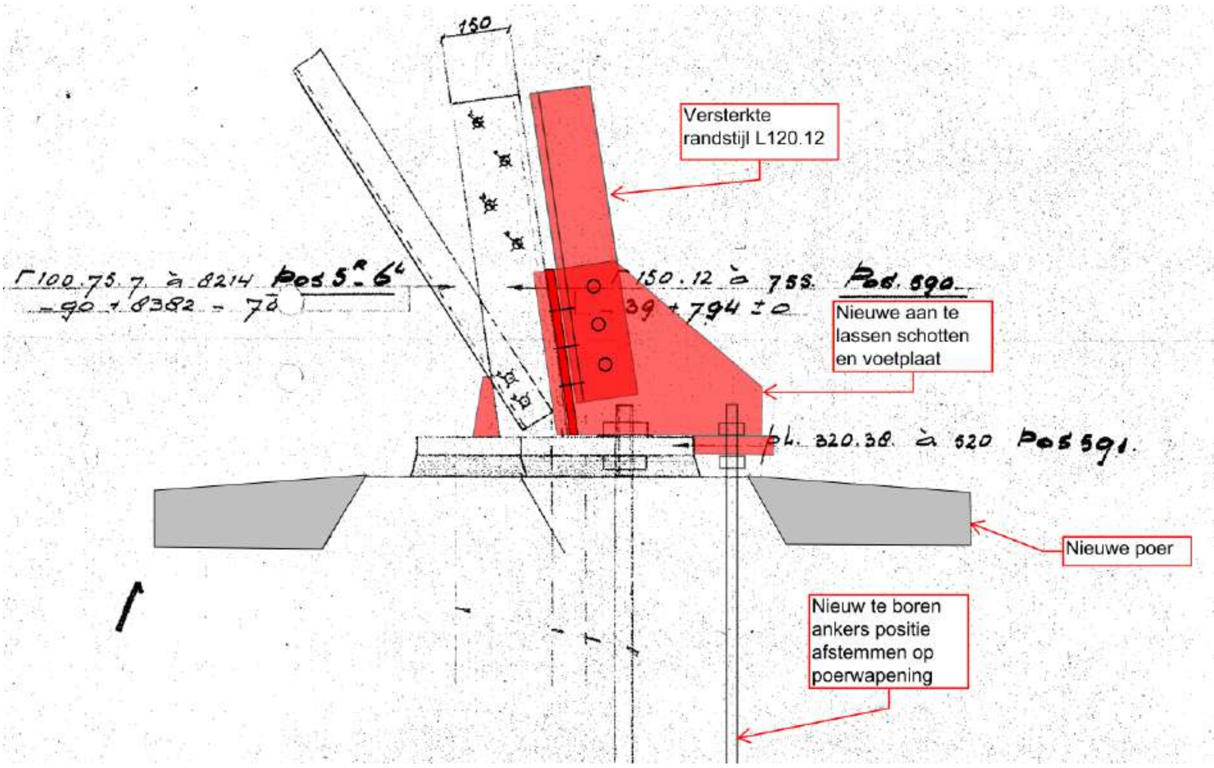


Figuur 6 Detaillering versterking randstijl

De voetplaat moet worden versterkt. De voorgestelde oplossing is om platen toe te voegen om de voetplaat en de randstijl te verbinden, waarmee de voetplaat wordt verstijfd tegen buiging en om de excentriciteit van de randstijl op de plaat op te heffen, zie Figuur 7 en Figuur 8. Deze oplossing vereist lassen op locatie. De berekeningen zijn toegevoegd aan Appendix D.



Figuur 7 Toevoeging van schetsplaten en vergroten van de voetplaat



Figuur 8 Detaillering van de voetplaat in combinatie met aangepaste poer

Een overzicht van het nettogewicht van de profielen die nodig zijn voor de versterkingen/aanpassingen is voor mast 84 gegeven in Tabel 7. Het gewicht van eventueel benodigde schetsplaten is niet meegenomen.

Tabel 7 Gewichten S+0 T (35) van aangepaste profielen

Staafgroep	Profiel	Materiaal	Bouten	Profiel nw.	Materiaal nw.	Bouten nw.	Maatregel	Aantal	Lengte (m)	Gewicht (kg)
106A	L150.12	S235	8M24-5.6t	L150.12 + L120.12	S355	8M24-8.8t	Profiel aangepast	4	1.64	148.5
106C	L150.12	S235		L150.12 + L120.12	S355		Profiel aangepast	4	5.60	507.1
107A	L150.12	S235	8M24-5.6t	L150.12 + L120.12	S355	8M24-8.8t	Profiel aangepast	4	4.40	398.4
115B	L150.10	S235	8M24-5.6t	L150.10 + L120.10	S355	8M24-8.8t	Profiel aangepast	4	5.30	404.8
106B	L150.12	S235	8M24-5.6t	L150.12 + L120.12	S355	8M24-8.8t	Profiel aangepast	4	2.15	194.7
107B	L150.12	S235	8M24-5.6t	L150.12 + L120.12	S355	8M24-8.8t	Profiel aangepast	4	7.20	652.0
17	L50.5	S235	1M12-5.6t	L60.6	S355	1M12-8.8t	Profiel uitgewisseld	8	2.86	126.5
49	L45.5	S235	1M12-5.6t	L55.6	S355	1M12-8.8t	Profiel uitgewisseld	4	2.64	53.3
48	L45.5	S235	1M12-5.6t	L50.5	S355	1M12-8.8t	Profiel uitgewisseld	4	2.32	35.6
60	L45.5	S235	1M12-5.6t	L55.6	S355	1M12-8.8t	Profiel uitgewisseld	4	2.67	53.9
59	L45.5	S235	1M12-5.6t	L50.5	S355	1M12-8.8t	Profiel uitgewisseld	4	2.37	36.4
5001				L50.5	S355	1M16-8.8t	Profiel toegevoegd	4	1.32	20.3
5002				L50.5	S355	1M16-8.8t	Profiel toegevoegd	4	1.17	18.0
5007				L50.5	S355	1M16-8.8t	Profiel toegevoegd	4	1.27	19.5
5008				L50.5	S355	1M16-8.8t	Profiel toegevoegd	4	1.27	19.5
								64	44.18	2688.4

5.3 Eisen verificatie

De verificatie van de van toepassing zijnde eisen is uitgevoerd in onderstaande Tabel 8.

Tabel 8 Verificatie eisen

Eis Id	Eis Tekst	Ja	Nee	N.v.t.	toelichting
BO Eis: H2.7-6	Aanpassingen uitvoerbaar?	X			De toe te voegen staalonderdelen zijn met geboute verbindingen te bevestigen. Dit is een bewezen methode. De verstijving van de voetplaat vereist in het werk lassen. Vanwege de locatie op de grond is dit uitvoerbaar en een bewezen oplossing.
PVE.05.001 5.14	Staaldelen in nabijheid van klimweg gewijzigd?	X			De wijzigingen in de nabijheid van de klimweg (knikverkorters) zijn in te passen zonder negatieve invloed op de begaanbaarheid. Het aanbrengen van de extra randstijl (vlinder) vereist het aanpassen van de klimweg. In Figuur 6 is het principe van de aanpassing van de klimpennen weergegeven. Hiernaast zal de latchways moeten worden aangepast.
	klimvoorziening nog in overeenstemming is met de NEN 1060:1964?	X			Na aanpassing van de staaldelen blijft de klimweg in overeenstemming

6 REFERENTIES

[1] „002.589.40 0817486 - 20-0473 - Verificatie & validatieplan 380kV verbinding Krimpen aan de IJssel - Geertruidenberg”.

[2] „002.589.40 0808624 - 20-0472 - E-studie deel 1 380kV verbinding Krimpen aan de IJssel - Geertruidenberg”.

[3] „002.589.40 0808629 - 20-0345 - Uitgangspuntenrapport 380kV verbinding Krimpen aan de IJssel - Geertruidenberg”.

APPENDIX A CONDUCTOR LOADS

Content

Data

Norm	NEN-EN50341-2-15:2019
Initial	
Consequence class	CC2-0
Reliability level	Afkeur
Reference period	30 jaar
After adjustment	
Consequence class	CC2
Reliability level	Verbouw
Reference period	50 jaar
Wind zone	II
Wind speed	27 m/s
Terrain categorie	II
Reduction factor C_{dir}	1,00
Ice region	B
Tower type	Steunmast
Tower height	48 m
Max. Span	395 m
Line angle	180°
Catenary	1400 m
Wind span	382 m
EDS Weight span	382 m
Min. Weight span	381 m
Max. Weight span	382 m

ISSUE	DATE	REVISION	CHK'D	APP'D
0.0	2020-11-26			

Client: TenneT Taking power further

DNV·GL

Title:

Berekening masttype S+0 II T

JOB No.	-	DATE	-
DRAWN	-	CHKD	-
DESIGN	-	APPD	-

Document name:

KIJ-GT_S+0 II T_35_Report.pdf

Project number:

Project client number:

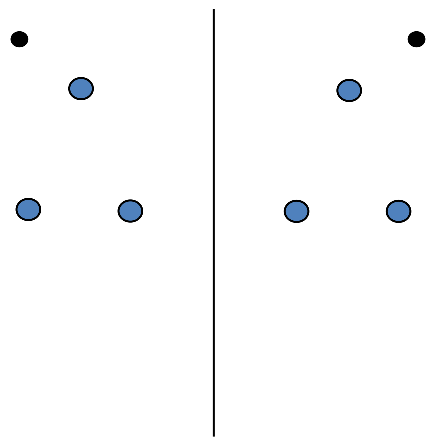
0.0

Project: KIJ-GT
Tower: S+0 II T
Number: 35

Conductor loads		Auteur:	TBR
		Versie:	v11.3

General

Description	S+0 II T
Tower type	Steunmast
Number of circuits	2
Configuration	2-circuit-donau
Number of earth wires	2



Configuratie geleiders

Starting points

Norm	NEN-EN50341-2-15:2019
Consequence class	CC2-0
Reliability level initial	Afkeur CC2-0
Reference period intial	30 jaar
Consequence class modified	CC2
Reliability level modified	Verbouw
Reference period modified	50 jaar
Wind zone	II
Wind speed	27,0 m/s
Terrain category	II
Reduction factor c_{dir}	1,00
Ice region phase conductor	B
Ice region earth conductor	B

Conductors back

Description	Voltage	Conductor Back	Bundle Ba	Ice region	Additional weight	Additional diameter	Catenary P_{back}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Conductors ahead

Description	Voltage	Conductor Ahead	Bundle Ah	Ice region	Additional weight	Additional diameter	Catenary P_{ahead}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Insulators *(1)*

Description	Suspension	Weight [kN]	Length [m]	Wind area [m^2]
Circuit 1	Halfverankering	2,00	4,30	1,00
Circuit 2	Halfverankering	2,00	4,30	1,00
Bliksemdraad 1	Vast (Bliksemdraad)	0,10	0,50	0,05
Bliksemdraad 2	Vast (Bliksemdraad)	0,10	0,50	0,05

1. Properties apply to the entire isolator set

Suspension height and position in mast

Circuits	Designation	Number	Suspension height	Attach point	Position in tower (3) Horizontal distance
Circuit 1	10	380ct1f1	28,2 m	32,5 m	-15,7 m
Circuit 1	11	380ct1f2	28,2 m	32,5 m	-8,7 m
Circuit 1	12	380ct1f3	39,5 m	43,8 m	-12,2 m
Circuit 2	20	380ct2f1	28,2 m	32,5 m	8,7 m
Circuit 2	21	380ct2f2	28,2 m	32,5 m	15,7 m
Circuit 2	22	380ct2f3	39,5 m	43,8 m	12,2 m
Bliksemdraad 1	1	bl1	43,3 m	43,8 m	-16,2 m
Bliksemdraad 2	3	bl2	43,3 m	43,8 m	16,2 m

1. Positive = adjacent mast higher
2. Positive = in direction of rotation coordinate system x => y

Project: KIJ-GT
Tower: S+0 II T
Number: 35

Height adjustment adjacent masts (wind and weight span adjustment)

	Back	Ahead	
Height increase for wind pressure	0,0 m	0,0 m	(positive: higher)
Height decrease for vertical load	0,0 m	0,0 m	(negative: decrease, more weight span)

Decrease: Niet in 0,9EG-combinaties

Height difference adjacent tower and change of direction with respect to Line direction

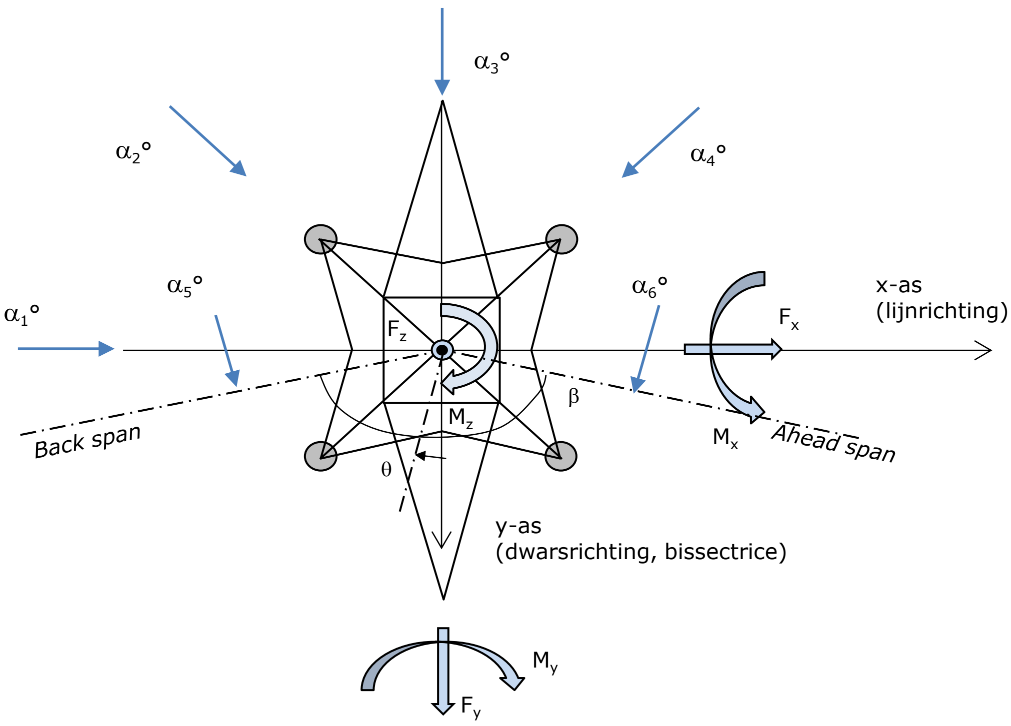
			Hoogteverschil		Richtingsverandering	
Circuits	Aanduiding	Nummer	Δh_back	Δh_ahead	Δy_back	Δy_ahead
Circuit 1	10	380ct1f1	0,1	0,0 m	0,0	0,0 m
Circuit 1	11	380ct1f2	0,1	0,0 m	0,0	0,0 m
Circuit 1	12	380ct1f3	0,1	0,0 m	0,0	0,0 m
Circuit 2	20	380ct2f1	0,1	0,0 m	0,0	0,0 m
Circuit 2	21	380ct2f2	0,1	0,0 m	0,0	0,0 m
Circuit 2	22	380ct2f3	0,1	0,0 m	0,0	0,0 m
Bliksemdraad 1	1	bl1	0,1	0,0 m	0,0	0,0 m
Bliksemdraad 2	3	bl2	0,1	0,0 m	0,0	0,0 m

Line and tower data

		Back	Ahead
		369,0	395,0 m
Ruling span √(ΣL³/ΣL)		376,2	376,2 m
Line angle	β	180 °	
Tower orientation with respect to bis	θ	0 °	
Section length		4495	4495 m
Height bottom of tower to ground level		0,5 m	
Wind directions considered	α_1	0 °	
Wind directions according to:	α_2	45 °	
Geleiderbelastingen	α_3	90 °	
	α_4	135 °	
	α_5	- °	
	α_6	- °	

Wind directions apply to the main direction of mast construction, not to the bisector.

Windrichtingen en positieve richtingen belastingen



Considered number of wind directions	
1a	4
3	4
4	1
6	1
Overig	1

Project: KIJ-GT
Tower: S+0 II T
Number: 35

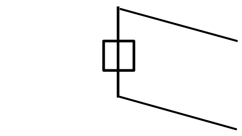
Absence of conductors

		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	380ct1f1	1	0	1	0	0,8	0
Circuit 1	380ct1f2	1	0	1	0	0,8	0
Circuit 1	380ct1f3	1	0	1	0	0,8	0
Circuit 2	380ct2f1	0	1	1	0	0,8	0
Circuit 2	380ct2f2	0	1	1	0	0,8	0
Circuit 2	380ct2f3	0	1	1	0	0,8	0
Bliksemdraad 1	bl1	1	0	1	0	1	0
Bliksemdraad 2	bl2	0	1	1	0	1	0

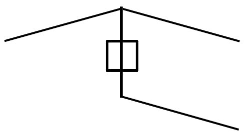
Load situations SPLS

Considered situations SPLS: SPLS for suspension tower not applicable

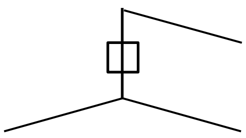
Principle of load situations:



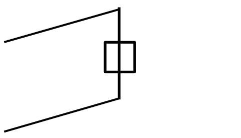
1. Ba All cts



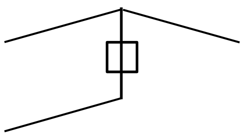
2. Ba ct1



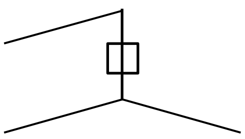
3. Ba ct2



4. Ah All cts



5. Ah ct1

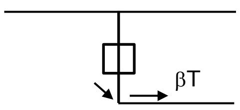


6. Ah ct2

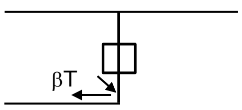
Load situation 5a. Conductor failure

Considered situations conductor failure 5a: 1, design assumption is symmetry back and ahead

Principle of load situations:



1. Ba



2. Ah

Project: KIJ-GT
Tower: S+0 II T
Number: 35

Load situations LC6. Construction and maintenance

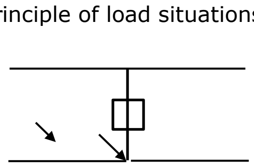
Under 6a, the load due to the presence of a line verhicle or line bicycle in combination with point load on the traverse is assesed.
Combination 6b does not contain any loads in conductor or on traverse. This combination has been added to be able to combine with separate control platforms, etc. The situations are applied in ULS and in every SPLS situation (in case of angle tower).

3,0 kN	2,0 kN
1,0 kN	1,0 kN

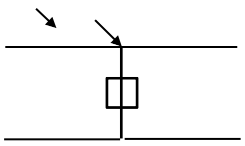
Considered situations construction and maintenance 6a: 1 up to 4, all possible situations

Presence line vehicle: Circuit, load present in all conductors of a circuit

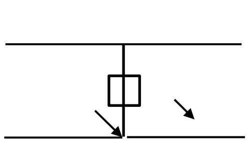
Principle of load situations:



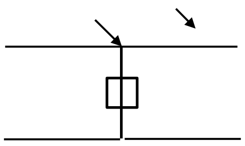
1. Ba Ct1



2. Ba Ct2



3. Ah Ct1



4. Ah Ct2

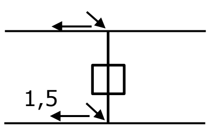
Load situations 8. Galloping as a static load

Conductor		
Suspension tower phase	0,866 W	1,5 W
Suspension tower earth	1,5 EDS	1,5 W
Strain tower phase and earth	1,5 EDS	1,5 W

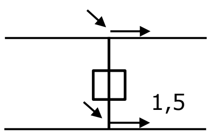
Considered situations galloping 8: None (existing structure)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principle of load situations:



1. Ba



2. Ah

Load combination 8. Galloping as a dynamic load

Only applies to tension towers
Load consists of EDS tensile load in one of the conductors on one side of the tower
Can be converted by user to fatigue spectrum via the load spectrum of table 4.11 / NL.1

DNV·GL

Project: KIJ-GT
Tower: S+0 II T
Number: 35

Tower structure

Properties

Tower type	Steunmast	
Tower designation	S+0 II T	
Base plate w.r.t. ground level	0,5	m
Tower height w.r.t. base plate	48,0	m
Tower self weight	205,0	kN

Width and slope at foundation	x-ri.	y-ri.	
Leg spread	9,00	9,00	m
Inclination of main leg	0,144	0,144	-
Horizontal force factor	1,4	1,4	-

Calculation Wind load

Dynamic factor G_T	1,00 *(Masthoogte < 60 m)*
Wind load diagonally to tower body proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Wind load diagonally on traverse proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Magnification factor diagonal wind to tower body	(1+0,2sin^2(2phi))
Magnification factor diagonal wind to cross arm	(1+0,2sin^2(2phi))
Magnification factor wind parallel to perpendicular to cross a	0,4

Properties mast sections line direction (front view, yz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	11,18	9,00	5,79	11,18	0,144	82,68	10,28	0,12	3,28
Middenstuk 1	21,18	5,79	4,44	10,00	0,068	51,15	8,08	0,16	3,12
Middenstuk 2	32,50	4,44	3,00	11,32	0,064	42,11	8,04	0,19	2,97
Bovenstuk 1	38,40	3,00	2,58	5,90	0,036	16,46	4,64	0,28	2,60
Bovenstuk 2	46,40	2,58	2,00	8,00	0,036	18,32	5,25	0,29	2,58
Topstuk	48,40	2,00		2,00		2,00	0,30	0,15	3,16
Ondertraverse	32,50	14,20		2,90		20,59	4,29	0,21	2,89
Boventraverse	43,80	15,10		2,50		18,88	4,17	0,22	2,84

Properties tower sections transverse direction (side view, xz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	11,18	9,00	5,79	11,18	0,144	82,68	10,28	0,12	3,28
Middenstuk 1	21,18	5,79	4,44	10,00	0,068	51,15	8,08	0,16	3,12
Middenstuk 2	32,50	4,44	3,00	11,32	0,064	42,11	8,04	0,19	2,97
Bovenstuk 1	38,40	3,00	2,58	5,90	0,036	16,46	4,64	0,28	2,60
Bovenstuk 2	46,40	2,58	2,00	8,00	0,036	18,32	5,25	0,29	2,58
Topstuk	48,40	2,00		2,00		2,00	0,30	0,15	3,16
Ondertraverse	32,50	14,20		2,90		20,59	4,29	0,21	2,89
Boventraverse	43,80	15,10		2,50		18,88	4,17	0,22	2,84

Note: Surface transverse direction is reduced in calculation.

Project: KIJ-GT
Tower: S+0 II T
Number: 35

Wind surface feeders telecom installations

Part	A (m^2/m)	Δh	A_1
Broekstuk 1	0,17	11,2	1,9
Middenstuk 1	0,17	10,0	1,7
Middenstuk 2	0,08	11,3	0,9
Bovenstuk 1	0,08	5,9	0,5
Bovenstuk 2	0,08	8,0	0,6

Input antennas

Description	A (m^2)	h (m)	C_f (m)
Antenne top	4,6	46	1,5
Antenne o.t.	2,3	20	1,5

Tower section loads longitudinal (x-direction) per wind direction

Description	p_w	F_{x1}	F_{x2}	F_{x3}	F_{x4}	h_{ef}	M_{y1}	M_{y2}	M_{y3}	M_{y4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,85	28,7	24,4	0,0	-24,4	5,6	160,6	136,3	0,0	-136,3
Middenstuk 1	1,00	25,2	21,4	0,0	-21,4	16,2	407,3	345,6	0,0	-345,6
Middenstuk 2	1,16	27,8	23,6	0,0	-23,6	26,8	745,1	632,3	0,0	-632,3
Bovenstuk 1	1,26	15,2	12,9	0,0	-12,9	35,5	538,1	456,6	0,0	-456,6
Bovenstuk 2	1,32	17,9	15,2	0,0	-15,2	42,4	759,2	644,2	0,0	-644,2
Topstuk	1,36	1,3	1,1	0,0	-1,1	47,4	61,1	51,8	0,0	-51,8
Ondertraverse	1,24	30,7	18,3	0,0	-18,3	33,5	1028,8	611,1	0,0	-611,1
Boventraverse	1,34	31,7	18,8	0,0	-18,8	44,6	1415,6	840,8	0,0	-840,8
Totaal		178,5	135,6	0,0	-135,6		5115,8	3718,7	0,0	-3718,7

Tower section loads longitudinal (y-direction) per wind direction

Description	p_w	F_{y1}	F_{y2}	F_{y3}	F_{x4}	h_{ef}	M_{x1}	M_{x2}	M_{x3}	M_{x4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,85	0,0	24,4	28,7	24,4	5,6	0,0	136,3	160,6	136,3
Middenstuk 1	1,00	0,0	21,4	25,2	21,4	16,2	0,0	345,6	407,3	345,6
Middenstuk 2	1,16	0,0	23,6	27,8	23,6	26,8	0,0	632,3	745,1	632,3
Bovenstuk 1	1,26	0,0	12,9	15,2	12,9	35,5	0,0	456,6	538,1	456,6
Bovenstuk 2	1,32	0,0	15,2	17,9	15,2	42,4	0,0	644,2	759,2	644,2
Topstuk	1,36	0,0	1,1	1,3	1,1	47,4	0,0	51,8	61,1	51,8
Ondertraverse	1,24	0,0	18,3	12,3	18,3	33,5	0,0	611,1	411,5	611,1
Boventraverse	1,34	0,0	18,8	12,7	18,8	44,6	0,0	840,8	566,2	840,8
Total		0,0	135,6	141,0	135,6		0,0	3718,7	3649,2	3718,7

Resulting loads from mast construction incl. Antenna without conductors level foundation (char. Value)

Load / wind direction	F_x	F_y	F_z	M_x	M_y	M_z
	[kN]	[kN]	[kN]	[kNm]	[kNm]	[kNm]
Permanente belasting	0	0	205	0	0	0
Windrichting 0°	191	0	0	0	5618	0
Windrichting 45°	145	145	0	4074	4074	0
Windrichting 90°	0	154	0	4151	0	0
Windrichting 135°	-145	145	0	4074	-4074	0

Project: KIJ-GT
Tower: S+0 II T
Number: 35

Intermediate results for conductor loads

Conductors back

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Conductors ahead

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Vertical load back

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Vertical load ahead

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	[N/m]	[N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Insulators

Conductor	$G_{isolator}$ [kN]	Number -	$F_{v,iso}$ [kN]	Length [m]	Wind surf. [m^2]	Wind heigth [m]	Pressure [kN/m^2]	Drag factor [-]	$F_{h,iso}$ [kN]
380ct1f1	2,00	1	2	4,3	1,0	30,85	1,21	1,2	1,45
380ct1f2	2,00	1	2	4,3	1,0	30,85	1,21	1,2	1,45
380ct1f3	2,00	1	2	4,3	1,0	42,15	1,32	1,2	1,58
380ct2f1	2,00	1	2	4,3	1,0	30,85	1,21	1,2	1,45
380ct2f2	2,00	1	2	4,3	1,0	30,85	1,21	1,2	1,45
380ct2f3	2,00	1	2	4,3	1,0	42,15	1,32	1,2	1,58
bl1	0,10	1	0,1	0,5	0,1	44,05	1,33	1,2	0,08
bl2	0,10	1	0,1	0,5	0,1	44,05	1,33	1,2	0,08

Project: KIJ-GT
Tower: S+0 II T
Number: 35

Wind load back

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	20,6	1,08	0,55	0,46	1,08	28,25	54,0	45,4	46,9	100,1	84,2
380ct1f2	20,6	1,08	0,55	0,46	1,08	28,25	54,0	45,4	46,9	100,1	84,2
380ct1f3	31,9	1,22	0,59	0,49	1,04	28,25	62,9	52,7	46,9	120,9	101,3
380ct2f1	20,6	1,08	0,55	0,46	1,08	28,25	54,0	45,4	46,9	100,1	84,2
380ct2f2	20,6	1,08	0,55	0,46	1,08	28,25	54,0	45,4	46,9	100,1	84,2
380ct2f3	31,9	1,22	0,59	0,49	1,04	28,25	62,9	52,7	46,9	120,9	101,3
bl1	36,3	1,27	0,60	0,50	1,16	22,24	19,4	16,3	41,5	37,6	31,5
bl2	36,3	1,27	0,60	0,50	1,16	22,13	19,4	16,2	41,4	37,5	31,4

Wind load ahead

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	19,4	1,06	0,55	0,46	1,08	28,25	52,8	44,4	46,9	97,4	81,9
380ct1f2	19,4	1,06	0,55	0,46	1,08	28,25	52,8	44,4	46,9	97,4	81,9
380ct1f3	30,7	1,21	0,58	0,49	1,04	28,25	62,1	52,1	46,9	118,9	99,7
380ct2f1	19,4	1,06	0,55	0,46	1,08	28,25	52,8	44,4	46,9	97,4	81,9
380ct2f2	19,4	1,06	0,55	0,46	1,08	28,25	52,8	44,4	46,9	97,4	81,9
380ct2f3	30,7	1,21	0,58	0,49	1,04	28,25	62,1	52,1	46,9	118,9	99,7
bl1	35,1	1,25	0,59	0,50	1,16	22,24	19,2	16,1	41,5	37,1	31,1
bl2	35,1	1,25	0,59	0,50	1,16	22,13	19,2	16,1	41,4	37,0	31,0

Project: KIJ-GT
Tower: S+0 II T
Number: 35

Auteur: TBR
Versie: v11.3

Conductor loads

Starting points

Consequence class: Afkeur CC2-0
Reference period: 30 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp °C	γ_G $G_{k,mast}$	γ_G $G_{k,geleider}$	Q_{pk}	γ_Q Q_{wk}	Q_{ik}	γ_a A_k
ULS 1a	Wind	10°	1,05	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,12	0,00	0,0
ULS 3	Wind+ice	-5°	1,05	1,05	0,00	0,34	0,97	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,05	0,00	0,34	0,97	0,0
ULS 4	Cold+wind	-20°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,05	0,00	0,22	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,05	1,05	1,20	0,22	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 7	Permanent	10°	1,15	1,15	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G G_k	γ_Q Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,05	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,05	1,05	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,05	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,05	1,05	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,05	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,05	1,05	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,05	1,05	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	0,94	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,28	0,88	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	4
Number of load combinations for ULS	36
Number of load combinations for SPLS	0
Number of load combinations for SLS	11
Number of concentrated loads	376

Project: KIJ-GT
Tower: S+0 II T
Number: 35

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-29,8	29,8	4,1	4,3	4,9	5,2
bl2	-30,0	30,0	4,1	4,3	4,9	5,2
380ct1f1	-110,4	110,4	12,0	12,5	15,0	16,0
380ct1f2	-110,4	110,4	12,0	12,5	15,0	16,0
380ct1f3	-113,0	113,0	13,9	14,7	15,0	16,0
380ct2f1	-110,4	110,4	12,0	12,5	15,0	16,0
380ct2f2	-110,4	110,4	12,0	12,5	15,0	16,0
380ct2f3	-113,0	113,0	13,9	14,7	15,0	16,0

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	381,6	381,7	381,8
bl2	381,6	381,7	381,8
380ct1f1	381,7	381,8	381,8
380ct1f2	381,7	381,8	381,8
380ct1f3	381,7	381,8	381,8
380ct2f1	381,7	381,8	381,8
380ct2f2	381,7	381,8	381,8
380ct2f3	381,7	381,8	381,8

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	381,8	381,8
bl2	381,8	381,8
380ct1f1	381,8	381,8
380ct1f2	381,8	381,8
380ct1f3	381,8	381,8
380ct2f1	381,8	381,8
380ct2f2	381,8	381,8
380ct2f3	381,8	381,8

Envelop of weight span over all combinations (incl. 0,9 combinations) For all conductors		Wind / Weight span ratio
Max. weight span	381,8 m	0,999 -
Min. weight span	381,5 m	0,999 -

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Project: KIJ-GT
Tower: S+0 II T
Number: 35

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	15,0	8,4	7,8	-31,5	31,4
bl2	15,0	8,4	7,8	-31,6	31,6
380ct1f1	51,3	24,6	31,0	-110,6	110,3
380ct1f2	51,3	24,6	31,0	-110,6	110,3
380ct1f3	51,3	28,6	31,0	-113,2	112,9
380ct2f1	51,3	24,6	31,0	-110,6	110,3
380ct2f2	51,3	24,6	31,0	-110,6	110,3
380ct2f3	51,3	28,6	31,0	-113,2	112,9

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	0,0	0,0	3,9	-15,0	15,0
bl2	0,0	0,0	3,9	-15,0	15,0
380ct1f1	0,0	0,0	19,5	-64,2	64,2
380ct1f2	0,0	0,0	19,5	-64,2	64,2
380ct1f3	0,0	0,0	19,5	-64,2	64,2
380ct2f1	0,0	0,0	19,5	-64,2	64,2
380ct2f2	0,0	0,0	19,5	-64,2	64,2
380ct2f3	0,0	0,0	19,5	-64,2	64,2

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	1,9	2,0
	bl2	1,9	2,0
	380ct1f1	9,4	10,1
	380ct1f2	9,4	10,1
	380ct1f3	9,4	10,1
	380ct2f1	9,4	10,1
	380ct2f2	9,4	10,1
	380ct2f3	9,4	10,1

Project: KIJ-GT
Tower: S+0 II T
Number: 35

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		0	172	131	6434	0	0
ULS 1a_0,9_90		0	172	131	6434	0	0
ULS 3_90		0	94	201	3539	0	0
ULS 3_0,9_90		0	94	201	3539	0	0
SLS 7		0	0	125	0	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

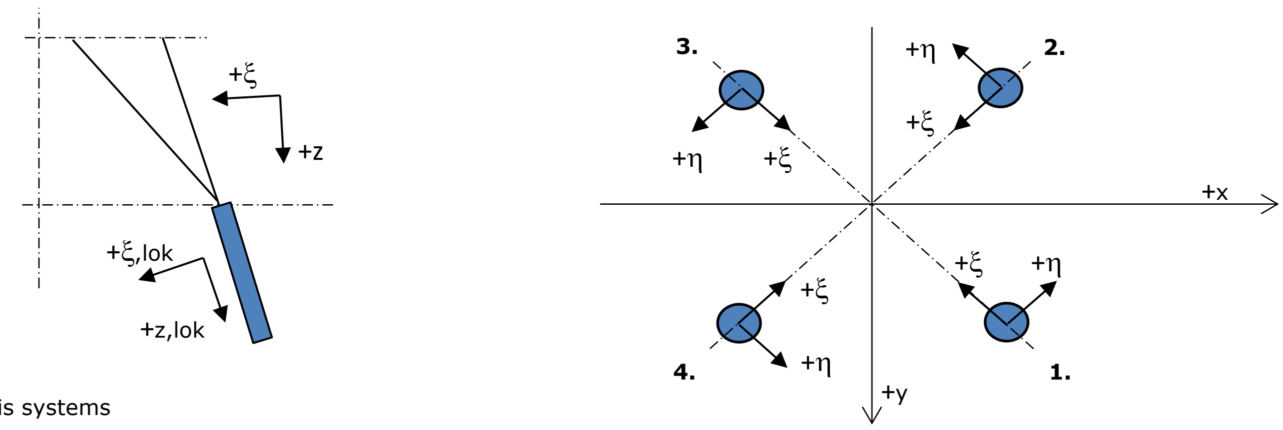
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	345	346	11100	0	0
ULS 3_90	0	146	416	4939	0	0
SLS 7	0	0	330	0	0	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_0,9_90	0	345	297	**11100**	0	0
ULS 1a_0	218	0	346	0	**6414**	0
ULS 5a Ba 10	51	0	329	133	1669	**-806**
ULS 1a_0,9_0,9_45	165	251	297	**7874**	**4649**	0

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_45	146	132	**782**	10	-197	-38	798
2	ULS 1a_0	72	-89	**443**	12	-114	-24	452
3	ULS 7	-19	-19	**95**	0	-27	-8	97
4	ULS 1a_135	-146	132	**782**	-10	-197	-38	798

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	0	0	0	0
2	ULS 1a_0,9_0,9_135	-114	100	**-622**	10	151	25	-634
3	ULS 1a_0,9_0,9_45	114	100	**-622**	-10	151	25	-634
4	ULS 1a_0,9_0,9_0	40	-57	**-282**	-12	68	11	-288

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_0,9_0,9_90	139	101	691	**27**	-170	-30	705
2	ULS 5a Ba 21	8	-58	182	**35**	-47	-10	186
3	ULS 5a Ba 21	-28	24	-3	**37**	-2	-3	-3
4	ULS 5a Ba 21	20	20	-18	**29**	0	-4	-18

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	ULS 5a Ba 10	8	58	182	**-35**	-47	-10	186
2	ULS 5a Ba 10	50	-13	168	**-27**	-45	-11	171
3	ULS 5a Ba 10	20	-20	-18	**-29**	0	-4	-18
4	ULS 5a Ba 10	-28	-24	-3	**-37**	-2	-3	-3

Project: KIJ-GT
Tower: S+0 II T
Number: 35

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	**0**	0	0	0
2	ULS 1a_0,9_0,9_135	-114	100	**-622**	**10**	151	25	-634
3	ULS 1a_0,9_0,9_45	114	100	**-622**	**-10**	151	25	-634
4	ULS 1a_0,9_0,9_0	40	-57	**-282**	**-12**	68	11	-288

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	17	17	82	0	-23	-7	84
2	SLS 7	17	-17	82	0	-23	-7	84
3	SLS 7	-17	-17	82	0	-23	-7	84
4	SLS 7	-17	17	82	0	-23	-7	84

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_45	146	132	**782**	10	-197	-38	798
Max. tension	ULS 1a_0,9_0,9_45	114	100	**-622**	-10	151	25	-634
Max. pos. torsie	ULS 5a Ba 21	-28	24	-3	**37**	-2	-3	-3
Max. neg. torsie	ULS 5a Ba 10	-28	-24	-3	**-37**	-2	-3	-3
Comb. tension+torsie	ULS 1a_0,9_0,9_45	114	100	**-622**	**-10**	151	25	-634

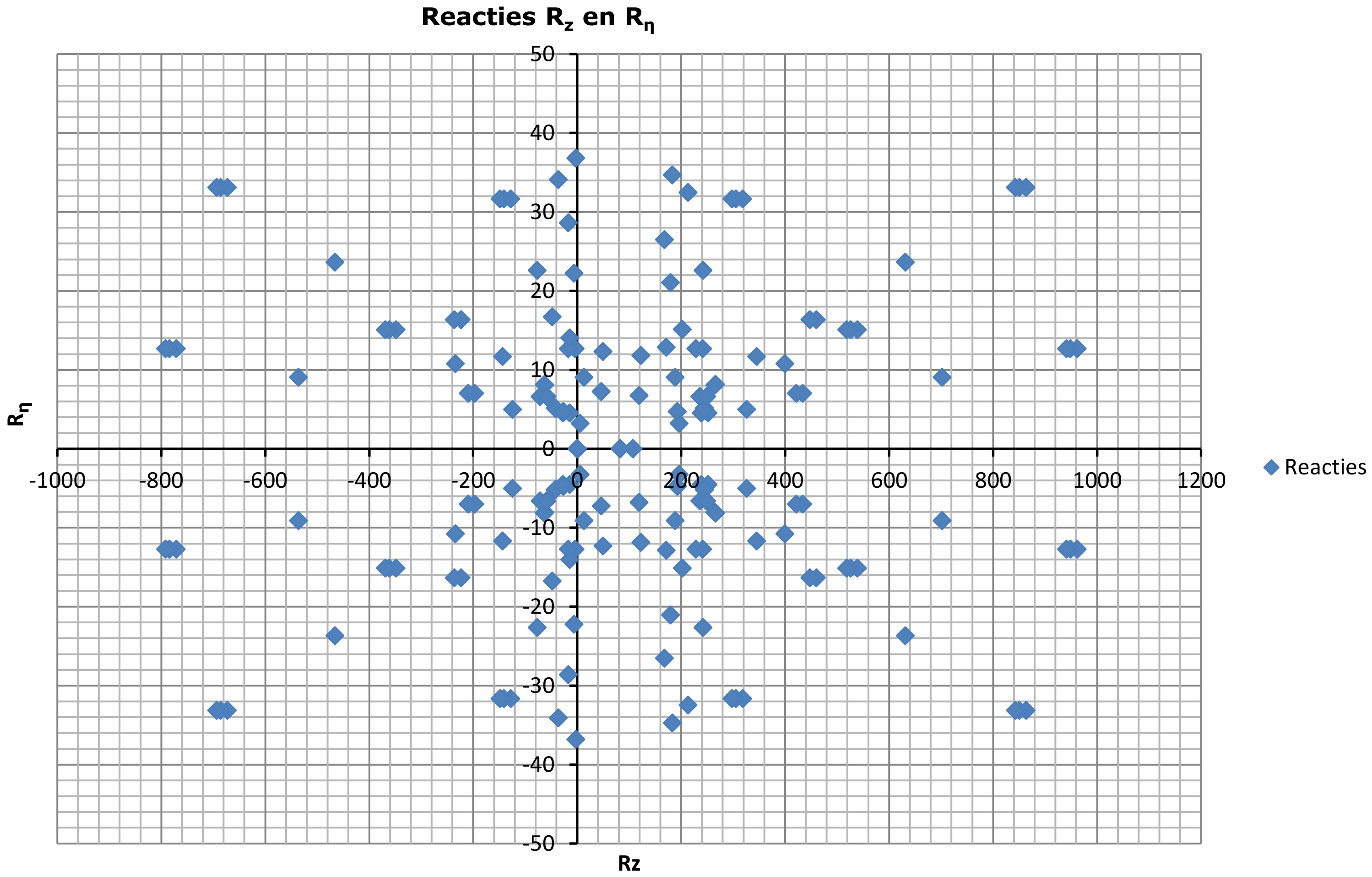
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	17	17	**82**	0	-23	-7	84
2	SLS 1a_135	-92	80	**-501**	9	121	19	-512
3	SLS 1a_45	92	80	**-501**	-9	121	19	-512
4	SLS 1a_0	29	-44	**-217**	-10	51	7	-221

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_45	125	113	**666**	9	-168	-33	680
2	SLS 1a_0	62	-77	**381**	10	-98	-21	389
3	SLS 7	-17	-17	**82**	0	-23	-7	84
4	SLS 1a_135	-125	113	**666**	-9	-168	-33	680

Project: KIJ-GT
Tower: S+0 II T
Number: 35



Project: KIJ-GT
Tower: S+0 II T
Number: 35

Auteur: TBR
Versie: v11.3

Conductor loads

Starting points

Consequence class	Verbouw CC2
Reference period	50 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,15	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,40	0,00	0,0
ULS 3	Wind+ice	-5°	1,15	1,15	0,00	0,42	1,30	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,15	0,00	0,42	1,30	0,0
ULS 4	Cold+wind	-20°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,15	0,00	0,28	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,15	1,15	1,30	0,28	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 7	Permanent	10°	1,30	1,30	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS	(strength, for angle towers: absence of conductors)			γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,15	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,15	1,15	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,15	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,15	1,15	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,15	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,15	1,15	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,15	1,15	0,0	0,24	0,0	0,0
SLS	(deformations, fatigue, EDS)							
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	1,00	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,30	1,00	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	4
Number of load combinations for ULS	36
Number of load combinations for SPLS	0
Number of load combinations for SLS	11
Number of concentrated loads	376

Project: KIJ-GT
Tower: S+0 II T
Number: 35

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-34,8	34,8	5,1	5,4	5,4	5,7
bl2	-35,1	35,1	5,1	5,4	5,4	5,7
380ct1f1	-128,4	128,4	15,0	15,6	17,7	18,9
380ct1f2	-128,4	128,4	15,0	15,6	17,7	18,9
380ct1f3	-131,7	131,7	17,4	18,3	17,7	18,9
380ct2f1	-128,4	128,4	15,0	15,6	17,7	18,9
380ct2f2	-128,4	128,4	15,0	15,6	17,7	18,9
380ct2f3	-131,7	131,7	17,4	18,3	17,7	18,9

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	381,6	381,7	381,8
bl2	381,6	381,7	381,8
380ct1f1	381,7	381,8	381,8
380ct1f2	381,7	381,8	381,8
380ct1f3	381,7	381,8	381,8
380ct2f1	381,7	381,8	381,8
380ct2f2	381,7	381,8	381,8
380ct2f3	381,7	381,8	381,8

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	381,8	381,8
bl2	381,8	381,8
380ct1f1	381,8	381,8
380ct1f2	381,8	381,8
380ct1f3	381,8	381,8
380ct2f1	381,8	381,8
380ct2f2	381,8	381,8
380ct2f3	381,8	381,8

Envelop of weight span over all combinations (incl. 0,9 combinations) For all conductors		Wind / Weight span ratio
Max. weight span	381,8 m	1,000 -
Min. weight span	381,4 m	0,998 -

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Project: KIJ-GT
Tower: S+0 II T
Number: 35

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	15,0	10,4	8,7	-34,9	34,8
bl2	15,0	10,4	8,6	-35,1	35,0
380ct1f1	51,3	30,6	36,6	-128,6	128,2
380ct1f2	51,3	30,6	36,6	-128,6	128,2
380ct1f3	51,3	35,6	36,6	-131,9	131,5
380ct2f1	51,3	30,6	36,6	-128,6	128,2
380ct2f2	51,3	30,6	36,6	-128,6	128,2
380ct2f3	51,3	35,6	36,6	-131,9	131,5

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	0,0	0,0	3,9	-15,0	15,0
bl2	0,0	0,0	3,9	-15,0	15,0
380ct1f1	0,0	0,0	19,5	-64,2	64,2
380ct1f2	0,0	0,0	19,5	-64,2	64,2
380ct1f3	0,0	0,0	19,5	-64,2	64,2
380ct2f1	0,0	0,0	19,5	-64,2	64,2
380ct2f2	0,0	0,0	19,5	-64,2	64,2
380ct2f3	0,0	0,0	19,5	-64,2	64,2

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	1,9	2,0
	bl2	1,9	2,0
	380ct1f1	9,4	10,1
	380ct1f2	9,4	10,1
	380ct1f3	9,4	10,1
	380ct2f1	9,4	10,1
	380ct2f2	9,4	10,1
	380ct2f3	9,4	10,1

Project: KIJ-GT
Tower: S+0 II T
Number: 35

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		0	215	144	8014	0	0
ULS 1a_0,9_90		0	215	144	8014	0	0
ULS 3_90		0	118	237	4409	0	0
ULS 3_0,9_90		0	118	237	4409	0	0
SLS 7		0	0	125	0	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

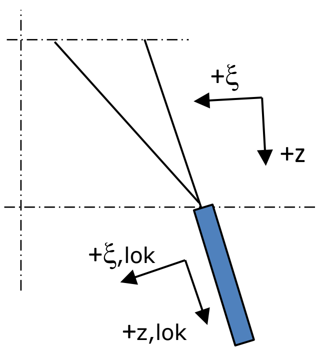
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	430	379	13825	0	0
ULS 3_90	0	182	473	6152	0	0
SLS 7	0	0	330	0	0	0

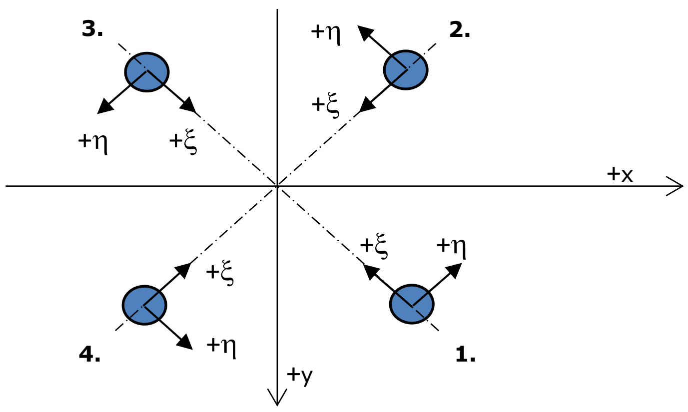
Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_0,9_90	0	430	297	**13825**	0	0
ULS 1a_0	271	0	379	0	**7989**	0
ULS 5a Ba 10	51	0	329	133	1669	**-806**
ULS 1a_0,9_0,9_45	205	313	297	**9807**	**5791**	0

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg





Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_45	180	162	**961**	13	-242	-46	981
2	ULS 1a_0	87	-108	**539**	15	-138	-29	550
3	ULS 7	-22	-22	**107**	0	-30	-9	109
4	ULS 1a_135	-180	162	**961**	-13	-242	-46	981

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	0	0	0	0
2	ULS 1a_0,9_0,9_135	-146	128	**-792**	13	194	33	-808
3	ULS 1a_0,9_0,9_45	146	128	**-792**	-13	194	33	-808
4	ULS 1a_0,9_0,9_0	53	-74	**-370**	-15	90	15	-377

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_0,9_0,9_90	169	122	842	**33**	-206	-35	859
2	ULS 5a Ba 21	8	-58	182	**35**	-47	-10	186
3	ULS 5a Ba 21	-28	24	-3	**37**	-2	-3	-3
4	ULS 5a Ba 21	20	20	-18	**29**	0	-4	-18

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	ULS 5a Ba 10	8	58	182	**-35**	-47	-10	186
2	ULS 5a Ba 10	50	-13	168	**-27**	-45	-11	171
3	ULS 1a_0,9_0,9_90	139	93	-694	**-33**	164	23	-708
4	ULS 5a Ba 10	-28	-24	-3	**-37**	-2	-3	-3

Project: KIJ-GT
Tower: S+0 II T
Number: 35

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	**0**	0	0	0
2	ULS 1a_0,9_0,9_135	-146	128	**-792**	**13**	194	33	-808
3	ULS 1a_0,9_0,9_45	146	128	**-792**	**-13**	194	33	-808
4	ULS 1a_0,9_0,9_0	53	-74	**-370**	**-15**	90	15	-377

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	17	17	82	0	-23	-7	84
2	SLS 7	17	-17	82	0	-23	-7	84
3	SLS 7	-17	-17	82	0	-23	-7	84
4	SLS 7	-17	17	82	0	-23	-7	84

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_45	180	162	**961**	13	-242	-46	981
Max. tension	ULS 1a_0,9_0,9_45	146	128	**-792**	-13	194	33	-808
Max. pos. torsie	ULS 5a Ba 21	-28	24	-3	**37**	-2	-3	-3
Max. neg. torsie	ULS 5a Ba 10	-28	-24	-3	**-37**	-2	-3	-3
Comb. tension+torsie	ULS 1a_0,9_0,9_45	146	128	**-792**	**-13**	194	33	-808

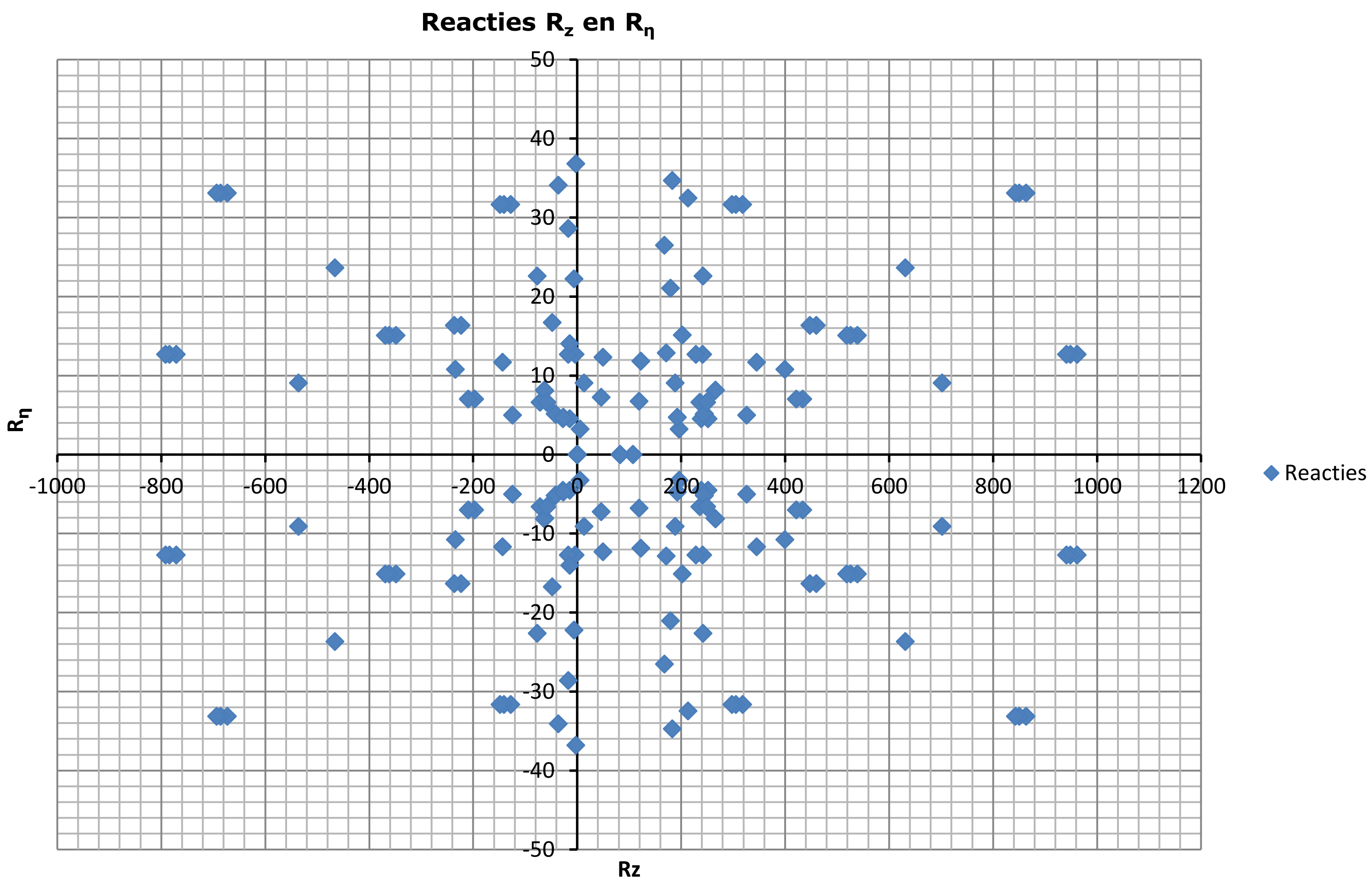
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	17	17	**82**	0	-23	-7	84
2	SLS 1a_135	-98	85	**-536**	9	130	21	-547
3	SLS 1a_45	98	85	**-536**	-9	130	21	-547
4	SLS 1a_0	32	-47	**-235**	-11	56	8	-239

Maximum compression load - SLS

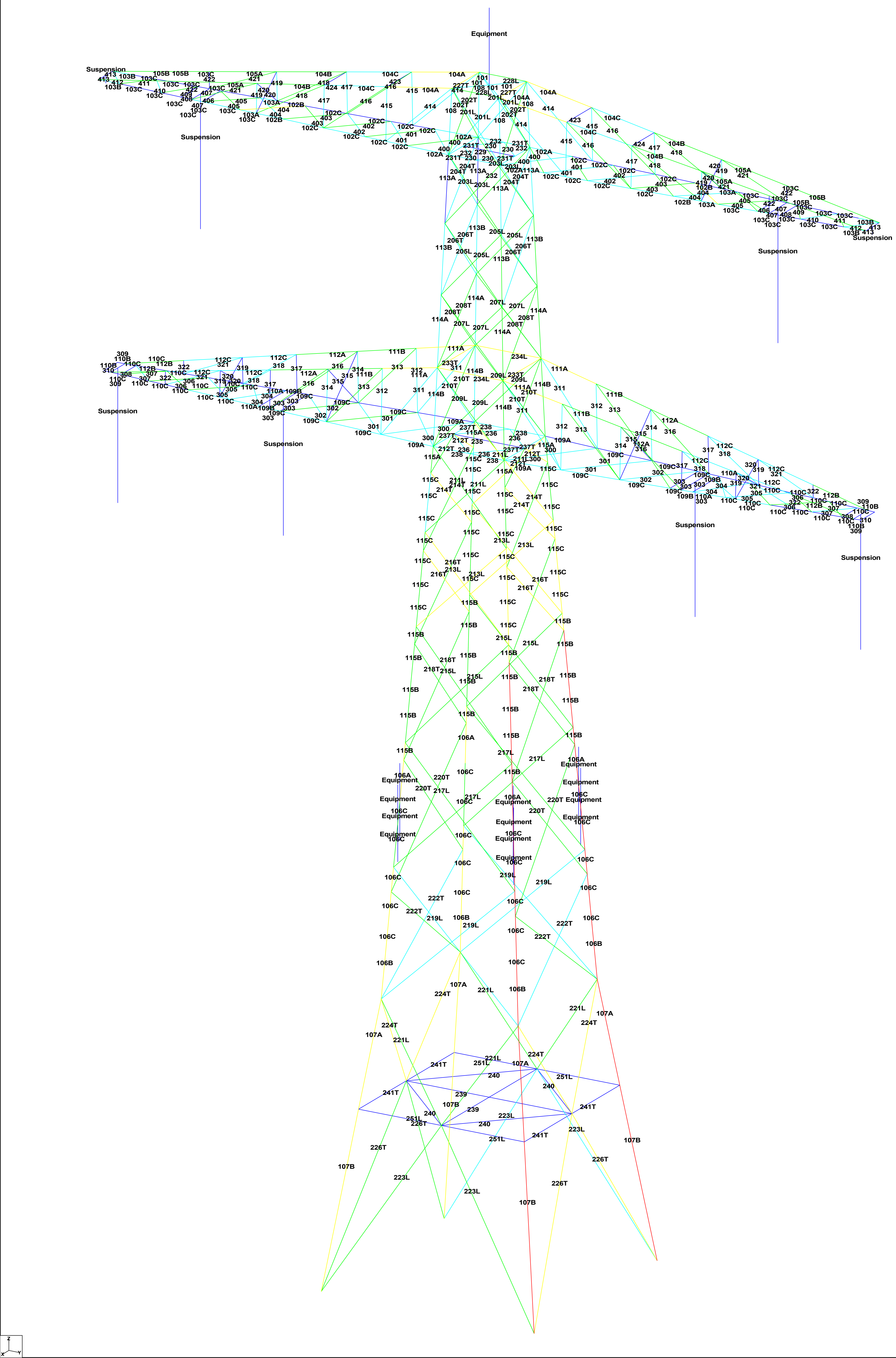
Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_45	131	119	**701**	9	-177	-34	716
2	SLS 1a_0	65	-80	**399**	11	-103	-22	408
3	SLS 7	-17	-17	**82**	0	-23	-7	84
4	SLS 1a_135	-131	119	**701**	-9	-177	-34	716

Project: KIJ-GT
Tower: S+0 II T
Number: 35



APPENDIX B PLS-TOWER OUTPUT

DNV GL Nederlands BV, Project: "S+0 (hv) II T"
Tower Version 16.12, 12:00:01 Tuesday, 21 April, 2020
Undeformed geometry displayed



% Usage Legend
0 <= % < 25
25 <= % < 50
50 <= % < 75
75 <= % < 100
100 <= %

Assessment of groups for initial mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0 T
Mast 35

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compression)	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)	Exceedance (Tens)
101		100x100x6	S235	2M16-5.6t	1.00	1.00	1.00	72	0.0		183.6	75.4	103.7	0.00		26.9	ULS 3_45	144.1	75.4	76.8	0.36	
108		90x90x8	S235	5M16-5.6t	1.00	1.00	1.00	146	-37.6	ULS 5a Ba 22	112.9	188.4	345.6	0.33		0.0		285.6	188.4	298.7	0.00	
113A		90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	76	-75.1	ULS 1a_135	251.3	338.9	414.7	0.30		28.2	ULS 1a_0,9_0,9_45	252.5	338.9	297.7	0.11	
114A		100x100x10	S235	4M24-5.6t	0.50	0.50	0.50	72	-214.3	ULS 1a_45	355.2	338.9	518.4	0.63		160.6	ULS 1a_0,9_0,9_135	362.9	338.9	443.1	0.47	
115A		150x150x10	S235	6M24-5.6t	1.77	1.37	1.14	39	-381.9	ULS 1a_45	643.5	508.3	777.6	0.75		266.8	ULS 1a_0,9_0,9_135	624.7	508.3	664.6	0.52	
106A		150x150x12	S235	8M24-5.6t	1.66	1.73	1.38	76	-700.1	ULS 1a_135	628.6	677.8	1244.2	1.11	knik, afschuiving	558.9	ULS 1a_0,9_0,9_135	740.3	677.8	1063.4	0.82	
106C		150x150x12	S235		1.81	1.89	1.51	87	-702.7	ULS 1a_135	575.2	0.0	0.0	1.22	knik	653.9	ULS 1a_0,9_0,9_45	817.8	0.0	0.0	0.80	
107A		150x150x12	S235	8M24-5.6t	0.33	0.33	0.33	49	-738.0	ULS 1a_45	735.4	677.8	1244.2	1.09	knik, afschuiving	610.5	ULS 1a_0,9_0,9_45	740.3	677.8	1063.4	0.90	
201L		70x70x7	S235	1M24-5.6t	0.52	0.52	0.52	127	-22.3	ULS 5a Ba 22	75.8	84.7	90.7	0.29		17.3	ULS 5a Ba 22	88.7	84.7	64.2	0.27	
202T		50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	178	-14.9	ULS 5a Ba 22	25.7	37.7	43.2	0.58		6.0	ULS 5a Ba 22	37.4	37.7	22.0	0.27	
203L		100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	93	-109.2	ULS 5a Ba 12	207.7	169.4	207.4	0.64		116.5	ULS 5a Ba 22	181.4	169.4	177.2	0.69	
204T		100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	93	-123.2	ULS 5a Ba 12	256.2	254.2	388.8	0.48		121.7	ULS 5a Ba 22	261.1	254.2	332.3	0.48	
205L		100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	99	-105.3	ULS 5a Ba 22	198.3	169.4	207.4	0.62		97.7	ULS 5a Ba 12	181.4	169.4	177.2	0.58	
206T		100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	99	-109.6	ULS 5a Ba 22	244.6	254.2	388.8	0.45		110.5	ULS 5a Ba 12	261.1	254.2	332.3	0.43	
207L		100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	103	-87.4	ULS 5a Ba 12	190.8	169.4	207.4	0.52		94.2	ULS 5a Ba 22	181.4	169.4	177.2	0.56	
208T		100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	104	-99.1	ULS 5a Ba 12	235.3	169.4	259.2	0.59		97.7	ULS 5a Ba 22	224.3	169.4	221.5	0.58	
209L		100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	112	-95.3	ULS 5a Ba 22	177.9	169.4	207.4	0.56		94.5	ULS 5a Ba 22	181.4	169.4	177.2	0.56	
210T		100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	112	-101.5	ULS 5a Ba 12	219.3	169.4	259.2	0.60		79.6	ULS 5a Ba 22	224.3	169.4	221.5	0.47	
211L		100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	76	-94.5	ULS 5a Ba 10	197.1	169.4	207.4	0.56		89.0	ULS 5a Ba 10	125.9	169.4	116.0	0.77	
212T		100x75x9	S235	2M24-5.6t	1.00	0.55	0.55	65	-96.1	ULS 5a Ba 21	245.9	169.4	233.3	0.57		93.0	ULS 5a Ba 21	121.3	169.4	130.6	0.77	
213L		100x75x7	S235	2M24-5.6t	0.52	0.25	0.25	85	-77.3	ULS 5a Ba 10	161.2	169.4	181.4	0.48		81.0	ULS 5a Ba 10	98.2	169.4	101.5	0.83	
214T		100x75x9	S235	2M24-5.6t	0.52	0.25	0.25	74	-96.3	ULS 5a Ba 21	221.2	169.4	233.3	0.57		99.4	ULS 5a Ba 21	119.9	169.4	130.6	0.83	
215L		100x75x7	S235	2M24-5.6t	0.52	0.25	0.25	101	-73.7	ULS 5a Ba 10	141.1	169.4	181.4	0.52		69.8	ULS 5a Ba 10	100.4	169.4	101.5	0.70	
216T		100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	86	-90.6	ULS 5a Ba 21	182.6	169.4	207.4	0.53		87.2	ULS 5a Ba 21	110.7	169.4	116.0	0.79	
217L		100x75x7	S235	2M20-5.6t	0.52	0.25	0.25	112	-59.3	ULS 5a Ba 10	129.0	117.6	151.2	0.50		61.9	ULS 5a Ba 10	115.4	117.6	106.9	0.58	
218T		100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	102	-80.2	ULS 5a Ba 21	159.3	169.4	207.4	0.50		82.9	ULS 5a Ba 21	113.2	169.4	116.0	0.73	
219L		100x75x8	S235	2M20-5.6t	0.52	0.25	0.25	123	-53.3	ULS 1a_90	133.9	117.6	172.8	0.45		50.1	ULS 5a Ba 10	128.6	117.6	104.7	0.48	
220T		100x75x9	S235	2M20-5.6t	0.52	0.25	0.25	117	-72.6	ULS 5a Ba 21	155.5	117.6	194.4	0.62		69.0	ULS 5a Ba 21	146.1	117.6	137.5	0.59	
221L		130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	124	-69.1	ULS 5a Ba 21	147.8	117.6	172.8	0.59		56.7	ULS 5a Ba 10	113.0	117.6	136.1	0.50	
222T		100x75x7	S235	2M20-5.6t	0.52	0.25	0.25	113	-53.4	ULS 5a Ba 21	127.3	117.6	151.2	0.45		55.8	ULS 5a Ba 21	107.3	117.6	91.6	0.61	
223L		100x75x7	S235	2M20-5.6t	0.33	0.20	0.20	105	-72.1	ULS 5a Ba 21	144.3	117.6	151.2	0.61		57.3	ULS 5a Ba 10	119.5	117.6	122.2	0.49	
224T		130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	124	-94.9	ULS 1a_90	147.8	117.6	172.8	0.81		84.3	ULS 1a_0,9_0,9_90	113.0	117.6	136.1	0.75	
226T		100x75x7	S235	2M20-5.6t	0.33	0.20	0.20	105	-94.8	ULS 1a_90	144.3	117.6	151.2	0.81		81.6	ULS 1a_0,9_0,9_90	119.5	117.6	122.2	0.69	
227T		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	206	-18.8	ULS 3_90	21.0	37.7	43.2	0.90		0.0		37.4	37.7	22.0	0.00	
228L		80x80x8	S235	4M20-5.6t	1.00	1.00	1.00	128	0.0		122.6	235.2	345.6	0.00		99.5	ULS 3_0	168.3	235.2	244.4	0.59	
229		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	225	-0.4	ULS 3_0	18.5	37.7	43.2	0.02		0.0		37.4	37.7	25.7	0.00	
230		80x80x8	S235	2M24-5.6t	1.00	1.00	1.00	99	-73.7	ULS 5a Ba 12	156.9	169.4	207.4	0.47		73.8	ULS 5a Ba 12	206.0	169.4	159.5	0.46	
231T		100x75x7	S235	3M24-5.6t	2.00	1.00	1.00	69	-45.7	ULS 5a Ba 22	182.6	254.2	272.2	0.25		63.7	ULS 5a Ba 22	214.1	254.2	217.6	0.30	
232		150x100x12	S235	8M24-5.6t	2.00	1.00	1.00	51	-245.2	ULS 5a Ba 12	512.4	677.8	1244.2	0.48		95.1	ULS 5a Ba 12	582.2	677.8	755.0	0.16	
233T		70x70x6	S235	1M20-5.6t	0.85	0.85	0.85	172	-38.1	ULS 1a_0,9_0,9_90	45.2	58.8	64.8	0.84		49.5	ULS 1a_90	82.9	58.8	52.4	0.95	
234L		80x80x8	S235	3M24-5.6t	1.00	1.00	1.00	178	0.0		82.2	254.2	311.0	0.00		145.5	ULS 3_0	169.8	254.2	239.3	0.86	
235		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	309	-0.5	ULS 3_90	11.3	37.7	43.2	0.05		0.0		37.4	37.7	22.0	0.00	
236		100x100x8	S235	2M24-5.6t	1.00	1.00	1.00	108	-75.6	ULS 5a Ba 21	182.9	169.4	207.4	0.45		75.9	ULS 5a Ba 21	208.1	169.4	177.2	0.45	
237T		100x75x7	S235	4M24-5.6t	1.00	1.00	1.00	94	-42.5	ULS 5a Ba 22	157.6	338.9	362.9	0.27		69.1	ULS 5a Ba 12	214.1	338.9	290.1	0.32	
238		150x100x14	S235	11M24-5.6t	2.00	1.00	1.00	70	-247.2	ULS 5a Ba 21	526.8	931.9	1995.8	0.47		74.1	ULS 5a Ba 21	666.7	931.9	1211.2	0.11	
239		100x50x6	S235	1M16-5.6t	0.50	0.50	0.50	327	-0.5	ULS 1a_90	18.6	37.7	51.8	0.03		0.0		55.3	37.7	28.0	0.00	
240		60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	272	-1.6	ULS 1a_90	14.1	37.7	43.2	0.11		3.1	ULS 1a_0,9_0,9_135	60.5	37.7	26.7	0.12	
241T		70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	255	-3.8	ULS 1a_135	28.9	37.7	51.8	0.13		1.3	ULS 1a_0,9_0,9_0	89.9	37.7	38.4	0.03	
251L		70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	255	-3.8	ULS 1a_135	28.9	37.7	51.8	0.13		1.0	ULS 1a_0,9_0,9_135	89.9	37.7	38.4	0.03	
113B		90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	79	-155.0	ULS 1a_45	245.5	338.9	414.7	0.63		104.2	ULS 1a_0,9_0,9_135	252.5	338.9	354.5	0.41	
114B		100x100x10	S235	6M24-5.6t	0.50	0.50	0.50	78	-250.0	ULS 1a_45	340.4	508.3	777.6	0.73		162.4	ULS 1a_0,9_0,9_135	362.9	508.3	651.3	0.45	
115B		150x150x10	S235	8M24-5.6t	4.00	4.23	3.33	76	-670.5	ULS 1a_135	530.0	677.8	1036.8	1.27	knik	527.9	ULS 1a_0,9_0,9_45	624.7	677.8	886.2	0.85	
115C		150x150x10	S235		3.14	2.74	2.28	57	-511.3	ULS 1a_135	593.8	0.0	0.0	0.86		381.4	ULS 1a_0,9_0,9_45	688.6	0.0	0.0	0.55	
106B		150x150x12	S235	8M24-5.6t	0.76	1.28	0.63	60	-799.7	ULS 1a_135	696.2	677.8	1244.2	1.18	knik, afschuiving	652.8	ULS 1a_0,9_0,9_45	740.3	677.8	1063.4	0.96	
107B		150x150x12	S235	8M24-5.6t	0.20	0.20	0.20	48	-740.7	ULS 1a_45	736.7	677.8	1244.2	1.09	knik, afschuiving	607.7	ULS 1a_0,9_0,9_45	740.3	677.8	1063.4	0.90	
102A		150x150x12	S235	8M24-5.6t	1.00	1.50	1.00	61	-302.2	ULS 5a Ba 12	689.3	677.8	1244.2	0.45		172.0	ULS 5a Ba 22	740.3	677.8	755.0	0.25	
102B		150x150x12	S235	6M24-5.6t	2.52	1.61	1.00	63	-142.5	ULS 5a Ba 12	682.7	508.3	933.1	0.28		36.9	ULS 5a Ba 22	740.3	508.3	797.5	0.07	
102C		150x150x12	S235		3.01	2.00	1.00	59	-273.8	ULS 5a Ba 12	698.8	0.0	0.0	0.39		149.1	ULS 5a Ba 22	817.8	0.0	0.0	0.18	
103A		120x120x8	S235	6M24-5.6t	2.64	4.00	1.00	76	-131.8	ULS 5a Ba 12	340.1	508.3	622.1	0.39		47.8	ULS 5a Ba 22	379.5	508.3	531.7	0.13	
103B		120x120x8	S235	2M16-5.6t	2.00	4.44	2.00	108	-30.5	ULS 6a_90 Ah Ct1	249.9	75.4	138.2	0.40		0.0		316.6	75.4	138.2	0.00	
103C		120x120x8	S235		1.71	1.00	1.00	76	-94.0	ULS 5a Ba 1	340.3	0.0	0.0	0.28		21.2	ULS 5a Ba 1	441.8	0.0	0.0	0.05	
104A		100x65x7*	S235	4M20-5.6t	1.00	1.00	1.00	202	0.0		63.1	235.2	302.4	0.00		107.6	ULS 3_0	115.2	235.2	207.0	0.93	
104B		100x65x7*	S235	3M20-5.6t	1.00	1.00	1.00	209	0.0		60.1	176.4	226.8	0.00		74.5	ULS 3_0	137.8	176.4	155.3	0.54	
104C		100x65x7*	S235		1.00	1.00	1.00	194	0.0		66.4	0.0	0.0	0.00		94.8	ULS 3_0	263.2	0.0	0.0	0.36	
105A		60x60x5	S235	2M16-5.6t	1.00	2.43	1.00	380	0.0		11.8	75.4	86.4	0.00		30.0	ULS 6a_90 Ah Ct2	98.8	75.4	56.0	0.54	
105B		60x60x5	S235	2M16-5.6t	1.00	1.70	1.00	379	0.0		11.8	75.4	86.4	0.00		30.0	ULS 6a_90 Ah Ct1	65.9	75.4	56.0	0.54	
415		60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	180	-8.2	ULS 3_0	30.7	37.7	43.2	0.27		0.0		60.5	37.7	26.7	0.00	
417		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	170	-9.3	ULS 3_0	27.4	37.7	43.2	0.34		0.0		37.4	37.7	18.4	0.00	
419		75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	107	-11.4	ULS 3_0	55.1	37.7	43.2	0.30		0.0		37.4	37.7	22.0	0.00	
422		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	70	-0.5	ULS 6a_90 Ah Ct1	58.8	37.7	43.2	0.01		0.0		37.4	37.7	18.4	0.00	
414		60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	325	0.0		12.6	37.7	43.2	0.00		13.2	ULS 3_0	60.5	37.7	32.0	0.41	
416		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	353	0.0		9.1	37.7	43.2	0.00		16.5	ULS 3_0	37.4	37.7	22.0	0.75	
418		50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	344	0.0		11.9	75.4	86.4	0.00		25.2	ULS 3_0	56.2	75.4	44.1	0.57	
421		60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	259	0.0		26.8	117.6	129.6	0.00		48.3	ULS 3_0	77.4	117.6	88.7	0.62	
420		45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	111	-1.6	ULS 1a_0,9_0,9_0	39.6	20.2	32.4	0.08		1.5	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.07	
400		60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	124	-20.7	ULS 5a Ba 22	48.1	58.8	54.0	0.43		19.4	ULS 5a Ba 12	54.7	58.8	37.0	0.53	
401		60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	119	-23.2	ULS 5a Ba 12	50.2	58.8	54.0	0.46		23.7	ULS 5a Ba 22	54.7	58.8	37.0	0.64	
402		60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	114	-25.8	ULS 5a Ba 22	52.1	58.8	54.0	0.50		25.5	ULS 5a Ba 12	54.7	58.8	37.0	0.69	
403		60x60x6	S235	1M20-5.6t	0.52	0.52	0.52	108	-29.6	ULS 5a Ba 12	65.2	58.8	64.8	0.50		28.7	ULS 5a Ba 22	65.7	58.8	44.4	0.65	
404		70x70x6	S235	1M24-5.6t	0.53	0.53	0.53	93	-32.0	ULS 5a Ba 22	86.5	84.7	77.8	0.41		34.1	ULS 5a Ba 12	76.0	84.7	44.0	0.77	
405		75x50x7	S235	1M24-5.6t	0.53	0.53	0.53	107	-41.9	ULS 5a Ba 12	76.2	84.7	90.7	0.55		38.4	ULS 5a Ba 22	98.8	84.7	58.0	0.66	
409		55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	142	-5.4	ULS 1a_135	37.9	37.7	43.2	0.14		16.3	ULS 5a Ba 1	53.3	37.7	32.0	0.51	
410		55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	140	-16.7	ULS 5a Ba 1	38.5	37.7	43.2	0.44		4.2	ULS 1a_135	53.3	37.7	32.0	0.13	
411		55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	135	-3.1	ULS 1a_135	40.2	37.7	43.2	0.08		17.1	ULS 5a Ba 1	53.3	37.7	32.0	0.53	
412		55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	129	-17.7	ULS 5a Ba 1	42.0	37.7	43.2	0.47		2.6	ULS 1a_0,9_0,9_135	53.3	37.7	32.0	0.08	
406		HEB160	S235		1.00	1.00	1.00	33	-2.0	ULS 1a_0,9_0,9_90	991.1	0.0	0.0	0.00		5.8	ULS 1a_90	1276.1	0.0	0.0	0.00	
407		HEB160	S235		2.00	2.00	2.00	32	-26.4	ULS 5a Ba 12	994.8	0.0	0.0	0.03		25.1	ULS 5a Ba 22	1276.1	0.0	0.0	0.02	

DNV·GL

Assessment of groups for initial mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0 T
Mast 35

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compression)	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)	Exceedance (Tens)
408		HEB160	S235		1.00	1.00	1.00	32	**-7.0**	ULS 5a Ba 1	998.4	0.0	0.0	0.01		**3.9**	ULS 1a_135	1276.1	0.0	0.0	0.00	
413		HEB160	S235	2M16-5.6t	2.00	2.00	2.00	25	**-1.4**	ULS 1a_0,9_0,9_135	1067.2	75.4	138.2	0.02		**14.2**	ULS 5a Ba 1	1296.6	75.4	124.6	0.19	
423		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	187	**0.0**	ULS 1a_90	24.0	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00	
424		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	169	**0.0**	ULS 3_90	27.5	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00	
111A		80x80x8	S235	3M24-5.6t	1.00	2.00	1.00	203	**0.0**		65.4	254.2	311.0	0.00		**131.5**	ULS 3_45	160.8	254.2	259.0	0.82	
111B		80x80x8	S235	3M20-5.6t	1.00	2.00	1.00	202	**0.0**		65.8	176.4	259.2	0.00		**116.3**	ULS 3_0	168.3	176.4	209.5	0.69	
112A		70x70x7	S235	3M20-5.6t	1.00	1.88	1.00	227	**0.0**		42.7	176.4	226.8	0.00		**92.2**	ULS 3_0	125.5	176.4	155.3	0.73	
112B		70x70x7	S235	3M20-5.6t	1.00	2.00	1.00	232	**0.0**		41.4	176.4	226.8	0.00		**80.6**	ULS 3_0	125.5	176.4	155.3	0.64	
112C		70x70x7	S235		1.00	2.14	1.00	227	**0.0**		42.7	0.0	0.0	0.00		**88.3**	ULS 3_0	220.9	0.0	0.0	0.40	
110A		120x120x11	S235	6M24-5.6t	1.64	1.00	1.00	60	**-191.1**	ULS 5a Ba 10	508.6	508.3	855.4	0.38		**104.3**	ULS 5a Ba 10	513.2	508.3	731.1	0.21	
110B		120x120x11	S235		1.00	1.00	1.00	13	**-0.4**	ULS 1a_0,9_0,9_90	599.7	0.0	0.0	0.00		**0.4**	ULS 1a_90	599.7	0.0	0.0	0.00	
110C		120x120x11	S235		1.71	1.29	1.00	66	**-158.9**	ULS 5a Ba 10	492.8	0.0	0.0	0.32		**80.7**	ULS 5a Ba 10	599.7	0.0	0.0	0.13	
109A		150x100x14	S235	11M24-5.6t	1.00	0.52	0.52	56	**-301.6**	ULS 5a Ba 10	673.7	931.9	1995.8	0.45		**143.4**	ULS 5a Ba 10	666.7	931.9	1211.2	0.22	
109B		150x100x14	S235	6M24-5.6t	4.78	1.00	1.00	47	**-206.3**	ULS 5a Ba 10	703.8	508.3	1088.6	0.41		**119.3**	ULS 5a Ba 10	666.7	508.3	930.5	0.23	
109C		150x100x14	S235		1.00	0.52	0.52	58	**-277.1**	ULS 5a Ba 10	665.2	0.0	0.0	0.42		**131.9**	ULS 5a Ba 10	775.5	0.0	0.0	0.17	
312		70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	185	**-14.0**	ULS 3_45	41.1	58.8	64.8	0.34		**0.0**		82.9	58.8	39.3	0.00	
314		70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	148	**-15.1**	ULS 3_135	54.9	58.8	64.8	0.27		**0.0**		82.9	58.8	39.3	0.00	
317		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	154	**-3.0**	ULS 1a_0	31.0	37.7	43.2	0.10		**0.0**		37.4	37.7	18.4	0.00	
319		75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-2.6**	ULS 1a_0	59.5	37.7	43.2	0.07		**0.0**		37.4	37.7	18.4	0.00	
322		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	53	**-1.0**	ULS 3_90	63.5	37.7	43.2	0.03		**0.0**		37.4	37.7	18.4	0.00	
311		60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	332	**0.0**		12.1	58.8	54.0	0.00		**17.0**	ULS 3_135	54.7	58.8	37.0	0.46	
313		60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	298	**0.0**		14.4	58.8	54.0	0.00		**23.1**	ULS 3_0	54.7	58.8	37.0	0.63	
316		50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	332	**0.0**		12.6	75.4	86.4	0.00		**30.7**	ULS 3_135	52.4	75.4	44.1	0.70	
318		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	274	**0.0**		13.7	37.7	43.2	0.00		**6.4**	ULS 5a Ba 21	37.4	37.7	22.0	0.29	
321		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	269	**0.0**		14.1	37.7	43.2	0.00		**8.7**	ULS 3_0	37.4	37.7	22.0	0.40	
315		45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	180	**-1.3**	ULS 1a_0	22.7	20.2	32.4	0.07		**1.2**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.06	
320		45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	115	**-1.2**	ULS 1a_0	38.2	20.2	32.4	0.06		**1.1**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.05	
300		70x70x7	S235	1M20-5.6t	0.53	0.53	0.53	142	**-24.2**	ULS 5a Ba 20	66.6	58.8	75.6	0.41		**22.2**	ULS 5a Ba 11	96.8	58.8	53.5	0.42	
301		70x70x7	S235	1M20-5.6t	0.54	0.54	0.54	138	**-27.1**	ULS 5a Ba 11	69.0	58.8	75.6	0.46		**29.7**	ULS 5a Ba 20	96.8	58.8	53.5	0.56	
302		70x70x7	S235	1M24-5.6t	0.54	0.54	0.54	119	**-33.5**	ULS 5a Ba 20	80.7	84.7	90.7	0.42		**30.2**	ULS 5a Ba 11	88.7	84.7	44.9	0.67	
304		60x60x5	S235	1M20-5.6t	0.53	0.53	0.53	104	**-18.0**	ULS 5a Ba 10	57.0	58.8	54.0	0.33		**17.6**	ULS 5a Ba 10	54.7	58.8	37.0	0.48	
305		60x60x5	S235	1M20-5.6t	0.54	0.54	0.54	112	**-24.9**	ULS 5a Ba 21	52.9	58.8	54.0	0.47		**24.7**	ULS 5a Ba 21	54.7	58.8	37.0	0.67	
306		75x50x5	S235	1M24-5.6t	0.55	0.55	0.55	112	**-29.5**	ULS 5a Ba 21	53.3	84.7	64.8	0.55		**29.9**	ULS 5a Ba 21	70.6	84.7	41.4	0.72	
307		75x50x7	S235	1M24-5.6t	0.54	0.54	0.54	87	**-37.7**	ULS 5a Ba 10	86.9	84.7	90.7	0.45		**36.4**	ULS 5a Ba 10	98.8	84.7	58.0	0.63	
303		HEB160	S235		2.00	2.00	2.00	50	**-26.0**	ULS 5a Ba 11	918.5	0.0	0.0	0.03		**25.4**	ULS 5a Ba 20	1276.1	0.0	0.0	0.02	
308		HEB160	S235		1.00	1.00	1.00	27	**-0.9**	ULS 1a_0,9_0,9_90	1015.5	0.0	0.0	0.00		**3.6**	ULS 1a_90	1276.1	0.0	0.0	0.00	
309		HEB160	S235		2.00	2.00	2.00	26	**-26.7**	ULS 5a Ba 21	1021.6	0.0	0.0	0.03		**24.9**	ULS 5a Ba 10	1276.1	0.0	0.0	0.02	
310		HEB160	S235		1.00	1.00	1.00	25	**-3.2**	ULS 1a_0,9_0,9_90	1025.6	0.0	0.0	0.00		**3.2**	ULS 1a_90	1276.1	0.0	0.0	0.00	

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Assessment of groups for strenghtened mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0 T
Mast 35

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compres	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)
101	0	100x100x6	S235	2M16-5.6t	1.00	1.00	1.00	72	0.0		183.6	75.4	103.7	0.00		27.0	ULS 3_45	144.1	75.4	76.8	0.36
108	0	90x90x8	S235	5M16-5.6t	1.00	1.00	1.00	146	-37.7	ULS 5a Ba 22	112.9	188.4	345.6	0.33		0.0		285.6	188.4	298.7	0.00
113A	0	90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	76	-75.0	ULS 1a_135	251.3	338.9	414.7	0.30		28.0	ULS 1a_0,9_0,9_45	252.5	338.9	297.7	0.11
114A	0	100x100x10	S235	4M24-5.6t	0.50	0.50	0.50	72	-214.2	ULS 1a_45	355.2	338.9	518.4	0.63		159.8	ULS 1a_0,9_0,9_135	362.9	338.9	443.1	0.47
115A	0	150x150x10	S235	6M24-5.6t	1.77	1.37	1.14	39	-377.7	ULS 1a_45	643.5	508.3	777.6	0.74		263.8	ULS 1a_0,9_0,9_135	624.7	508.3	664.6	0.52
106A	0	L150.12 + L12	S235	8M24-8.8t	0.97	0.97	0.62	37	-715.0	ULS 1a_135	1358.6	1084.4	2488.3	0.66		570.0	ULS 1a_0,9_0,9_135	1454.1	1084.4	2126.8	0.53
106C	0	L150.12 + L12	S235		1.97	1.62	1.39	73	-806.4	ULS 1a_135	1079.5	0.0	0.0	0.75		657.8	ULS 1a_0,9_0,9_45	1465.0	0.0	0.0	0.45
107A	0	L150.12 + L12	S235	8M24-8.8t	0.33	0.33	0.33	51	-770.7	ULS 1a_45	1265.5	1084.4	2488.3	0.71		635.9	ULS 1a_0,9_0,9_45	1454.1	1084.4	2126.8	0.59
201L	0	70x70x7	S235	1M24-5.6t	0.52	0.52	0.52	127	-22.2	ULS 5a Ba 22	75.8	84.7	90.7	0.29		17.3	ULS 5a Ba 22	88.7	84.7	64.2	0.27
202T	0	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	178	-15.0	ULS 5a Ba 22	25.7	37.7	43.2	0.58		6.0	ULS 5a Ba 22	37.4	37.7	22.0	0.27
203L	0	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	93	-109.3	ULS 5a Ba 12	207.7	169.4	207.4	0.65		116.5	ULS 5a Ba 22	181.4	169.4	177.2	0.69
204T	0	100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	93	-123.1	ULS 5a Ba 12	256.2	254.2	388.8	0.48		121.6	ULS 5a Ba 22	261.1	254.2	332.3	0.48
205L	0	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	99	-105.4	ULS 5a Ba 22	198.3	169.4	207.4	0.62		97.8	ULS 5a Ba 12	181.4	169.4	177.2	0.58
206T	0	100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	99	-109.5	ULS 5a Ba 22	244.6	254.2	388.8	0.45		110.5	ULS 5a Ba 12	261.1	254.2	332.3	0.43
207L	0	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	103	-87.4	ULS 5a Ba 12	190.8	169.4	207.4	0.52		94.2	ULS 5a Ba 22	181.4	169.4	177.2	0.56
208T	0	100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	104	-99.1	ULS 5a Ba 12	235.3	169.4	259.2	0.58		97.7	ULS 5a Ba 22	224.3	169.4	221.5	0.58
209L	0	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	112	-95.3	ULS 5a Ba 12	177.9	169.4	207.4	0.56		94.5	ULS 5a Ba 22	181.4	169.4	177.2	0.56
210T	0	100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	112	-101.4	ULS 5a Ba 12	219.3	169.4	259.2	0.60		79.6	ULS 5a Ba 22	224.3	169.4	221.5	0.47
211L	0	100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	76	-94.8	ULS 5a Ba 10	197.1	169.4	207.4	0.56		89.5	ULS 5a Ba 10	125.9	169.4	116.0	0.77
212T	0	100x75x9	S235	2M24-5.6t	1.00	0.55	0.55	65	-96.1	ULS 5a Ba 21	245.9	169.4	233.3	0.57		93.0	ULS 5a Ba 21	121.3	169.4	130.6	0.77
213L	0	100x75x7	S235	2M24-5.6t	0.52	0.25	0.25	85	-77.9	ULS 5a Ba 10	161.2	169.4	181.4	0.48		80.5	ULS 5a Ba 10	98.2	169.4	101.5	0.82
214T	0	100x75x9	S235	2M24-5.6t	0.52	0.25	0.25	74	-96.7	ULS 5a Ba 21	221.2	169.4	233.3	0.57		99.0	ULS 5a Ba 21	119.9	169.4	130.6	0.83
215L	0	100x75x7	S235	2M24-5.6t	0.52	0.25	0.25	101	-73.1	ULS 5a Ba 10	141.1	169.4	181.4	0.52		70.3	ULS 5a Ba 10	100.4	169.4	101.5	0.70
216T	0	100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	86	-90.1	ULS 5a Ba 21	182.6	169.4	207.4	0.53		87.8	ULS 5a Ba 21	110.7	169.4	116.0	0.79
217L	0	100x75x7	S235	2M20-5.6t	0.52	0.25	0.25	112	-59.9	ULS 5a Ba 10	129.0	117.6	151.2	0.51		61.2	ULS 5a Ba 10	115.4	117.6	106.9	0.57
218T	0	100x75x8	S235	2M24-5.6t	0.52	0.25	0.25	102	-81.0	ULS 5a Ba 21	159.3	169.4	207.4	0.51		82.1	ULS 5a Ba 21	113.2	169.4	116.0	0.73
219L	0	100x75x8	S235	2M20-5.6t	0.52	0.25	0.25	123	-57.0	ULS 1a_90	133.9	117.6	172.8	0.48		52.2	ULS 1a_0,9_0,9_90	128.6	117.6	104.7	0.50
220T	0	100x75x9	S235	2M20-5.6t	0.52	0.25	0.25	117	-71.8	ULS 5a Ba 21	155.5	117.6	194.4	0.61		69.9	ULS 5a Ba 21	146.1	117.6	137.5	0.59
221L	0	130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	124	-67.3	ULS 5a Ba 21	147.8	117.6	172.8	0.57		55.6	ULS 5a Ba 10	113.0	117.6	136.1	0.49
222T	0	100x75x7	S235	2M20-5.6t	0.52	0.25	0.25	113	-54.4	ULS 5a Ba 21	127.3	117.6	151.2	0.46		54.8	ULS 5a Ba 21	107.3	117.6	91.6	0.60
223L	0	100x75x7	S235	2M20-5.6t	0.33	0.20	0.20	105	-70.8	ULS 5a Ba 21	144.3	117.6	151.2	0.60		55.5	ULS 5a Ba 10	119.5	117.6	122.2	0.47
224T	0	130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	124	-89.6	ULS 1a_90	147.8	117.6	172.8	0.76		70.4	ULS 1a_0,9_0,9_90	113.0	117.6	136.1	0.62
226T	0	100x75x7	S235	2M20-5.6t	0.33	0.20	0.20	105	-90.2	ULS 1a_90	144.3	117.6	151.2	0.77		67.5	ULS 1a_0,9_0,9_90	119.5	117.6	122.2	0.57
227T	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	206	-18.8	ULS 3_90	21.0	37.7	43.2	0.90		0.0		37.4	37.7	22.0	0.00
228L	0	80x80x8	S235	4M20-5.6t	1.00	1.00	1.00	128	0.0		122.6	235.2	345.6	0.00		99.5	ULS 3_0	168.3	235.2	244.4	0.59
229	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	225	-0.4	ULS 3_0	18.5	37.7	43.2	0.02		0.0		37.4	37.7	25.7	0.00
230	0	80x80x8	S235	2M24-5.6t	1.00	1.00	1.00	99	-73.7	ULS 5a Ba 12	156.9	169.4	207.4	0.47		73.7	ULS 5a Ba 12	206.0	169.4	159.5	0.46
231T	0	100x75x7	S235	3M24-5.6t	2.00	1.00	1.00	69	-45.6	ULS 5a Ba 22	182.6	254.2	272.2	0.25		63.7	ULS 5a Ba 22	214.1	254.2	217.6	0.30
232	0	150x100x12	S235	8M24-5.6t	2.00	1.00	1.00	51	-245.0	ULS 5a Ba 12	512.4	677.8	1244.2	0.48		94.9	ULS 5a Ba 12	582.2	677.8	755.0	0.16
233T	0	70x70x6	S235	1M20-5.6t	0.85	0.85	0.85	172	-37.6	ULS 1a_0,9_0,9_90	45.2	58.8	64.8	0.83		48.8	ULS 1a_90	82.9	58.8	52.4	0.93
234L	0	80x80x8	S235	3M24-5.6t	1.00	1.00	1.00	178	0.0		82.2	254.2	311.0	0.00		145.4	ULS 3_0	169.8	254.2	239.3	0.86
235	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	309	-0.5	ULS 3_0	11.3	37.7	43.2	0.05		0.0		37.4	37.7	22.0	0.00
236	0	100x100x8	S235	2M24-5.6t	1.00	1.00	1.00	108	-75.7	ULS 5a Ba 21	182.9	169.4	207.4	0.45		75.9	ULS 5a Ba 21	208.1	169.4	177.2	0.45
237T	0	100x75x7	S235	4M24-5.6t	1.00	1.00	1.00	94	-42.2	ULS 5a Ba 22	157.6	338.9	362.9	0.27		69.3	ULS 5a Ba 12	214.1	338.9	290.1	0.32
238	0	150x100x14	S235	11M24-5.6t	2.00	1.00	1.00	70	-245.7	ULS 5a Ba 21	526.8	931.9	1995.8	0.47		73.6	ULS 5a Ba 21	666.7	931.9	1211.2	0.11
239	0	100x50x6	S235	1M16-5.6t	0.50	0.50	0.50	327	-0.4	ULS 1a_90	18.6	37.7	51.8	0.02		0.0		55.3	37.7	28.0	0.00
240	0	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	272	-2.6	ULS 1a_45	14.1	37.7	43.2	0.19		3.5	ULS 1a_0,9_0,9_135	60.5	37.7	26.7	0.13
241T	0	70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	255	-3.4	ULS 1a_0	28.9	37.7	51.8	0.12		1.8	ULS 1a_0,9_0,9_0	89.9	37.7	38.4	0.05
251L	0	70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	255	-4.0	ULS 1a_90	28.9	37.7	51.8	0.14		1.6	ULS 1a_0,9_0,9_135	89.9	37.7	38.4	0.04
113B	0	90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	79	-154.9	ULS 1a_45	245.5	338.9	414.7	0.63		103.7	ULS 1a_0,9_0,9_135	252.5	338.9	354.5	0.41
114B	0	100x100x10	S235	6M24-5.6t	0.50	0.50	0.50	78	-250.5	ULS 1a_45	340.4	508.3	777.6	0.74		161.6	ULS 1a_0,9_0,9_135	362.9	508.3	651.3	0.45
115B	0	L150.10 + L12	S235	8M24-8.8t	1.70	1.70	1.42	87	-611.8	ULS 1a_135	795.9	0.0	0.0	0.77		530.4	ULS 1a_0,9_0,9_45	1225.2	1084.4	1772.3	0.49
115C	0	150x150x10	S235		3.14	2.74	2.28	57	-519.6	ULS 1a_135	593.8	0.0	0.0	0.88		386.0	ULS 1a_0,9_0,9_45	688.6	0.0	0.0	0.56
106B	0	L150.12 + L12	S235	8M24-8.8t	0.76	1.28	0.63	65	-808.7	ULS 1a_135	1153.6	1084.4	2488.3	0.75		656.2	ULS 1a_0,9_0,9_45	1454.1	1084.4	2126.8	0.61
107B	0	L150.12 + L12	S235	8M24-8.8t	0.20	0.20	0.20	51	-774.3	ULS 1a_45	1268.5	1084.4	2488.3	0.71		632.6	ULS 1a_0,9_0,9_45	1454.1	1084.4	2126.8	0.58
102A	0	150x150x12	S235	8M24-5.6t	1.00	1.50	1.00	61	-302.1	ULS 5a Ba 12	689.3	677.8	1244.2	0.45		171.8	ULS 5a Ba 22	740.3	677.8	755.0	0.25
102B	0	150x150x12	S235	6M24-5.6t	2.52	1.61	1.00	63	-142.5	ULS 5a Ba 12	682.7	508.3	933.1	0.28		36.8	ULS 5a Ba 22	740.3	508.3	797.5	0.07
102C	0	150x150x12	S235		3.01	2.00	1.00	59	-273.8	ULS 5a Ba 12	698.8	0.0	0.0	0.39		148.9	ULS 5a Ba 22	817.8	0.0	0.0	0.18
103A	0	120x120x8	S235	6M24-5.6t	2.64	4.00	1.00	76	-131.8	ULS 5a Ba 12	340.1	508.3	622.1	0.39		47.7	ULS 5a Ba 22	379.5	508.3	531.7	0.13
103B	0	120x120x8	S235	2M16-5.6t	2.00	4.44	2.00	108	-30.5	ULS 6a_90 Ah Ct1	249.9	75.4	138.2	0.40		0.0		316.6	75.4	138.2	0.00
103C	0	120x120x8	S235		1.71	1.00	1.00	76	-94.0	ULS 5a Ba 1	340.3	0.0	0.0	0.28		21.2	ULS 5a Ba 1	441.8	0.0	0.0	0.05
104A	0	100x65x7*	S235	4M20-5.6t	1.00	1.00	1.00	202	0.0		63.1	235.2	302.4	0.00		107.6	ULS 3_0	115.2	235.2	207.0	0.93
104B	0	100x65x7*	S235	3M20-5.6t	1.00	1.00	1.00	209	0.0		60.1	176.4	226.8	0.00		74.5	ULS 3_0	137.8	176.4	155.3	0.54
104C	0	100x65x7*	S235		1.00	1.00	1.00	194	0.0		66.4	0.0	0.0	0.00		94.8	ULS 3_0	263.2	0.0	0.0	0.36
105A	0	60x60x5	S235	2M16-5.6t	1.00	2.43	1.00	380	0.0		11.8	75.4	86.4	0.00		30.0	ULS 6a_90 Ah Ct2	98.8	75.4	56.0	0.54
105B	0	60x60x5	S235	2M16-5.6t	1.00	1.70	1.00	379	0.0		11.8	75.4	86.4	0.00		30.0	ULS 6a_90 Ah Ct1	65.9	75.4	56.0	0.54
415	0	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	180	-8.2	ULS 3_0	30.7	37.7	43.2	0.27		0.0		60.5	37.7	26.7	0.00
417	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	170	-9.3	ULS 3_0	27.4	37.7	43.2	0.34		0.0		37.4	37.7	18.4	0.00
419	0	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	107	-11.4	ULS 3_0	55.1	37.7	43.2	0.30		0.0		37.4	37.7	22.0	0.00
422	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	70	-0.5	ULS 6a_90 Ah Ct1	58.8	37.7	43.2	0.01		0.0		37.4	37.7	18.4	0.00
414	0	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	325	0.0		12.6	37.7	43.2	0.00		13.2	ULS 3_0	60.5	37.7	32.0	0.41
416	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	353	0.0		9.1	37.7	43.2	0.00		16.5	ULS 3_0	37.4	37.7	22.0	0.75
418	0	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	344	0.0		11.9	75.4	86.4	0.00		25.2	ULS 3_0	56.2	75.4	44.1	0.57
421	0	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	259	0.0		26.8	117.6	129.6	0.00		48.3	ULS 3_135	77.4	117.6	88.7	0.62
420	0	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	111	-1.6	ULS 1a_0,9_0,9_0	39.6	20.2	32.4	0.08		1.5	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.07
400	0	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	124	-20.7	ULS 5a Ba 22	48.1	58.8	54.0	0.43		19.4	ULS 5a Ba 12	54.7	58.8	37.0	0.53
401	0	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	119	-23.2	ULS 5a Ba 12	50.2	58.8	54.0	0.46		23.7	ULS 5a Ba 22	54.7	58.8	37.0	0.64
402	0	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	114	-25.8	ULS 5a Ba 22	52.1	58.8	54.0	0.50		25.5	ULS 5a Ba 12	54.7	58.8	37.0	0.69
403	0	60x60x6	S235	1M20-5.6t	0.52	0.52	0.52	108	-29.6	ULS 5a Ba 12	65.2	58.8	64.8	0.50		28.7	ULS 5a Ba 22	65.7	58.8	44.4	0.65
404	0	70x70x6	S235	1M24-5.6t	0.53	0.53	0.53	93	-32.0	ULS 5a Ba 22	86.5	84.7	77.8	0.41		34.1	ULS 5a Ba 12	76.0	84.7	44.0	0.77
405	0	75x50x7	S235	1M24-5.6t	0.53	0.53	0.53	107	-41.9	ULS 5a Ba 12	76.2	84.7	90.7	0.55		38.4	ULS 5a Ba 22	98.8	84.7	58.0	0.66

DNV·GL

Assessment of groups for strengthened mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0 T
Mast 35

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compres	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)
409	0	55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	142	**-5.3**	ULS 1a_135	37.9	37.7	43.2	0.14		**16.3**	ULS 5a Ba 1	53.3	37.7	32.0	0.51
410	0	55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	140	**-16.7**	ULS 5a Ba 1	38.5	37.7	43.2	0.44		**4.2**	ULS 1a_135	53.3	37.7	32.0	0.13
411	0	55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	135	**-3.0**	ULS 1a_135	40.2	37.7	43.2	0.08		**17.1**	ULS 5a Ba 1	53.3	37.7	32.0	0.53
412	0	55x55x5	S235	1M16-5.6t	1.00	1.00	1.00	129	**-17.7**	ULS 5a Ba 1	42.0	37.7	43.2	0.47		**2.4**	ULS 1a_0,9_0,9_135	53.3	37.7	32.0	0.07
406	0	HEB160	S235		1.00	1.00	1.00	33	**-2.0**	ULS 1a_0,9_0,9_90	991.1	0.0	0.0	0.00		**5.7**	ULS 1a_90	1276.1	0.0	0.0	0.00
407	0	HEB160	S235		2.00	2.00	2.00	32	**-26.4**	ULS 5a Ba 12	994.8	0.0	0.0	0.03		**25.1**	ULS 5a Ba 22	1276.1	0.0	0.0	0.02
408	0	HEB160	S235		1.00	1.00	1.00	32	**-7.0**	ULS 5a Ba 1	998.4	0.0	0.0	0.01		**4.0**	ULS 1a_135	1276.1	0.0	0.0	0.00
413	0	HEB160	S235	2M16-5.6t	2.00	2.00	2.00	25	**-1.3**	ULS 1a_0,9_0,9_135	1067.2	75.4	138.2	0.02		**14.2**	ULS 5a Ba 1	1296.6	75.4	124.6	0.19
423	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	187	**0.0**	ULS 3_90	24.0	37.7	43.2	0.00		**0.0**	ULS 1a_0,9_0,9_90	37.4	37.7	22.0	0.00
424	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	169	**0.0**	ULS 3_90	27.5	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00
111A	0	80x80x8	S235	3M24-5.6t	1.00	2.00	1.00	203	**0.0**		65.4	254.2	311.0	0.00		**131.5**	ULS 3_45	160.8	254.2	259.0	0.82
111B	0	80x80x8	S235	3M20-5.6t	1.00	2.00	1.00	202	**0.0**		65.8	176.4	259.2	0.00		**116.3**	ULS 3_0	168.3	176.4	209.5	0.69
112A	0	70x70x7	S235	3M20-5.6t	1.00	1.88	1.00	227	**0.0**		42.7	176.4	226.8	0.00		**92.2**	ULS 3_0	125.5	176.4	155.3	0.73
112B	0	70x70x7	S235	3M20-5.6t	1.00	2.00	1.00	232	**0.0**		41.4	176.4	226.8	0.00		**80.5**	ULS 3_0	125.5	176.4	155.3	0.64
112C	0	70x70x7	S235		1.00	2.14	1.00	227	**0.0**		42.7	0.0	0.0	0.00		**88.3**	ULS 3_0	220.9	0.0	0.0	0.40
110A	0	120x120x11	S235	6M24-5.6t	1.64	1.00	1.00	60	**-191.1**	ULS 5a Ba 10	508.6	508.3	855.4	0.38		**104.2**	ULS 5a Ba 10	513.2	508.3	731.1	0.21
110B	0	120x120x11	S235		1.00	1.00	1.00	13	**-0.4**	ULS 1a_0,9_0,9_90	599.7	0.0	0.0	0.00		**0.4**	ULS 1a_90	599.7	0.0	0.0	0.00
110C	0	120x120x11	S235		1.71	1.29	1.00	66	**-158.9**	ULS 5a Ba 10	492.8	0.0	0.0	0.32		**80.6**	ULS 5a Ba 10	599.7	0.0	0.0	0.13
109A	0	150x100x14	S235	11M24-5.6t	1.00	0.52	0.52	56	**-301.6**	ULS 5a Ba 10	673.7	931.9	1995.8	0.45		**143.3**	ULS 5a Ba 10	666.7	931.9	1211.2	0.22
109B	0	150x100x14	S235	6M24-5.6t	4.78	1.00	1.00	47	**-206.3**	ULS 5a Ba 10	703.8	508.3	1088.6	0.41		**119.2**	ULS 5a Ba 10	666.7	508.3	930.5	0.23
109C	0	150x100x14	S235		1.00	0.52	0.52	58	**-277.1**	ULS 5a Ba 10	665.2	0.0	0.0	0.42		**131.8**	ULS 5a Ba 10	775.5	0.0	0.0	0.17
312	0	70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	185	**-14.0**	ULS 3_45	41.1	58.8	64.8	0.34		**0.0**		82.9	58.8	39.3	0.00
314	0	70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	148	**-15.1**	ULS 3_135	54.9	58.8	64.8	0.27		**0.0**		82.9	58.8	39.3	0.00
317	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	154	**-3.0**	ULS 1a_0	31.0	37.7	43.2	0.10		**0.0**		37.4	37.7	18.4	0.00
319	0	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-2.6**	ULS 1a_0	59.5	37.7	43.2	0.07		**0.0**		37.4	37.7	18.4	0.00
322	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	53	**-1.0**	ULS 3_90	63.5	37.7	43.2	0.03		**0.0**		37.4	37.7	18.4	0.00
311	0	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	332	**0.0**		12.1	58.8	54.0	0.00		**17.0**	ULS 3_135	54.7	58.8	37.0	0.46
313	0	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	298	**0.0**		14.4	58.8	54.0	0.00		**23.1**	ULS 3_45	54.7	58.8	37.0	0.63
316	0	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	332	**0.0**		12.6	75.4	86.4	0.00		**30.7**	ULS 3_135	52.4	75.4	44.1	0.70
318	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	274	**0.0**		13.7	37.7	43.2	0.00		**6.4**	ULS 5a Ba 21	37.4	37.7	22.0	0.29
321	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	269	**0.0**		14.1	37.7	43.2	0.00		**8.7**	ULS 3_0	37.4	37.7	22.0	0.40
315	0	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	180	**-1.3**	ULS 1a_0	22.7	20.2	32.4	0.07		**1.2**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.06
320	0	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	115	**-1.2**	ULS 1a_0	38.2	20.2	32.4	0.06		**1.1**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.05
300	0	70x70x7	S235	1M20-5.6t	0.53	0.53	0.53	142	**-24.2**	ULS 5a Ba 20	66.6	58.8	75.6	0.41		**22.2**	ULS 5a Ba 11	96.8	58.8	53.5	0.42
301	0	70x70x7	S235	1M20-5.6t	0.54	0.54	0.54	138	**-27.1**	ULS 5a Ba 11	69.0	58.8	75.6	0.46		**29.7**	ULS 5a Ba 20	96.8	58.8	53.5	0.56
302	0	70x70x7	S235	1M24-5.6t	0.54	0.54	0.54	119	**-33.5**	ULS 5a Ba 20	80.7	84.7	90.7	0.41		**30.2**	ULS 5a Ba 11	88.7	84.7	44.9	0.67
304	0	60x60x5	S235	1M20-5.6t	0.53	0.53	0.53	104	**-18.0**	ULS 5a Ba 10	57.0	58.8	54.0	0.33		**17.6**	ULS 5a Ba 10	54.7	58.8	37.0	0.48
305	0	60x60x5	S235	1M20-5.6t	0.54	0.54	0.54	112	**-24.9**	ULS 5a Ba 21	52.9	58.8	54.0	0.47		**24.6**	ULS 5a Ba 21	54.7	58.8	37.0	0.67
306	0	75x50x5	S235	1M24-5.6t	0.55	0.55	0.55	112	**-29.4**	ULS 5a Ba 21	53.3	84.7	64.8	0.55		**29.9**	ULS 5a Ba 21	70.6	84.7	41.4	0.72
307	0	75x50x7	S235	1M24-5.6t	0.54	0.54	0.54	87	**-37.7**	ULS 5a Ba 10	86.9	84.7	90.7	0.45		**36.4**	ULS 5a Ba 10	98.8	84.7	58.0	0.63
303	0	HEB160	S235		2.00	2.00	2.00	50	**-26.0**	ULS 5a Ba 11	918.5	0.0	0.0	0.03		**25.4**	ULS 5a Ba 20	1276.1	0.0	0.0	0.02
308	0	HEB160	S235		1.00	1.00	1.00	27	**-1.0**	ULS 1a_0,9_0,9_90	1015.5	0.0	0.0	0.00		**3.6**	ULS 1a_90	1276.1	0.0	0.0	0.00
309	0	HEB160	S235		2.00	2.00	2.00	26	**-26.7**	ULS 5a Ba 21	1021.6	0.0	0.0	0.03		**24.9**	ULS 5a Ba 10	1276.1	0.0	0.0	0.02
310	0	HEB160	S235		1.00	1.00	1.00	25	**-3.1**	ULS 1a_0,9_0,9_90	1025.6	0.0	0.0	0.00		**3.2**	ULS 1a_90	1276.1	0.0	0.0	0.00

Assessment of groups for strengthened mast (verbouw level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+0 T
Mast 35

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compressi	Load Case (Compres	Buckling	Shear (Comp)	Bearing (Com	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens	Bearing (Tens	U.C. (Tens)
106A		**L150.12 + L120.12**	S235	**8M24-8.8t**	**0.97**	**0.97**	**0.62**	37	**-879.8**	ULS 1a_135	1358.6	1084.4	2488.3	0.81		**726.1**	ULS 1a_0,9_0,9_135	1454.1	1084.4	2126.8	0.67
106C		**L150.12 + L120.12**	S235		**1.97**	**1.62**	**1.39**	73	**-992.7**	ULS 1a_135	1079.5	0.0	0.0	0.92		**836.3**	ULS 1a_0,9_0,9_45	1465.0	0.0	0.0	0.57
107A		**L150.12 + L120.12**	S235	**8M24-8.8t**	0.33	0.33	0.33	51	**-948.8**	ULS 1a_45	1265.5	1084.4	2488.3	0.88		**808.0**	ULS 1a_0,9_0,9_135	1454.1	1084.4	2126.8	0.75
115B		**L150.10 + L120.10**	S235	**8M24-8.8t**	**1.70**	**1.70**	**1.42**	87	**-751.7**	ULS 1a_135	795.9	0.0	0.0	0.94		**676.8**	ULS 1a_0,9_0,9_45	1225.2	1084.4	1772.3	0.62
106B		**L150.12 + L120.12**	S235	**8M24-8.8t**	0.76	1.28	0.63	65	**-995.2**	ULS 1a_135	1153.6	1084.4	2488.3	0.92		**834.8**	ULS 1a_0,9_0,9_45	1454.1	1084.4	2126.8	0.77
107B		**L150.12 + L120.12**	S235	**8M24-8.8t**	0.20	0.20	0.20	51	**-952.9**	ULS 1a_45	1268.5	1084.4	2488.3	0.88		**804.6**	ULS 1a_0,9_0,9_135	1454.1	1084.4	2126.8	0.74

APPENDIX C REDUNDANT MEMBERS CHECK

DNV·GL

Knikverkorters initial construction (afkeur)

Date: 2020-12-01
Author: Muhammed Khan
Version: 1.8

KIJ-GT
S+0 T
35

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Net Section Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type
14	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	0.59	0	68	12.7	0.15	53.2	20.2	27.7	38.9	0.57	0.63	
3020	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.47	75	169	12.7	0.00	24.7	20.2	27.7	38.9	0.57	0.63	
3012	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.29	0	148	12.7	0.32	29.1	20.2	27.7	38.9	0.57	0.63	
19	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.78	53	204	12.7	0.00	19.0	20.2	27.7	38.9	0.57	0.67	
11	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.99	0	229	12.7	0.50	16.2	20.2	27.7	38.9	0.57	0.87	
33	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	2.28	38	262	12.7	0.00	13.1	20.2	27.7	38.9	0.57	0.97	
10	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.69	0	276	12.7	0.67	13.5	20.2	27.7	44.6	0.72	0.94	
17	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.86	30	294	12.7	0.62	12.2	20.2	27.7	44.6	0.72	1.04	Buckling
16	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.75	29	283	12.7	0.60	13.0	20.2	27.7	44.6	0.72	0.98	
8	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.22	0	228	12.7	0.56	18.1	20.2	27.7	44.6	0.72	0.77	
15	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.89	48	217	12.7	0.00	17.4	20.2	27.7	38.9	0.57	0.73	
7	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.06	0	122	12.7	0.27	36.2	20.2	27.7	38.9	0.57	0.63	
26	Pootverband	Enkele staaf	L45.5	S235	M12	5.6	1.57	0	180	1.5	0.39	22.6	20.2	27.7	38.9	0.57	0.69	
24	Pootverband	Enkele staaf	L45.5	S235	M12	5.6	2.77	75	318	1.5	0.00	9.7	20.2	27.7	38.9	0.57	0.15	
25	Pootverband	Kniksteun en verticale steun	L45.5	S235	M12	5.6	3.21	0	238	1.5	0.40	12.6	20.2	27.7	38.9	0.42	0.98	
23	Pootverband	Enkele staaf	L50.5	S235	M12	5.6	3.00	59	308	1.5	0.00	11.3	20.2	27.7	44.6	0.72	0.13	
28	Tussenschot	Kniksteun en verticale steun	L60.5	S235	M12	5.6	4.83	0	264	0.3	0.60	14.8	20.2	27.7	67.7	0.81	0.78	
27	Tussenschot	Kruisende staaf halverwege	L100.50.6	S235	M12	5.6	7.00	0	329	0.3	0.88	18.5	20.2	33.2	53.6	3.24	0.27	
50	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.24	0	142	13.6	0.31	30.5	20.2	27.7	38.9	0.57	0.67	
47	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.83	49	210	13.6	0.00	18.3	20.2	27.7	38.9	0.57	0.74	
49	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.64	0	303	13.6	0.66	10.4	20.2	27.7	38.9	0.57	1.30	Buckling Bending
46	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.79	40	205	13.6	0.00	18.9	20.2	27.7	38.9	0.57	0.72	
45	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.66	51	191	13.6	0.00	21.0	20.2	27.7	38.9	0.57	0.67	
48	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.32	0	266	13.6	0.58	12.8	20.2	27.7	38.9	0.57	1.06	Buckling Bending
44	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.60	41	184	13.6	0.00	22.1	20.2	27.7	38.9	0.57	0.67	
270	1e tussenstul	Kruisende staaf halverwege	L100.50.6	S235	M12	5.6	7.00	0	329	13.6	0.88	18.5	20.2	33.2	53.6	3.24	0.73	
58	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.67	43	192	13.6	0.00	20.8	20.2	27.7	38.9	0.57	0.67	
60	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.67	0	307	13.6	0.67	10.2	20.2	27.7	38.9	0.57	1.33	Buckling Bending
57	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.67	35	192	13.6	0.00	20.8	20.2	27.7	38.9	0.57	0.67	
56	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.71	51	196	13.6	0.00	20.1	20.2	27.7	38.9	0.57	0.68	
59	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.37	0	272	13.6	0.59	12.4	20.2	27.7	38.9	0.57	1.10	Buckling Bending
55	1e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.65	42	190	13.6	0.00	21.1	20.2	27.7	38.9	0.57	0.67	
80	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.49	52	171	11.8	0.00	24.3	20.2	27.7	38.9	0.57	0.59	
83	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.02	0	232	11.8	0.51	15.8	20.2	27.7	38.9	0.57	0.88	
79	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.42	42	163	11.8	0.00	25.8	20.2	27.7	38.9	0.57	0.59	
78	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.25	51	144	11.8	0.00	30.2	20.2	27.7	38.9	0.57	0.59	
82	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.76	0	202	11.8	0.44	19.3	20.2	27.7	38.9	0.57	0.77	
77	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.19	41	137	11.8	0.00	32.0	20.2	27.7	38.9	0.57	0.59	
76	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.13	53	130	11.8	0.00	33.9	20.2	27.7	38.9	0.57	0.59	
81	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.53	0	176	11.8	0.38	23.4	20.2	27.7	38.9	0.57	0.67	
75	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.06	43	122	11.8	0.00	36.2	20.2	27.7	38.9	0.57	0.59	
96	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.50	52	172	11.8	0.00	24.0	20.2	27.7	38.9	0.57	0.59	
99	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	2.06	0	237	11.8	0.52	15.3	20.2	27.7	38.9	0.57	0.90	
95	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.43	42	164	11.8	0.00	25.6	20.2	27.7	38.9	0.57	0.59	
94	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.26	50	145	11.8	0.00	29.9	20.2	27.7	38.9	0.57	0.59	
98	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.80	0	207	11.8	0.45	18.7	20.2	27.7	38.9	0.57	0.79	
93	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.21	40	139	11.8	0.00	31.4	20.2	27.7	38.9	0.57	0.59	
92	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.05	46	120	11.8	0.00	36.8	20.2	27.7	38.9	0.57	0.59	
97	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.60	0	183	11.8	0.40	22.1	20.2	27.7	38.9	0.57	0.70	
91	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	1.01	37	116	11.8	0.00	38.0	20.2	27.7	38.9	0.57	0.59	
90	2e tussenstul	Enkele staaf	L45.5	S235	M12	5.6	0.96	42	110	11.8	0.00	39.9	20.2	27.7	38.9	0.57	0.59	

Knikverkorters adjusted construction (verbouw)

Date: 2020-12-01
Author: Muhammed Khan
Version: 1.8

KIJ-GT

S+0 T
35

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness (-)	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Block Tearing Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type	Mitigation
17	Onderstuk	Enkele staaf	**L60.6**	**S355**	M12	**8.8**	2.86	30	245	**12.7**	**0.80**	25.6	32.3	45.2	157.6	1.88	0.50		Profile exchanged
49	1e tussenstul	Enkele staaf	**L55.6**	**S355**	M12	**8.8**	2.64	0	246	**13.6**	**0.86**	23.1	32.3	45.2	134.1	1.56	0.59		Profile exchanged
48	1e tussenstul	Enkele staaf	**L50.5**	**S355**	M12	**8.8**	2.32	0	238	**13.6**	**0.75**	18.6	32.3	37.7	92.1	1.08	0.73		Profile exchanged
60	1e tussenstul	Enkele staaf	**L55.6**	**S355**	M12	**8.8**	2.67	0	249	**13.6**	**0.87**	22.7	32.3	45.2	134.1	1.56	0.60		Profile exchanged
59	1e tussenstul	Enkele staaf	**L50.5**	**S355**	M12	**8.8**	2.37	0	244	**13.6**	**0.8**	18.0	32.3	37.7	92.1	1.1	0.76		Profile exchanged
5001	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.32	0	136	**13.6**	**0.43**	42.3	60.3	43.6	51.0	1.08	0.40		Profile added
5002	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.17	0	120	**13.6**	**0.38**	49.2	60.3	43.6	51.0	1.08	0.35		Profile added
5007	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.27	0	130	**13.6**	**0.41**	44.4	60.3	43.6	51.0	1.08	0.38		Profile added
5008	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.27	0	130	**13.6**	**0.41**	44.4	60.3	43.6	51.0	1.08	0.38		Profile added

Comment

1) Pos numbers 5001, 5002, 5007 and 5008 are new added redundants

APPENDIX D ANCHOR CHECKS AND SHEAR BLOCKS

ANCHORS S+0 II T

The tower is connected to the pile cap of the foundation via anchor rods.

Anchors

The tower legs are connected to the foundation with a foot plate 320x520x38 mm and four anchor rods with diameter 38 mm. The thickness and dimensions have been verified by field investigation[1].

The anchor rods are connected to a horizontal rod "schieter" which allows for distribution of the tensile force to the concrete.

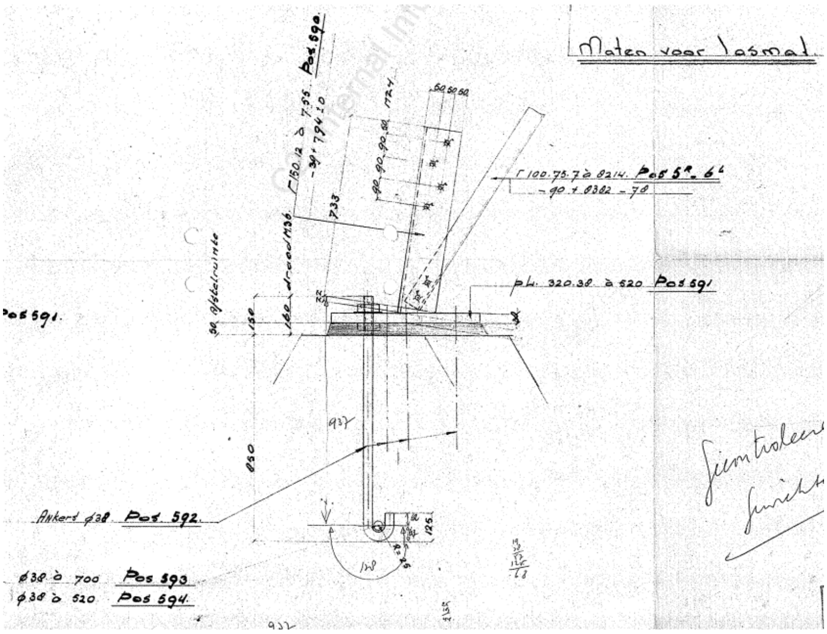


Figure 1 Anchor detail

Figure 2 Foot plate with schematisation of effective width and leverage arm

[1] Rapport Bejan Bouw en Betontechniek d.d. 4-11-2020; 200152A-003 Krimpen aan den IJssel - Geertruidenberg v1.0.pdf

Loads

The loads coming from the tower are based on S+0 II T structure number 35 in wind zone II and can be seen in Table 1.

Table 1 Foundation loads wind zone II for tower 39

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_45	146	132	**782**	10	-197	-38	798
Max. tension	ULS 1a_0,9_0,9_45	114	100	**-622**	-10	151	25	-634
Max. pos. torsie	ULS 5a Ba 21	-28	24	-3	**37**	-2	-3	-3
Max. neg. torsie	ULS 5a Ba 10	-28	-24	-3	**-37**	-2	-3	-3
Comb. tension+torsie	ULS 1a_0,9_0,9_45	114	100	**-622**	**-10**	151	25	-634

Foot plate and anchors

The strength of the foot plate will be determined with the eccentricity of 110 mm shown in Figure 2. The effective width is equal to half of the foot plate, 160 mm.

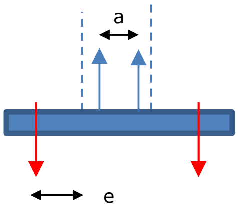


Figure 3 Scheme for check of foot plate

e: 110 mm

In the spreadsheet the anchor bolts and foot plate have been checked. The concrete strength is assumed to be equal or more than C20/25. This assumption is higher than what would be derived for old designation K225 but has been verified with concrete cylinder tests. Refer to aforementioned investigation. The foot plate is embedded in concrete. The anchor bolts will not be loaded by bending.

Check

See output of spreadsheet: the anchor fulfills the requirement, but the foot plate has insufficient capacity:

Tower 35: U.C. = 156 / 123 = 1,26 ≥ 1,00 Not ok

The foot plate needs to be strengthened. This can be done with additional vertical stiffeners that will be positioned to the tower leg. See Figure 4.

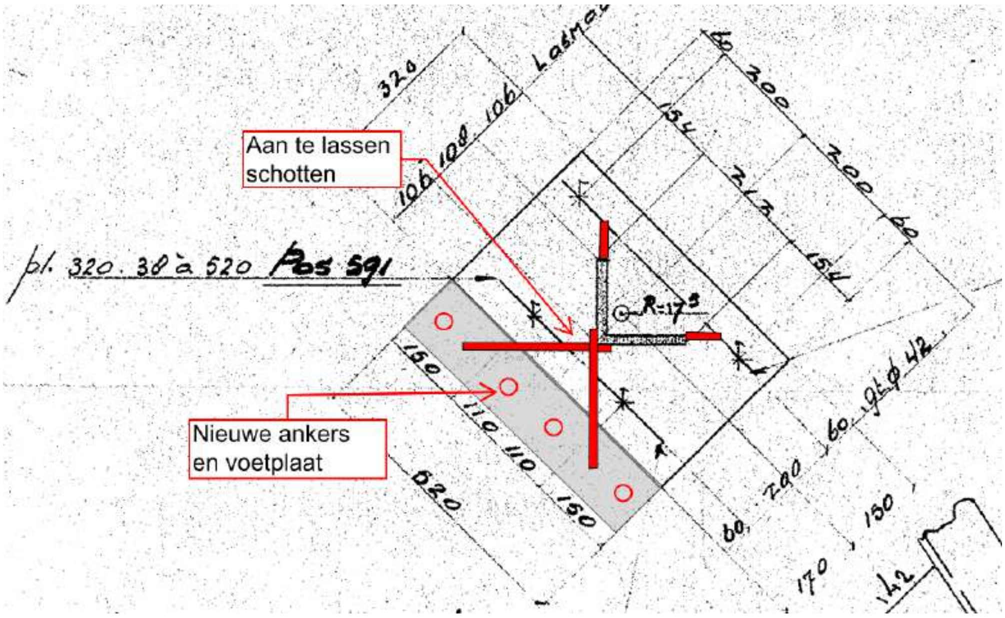
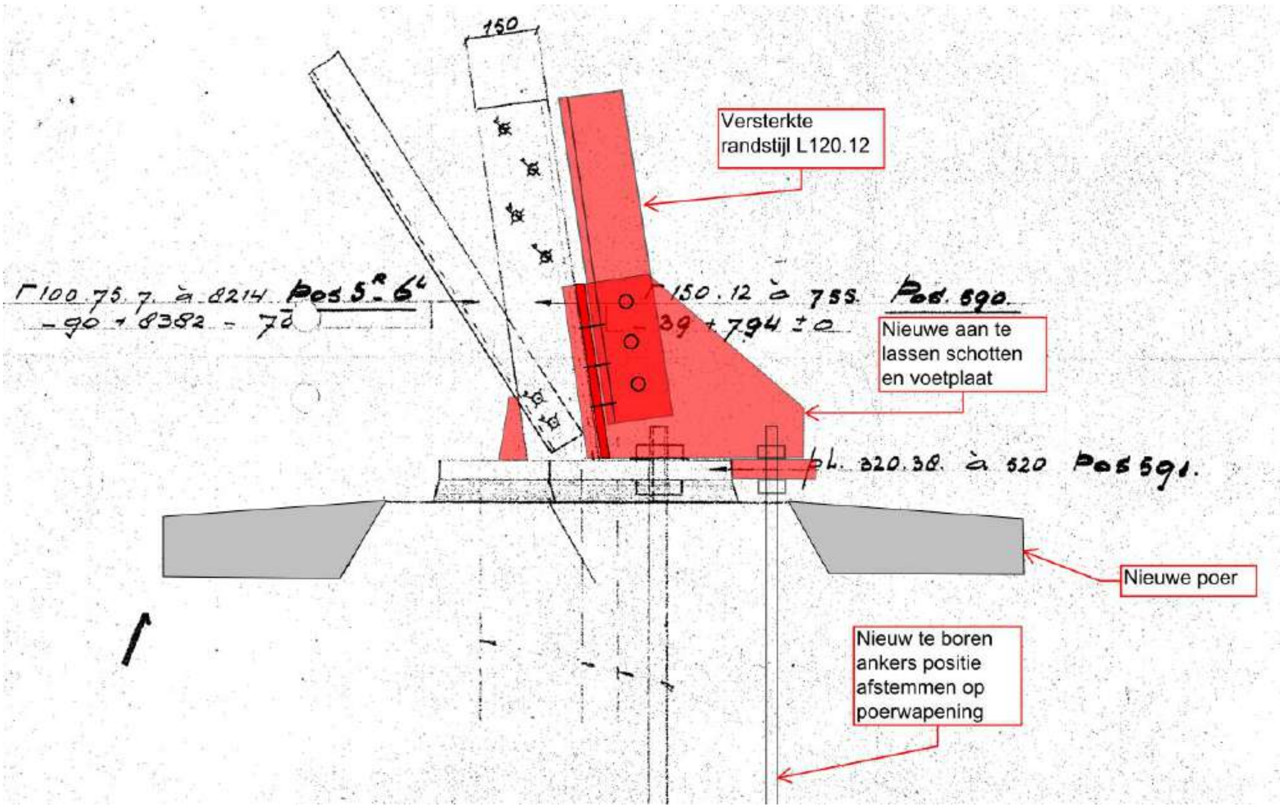


Figure 4 Stiffeners



Figuur 5 Modified anchor detail

Since the main leg will be strengthened with an additional profile, the tower will exert eccentric forces on the anchor group. To overcome this issue, a modified anchor detail is proposed, where new anchor bolts will be drilled in the existing concrete pile cap. See Figure 4.

For the detail-engineering the loads for tower 39 for verbouw load should be used.

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Project: Krimpen - Geertruidenberg 380 | Date: 30-11-2020 | Version: 2.6

Anchors

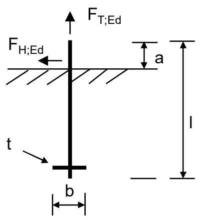
NEN-EN 1992-1-1 and 1993-1-8 with NA

CUR-BmS 10

Subject:	**S+0 II T**	**Checks:**		
		Anchor bolt to tension	1,26	**not OK**
		Anchor bolt to shear	0,60	**OK**
		Dowel ("schieter")	0,99	**OK**

Inputs

Anchor diameter		**M38**	
Achor quality		**4.6**	
Thread		Cut	
Anchor length	l =	900	mm
Anchor length above concrete	a =	110	mm



Load on anchor group

T: the external tension force on the anchor group

Tension force	T =	**622**	kN
Shear force	$F_{H,Ed}$ =	**197**	kN
Number of anchors for tension		4	
Number of anchors for shear		4	
$F_{T;Ed} = T / n =$		155,5	kN
$F_{v;Ed} = F_{H,Ed} / n =$		49,3	kN

Anchor properties

$d_b =$	38,00	mm
$A_{b;s} =$	910	mm^2
$f_{yb} =$	240	N/mm^2
$f_{ub} =$	400	
γ_{Mb}	1,25	-
$\alpha_{red;2}$	0,85	-
$\alpha_b = 0,44 - 0,0003 f_{yb} =$	0,37	-

Capacity per anchor

$F_{T;Rd} = 0,9\alpha_{red;2} f_{ub} A_s / g_{M2} =$	**200,6**	kN
$F_{v;Rd} = \alpha_b f_{ub} A_s / g_{Mb} =$	**82,0**	kN

Foot plate

$F_{t,Rd}$: the tensile force in the anchors when yielding of foot plate is reached.

Steel material		**S235**	
Thickness	t =	38	mm
Width	b_{ef} =	160	mm
Leverage arm	m =	110	mm
$M_{pl,Rd} = 1/4 b_{ef} t_p^2 f_{yd} =$		13,6	kNm
$F_{t,Rd} = M_{pl,Rd} / m =$		123,4	kN

Check of dowel ("schieter")

$\frac{\sigma_b'}{f_{cd}} = \frac{28,1}{40,0} = 0,70$ **OK**

$\frac{F_{T,Ed}}{F_{v;Rd}} = \frac{156}{157} = 0,99$ **OK**

Capacity of concrete

Concrete strength	**C20/25**	
f_{ck} =	20	N/mm^2
k_b =	3	-
γ_{Mc} =	1,5	-
$f_{cd} = f_{ck} k_b / \gamma_{Mc}$ =	40	MPa

Dowel

Diameter	d_S =	**38**	mm
Length	b =	**220**	mm
Spread	$c = t\sqrt{(f_{yd} / 3f_{jd})}$ =	54	mm
Effective length	$b_{eff} = \min(b; d+2c)$	145	mm
Cross section	$A_S = \pi/4\ d_S^2$ =	1134	mm^2
Distributed load	$q = F_{T,Ed} / b_{eff}$ =	1069	kN/m
Concrete pressure	$\sigma_b' = q / d_S$ =	28,1	MPa

Shear stress in dowel

Load	$F_{T,Ed}$ =	156	kN
Allowable	$F_{v,Rd} = f_{yd} / \sqrt{3} \times A_s$ =	157	kN

Capacity of foot plate

$\frac{F_{T,Ed}}{F_{t;Rd}} = \frac{155,5}{123,4} = 1,26$ **not OK**

Capacity of anchor for tension

$\frac{F_{T,Ed}}{F_{T;Rd}} = \frac{155,5}{200,6} = 0,78$ **OK**

Check foot plate for tension

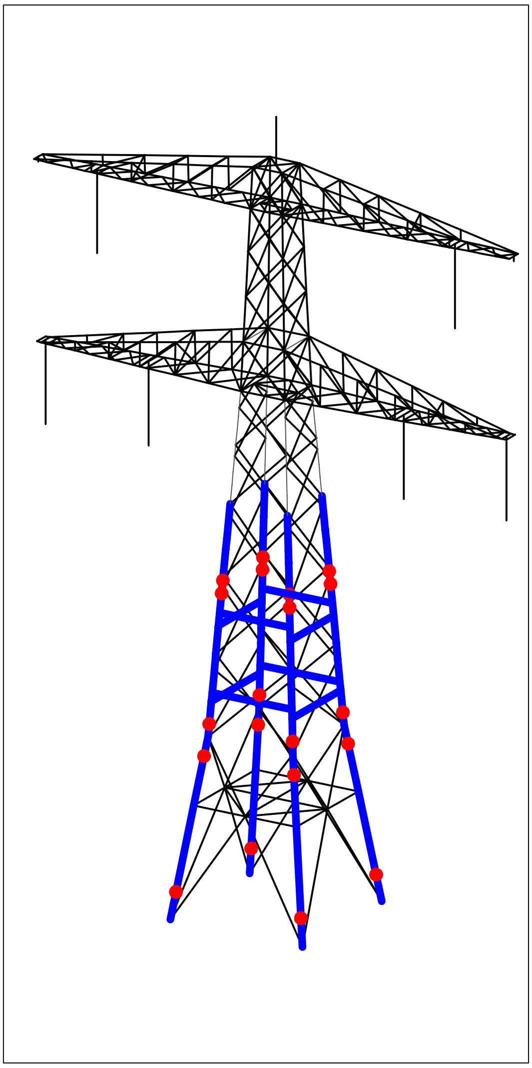
$\frac{T}{n \times F_{t;Rd}} = \frac{622,0}{493,6} = 1,26$ **not OK**

Check anchor for shear

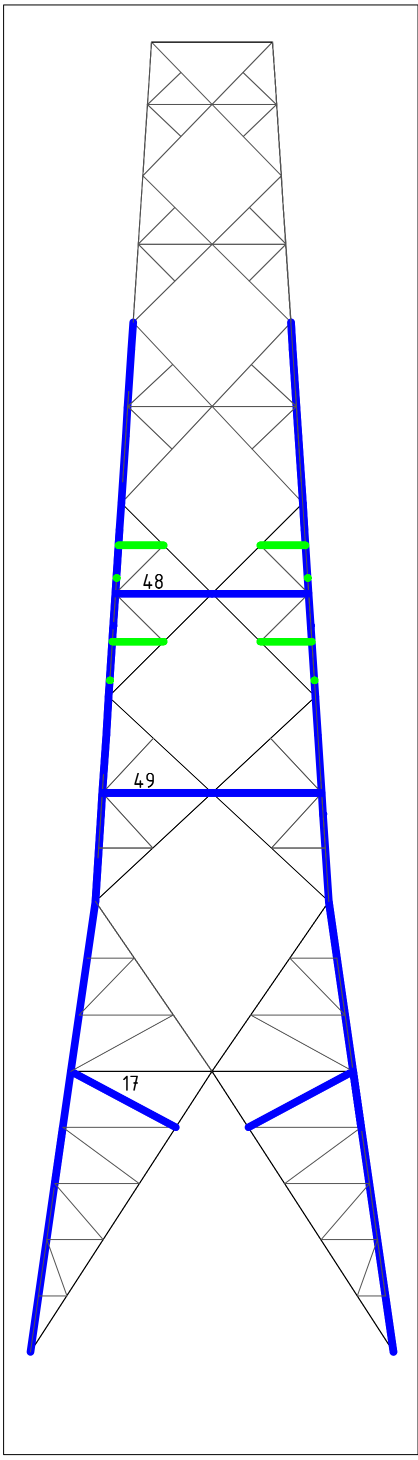
$\frac{F_{v,Ed}}{F_{v;Rd}} = \frac{49,3}{82,0} = 0,60$ **OK**

APPENDIX E DRAWINGS

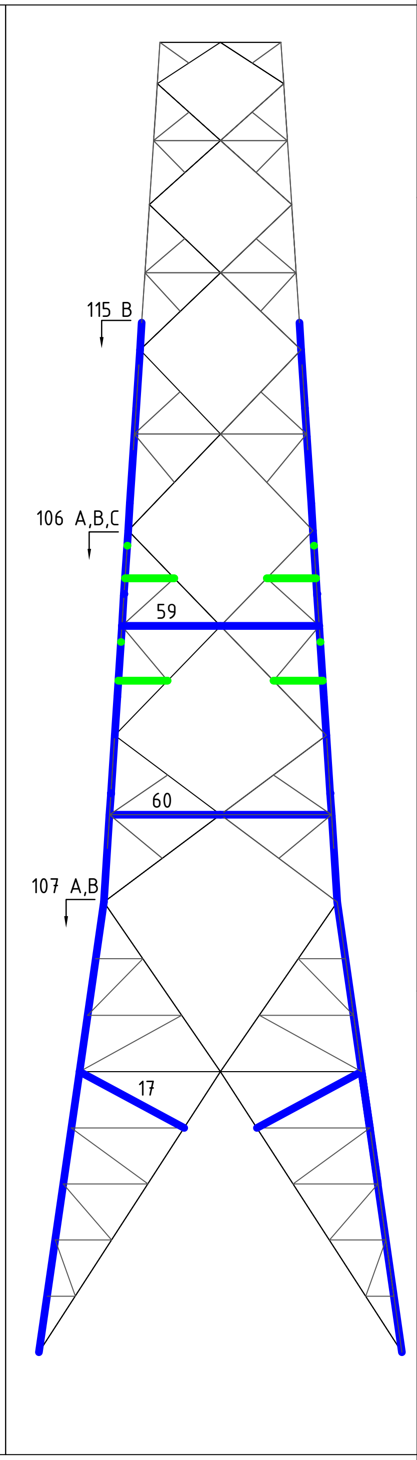
Initial Profiles and Bolts					Final Profiles and Bolts			
Group label	Profile type (ini)	Profile size (ini)	Steel quality (ini)	Bolt size and quality (ini)	Profile type (new)	Profile size (new)	Steel quality (new)	Bolt size and quality (new)
17	EA	L50x5	S235 t<=40	M12-5.6t-NEN2012	EA	L60x6	S355 t<=40	M12-8.8t-NEN2012
49	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L55x6	S355 t<=40	M12-8.8t-NEN2012
48	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L50x5	S355 t<=40	M12-8.8t-NEN2012
60	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L55x6	S355 t<=40	M12-8.8t-NEN2012
59	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L50x5	S355 t<=40	M12-8.8t-NEN2012
107 A,B	EA	L150x150x12	S235 t<=40	M24-5.6t-NEN2012	XEA	L150x150x12 + L120x120x12	S355 t<=40	M24-8.8t-NEN2012
106 A,B,C	EA	L150x150x12	S235 t<=40	M24-5.6t-NEN2012	XEA	L150x150x12 + L120x120x12	S355 t<=40	M24-8.8t-NEN2012
115 B	EA	L150x150x10	S235 t<=40	M24-5.6t-NEN2012	XEA	L150x150x10 + L120x120x10	S355 t<=40	M24-8.8t-NEN2012



Overview



Front view



Side view

Notes and legend:

- New redundants according to drawing
- Size for new redundants is L50x50x5
- Other changes according to the table
- All changes are symmetrical unless otherwise indicated
- Material quality t = 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

Profile exchanged
New redundant
Bolt exchanged

01	25-11-2020	Version 2.0 - Profile exchange added
00	16-4-2020	Version 1.0

DNV·GL

Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-003

Design state: FINAL | Scale: -

Drawn by: MuK 25-11-2020 | Units: m

Checked by: TBR 25-11-2020 | Project no: 10166260

Approved by: JHu 25-11-2020 | Company: TenneT

Description: Modifications overview for mast type S+0T Mast 35

Revision: 01

Format: A2

DNV GL Energy & Sustainability, Utrechtseweg 310, 6812 AR Arnhem, tel: +31 26 3 56 91 11, www.dnvgl.com

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Bijlage 16 Rapportage Mastconstructie S+30

“TOETSING EN HERONTWERP MASTEN EN FUNDATIES BBB380”

KIJ-GT380 – Rapportage mast S+30

TenneT TSO B.V.

Meridian doc. nr.: 002.589.40 0916496
Rapport nr.: 21-1074 Rev.0
Datum: 2021-07-02

Projectnaam:	“Toetsing en herontwerp masten en fundaties BBB380”	DNV GL - Energy
		Energy Advisory
Rapport titel:	KIJ-GT380 – Rapportage mast S+30	Postbus 9035
Klant:	TenneT TSO B.V.	6800 ET ARNHEM
Contactpersoon:	[redacted]	
Datum:	2021-07-02	
Project nr.:	10166260	[redacted]
Organisatie unit:	TDT	
Meridian doc.nr.:	002.589.40 0916496	
Rapport nr.:	21-1074 Rev.0	

Geschreven door: Beoordeeld door: Goedgekeurd door:

[redacted]

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Trefwoorden:

Versie	Datum	Reden voor uitgave	Auteur	Beoordeeld	Goedgekeurd
0	2021-07-02	Eerste uitgave	[redacted]	[redacted]	[redacted]

DNV GL Netherlands B.V.

Inhoud

1 INLEIDING

1.1 Inleiding

Om in de toekomst meer elektriciteit te kunnen transporteren is het noodzakelijk om naast de nieuwbouw van verbindingen bestaande hoogspanningsverbindingen aan te passen zodat er een grotere transportcapaciteit mogelijk wordt gemaakt.

Om die reden is de opdrachtgever (OG) voornemens de bestaande 380 kV-koppelnetring op te waarderen. Het opwaarderen van de bestaande verbindingen valt onder het programma "Beter benutten bestaande 380 kV-ring" en omvat de volgende deelprojecten:

- Opwaardering 380 kV-verbinding Lelystad – Ens (LLS-ENS380)
- Opwaardering 380 kV-verbinding Diemen – Lelystad (DIM-LLS380)
- Opwaardering 380 kV-verbinding Rilland – Zandvliet (RLL-ZVL380)
- Opwaardering 380 kV-verbinding Krimpen aan den IJssel - Geertruidenberg (KIJ-GT380)
- Opwaardering 380 kV-verbinding Ens - Zwolle (ENS-ZL380)
- Opwaardering 380 kV-verbinding Maasbracht - Eindhoven (MBT-EHV380)

Om te komen tot een DO waarmee de werkzaamheden kunnen worden gestart is door TenneT aan DNV GL opdracht verstrekt voor de volgende onderdelen:

1. In eerste fase het opstellen en creëren van:

1.1 E-studie deel 1

1.2 Uitgangspuntenrapporten ten behoeve van de constructieve analyse van masten en fundaties

1.3 Sonderingmodellen

1.4 Fundatiemodellen

1.5 Mastmodellen

2. In tweede fase de uitvoering van de DO-fase bevattende:

2.1 Toetsing conform het uitgangspuntenrapport van de bestaande fundaties

2.2 Globale specificatie van benodigde fundatieversterkingen ten behoeve van aanbesteding

2.3 Toetsing conform het uitgangspuntenrapport van de bestaande masten

2.4 Globale specificatie van benodigde mastversterkingen ten behoeve van aanbesteding

2.5 E-studie deel 2

In deze studie wordt voor de lijn Krimpen aan den IJssel - Geertruidenberg de controle van de mastconstructie van masttype S+30 gerapporteerd.

Inhoudelijk is de Nederlandse versie van de rapportage ongewijzigd ten opzichte van de Engelse versie. Om deze reden zijn de bijlagen in dit rapport één op één overgenomen uit de Engelse versie. Hierdoor wijkt het revisienummer van de bijlagen af van het revisienummer van de rapportage.

1.2 Doelstelling en scope van dit rapport

Het doel van deze studie is om te bepalen of de in dit rapport beschreven bestaande mast geschikt is om te worden uitgerust met de ACCCZ-Warsaw geleider.

Nadat de wijzigingen zijn toegepast dient aantoonbaar geverifieerd te worden dat het systeem voldoet aan de vigerende eisen.

1.3 Relatie overige documenten

1.3.1 Verificatie & validatie plan

De door TenneT aangeleverde set met eisen is beoordeeld op relevantie en voor de relevante eisen is aangegeven in welk document wordt aangetoond dat er aan de eis wordt voldaan. De resultaten hiervan zijn opgenomen in het rapport "Verificatie & Validatieplan 380 kV verbinding Krimpen aan den IJssel - Geertruidenberg" [1].

1.3.2 E-studie deel 1

In de rapportage "KIJ-GT380 - E-studie deel 1" [2] is bepaald welke aanpassingen benodigd zijn om de ACCCZ Warsaw geleider toe te passen binnen de verbinding Krimpen aan den IJssel - Geertruidenberg. Uit de E-studie volgen geen zaken die relevant zijn voor de constructie van masttype S+30.

1.3.3 Uitgangspunten rapport

De uitgangspunten op basis waarvan de berekeningen in deze rapportage zijn uitgevoerd zijn opgenomen in het rapport "Uitgangspuntenrapport 380kV verbinding Krimpen aan den IJssel - Geertruidenberg" [3]

2 EISEN

In onderstaande Tabel 1 zijn de eisen opgenomen die binnen deze rapportage worden getoetst.

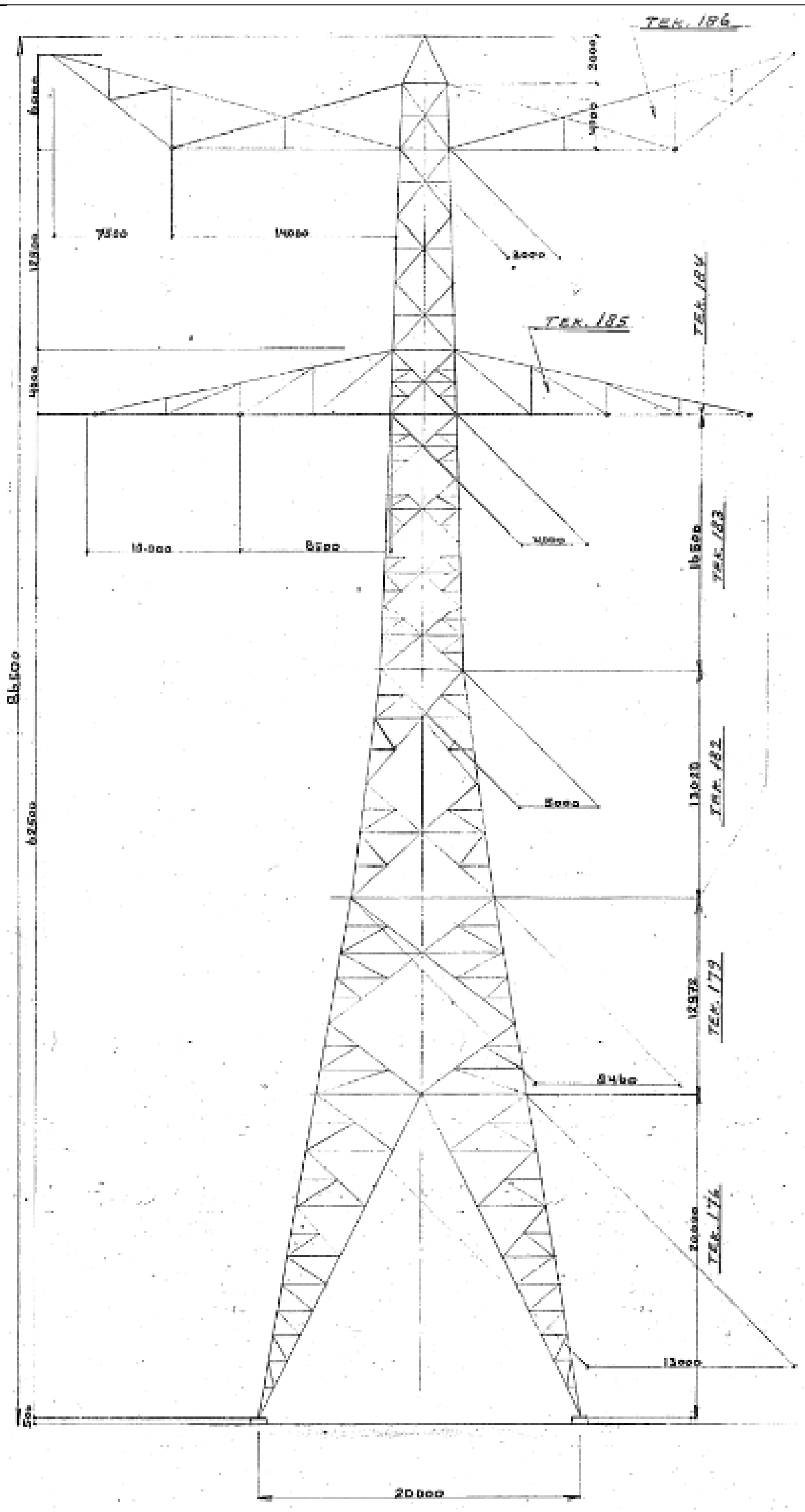
Tabel 1 Relevante eisen

Eis Id	Titel	Eis Tekst	Bewijsvoering
BO Eis: H2.7-6	Omgeving, beperkings factoren	Het ontwerp dient geverifieerd te worden op de uitvoerbaarheid.	Tabel 6
PVE.05.001 5.14	Masten	Aanwijzingen t.a.v. klimvoorziening en valbeveiliging: Huidige klimweg blijft gehandhaafd en zal voldoen aan de eisen zoals opgenomen in de NEN 1060:1977. Valbeveiliging is/zal worden uitgevoerd in het type "latch way". Indien staaldelen in de nabijheid (aangrenzend profiel) van de klimweg gewijzigd worden, dient geverifieerd te worden dat de klimvoorziening in overeenstemming is met de NEN 1060:1977.	Tabel 6

3 BEREKENINGEN

3.1 Mastbeeld

Het mastbeeld op basis van de Asset-data is weergegeven in Figuur 1.



Figuur 1 Mastbeeld

3.2 Mastenlijst

In deze rapportage wordt masttype S+30 getoetst. In de verbinding KIJ-GT komt maar één mast voor van het type S+30 (mast 14), de gegevens van de mast zijn in Tabel 2 weergegeven. De berekening van de geleiderbelastingen is in dit geval locatie specifiek uitgevoerd.

Tabel 2 Mastnummers

Mastnummer	Masttype	Maatgevend mastnummer	Wind span (m)	Weight span (m)	Hoogteverschil
14	S+30	14	524	482	-35.4

3.3 Uitgangspunten berekening

De berekening is uitgevoerd op basis van de uitgangspunten zoals opgenomen in het uitgangspuntenrapport [3]. Hierin is een volledig overzicht opgenomen van de belastingcombinaties en toegepaste belastingfactoren.

Tabel 3 Uitgangspunten berekening

Algemeen	Norm	NEN-EN50341-2-15:2019
	Windgebied	II
	Terreincategorie	II (onbebouwde omgeving)
	Reductiefactor cdir	1,00
Situatie initieel	Gevolgklasse	CC2-0
	Betrouwbaarheidsniveau	Afkeur CC2-0
	Referentieperiode	30 jaar
Situatie na aanpassingen	Gevolgklasse	CC2
	Betrouwbaarheidsniveau	Verbouw
	Referentieperiode	50 jaar

3.4 Proces stappen

Het proces van het bepalen van eventueel benodigde verstevigingen bestaat uit de volgende stappen:

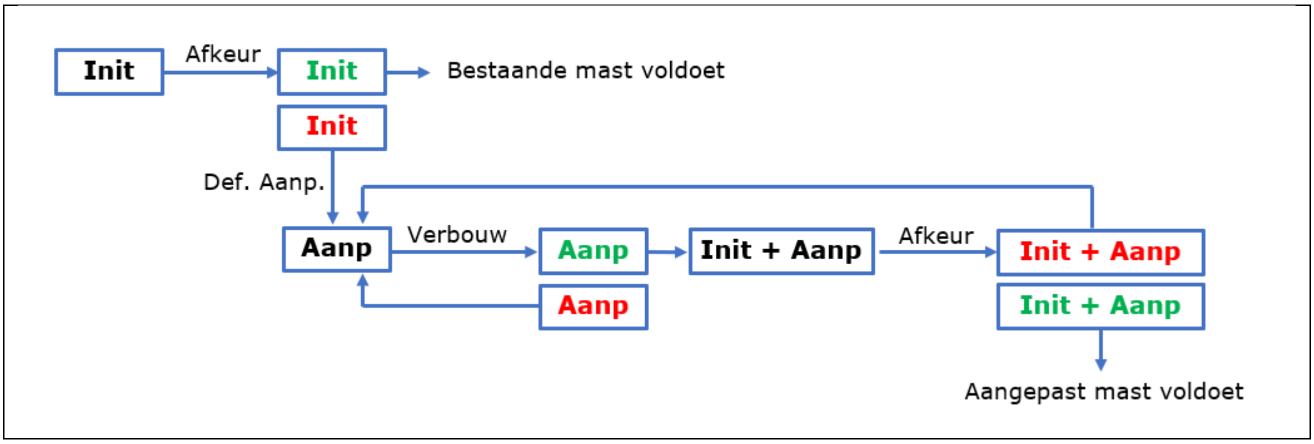
Stap 1: Toets bestaande (Init) mast op Afkeur

Stap 2: Definiëren benodigde aanpassingen indien initiële mast niet voldoet aan toets op Afkeur (Def. Aanp.)

Stap 3: Het toetsen van (alleen) de uitgewerkte aanpassingen (Aanp) op Verbouw

Stap 4: Het opnieuw toetsen van de complete mast inclusief aanpassingen (Initi + Aanp) op Afkeur

Het hierboven omschreven proces is in Figuur 2 weergegeven.



Figuur 2 Proces diagram

3.5 Geleiderbelastingen

De berekening is uitgevoerd met het geleiderbelastingenprogramma van DNV GL. In Appendix A zijn de resultaten van de geleiderbelastingen samengevat.

3.6 Reacties op de fundering

De oplegreacties op de fundering worden ontleend aan de uitvoer van het geleiderbelastingenprogramma, zie ook Appendix A.

3.7 Modellering

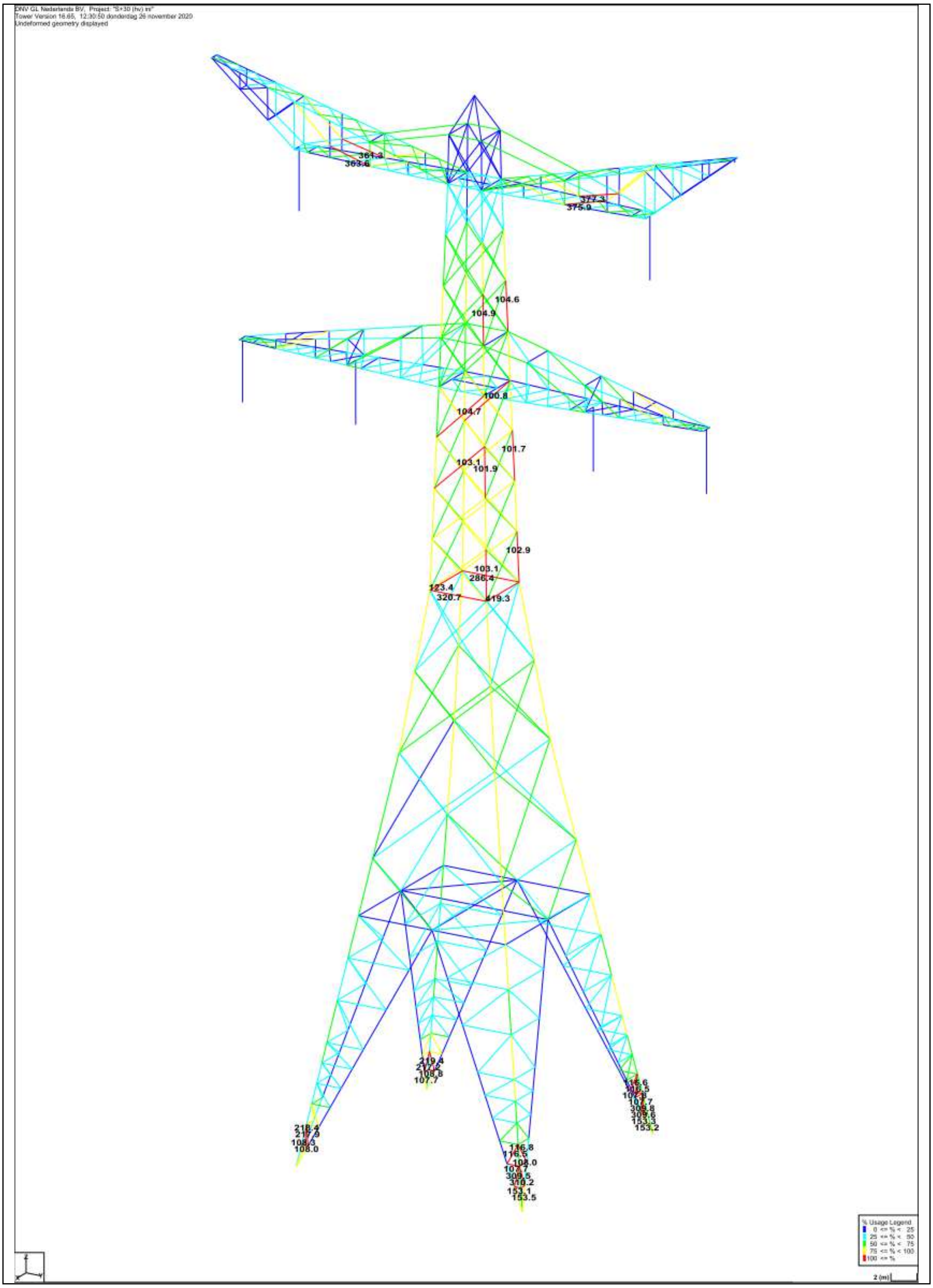
Op basis van de as-built tekeningen is de mast in PLS-TOWER ingevoerd. De hoofdelementen zijn gemodelleerd. Niet-dragende profielen als knikverkorters zijn weggelaten en worden separaat getoetst. De profielen inclusief de boutverbindingen zijn in PLS-TOWER ingevoerd en getoetst. Controle van de schetsplaten en andere detailverbindingen valt buiten de scope.

De geleiderbelastingen vanuit het geleiderbelastingenprogramma zijn als invoer voor de belastingen gebruikt.

Diagonalen in voor- en achtervlak respectievelijk de twee zijvlakken zijn samengenomen in een groep en de toetsing wordt per staafgroep uitgevoerd. Ingeval dat een element uit een groep is overbelast, geldt dit voor alle elementen uit de betreffende groep.

4 TOETSING MAST

Het resultaat van de controle van de mastconstructie type S+30 met belastingen op afkeurniveau is weergegeven in onderstaande figuren.



Figuur 3 Resultaat PLS-TOWER S+30 (14)

De resultaten van de controles van profielen, knikverkorters en ankers randstijl zijn opgenomen in Tabel 4. Figuur 3 laat zien dat een aantal knikverkorters niet voldoen volgens de PLS-Tower berekening. Aanvullend is er een meer nauwkeurige berekening gemaakt met behulp van Axis VM en een op Excel gebaseerd programma ontwikkeld door DNV GL. Uit deze berekeningen blijkt dat de belasting op de knikverkorters binnen acceptabele grenzen blijft.

Tabel 4 Samenvatting controle

Controle van	Beoordeling		Referentie
Profielen		**Voldoen niet**	Figuur 3
Knikverkorters	Voldoen		Appendix C
Ankers en voetplaat	Voldoen		Appendix D

5 AANPASSINGEN

5.1 Inleiding

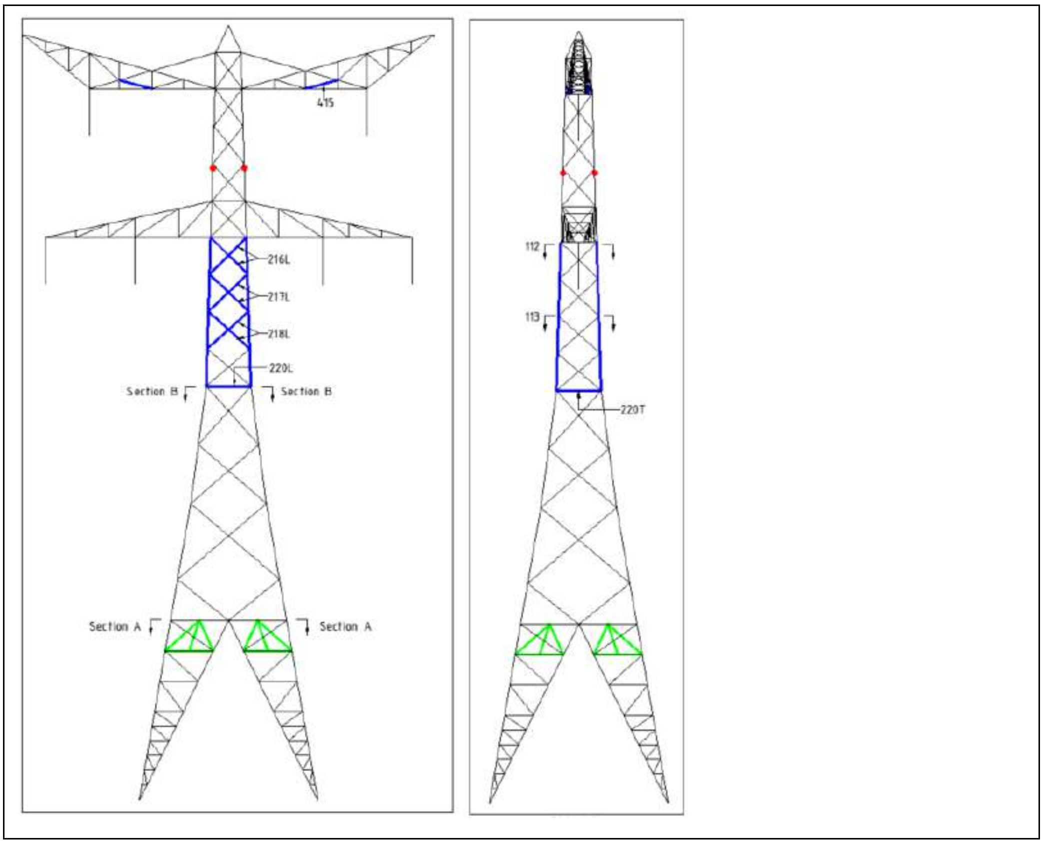
Een versterkingsvoorstel om de mast aan afkeurniveau te laten voldoen en nieuwe onderdelen aan verbouwniveau is uitgewerkt. Dit voorstel bevat de volgende maatregelen:

- Vervangen van kruisverbanden in het middenstuk van de mast;
- Vervangen van een diagonaal in de boventraverse;
- Toevoeging van een staaf aan de randstijl in het middenstuk van de mast om de knikcapaciteit te verhogen;
- Toevoeging van knikverkorters om de hoofdiagonaal van het broekstuk te stabiliseren;
- Aanbrengen van een aanvullend stabiliteitsverband in het centrum van de mast.

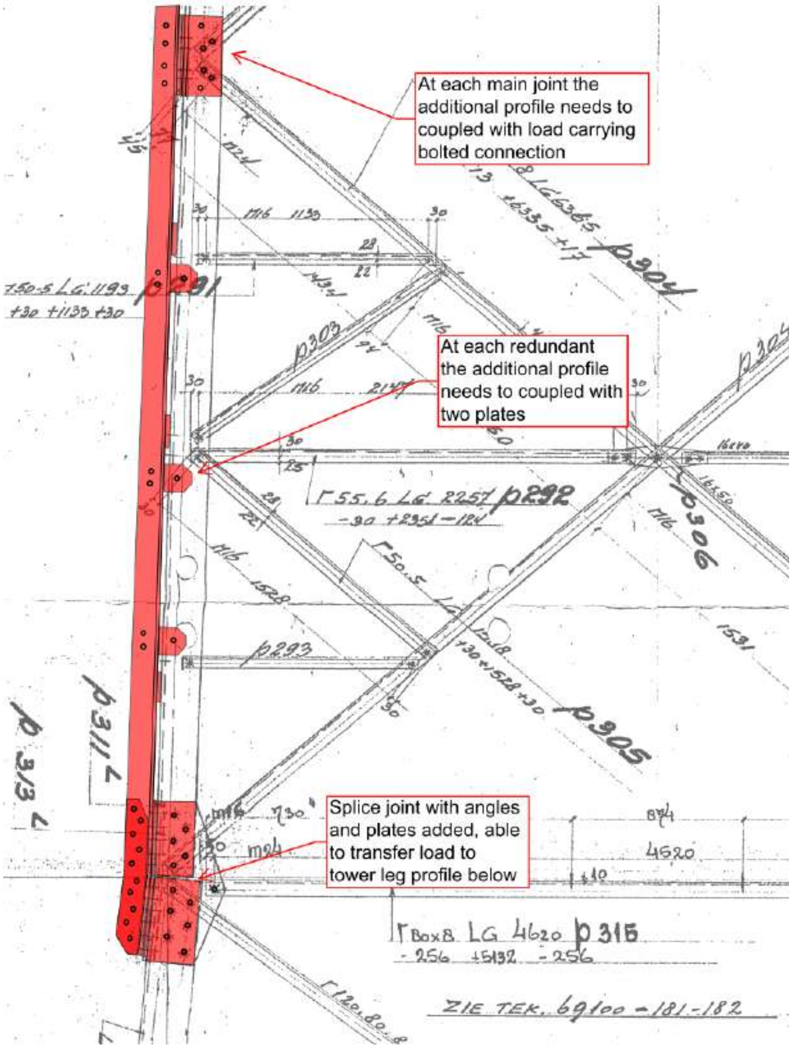
Het aanbrengen van een aanvullend stabiliteitsverband in het centrum van de mast wordt geadviseerd om de algehele stabiliteit van de mast te verbeteren. Dit advies is gebaseerd op de Cigre-publicatie nr. 196 “Diaphragms for steel supports”.

5.2 Aanpassingen

Zoals blijkt uit de uitvoer van PLS Tower, zie Appendix B, moeten de onderdelen die zijn weergegeven in Figuur 4 worden aangepast. Het grootste gedeelte van de aanpassingen bevindt zich in het tussenstuk van de mast, waarin kruisverbanden moeten worden vervangen, staven worden toegevoegd aan de randstijlen en een aanvullend stabiliteitsverband moet worden aangebracht. Voor afmetingen profielen en bouten, zie Appendix E.

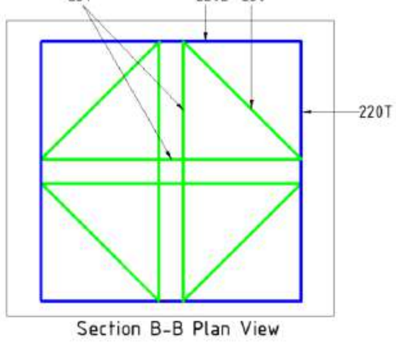


Figuur 4 Aanpassingen voor S+30 (14), vooraanzicht (links) en zijaanzicht (rechts)



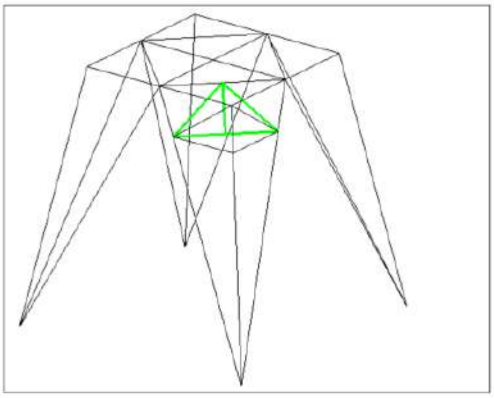
Figuur 5 Principe versterking van de randstijl in het bovenste tussenstuk

De mast S+30 is een relatief slanke constructie zonder horizontale stabiliteitsverbanden in het mastlichaam. Om deze reden wordt er geadviseerd om een stabiliteitsverband aan te brengen ter plaatse van doorsnede B-B, zie Figuur 4. De vorm van het verband is weergegeven in Figuur 6. Voor afmetingen profielen en bouten, zie Appendix E.



Figuur 6 Aanbevolen stabiliteitsverband ter hoogte van doorsnede B-B

Het onderste gedeelte van het mastlichaam is ook relatief slank met een hoogte van 20m zonder dat de hoofdiagonalen UNP300 worden gesteund door aanvullende stabiliteitsverbanden. Het overschrijden van de slankheid van 180 voor primaire stabiliteitsverbanden in combinatie met optredende windbelasting loodrecht op de profielen vormen een risico voor de stabiliteit van de constructie. Om de stabiliteit van dit gedeelte te verbeteren wordt er geadviseerd om een stabiliteitsverband toe te voegen, zoals weergegeven in Figuur 7.



Figuur 7 Aanbevolen stabiliteitsverband voor de UNP300 diagonalen

Een overzicht van het nettogewicht van de profielen die nodig zijn voor de versterkingen/aanpassingen is voor mast 14 gegeven in Tabel 5. Het gewicht van eventueel benodigde schetsplaten is niet meegenomen.

Tabel 5 Gewichten S+30 (14) van uitgewisselde profielen

Staafgroep	Profiel	Materiaal	Bouten	Profiel nw.	Materiaal nw.	Bouten nw.	Maatregel	Aantal	Lengte (m)	Gewicht (kg)
415	L55.6	S235	1M16-5.6t	L80.8	S355	1M16-8.8t	Profiel uitgewisseld	4	3.78	146.67
112A	L160.17	S235	12M24-5.6t	L160.17 + L120.15	S355	12M24-8.8t	Profiel versterkt	4	4.08	455.87
112B	L160.17	S235	8M24-5.6t	L160.17 + L120.15	S355	8M24-8.8t	Profiel versterkt	4	4.14	462.58
216L	L120.80.8	S235	2M24-5.6t	L120.80.8	S355	2M24-8.8t	Profiel uitgewisseld	4	5.80	283.75
217L	L120.80.8	S235	2M24-5.6t	L120.80.8	S355	2M24-8.8t	Profiel uitgewisseld	4	6.02	294.51
113A	L200.18	S235	10M24-5.6t	L200.18 + L160.15	S355	10M24-8.8t	Profiel versterkt	4	4.15	632.03
113B	L200.18	S235	10M24-5.6t	L200.18 + L160.15	S355	10M24-8.8t	Profiel versterkt	4	4.15	632.03
218L	L120.80.8	S235	2M24-5.6t	L120.80.8	S355	2M24-8.8t	Profiel uitgewisseld	4	6.22	304.29
220L	L80.8	S235	1M24-5.6t	L120.10	S355	2M24-8.8t	Profiel uitgewisseld	4	5.00	366.09
220T	L80.8	S235	1M24-5.6t	L120.10	S355	2M24-8.8t	Profiel uitgewisseld	4	5.00	366.09
247				L120.10	S355	1M20-8.8t	Profiel toegevoegd	8	5.35	779.65
248				L120.10	S355	1M20-8.8t	Profiel toegevoegd	4	7.64	559.39
249				L80.8	S355	1M16-8.8t	Profiel toegevoegd	4	3.74	145.12
250				L75.7	S355	1M16-8.8t	Profiel toegevoegd	4	3.54	112.87
251				L70.6	S355	1M16-8.8t	Profiel toegevoegd	4	5.00	127.62
								60	**73.61**	**5668.56**

5.3 Eisen verificatie

De verificatie van de van toepassing zijnde eisen is uitgevoerd in onderstaande Tabel 6.

Tabel 6 Verificatie eisen

Eis Id	Eis Tekst	Ja	Nee	N.v.t.	toelichting
BO Eis: H2.7-6	Aanpassingen uitvoerbaar?	X			De toe te voegen staalonderdelen zijn met geboute verbindingen te bevestigen. Dit is een bewezen methode.
PVE.05.001 5.14	Staaldelen in nabijheid van klimweg gewijzigd?	X			De wijzigingen in de nabijheid van de klimweg (diagonalen, randstijlen) zijn in te passen zonder negatieve invloed op de begaanbaarheid.
	klimvoorziening nog in overeenstemming is met de NEN 1060:1964?			X	Geen wijzigingen

6 REFERENTIES

[1] „002.589.40 0817486 - 20-0473 - Verificatie & validatieplan 380kV verbinding Krimpen aan de IJssel - Geertruidenberg”.

[2] „002.589.40 0808624 - 20-0472 - E-studie deel 1 380kV verbinding Krimpen aan de IJssel - Geertruidenberg”.

[3] „002.589.40 0808629 - 20-0345 - Uitgangspuntenrapport 380kV verbinding Krimpen aan de IJssel - Geertruidenberg”.

APPENDIX A CONDUCTOR LOADS

Content

ISSUE	DATE	REVISION	CHK'D	APP'D
0.0	2020-11-26			

Data

Norm	NEN-EN50341-2-15:2019
Initial	
Consequence class	CC2-0
Reliability level	Afkeur
Reference period	30 jaar
After adjustment	
Consequence class	CC2
Reliability level	Verbouw
Reference period	50 jaar
Wind zone	II
Wind speed	27 m/s
Terrain categorie	II
Reduction factor C_{dir}	1,00
Ice region	B
Tower type	Steunmast
Tower height	86 m
Max. Span	589 m
Line angle	180°
Catenary	1400 m
Wind span	522 m
EDS Weight span	468 m
Min. Weight span	267 m
Max. Weight span	470 m

Client:

Title:

Berekening masttype S+30 II

JOB No.	-	DATE	-
DRAWN	-	CHKD	-
DESIGN	-	APPD	-

Document name:

KIJ-GT_S+30 II_14_Report.pdf

Project number:

Project client number:

0.0

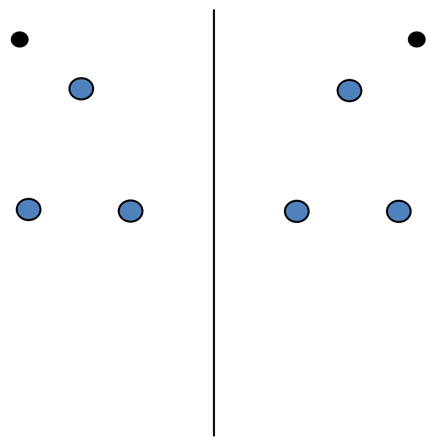
Project: KIJ-GT
Tower: S+30 II
Number: 14

Auteur: TBR
Versie: v11.3

Conductor loads

General

Description	S+30 II
Tower type	Steunmast
Number of circuits	2
Configuration	2-circuit-donau
Number of earth wires	2



Configuratie geleiders

Starting points

Norm	NEN-EN50341-2-15:2019
Consequence class	CC2-0
Reliability level initial	Afkeur CC2-0
Reference period intial	30 jaar
Consequence class modified	CC2
Reliability level modified	Verbouw
Reference period modified	50 jaar
Wind zone	II
Wind speed	27,0 m/s
Terrain category	II
Reduction factor c_{dir}	1,00
Ice region phase conductor	B
Ice region earth conductor	B

Conductors back

Description	Voltage	Conductor Back	Bundle Ba	Ice region	Additional weight	Additional diameter	Catenary P_{back}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Conductors ahead

Description	Voltage	Conductor Ahead	Bundle Ah	Ice region	Additional weight	Additional diameter	Catenary P_{ahead}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Insulators *(1)*

Description	Suspension	Weight [kN]	Length [m]	Wind area [m^2]
Circuit 1	Halfverankering	2,00	4,30	1,00
Circuit 2	Halfverankering	2,00	4,30	1,00
Bliksemdraad 1	Vast (Bliksemdraad)	0,10	0,50	0,05
Bliksemdraad 2	Vast (Bliksemdraad)	0,10	0,50	0,05

1. Properties apply to the entire isolator set

Suspension height and position in mast

Circuits	Designation	Number	Suspension height	Attach point	Position in tower (3) Horizontal distance
Circuit 1	21	380ct1f1	58,2 m	62,5 m	20,5 m
Circuit 1	20	380ct1f2	58,2 m	62,5 m	10,5 m
Circuit 1	22	380ct1f3	74,7 m	79,0 m	15,5 m
Circuit 2	10	380ct2f1	58,2 m	62,5 m	-20,5 m
Circuit 2	11	380ct2f2	58,2 m	62,5 m	-10,5 m
Circuit 2	12	380ct2f3	74,7 m	79,0 m	-15,5 m
Bliksemdraad 1	3	bl1	84,5 m	85,0 m	23,0 m
Bliksemdraad 2	1	bl2	84,5 m	85,0 m	-23,0 m

1. Positive = adjacent mast higher
2. Positive = in direction of rotation coordinate system x => y

Project: KIJ-GT
Tower: S+30 II
Number: 14

Height adjustment adjacent masts (wind and weight span adjustment)

	Back	Ahead	
Height increase for wind pressure	0,0 m	0,0 m	(positive: higher)
Height decrease for vertical load	0,0 m	0,0 m	(negative: decrease, more weight span)

Decrease: Niet in 0,9EG-combinaties

Height difference adjacent tower and change of direction with respect to Line direction

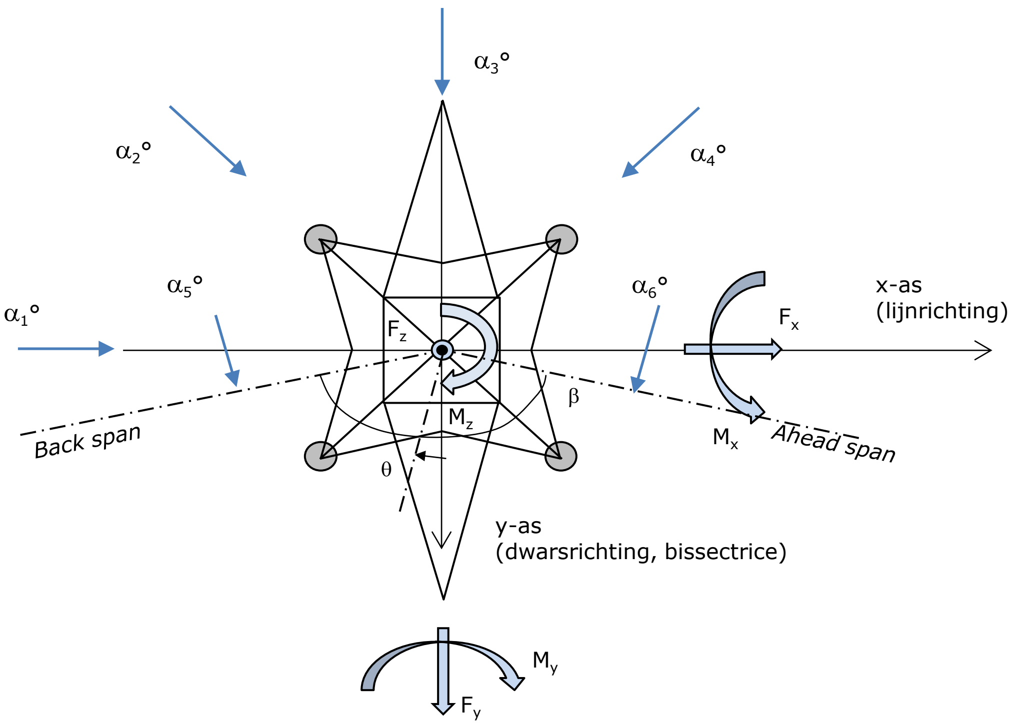
			Hoogteverschil		Richtingsverandering	
Circuits	Aanduiding	Nummer	Δh_back	Δh_ahead	Δy_back	Δy_ahead
Circuit 1	21	380ct1f1	65,0	-30,6 m	5,0	-4,8 m
Circuit 1	20	380ct1f2	65,0	-30,6 m	1,0	-1,8 m
Circuit 1	22	380ct1f3	75,5	-35,8 m	3,0	-3,3 m
Circuit 2	10	380ct2f1	65,0	-30,6 m	-5,0	4,8 m
Circuit 2	11	380ct2f2	65,0	-30,6 m	-1,0	1,8 m
Circuit 2	12	380ct2f3	75,5	-35,8 m	-3,0	3,3 m
Bliksemdraad 1	3	bl1	75,6	-42,0 m	8,5	-6,8 m
Bliksemdraad 2	1	bl2	75,6	-42,0 m	-8,5	6,8 m

Line and tower data

		Back	Ahead
		589,0	454,0 m
Ruling span √(ΣL³/ΣL)		552,7	552,7 m
Line angle	β	180 °	
Tower orientation with respect to bis	θ	0 °	
Section length		2418	2418 m
Height bottom of tower to ground level		0,5 m	
Wind directions considered	α_1	0 °	
Wind directions according to:	α_2	45 °	
Geleiderbelastingen	α_3	90 °	
	α_4	135 °	
	α_5	- °	
	α_6	- °	

Wind directions apply to the main direction of mast construction, not to the bisector.

Windrichtingen en positieve richtingen belastingen



Considered number of wind directions	
1a	4
3	4
4	1
6	1
Overig	1

Project: KIJ-GT
Tower: S+30 II
Number: 14

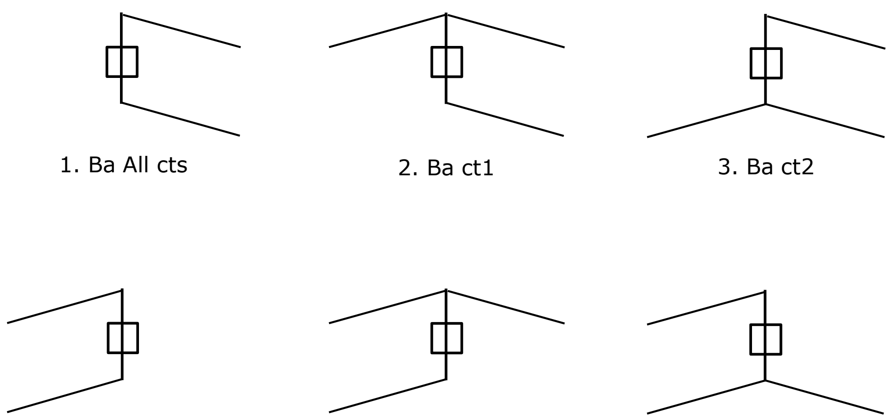
Absence of conductors

		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	380ct1f1	1	0	1	0	0,8	0
Circuit 1	380ct1f2	1	0	1	0	0,8	0
Circuit 1	380ct1f3	1	0	1	0	0,8	0
Circuit 2	380ct2f1	0	1	1	0	0,8	0
Circuit 2	380ct2f2	0	1	1	0	0,8	0
Circuit 2	380ct2f3	0	1	1	0	0,8	0
Bliksemdraad 1	bl1	1	0	1	0	1	0
Bliksemdraad 2	bl2	0	1	1	0	1	0

Load situations SPLS

Considered situations SPLS: SPLS for suspension tower not applicable

Principle of load situations:

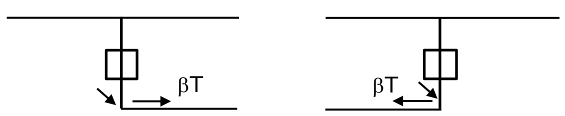


1. Ba All cts
2. Ba ct1
3. Ba ct2
4. Ah All cts
5. Ah ct1
6. Ah ct2

Load situation 5a. Conductor failure

Considered situations conductor failure 5a: 1, design assumption is symmetry back and ahead

Principle of load situations:



1. Ba
2. Ah

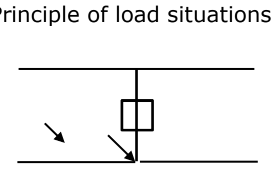
Load situations LC6. Construction and maintenance
Under 6a, the load due to the presence of a line verhicle or line bicycle in combination with point load on the traverse is assesed.
Combination 6b does not contain any loads in conductor or on traverse. This combination has been added to be able to combine with separate control platforms, etc. The situations are applied in ULS and in every SPLS situation (in case of angle tower).

3,0 kN	2,0 kN
1,0 kN	1,0 kN

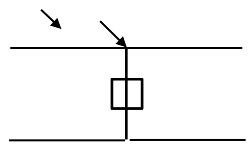
Considered situations construction and maintenance 6a: 1 up to 4, all possible situations

Presence line vehicle: Circuit, load present in all conductors of a circuit

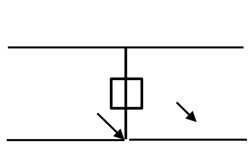
Principle of load situations:



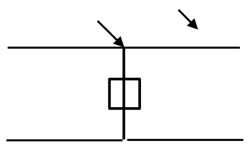
1. Ba Ct1



2. Ba Ct2



3. Ah Ct1



4. Ah Ct2

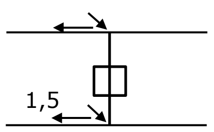
Load situations 8. Galloping as a static load

Conductor		
Suspension tower phase	0,866 W	1,5 W
Suspension tower earth	1,5 EDS	1,5 W
Strain tower phase and earth	1,5 EDS	1,5 W

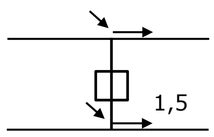
Considered situations galloping 8: None (existing structure)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principle of load situations:



1. Ba



2. Ah

Load combination 8. Galloping as a dynamic load
Only applies to tension towers
Load consists of EDS tensile load in one of the conductors on one side of the tower
Can be converted by user to fatigue spectrum via the load spectrum of table 4.11 / NL.1

Project: KIJ-GT
Tower: S+30 II
Number: 14

Tower structure

Properties

Tower type	Steunmast		
Tower designation	S+30 II		
Base plate w.r.t. ground level	0,5	m	
Tower height w.r.t. base plate	86,0	m	
Tower self weight	825,0	kN	

Width and slope at foundation	x-ri.	y-ri.	
Leg spread	20,00	20,00	m
Inclination of main leg	0,175	0,175	-
Horizontal force factor	1,1	1,1	-

Calculation Wind load

Dynamic factor G_T	1,00 *(Masthoogte < 60 m)*
Wind load diagonally to tower body proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Wind load diagonally on traverse proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Magnification factor diagonal wind to tower body	(1+0,2sin^2(2phi))
Magnification factor diagonal wind to cross arm	(1+0,2sin^2(2phi))
Magnification factor wind parallel to perpendicular to cross a	0,4

Properties mast sections line direction (front view, yz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	20,00	20,00	13,00	20,00	0,175	330,00	37,87	0,11	3,33
Middenstuk 1	32,97	13,00	8,46	12,97	0,175	139,19	19,88	0,14	3,19
Middenstuk 2	46,00	8,46	5,00	13,03	0,133	87,68	17,21	0,20	2,95
Bovenstuk 1	62,50	5,00	4,00	16,50	0,030	74,25	16,26	0,22	2,85
Bovenstuk 2	83,00	4,00	2,88	20,50	0,027	70,48	21,63	0,31	2,51
Topstuk	86,00	2,88		3,00		4,31	1,00	0,23	2,80
Ondertraverse	62,50	18,50		4,00		37,00	8,60	0,23	2,79
Boventraverse	79,00	21,50		6,00		64,50	12,65	0,20	2,95

Properties tower sections transverse direction (side view, xz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	20,00	20,00	13,00	20,00	0,175	330,00	37,87	0,11	3,33
Middenstuk 1	32,97	13,00	8,46	12,97	0,175	139,19	19,88	0,14	3,19
Middenstuk 2	46,00	8,46	5,00	13,03	0,133	87,68	17,21	0,20	2,95
Bovenstuk 1	62,50	5,00	4,00	16,50	0,030	74,25	16,26	0,22	2,85
Bovenstuk 2	83,00	4,00	2,88	20,50	0,027	70,48	21,63	0,31	2,51
Topstuk	86,00	2,88		3,00		4,31	1,00	0,23	2,80
Ondertraverse	62,50	18,50		4,00		37,00	8,60	0,23	2,79
Boventraverse	79,00	21,50		6,00		64,50	12,65	0,20	2,95

Note: Surface transverse direction is reduced in calculation.

Project: KIJ-GT
Tower: S+30 II
Number: 14

Wind surface feeders telecom installations

Part	A (m^2/m)	Δh	A_1
Broekstuk 1			
Middenstuk 1			
Middenstuk 2			
Bovenstuk 1			
Bovenstuk 2			

Input antennas

Description	A (m^2)	h (m)	C_f (m)
Antenne 1			
Schotel			
Schotel			

Tower section loads longitudinal (x-direction) per wind direction

Description	p_w	F_{x1}	F_{x2}	F_{x3}	F_{x4}	h_{ef}	M_{y1}	M_{y2}	M_{y3}	M_{y4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,85	107,4	91,1	0,0	-91,1	10,0	1073,9	911,3	0,0	-911,3
Middenstuk 1	1,16	73,5	62,4	0,0	-62,4	26,5	1947,3	1652,3	0,0	-1652,3
Middenstuk 2	1,30	65,7	55,7	0,0	-55,7	39,5	2593,7	2200,8	0,0	-2200,8
Bovenstuk 1	1,41	65,2	55,4	0,0	-55,4	54,3	3539,6	3003,5	0,0	-3003,5
Bovenstuk 2	1,52	82,3	69,9	0,0	-69,9	72,8	5990,9	5083,5	0,0	-5083,5
Topstuk	1,57	4,4	3,7	0,0	-3,7	84,5	371,2	315,0	0,0	-315,0
Ondertraverse	1,47	70,6	41,9	0,0	-41,9	63,8	4504,6	2675,6	0,0	-2675,6
Boventraverse	1,56	116,1	69,0	0,0	-69,0	81,0	9404,6	5586,0	0,0	-5586,0
Totaal		585,3	449,1	0,0	-449,1		29425,8	21427,9	0,0	-21427,9

Tower section loads longitudinal (y-direction) per wind direction

Description	p_w	F_{y1}	F_{y2}	F_{y3}	F_{x4}	h_{ef}	M_{x1}	M_{x2}	M_{x3}	M_{x4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,85	0,0	91,1	107,4	91,1	10,0	0,0	911,3	1073,9	911,3
Middenstuk 1	1,16	0,0	62,4	73,5	62,4	26,5	0,0	1652,3	1947,3	1652,3
Middenstuk 2	1,30	0,0	55,7	65,7	55,7	39,5	0,0	2200,8	2593,7	2200,8
Bovenstuk 1	1,41	0,0	55,4	65,2	55,4	54,3	0,0	3003,5	3539,6	3003,5
Bovenstuk 2	1,52	0,0	69,9	82,3	69,9	72,8	0,0	5083,5	5990,9	5083,5
Topstuk	1,57	0,0	3,7	4,4	3,7	84,5	0,0	315,0	371,2	315,0
Ondertraverse	1,47	0,0	41,9	28,2	41,9	63,8	0,0	2675,6	1801,8	2675,6
Boventraverse	1,56	0,0	69,0	46,4	69,0	81,0	0,0	5586,0	3761,8	5586,0
Total		0,0	449,1	473,3	449,1		0,0	21427,9	21080,3	21427,9

Resulting loads from mast construction incl. Antenna without conductors level foundation (char. Value)

Load / wind direction	F_x	F_y	F_z	M_x	M_y	M_z
	[kN]	[kN]	[kN]	[kNm]	[kNm]	[kNm]
Permanente belasting	0	0	825	0	0	0
Windrichting 0°	585	0	0	0	29426	0
Windrichting 45°	449	449	0	21428	21428	0
Windrichting 90°	0	473	0	21080	0	0
Windrichting 135°	-449	449	0	21428	-21428	0

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Project: KIJ-GT
Tower: S+30 II
Number: 14

Intermediate results for conductor loads

Conductors back

Circuit	Geleider	Diameter [mm]	A [mm²]	G [N/m]	E [N/mm²]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Conductors ahead

Circuit	Geleider	Diameter [mm]	A [mm²]	G [N/m]	E [N/mm²]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Vertical load back

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Vertical load ahead

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	[N/m]	[N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Insulators

Conductor	$G_{isolator}$ [kN]	Number -	$F_{v,iso}$ [kN]	Length [m]	Wind surf. [m²]	Wind heigth [m]	Pressure [kN/m²]	Drag factor [-]	$F_{h,iso}$ [kN]
380ct1f1	2,00	1	2	4,3	1,0	60,85	1,45	1,2	1,74
380ct1f2	2,00	1	2	4,3	1,0	60,85	1,45	1,2	1,74
380ct1f3	2,00	1	2	4,3	1,0	77,35	1,54	1,2	1,85
380ct2f1	2,00	1	2	4,3	1,0	60,85	1,45	1,2	1,74
380ct2f2	2,00	1	2	4,3	1,0	60,85	1,45	1,2	1,74
380ct2f3	2,00	1	2	4,3	1,0	77,35	1,54	1,2	1,85
bl1	0,10	1	0,1	0,5	0,1	85,25	1,58	1,2	0,09
bl2	0,10	1	0,1	0,5	0,1	85,25	1,58	1,2	0,09

Project: KIJ-GT
Tower: S+30 II
Number: 14

Wind load back

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	70,5	1,51	0,62	0,57	0,97	28,25	77,1	70,4	46,9	158,4	144,6
380ct1f2	70,5	1,51	0,62	0,57	0,97	28,25	77,1	70,4	46,9	158,4	144,6
380ct1f3	92,3	1,61	0,64	0,59	0,95	28,25	82,9	75,6	46,9	174,5	159,1
380ct2f1	70,5	1,51	0,62	0,57	0,97	28,25	77,1	70,4	46,9	158,4	144,6
380ct2f2	70,5	1,51	0,62	0,57	0,97	28,25	77,1	70,4	46,9	158,4	144,6
380ct2f3	92,3	1,61	0,64	0,59	0,95	28,25	82,9	75,6	46,9	174,5	159,1
bl1	103,5	1,65	0,65	0,59	1,09	22,24	26,0	23,7	41,5	53,6	48,8
bl2	103,5	1,65	0,65	0,59	1,09	22,13	26,0	23,7	41,4	53,5	48,7

Wind load ahead

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	31,1	1,21	0,56	0,51	1,04	28,25	60,0	55,0	46,9	115,1	105,4
380ct1f2	31,1	1,21	0,56	0,51	1,04	28,25	60,0	55,0	46,9	115,1	105,4
380ct1f3	45,0	1,34	0,59	0,54	1,01	28,25	67,6	61,8	46,9	133,6	122,2
380ct2f1	31,1	1,21	0,56	0,51	1,04	28,25	60,0	55,0	46,9	115,1	105,4
380ct2f2	31,1	1,21	0,56	0,51	1,04	28,25	60,0	55,0	46,9	115,1	105,4
380ct2f3	45,0	1,34	0,59	0,54	1,01	28,25	67,6	61,8	46,9	133,6	122,2
bl1	52,5	1,40	0,60	0,55	1,13	22,24	21,2	19,4	41,5	41,8	38,2
bl2	52,5	1,40	0,60	0,55	1,14	22,13	21,1	19,3	41,4	41,7	38,2

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Project: KIJ-GT
Tower: S+30 II
Number: 14

Conductor loads		Auteur:	TBR
		Versie:	v11.3

Starting points

Consequence class	Afkeur CC2-0
Reference period	30 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,05	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,12	0,00	0,0
ULS 3	Wind+ice	-5°	1,05	1,05	0,00	0,34	0,97	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,05	0,00	0,34	0,97	0,0
ULS 4	Cold+wind	-20°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,05	0,00	0,22	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,05	1,05	1,20	0,22	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 7	Permanent	10°	1,15	1,15	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,05	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,05	1,05	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,05	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,05	1,05	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,05	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,05	1,05	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,05	1,05	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	0,94	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,28	0,88	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	4
Number of load combinations for ULS	36
Number of load combinations for SPLS	0
Number of load combinations for SLS	11
Number of concentrated loads	376

Project: KIJ-GT
Tower: S+30 II
Number: 14

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-36,3	36,4	9,2	5,0	2,6	7,6
bl2	-36,5	36,5	8,1	5,9	2,6	7,6
380ct1f1	-119,4	119,5	27,5	15,2	11,8	26,0
380ct1f2	-119,5	119,5	26,7	15,9	11,8	26,0
380ct1f3	-122,8	122,8	29,2	17,5	9,9	27,6
380ct2f1	-119,7	119,6	25,5	17,4	11,8	26,0
380ct2f2	-119,6	119,6	26,3	16,7	11,8	26,0
380ct2f3	-123,0	122,9	27,8	19,1	9,9	27,6

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	356,4	456,0	467,9
bl2	356,3	455,3	467,9
380ct1f1	397,7	455,0	461,5
380ct1f2	397,7	455,0	461,5
380ct1f3	375,2	444,7	452,6
380ct2f1	397,7	455,0	461,5
380ct2f2	397,7	455,0	461,5
380ct2f3	375,2	444,7	452,6

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	468,1	469,3
bl2	468,1	469,0
380ct1f1	461,7	462,0
380ct1f2	461,7	462,0
380ct1f3	452,8	453,1
380ct2f1	461,7	462,0
380ct2f2	461,7	462,0
380ct2f3	452,8	453,1

Envelop of weight span over all combinations (incl. 0,9 combinations) For all conductors		Wind / Weight span ratio
Max. weight span	469,3 m	0,900 -
Min. weight span	309,8 m	0,594 -

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Project: KIJ-GT
Tower: S+30 II
Number: 14

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	15,0	14,2	9,1	-39,2	33,7
bl2	15,0	14,0	9,1	-39,2	33,7
380ct1f1	51,3	42,7	37,1	-124,4	115,5
380ct1f2	51,3	42,6	37,1	-124,4	115,5
380ct1f3	51,3	46,6	36,4	-130,7	118,7
380ct2f1	51,3	42,9	37,1	-124,4	115,5
380ct2f2	51,3	43,0	37,1	-124,4	115,5
380ct2f3	51,3	46,9	36,4	-130,7	118,7

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	0,0	0,0	4,8	-15,0	15,0
bl2	0,0	0,0	4,8	-15,0	15,0
380ct1f1	0,0	-0,1	23,2	-64,2	64,2
380ct1f2	0,0	-0,1	23,2	-64,2	64,2
380ct1f3	0,0	-0,1	22,7	-64,2	64,2
380ct2f1	0,0	0,1	23,2	-64,2	64,2
380ct2f2	0,0	0,1	23,2	-64,2	64,2
380ct2f3	0,0	0,1	22,7	-64,2	64,2

1 **Control uplift SLS-wind**

Combinatie	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	0,8	3,9
	bl2	0,8	3,9
	380ct1f1	6,8	16,0
	380ct1f2	6,8	16,0
	380ct1f3	5,5	16,9
	380ct2f1	6,8	16,0
	380ct2f2	6,8	16,0
	380ct2f3	5,5	16,9

Project: KIJ-GT
Tower: S+30 II
Number: 14

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		0	293	129	20486	0	8
ULS 1a_0,9_90		0	293	129	20486	0	8
ULS 3_90		0	174	229	12183	0	5
ULS 3_0,9_90		0	174	229	12183	0	5
SLS 7		0	0	148	0	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

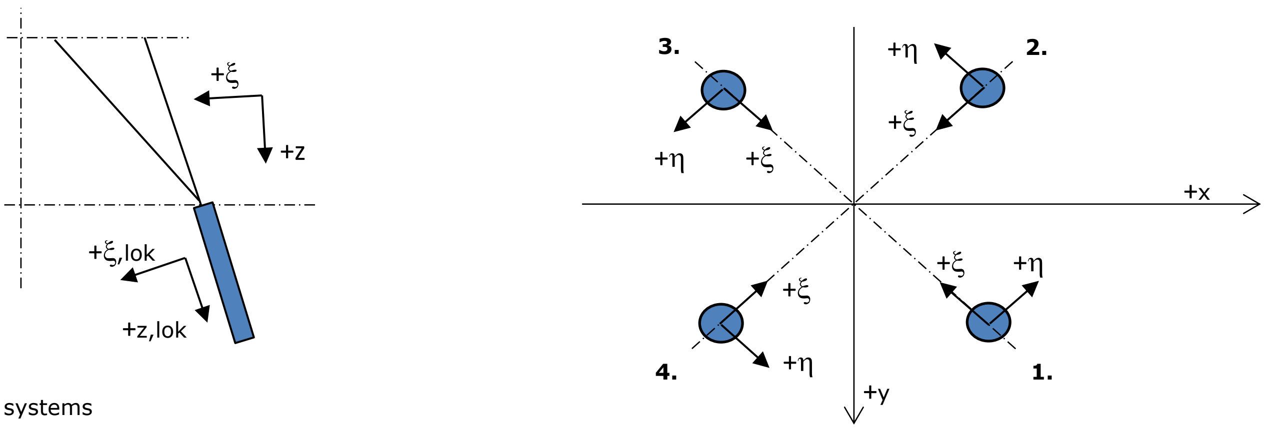
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	825	995	44181	0	8
ULS 3_90	0	333	1095	19292	0	5
SLS 7	0	0	973	0	0	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	825	995	**44181**	0	8
ULS 1a_0	661	0	1021	0	**33298**	0
ULS 5a Ba 21	51	0	974	-157	3209	**1052**
ULS 1a_0,9_0,9_45	507	654	865	**34509**	**24242**	4

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_45	342	329	**1722**	9	-474	-48	1774
2	ULS 1a_0	214	-209	**1088**	-4	-300	-30	1121
3	ULS 7	-54	-54	**280**	0	-76	-7	288
4	ULS 1a_135	-341	329	**1721**	-9	-474	-48	1773

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	0	0	0	0
2	ULS 1a_0,9_0,9_135	-251	238	**-1252**	9	346	36	-1290
3	ULS 1a_0,9_0,9_45	251	239	**-1252**	-9	346	36	-1290
4	ULS 1a_0,9_0,9_0	123	-118	**-614**	4	171	19	-632

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 5a Ba 21	72	49	320	**16**	-86	-7	330
2	ULS 5a Ba 21	47	-76	328	**20**	-87	-6	338
3	ULS 5a Ba 21	-48	-18	167	**21**	-47	-6	172
4	ULS 5a Ba 21	-20	44	159	**17**	-46	-6	164

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	ULS 5a Ba 10	47	76	328	**-20**	-87	-6	338
2	ULS 5a Ba 10	72	-49	320	**-16**	-86	-7	329
3	ULS 5a Ba 10	-20	-44	159	**-17**	-46	-6	164
4	ULS 5a Ba 10	-48	18	167	**-21**	-47	-6	172

Project: KIJ-GT
Tower: S+30 II
Number: 14

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	**0**	0	0	0
2	ULS 1a_0,9_0,9_135	-251	238	**-1252**	**9**	346	36	-1290
3	ULS 1a_0,9_0,9_45	251	239	**-1252**	**-9**	346	36	-1290
4	ULS 1a_0,9_0,9_0	123	-118	**-614**	**4**	171	19	-632

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	47	47	243	0	-66	-6	251
2	SLS 7	47	-47	243	0	-66	-6	251
3	SLS 7	-47	-47	243	0	-66	-6	251
4	SLS 7	-47	47	243	0	-66	-6	251

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_45	342	329	**1722**	9	-474	-48	1774
Max. tension	ULS 1a_0,9_0,9_45	251	239	**-1252**	-9	346	36	-1290
Max. pos. torsie	ULS 5a Ba 21	-48	-18	167	**21**	-47	-6	172
Max. neg. torsie	ULS 5a Ba 10	-48	18	167	**-21**	-47	-6	172
Comb. tension+torsie	ULS 1a_0,9_0,9_45	251	239	**-1252**	**-9**	346	36	-1290

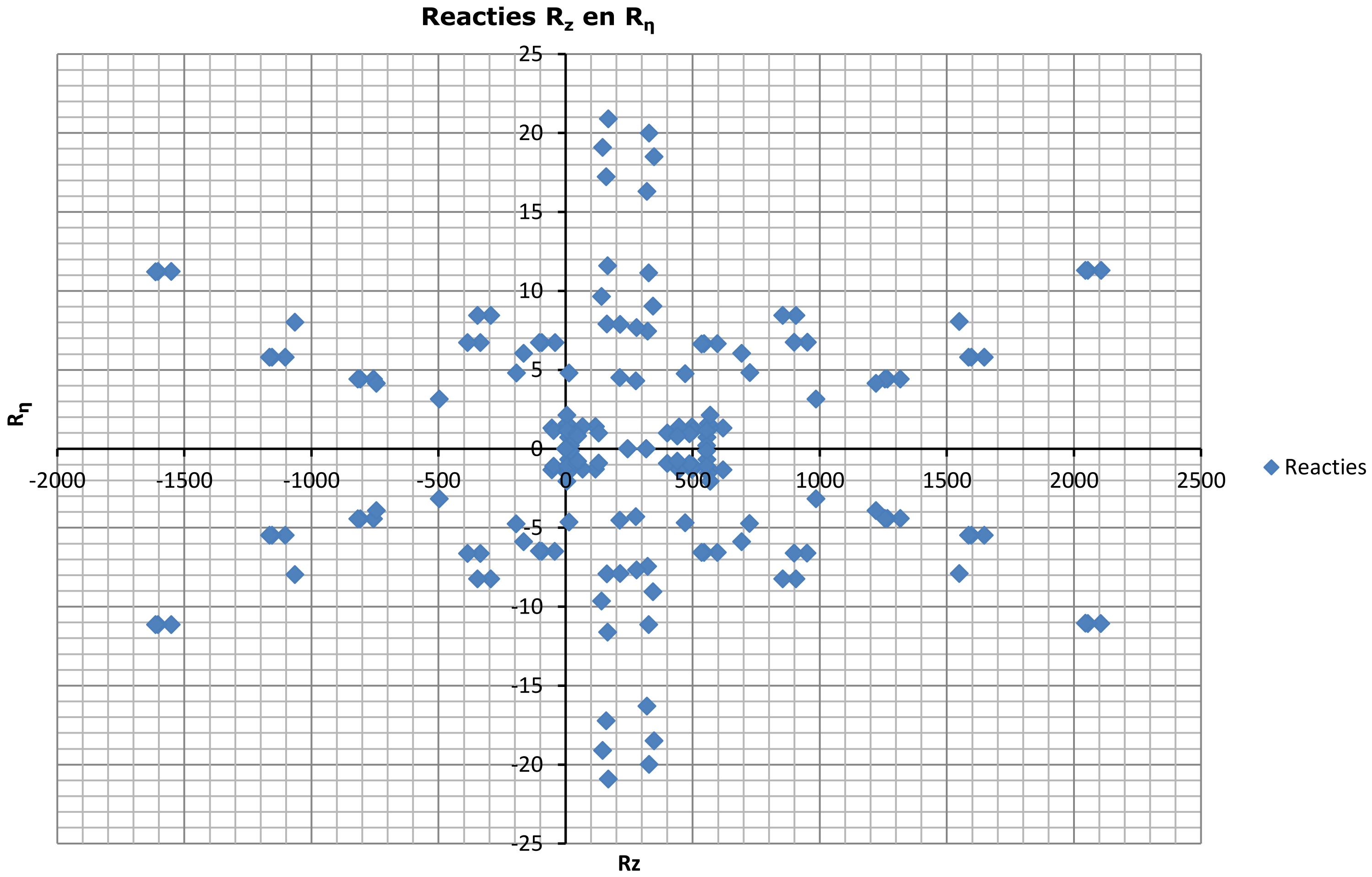
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	47	47	**243**	0	-66	-6	251
2	SLS 1a_135	-199	189	**-991**	8	274	29	-1021
3	SLS 1a_45	199	189	**-991**	-8	274	29	-1021
4	SLS 1a_0	92	-88	**-455**	3	127	14	-469

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_45	292	281	**1474**	8	-406	-41	1518
2	SLS 1a_0	185	-181	**942**	-3	-259	-26	970
3	SLS 7	-47	-47	**243**	0	-66	-6	251
4	SLS 1a_135	-292	282	**1474**	-7	-406	-41	1518

Project: KIJ-GT
Tower: S+30 II
Number: 14



Project: KIJ-GT
Tower: S+30 II
Number: 14

Conductor loads

Auteur: TBR
Versie: v11.3

Starting points

Consequence class Verbouw CC2
Reference period 50 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,15	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,40	0,00	0,0
ULS 3	Wind+ice	-5°	1,15	1,15	0,00	0,42	1,30	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,15	0,00	0,42	1,30	0,0
ULS 4	Cold+wind	-20°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,15	0,00	0,28	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,15	1,15	1,30	0,28	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 7	Permanent	10°	1,30	1,30	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,15	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,15	1,15	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,15	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,15	1,15	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,15	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,15	1,15	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,15	1,15	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	1,00	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,30	1,00	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	4
Number of load combinations for ULS	36
Number of load combinations for SPLS	0
Number of load combinations for SLS	11
Number of concentrated loads	376

Project: KIJ-GT
Tower: S+30 II
Number: 14

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-43,3	43,4	11,5	6,2	2,9	8,7
bl2	-43,6	43,6	10,1	7,4	2,9	8,7
380ct1f1	-141,2	141,3	34,3	19,0	14,0	30,8
380ct1f2	-141,4	141,4	33,3	19,8	14,0	30,8
380ct1f3	-145,5	145,6	36,3	21,8	11,8	32,6
380ct2f1	-141,6	141,5	31,8	21,6	14,0	30,8
380ct2f2	-141,4	141,4	32,8	20,8	14,0	30,8
380ct2f3	-145,7	145,7	34,7	23,7	11,8	32,6

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	348,2	455,0	467,9
bl2	348,1	454,2	467,9
380ct1f1	392,2	454,5	461,5
380ct1f2	392,2	454,5	461,5
380ct1f3	368,6	444,1	452,6
380ct2f1	392,2	454,5	461,5
380ct2f2	392,2	454,5	461,5
380ct2f3	368,6	444,1	452,6

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	468,4	470,3
bl2	468,4	470,0
380ct1f1	461,9	462,7
380ct1f2	461,9	462,7
380ct1f3	453,1	454,0
380ct2f1	461,9	462,7
380ct2f2	461,9	462,7
380ct2f3	453,1	454,0

Envelop of weight span over all combinations (incl. 0,9 combinations) For all conductors		Wind / Weight span ratio
Max. weight span	470,3 m	0,902 -
Min. weight span	267,2 m	0,512 -

Project: KIJ-GT
Tower: S+30 II
Number: 14

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	15,0	17,7	10,6	-46,9	40,1
bl2	15,0	17,5	10,6	-46,8	40,1
380ct1f1	51,3	53,2	43,9	-147,8	136,3
380ct1f2	51,3	53,1	43,9	-147,8	136,3
380ct1f3	51,3	58,1	43,1	-155,7	140,4
380ct2f1	51,3	53,4	43,9	-147,8	136,3
380ct2f2	51,3	53,5	43,9	-147,8	136,3
380ct2f3	51,3	58,4	43,1	-155,7	140,4

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	0,0	0,0	4,8	-15,0	15,0
bl2	0,0	0,0	4,8	-15,0	15,0
380ct1f1	0,0	-0,1	23,2	-64,2	64,2
380ct1f2	0,0	-0,1	23,2	-64,2	64,2
380ct1f3	0,0	-0,1	22,7	-64,2	64,2
380ct2f1	0,0	0,1	23,2	-64,2	64,2
380ct2f2	0,0	0,1	23,2	-64,2	64,2
380ct2f3	0,0	0,1	22,7	-64,2	64,2

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	0,8	3,9
	bl2	0,7	3,9
	380ct1f1	6,8	16,0
	380ct1f2	6,8	16,0
	380ct1f3	5,5	16,9
	380ct2f1	6,8	16,0
	380ct2f2	6,8	16,0
	380ct2f3	5,5	16,9

Project: KIJ-GT
Tower: S+30 II
Number: 14

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		0	365	136	25516	0	10
ULS 1a_0,9_90		0	365	136	25516	0	10
ULS 3_90		0	217	271	15175	0	6
ULS 3_0,9_90		0	217	271	15175	0	6
SLS 7		0	0	148	0	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

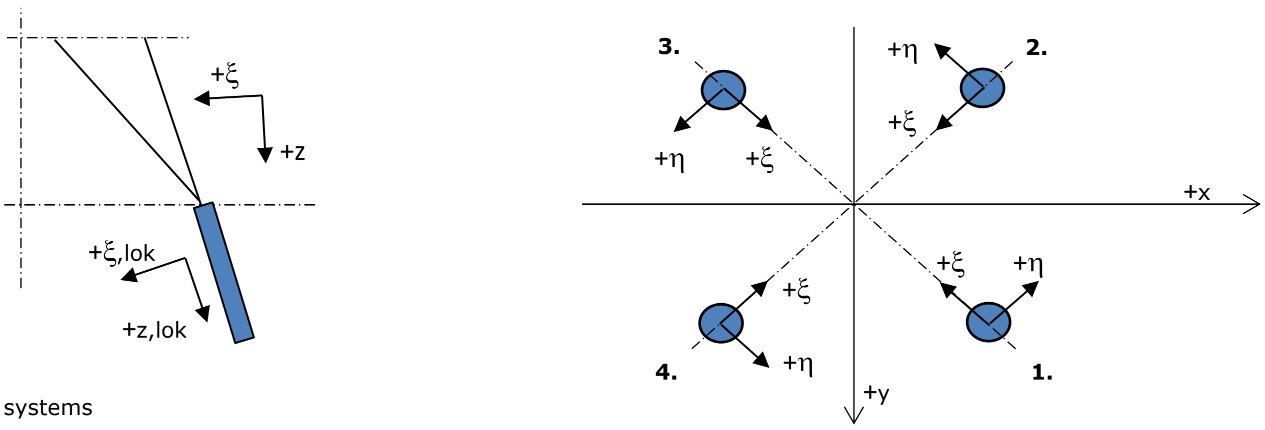
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	1027	1085	55028	0	10
ULS 3_90	0	415	1219	24028	0	6
SLS 7	0	0	973	0	0	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	1027	1085	**55028**	0	10
ULS 1a_0	823	0	1119	0	**41473**	0
ULS 5a Ba 21	51	0	974	-157	3209	**1052**
ULS 1a_0,9_0,9_45	632	814	861	**42983**	**30194**	5

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_45	418	402	**2106**	11	-580	-59	2170
2	ULS 1a_0	260	-253	**1317**	-4	-363	-37	1356
3	ULS 7	-61	-61	**316**	0	-86	-8	326
4	ULS 1a_135	-418	402	**2106**	-11	-580	-59	2169

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	0	0	0	0
2	ULS 1a_0,9_0,9_135	-323	307	**-1614**	11	446	47	-1662
3	ULS 1a_0,9_0,9_45	323	307	**-1614**	-11	446	47	-1663
4	ULS 1a_0,9_0,9_0	164	-157	**-818**	4	227	25	-843

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 5a Ba 21	72	49	320	**16**	-86	-7	330
2	ULS 5a Ba 21	47	-76	328	**20**	-87	-6	338
3	ULS 5a Ba 21	-48	-18	167	**21**	-47	-6	172
4	ULS 5a Ba 21	-20	44	159	**17**	-46	-6	164

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	ULS 5a Ba 10	47	76	328	**-20**	-87	-6	338
2	ULS 5a Ba 10	72	-49	320	**-16**	-86	-7	329
3	ULS 5a Ba 10	-20	-44	159	**-17**	-46	-6	164
4	ULS 5a Ba 10	-48	18	167	**-21**	-47	-6	172

Project: KIJ-GT
Tower: S+30 II
Number: 14

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	**0**	0	0	0
2	ULS 1a_0,9_0,9_135	-323	307	**-1614**	**11**	446	47	-1662
3	ULS 1a_0,9_0,9_45	323	307	**-1614**	**-11**	446	47	-1663
4	ULS 1a_0,9_0,9_0	164	-157	**-818**	**4**	227	25	-843

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	47	47	243	0	-66	-6	251
2	SLS 7	47	-47	243	0	-66	-6	251
3	SLS 7	-47	-47	243	0	-66	-6	251
4	SLS 7	-47	47	243	0	-66	-6	251

Envelope of load combinations for all of the legs

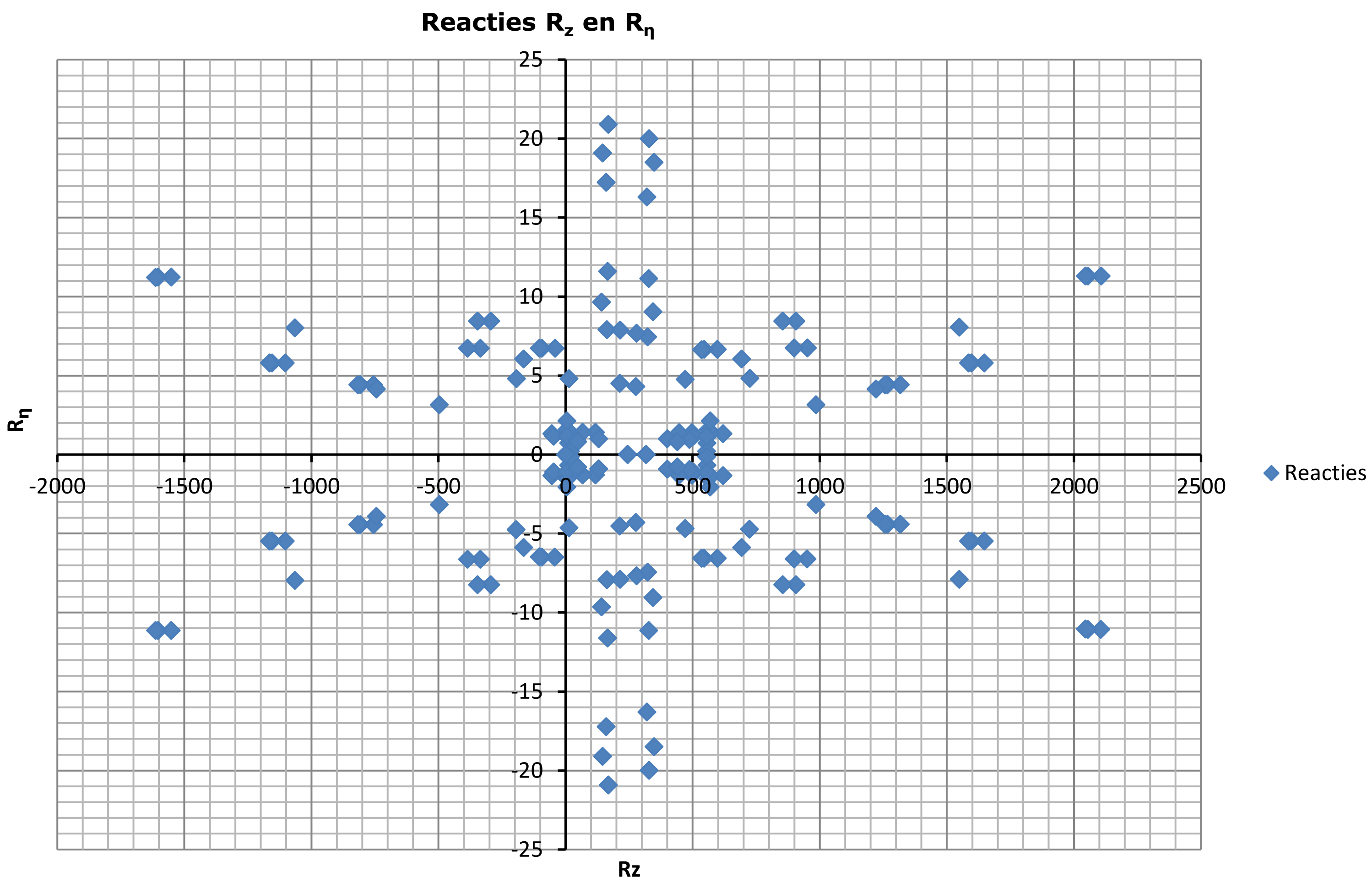
Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_45	418	402	**2106**	11	-580	-59	2170
Max. tension	ULS 1a_0,9_0,9_45	323	307	**-1614**	-11	446	47	-1663
Max. pos. torsie	ULS 5a Ba 21	-48	-18	167	**21**	-47	-6	172
Max. neg. torsie	ULS 5a Ba 10	-48	18	167	**-21**	-47	-6	172
Comb. tension+torsie	ULS 1a_0,9_0,9_45	323	307	**-1614**	**-11**	446	47	-1663

Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	47	47	**243**	0	-66	-6	251
2	SLS 1a_135	-214	203	**-1065**	8	295	31	-1097
3	SLS 1a_45	214	203	**-1065**	-8	295	31	-1098
4	SLS 1a_0	100	-96	**-497**	3	139	15	-512

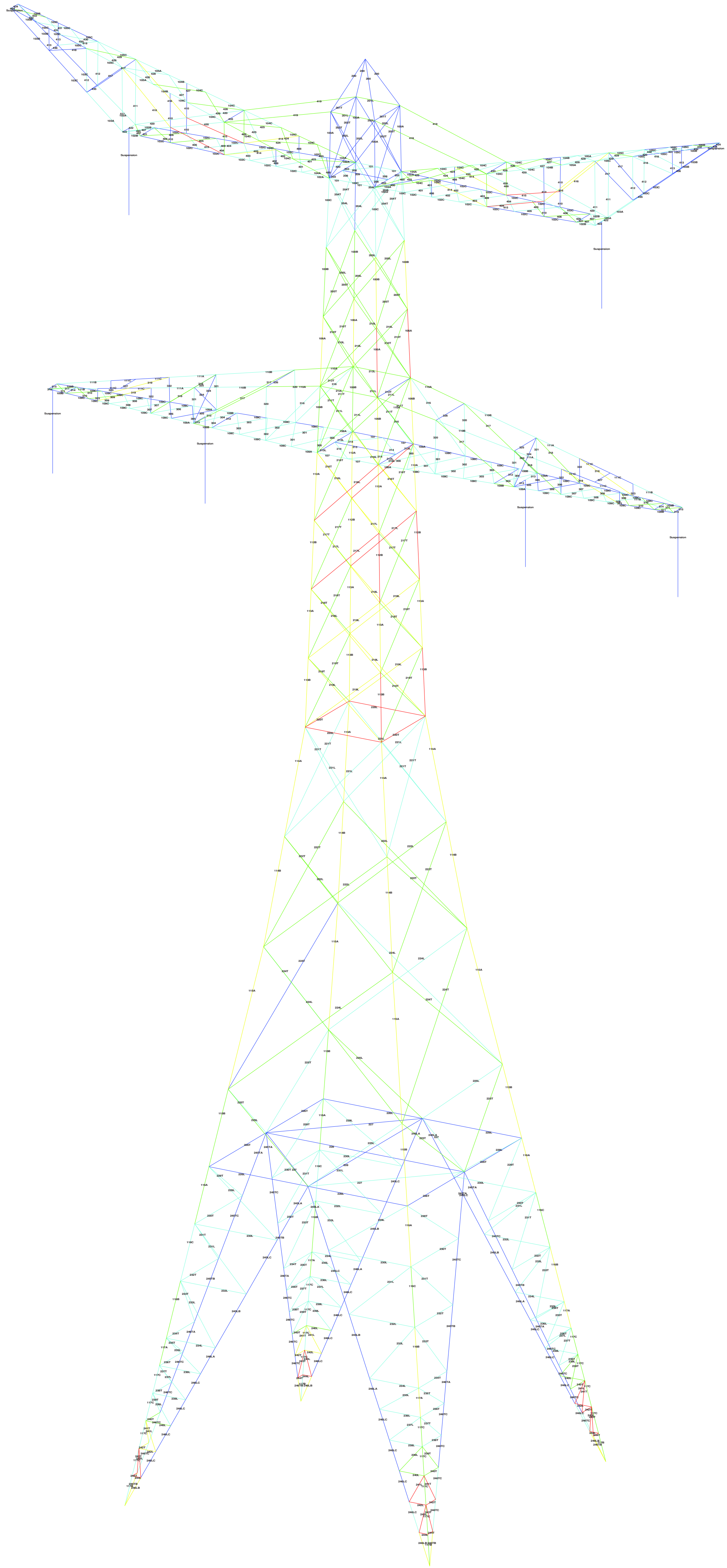
Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_45	307	296	**1548**	8	-426	-43	1595
2	SLS 1a_0	194	-189	**984**	-3	-271	-28	1013
3	SLS 7	-47	-47	**243**	0	-66	-6	251
4	SLS 1a_135	-307	296	**1548**	-8	-426	-43	1594


Reacties R_z en R_η
25
20
15
10
5
0
-5
-10
-15
-20
-25
-2000
-1500
-1000
-500
0
500
1000
1500
2000
2500
R_η
Rz
Reacties

APPENDIX B PLS-TOWER OUTPUT

DNV GL Nederlands BV, Project "S+30 (hv) ini"
Tower Version 16.28, 14:44:39 woensdag 24 juni 2020
Undeformed geometry displayed



DNV·GL

Assessment of groups for initial mast (afkeur level)

Date	3-7-2020
Author	MKh
Version	1.0

KIJ-GT380
S+30
14

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
100A	BVNSTK - Main Leg Members	150x150x10	S235	8M24-5.6t	0.52	0.52	0.52	70	**-54.8**	ULS 1a_90	550.6	669.3	1036.8	0.10		**2.7**	ULS 1a_0,9_0,9_90	624.7	669.3	974.8	0.00	
100B	BVNSTK - Main Leg Members	150x150x10	S235	6M24-5.6t	0.53	0.53	0.53	74	**-406.2**	ULS 1a_45	534.2	508.3	777.6	0.80		**308.6**	ULS 1a_0,9_0,9_45	624.7	508.3	664.6	0.61	
100C	BVNSTK - Main Leg Members	150x150x10	S235		0.52	0.52	0.52	73	**-201.4**	ULS 1a_45	540.2	0.0	0.0	0.37		**118.1**	ULS 1a_0,9_0,9_45	688.6	0.0	0.0	0.17	
200	Top Cap Members	100x100x6	S235	2M16-5.6t	0.43	0.43	0.43	79	**-15.3**	ULS 5a Ba 12	174.2	75.4	103.7	0.20		**15.0**	ULS 5a Ba 12	144.1	75.4	76.8	0.20	
201L	BVNSTK - Upper horiz front 2nd crossarm	120x120x8	S235	4M24-5.6t	1.00	1.00	1.00	121	**0.0**		199.4	338.9	414.7	0.00		**162.3**	ULS 3_0	263.0	338.9	354.5	0.62	
201T	BVNSTK - Upper horiz side 2nd crossarm	70x70x7	S235	3M24-5.6t	1.00	1.00	1.00	211	**-4.2**	ULS 1a_0,9_0,9_90	49.5	254.2	272.2	0.08		**5.9**	ULS 1a_90	119.2	254.2	192.5	0.05	
202L	BVNSTK - First CD from the top front	120x120x10	S235	2M24-5.6t	0.53	0.53	0.53	111	**-37.6**	ULS 1a_0,9_0,9_45	266.4	169.4	259.2	0.22		**37.2**	ULS 1a_45	278.4	169.4	221.5	0.22	
202T	BVNSTK - First CD from the top side	120x120x10	S235	2M24-5.6t	0.53	0.53	0.53	111	**-24.9**	ULS 1a_45	266.4	169.4	259.2	0.15		**3.6**	ULS 1a_0,9_0,9_45	278.4	169.4	221.5	0.02	
101	BVNSTK - Lower horiz front 2nd crossarm	160x160x15	S235	11M24-5.6t	1.00	2.00	1.00	61	**-349.9**	ULS 1a_0	926.7	924.2	2138.4	0.38		**111.8**	ULS 1a_0,9_0,9_0	1008.5	924.2	1644.9	0.12	
203	BVNSTK - Lower horiz side 2nd crossarm	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	98	**-31.9**	ULS 5a Ba 12	188.3	338.9	414.7	0.17		**61.9**	ULS 5a Ba 12	293.9	338.9	354.5	0.21	
204L	BVNSTK - Second CD from the top front	120x120x10	S235	3M24-5.6t	0.53	0.53	0.53	117	**-113.4**	ULS 5a Ba 22	254.5	254.2	388.8	0.45		**113.3**	ULS 5a Ba 12	324.0	254.2	332.3	0.45	
204T	BVNSTK - Second CD from the top side	120x120x10	S235	3M24-5.6t	0.53	0.53	0.53	117	**-126.3**	ULS 5a Ba 22	254.5	254.2	388.8	0.50		**120.5**	ULS 5a Ba 12	324.0	254.2	332.3	0.47	
205L	BVNSTK - Third CD from the top front	120x120x10	S235	2M24-5.6t	0.53	0.53	0.53	121	**-101.3**	ULS 5a Ba 12	246.7	169.4	259.2	0.60		**99.5**	ULS 5a Ba 22	278.4	169.4	221.5	0.59	
205T	BVNSTK - Third CD from the top side	120x120x10	S235	2M24-5.6t	0.53	0.53	0.53	121	**-106.5**	ULS 5a Ba 12	246.7	169.4	259.2	0.63		**111.7**	ULS 5a Ba 22	278.4	169.4	221.5	0.66	
206T	BVNSTK - Side horiz 1	70x70x7	S235		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00	
207T	BVNSTK - Side horiz 2	70x70x7	S235		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00	
208	BVNSTK - Diaphragm diag 2nd crossarm	100x100x8	S235	2M24-5.6t	1.00	1.00	1.00	108	**-64.1**	ULS 5a Ba 22	182.9	169.4	207.4	0.38		**64.6**	ULS 5a Ba 22	181.4	169.4	177.2	0.38	
209	BVNSTK - Diaphragm horiz 2nd crossarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	309	**-0.9**	ULS 3_0	11.3	37.7	43.2	0.08		**0.0**		37.4	37.7	22.0	0.00	
400	Tweede DWSRM - CD under 1 from tower	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	145	**-13.6**	ULS 5a Ba 12	60.5	58.8	75.6	0.23		**13.4**	ULS 5a Ba 22	76.6	58.8	51.8	0.26	
401	Tweede DWSRM - CD under 2 from tower	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	135	**-16.3**	ULS 5a Ba 22	65.4	58.8	75.6	0.28		**16.6**	ULS 5a Ba 12	76.6	58.8	51.8	0.32	
402	Tweede DWSRM - CD under 3 from tower	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	128	**-17.8**	ULS 5a Ba 12	69.3	58.8	75.6	0.30		**17.5**	ULS 5a Ba 22	76.6	58.8	51.8	0.34	
403	Tweede DWSRM - CD under 4 from tower	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	122	**-19.7**	ULS 5a Ba 22	73.3	58.8	75.6	0.33		**20.0**	ULS 5a Ba 12	76.6	58.8	51.8	0.39	
404	Tweede DWSRM - CD under 5 from tower	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	115	**-23.0**	ULS 5a Ba 22	77.4	58.8	75.6	0.39		**21.9**	ULS 5a Ba 12	76.6	58.8	51.8	0.42	
405	Tweede DWSRM - CD under 6 from tower	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	113	**-25.6**	ULS 5a Ba 12	78.7	58.8	75.6	0.43		**28.5**	ULS 5a Ba 22	76.6	58.8	51.8	0.55	
406	Tweede DWSRM - CD under 7 from tower	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	112	**-37.2**	ULS 5a Ba 22	79.8	58.8	75.6	0.63		**31.5**	ULS 5a Ba 12	76.6	58.8	51.8	0.61	
407	Tweede DWSRM - CD under 8 from tower	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	81	**-34.2**	ULS 5a Ba 22	101.0	58.8	75.6	0.58		**23.3**	ULS 5a Ba 12	76.6	58.8	51.8	0.45	
408	Tweede DWSRM - Front vert 1 from tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	104	**0.0**		47.1	37.7	43.2	0.00		**2.9**	ULS 1a_0	37.4	37.7	22.0	0.13	
409	Tweede DWSRM - Front vert 2 from tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	204	**0.0**		21.2	37.7	43.2	0.00		**15.0**	ULS 3_90	37.4	37.7	22.0	0.68	
410	Tweede DWSRM - Front vert 3 from tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	213	**-3.1**	ULS 1a_45	22.5	37.7	43.2	0.14		**3.6**	ULS 3_0	37.4	37.7	22.0	0.16	
411	Tweede DWSRM - Front vert 4 from tower	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	334	**-4.5**	ULS 1a_45	14.3	37.7	51.8	0.31		**5.7**	ULS 1a_0,9_0,9_45	72.6	37.7	38.4	0.15	
412	Tweede DWSRM - Front vert 5 from tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	273	**-4.0**	ULS 1a_135	13.7	37.7	43.2	0.29		**0.0**		37.4	37.7	22.0	0.00	
413	Tweede DWSRM - Front vert 6 from tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	138	**-3.1**	ULS 1a_135	35.3	37.7	43.2	0.09		**0.0**		37.4	37.7	22.0	0.00	
414	Tweede DWSRM - Front diag 1 from tower	55x55x6	S235	1M16-5.6t	1.00	1.00	1.00	344	**-10.5**	ULS 1a_0	11.8	37.7	51.8	0.89		**0.0**		55.3	37.7	33.6	0.00	
415	Tweede DWSRM - Front diag 2 from tower	55x55x6	S235	1M16-5.6t	1.00	1.00	1.00	356	**-42.3**	ULS 3_90	11.2	37.7	51.8	3.77	knik, afschuiving	**0.0**		55.3	37.7	33.6	0.00	
416	Tweede DWSRM - Front diag 3 from tower	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	324	**-20.5**	ULS 1a_0,9_0,9_45	20.5	37.7	60.5	1.00		**0.0**	ULS 1a_0	104.8	37.7	44.8	0.00	
417	Tweede DWSRM - Front diag 4 from tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	322	**0.0**		10.6	37.7	43.2	0.00		**4.2**	ULS 1a_45	37.4	37.7	18.4	0.23	
418	Tweede DWSRM - Front diag 5 from tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	269	**0.0**		14.1	37.7	43.2	0.00		**5.3**	ULS 1a_135	37.4	37.7	18.4	0.29	
419	Tweede DWSRM - Main diag from tower	120x120x10	S235	4M24-5.6t	1.00	1.00	1.00	316	**0.0**		65.9	338.9	518.4	0.00		**172.1**	ULS 3_45	324.0	338.9	443.1	0.53	
420	Tweede DWSRM - Main front diag	120x120x10	S235	4M24-5.6t	1.00	1.00	1.00	144	**0.0**		203.6	338.9	518.4	0.00		**152.8**	ULS 3_45	324.0	338.9	443.1	0.47	
102A	Tweede DWSRM - Main member bottom	160x160x15	S235	11M24-5.6t	1.00	1.95	1.00	73	**-302.4**	ULS 5a Ba 22	857.7	924.2	2138.4	0.35		**83.0**	ULS 5a Ba 12	1008.5	924.2	1827.7	0.09	
102C	Tweede DWSRM - Main member bottom	160x160x15	S235		1.00	2.06	1.00	73	**-286.2**	ULS 5a Ba 22	857.8	0.0	0.0	0.33		**66.5**	ULS 5a Ba 12	1097.7	0.0	0.0	0.06	
102B	Tweede DWSRM - Main member bottom	160x160x15	S235	6M24-5.6t	1.00	2.71	1.00	66	**-144.0**	ULS 3_0	899.0	488.2	1166.4	0.30		**0.0**		787.2	488.2	996.9	0.00	
421	Tweede DWSRM - Horiz under 1	HEB160	S235	2M20-5.6t	1.00	1.00	1.00	39	**0.0**		1004.9	117.6	172.8	0.00		**14.1**	ULS 3_90	1278.1	117.6	0.0	0.12	
422	Tweede DWSRM - Horiz under 2	HEB160	S235	2M20-5.6t	2.00	2.00	2.00	36	**-21.3**	ULS 5a Ba 12	1020.1	117.6	172.8	0.18		**30.2**	ULS 5a Ba 22	1278.1	117.6	0.0	0.26	
103A	Tweede DWSRM - Main member under r	150x100x10	S235	1M24-5.6t	1.00	1.00	1.00	143	**-27.6**	ULS 5a Ba 22	186.0	84.7	129.6	0.33		**0.0**		155.5	84.7	99.7	0.00	
103B	Tweede DWSRM - Main member under r	150x100x10	S235	1M24-5.6t	1.00	1.00	1.00	152	**-20.8**	ULS 5a Ba 22	165.4	84.7	129.6	0.25		**0.0**		155.5	84.7	99.7	0.00	
103C	Tweede DWSRM - Main member under r	150x100x10	S235		1.00	1.00	1.00	150	**-24.6**	ULS 5a Ba 22	189.0	0.0	0.0	0.13		**0.0**		571.3	0.0	0.0	0.00	
423	Tweede DWSRM - CD Top 1 from tower	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	210	**-13.8**	ULS 1a_0	20.4	37.7	43.2	0.67		**13.7**	ULS 1a_0,9_0	37.4	37.7	22.0	0.62	
424	Tweede DWSRM - CD Top 2 from tower	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	194	**-12.5**	ULS 1a_0,9_0	22.8	37.7	43.2	0.55		**12.5**	ULS 1a_0	37.4	37.7	22.0	0.57	
425	Tweede DWSRM - CD Top 3 from tower	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	187	**-11.7**	ULS 1a_0	24.0	37.7	43.2	0.49		**11.5**	ULS 1a_0,9_0	37.4	37.7	22.0	0.52	
426	Tweede DWSRM - CD Top 4 from tower	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	182	**-12.6**	ULS 1a_0,9_0,9_0	24.8	37.7	43.2	0.51		**12.9**	ULS 1a_0	37.4	37.7	22.0	0.58	
427	Tweede DWSRM - CD Top 5 from tower	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	168	**-11.4**	ULS 1a_0	27.7	37.7	43.2	0.41		**11.2**	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.51	
428	Tweede DWSRM - CD Top 6 from tower	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	150	**-9.6**	ULS 1a_0	31.8	37.7	43.2	0.30		**9.8**	ULS 1a_0	37.4	37.7	22.0	0.44	
429	Tweede DWSRM - CD Top 7 from tower	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	164	**-11.3**	ULS 1a_0	28.7	37.7	43.2	0.40		**11.1**	ULS 1a_0	37.4	37.7	22.0	0.50	
430	Tweede DWSRM - CD Top 8 from tower	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	123	**-9.2**	ULS 1a_0,9_0,9_0	40.0	37.7	43.2	0.24		**9.5**	ULS 1a_0	37.4	37.7	22.0	0.43	
431	Tweede DWSRM - CD Top 9 from tower	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	111	**-10.6**	ULS 5a Ba 3	44.4	37.7	43.2	0.28		**10.1**	ULS 5a Ba 3	37.4	37.7	22.0	0.46	
432	Tweede DWSRM - CD Top 10 from tower	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	117	**-14.6**	ULS 5a Ba 3	42.0	37.7	43.2	0.39		**16.0**	ULS 5a Ba 3	37.4	37.7	22.0	0.72	
433	Tweede DWSRM - Horiz on top	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	234	**-3.8**	ULS 3_90	17.4	37.7	43.2	0.22		**0.0**		37.4	37.7	22.0	0.00	
434	Tweede DWSRM - Horiz at end of raised	HEB160	S235	2M12-5.6t	2.00	2.00	2.00	20	**-7.8**	ULS 5a Ba 3	1087.1	40.3	103.7	0.19		**7.2**	ULS 5a Ba 3	1315.0	40.3	57.6	0.18	
435	Tweede DWSRM - Horiz bracing raised 1	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	127	**-0.2**	ULS 1a_0,9_90	38.6	37.7	43.2	0.01		**0.1**	ULS 1a_0,9_0,9_90	37.4	37.7	22.0	0.00	
436	Tweede DWSRM - Horiz bracing raised 2	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	105	**0.0**		46.6	37.7	43.2	0.00		**0.1**	ULS 5a Ba 22	37.4	37.7	22.0	0.00	
104A	Tweede DWSRM - Main member top 1	120x120x8	S235	3M24-5.6t	1.00	1.47	1.00	107	**-157.9**	ULS 1a_0	223.0	254.2	311.0	0.71		**137.3**	ULS 1a_0,9_0	263.0	254.2	262.5	0.54	
104B	Tweede DWSRM - Main member top 1	120x120x8	S235	4M24-5.6t	2.04	2.84	1.00	91	**-67.2**	ULS 5a Ba 3	242.1	338.9	414.7	0.28		**97.8**	ULS 5a Ba 3	379.5	338.9	354.5	0.29	
104C	Tweede DWSRM - Main member top 1	120x120x8	S235		2.00	3.13	1.00	101	**-140.1**	ULS 1a_0	223.0	0.0	0.0	0.63		**129.0**	ULS 1a_0,9_0	441.8	0.0	0.0	0.29	
105A	Tweede DWSRM - Main member top 2	100x100x6	S235	4M24-5.6t	1.54	1.00	1.00	111	**-58.4**	ULS 5a Ba 3	127.2	338.9	311.0	0.46		**89.2**	ULS 5a Ba 3	225.0	338.9	265.8	0.40	
105B	Tweede DWSRM - Main member top 2	100x100x6	S235	2M16-5.6t	1.00	1.43	1.00	95	**-6.5**	ULS 1a_0,9_0,9_90	154.1	75.4	103.7	0.09		**17.7**	ULS 1a_90	203.8	75.4	103.7	0.23	
105C	Tweede DWSRM - Main member top 2	100x100x6	S235		1.00	1.00	1.00	127	**-49.1**	ULS 5a Ba 3	116.8	0.0	0.0	0.42		**71.8**	ULS 5a Ba 3	277.3	0.0	0.0	0.26	
106A	Vierde TSNSTK - Main leg member	150x150x14	S235	6M24-5.6t	0.53	0.53	0.53	75	**-533.0**	ULS 1a_45	727.9	508.3	1088.6	1.05	afschuiving	**437.2**	ULS 1a_0,9_0,9_45	851.7	508.3	930.5	0.86	
106B	Vierde TSNSTK - Main leg member	150x150x14	S235	10M24-5.6t	0.27	0.27	0.27	37	**-660.6**	ULS 1a_45	891.0	847.2	1814.4	0.78		**502.1**	ULS 1a_0,9_0,9_45	851.7	847.2	1798.9	0.59	
210L	Vierde TSNSTK - First CD front	120x120x10	S235	2M24-5.6t	0.53	0.53	0.53	124	**-88.6**	ULS 5a Ba 22	239.3	169.4	259.2	0.52		**90.6**	ULS 5a Ba 12	278.4	169.4	221.5	0.53	
210T	Vierde TSNSTK - First CD side	120x120x10	S235	2M24-5.6t	0.53	0.53	0.53	124	**-100.1**	ULS 5a Ba 22	239.3	169.4	259.2	0.59		**94.8**	ULS 5a Ba 12	278.4	169.4	221.5	0.56	
211L	Vierde TSNSTK - Second CD front	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	87	**-108.3**	ULS 1a_45	217.9	169.4	207.4	0.64		**99.7**	ULS 1a_0,9_135	138.1	169.4	172.2	0.72	
211T	Vierde TSNSTK - Second CD side	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	87	**-107.2**	ULS 1a_135	217.9	169.4	207.4	0.63		**82.8**	ULS 1a_0,9_0,9_45	138.1	169.4	172.2	0.60	
212L	Vierde TSNSTK - Upper horiz lower CA fr	120x120x10	S235	4M24-5.6t	1.00	1.00	1.00	159	**0.0**		179.6	338.9	518.4	0.00		**202.8**	ULS 3_0	324.0	338.9	443.1	0.63	
212T	Vierde TSNSTK - Upper horiz lower CA s	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	192	**-51.4**	ULS 1a_0,9_90	93.8	254.2	311.0	0.55		**53.3**	ULS 1a_90	223.0	254.2	265.8	0.24	
107	Vierde TSNSTK - Lower horiz lower CA fr	180x180x15	S235	12M24-5.6t	1.00	2.00	1.00	73	**-276.1**	ULS 5a Ba 21	959.5	999.7	2332.8	0.29		**28.0**	ULS 5a Ba 21	1144.0	999.7	1993.8	0.03	
213L	Vierde TSNSTK - Lower horiz lower CA s	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	131	**-34.7**	ULS 5a Ba 10	143.1	338.9	414.7	0.24		**68.4**	ULS 5a Ba 10	293.9	338.9	354.5	0.23	
214	Vierde TSNSTK - Diaphragm diagonal	120x120x8	S235	2M24-5.6t	1.00	1.00	1.00	119	**-70.9**	ULS 5a Ba 21	202.8	169.4	207.4	0.42		**71.9**	ULS 5a Ba 21	226.0	169.4	177.2	0.42	
215	Vierde TSNSTK - Diaphragm horiz	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	342	**-1.2**	ULS 3_0	13.8	58.8	64.8	0.09		**0.0**		65.7	58.8	44.4	0.00	
300	Eerste DWSRM - CD under 1 from tower	75x75x7#	S235	1M24-5.6t	0.53	0.53	0.53	153	**-16.8**	ULS 5a Ba 11	66.2	84.7	90.7	0.25		**19.6**	ULS 5a Ba 20	98.8	84.7	72.5	0.27	
301	Eerste DWSRM - CD under 2 from tower	75x75x7#	S235	1M24-5.6t	0.53	0.53	0.53	144	**-22.5**	ULS 5a Ba 20	71.6	84.7	90.7	0.31		**20.1**	ULS 5a Ba 11	98.8	84.7	72.5	0.28	
302	Eerste DWSRM - CD under 3 from tower	75x75x7#	S235	1M24-5.6t	0.53	0.53	0.53	134	**-21.7**	ULS 5a Ba 11	77.3	84.7	90.7	0.28		**24.6**	ULS 5a Ba 20	98.8	84.7	72.5	0.34	
303	Eerste DWSRM - CD under 4 from tower	75x75x7#	S235	1M24-5.6t	0.53	0.53	0.53	128	**-29.5**	ULS 5a Ba 20	81.6	84.7	90.7	0.36		**25.2**	ULS 5a Ba 11	98.8	84.7	72.5	0.35	
304	Eerste DWSRM - CD under 5 from tower	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	126	**-27.7**	ULS 5a Ba 11	70.6	58.8	75.6	0.47		**21.9**	ULS 5a Ba 11	86.7	58.8	59.5	0.37	
305	Eerste DWSRM - CD under 6 from tower	60x60x6	S235	1M20-5.6t	0.53	0.53	0.53	133	**-12.6**	ULS 5a Ba 10	53.0	58.8	64.8	0.24		**10.9**	ULS 5a Ba 10	65.7	58.8	44.4	0.25	
306	Eerste DWSRM - CD under 7 from tower	60x60x6	S235	1M20-5.6t	0.53	0.53	0.53	121	**-13.2**	ULS 5a Ba 21	58.5	58.8	64.8	0.23		**13.9**	ULS 5a Ba 21	65.7	58.8	44.4	0.31	
307	Eerste DWSRM - CD under 8 from tower	60x60x6	S235	1M20-5.6t	0.53	0.53	0.53	112	**-15.6**	ULS 5a Ba 10	63.0	58.8	64.8	0.26		**15.4**	ULS 5a Ba 10	65.7	58.8	44.4	0.35	
308	Eerste DWSRM - CD under 9 from tower	60x60x6	S235	1M20-5.6t	0.54	0.54	0.54	106	**-18.7**	ULS 5a Ba 21	66.5	58.8	64.8	0.32		**17.9**	ULS 5a Ba 21	65.7	58.8	44.4	0.40	

DNV·GL

Assessment of groups for initial mast (afkeur level)

Date	3-7-2020
Author	MKh
Version	1.0

KIJ-GT380
S+30
14

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
309	Eerste DWSRM - CD under 10 from towe	60x60x6	S235	1M20-5.6t	0.54	0.54	0.54	98	-21.3	ULS 5a Ba 10	71.2	58.8	64.8	0.36		23.2	ULS 5a Ba 10	65.7	58.8	44.4	0.52	
310	Eerste DWSRM - CD under 11 from towe	60x60x6	S235	1M20-5.6t	0.55	0.55	0.55	97	-32.9	ULS 5a Ba 21	71.8	58.8	64.8	0.56		28.4	ULS 5a Ba 21	65.7	58.8	44.4	0.64	
311	Eerste DWSRM - CD under 12 from towe	60x60x6	S235	1M20-5.6t	0.55	0.55	0.55	77	-37.0	ULS 5a Ba 10	81.7	58.8	64.8	0.63		27.2	ULS 5a Ba 10	65.7	58.8	44.4	0.61	
312	Eerste DWSRM - Horiz under 1	HEB160	S235	2M20-5.6t	1.00	1.00	1.00	70	-6.5	ULS 1a_0,9_0,9_90	842.3	117.6	172.8	0.06		15.0	ULS 1a_90	1278.1	117.6	0.0	0.13	
313	Eerste DWSRM - Horiz under 2	HEB160	S235	2M20-5.6t	2.00	2.00	2.00	65	-21.4	ULS 5a Ba 11	870.7	117.6	172.8	0.18		30.0	ULS 5a Ba 20	1278.1	117.6	0.0	0.26	
314	Eerste DWSRM - Horiz under 3	HEB160	S235	2M20-5.6t	1.00	1.00	1.00	30	0.0		1046.7	117.6	172.8	0.00		11.3	ULS 3_90	1278.1	117.6	0.0	0.10	
315	Eerste DWSRM - Horiz under 4	HEB160	S235	2M20-5.6t	2.00	2.00	2.00	25	-22.8	ULS 5a Ba 21	1067.2	117.6	172.8	0.19		28.9	ULS 5a Ba 10	1278.1	117.6	0.0	0.25	
316	Eerste DWSRM - Front diag 1	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	465	0.0		10.2	117.6	129.6	0.00		31.5	ULS 3_45	77.4	117.6	88.7	0.41	
317	Eerste DWSRM - Front diag 2	60x60x8	S235	2M20-5.6t	1.00	1.00	1.00	509	0.0		11.4	117.6	172.8	0.00		54.2	ULS 3_0	100.5	117.6	118.3	0.54	
318	Eerste DWSRM - Front diag 3	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	377	0.0		8.2	37.7	43.2	0.00		13.6	ULS 7	37.4	37.7	22.0	0.62	
319	Eerste DWSRM - Front diag 4	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	410	0.0		7.1	37.7	43.2	0.00		18.7	ULS 7	37.4	37.7	22.0	0.85	
320	Eerste DWSRM - Front vert 1	100x100x6	S235	1M20-5.6t	1.00	1.00	1.00	163	-21.0	ULS 3_0	70.4	58.8	64.8	0.36		0.0		117.5	58.8	52.4	0.00	
321	Eerste DWSRM - Front vert 2	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	199	-7.4	ULS 1a_0	27.5	37.7	43.2	0.27		0.0		37.4	37.7	22.0	0.00	
322	Eerste DWSRM - Front vert 3	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	156	-5.4	ULS 7	30.4	37.7	43.2	0.18		0.0		37.4	37.7	22.0	0.00	
323	Eerste DWSRM - Front vert 4	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	75	-2.5	ULS 3_135	57.4	37.7	43.2	0.07		0.0		37.4	37.7	22.0	0.00	
108A	Eerste DWSRM - Main member lower 1	180x180x15	S235	12M24-5.6t	1.00	1.99	1.00	65	-339.9	ULS 5a Ba 21	1008.7	999.7	2332.8	0.34		91.4	ULS 5a Ba 10	1144.0	999.7	1993.8	0.09	
108B	Eerste DWSRM - Main member lower 1	180x180x15	S235	6M24-5.6t	1.00	4.06	1.00	93	-287.3	ULS 5a Ba 21	816.1	508.3	1166.4	0.57		74.8	ULS 5a Ba 10	1144.0	508.3	996.9	0.15	
108C	Eerste DWSRM - Main member lower 1	180x180x15	S235		1.00	2.76	1.00	89	-308.7	ULS 5a Ba 21	843.1	0.0	0.0	0.37		92.7	ULS 5a Ba 10	1220.5	0.0	0.0	0.08	
109A	Eerste DWSRM - Main member lower 2	150x150x12	S235	6M24-5.6t	1.00	1.90	1.00	63	-242.6	ULS 5a Ba 10	681.6	508.3	933.1	0.48		94.3	ULS 5a Ba 21	740.3	508.3	797.5	0.19	
109B	Eerste DWSRM - Main member lower 2	150x150x12	S235	5M24-5.6t	1.00	2.79	1.00	74	-97.2	ULS 3_90	637.2	420.1	777.6	0.23		0.0		554.4	420.1	664.6	0.00	
109C	Eerste DWSRM - Main member lower 2	150x150x12	S235		1.00	2.11	1.00	65	-229.8	ULS 5a Ba 10	673.5	0.0	0.0	0.34		80.3	ULS 5a Ba 21	817.8	0.0	0.0	0.10	
110A	Eerste DWSRM - Main member upper 1	120x120x10	S235	4M24-5.6t	1.00	1.00	1.00	160	0.0		178.3	338.9	518.4	0.00		168.9	ULS 3_0	324.0	338.9	443.1	0.52	
110B	Eerste DWSRM - Main member upper 1	120x120x10	S235	4M24-5.6t	1.00	1.00	1.00	215	0.0		119.4	338.9	518.4	0.00		126.2	ULS 3_0	466.6	338.9	443.1	0.37	
111A	Eerste DWSRM - Main member upper 2	120x120x8	S235	4M24-5.6t	1.00	1.70	1.00	139	0.0		162.4	338.9	414.7	0.00		115.9	ULS 3_0	379.5	338.9	354.5	0.34	
111B	Eerste DWSRM - Main member upper 2	120x120x8	S235	3M24-5.6t	1.46	1.00	1.00	146	0.0		161.8	254.2	311.0	0.00		99.2	ULS 3_0	263.0	254.2	265.8	0.39	
111C	Eerste DWSRM - Main member upper 2	120x120x8	S235		2.35	3.17	1.00	137	0.0		165.0	0.0	0.0	0.00		99.2	ULS 3_0	441.8	0.0	0.0	0.22	
324	Eerste DWSRM - Doorsnede BB CD	50x50x5	S235	1M16-5.6t	0.50	0.50	0.50	172	-5.0	ULS 1a_0	26.9	37.7	43.2	0.19		2.4	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.11	
325	Eerste DWSRM - Doorsnede BB Horiz	75x50x5	S235	1M24-5.6t	1.00	1.00	1.00	230	0.0		22.4	84.7	64.8	0.00		1.1	ULS 7	63.4	84.7	36.7	0.03	
326	Eerste DWSRM - Horiz on top 1	80x80x8	S235	1M24-5.6t	1.00	1.00	1.00	206	-0.1	ULS 1a_90	53.9	84.7	103.7	0.00		0.0	ULS 1a_0,9_0,9_90	124.4	84.7	70.9	0.00	
327	Eerste DWSRM - Horiz on top 2	75x50x5	S235	1M24-5.6t	1.00	1.00	1.00	160	-0.1	ULS 1a_90	36.8	84.7	64.8	0.00		0.0	ULS 1a_0,9_0,9_45	63.4	84.7	36.7	0.00	
112A	Derde TSNSTK - Main member	160x160x17	S235	12M24-5.6t	0.27	0.27	0.27	35	-958.6	ULS 1a_45	1159.5	999.7	2643.8	0.96		750.4	ULS 1a_0,9_0,9_45	1116.1	999.7	2259.7	0.75	
112B	Derde TSNSTK - Main member	160x160x17	S235	8M24-5.6t	0.26	0.26	0.26	34	-1184.8	ULS 1a_45	1163.0	1355.5	1762.6	1.02	knik	957.2	ULS 1a_0,9_0,9_45	1116.1	1355.5	1506.5	0.86	
216L	Derde TSNSTK - CD 1 from top front	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	91	-151.9	ULS 1a_90	211.8	169.4	207.4	0.90		144.6	ULS 1a_0,9_0,9_90	138.1	169.4	172.2	1.05	nettodsn.
216T	Derde TSNSTK - CD 1 from top side	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	91	-104.7	ULS 5a Ba 21	211.8	169.4	207.4	0.62		107.7	ULS 5a Ba 10	138.1	169.4	172.2	0.78	
217L	Derde TSNSTK - CD 2 from top front	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	94	-139.8	ULS 1a_0,9_0,9_90	206.0	169.4	207.4	0.83		142.4	ULS 1a_90	138.1	169.4	172.2	1.03	nettodsn.
217T	Derde TSNSTK - CD 2 from top side	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	94	-99.7	ULS 5a Ba 21	206.0	169.4	207.4	0.59		97.2	ULS 5a Ba 21	138.1	169.4	172.2	0.70	
113A	Tweede TSNSTK - Main member	200x200x18	S235	10M24-5.6t	0.27	0.27	0.27	29	-1440.1	ULS 1a_45	1580.2	1694.4	2332.8	0.91		1196.1	ULS 1a_0,9_0,9_45	1548.5	1694.4	1993.8	0.77	
113B	Tweede TSNSTK - Main member	200x200x18	S235	10M24-5.6t	0.27	0.27	0.27	29	-1628.6	ULS 1a_45	1580.2	1694.4	2332.8	1.03	knik	1370.0	ULS 1a_0,9_0,9_45	1548.5	1694.4	2013.8	0.88	
218L	Tweede TSNSTK - CD 1 from top front	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	97	-139.8	ULS 1a_90	201.0	169.4	207.4	0.82		136.0	ULS 1a_0,9_0,9_90	138.1	169.4	172.2	0.98	
218T	Tweede TSNSTK - CD 1 from top side	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	97	-89.6	ULS 5a Ba 10	201.0	169.4	207.4	0.53		91.9	ULS 5a Ba 21	138.1	169.4	172.2	0.67	
219L	Tweede TSNSTK - CD 2 from top front	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	100	-131.4	ULS 1a_90	196.2	169.4	207.4	0.78		128.8	ULS 1a_90	134.0	169.4	159.5	0.96	
219T	Tweede TSNSTK - CD 2 from top side	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	100	-91.2	ULS 1a_135	196.2	169.4	207.4	0.54		89.2	ULS 1a_0,9_0,9_45	134.0	169.4	159.5	0.67	
220L	Tweede TSNSTK - Horiz at bottom	80x80x8	S235	1M24-5.6t	1.00	1.00	1.00	321	-87.4	ULS 1a_0	27.3	84.7	103.7	3.21	knik, afschuiving	80.2	ULS 1a_0	124.4	84.7	88.6	0.95	
220T	Tweede TSNSTK - Horiz at bottom	80x80x8	S235	1M24-5.6t	1.00	1.00	1.00	321	-114.3	ULS 1a_90	27.3	84.7	103.7	4.19	knik, afschuiving, stuik	104.5	ULS 1a_90	124.4	84.7	88.6	1.23	afschuiving, stuik
114A	Eerste TSNSTK - Main member	250x250x18	S235	12M24-5.6t	0.29	0.29	0.29	39	-1745.1	ULS 1a_45	1932.6	1859.6	2799.4	0.94		1509.9	ULS 1a_0,9_0,9_45	2030.6	1859.6	2799.4	0.81	
114B	Eerste TSNSTK - Main member	250x250x18	S235	12M24-5.6t	0.29	0.29	0.29	39	-1712.9	ULS 1a_45	1930.7	1859.6	2799.4	0.92		1414.6	ULS 1a_0,9_0,9_45	2030.6	1859.6	2799.4	0.76	
221L	Eerste TSNSTK - CD 1 from top front	120x80x12	S235	2M24-5.6t	0.58	0.29	0.29	150	-73.0	ULS 5a Ba 10	189.0	169.4	311.0	0.43		68.8	ULS 5a Ba 10	250.6	169.4	265.8	0.41	
221T	Eerste TSNSTK - CD 1 from top side	120x80x12	S235	2M24-5.6t	0.58	0.29	0.29	150	-72.4	ULS 5a Ba 21	189.0	169.4	311.0	0.43		69.3	ULS 5a Ba 10	250.6	169.4	265.8	0.41	
222L	Eerste TSNSTK - CD 2 from top front	120x80x10	S235	1M24-5.6t	0.56	0.29	0.29	172	-48.0	ULS 5a Ba 10	101.6	84.7	129.6	0.57		47.9	ULS 5a Ba 10	155.5	84.7	110.8	0.57	
222T	Eerste TSNSTK - CD 2 from top side	120x80x10	S235	1M24-5.6t	0.56	0.29	0.29	172	-48.7	ULS 5a Ba 10	101.6	84.7	129.6	0.58		46.8	ULS 5a Ba 21	155.5	84.7	110.8	0.55	
223L	Eerste TSNSTK - Horiz at bottom	100x100x8	S235		0.00	0.00	0.00	0	0.0		0.0	0.0	0.0	0.00		0.0		0.0	0.0	0.0	0.00	
223T	Eerste TSNSTK - Horiz at bottom	100x100x8	S235		0.00	0.00	0.00	0	0.0		0.0	0.0	0.0	0.00		0.0		0.0	0.0	0.0	0.00	
115A	Onderstuk 2 - Main member	250x250x20	S235	12M24-5.6t	0.29	0.29	0.29	51	-1635.5	ULS 1a_45	2028.6	1859.6	3110.4	0.88		1395.4	ULS 1a_0,9_0,9_45	2244.7	1859.6	3110.4	0.75	
115B	Onderstuk 2 - Main member	250x250x20	S235	14M24-5.6t	0.50	0.50	0.50	48	-1659.2	ULS 1a_45	2058.2	2100.4	3628.8	0.81		1322.6	ULS 1a_0,9_0,9_45	2244.7	2100.4	3101.5	0.63	
224L	Onderstuk 2 - CD 1 from top front	150x100x12	S235	2M24-5.6t	1.00	0.29	0.29	275	-48.9	ULS 1a_0	97.8	169.4	311.0	0.50		50.7	ULS 1a_0,9_0,9_90	264.6	169.4	265.8	0.30	
224T	Onderstuk 2 - CD 1 from top side	150x100x12	S235	2M24-5.6t	1.00	0.29	0.29	275	-65.9	ULS 1a_90	99.5	169.4	311.0	0.66		31.5	ULS 5a Ba 22	264.6	169.4	265.8	0.19	
225L	Onderstuk 2 - Diag 1 front	150x100x10	S235	1M24-5.6t	1.00	0.50	0.50	170	-34.4	ULS 1a_0,9_0,9_90	122.6	84.7	129.6	0.41		44.7	ULS 1a_135	213.1	84.7	110.8	0.53	
225T	Onderstuk 2 - Diag 1 side	150x100x10	S235	1M24-5.6t	1.00	0.50	0.50	170	-25.1	ULS 5a Ba 22	122.6	84.7	129.6	0.30		45.9	ULS 1a_45	213.1	84.7	110.8	0.54	
226L	Onderstuk 1 - Diaphragm horiz front	200x200x16	S235	3M24-5.6t	1.00	1.00	1.00	165	-24.7	ULS 1a_45	456.7	254.2	622.1	0.10		13.4	ULS 1a_0,9_90	1110.9	254.2	531.7	0.05	
226T	Onderstuk 1 - Diaphragm horiz side	200x200x16	S235	3M24-5.6t	1.00	1.00	1.00	165	-25.0	ULS 1a_135	456.7	254.2	622.1	0.10		13.2	ULS 1a_0,9_0	1110.9	254.2	531.7	0.05	
227	onderstuk 1 - Diaphragm diag	150x150x10	S235	1M20-5.6t	1.00	1.00	1.00	310	-14.6	ULS 1a_135	68.7	58.8	108.0	0.25		24.9	ULS 1a_135	368.6	58.8	87.3	0.42	
228	Onderstuk 1 - Diaphragm CD	150x100x10	S235	1M20-5.6t	0.50	0.50	0.50	301	-1.5	ULS 1a_0	59.7	58.8	108.0	0.03		0.0		224.6	58.8	87.3	0.00	
116A	Onderstuk 1 - Main member 1	250x250x24	S235	14M24-5.6t	0.50	0.50	0.50	35	-1666.6	ULS 1a_45	2565.0	2100.4	4354.6	0.79		1300.0	ULS 1a_0,9_0,9_45	2655.2	2100.4	3721.8	0.62	
116B	Onderstuk 1 - Main member 1	250x250x24	S235	14M24-5.6t	0.50	0.50	0.50	35	-1664.1	ULS 1a_45	2565.5	2100.4	4354.6	0.79		1259.2	ULS 1a_0,9_0,9_45	2655.2	2100.4	3721.8	0.60	
116C	Onderstuk 1 - Main member 1	250x250x24	S235		0.50	0.50	0.50	35	-1669.8	ULS 1a_45	2565.5	0.0	0.0	0.65		1284.2	ULS 1a_0,9_0,9_45	2700.6	0.0	0.0	0.48	
117A	Onderstuk 1 - Main member 2	250x250x24	S235	14M24-5.6t	1.00	1.00	1.00	34	-1660.4	ULS 1a_45	2577.7	2100.4	4354.6	0.79		1243.6	ULS 1a_0,9_0,9_45	2655.2	2100.4	3721.8	0.59	
117B	Onderstuk 1 - Main member 2	250x250x24	S235	14M24-5.6t	1.00	1.00	1.00	37	-1297.3	ULS 1a_45	2550.1	2100.4	4354.6	0.62		947.6	ULS 1a_0,9_0,9_45	2655.2	2100.4	3721.8	0.45	
117C	Onderstuk 1 - Main member 2	250x250x24	S235		1.00	1.00	1.00	34	-1648.0	ULS 1a_45	2577.7	0.0	0.0	0.64		1222.2	ULS 1a_0,9_0,9_45	2700.6	0.0	0.0	0.45	
229L	Onderstuk 1 diag 1 front	100x100x6	S235	1M16-5.6t	1.00	0.52	0.52	192	-10.6	ULS 1a_0,9_45	45.6	37.7	51.8	0.28		14.2	ULS 1a_90	141.7	37.7	38.4	0.38	
229T	Onderstuk 1 diag 1 side	100x100x6	S235	1M16-5.6t	1.00	0.52	0.52	192	-10.0	ULS 1a_0,9_135	45.6	37.7	51.8	0.26		12.9	ULS 1a_45	141.7	37.7	38.4	0.34	
230L	Onderstuk 1 diag 2 front	100x100x8	S235	1M16-5.6t	1.00	1.00	1.00	276	-17.2	ULS 1a_0	43.7	37.7	69.1	0.46		17.2	ULS 1a_0	188.9	37.7	51.2	0.46	
230T	Onderstuk 1 diag 2 side	100x100x8	S235	1M16-5.6t	1.00	1.00	1.00	276	-17.2	ULS 1a_0	43.7	37.7	69.1	0.46		17.2	ULS 1a_0	188.9	37.7	51.2	0.46	
231L	Onderstuk 1 diag 3 front	75x75x7#	S235	1M16-5.6t	1.00	0.53	0.53	221	-12.5	ULS 1a_0,9_135	33.2	37.7	60.5	0.38		14.4	ULS 1a_90	114.9	37.7	44.8	0.38	
231T	Onderstuk 1 diag 3 side	75x75x7#	S235	1M16-5.6t	1.00	0.53	0.53	221	-12.0	ULS 1a_0,9_45	33.2	37.7	60.5	0.36		12.8	ULS 1a_0	114.9	37.7	44.8	0.34	
232L	Onderstuk 1 diag 4 front	100x100x6	S235	1M16-5.6t	1.00	1.00	1.00	219	-18.5	ULS 1a_0	47.1	37.7	51.8	0.49		18.5	ULS 1a_0	141.7	37.7	38.4	0.49	
232T	Onderstuk 1 diag 4 side	100x100x6	S235	1M16-5.6t	1.00	1.00	1.00	219	-18.5	ULS 1a_0	47.1	37.7	51.8	0.49		18.5	ULS 1a_0	141.7	37.7	38.4	0.49	
233L	Onderstuk 1 diag 5 front	65x65x7	S235	1M16-5.6t	1.00	0.53	0.53	220	-12.9	ULS 1a_0,9_90	28.4	37.7	60.5	0.45		17.4	ULS 1a_90	94.8	37.7	44.8	0.46	
233T	Onderstuk 1 diag 5 side	65x65x7	S235	1M16-5.6t	1.00	0.53	0.53	220	-11.9	ULS 1a_0,9_45	28.4	37.7	60.5	0.42		14.5	ULS 1a_0	94.8	37.7	44.8	0.39	
234L	Onderstuk 1 diag 6 front	75x75x7#	S235	1M16-5.6t	1.00	1.00	1.00	219	-15.2	ULS 1a_90	40.9	37.7	60.5	0.40		11.1	ULS 1a_0,9_90	114.9	37.7	44.8	0.30	
234T	Onderstuk 1 diag 6 side	75x75x7#	S235	1M16-5.6t	1.00	1.00	1.00	219	-13.3	ULS 1a_135	40.9	37.7	60.5	0.35		9.7	ULS 1a_0,9_0	114.9	37.7	44.8	0.26	
235L	Onderstuk 1 diag 7 front	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	214	-10.4	ULS 1a_0,9_90	38.9	37.7	60.5	0.28		13.1	ULS 1a_90	104.8	37.7	44.8	0.35	
235T	Onderstuk 1 diag 7 side	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	214	-8.7	ULS 1a_0,9_0	38.9	37.7	60.5	0.23		11.2	ULS 1a_135	104.8	37.7	44.8	0.30	
236L	Onderstuk 1 diag 8 front	65x65x7	S235	1M16-5.6t	1.00	1.00	1.00	213	-14.5	ULS 1a_0	36.2	37.7	60.5	0.40		14.5	ULS 1a_0	94.8	37.7	44.8	0.38	
236T	Onderstuk 1 diag 8 side	65x65x7	S235	1M16-5.6t	1.00	1.00	1.00	213	-14.5	ULS 1a_0	36.2	37.7	60.5	0.40		14.5	ULS 1a_0	94.8	37.7	44.8	0.38	
237L	Onderstuk 1 diag 9 front	65x65x7	S235	1M16-5.6t	1.00	1.00	1.00	198	-14.4	ULS 1a_0,9_90	40.2	37.7	60.5	0.38		14.9	ULS 1a_0,9_0,9_90	94.8	37.7	44.8	0.40	
237T	Onderstuk 1 diag 9 side	65x65x7	S235	1M16-5.6t	1.00	1.00	1.00	198	-12.0	ULS 1a_0,9_45	40.2	37.7	60.5	0.32		14.5	ULS 1a_0,9_0,9_135	94.8	37.7	44.8	0.38	
238L	Onderstuk 1 diag 10 front	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	184	-16.4	ULS 1a_0	35.2	37.7	51.8	0.47		16.4	ULS 1a_0	72.6	37.7	38.4	0.44	
238T	Onderstuk 1 diag 10 side	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	184	-16.4	ULS 1a_0	35.2	37.7	51.8	0.47		16.4	ULS 1a_0	72.6	37.7	38.4	0.44	

DNV·GL

Assessment of groups for initial mast (afkeur level)

Date 3-7-2020
Author MKh
Version 1.0

KIJ-GT380
S+30
14

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
239L	Onderstuk 1 diag 11 front	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	182	**-19.1**	ULS 1a_135	35.9	37.7	51.8	0.53		**17.9**	ULS 1a_0,9_0,9_45	72.6	37.7	38.4	0.48	
239T	Onderstuk 1 diag 11 side	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	182	**-19.2**	ULS 1a_45	35.9	37.7	51.8	0.53		**17.8**	ULS 1a_0,9_0,9_135	72.6	37.7	38.4	0.47	
240L	Onderstuk 1 diag 12 front	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	139	**-19.7**	ULS 1a_0,9_0,9_45	50.2	37.7	51.8	0.52		**22.1**	ULS 1a_135	72.6	37.7	38.4	0.59	
240T	Onderstuk 1 diag 12 side	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	139	**-19.6**	ULS 1a_0,9_0,9_135	50.2	37.7	51.8	0.52		**22.1**	ULS 1a_45	72.6	37.7	38.4	0.59	
241L	Onderstuk 1 diag 13 front	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	157	**-43.9**	ULS 1a_135	43.3	37.7	51.8	1.17	knik, afschuiving	**33.5**	ULS 1a_0,9_0,9_45	72.6	37.7	38.4	0.89	
241T	Onderstuk 1 diag 13 side	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	157	**-44.0**	ULS 1a_45	43.3	37.7	51.8	1.17	knik, afschuiving	**33.3**	ULS 1a_0,9_0,9_135	72.6	37.7	38.4	0.88	
242L	Onderstuk 1 diag 14 front	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	94	**-29.8**	ULS 1a_0,9_0,9_45	73.3	37.7	51.8	0.79		**40.6**	ULS 1a_135	72.6	37.7	38.4	1.08	afschuiving, stuik
242T	Onderstuk 1 diag 14 side	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	94	**-29.7**	ULS 1a_0,9_0,9_135	73.3	37.7	51.8	0.79		**40.7**	ULS 1a_45	72.6	37.7	38.4	1.08	afschuiving, stuik
243L	Onderstuk 1 diag 15 front	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	143	**-116.7**	ULS 1a_135	48.6	37.7	51.8	3.10	knik, afschuiving, stuik	**82.7**	ULS 1a_0,9_0,9_45	72.6	37.7	38.4	2.19	afschuiving, nettodsn.,
243T	Onderstuk 1 diag 15 side	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	143	**-116.9**	ULS 1a_45	48.6	37.7	51.8	3.10	knik, afschuiving, stuik	**82.3**	ULS 1a_0,9_0,9_135	72.6	37.7	38.4	2.18	afschuiving, nettodsn.,
244L	Onderstuk 1 diag 16 front	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	49	**-41.0**	ULS 1a_0,9_0,9_45	92.8	37.7	51.8	1.09	afschuiving	**57.7**	ULS 1a_135	72.6	37.7	38.4	1.53	afschuiving, stuik
244T	Onderstuk 1 diag 16 side	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	49	**-40.8**	ULS 1a_0,9_0,9_135	92.8	37.7	51.8	1.08	afschuiving	**57.8**	ULS 1a_45	72.6	37.7	38.4	1.54	afschuiving, stuik
245LA	Onderstuk 1 main diag bracing front	UNP300	S235	2M24-5.6t	5.93	1.00	1.00	193	**-51.7**	ULS 5a Ba 10	326.6	338.9	259.2	0.20		**42.6**	ULS 5a Ba 10	584.8	338.9	221.5	0.19	
245LB	Onderstuk 1 main diag bracing front	UNP300	S235	7M24-5.6t	5.94	1.00	1.00	193	**-53.9**	ULS 5a Ba 10	298.1	593.0	907.2	0.18		**52.9**	ULS 1a_0,9_45	1320.9	593.0	775.4	0.09	
245LC	Onderstuk 1 main diag bracing front	UNP300	S235		5.94	1.00	1.00	193	**-52.8**	ULS 5a Ba 10	298.1	0.0	0.0	0.18		**46.9**	ULS 1a_0,9_45	1380.9	0.0	0.0	0.03	
245TA	Onderstuk 1 main diag bracing side	UNP300	S235	2M24-5.6t	5.93	1.00	1.00	193	**-53.4**	ULS 5a Ba 22	326.6	338.9	259.2	0.21		**47.1**	ULS 5a Ba 12	584.8	338.9	221.5	0.21	
245TB	Onderstuk 1 main diag bracing side	UNP300	S235	7M24-5.6t	5.94	1.00	1.00	193	**-55.3**	ULS 5a Ba 22	298.1	593.0	907.2	0.19		**54.3**	ULS 1a_0,9_0,9_135	1320.9	593.0	775.4	0.09	
245TC	Onderstuk 1 main diag bracing side	UNP300	S235		5.94	1.00	1.00	193	**-54.3**	ULS 5a Ba 22	298.1	0.0	0.0	0.18		**48.6**	ULS 1a_0,9_0,9_135	1380.9	0.0	0.0	0.04	
246LA	Onderstuk 1 main diag bracing front	UNP300	S235	7M24-5.6t	12.31	1.00	1.00	193	**-54.3**	ULS 5a Ba 10	298.0	593.0	907.2	0.18		**60.8**	ULS 1a_0,9_0,9_45	1320.9	593.0	775.4	0.10	
246LB	Onderstuk 1 main diag bracing front	UNP300	S235	2M24-5.6t	11.36	1.00	1.00	193	**-240.5**	ULS 1a_45	326.7	338.9	259.2	0.93		**167.3**	ULS 1a_0,9_0,9_135	584.8	338.9	221.5	0.76	
246LC	Onderstuk 1 main diag bracing front	UNP300	S235		12.31	1.00	1.00	193	**-118.0**	ULS 1a_45	298.0	0.0	0.0	0.40		**84.4**	ULS 1a_0,9_0,9_135	1380.9	0.0	0.0	0.06	
246TA	Onderstuk 1 main diag bracing side	UNP300	S235	7M24-5.6t	12.31	1.00	1.00	193	**-55.6**	ULS 5a Ba 22	298.0	593.0	907.2	0.19		**61.4**	ULS 1a_0,9_0,9_135	1320.9	593.0	775.4	0.10	
246TB	Onderstuk 1 main diag bracing side	UNP300	S235	2M24-5.6t	11.36	1.00	1.00	193	**-240.3**	ULS 1a_135	326.7	338.9	259.2	0.93		**167.4**	ULS 1a_0,9_0,9_45	584.8	338.9	221.5	0.76	
246TC	Onderstuk 1 main diag bracing side	UNP300	S235		12.31	1.00	1.00	193	**-117.7**	ULS 1a_135	298.0	0.0	0.0	0.40		**84.8**	ULS 1a_0,9_0,9_45	1380.9	0.0	0.0	0.06	

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Assessment of groups for strenghtened mast (afkeur level)

Date 3-7-2020
Author MKh
Version 1.0

KIJ-GT380
S+30
14

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
100A	BVNSTK - Main	150x150x10	S235	8M24-5.6t	0.52	0.52	0.52	70	**-55.1**	ULS 1a_90	550.6	669.3	1036.8	0.10		**2.5**	ULS 1a_0,9_0,9_90	624.7	669.3	974.8	0.00
100B	BVNSTK - Main	150x150x10	S235	6M24-5.6t	0.53	0.53	0.53	74	**-409.4**	ULS 1a_45	534.2	508.3	777.6	0.81		**307.5**	ULS 1a_0,9_0,9_45	624.7	508.3	664.6	0.60
100C	BVNSTK - Main	150x150x10	S235		0.52	0.52	0.52	73	**-201.9**	ULS 1a_45	540.2	0.0	0.0	0.37		**118.8**	ULS 1a_0,9_0,9_45	688.6	0.0	0.0	0.17
200	Top Cap Membe	100x100x6	S235	2M16-5.6t	0.43	0.43	0.43	79	**-15.5**	ULS 5a Ba 12	174.2	75.4	103.7	0.21		**15.2**	ULS 5a Ba 12	144.1	75.4	76.8	0.20
201L	BVNSTK - Uppe	120x120x8	S235	4M24-5.6t	1.00	1.00	1.00	121	**0.0**		199.4	338.9	414.7	0.00		**164.9**	ULS 3_0	263.0	338.9	354.5	0.63
201T	BVNSTK - Uppe	70x70x7	S235	3M24-5.6t	1.00	1.00	1.00	211	**-4.2**	ULS 1a_0,9_0,9_90	49.5	254.2	272.2	0.08		**5.9**	ULS 1a_90	119.2	254.2	192.5	0.05
202L	BVNSTK - First	120x120x10	S235	2M24-5.6t	0.53	0.53	0.53	111	**-35.9**	ULS 1a_0,9_0,9_45	266.4	169.4	259.2	0.21		**38.1**	ULS 1a_45	278.4	169.4	221.5	0.22
202T	BVNSTK - First	120x120x10	S235	2M24-5.6t	0.53	0.53	0.53	111	**-25.0**	ULS 1a_45	266.4	169.4	259.2	0.15		**3.2**	ULS 1a_0,9_0,9_45	278.4	169.4	221.5	0.02
101	BVNSTK - Lowe	160x160x15#	S235	11M24-5.6t	1.00	2.00	1.00	61	**-352.6**	ULS 1a_0	926.7	924.2	2138.4	0.38		**112.3**	ULS 1a_0,9_0,9_0	1008.5	924.2	1644.9	0.12
203	BVNSTK - Lowe	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	98	**-31.8**	ULS 5a Ba 12	188.3	338.9	414.7	0.17		**61.9**	ULS 5a Ba 12	293.9	338.9	354.5	0.21
204L	BVNSTK - Seco	120x120x10	S235	3M24-5.6t	0.53	0.53	0.53	117	**-113.3**	ULS 5a Ba 22	254.5	254.2	388.8	0.45		**113.2**	ULS 5a Ba 12	324.0	254.2	332.3	0.45
204T	BVNSTK - Seco	120x120x10	S235	3M24-5.6t	0.53	0.53	0.53	117	**-126.3**	ULS 5a Ba 22	254.5	254.2	388.8	0.50		**120.5**	ULS 5a Ba 12	324.0	254.2	332.3	0.47
205L	BVNSTK - Third	120x120x10	S235	2M24-5.6t	0.53	0.53	0.53	121	**-101.1**	ULS 5a Ba 12	246.7	169.4	259.2	0.60		**99.5**	ULS 5a Ba 22	278.4	169.4	221.5	0.59
205T	BVNSTK - Third	120x120x10	S235	2M24-5.6t	0.53	0.53	0.53	121	**-106.6**	ULS 5a Ba 12	246.7	169.4	259.2	0.63		**111.7**	ULS 5a Ba 22	278.4	169.4	221.5	0.66
206T	BVNSTK - Side	70x70x7	S235		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
207T	BVNSTK - Side	70x70x7	S235		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
208	BVNSTK - Diapl	100x100x8	S235	2M24-5.6t	1.00	1.00	1.00	108	**-64.0**	ULS 5a Ba 22	182.9	169.4	207.4	0.38		**64.6**	ULS 5a Ba 22	181.4	169.4	177.2	0.38
209	BVNSTK - Diapl	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	309	**-0.9**	ULS 3_0	11.3	37.7	43.2	0.08		**0.0**		37.4	37.7	22.0	0.00
400	Tweede DWSRM	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	145	**-13.6**	ULS 5a Ba 12	60.5	58.8	75.6	0.23		**13.3**	ULS 5a Ba 22	76.6	58.8	51.8	0.26
401	Tweede DWSRM	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	135	**-16.2**	ULS 5a Ba 22	65.4	58.8	75.6	0.28		**16.6**	ULS 5a Ba 12	76.6	58.8	51.8	0.32
402	Tweede DWSRM	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	128	**-17.9**	ULS 5a Ba 12	69.3	58.8	75.6	0.30		**17.4**	ULS 5a Ba 22	76.6	58.8	51.8	0.34
403	Tweede DWSRM	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	122	**-19.5**	ULS 5a Ba 12	73.3	58.8	75.6	0.33		**20.2**	ULS 5a Ba 22	76.6	58.8	51.8	0.39
404	Tweede DWSRM	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	115	**-23.3**	ULS 5a Ba 22	77.4	58.8	75.6	0.40		**21.6**	ULS 5a Ba 12	76.6	58.8	51.8	0.42
405	Tweede DWSRM	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	113	**-25.1**	ULS 5a Ba 12	78.7	58.8	75.6	0.43		**29.0**	ULS 5a Ba 22	76.6	58.8	51.8	0.56
406	Tweede DWSRM	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	112	**-38.0**	ULS 5a Ba 22	79.8	58.8	75.6	0.65		**30.8**	ULS 5a Ba 12	76.6	58.8	51.8	0.59
407	Tweede DWSRM	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	81	**-35.4**	ULS 5a Ba 22	101.0	58.8	75.6	0.60		**22.1**	ULS 5a Ba 12	76.6	58.8	51.8	0.43
408	Tweede DWSRM	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	104	**0.0**		47.1	37.7	43.2	0.00		**3.1**	ULS 1a_0	37.4	37.7	22.0	0.14
409	Tweede DWSRM	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	204	**0.0**		21.2	37.7	43.2	0.00		**15.4**	ULS 4_45	37.4	37.7	22.0	0.70
410	Tweede DWSRM	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	213	**-3.2**	ULS 7	22.5	37.7	43.2	0.14		**3.8**	ULS 5a Ba 22	37.4	37.7	22.0	0.17
411	Tweede DWSRM	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	334	**-4.6**	ULS 7	14.3	37.7	51.8	0.32		**5.6**	SLS 7	72.6	37.7	38.4	0.15
412	Tweede DWSRM	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	273	**-4.1**	ULS 1a_135	13.7	37.7	43.2	0.30		**0.0**		37.4	37.7	22.0	0.00
413	Tweede DWSRM	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	138	**-3.1**	ULS 1a_135	35.3	37.7	43.2	0.09		**0.0**		37.4	37.7	22.0	0.00
414	Tweede DWSRM	55x55x6	S235	1M16-5.6t	1.00	1.00	1.00	344	**-11.0**	ULS 1a_0	11.8	37.7	51.8	0.93		**0.0**		55.3	37.7	33.6	0.00
415	Tweede DWSRM	**80x80x8**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	242	**-44.9**	SLS 7	46.5	60.3	94.1	0.96		**0.0**		194.4	60.3	69.7	0.00
416	Tweede DWSRM	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	324	**-20.5**	SLS 7	20.5	37.7	60.5	1.00		**0.0**	ULS 1a_0	104.8	37.7	44.8	0.00
417	Tweede DWSRM	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	322	**0.0**		10.6	37.7	43.2	0.00		**4.3**	ULS 1a_45	37.4	37.7	18.4	0.24
418	Tweede DWSRM	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	269	**0.0**		14.1	37.7	43.2	0.00		**5.3**	ULS 1a_135	37.4	37.7	18.4	0.29
419	Tweede DWSRM	120x120x10	S235	4M24-5.6t	1.00	1.00	1.00	316	**0.0**		65.9	338.9	518.4	0.00		**173.3**	ULS 3_45	324.0	338.9	443.1	0.53
420	Tweede DWSRM	120x120x10	S235	4M24-5.6t	1.00	1.00	1.00	144	**0.0**		203.6	338.9	518.4	0.00		**155.6**	ULS 3_45	324.0	338.9	443.1	0.48
102A	Tweede DWSRM	160x160x15#	S235	11M24-5.6t	1.00	1.95	1.00	73	**-302.1**	ULS 5a Ba 22	857.7	924.2	2138.4	0.35		**82.0**	ULS 5a Ba 12	1008.5	924.2	1827.7	0.09
102C	Tweede DWSRM	160x160x15#	S235		1.00	2.06	1.00	73	**-286.0**	ULS 5a Ba 22	857.8	0.0	0.0	0.33		**65.5**	ULS 5a Ba 12	1097.7	0.0	0.0	0.06
102B	Tweede DWSRM	160x160x15#	S235	6M24-5.6t	1.00	2.71	1.00	66	**-146.6**	ULS 3_0	899.0	488.2	1166.4	0.30		**0.0**		787.2	488.2	996.9	0.00
421	Tweede DWSRM	HEB160	S235	2M20-5.6t	1.00	1.00	1.00	39	**-0.3**	ULS 1a_0,9_0,9_90	1004.9	117.6	172.8	0.00		**14.1**	ULS 3_90	1278.1	117.6	0.0	0.12
422	Tweede DWSRM	HEB160	S235	2M20-5.6t	2.00	2.00	2.00	36	**-20.3**	ULS 5a Ba 12	1020.1	117.6	172.8	0.17		**31.1**	ULS 5a Ba 22	1278.1	117.6	0.0	0.26
103A	Tweede DWSRM	150x100x10	S235	1M24-5.6t	1.00	1.00	1.00	143	**-27.8**	ULS 5a Ba 22	186.0	84.7	129.6	0.33		**0.0**		155.5	84.7	99.7	0.00
103B	Tweede DWSRM	150x100x10	S235	1M24-5.6t	1.00	1.00	1.00	152	**-20.8**	ULS 5a Ba 22	165.4	84.7	129.6	0.25		**0.0**		155.5	84.7	99.7	0.00
103C	Tweede DWSRM	150x100x10	S235		1.00	1.00	1.00	150	**-24.7**	ULS 5a Ba 22	189.0	0.0	0.0	0.13		**0.0**		571.3	0.0	0.0	0.00
423	Tweede DWSRM	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	210	**-13.9**	ULS 1a_0,9_0,9_0	20.4	37.7	43.2	0.68		**13.8**	ULS 1a_0,9_0	37.4	37.7	22.0	0.62
424	Tweede DWSRM	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	194	**-12.6**	ULS 1a_0,9_0	22.8	37.7	43.2	0.55		**12.6**	ULS 1a_0	37.4	37.7	22.0	0.57
425	Tweede DWSRM	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	187	**-11.8**	ULS 1a_0,9_0,9_0	24.0	37.7	43.2	0.49		**11.6**	ULS 1a_0,9_0	37.4	37.7	22.0	0.53
426	Tweede DWSRM	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	182	**-12.7**	ULS 1a_0	24.8	37.7	43.2	0.51		**12.9**	ULS 1a_0,9_0	37.4	37.7	22.0	0.59
427	Tweede DWSRM	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	168	**-11.5**	ULS 1a_0,9_0	27.7	37.7	43.2	0.42		**11.3**	ULS 1a_0	37.4	37.7	22.0	0.51
428	Tweede DWSRM	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	150	**-9.8**	ULS 1a_0	31.8	37.7	43.2	0.31		**9.8**	ULS 1a_0,9_0	37.4	37.7	22.0	0.45
429	Tweede DWSRM	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	164	**-11.4**	ULS 1a_0,9_0	28.7	37.7	43.2	0.40		**11.2**	ULS 1a_0	37.4	37.7	22.0	0.51
430	Tweede DWSRM	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	123	**-9.3**	ULS 1a_0	40.0	37.7	43.2	0.25		**9.6**	ULS 1a_0,9_0	37.4	37.7	22.0	0.43
431	Tweede DWSRM	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	111	**-10.7**	ULS 5a Ba 3	44.4	37.7	43.2	0.28		**10.1**	ULS 5a Ba 3	37.4	37.7	22.0	0.46
432	Tweede DWSRM	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	117	**-14.5**	ULS 5a Ba 3	42.0	37.7	43.2	0.39		**16.0**	ULS 5a Ba 3	37.4	37.7	22.0	0.73
433	Tweede DWSRM	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	234	**-3.6**	ULS 3_90	17.4	37.7	43.2	0.21		**0.0**		37.4	37.7	22.0	0.00
434	Tweede DWSRM	HEB160	S235	2M12-5.6t	2.00	2.00	2.00	20	**-7.8**	ULS 5a Ba 3	1087.1	40.3	103.7	0.19		**7.2**	ULS 5a Ba 3	1315.0	40.3	57.6	0.18
435	Tweede DWSRM	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	127	**-0.2**	ULS 1a_0,9_90	38.6	37.7	43.2	0.00		**0.1**	ULS 1a_0,9_0,9_90	37.4	37.7	22.0	0.00
436	Tweede DWSRM	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	105	**0.0**		46.6	37.7	43.2	0.00		**0.1**	ULS 5a Ba 22	37.4	37.7	22.0	0.00
104A	Tweede DWSRM	120x120x8	S235	3M24-5.6t	1.00	1.47	1.00	107	**-158.9**	ULS 1a_0	223.0	254.2	311.0	0.71		**138.3**	ULS 1a_0,9_0	263.0	254.2	262.5	0.54
104B	Tweede DWSRM	120x120x8	S235	4M24-5.6t	2.04	2.84	1.00	91	**-67.2**	ULS 5a Ba 3	242.1	338.9	414.7	0.28		**100.6**	ULS 5a Ba 3	379.5	338.9	354.5	0.30
104C	Tweede DWSRM	120x120x8	S235		2.00	3.13	1.00	101	**-141.0**	ULS 1a_0	223.0	0.0	0.0	0.63		**130.1**	ULS 1a_0,9_0	441.8	0.0	0.0	0.29
105A	Tweede DWSRM	100x100x6	S235	4M24-5.6t	1.54	1.00	1.00	111	**-58.4**	ULS 5a Ba 3	127.2	338.9	311.0	0.46		**92.0**	ULS 5a Ba 3	225.0	338.9	265.8	0.41
105B	Tweede DWSRM	100x100x6	S235	2M16-5.6t	1.00	1.43	1.00	95	**-6.3**	ULS 1a_0,9_0,9_90	154.1	75.4	103.7	0.08		**17.7**	ULS 1a_90	203.8	75.4	103.7	0.23
105C	Tweede DWSRM	100x100x6	S235		1.00	1.00	1.00	127	**-49.1**	ULS 5a Ba 3	116.8	0.0	0.0	0.42		**71.9**	ULS 5a Ba 3	277.3	0.0	0.0	0.26
106A	Vierde TSNSTK	150x150x14	S235	**6M24-8.8t**	0.53	0.53	0.53	75	**-538.1**	ULS 1a_45	727.9	813.3	1088.6	0.74		**434.4**	ULS 1a_0,9_0,9_45	851.7	813.3	930.5	0.53
106B	Vierde TSNSTK	150x150x14	S235	10M24-5.6t	0.27	0.27	0.27	37	**-668.2**	ULS 1a_45	891.0	847.2	1814.4	0.79		**498.0**	ULS 1a_0,9_0,9_45	851.7	847.2	1798.9	0.59
210L	Vierde TSNSTK	120x120x10	S235	2M24-5.6t	0.53	0.53	0.53	124	**-88.6**	ULS 5a Ba 22	239.3	169.4	259.2	0.52		**90.5**	ULS 5a Ba 12	278.4	169.4	221.5	0.53
210T	Vierde TSNSTK	120x120x10	S235	2M24-5.6t	0.53	0.53	0.53	124	**-100.1**	ULS 5a Ba 22	239.3	169.4	259.2	0.59		**94.7**	ULS 5a Ba 12	278.4	169.4	221.5	0.56
211L	Vierde TSNSTK	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	87	**-109.4**	ULS 1a_45	217.9	169.4	207.4	0.65		**98.9**	ULS 1a_0,9_135	138.1	169.4	172.2	0.72
211T	Vierde TSNSTK	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	87	**-107.5**	ULS 1a_135	217.9	169.4	207.4	0.63		**82.1**	ULS 1a_0,9_0,9_45	138.1	169.4	172.2	0.59
212L	Vierde TSNSTK	120x120x10	S235	4M24-5.6t	1.00	1.00	1.00	159	**0.0**		179.6	338.9	518.4	0.00		**202.9**	ULS 3_0	324.0	338.9	443.1	0.63
212T	Vierde TSNSTK	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	192	**-51.2**	ULS 1a_0,9_90	93.8	254.2	311.0	0.55		**53.1**	ULS 1a_90	223.0	254.2	265.8	0.24
107	Vierde TSNSTK	180x180x15#	S235	12M24-5.6t	1.00	2.00	1.00	73	**-274.6**	ULS 5a Ba 21	959.5	999.7	2332.8	0.29		**27.0**	ULS 5a Ba 21	1144.0	999.7	1993.8	0.03
213L	Vierde TSNSTK	100x100x8	S235	4M24-5.6t	1.00	2.00	1.00	131	**-34.0**	ULS 5a Ba 10	143.1	338.9	414.7	0.24		**67.6**	ULS 5a Ba 10	293.9	338.9	354.5	0.23
214	Vierde TSNSTK	120x120x8	S235	2M24-5.6t	1.00	1.00	1.00	119	**-69.9**	ULS 5a Ba 10	202.8	169.4	207.4	0.41		**71.0**	ULS 5a Ba 21	226.0	169.4	177.2	0.42
215	Vierde TSNSTK	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	342	**-1.2**	ULS 3_0	13.8	58.8	64.8	0.09		**0.0**		65.7	58.8	44.4	0.00
300	Eerste DWSRM	75x75x7#	S235	1M24-5.6t	0.53	0.53	0.53	153	**-16.7**	ULS 5a Ba 11	66.2	84.7	90.7	0.25		**19.6**	ULS 5a Ba 20	98.8	84.7	72.5	0.27
301	Eerste DWSRM	75x75x7#	S235	1M24-5.6t	0.53	0.53	0.53	144	**-22.5**	ULS 5a Ba 20	71.6	84.7	90.7	0.31		**20.2**	ULS 5a Ba 11	98.8	84.7	72.5	0.28
302	Eerste DWSRM	75x75x7#	S235	1M24-5.6t	0.53	0.53	0.53	134	**-21.7**	ULS 5a Ba 11	77.3	84.7	90.7	0.28		**24.6**	ULS 5a Ba 20	98.8	84.7	72.5	0.34

Assessment of groups for strenghtened mast (afkeur level)

Date	3-7-2020
Author	MKh
Version	1.0

KIJ-GT380
S+30
14

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
303	Eerste DWSRM	75x75x7#	S235	1M24-5.6t	0.53	0.53	0.53	128	-29.5	ULS 5a Ba 20	81.6	84.7	90.7	0.36		25.2	ULS 5a Ba 11	98.8	84.7	72.5	0.35
304	Eerste DWSRM	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	126	-27.7	ULS 5a Ba 11	70.6	58.8	75.6	0.47		21.9	ULS 5a Ba 11	86.7	58.8	59.5	0.37
305	Eerste DWSRM	60x60x6	S235	1M20-5.6t	0.53	0.53	0.53	133	-12.6	ULS 5a Ba 10	53.0	58.8	64.8	0.24		10.9	ULS 5a Ba 10	65.7	58.8	44.4	0.25
306	Eerste DWSRM	60x60x6	S235	1M20-5.6t	0.53	0.53	0.53	121	-13.2	ULS 5a Ba 21	58.5	58.8	64.8	0.23		13.9	ULS 5a Ba 21	65.7	58.8	44.4	0.31
307	Eerste DWSRM	60x60x6	S235	1M20-5.6t	0.53	0.53	0.53	112	-15.6	ULS 5a Ba 10	63.0	58.8	64.8	0.26		15.4	ULS 5a Ba 10	65.7	58.8	44.4	0.35
308	Eerste DWSRM	60x60x6	S235	1M20-5.6t	0.54	0.54	0.54	106	-18.7	ULS 5a Ba 21	66.5	58.8	64.8	0.32		17.9	ULS 5a Ba 21	65.7	58.8	44.4	0.40
309	Eerste DWSRM	60x60x6	S235	1M20-5.6t	0.54	0.54	0.54	98	-21.3	ULS 5a Ba 10	71.2	58.8	64.8	0.36		23.2	ULS 5a Ba 10	65.7	58.8	44.4	0.52
310	Eerste DWSRM	60x60x6	S235	1M20-5.6t	0.55	0.55	0.55	97	-32.9	ULS 5a Ba 21	71.8	58.8	64.8	0.56		28.4	ULS 5a Ba 21	65.7	58.8	44.4	0.64
311	Eerste DWSRM	60x60x6	S235	1M20-5.6t	0.55	0.55	0.55	77	-36.9	ULS 5a Ba 10	81.7	58.8	64.8	0.63		27.2	ULS 5a Ba 10	65.7	58.8	44.4	0.61
312	Eerste DWSRM	HEB160	S235	2M20-5.6t	1.00	1.00	1.00	70	-6.4	ULS 1a_0,9_0,9_90	842.3	117.6	172.8	0.05		14.9	ULS 1a_90	1278.1	117.6	0.0	0.13
313	Eerste DWSRM	HEB160	S235	2M20-5.6t	2.00	2.00	2.00	65	-21.4	ULS 5a Ba 11	870.7	117.6	172.8	0.18		30.0	ULS 5a Ba 20	1278.1	117.6	0.0	0.26
314	Eerste DWSRM	HEB160	S235	2M20-5.6t	1.00	1.00	1.00	30	0.0		1046.7	117.6	172.8	0.00		11.3	ULS 3_90	1278.1	117.6	0.0	0.10
315	Eerste DWSRM	HEB160	S235	2M20-5.6t	2.00	2.00	2.00	25	-22.8	ULS 5a Ba 21	1067.2	117.6	172.8	0.19		28.9	ULS 5a Ba 10	1278.1	117.6	0.0	0.25
316	Eerste DWSRM	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	465	0.0		10.2	117.6	129.6	0.00		31.5	ULS 3_45	77.4	117.6	88.7	0.41
317	Eerste DWSRM	60x60x8	S235	2M20-5.6t	1.00	1.00	1.00	509	0.0		11.4	117.6	172.8	0.00		54.2	ULS 3_0	100.5	117.6	118.3	0.54
318	Eerste DWSRM	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	377	0.0		8.2	37.7	43.2	0.00		13.6	ULS 7	37.4	37.7	22.0	0.62
319	Eerste DWSRM	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	410	0.0		7.1	37.7	43.2	0.00		18.7	ULS 7	37.4	37.7	22.0	0.85
320	Eerste DWSRM	100x100x6	S235	1M20-5.6t	1.00	1.00	1.00	163	-21.0	ULS 3_0	70.4	58.8	64.8	0.36		0.0		117.5	58.8	52.4	0.00
321	Eerste DWSRM	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	199	-7.4	ULS 1a_0	27.5	37.7	43.2	0.27		0.0		37.4	37.7	22.0	0.00
322	Eerste DWSRM	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	156	-5.4	ULS 7	30.4	37.7	43.2	0.18		0.0		37.4	37.7	22.0	0.00
323	Eerste DWSRM	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	75	-2.5	ULS 3_135	57.4	37.7	43.2	0.07		0.0		37.4	37.7	22.0	0.00
108A	Eerste DWSRM	180x180x15#	S235	12M24-5.6t	1.00	1.99	1.00	65	-340.0	ULS 5a Ba 21	1008.7	999.7	2332.8	0.34		91.4	ULS 5a Ba 10	1144.0	999.7	1993.8	0.09
108B	Eerste DWSRM	180x180x15#	S235	6M24-5.6t	1.00	4.06	1.00	93	-287.4	ULS 5a Ba 21	816.1	508.3	1166.4	0.57		74.9	ULS 5a Ba 10	1144.0	508.3	996.9	0.15
108C	Eerste DWSRM	180x180x15#	S235		1.00	2.76	1.00	89	-308.9	ULS 5a Ba 21	843.1	0.0	0.0	0.37		92.8	ULS 5a Ba 10	1220.5	0.0	0.0	0.08
109A	Eerste DWSRM	150x150x12	S235	6M24-5.6t	1.00	1.90	1.00	63	-242.8	ULS 5a Ba 10	681.6	508.3	933.1	0.48		94.4	ULS 5a Ba 21	740.3	508.3	797.5	0.19
109B	Eerste DWSRM	150x150x12	S235	5M24-5.6t	1.00	2.79	1.00	74	-97.2	ULS 3_90	637.2	420.1	777.6	0.23		0.0		554.4	420.1	664.6	0.00
109C	Eerste DWSRM	150x150x12	S235		1.00	2.11	1.00	65	-230.0	ULS 5a Ba 10	673.5	0.0	0.0	0.34		80.4	ULS 5a Ba 21	817.8	0.0	0.0	0.10
110A	Eerste DWSRM	120x120x10	S235	4M24-5.6t	1.00	1.00	1.00	160	0.0		178.3	338.9	518.4	0.00		168.9	ULS 3_0	324.0	338.9	443.1	0.52
110B	Eerste DWSRM	120x120x10	S235	4M24-5.6t	1.00	1.00	1.00	215	0.0		119.4	338.9	518.4	0.00		126.2	ULS 3_0	466.6	338.9	443.1	0.37
111A	Eerste DWSRM	120x120x8	S235	4M24-5.6t	1.00	1.70	1.00	139	0.0		162.4	338.9	414.7	0.00		115.9	ULS 3_0	379.5	338.9	354.5	0.34
111B	Eerste DWSRM	120x120x8	S235	3M24-5.6t	1.46	1.00	1.00	146	0.0		161.8	254.2	311.0	0.00		99.2	ULS 3_0	263.0	254.2	265.8	0.39
111C	Eerste DWSRM	120x120x8	S235		2.35	3.17	1.00	137	0.0		165.0	0.0	0.0	0.00		99.2	ULS 3_0	441.8	0.0	0.0	0.22
324	Eerste DWSRM	50x50x5	S235	1M16-5.6t	0.50	0.50	0.50	172	-5.0	ULS 1a_0	26.9	37.7	43.2	0.19		2.4	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.11
325	Eerste DWSRM	75x50x5	S235	1M24-5.6t	1.00	1.00	1.00	230	0.0		22.4	84.7	64.8	0.00		1.1	ULS 7	63.4	84.7	36.7	0.03
326	Eerste DWSRM	80x80x8	S235	1M24-5.6t	1.00	1.00	1.00	206	-0.1	ULS 1a_90	53.9	84.7	103.7	0.00		0.0	ULS 1a_0,9_0,9_90	124.4	84.7	70.9	0.00
327	Eerste DWSRM	75x50x5	S235	1M24-5.6t	1.00	1.00	1.00	160	-0.1	ULS 1a_90	36.8	84.7	64.8	0.00		0.0	ULS 1a_0,9_0,9_45	63.4	84.7	36.7	0.00
112A	Derde TSNSTK	L160.17 + L120.1	S235	12M24-8.8t	0.27	0.27	0.27	39	-961.8	ULS 1a_45	1855.2	1599.5	5287.7	0.60		743.7	ULS 1a_0,9_0,9_45	1992.8	1599.5	4519.4	0.46
112B	Derde TSNSTK	L160.17 + L120.1	S235	8M24-8.8t	0.26	0.26	0.26	38	-1197.6	ULS 1a_45	1862.8	2168.8	3525.1	0.64		966.4	ULS 1a_0,9_0,9_45	1992.8	2168.8	3012.9	0.49
216L	Derde TSNSTK	120x80x8	S355	2M24-8.8t	0.53	0.27	0.27	91	-153.0	ULS 1a_90	264.0	271.1	282.2	0.58		145.1	ULS 1a_0,9_0,9_90	188.0	271.1	241.2	0.77
216T	Derde TSNSTK	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	91	-103.9	ULS 5a Ba 21	211.8	169.4	207.4	0.61		106.7	ULS 5a Ba 21	138.1	169.4	172.2	0.77
217L	Derde TSNSTK	120x80x8	S355	2M24-8.8t	0.53	0.27	0.27	94	-140.8	ULS 1a_0,9_0,9_90	254.9	271.1	282.2	0.55		144.9	ULS 1a_90	188.0	271.1	241.2	0.77
217T	Derde TSNSTK	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	94	-98.7	ULS 5a Ba 21	206.0	169.4	207.4	0.58		96.6	ULS 5a Ba 10	138.1	169.4	172.2	0.70
113A	Tweede TSNSTI	L200.18 + L160.1	S235	10M24-8.8t	0.27	0.27	0.27	31	-1446.0	ULS 1a_45	2580.7	2711.0	4665.6	0.56		1202.4	ULS 1a_0,9_0,9_45	2742.6	2711.0	3987.7	0.44
113B	Tweede TSNSTI	L200.18 + L160.1	S235	10M24-8.8t	0.27	0.27	0.27	31	-1645.2	ULS 1a_45	2580.7	2711.0	4665.6	0.64		1397.0	ULS 1a_0,9_0,9_45	2742.6	2711.0	4027.6	0.52
218L	Tweede TSNSTI	120x80x8	S355	2M24-8.8t	0.53	0.27	0.27	97	-142.3	ULS 1a_90	247.3	271.1	282.2	0.58		138.5	ULS 1a_0,9_0,9_90	188.0	271.1	241.2	0.74
218T	Tweede TSNSTI	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	97	-91.9	ULS 1a_0,9_0,9_0	201.0	169.4	207.4	0.54		93.5	ULS 1a_0	138.1	169.4	172.2	0.68
219L	Tweede TSNSTI	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	100	-133.3	ULS 1a_90	196.2	169.4	207.4	0.79		130.9	ULS 1a_0,9_90	134.0	169.4	159.5	0.98
219T	Tweede TSNSTI	120x80x8	S235	2M24-5.6t	0.53	0.27	0.27	100	-91.3	ULS 1a_0	196.2	169.4	207.4	0.54		85.9	ULS 1a_0,9_0,9_45	134.0	169.4	159.5	0.64
220L	Tweede TSNSTI	120x120x10	S355	2M24-8.8t	2.00	1.00	1.00	136	-99.4	ULS 1a_0	241.3	271.1	352.8	0.41		66.4	ULS 1a_0,9_0,9_0	378.9	271.1	301.5	0.25
220T	Tweede TSNSTI	120x120x10	S355	2M24-8.8t	2.00	1.00	1.00	136	-128.3	ULS 1a_90	241.3	271.1	352.8	0.53		92.8	ULS 1a_0,9_0,9_90	378.9	271.1	301.5	0.34
114A	Eerste TSNSTK	250x250x18#	S235	12M24-5.6t	0.29	0.29	0.29	39	-1785.9	ULS 1a_45	1932.6	1859.6	2799.4	0.96		1497.8	ULS 1a_0,9_0,9_45	2030.6	1859.6	2799.4	0.81
114B	Eerste TSNSTK	250x250x18#	S235	12M24-5.6t	0.29	0.29	0.29	39	-1750.7	ULS 1a_45	1930.7	1859.6	2799.4	0.94		1460.1	ULS 1a_0,9_0,9_45	2030.6	1859.6	2799.4	0.79
221L	Eerste TSNSTK	120x80x12	S235	2M24-5.6t	0.58	0.29	0.29	150	-68.1	ULS 5a Ba 10	189.0	169.4	311.0	0.40		71.2	ULS 5a Ba 10	250.6	169.4	265.8	0.42
221T	Eerste TSNSTK	120x80x12	S235	2M24-5.6t	0.58	0.29	0.29	150	-70.2	ULS 5a Ba 21	189.0	169.4	311.0	0.41		74.2	ULS 5a Ba 10	250.6	169.4	265.8	0.44
222L	Eerste TSNSTK	120x80x10	S235	1M24-5.6t	0.56	0.29	0.29	172	-49.5	ULS 5a Ba 10	101.6	84.7	129.6	0.58		44.5	ULS 5a Ba 10	155.5	84.7	110.8	0.53
222T	Eerste TSNSTK	120x80x10	S235	1M24-5.6t	0.56	0.29	0.29	172	-52.0	ULS 5a Ba 10	101.6	84.7	129.6	0.61		45.4	ULS 5a Ba 21	155.5	84.7	110.8	0.54
223L	Eerste TSNSTK	100x100x8	S235		0.00	0.00	0.00	0	0.0		0.0	0.0	0.0	0.00		0.0		0.0	0.0	0.0	0.00
223T	Eerste TSNSTK	100x100x8	S235		0.00	0.00	0.00	0	0.0		0.0	0.0	0.0	0.00		0.0		0.0	0.0	0.0	0.00
115A	Onderstuk 2 - N	250x250x20#	S235	12M24-5.6t	0.29	0.29	0.29	51	-1693.7	ULS 1a_45	2028.6	1859.6	3110.4	0.91		1395.3	ULS 1a_0,9_0,9_45	2244.7	1859.6	3110.4	0.75
115B	Onderstuk 2 - N	250x250x20#	S235	14M24-5.6t	0.50	0.50	0.50	48	-1715.7	ULS 1a_45	2058.2	2100.4	3628.8	0.83		1367.9	ULS 1a_0,9_0,9_45	2244.7	2100.4	3101.5	0.65
224L	Onderstuk 2 - C	150x100x12	S235	2M24-5.6t	1.00	0.29	0.29	275	-44.5	ULS 1a_0	97.8	169.4	311.0	0.46		50.0	ULS 1a_0,9_0,9_90	264.6	169.4	265.8	0.29
224T	Onderstuk 2 - C	150x100x12	S235	2M24-5.6t	1.00	0.29	0.29	275	-60.6	ULS 1a_90	99.6	169.4	311.0	0.61		49.3	ULS 1a_0,9_0,9_135	264.6	169.4	265.8	0.29
225L	Onderstuk 2 - D	150x100x10	S235	1M24-5.6t	1.00	0.50	0.50	170	-33.8	ULS 1a_0,9_0,9_90	122.6	84.7	129.6	0.40		40.5	ULS 1a_135	213.1	84.7	110.8	0.48
225T	Onderstuk 2 - D	150x100x10	S235	1M24-5.6t	1.00	0.50	0.50	170	-27.6	ULS 1a_0,9_0,9_135	122.6	84.7	129.6	0.33		41.8	ULS 1a_45	213.1	84.7	110.8	0.49
226L	Onderstuk 1 - D	200x200x16	S235	3M24-5.6t	1.00	1.00	1.00	165	-44.8	ULS 1a_45	456.7	254.2	622.1	0.18		22.4	ULS 1a_0,9_135	1110.9	254.2	531.7	0.09
226T	Onderstuk 1 - D	200x200x16	S235	3M24-5.6t	1.00	1.00	1.00	165	-45.2	ULS 1a_135	456.7	254.2	622.1	0.18		22.8	ULS 1a_0,9_45	1110.9	254.2	531.7	0.09
227	onderstuk 1 - D	150x150x10	S235	1M20-5.6t	1.00	2.00	1.00	199	-13.2	ULS 1a_45	144.4	58.8	108.0	0.22		12.6	ULS 1a_135	368.6	58.8	87.3	0.21
228	Onderstuk 1 - D	150x100x10	S235	1M20-5.6t	0.50	0.50	0.50	301	-0.7	ULS 1a_90	59.7	58.8	108.0	0.01		0.0		224.6	58.8	87.3	0.00
116A	Onderstuk 1 - N	250x250x24#	S235	14M24-5.6t	0.50	0.50	0.50	35	-1707.6	ULS 1a_45	2565.0	2100.4	4354.6	0.81		1317.6	ULS 1a_0,9_0,9_45	2655.2	2100.4	3721.8	0.63
116B	Onderstuk 1 - N	250x250x24#	S235	14M24-5.6t	0.50	0.50	0.50	35	-1703.9	ULS 1a_45	2565.5	2100.4	4354.6	0.81		1275.3	ULS 1a_0,9_0,9_45	2655.2	2100.4	3721.8	0.61
116C	Onderstuk 1 - N	250x250x24#	S235		0.50	0.50	0.50	35	-1709.2	ULS 1a_45	2565.5	0.0	0.0	0.67		1300.2	ULS 1a_0,9_0,9_45	2700.6	0.0	0.0	0.48
117A	Onderstuk 1 - N	250x250x24#	S235	14M24-5.6t	1.00	1.00	1.00	34	-1700.4	ULS 1a_45	2577.7	2100.4	4354.6	0.81		1259.2	ULS 1a_0,9_0,9_45	2655.2	2100.4	3721.8	0.60
117B	Onderstuk 1 - N	250x250x24#	S235	14M24-5.6t	1.00	1.00	1.00	37	-1335.4	ULS 1a_45	2550.1	2100.4	4354.6	0.64		963.0	ULS 1a_0,9_0,9_45	2655.2	2100.4	3721.8	0.46
117C	Onderstuk 1 - N	250x250x24#	S235		1.00	1.00	1.00	34	-1688.4	ULS 1a_45	2577.7	0.0	0.0	0.66		1237.3	ULS 1a_0,9_0,9_45	2700.6	0.0	0.0	0.46
229L	Onderstuk 1 dia	100x100x6	S235	1M16-5.6t	1.00	0.52	0.52	192	-14.8	ULS 1a_0,9_135	45.6	37.7	51.8	0.39		35.2	ULS 1a_45	141.7	37.7	38.4	0.93
229T	Onderstuk 1 dia	100x100x6	S235	1M16-5.6t	1.00	0.52	0.52	192	-14.9	ULS 1a_0,9_45	45.6	37.7	51.8	0.39		35.3	ULS 1a_135	141.7	37.7	38.4	0.94
230L	Onderstuk 1 dia	100x100x8	S235	1M16-5.6t	1.00	1.00	1.00	276	-17.3	ULS 1a_0	43.7	37.7	69.1	0.46		17.3	ULS 1a_0	188.9	37.7	51.2	0.46
230T	Onderstuk 1 dia	100x100x8	S235	1M16-5.6t	1.00	1.00	1.00	276	-17.3	ULS 1a_0	43.7	37.7	69.1	0.46		17.3	ULS 1a_0	188.9	37.7	51.2	0.46
231L	Onderstuk 1 dia	75x75x7#	S235	1M16-5.6t	1.00	0.53	0.53	221	-10.6	ULS 1a_0,9_135	33.2	37.7	60.5	0.32		15.4	ULS 1a_90	114.9	37.7	44.8	0.41
231T	Onderstuk 1 dia	75x75x7#	S235	1M16-5.6t	1.00	0.53	0.53	221	-10.0	ULS 1a_0,9_45	33.2	37.7	60.5	0.30		13.3	ULS 1a_0	114.9	37.7	44.8	0.35
232L	Onderstuk 1 dia	100x100x6	S235	1M16-5.6t	1.00	1.00	1.00	219	-18.5	ULS 1a_0	47.1	37.7	51.8	0.49		18.5	ULS 1a_0	141.7	37.7	38.4	0.49
232T	Onderstuk 1 dia	100x100x6	S235	1M16-5.6t	1.00	1.00	1.00	219	-18.5	ULS 1a_0	47.1	37.7	51.8	0.49		18.5	ULS 1a_0	141.7	37.7	38.4	0.49

DNV·GL

Assessment of groups for strengthened mast (afkeur level)

Date 3-7-2020
Author MKh
Version 1.0

KIJ-GT380
S+30
14

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
233L	Onderstuk 1 dia	65x65x7	S235	1M16-5.6t	1.00	0.53	0.53	220	**-13.6**	ULS 1a_0,9_135	28.4	37.7	60.5	0.48		**17.3**	ULS 1a_90	94.8	37.7	44.8	0.46
233T	Onderstuk 1 dia	65x65x7	S235	1M16-5.6t	1.00	0.53	0.53	220	**-12.7**	ULS 1a_0,9_45	28.4	37.7	60.5	0.45		**14.3**	ULS 1a_0	94.8	37.7	44.8	0.38
234L	Onderstuk 1 dia	75x75x7#	S235	1M16-5.6t	1.00	1.00	1.00	219	**-15.5**	ULS 1a_90	40.9	37.7	60.5	0.41		**11.0**	ULS 1a_0,9_90	114.9	37.7	44.8	0.29
234T	Onderstuk 1 dia	75x75x7#	S235	1M16-5.6t	1.00	1.00	1.00	219	**-14.0**	ULS 1a_135	40.9	37.7	60.5	0.37		**9.6**	ULS 1a_0,9_0	114.9	37.7	44.8	0.25
235L	Onderstuk 1 dia	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	214	**-10.2**	ULS 1a_0,9_90	38.9	37.7	60.5	0.27		**13.3**	ULS 1a_90	104.8	37.7	44.8	0.35
235T	Onderstuk 1 dia	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	214	**-13.1**	ULS 1a_0	38.9	37.7	60.5	0.35		**13.1**	ULS 1a_0	104.8	37.7	44.8	0.35
236L	Onderstuk 1 dia	65x65x7	S235	1M16-5.6t	1.00	1.00	1.00	213	**-14.2**	ULS 1a_0	36.2	37.7	60.5	0.39		**14.2**	ULS 1a_0	94.8	37.7	44.8	0.38
236T	Onderstuk 1 dia	65x65x7	S235	1M16-5.6t	1.00	1.00	1.00	213	**-14.2**	ULS 1a_0	36.2	37.7	60.5	0.39		**14.2**	ULS 1a_0	94.8	37.7	44.8	0.38
237L	Onderstuk 1 dia	65x65x7	S235	1M16-5.6t	1.00	1.00	1.00	198	**-14.1**	ULS 1a_0,9_90	40.2	37.7	60.5	0.38		**15.1**	ULS 1a_0,9_0,9_90	94.8	37.7	44.8	0.40
237T	Onderstuk 1 dia	65x65x7	S235	1M16-5.6t	1.00	1.00	1.00	198	**-11.6**	ULS 1a_0,9_45	40.2	37.7	60.5	0.31		**14.8**	ULS 1a_0,9_0,9_135	94.8	37.7	44.8	0.39
238L	Onderstuk 1 dia	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	184	**-15.9**	ULS 1a_0	35.2	37.7	51.8	0.45		**15.9**	ULS 1a_0	72.6	37.7	38.4	0.42
238T	Onderstuk 1 dia	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	184	**-15.9**	ULS 1a_0	35.2	37.7	51.8	0.45		**15.9**	ULS 1a_0	72.6	37.7	38.4	0.42
239L	Onderstuk 1 dia	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	182	**-18.7**	ULS 1a_135	35.9	37.7	51.8	0.52		**18.3**	ULS 1a_0,9_0,9_45	72.6	37.7	38.4	0.49
239T	Onderstuk 1 dia	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	182	**-18.7**	ULS 1a_45	35.9	37.7	51.8	0.52		**18.3**	ULS 1a_0,9_0,9_135	72.6	37.7	38.4	0.49
240L	Onderstuk 1 dia	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	139	**-19.9**	ULS 1a_0,9_0,9_45	50.2	37.7	51.8	0.53		**21.7**	ULS 1a_135	72.6	37.7	38.4	0.58
240T	Onderstuk 1 dia	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	139	**-19.8**	ULS 1a_0,9_0,9_135	50.2	37.7	51.8	0.53		**21.8**	ULS 1a_45	72.6	37.7	38.4	0.58
241L	Onderstuk 1 dia	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	157	**-43.7**	ULS 1a_135	43.3	37.7	51.8	1.16		**33.5**	ULS 1a_0,9_0,9_45	72.6	37.7	38.4	0.89
241T	Onderstuk 1 dia	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	157	**-43.8**	ULS 1a_45	43.3	37.7	51.8	1.16		**33.4**	ULS 1a_0,9_0,9_135	72.6	37.7	38.4	0.89
242L	Onderstuk 1 dia	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	94	**-29.6**	ULS 1a_0,9_0,9_45	73.3	37.7	51.8	0.79		**40.6**	ULS 1a_135	72.6	37.7	38.4	1.08
242T	Onderstuk 1 dia	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	94	**-29.6**	ULS 1a_0,9_0,9_135	73.3	37.7	51.8	0.78		**40.7**	ULS 1a_45	72.6	37.7	38.4	1.08
243L	Onderstuk 1 dia	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	143	**-118.3**	ULS 1a_135	48.6	37.7	51.8	3.14		**81.8**	ULS 1a_0,9_0,9_45	72.6	37.7	38.4	2.17
243T	Onderstuk 1 dia	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	143	**-118.5**	ULS 1a_45	48.6	37.7	51.8	3.14		**81.7**	ULS 1a_0,9_0,9_135	72.6	37.7	38.4	2.17
244L	Onderstuk 1 dia	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	49	**-39.5**	ULS 1a_0,9_0,9_45	92.8	37.7	51.8	1.05		**59.0**	ULS 1a_135	72.6	37.7	38.4	1.57
244T	Onderstuk 1 dia	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	49	**-39.4**	ULS 1a_0,9_0,9_135	92.8	37.7	51.8	1.05		**59.1**	ULS 1a_45	72.6	37.7	38.4	1.57
245LA	Onderstuk 1 ma	UNP300	S235	2M24-5.6t	5.93	1.00	1.00	193	**-51.0**	ULS 5a Ba 10	326.6	338.9	259.2	0.20		**42.5**	ULS 5a Ba 10	584.8	338.9	221.5	0.19
245LB	Onderstuk 1 ma	UNP300	S235	7M24-5.6t	5.94	1.00	1.00	193	**-52.6**	ULS 5a Ba 10	298.1	593.0	907.2	0.18		**47.8**	ULS 1a_0,9_45	1320.9	593.0	775.4	0.08
245LC	Onderstuk 1 ma	UNP300	S235		5.94	1.00	1.00	193	**-52.1**	ULS 5a Ba 10	298.1	0.0	0.0	0.17		**41.6**	ULS 1a_0,9_45	1380.9	0.0	0.0	0.03
245TA	Onderstuk 1 ma	UNP300	S235	2M24-5.6t	5.93	1.00	1.00	193	**-53.2**	ULS 5a Ba 22	326.6	338.9	259.2	0.21		**47.1**	ULS 5a Ba 12	584.8	338.9	221.5	0.21
245TB	Onderstuk 1 ma	UNP300	S235	7M24-5.6t	5.94	1.00	1.00	193	**-54.5**	ULS 5a Ba 22	298.1	593.0	907.2	0.18		**48.6**	ULS 1a_0,9_0,9_135	1320.9	593.0	775.4	0.08
245TC	Onderstuk 1 ma	UNP300	S235		5.94	1.00	1.00	193	**-54.1**	ULS 5a Ba 22	298.1	0.0	0.0	0.18		**45.2**	ULS 5a Ba 12	1380.9	0.0	0.0	0.03
246LA	Onderstuk 1 ma	UNP300	S235	7M24-5.6t	12.31	1.00	1.00	193	**-56.8**	ULS 1a_135	298.0	593.0	907.2	0.19		**55.8**	ULS 1a_0,9_0,9_45	1320.9	593.0	775.4	0.09
246LB	Onderstuk 1 ma	UNP300	S235	2M24-5.6t	11.36	1.00	1.00	193	**-250.2**	ULS 1a_45	326.7	338.9	259.2	0.97		**182.8**	ULS 1a_0,9_0,9_135	584.8	338.9	221.5	0.83
246LC	Onderstuk 1 ma	UNP300	S235		12.31	1.00	1.00	193	**-125.8**	ULS 1a_45	298.0	0.0	0.0	0.42		**100.9**	ULS 1a_0,9_0,9_135	1380.9	0.0	0.0	0.07
246TA	Onderstuk 1 ma	UNP300	S235	7M24-5.6t	12.31	1.00	1.00	193	**-60.0**	ULS 1a_0	298.0	593.0	907.2	0.20		**55.8**	ULS 1a_0,9_0,9_135	1320.9	593.0	775.4	0.09
246TB	Onderstuk 1 ma	UNP300	S235	2M24-5.6t	11.36	1.00	1.00	193	**-249.8**	ULS 1a_135	326.7	338.9	259.2	0.96		**183.1**	ULS 1a_0,9_0,9_45	584.8	338.9	221.5	0.83
246TC	Onderstuk 1 ma	UNP300	S235		12.31	1.00	1.00	193	**-125.4**	ULS 1a_135	298.0	0.0	0.0	0.42		**101.2**	ULS 1a_0,9_0,9_45	1380.9	0.0	0.0	0.07
247	247	**120x120x10**	S355	1M20-8.8t	1.00	1.00	1.00	227	**-12.9**	ULS 1a_45	97.3	94.1	147.0	0.14		**7.4**	7.438	ULS 1a_0,9_1	188.2	133.6	0.08
248	248	**120x120x10**	S355	1M20-8.8t	1.00	1.00	1.00	162	**-12.6**	ULS 1a_45	160.9	94.1	147.0	0.13		**11.0**	11.04	ULS 1a_0,9_4	188.2	133.6	0.12
249	249	**80x80x8**	S355	1M16-8.8t	1.00	1.00	1.00	240	**-0.1**	ULS 1a_0,9_0,9_45	47.2	60.3	94.1	0.00		**3.6**	3.55	ULS 1a_135	131.7	81.3	0.06
250	250	**75x75x7#**	S355	1M16-8.8t	1.00	1.00	1.00	241	**-2.7**	ULS 1a_135	38.9	60.3	82.3	0.07		**6.4**	6.391	ULS 1a_135	156.4	61.0	0.11
251	251	**70x70x6**	S355	1M16-8.8t	0.50	1.00	0.50	235	**0.0**	ULS 1a_90	27.5	60.3	70.6	0.00		**0.0**		0.0	122.3	52.3	0.00

Note: Groups 241L/T - 244L/T are redundant members which were analysed more accurately using Axis VM. The results of the Axis VM study showed that the redundant members did not need to be replaced.

Assessment of groups for strengthened mast (verbouw level)

Date 3-7-2020
Author MKh
Version 1.0

KIJ-GT380
S+30
14

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
415	Tweede DWSRM - F	**80x80x8**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	242	**-44.9**	SLS 7	46.5	60.3	94.1	0.96		**0.0**		194.4	60.3	69.7	0.00
106A	Vierde TSNSTK - Ma	150x150x14	S235	**6M24-8.8t**	0.53	0.53	0.53	75	**-662.1**	ULS 1a_45	727.9	813.3	1088.6	0.91		**553.4**	ULS 1a_0,9_0,9_45	851.7	813.3	930.5	0.68
112A	Derde TSNSTK - Ma	**L160.17 + L120.15**	S235	**12M24-8.8t**	0.27	0.27	0.27	39	**-1180.7**	ULS 1a_45	1855.2	1599.5	5287.7	0.74		**952.4**	ULS 1a_0,9_0,9_45	1992.8	1599.5	4519.4	0.60
112B	Derde TSNSTK - Ma	**L160.17 + L120.15**	S235	**8M24-8.8t**	0.26	0.26	0.26	38	**-1473.4**	ULS 1a_45	1862.8	2168.8	3525.1	0.79		**1231.4**	ULS 1a_0,9_0,9_45	1992.8	2168.8	3012.9	0.62
216L	Derde TSNSTK - CD	120x80x8	**S355**	**2M24-8.8t**	0.53	0.27	0.27	91	**-187.4**	ULS 1a_90	264.0	271.1	282.2	0.71		**178.9**	ULS 1a_0,9_0,9_90	188.0	271.1	241.2	0.95
217L	Derde TSNSTK - CD	120x80x8	**S355**	**2M24-8.8t**	0.53	0.27	0.27	94	**-173.7**	ULS 1a_0,9_0,9_90	254.9	271.1	282.2	0.68		**177.5**	ULS 1a_90	188.0	271.1	241.2	0.94
113A	Tweede TSNSTK - M	**L200.18 + L160.15**	S235	**10M24-8.8t**	0.27	0.27	0.27	31	**-1782.1**	ULS 1a_45	2580.7	2711.0	4665.6	0.69		**1526.6**	ULS 1a_0,9_0,9_45	2742.6	2711.0	3987.7	0.56
113B	Tweede TSNSTK - M	**L200.18 + L160.15**	S235	**10M24-8.8t**	0.27	0.27	0.27	31	**-2030.0**	ULS 1a_45	2580.7	2711.0	4665.6	0.79		**1769.7**	ULS 1a_0,9_0,9_45	2742.6	2711.0	4027.6	0.65
218L	Tweede TSNSTK - C	120x80x8	**S355**	**2M24-8.8t**	0.53	0.27	0.27	97	**-174.9**	ULS 1a_90	247.3	271.1	282.2	0.71		**170.4**	ULS 1a_0,9_0,9_90	188.0	271.1	241.2	0.91
220L	Tweede TSNSTK - H	**120x120x10**	**S355**	**2M24-8.8t**	**2.00**	1.00	1.00	136	**-122.5**	ULS 1a_0	241.3	271.1	352.8	0.51		**85.7**	ULS 1a_0,9_0,9_0	378.9	271.1	301.5	0.32
220T	Tweede TSNSTK - H	**120x120x10**	**S355**	**2M24-8.8t**	**2.00**	1.00	1.00	136	**-159.8**	ULS 1a_90	241.3	271.1	352.8	0.66		**117.5**	ULS 1a_0,9_0,9_90	378.9	271.1	301.5	0.43
247	Binnenpootverband	**120x120x10**	S355	1M20-8.8t	1.00	1.00	1.00	227	**-15.7**	ULS 1a_135	97.3	94.1	147.0	0.17		**10.0**	ULS 1a_0,9_45	188.2	94.1	133.6	0.11
248	Binnenpootverband	**120x120x10**	S355	1M20-8.8t	1.00	1.00	1.00	162	**-15.6**	ULS 1a_45	160.9	94.1	147.0	0.17		**14.0**	ULS 1a_0,9_45	188.2	94.1	133.6	0.15
249	Binnenpootverband	**80x80x8**	S355	1M16-8.8t	1.00	1.00	1.00	240	**-0.5**	ULS 1a_0,9_0,9_45	47.2	60.3	94.1	0.01		**4.1**	ULS 1a_135	131.7	60.3	81.3	0.07
250	Toegevoegde horizo	**75x75x7#**	S355	1M16-8.8t	1.00	1.00	1.00	241	**-4.1**	ULS 1a_45	38.9	60.3	82.3	0.11		**8.8**	ULS 1a_45	156.4	60.3	61.0	0.15
251	Toegevoegde horizo	**70x70x6**	S355	1M16-8.8t	0.50	1.00	0.50	235	**0.0**	ULS 1a_90	29.4	60.3	70.6	0.00		**0.0**		122.3	60.3	52.3	0.00

APPENDIX C REDUNDANT MEMBERS CHECK

Knikverkorters initial construction (afkeur)

Date: 2020-06-25
Author: Muhammed Khan
Version: 1.8

KIJ-GT
S+30
14

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness (-)	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Block Tearing Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type	Notes
95	Onderstuk	Enkele staaf	L60.6	S235	M16	5.6	0.40	0	34	25.8	0.10	98.7	37.7	38.4	72.6	1.24	0.68		
109	Onderstuk	Enkele staaf	L60.6	S235	M16	5.6	1.63	86	139	25.8	0.00	50.2	37.7	38.4	72.6	1.24	0.68		
94	Onderstuk	Enkele staaf	L60.6	S235	M16	5.6	0.92	0	78	25.8	0.23	81.3	37.7	38.4	72.6	1.24	0.68		
108	Onderstuk	Enkele staaf	L60.6	S235	M16	5.6	1.75	69	149	25.8	0.00	46.3	37.7	38.4	72.6	1.24	0.68		
90	Onderstuk	Enkele staaf	L60.6	S235	M16	5.6	1.44	0	123	25.8	0.36	57.6	37.7	38.4	72.6	1.24	0.68		
107	Onderstuk	Enkele staaf	L60.6	S235	M16	5.6	1.99	55	171	25.8	0.00	39.1	37.7	38.4	72.6	1.24	0.68		
89	Onderstuk	Enkele staaf	L60.6	S235	M16	5.6	1.96	0	167	25.8	0.49	40.1	37.7	38.4	72.6	1.24	0.68		
106	Onderstuk	Enkele staaf	L65.7	S235	M16	5.6	2.33	44	185	25.8	0.00	44.1	37.7	44.8	104.8	1.69	0.68		
87	Onderstuk	Enkele staaf	L65.7	S235	M16	5.6	2.48	0	197	25.8	0.62	40.6	37.7	44.8	104.8	1.69	0.68		
105	Onderstuk	Enkele staaf	L70.7	S235	M16	5.6	2.72	35	199	25.8	0.00	43.1	37.7	44.8	125.0	1.98	0.68		
126	Onderstuk	Enkele staaf	L75.7	S235	M16	5.6	3.00	0	205	25.8	0.75	44.6	37.7	44.8	145.2	2.27	0.68		
104	Onderstuk	Enkele staaf	L65.7	S235	M16	5.6	2.41	38	192	25.8	0.00	42.1	37.7	44.8	104.8	1.69	0.68		
85	Onderstuk	Enkele staaf	L60.6	S235	M16	5.6	1.56	0	133	25.8	0.39	52.7	37.7	38.4	72.6	1.24	0.68		
103	Onderstuk	Kniksteun op 0,5L	L65.7	S235	M16	5.6	4.10	53	209	25.8	0.00	30.4	37.7	44.8	104.8	1.69	0.85		
84	Onderstuk	Enkele staaf	L100.6	S235	M16	5.6	4.08	0	206	25.8	1.02	51.6	37.7	38.4	210.8	4.10	0.68		
101	Onderstuk	Enkele staaf	L70.7	S235	M16	5.6	2.89	31	212	25.8	0.00	39.5	37.7	44.8	125.0	1.98	0.68		
82	Onderstuk	Enkele staaf	L60.6	S235	M16	5.6	2.12	0	181	25.8	0.53	36.1	37.7	38.4	72.6	1.2	0.71		
100	Onderstuk	Kniksteun op 0,5L	L75.7	S235	M16	5.6	4.82	43	212	25.8	0.00	34.7	37.7	44.8	145.2	2.3	0.74		
81	Onderstuk	Enkele staaf	L100.8	S235	M16	5.6	5.15	0	262	25.8	1.29	47.4	37.7	51.2	281.1	4.8	0.68		
98	Onderstuk	Enkele staaf	L75.7	S235	M16	5.6	3.31	27	226	25.8	0.74	38.6	37.7	44.8	145.2	2.3	0.68		
79	Onderstuk	Enkele staaf	L65.7	S235	M16	5.6	2.59	0	205	25.8	0.65	38.2	37.7	44.8	104.8	1.7	0.68		
97	Onderstuk	Kniksteun op 0,5L	L100.6	S235	M16	5.6	5.83	34	190	25.8	0.00	46.6	37.7	38.4	210.8	4.1	0.68		
110	Tussenschot	Kniksteun en verticale steur	L150.10	S235	M20	5.6	8.69	0	188	4.6	1.09	117.0	58.8	87.3	599.0	10.61	0.11		
111	Tussenschot	Kruisende staaf halverwege	L150.100.10	S235	M20	5.6	12.65	0	291	4.6	1.58	61.1	58.8	87.3	311.0	12.72	0.12		
255	1e tussenstuk	Enkele staaf	L80.8	S235	M16	5.6	4.11	33	263	20.6	0.00	37.3	37.7	51.2	188.9	2.95	0.55		
259	1e tussenstuk	Enkele staaf	L70.7	S235	M16	5.6	3.11	0	228	20.6	0.78	35.5	37.7	44.8	125.0	1.98	0.58		
258	1e tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	2.29	0	196	20.6	0.57	32.4	37.7	38.4	72.6	1.24	0.63		
254	1e tussenstuk	Enkele staaf	L70.7	S235	M16	5.6	3.07	50	225	20.6	0.00	36.2	37.7	44.8	125.0	1.98	0.57		
257	1e tussenstuk	Enkele staaf	L100.6	S235	M16	5.6	4.59	0	232	20.6	1.15	43.4	37.7	38.4	210.8	4.10	0.55		
253	1e tussenstuk	Enkele staaf	L70.7	S235	M16	5.6	3.18	31	233	20.6	0.00	34.3	37.7	44.8	125.0	1.98	0.60		
256	1e tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	2.30	0	196	20.6	0.57	32.3	37.7	38.4	72.6	1.24	0.64		
272	1e tussenstuk	Enkele staaf	L100.8	S235	M24	5.6	8.08	0	410	20.6	2.02	22.8	84.7	88.6	216.6	4.76	0.90		
364	2e tussenstuk	Enkele staaf	L55.6	S235	M16	5.6	1.74	0	162	19.3	0.44	38.1	37.7	37.8	55.3	1.03	0.51		
370	2e tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	2.36	49	202	19.3	0.00	31.1	37.7	38.4	72.6	1.24	0.62		
363	2e tussenstuk	Enkele staaf	L75.7	S235	M16	5.6	3.52	0	240	19.3	0.88	35.2	37.7	44.8	145.2	2.27	0.55		
368	2e tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	2.38	34	204	19.3	0.00	30.7	37.7	38.4	72.6	1.24	0.63		
364	2e tussenstuk	Enkele staaf	L55.6	S235	M16	5.6	1.74	0	162	19.3	0.44	38.1	37.7	37.8	55.3	1.03	0.51		
382	2e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.36	0	140	19.3	0.34	34.8	37.7	30.8	37.4	0.72	0.63		
367	2e tussenstuk	Enkele staaf	L55.6	S235	M16	5.6	2.11	58	197	19.3	0.00	29.4	37.7	37.8	55.3	1.03	0.66		
362	2e tussenstuk	Enkele staaf	L65.7	S235	M16	5.6	2.67	0	212	19.3	0.67	36.5	37.7	44.8	104.8	1.69	0.53		
365	2e tussenstuk	Enkele staaf	L55.6	S235	M16	5.6	1.97	39	184	19.3	0.00	32.3	37.7	37.8	55.3	1.03	0.60		
361	2e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.30	0	134	19.3	0.33	36.6	37.7	30.8	37.4	0.72	0.63		
315	2e tussenstuk	Enkele staaf	L80.8	S235	M24	5.6	4.62	0	296	19.3	1.16	30.9	84.7	88.6	124.4	2.95	0.62		
293	3e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.13	0	116	25.8	0.28	42.4	37.7	30.8	37.4	0.72	0.84		
305	3e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.53	40	157	25.8	0.00	30.2	37.7	30.8	37.4	0.72	0.86		
292	3e tussenstuk	Enkele staaf	L55.6	S235	M16	5.6	2.26	0	211	25.8	0.56	26.7	37.7	37.8	55.3	1.03	0.97		
303	3e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.49	35	154	25.8	0.00	31.1	37.7	30.8	37.4	0.72	0.84		
291	3e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.13	0	116	25.8	0.28	42.4	37.7	30.8	37.4	0.72	0.84		
290	3e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.07	0	110	25.8	0.27	44.7	37.7	30.8	37.4	0.72	0.84		
302	3e tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.49	42	153	25.8	0.00	31.3	37.7	30.8	37.4	0.72	0.84		
289	3e tussenstuk	Enkele staaf	L55.6	S235	M16	5.6	2.22	0	208	25.8	0.56	27.3	37.7	37.8	55.3	1.03	0.95		

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Knikverkorters final construction (verbouw)

Date: 2020-06-25
Author: Muhammed Khan
Version: 1.8

KIJ-GT

S+30

14

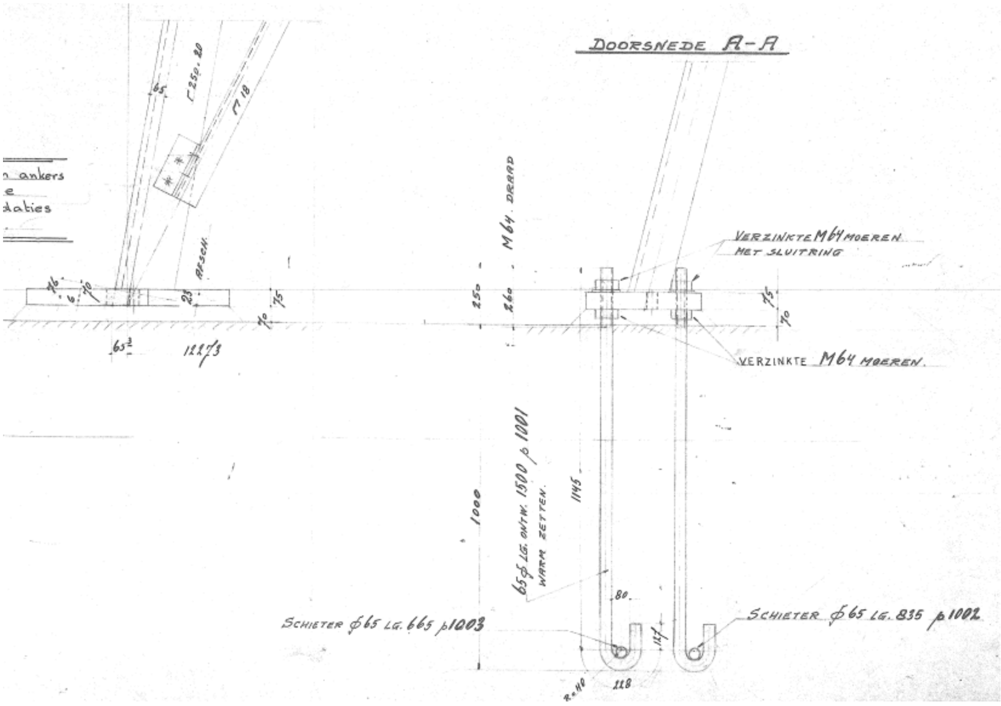
Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness (-)	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Block Tearing Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type	Mitigation
BPV 1 (247)	Pootverband	Enkele staaf	**L120.10**	**S355**	**M20**	**8.8**	5.35	44	225	**3.3**	0.00	98.3	94.1	118.8	580.2	12.83	0.03		Profile added
BPV 2 (248)	Pootverband	Kniksteun en vertic	**L120.10**	**S355**	**M20**	**8.8**	7.64	0	208	**3.3**	1.24	93.2	94.1	118.8	580.2	12.83	0.13		Profile added
BPV 3 (248)	Pootverband	Enkele staaf	**L80.8**	**S355**	**M16**	**8.8**	3.74	90	240	**3.3**	0.00	47.1	60.3	69.7	257.2	4.46	0.07		Profile added
TTH1 (251)	Tussenschot	Kruisende staaf hal	**L70.6**	**S355**	**M16**	**8.8**	5.00	0	235	**2.4**	0.81	27.4	60.3	52.3	145.8	2.58	0.31		Profile added
TTH2 (250)	Tussenschot	Enkele staaf	**L75.7**	**S355**	**M16**	**8.8**	3.54	0	242	**2.4**	1.15	38.3	60.3	61.0	197.6	3.44	0.33		Profile added

APPENDIX D CHECK ANCHORS

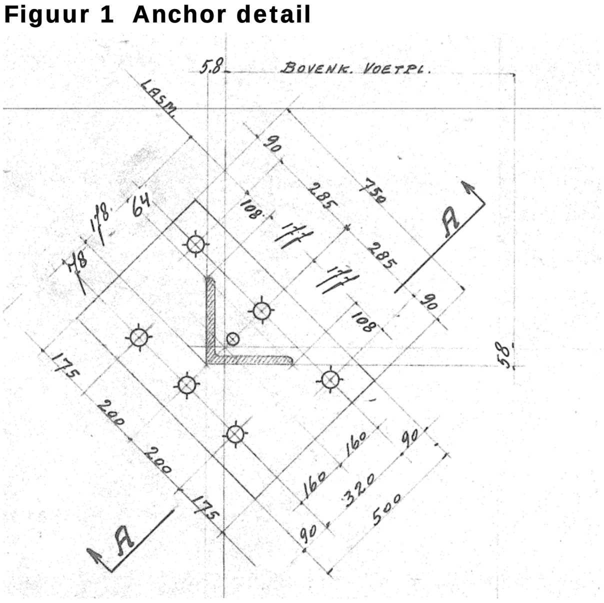
ANCHORS S+30

No as-built drawings are available for type S+30. The foot plate and anchors have been measured in the field[1]. This has confirmed the assumption that S+30 is similar to tower structure S+48 with respect to foot plate and anchors. The tower legs are connected to the foundation with a foot plate 500x750x75 mm and six anchors with diameter 65 mm. This will be the basis of the check.

De anchor rods are connected to a horizontal rod "schieter" which allows for distribution of the tensile force to the concrete.



Figuur 1 Anchor detail



Figuur 2 Foot plate

[1] Rapport Bejan Bouw en Betontechniek d.d. 4-11-2020; 200152A-003 Krimpen aan den IJssel - Geertruidenberg v1.0.pdf

Loads

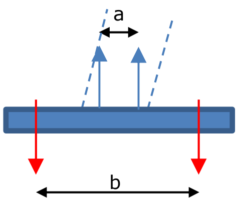
De loads coming from the tower are based on S+30 structure number 14:

Omhullenden ongeacht stijl

Belasting	Combinatie	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. druk	ULS 1a_45	342	329	**1722**	9	-474	-48	1774
Max. trek	ULS 1a_0,9_0,9_45	251	239	**-1252**	-9	346	36	-1290
Max. pos. torsie	ULS 5a Ba 21	-48	-18	167	**21**	-47	-6	172
Max. neg. torsie	ULS 5a Ba 10	-48	18	167	**-21**	-47	-6	172
Comb. trek+torsie	ULS 1a_0,9_0,9_45	251	239	**-1252**	**-9**	346	36	-1290

Foot plate and anchors

The strength of the foot plate will be determined assuming a horizontal yield line across the length of the plate. The tensile force is distributed to two point loads each separated by half of the diagonal width of the tower leg.



Figuur 3 Scheme for check of foot plate

a: $1/2 \cdot 250 / \sqrt{2} = 88$ mm

b: 320 mm

The eccentricity becomes $1/2 \cdot (320-88) = 116$ mm

In the spreadsheet the anchor bolts and foot plate have been checked. The concrete strength is assumed to be equal or more than C20/25. This assumption is higher than what would be derived for old designation K225 but has been verified with concrete cylinder tests. Refer to aforementioned investigation report. The foot plate is embedded in concrete. The anchor bolts will not be loaded by bending.

The anchors and plates fulfill the required strength. See the output:

Tower 14: U.C. = $208 / 460 = 0{,}45 \leq 1{,}00$ OK

Conclusion: The foot plates of tower structure S+30 have sufficient strength.

Main bracing broekstuk

The connection of the bracing is verified into more detail because of the eccentricity associated with the connection angles.

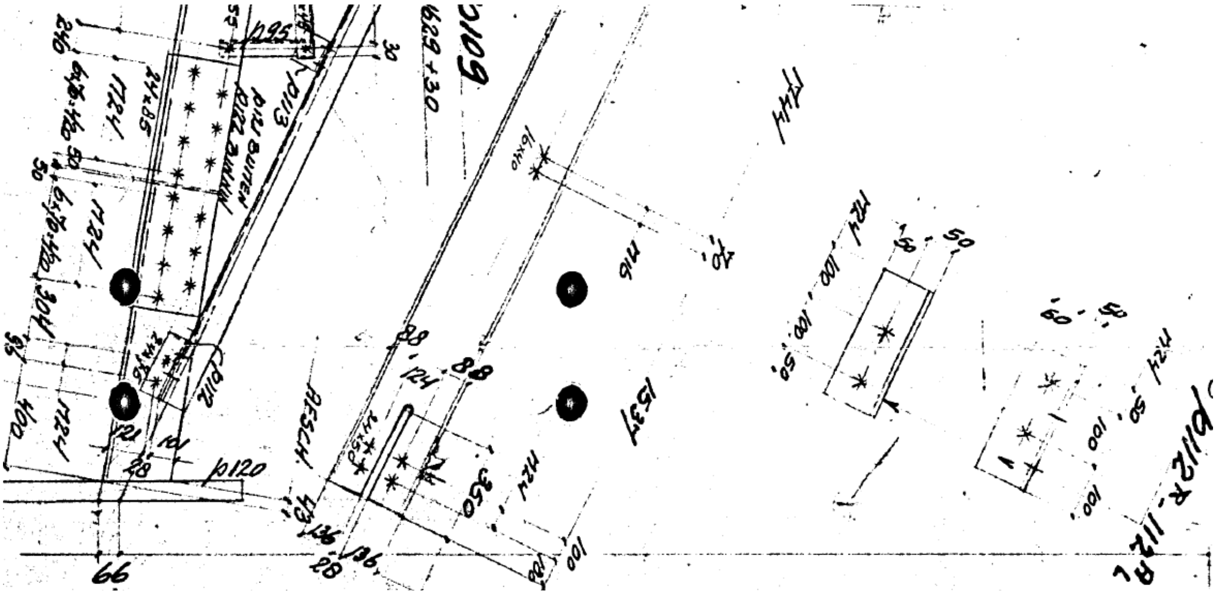


Figure 1 Relevant dimensions for the calculation of connection capacity

The maximum possible force in the diagonal is calculated as shown below. The calculated force is the maximum force which can occur before the two bolts connecting the main diagonal to the leg fail under shear.

$M = 0.05 \times F$

$F_v = 0.5 \times F$

$F_H = 0.05F / 0.1 = 0.5F$

$F_{Res} = ((0.5F)^2 + (0.5F)^2)^{0.5}$

$= 0.707F$

M24-5.6 $F_{v,RD} = 85$ kN

Considering two shear planes: 85 x 2 = 170 kN

Maximum force = 170/ 0.707 = 240.42 kN

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Project: Krimpen - Geertruidenberg 380

Date: 30-11-2020
Version: 2.6

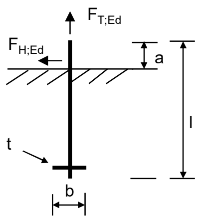
Anchors

NEN-EN 1992-1-1 and 1993-1-8 with NA
CUR-BmS 10

Subject:	**S+30 II**	**Checks:**		
		Anchor bolt to tension	0,32	**OK**
		Anchor bolt to shear	0,29	**OK**
		Dowel ("schieter")	0,45	**OK**

Inputs

Anchor diameter		**M64**	
Achor quality		**4.6**	
Thread		Cut	
Anchor length	l =	1500	mm
Anchor length above concrete	a =	250	mm



Load on anchor group

T: the external tension force on the anchor group

Tension force	T =	**1252**	kN
Shear force	$F_{H,Ed}$ =	**474**	kN
Number of anchors for tension		6	
Number of anchors for shear		6	
$F_{T;Ed} = T / n =$		208,7	kN
$F_{v;Ed} = F_{H,Ed} / n =$		79,0	kN

Anchor properties

$d_b =$	64,00	mm
$A_{b;s} =$	2676	mm^2
$f_{yb} =$	240	N/mm^2
$f_{ub} =$	400	
γ_{Mb}	1,25	-
$\alpha_{red;2}$	0,85	-
$\alpha_b = 0{,}44 - 0{,}0003 f_{yb} =$	0,37	-

Capacity per anchor

$F_{T;Rd} = 0{,}9\alpha_{red;2} f_{ub} A_s / g_{M2} =$	**655,1**	kN
$F_{v;Rd} = \alpha_b f_{ub} A_s / g_{Mb} =$	**267,9**	kN

Foot plate

$F_{t,Rd}$: the tensile force in the anchors when yielding of foot plate is reached.

Steel material		**S235**	
Thickness	t =	75	mm
Width	b_{ef} =	250	mm
Leverage arm	m =	116	mm
$M_{pl,Rd} = 1/4 b_{ef} t_p^2 f_{yd} =$		82,6	kNm
$F_{t,Rd} = M_{pl,Rd} / m =$		712,2	kN

Check of dowel ("schieter")

$$\frac{\sigma_b'}{f_{cd}} = \frac{12{,}9}{40{,}0} = 0{,}32 \quad \textbf{OK}$$

$$\frac{F_{T,Ed}}{F_{v;Rd}} = \frac{209}{460} = 0{,}45 \quad \textbf{OK}$$

Capacity of concrete

Concrete strength		**C20/25**	
$f_{ck} =$		20	N/mm^2
$k_b =$		3	-
$\gamma_{Mc} =$		1,5	-
$f_{cd} = f_{ck} k_b / \gamma_{Mc} =$		40	MPa

Dowel

Diameter	$d_S =$	**65**	mm
Length	b =	**300**	mm
Spread	$c = t\sqrt{(f_{yd} / 3f_{jd})} =$	92	mm
Effective length	$b_{eff} = \min(b; d+2c)$	249	mm
Cross section	$A_S = \pi/4\, d_S^2 =$	3318	mm^2
Distributed load	$q = F_{T,Ed} / b_{eff} =$	839	kN/m
Concrete pressure	$\sigma_b' = q / d_S =$	12,9	MPa
Shear stress in dowel			
Load	$F_{T,Ed} =$	209	kN
Allowable	$F_{v,Rd} = f_{yd} / \sqrt{3} \times A_s =$	460	kN

Capacity of foot plate

$$\frac{F_{T,Ed}}{F_{t;Rd}} = \frac{208{,}7}{712{,}2} = 0{,}29 \quad \textbf{OK}$$

Capacity of anchor for tension

$$\frac{F_{T,Ed}}{F_{T;Rd}} = \frac{208{,}7}{655{,}1} = 0{,}32 \quad \textbf{OK}$$

Check foot plate for tension

$$\frac{T}{n \times F_{t;Rd}} = \frac{1252{,}0}{4273{,}3} = 0{,}29 \quad \textbf{OK}$$

Check anchor for shear

$$\frac{F_{v,Ed}}{F_{v;Rd}} = \frac{79{,}0}{267{,}9} = 0{,}29 \quad \textbf{OK}$$

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INTERACTION BETWEEN MAIN DIAGONAL AND REDUNDANTS HIP STRUCTURE S+30.

From the analysis with PLS Tower it shows that a large portion of the axial force in the tower leg is transferred to the main diagonal, resulting in greatly overloading the redundant members and the diagonal itself. An separate investigation was performed to the real behaviour of the redundants, since they are eccentrically attached and thereby less stiff than modelled in PLS Tower.

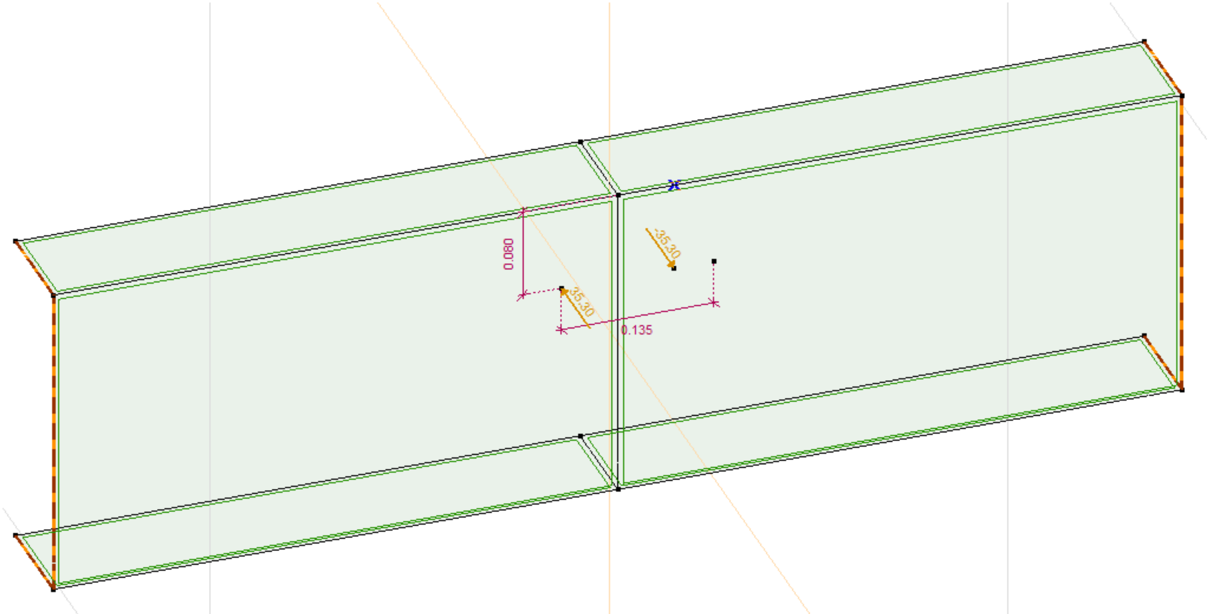


Figure 1 Loading – stand alone UNP 300 model

The main diagonal of the tower leg is UNP 300. A stand alone Axis VM model is created for evaluating the rotational spring stiffness of the web of the UNP 300 section. A length of the 1m of UNP 300 is modelled with shell elements. The ends are restrained for all degrees of freedom. A couple is applied in the web by applying equal and opposite force of 35.3 kN at the position of bolts in the web. Figure 2 shows the location of bolts in the web.

Figure 2 Onderstuk - detail for UNP - redundant connection

The value 35.3 kN of load is found by an iterative method. Applying the load, the rotational stiffness of the web is found by the formula below. This stiffness is applied along the full model of the onderstuk as explained later. The developing force in the diagonals is then compared to the force applied to the web as shown in Figure 1. The starting value of rotational spring was taken as 500 kNm and the corresponding Force was 100 kN.

The axial force in diagonals in the full model was approximately 50 kN. Thus the axial force in the model for web analysis was reduced and the iteration continues till the applied axial force applied in the web of the UNP section and the axial force in the diagonals in the full model converge. This occurs for a load value of 35.3kN. The corresponding, rotational stiffness is calculated below.

The rotational spring stiffness is calculate via

$$K_{rot} = \frac{M}{\theta} = \frac{35.3*0.10}{0.0153} = \frac{235kNm}{rad}$$

K_{rot} - rotational stiffness of the web of UNP 300.
M – Moment applied in the UNP section.
Θ – Rotation of the web in rad.

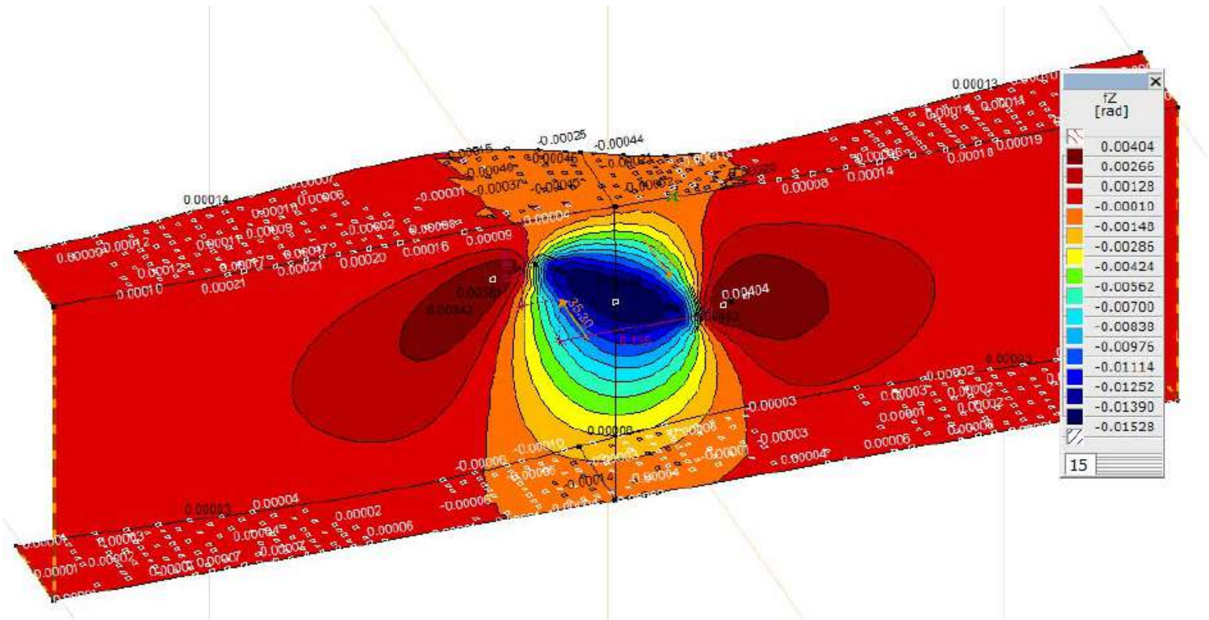


Figure 3 Rotation of the web for the force from diagonal L60.6

The rotation 0.0153 rad used for the calculation of rotational stiffness in equation 1 is seen in Figure 3.

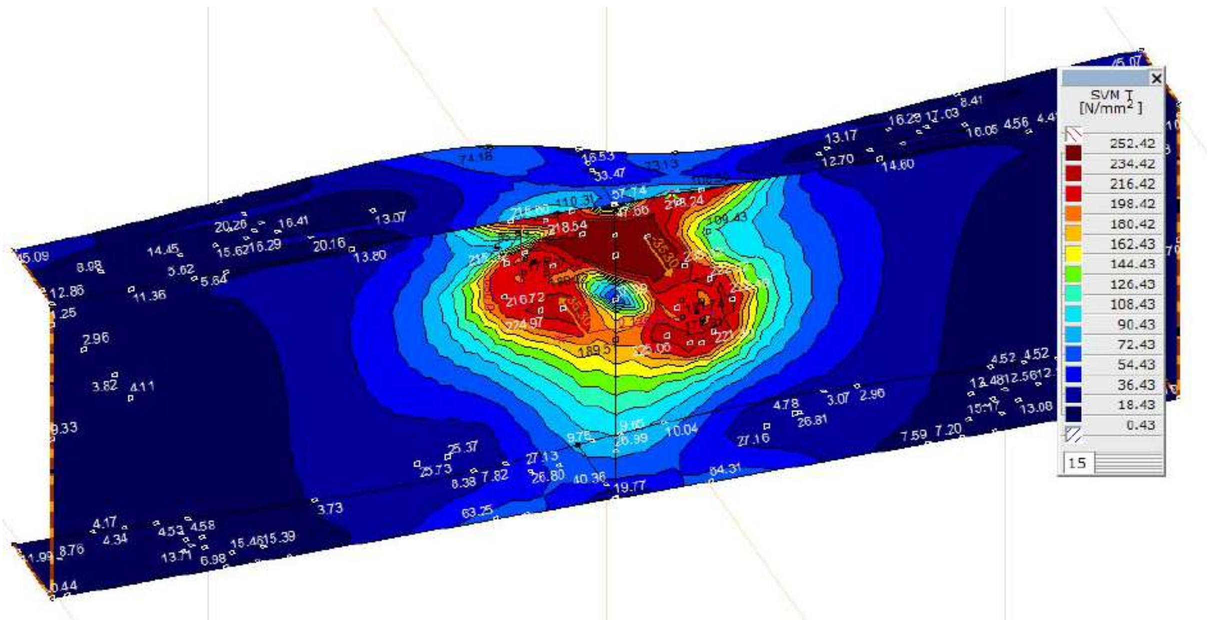


Figure 4 Stress in the web of UNP 300 member

The stress in UNP 300 section is shown in Figure 4. The entire web has not platicised and thus the main diagonal in the tower onderstuk is within design limits. No additional strengthening is required for the UNP 300 member.

Figure 5 shows the geometry modelled in acordance with the drawings from the asset data.

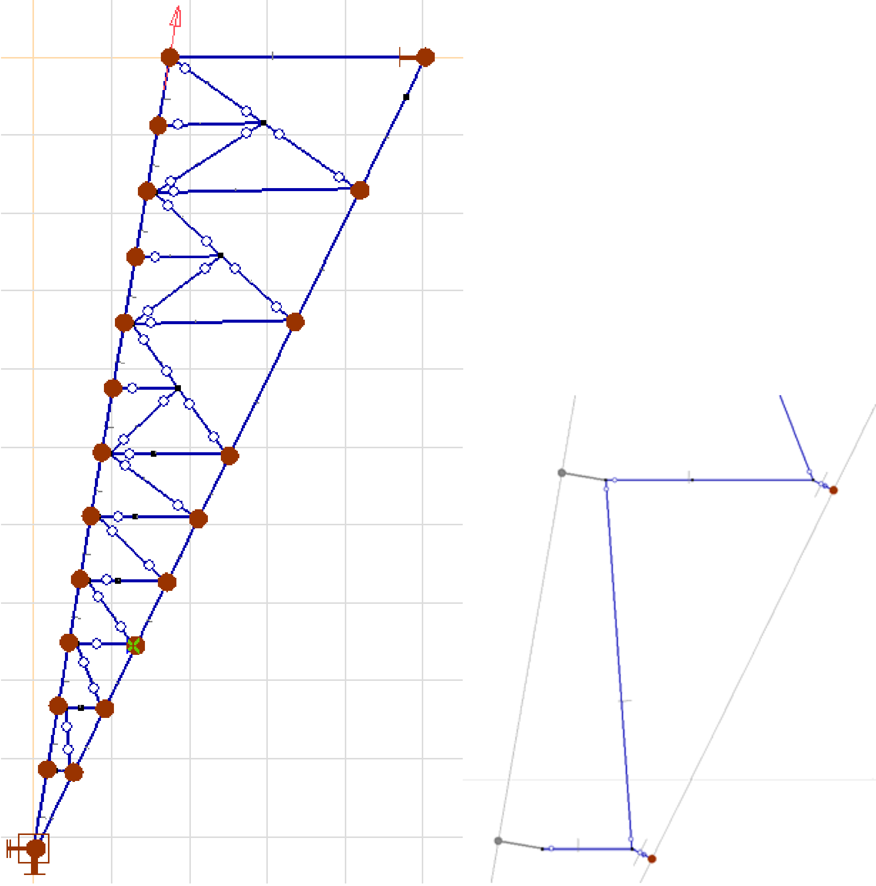


Figure 5 Axis VM model - geometry and dimensions

Figure 5 shows the beam end release applied in the full models between the redundant diagonals and the leg and primary diagonals. The diagonals and the leg members are connected by a fictitious member with a hinge at the end of the diagonal and the value of 235 kNm/m for rotational rigidity a the end of the leg or UNP member. The fictitious member is assigned the cross-section properties of the 130 x 7 mm plate.

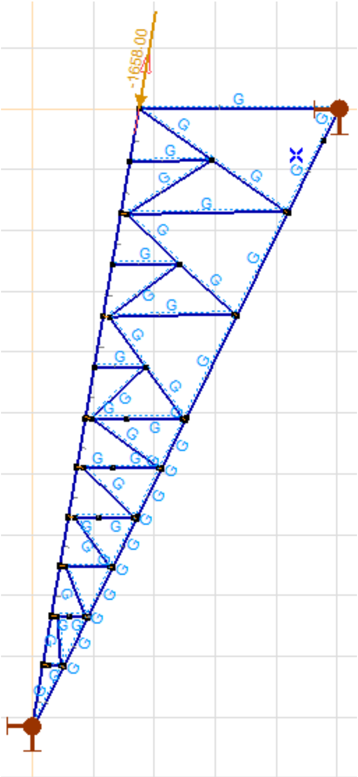


Figure 6 Axial loading in Leg member and self-weight application.

Figure 6 shows the loading. The axial force is taken from the S+30 tower model. The axial force in the lowest leg segment in the PLS Tower model (1658 kN) together with the dead weight are applied in the AxisVM model.

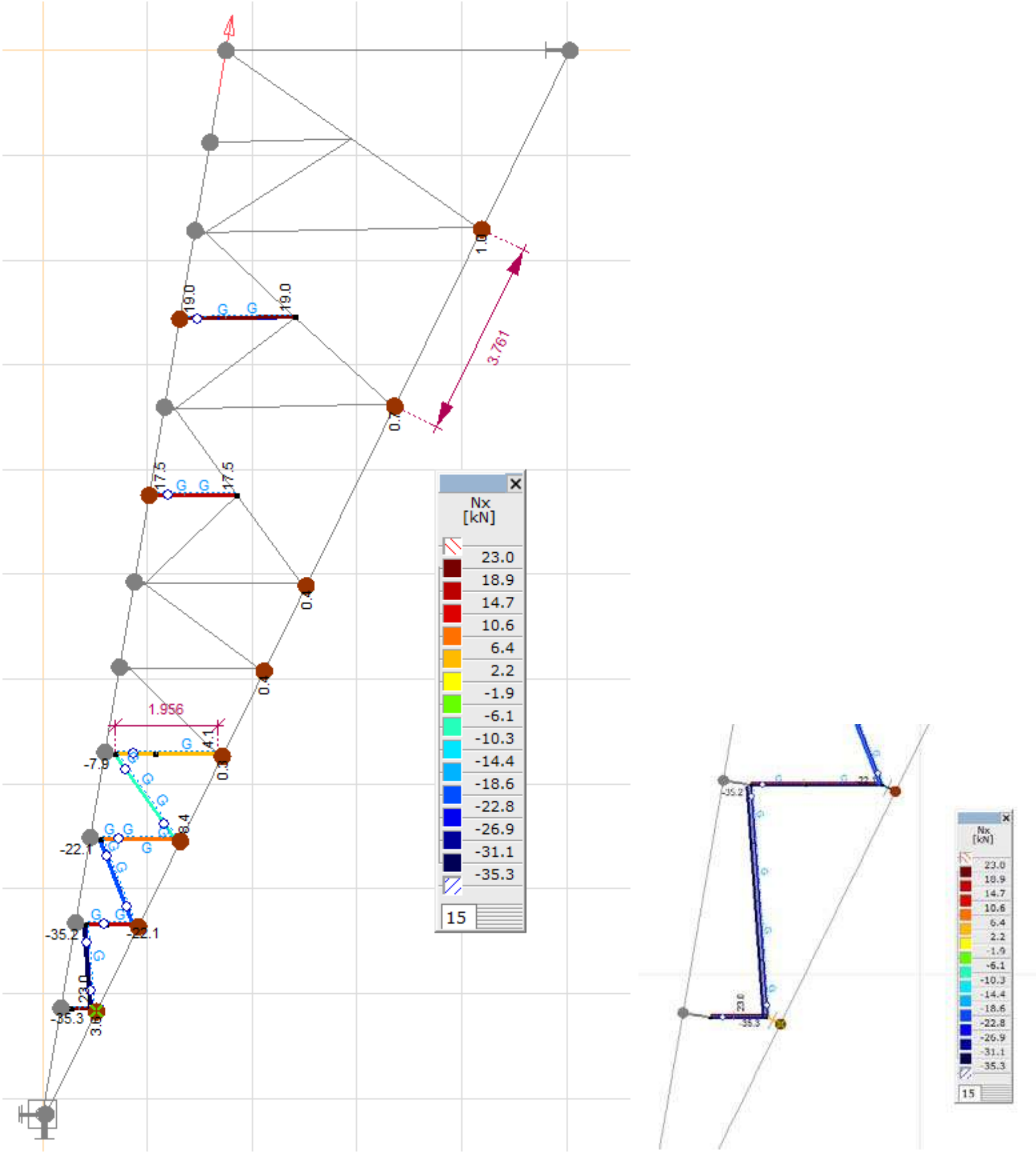


Figure 7 Axial force (Nx) in AxisVM post processing

Figure 7 shows the axial force in the redundant diagonals . The maximum compressive force occurs in the lower most members. The value being 35.3 kN in horizontal diagonal and 23 kN in the horizontal member. Forces in the rest of the diagonals are small and within the capacity of the members. Figure 8 shows the capacity of the members from PLS Tower.

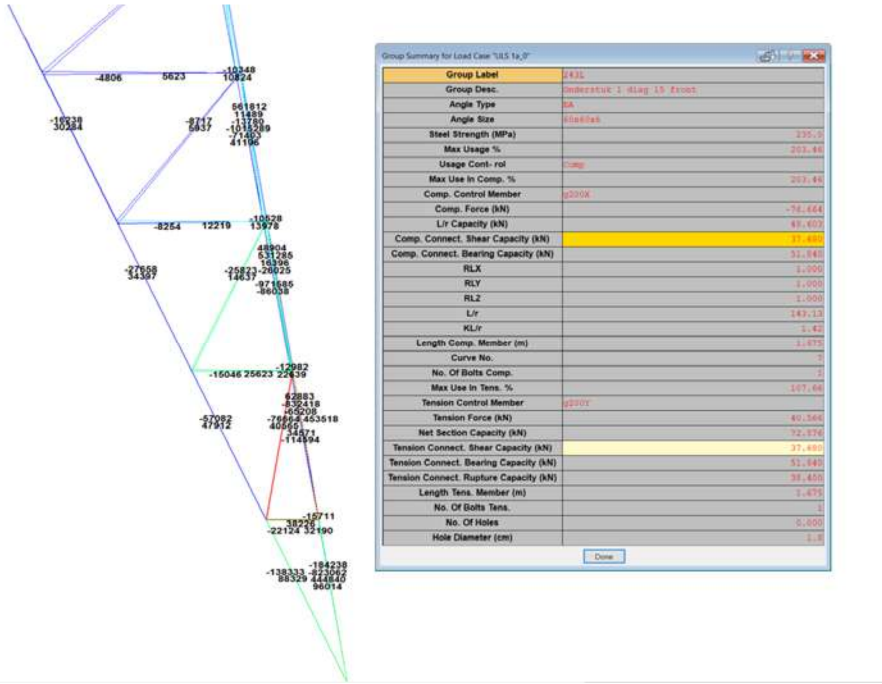
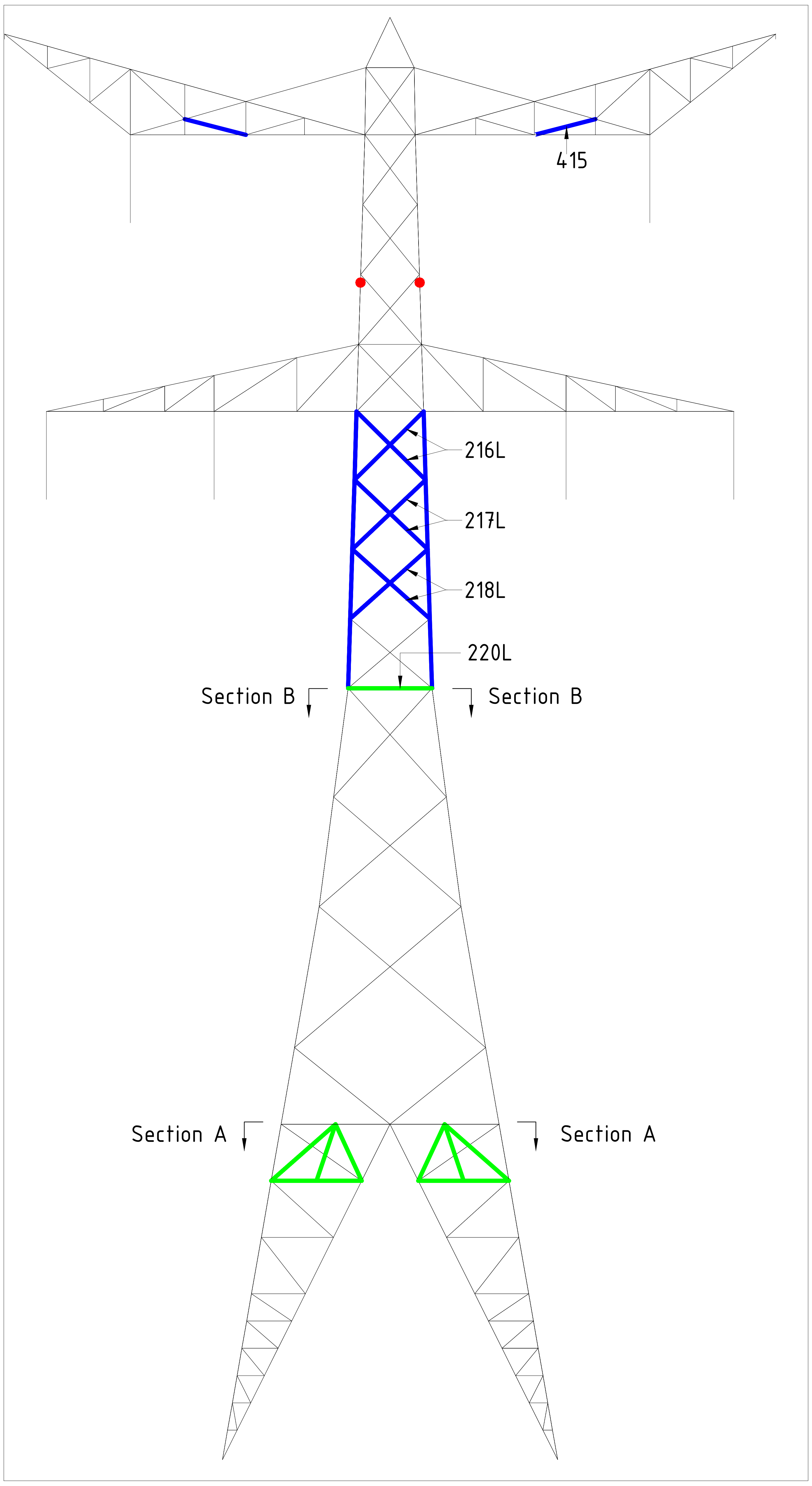


Figure 8 L60.6 capacity from PLS tower

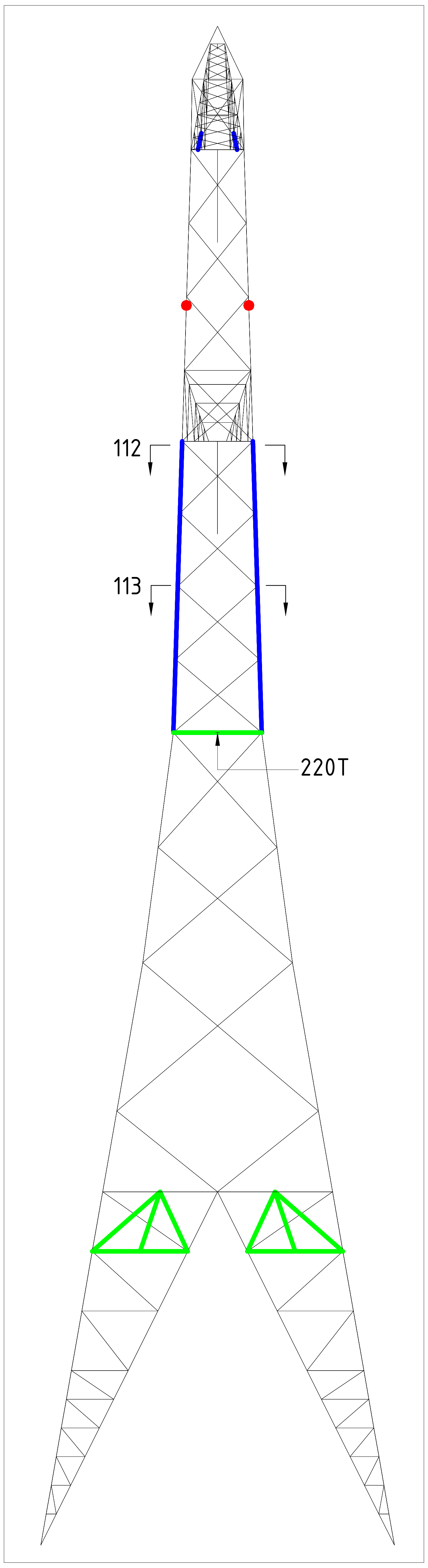
Based on these results it can be deduced that the redundant members are less stiff and attract less force from the tower leg. The redundants do not need to be replaced and the main diagonal does not need a strengthened connection.

APPENDIX E DRAWINGS

Initial Profiles and Bolts					Final Profiles and Bolts			
Group label	Profile type (ini)	Profile size (ini)	Steel quality (ini)	Bolt size and quality (ini)	Profile type (new)	Profile size (new)	Steel quality (new)	Bolt size and quality (new)
415	EA	L55x6	S235 t<=40	M16-5.6t-NEN2012	EA	L80x8	S355 t<=40	M16-8.8t-NEN2012
112	EA	L160x17	S235 t<=40	M24-5.6t-NEN2012	XEA	L160x17 + L120x15	S355 t<=40	M24-8.8t-NEN2012
113	EA	L200x18	S235 t<=40	M24-5.6t-NEN2012	XEA	L200x18 + L160x15	S355 t<=40	M24-8.8t-NEN2012
216L	UA	L120x80x8	S235 t<=40	M24-5.6t-NEN2012	UA	L120x80x8	S355 t<=40	M24-8.8t-NEN2012
217L	UA	L120x80x8	S235 t<=40	M24-5.6t-NEN2012	UA	L120x80x8	S355 t<=40	M24-8.8t-NEN2012
218L	UA	L120x80x8	S235 t<=40	M24-5.6t-NEN2012	UA	L120x80x8	S355 t<=40	M24-8.8t-NEN2012
220L	EA	L80x8	S235 t<=40	M24-5.6t-NEN2012	EA	L120x10	S355 t<=40	M24-8.8t-NEN2012
220T	EA	L80x8	S235 t<=40	M24-5.6t-NEN2012	EA	L120x10	S355 t<=40	M24-8.8t-NEN2012
247					EA	L120x10	S355 t<=40	M20-8.8t-NEN2012
248					EA	L120x10	S355 t<=40	M20-8.8t-NEN2012
249					EA	L80x8	S355 t<=40	M16-8.8t-NEN2012
250					EA	L75x7	S355 t<=40	M16-8.8t-NEN2012
251					EA	L70x6	S355 t<=40	M16-8.8t-NEN2012



Front View



Side View

Notes and legend:

- New redundants according to drawing
- Size for new redundants is 50x50x5
- Other changes according to the table
- All changes are symmetrical unless otherwise indicated
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

Profile exchanged
New redundant
Bolt exchanged

00	25-6-2020	Version 1.0

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Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-016

Design state: FINAL		Scale: -
Drawn by: MuK	25-6-2020	Units: m
Checked by: TBR	25-6-2020	Project no: 10166260
Approved by: JHu	26-6-2020	Company: TenneT

Description: Modifications overview for mast type S+30 (mast 14)
Page 1 of 2

Revision: 00

Format: A2

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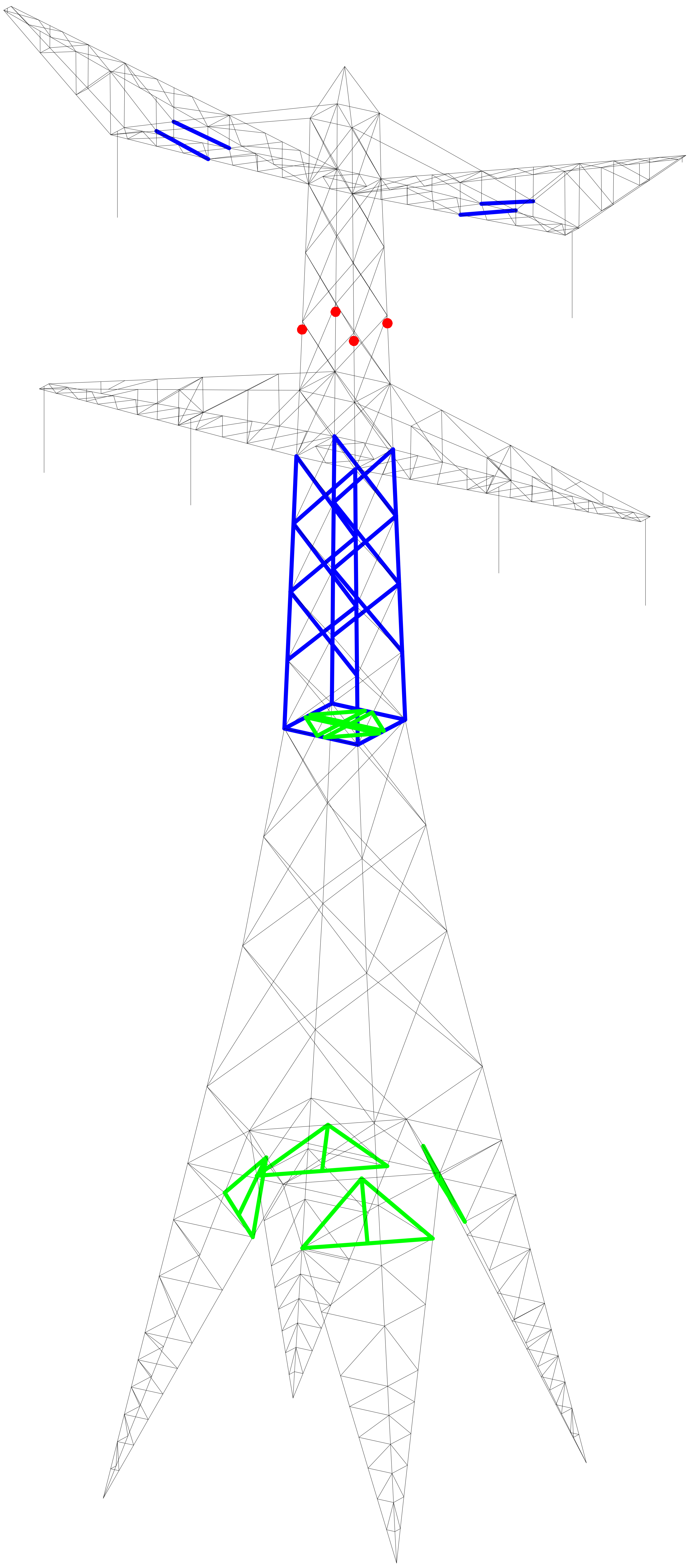
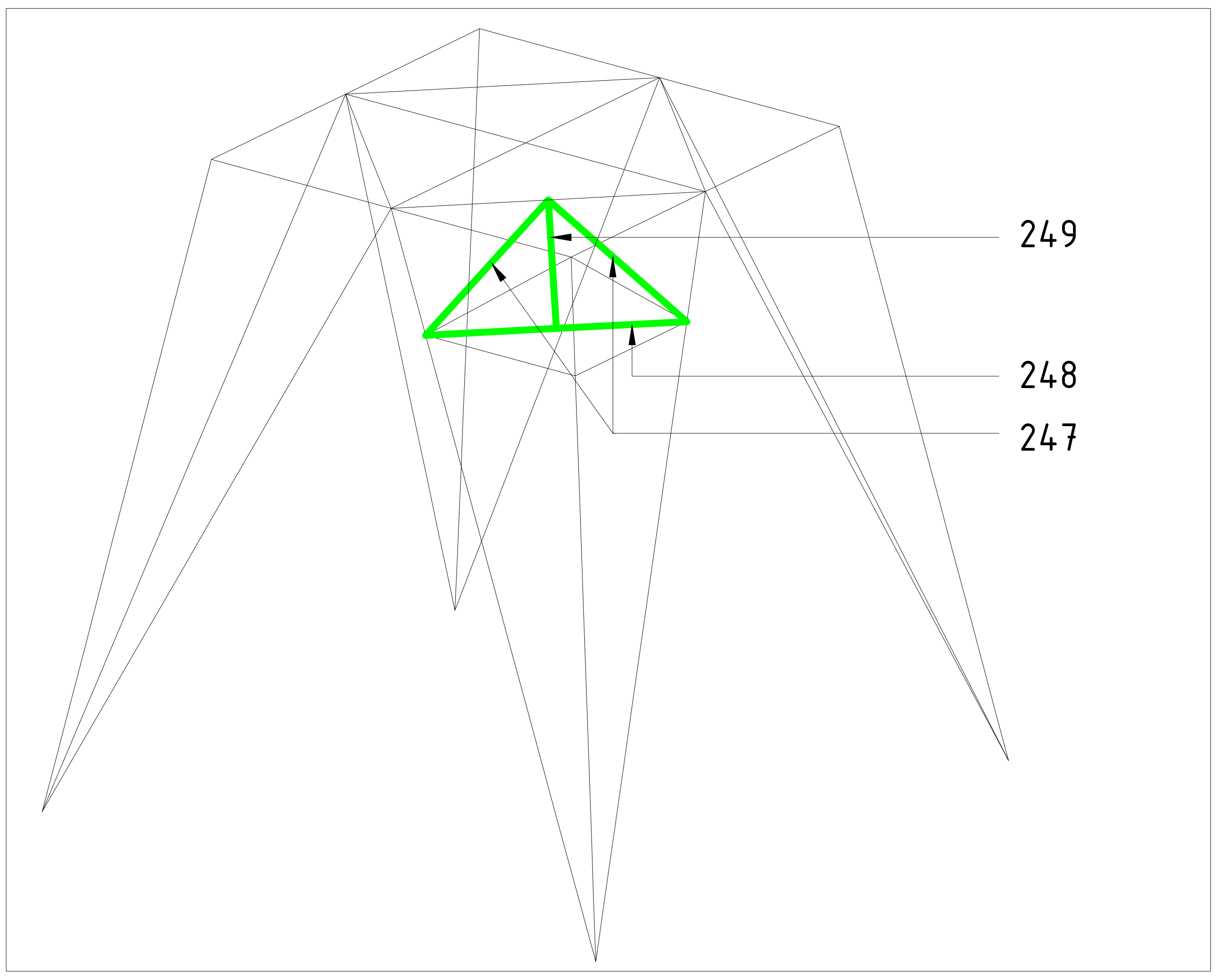
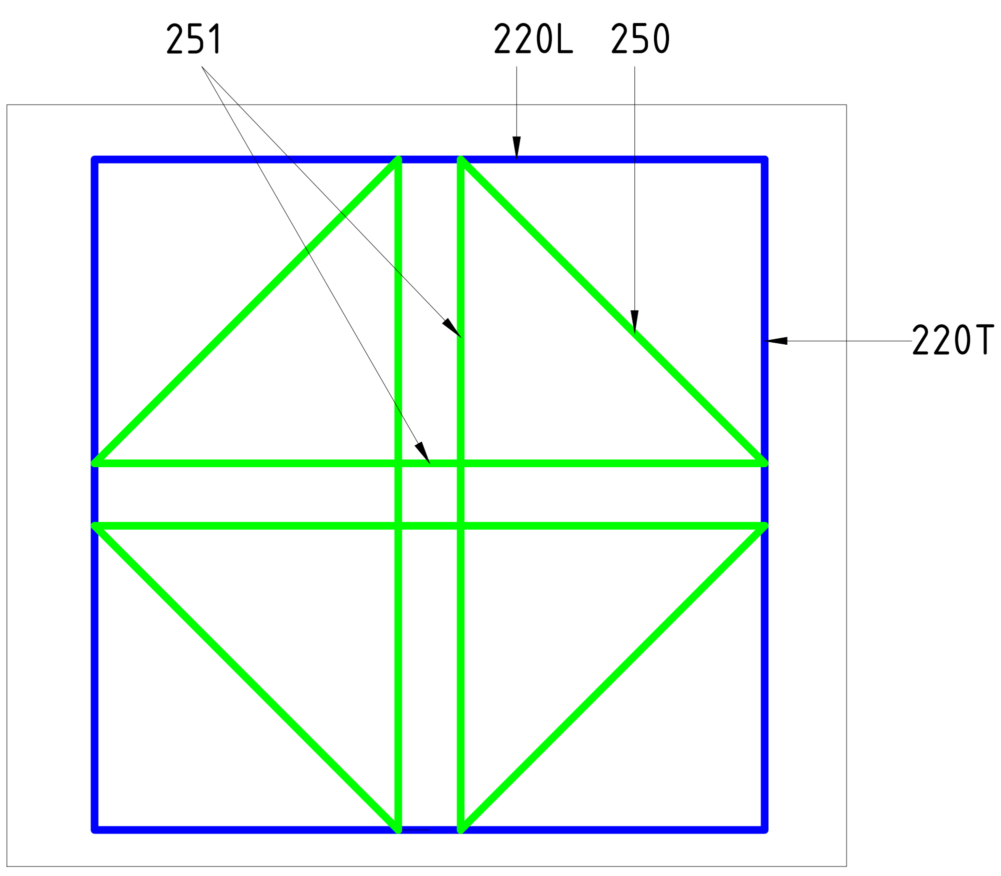


Overview



Section A-A Overview



Section B-B Plan View

Notes and legend:

- **New redundants according to drawing**
- **Size for new redundants is 50x50x5**
- **Other changes according to the table**
- **All changes are symmetrical unless otherwise indicated**
- **Material quality t ≤ 16mm S355J0**
- **Material quality t > 16mm S355J2**
- **Bolt quality 8.8 rolled**

Profile exchanged
New redundant
Bolt exchanged

00	25-6-2020	Version 1.0

DNV·GL

Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-016

Design state: FINAL		Scale: -	
Drawn by: MuK	25-6-2020	Units: m	
Checked by: TBR	25-6-2020	Project no: 10166260	
Approved by: JHu	26-6-2020	Company: TenneT	

Description: Modifications overview for mast type S+30 (mast 14) Page 2 of 2

Revision: 00

Format: A2

DNV GL Energy & Sustainability, Utrechtseweg 310, 6812 AR Arnhem, tel: +31 26 3 56 91 11, www.dnvgl.com

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Bijlage 17 Rapportage Mastconstructie S+6

“TOETSING EN HERONTWERP MASTEN EN FUNDATIES BBB380”

KIJ-GT380 – Rapportage mast S+6

TenneT TSO B.V.

Meridian doc. nr.: 002.589.40 0916502
Rapport nr.: 21-1088 Rev.0
Datum: 2021-07-05

Projectnaam:	"Toetsing en herontwerp masten en fundaties BBB380"	DNV GL - Energy Energy Advisory Postbus 9035 6800 ET ARNHEM
Rapport titel:	KIJ-GT380 – Rapportage mast S+6	
Klant:	TenneT TSO B.V.	
Contactpersoon:	[redacted]	
Datum:	2021-07-05	
Project nr.:	10166260	[redacted]
Organisatie unit:	TDT	
Meridian doc.nr.:	002.589.40 0916502	
Rapport nr.:	21-1088 Rev.0	

Geschreven door: Beoordeeld door: Goedgekeurd door:

[redacted]

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Trefwoorden:

Versie	Datum	Reden voor uitgave	Auteur	Beoordeeld	Goedgekeurd
0	2021-07-05	Eerste uitgave	[redacted]	[redacted]	[redacted]

DNV GL Netherlands B.V.

Inhoud

1 INLEIDING

1.1 Inleiding

Om in de toekomst meer elektriciteit te kunnen transporteren is het noodzakelijk om naast de nieuwbouw van verbindingen bestaande hoogspanningsverbindingen aan te passen zodat er een grotere transportcapaciteit mogelijk wordt gemaakt.

Om die reden is de opdrachtgever (OG) voornemens de bestaande 380 kV-koppelnetring op te waarderen. Het opwaarderen van de bestaande verbindingen valt onder het programma "Beter benutten bestaande 380 kV-ring" en omvat de volgende deelprojecten:

- Opwaardering 380 kV-verbinding Lelystad – Ens (LLS-ENS380)
- Opwaardering 380 kV-verbinding Diemen – Lelystad (DIM-LLS380)
- Opwaardering 380 kV-verbinding Rilland – Zandvliet (RLL-ZVL380)
- Opwaardering 380 kV-verbinding Krimpen aan den IJssel - Geertruidenberg (KIJ-GT380)
- Opwaardering 380 kV-verbinding Ens - Zwolle (ENS-ZL380)
- Opwaardering 380 kV-verbinding Maasbracht - Eindhoven (MBT-EHV380)

Om te komen tot een DO waarmee de werkzaamheden kunnen worden gestart is door TenneT aan DNV GL opdracht verstrekt voor de volgende onderdelen:

1. In eerste fase het opstellen en creëren van:

1.1 E-studie deel 1

1.2 Uitgangspuntenrapporten ten behoeve van de constructieve analyse van masten en fundaties

1.3 Sonderingmodellen

1.4 Fundatiemodellen

1.5 Mastmodellen

2. In tweede fase de uitvoering van de DO-fase bevattende:

2.1 Toetsing conform het uitgangspuntenrapport van de bestaande fundaties

2.2 Globale specificatie van benodigde fundatieversterkingen ten behoeve van aanbesteding

2.3 Toetsing conform het uitgangspuntenrapport van de bestaande masten

2.4 Globale specificatie van benodigde mastversterkingen ten behoeve van aanbesteding

2.5 E-studie deel 2

In deze studie wordt voor de lijn Krimpen aan den IJssel - Geertruidenberg de controle van de mastconstructie van masttype S+6 gerapporteerd.

Inhoudelijk is de Nederlandse versie van de rapportage ongewijzigd ten opzichte van de Engelse versie. Om deze reden zijn de bijlagen in dit rapport één op één overgenomen uit de Engelse versie. Hierdoor wijkt het revisienummer van de bijlagen af van het revisienummer van de rapportage.

1.2 Doelstelling en scope van dit rapport

Het doel van deze studie is om te bepalen of de in dit rapport beschreven bestaande mast geschikt is om te worden uitgerust met de ACCCZ-Warsaw geleider.

Nadat de wijzigingen zijn toegepast dient aantoonbaar geverifieerd te worden dat het systeem voldoet aan de vigerende eisen.

1.3 Relatie overige documenten

1.3.1 Verificatie & validatie plan

De door TenneT aangeleverde set met eisen is beoordeeld op relevantie en voor de relevante eisen is aangegeven in welk document wordt aangetoond dat er aan de eis wordt voldaan. De resultaten hiervan zijn opgenomen in het rapport "Verificatie & Validatieplan 380 kV verbinding Krimpen aan den IJssel - Geertruidenberg" [1].

1.3.2 E-studie deel 1

In de rapportage "KIJ-GT380 - E-studie deel 1" [2] is bepaald welke aanpassingen benodigd zijn om de ACCCZ Warsaw geleider toe te passen binnen de verbinding Krimpen aan den IJssel - Geertruidenberg. Uit de E-studie volgen geen zaken die relevant zijn voor de constructie van masttype S+6.

1.3.3 Uitgangspunten rapport

De uitgangspunten op basis waarvan de berekeningen in deze rapportage zijn uitgevoerd zijn opgenomen in het rapport "Uitgangspuntenrapport 380kV verbinding Krimpen aan den IJssel - Geertruidenberg" [3]

2 EISEN

In onderstaande Tabel 1 zijn de eisen opgenomen die binnen deze rapportage worden getoetst.

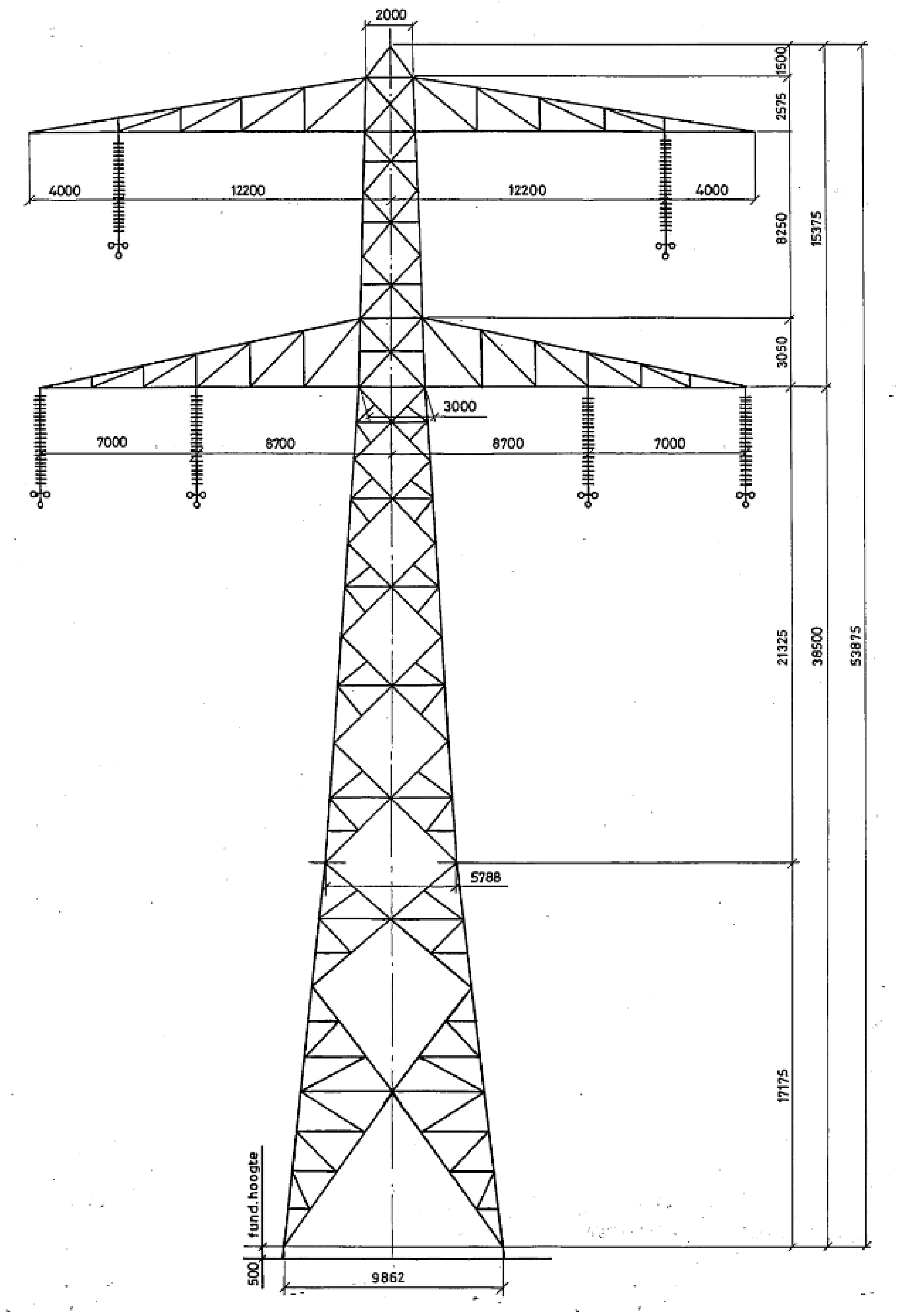
Tabel 1 Relevante eisen

Eis Id	Titel	Eis Tekst	Bewijsvoering
BO Eis: H2.7-6	Omgeving, beperkings factoren	Het ontwerp dient geverifieerd te worden op de uitvoerbaarheid.	Tabel 6
PVE.05.001 5.14	Masten	Aanwijzingen t.a.v. klimvoorziening en valbeveiliging: Huidige klimweg blijft gehandhaafd en zal voldoen aan de eisen zoals opgenomen in de NEN 1060:1977. Valbeveiliging is/zal worden uitgevoerd in het type "latch way". Indien staaldelen in de nabijheid (aangrenzend profiel) van de klimweg gewijzigd worden, dient geverifieerd te worden dat de klimvoorziening in overeenstemming is met de NEN 1060:1977.	Tabel 6

3 BEREKENINGEN

3.1 Mastbeeld

Het mastbeeld op basis van de Asset-data is weergegeven in Figuur 1.



Figuur 1 Mastbeeld

3.2 Mastenlijst

In deze rapportage wordt masttype S+6 getoetst. De berekening is uitgevoerd voor windgebied II, er zijn geen masten van dit type in windgebied III. De wind en weight span van de verschillende masten zijn in Tabel 2 weergegeven. Het maatgevende mastnummer is aangegeven. Bij de masten is rekening gehouden met verhoogde windbelasting als gevolg van een hogere aangrenzende mast (hoger is een negatieve waarde). Voor masttype S+6 komen enkel lager aangrenzende masten voor.

Tabel 2 Mastnummers

Mastnummer	Masttype	Maatgevend mastnummer	Wind span (m)	Weight span (m)	Hoogteverschil
4	S+6 II	10	346	369	5.6
5	S+6 II	10	338	361	6.0
9	S+6 II	10	366	391	5.6
10	S+6 II	10	367	392	5.8
27	S+6 II	10	358	381	6.1
28	S+6 II	10	355	377	5.8
43	S+6 II	10	267	288	5.7
44	S+6 II	10	262	284	5.8

3.3 Uitgangspunten berekening

De berekening is uitgevoerd op basis van de uitgangspunten zoals opgenomen in het uitgangspuntenrapport [3]. Hierin is een volledig overzicht opgenomen van de belastingcombinaties en toegepaste belastingfactoren

Tabel 3 Uitgangspunten berekening

Algemeen	Norm Windgebied Terreincategorie Reductiefactor cdir	NEN-EN50341-2-15:2019 II II (onbebouwde omgeving) 1,00
Situatie initieel	Gevolgklasse Betrouwbaarheidsniveau Referentieperiode	CC2-0 Afkeur CC2-0 30 jaar
Situatie na aanpassingen	Gevolgklasse Betrouwbaarheidsniveau Referentieperiode	CC2 Verbouw 50 jaar

3.4 Proces stappen

Het proces van het bepalen van eventueel benodigde verstevigingen bestaat uit de volgende stappen:

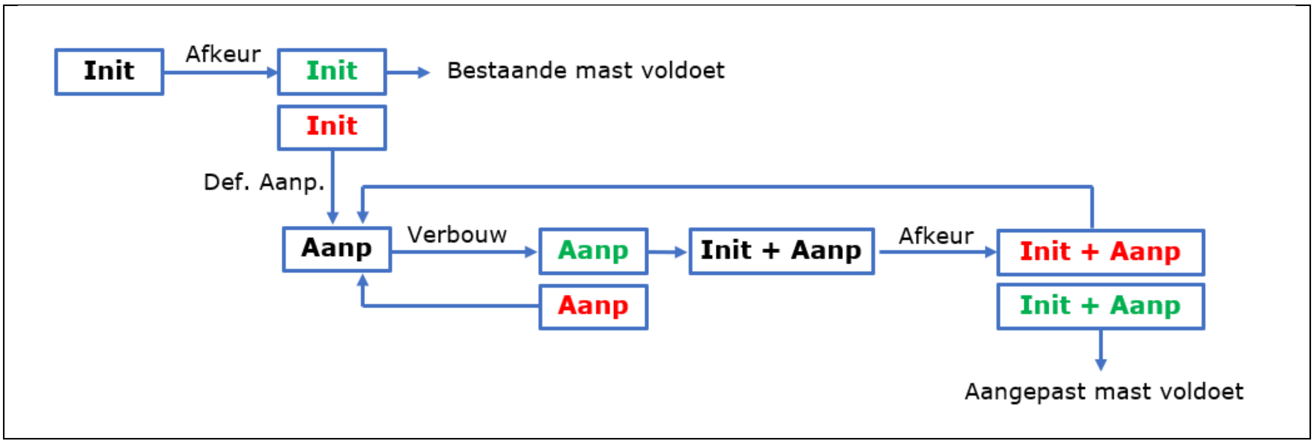
Stap 1: Toets bestaande (Init) mast op Afkeur

Stap 2: Definiëren benodigde aanpassingen indien initiële mast niet voldoet aan toets op Afkeur (Def. Aanp.)

Stap 3: Het toetsen van (alleen) de uitgewerkte aanpassingen (Aanp) op Verbouw

Stap 4: Het opnieuw toetsen van de complete mast inclusief aanpassingen (Initi + Aanp) op Afkeur

Het hierboven omschreven proces is in Figuur 2 weergegeven.



Figuur 2 Proces diagram

3.5 Geleiderbelastingen

De berekening is uitgevoerd met het geleiderbelastingenprogramma van DNV GL. In Appendix A zijn de resultaten van de geleiderbelastingen samengevat.

3.6 Reacties op de fundering

De oplegreacties op de fundering worden ontleend aan de uitvoer van het geleiderbelastingenprogramma, zie ook Appendix A.

3.7 Modellering

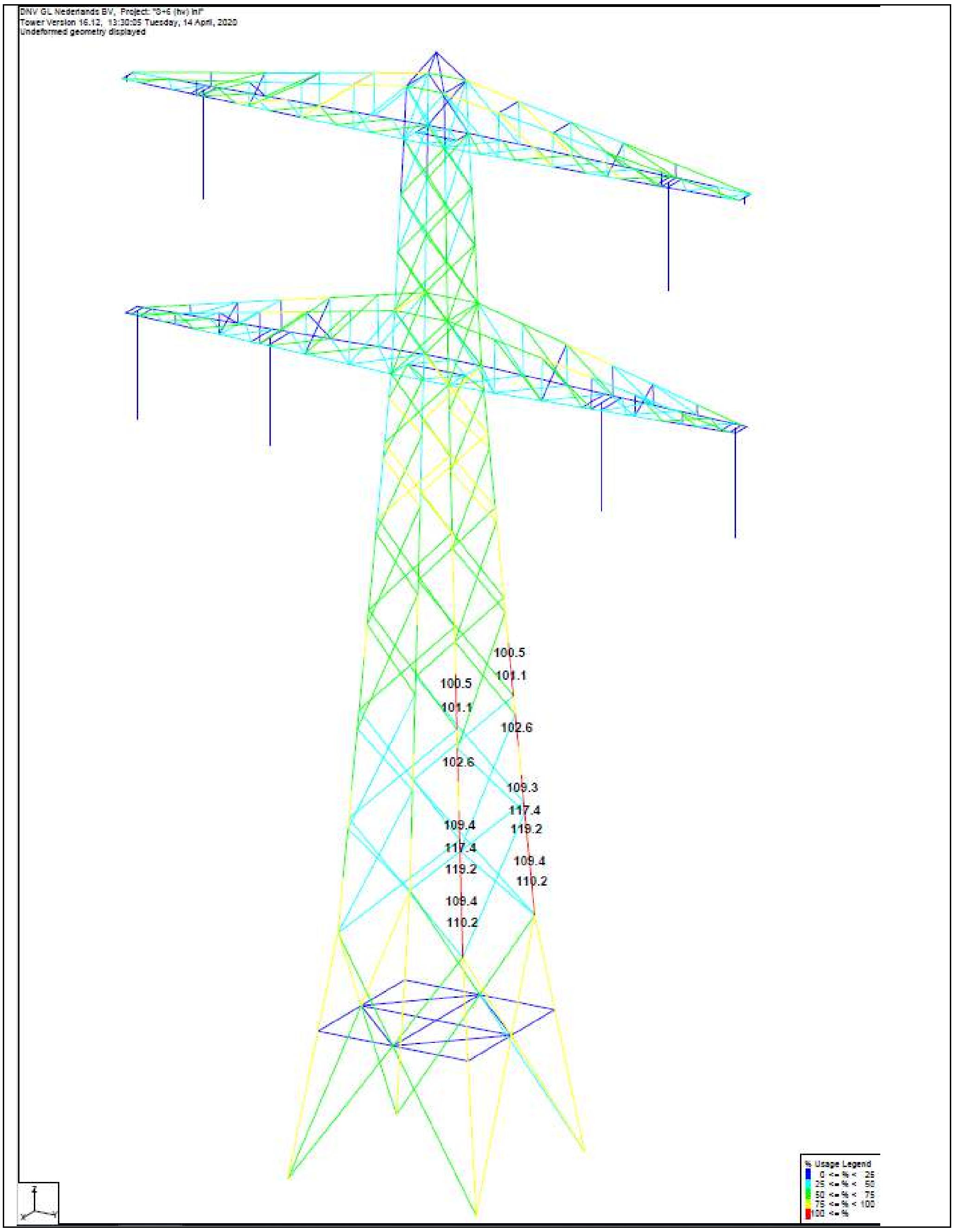
Op basis van de as-built tekeningen is de mast in PLS-TOWER ingevoerd. De hoofdelementen zijn gemodelleerd. Niet-dragende profielen als knikverkorters zijn weggelaten en worden separaat getoetst. De profielen inclusief de boutverbindingen zijn in PLS-TOWER ingevoerd en getoetst. Controle van de schetsplaten en andere detailverbindingen valt buiten de scope.

De geleiderbelastingen vanuit het geleiderbelastingenprogramma zijn als invoer voor de belastingen gebruikt.

Diagonalen in voor- en achtervlak respectievelijk de twee zijvlakken zijn samengenomen in een groep en de toetsing wordt per staafgroep uitgevoerd. Ingeval dat een element uit een groep is overbelast, geldt dit voor alle elementen uit de betreffende groep.

4 TOETSING MAST

Het resultaat van de controle van de mastconstructie type S+6 met belastingen op afkeurniveau is weergegeven in onderstaande figuren.



Figuur 3 Resultaat PLS-TOWER S+6

De resultaten van de controles van profielen, knikverkorters en ankers randstijl zijn opgenomen in Tabel 4.

Tabel 4 Samenvatting controle

Controle van	Beoordeling		Referentie
Profielen		**Voldoen niet**	Figuur 3
Knikverkorters		**Voldoen niet**	Appendix C
Ankers en voetplaat		**Voldoen niet**	Appendix D

5 AANPASSINGEN

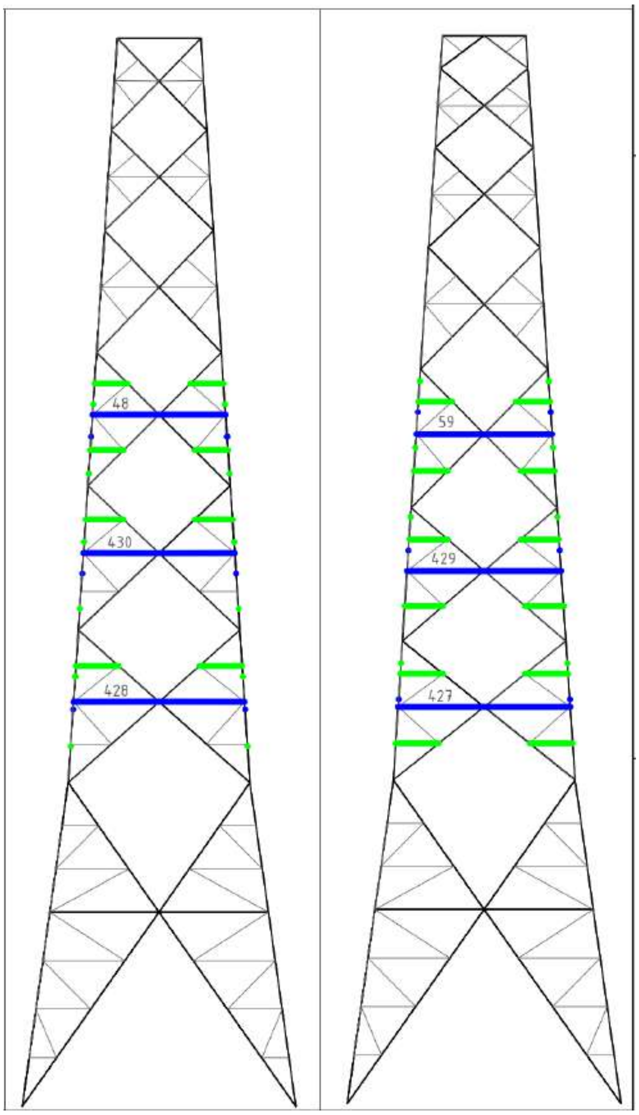
5.1 Inleiding

Een versterkingsvoorstel om de mast aan afkeurniveau te laten voldoen en nieuwe onderdelen aan verbouwniveau is uitgewerkt. Dit voorstel bevat de volgende maatregelen:

- Knikverkorters vervangen;
- Knikverkorters toevoegen;
- Bouten vervangen;
- Voetplaat verzwaren.

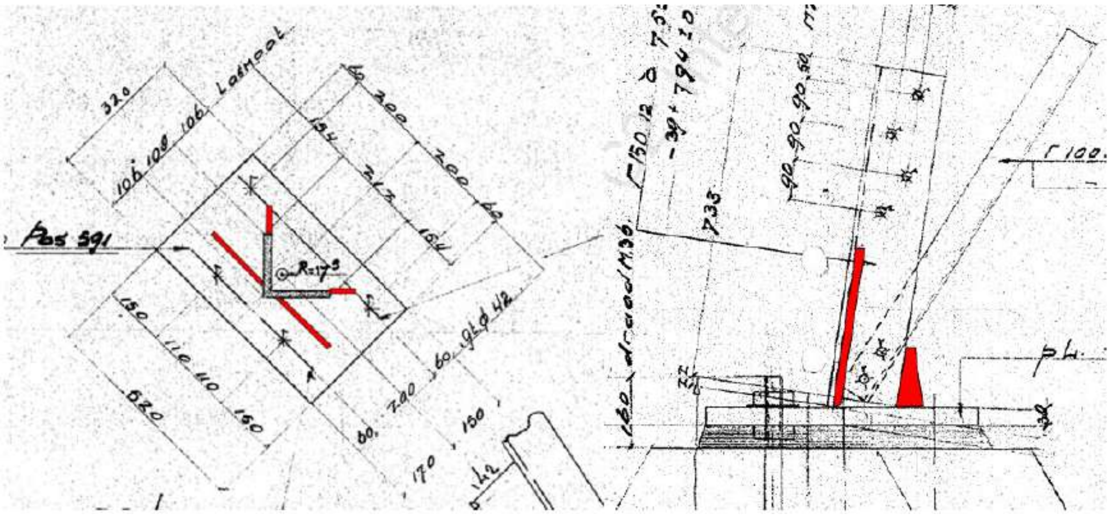
5.2 Aanpassingen

Voor berekening, zie Appendix C. Voor afmetingen profielen en bouten, zie Appendix E. De benodigde aanpassingen zijn weergegeven in Figuur 4.



Figuur 4 Principe aanpassing (blauw) /en toevoeging (groen) knikverkorters voor S+6

De voetplaat van masttype S+6 moet verzwaard worden. Een aanpassingsvoorstel voor de voetplaat en ankers is de voetplaat versterken met in het werk aan te lassen verstijvingsplaten. Zie hiervoor Figuur 5. Voor de berekening van de ankerverbinding zie Appendix D.



Figuur 5 Principe van te versterken ankerplaat

Een overzicht van het nettogewicht van de profielen die nodig zijn voor de versterkingen/aanpassingen is voor mast 10 gegeven in Tabel 5. Het gewicht van eventueel benodigde schetsplaten is niet meegenomen. Ook de benodigde onderdelen voor de verbinding van de postisolator zijn niet in de tabel opgenomen. Voor mast 61 zijn geen constructieve aanpassingen benodigd, behalve de toepassing van postisolatoren.

Tabel 5 Gewichten S+6 (10) van toegevoegde knikverkorters en uitgewisselde profielen

Staafgroep	Profiel	Materiaal	Bouten	Profiel nw.	Materiaal nw.	Bouten nw.	Maatregel	Aantal	Lengte (m)	Gewicht (kg)
428	L50.5	S235	1M12-5.6t	L65.6	S355	1M12-8.8t	Profiel uitgewisseld	4	2.99	72.0
427	L50.5	S235	1M12-5.6t	L65.6	S355	1M12-8.8t	Profiel uitgewisseld	4	3.10	74.7
430	L45.5	S235	1M12-5.6t	L55.6	S355	1M12-8.8t	Profiel uitgewisseld	4	2.64	53.3
48	L45.5	S235	1M12-5.6t	L50.5	S355	1M12-8.8t	Profiel uitgewisseld	4	2.32	35.6
429	L45.5	S235	1M12-5.6t	L60.6	S355	1M12-8.8t	Profiel uitgewisseld	4	2.78	61.5
59	L45.5	S235	1M12-5.6t	L50.5	S355	1M12-8.8t	Profiel uitgewisseld	4	2.37	36.4
6001				L50.5	S355	1M16-8.8t	Profielen toegevoegd	4	1.55	23.8
6002				L50.5	S355	1M16-8.8t	Profielen toegevoegd	4	1.36	20.9
6003				L50.5	S355	1M16-8.8t	Profielen toegevoegd	4	1.20	18.4
6004				L50.5	S355	1M16-8.8t	Profielen toegevoegd	4	1.20	18.4
6005				L50.5	S355	1M16-8.8t	Profielen toegevoegd	4	1.55	23.8
6006				L50.5	S355	1M16-8.8t	Profielen toegevoegd	4	1.55	23.8
6007				L50.5	S355	1M16-8.8t	Profielen toegevoegd	4	1.40	21.5
6008				L50.5	S355	1M16-8.8t	Profielen toegevoegd	4	1.40	21.5
6009				L50.5	S355	1M16-8.8t	Profielen toegevoegd	4	1.23	18.9
6010				L50.5	S355	1M16-8.8t	Profielen toegevoegd	4	1.23	18.9
								64	29.87	543.5

5.3 Eisen verificatie

De verificatie van de van toepassing zijnde eisen is uitgevoerd in onderstaande Tabel 6.

Tabel 6 Verificatie eisen

Eis Id	Eis Tekst	Ja	Nee	N.v.t.	toelichting
BO Eis: H2.7-6	Aanpassingen uitvoerbaar?	X			De toe te voegen staalonderdelen zijn met geboute verbindingen te bevestigen. Dit is een bewezen methode. De verstijving van de voetplaat vereist in het werk lassen. Vanwege de locatie op de grond is dit uitvoerbaar en een bewezen oplossing.
PVE.05.001 5.14	Staaldelen in nabijheid van klimweg gewijzigd?	X			De wijzigingen in de nabijheid van de klimweg (knikverkorters) zijn in te passen zonder negatieve invloed op de begaanbaarheid.
	klimvoorziening nog in overeenstemming is met de NEN 1060:1964?			X	Geen wijzigingen

6 REFERENTIES

[1] „002.589.40 0817486 - 20-0473 - Verificatie & validatieplan 380kV verbinding Krimpen aan de IJssel - Geertruidenberg".

[2] „002.589.40 0808624 - 20-0472 - E-studie deel 1 380kV verbinding Krimpen aan de IJssel - Geertruidenberg".

[3] „002.589.40 0808629 - 20-0345 - Uitgangspuntenrapport 380kV verbinding Krimpen aan de IJssel - Geertruidenberg".

APPENDIX A CONDUCTOR LOADS

Content

ISSUE	DATE	REVISION	CHK'D	APP'D
0.0	2020-11-26			

Data

Norm	NEN-EN50341-2-15:2019
Initial	
Consequence class	CC2-0
Reliability level	Afkeur
Reference period	30 jaar
After adjustment	
Consequence class	CC2
Reliability level	Verbouw
Reference period	50 jaar
Wind zone	II
Wind speed	27 m/s
Terrain categorie	II
Reduction factor C_{dir}	1,00
Ice region	B
Tower type	Steunmast
Tower height	54 m
Max. Span	375 m
Line angle	180°
Catenary	1400 m
Wind span	367 m
EDS Weight span	391 m
Min. Weight span	388 m
Max. Weight span	431 m

Client: TenneT Taking power further

DNV·GL

Title:

Berekening masttype S+6 II

JOB No.	-	DATE	-
DRAWN	-	CHKD	-
DESIGN	-	APPD	-

Document name:

KIJ-GT_S+6 II_10_Report.pdf

Project number:

Project client number:

0.0

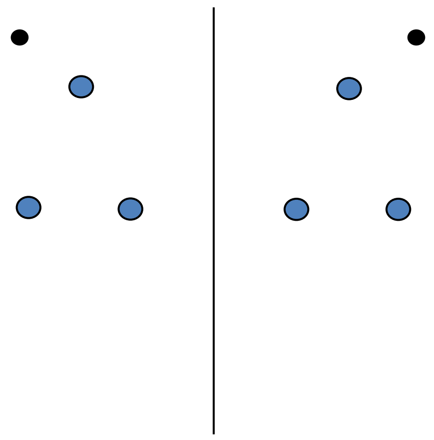
Project: KIJ-GT
Tower: S+6 II
Number: 10

Conductor loads

Auteur: TBR
Versie: v11.3

General

Description	S+6 II
Tower type	Steunmast
Number of circuits	2
Configuration	2-circuit-donau
Number of earth wires	2



Configuratie geleiders

Starting points

Norm	NEN-EN50341-2-15:2019
Consequence class	CC2-0
Reliability level initial	Afkeur CC2-0
Reference period intial	30 jaar
Consequence class modified	CC2
Reliability level modified	Verbouw
Reference period modified	50 jaar
Wind zone	II
Wind speed	27,0 m/s
Terrain category	II
Reduction factor c_{dir}	1,00
Ice region phase conductor	B
Ice region earth conductor	B

Conductors back

Description	Voltage	Conductor Back	Bundle Ba	Ice region	Additional weight	Additional diameter	Catenary P_{back}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Conductors ahead

Description	Voltage	Conductor Ahead	Bundle Ah	Ice region	Additional weight	Additional diameter	Catenary P_{ahead}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Insulators *(1)*

Description	Suspension	Weight [kN]	Length [m]	Wind area [m^2]
Circuit 1	Halfverankering	2,00	4,30	1,00
Circuit 2	Halfverankering	2,00	4,30	1,00
Bliksemdraad 1	Vast (Bliksemdraad)	0,10	0,50	0,05
Bliksemdraad 2	Vast (Bliksemdraad)	0,10	0,50	0,05

1. Properties apply to the entire isolator set

Suspension height and position in mast

Circuits	Designation	Number	Suspension height	Attach point	Position in tower (3) Horizontal distance
Circuit 1	21	380ct1f1	34,2 m	38,5 m	15,7 m
Circuit 1	20	380ct1f2	34,2 m	38,5 m	8,7 m
Circuit 1	22	380ct1f3	45,5 m	49,8 m	12,2 m
Circuit 2	10	380ct2f1	34,2 m	38,5 m	-15,7 m
Circuit 2	11	380ct2f2	34,2 m	38,5 m	-8,7 m
Circuit 2	12	380ct2f3	45,5 m	49,8 m	-12,2 m
Bliksemdraad 1	1	bl1	49,3 m	49,8 m	16,2 m
Bliksemdraad 2	3	bl2	49,3 m	49,8 m	-16,2 m

1. Positive = adjacent mast higher
2. Positive = in direction of rotation coordinate system x => y

Project: KIJ-GT
Tower: S+6 II
Number: 10

Height adjustment adjacent masts (wind and weight span adjustment)

	Back	Ahead	
Height increase for wind pressure	0,0 m	0,0 m	(positive: higher)
Height decrease for vertical load	0,0 m	0,0 m	(negative: decrease, more weight span)

Decrease: Niet in 0,9EG-combinaties

Height difference adjacent tower and change of direction with respect to Line direction

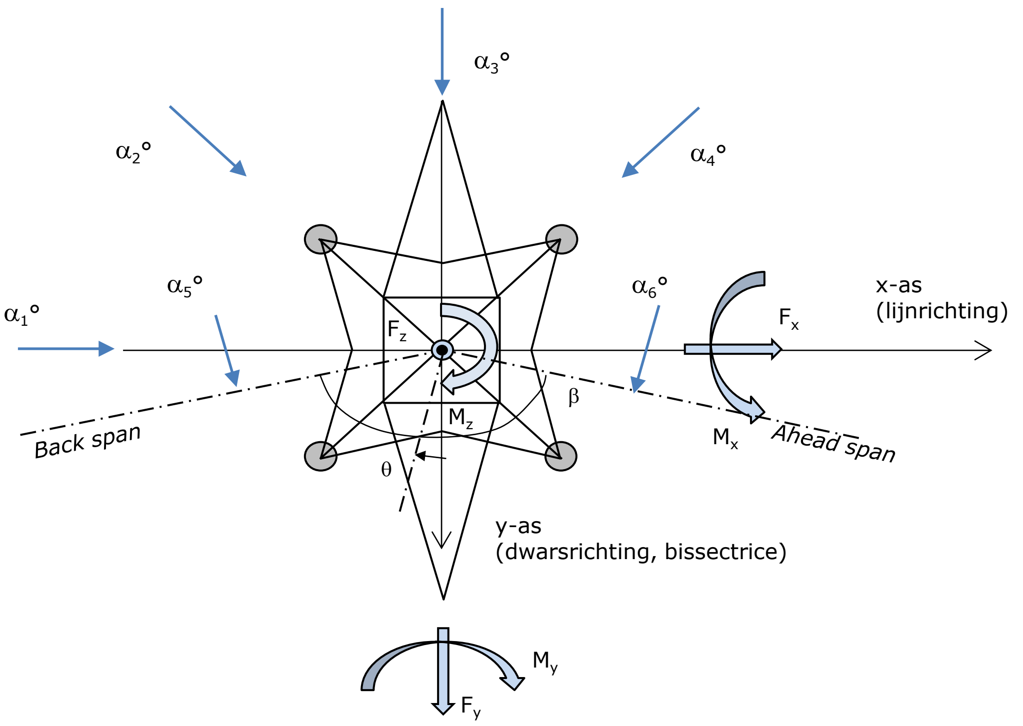
			Hoogteverschil		Richtingsverandering	
Circuits	Aanduiding	Nummer	Δh_back	Δh_ahead	Δy_back	Δy_ahead
Circuit 1	21	380ct1f1	0,0	-6,5 m	0,0	0,0 m
Circuit 1	20	380ct1f2	0,0	-6,5 m	0,0	0,0 m
Circuit 1	22	380ct1f3	0,0	-6,5 m	0,0	0,0 m
Circuit 2	10	380ct2f1	0,0	-6,5 m	0,0	0,0 m
Circuit 2	11	380ct2f2	0,0	-6,5 m	0,0	0,0 m
Circuit 2	12	380ct2f3	0,0	-6,5 m	0,0	0,0 m
Bliksemdraad 1	1	bl1	0,0	-6,2 m	0,0	0,0 m
Bliksemdraad 2	3	bl2	0,0	-6,2 m	0,0	0,0 m

Line and tower data

		Back	Ahead
		358,0	375,0 m
Ruling span $\sqrt{(\Sigma L^3/\Sigma L)}$		369,2	369,2 m
Line angle	β	180 °	
Tower orientation with respect to bis	θ	0 °	
Section length		1107	1107 m
Height bottom of tower to ground level		0,5 m	
Wind directions considered	α_1	0 °	
Wind directions according to:	α_2	45 °	
Geleiderbelastingen	α_3	90 °	
	α_4	135 °	
	α_5	- °	
	α_6	- °	

Wind directions apply to the main direction of mast construction, not to the bisector.

Windrichtingen en positieve richtingen belastingen



Considered number of wind directions	
1a	4
3	4
4	1
6	1
Overig	1

Project: KIJ-GT
Tower: S+6 II
Number: 10

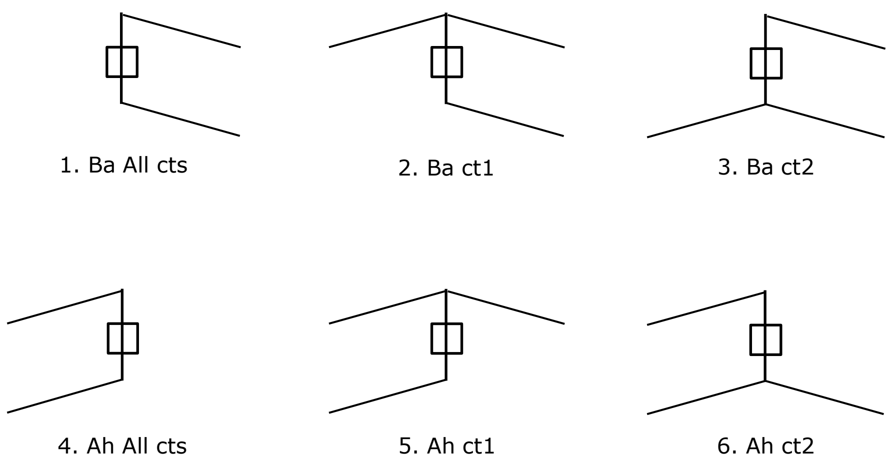
Absence of conductors

		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	380ct1f1	1	0	1	0	0,8	0
Circuit 1	380ct1f2	1	0	1	0	0,8	0
Circuit 1	380ct1f3	1	0	1	0	0,8	0
Circuit 2	380ct2f1	0	1	1	0	0,8	0
Circuit 2	380ct2f2	0	1	1	0	0,8	0
Circuit 2	380ct2f3	0	1	1	0	0,8	0
Bliksemdraad 1	bl1	1	0	1	0	1	0
Bliksemdraad 2	bl2	0	1	1	0	1	0

Load situations SPLS

Considered situations SPLS: SPLS for suspension tower not applicable

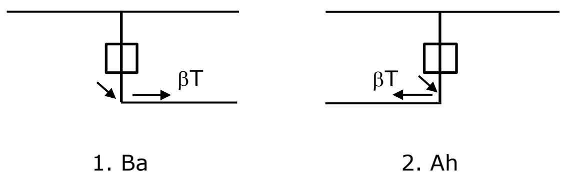
Principle of load situations:



Load situation 5a. Conductor failure

Considered situations conductor failure 5a: 1, design assumption is symmetry back and ahead

Principle of load situations:



Project: KIJ-GT
Tower: S+6 II
Number: 10

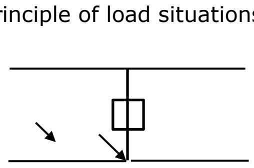
Load situations LC6. Construction and maintenance
Under 6a, the load due to the presence of a line verhicle or line bicycle in combination with point load on the traverse is assesed.
Combination 6b does not contain any loads in conductor or on traverse. This combination has been added to be able to combine with separate control platforms, etc. The situations are applied in ULS and in every SPLS situation (in case of angle tower).

3,0 kN	2,0 kN
1,0 kN	1,0 kN

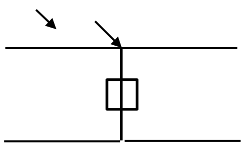
Considered situations construction and maintenance 6a: 1 up to 4, all possible situations

Presence line vehicle: Circuit, load present in all conductors of a circuit

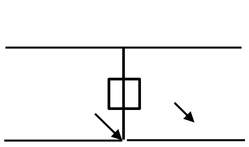
Principle of load situations:



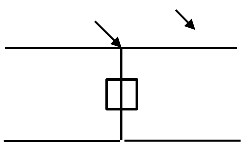
1. Ba Ct1



2. Ba Ct2



3. Ah Ct1



4. Ah Ct2

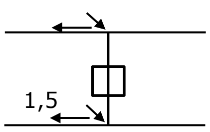
Load situations 8. Galloping as a static load

Conductor		
Suspension tower phase	0,866 W	1,5 W
Suspension tower earth	1,5 EDS	1,5 W
Strain tower phase and earth	1,5 EDS	1,5 W

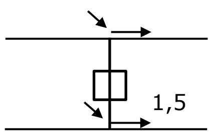
Considered situations galloping 8: None (existing structure)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principle of load situations:



1. Ba



2. Ah

Load combination 8. Galloping as a dynamic load
Only applies to tension towers
Load consists of EDS tensile load in one of the conductors on one side of the tower
Can be converted by user to fatigue spectrum via the load spectrum of table 4.11 / NL.1

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Project: KIJ-GT
Tower: S+6 II
Number: 10

Tower structure

Properties

Tower type	Steunmast	
Tower designation	S+6 II	
Base plate w.r.t. ground level	0,5	m
Tower height w.r.t. base plate	54,0	m
Tower self weight	250,0	kN

Width and slope at foundation	x-ri.	y-ri.	
Leg spread	9,86	9,86	m
Inclination of main leg	0,142	0,142	-
Horizontal force factor	1,4	1,4	-

Calculation Wind load

Dynamic factor G_T	1,00 *(Masthoogte < 60 m)*
Wind load diagonally to tower body proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Wind load diagonally on traverse proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Magnification factor diagonal wind to tower body	(1+0,2sin^2(2phi))
Magnification factor diagonal wind to cross arm	(1+0,2sin^2(2phi))
Magnification factor wind parallel to perpendicular to cross a	0,4

Properties mast sections line direction (front view, yz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	11,67	9,86	6,55	11,67	0,142	95,74	9,11	0,10	3,43
Middenstuk 1	27,18	6,55	4,50	15,51	0,066	85,66	11,31	0,13	3,24
Middenstuk 2	38,50	4,50	3,00	11,32	0,066	42,44	8,60	0,20	2,92
Bovenstuk 1	44,37	3,00	2,56	5,87	0,037	16,32	4,16	0,25	2,70
Bovenstuk 2	52,38	2,56	2,00	8,01	0,035	18,26	5,10	0,28	2,61
Topstuk	53,88	2,00		1,50		1,50	0,38	0,25	2,71
Ondertraverse	38,50	14,20		3,05		21,66	4,63	0,21	2,87
Boventraverse	49,80	15,10		2,58		19,48	4,63	0,24	2,77

Properties tower sections transverse direction (side view, xz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	11,67	9,86	6,55	11,67	0,142	95,74	9,11	0,10	3,43
Middenstuk 1	27,18	6,55	4,50	15,51	0,066	85,66	11,31	0,13	3,24
Middenstuk 2	38,50	4,50	3,00	11,32	0,066	42,44	8,60	0,20	2,92
Bovenstuk 1	44,37	3,00	2,56	5,87	0,037	16,32	4,16	0,25	2,70
Bovenstuk 2	52,38	2,56	2,00	8,01	0,035	18,26	5,10	0,28	2,61
Topstuk	53,88	2,00		1,50		1,50	0,38	0,25	2,71
Ondertraverse	38,50	14,20		3,05		21,66	4,63	0,21	2,87
Boventraverse	49,80	15,10		2,58		19,48	4,63	0,24	2,77

Note: Surface transverse direction is reduced in calculation.

Project: KIJ-GT
Tower: S+6 II
Number: 10

Wind surface feeders telecom installations

Part	A (m^2/m)	Δh	A_1
Broekstuk 1			
Middenstuk 1			
Middenstuk 2			
Bovenstuk 1			
Bovenstuk 2			

Input antennas

Description	A (m^2)	h (m)	C_f (m)
Antenne 1			
Schotel			
Schotel			

Tower section loads longitudinal (x-direction) per wind direction

Description	p_w	F_{x1}	F_{x2}	F_{x3}	F_{x4}	h_{ef}	M_{y1}	M_{y2}	M_{y3}	M_{y4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,85	26,6	22,6	0,0	-22,6	5,8	155,3	131,8	0,0	-131,8
Middenstuk 1	1,06	38,8	32,9	0,0	-32,9	19,4	753,3	639,2	0,0	-639,2
Middenstuk 2	1,23	30,9	26,2	0,0	-26,2	32,8	1015,1	861,4	0,0	-861,4
Bovenstuk 1	1,31	14,8	12,5	0,0	-12,5	41,4	611,4	518,8	0,0	-518,8
Bovenstuk 2	1,37	18,2	15,4	0,0	-15,4	48,4	880,4	747,1	0,0	-747,1
Topstuk	1,40	1,4	1,2	0,0	-1,2	53,1	76,6	65,0	0,0	-65,0
Ondertraverse	1,30	34,4	20,5	0,0	-20,5	39,5	1361,1	808,5	0,0	-808,5
Boventraverse	1,38	35,5	21,1	0,0	-21,1	50,7	1799,5	1068,8	0,0	-1068,8
Totaal		200,7	152,5	0,0	-152,5		6652,8	4840,5	0,0	-4840,5

Tower section loads longitudinal (y-direction) per wind direction

Description	p_w	F_{y1}	F_{y2}	F_{y3}	F_{x4}	h_{ef}	M_{x1}	M_{x2}	M_{x3}	M_{x4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,85	0,0	22,6	26,6	22,6	5,8	0,0	131,8	155,3	131,8
Middenstuk 1	1,06	0,0	32,9	38,8	32,9	19,4	0,0	639,2	753,3	639,2
Middenstuk 2	1,23	0,0	26,2	30,9	26,2	32,8	0,0	861,4	1015,1	861,4
Bovenstuk 1	1,31	0,0	12,5	14,8	12,5	41,4	0,0	518,8	611,4	518,8
Bovenstuk 2	1,37	0,0	15,4	18,2	15,4	48,4	0,0	747,1	880,4	747,1
Topstuk	1,40	0,0	1,2	1,4	1,2	53,1	0,0	65,0	76,6	65,0
Ondertraverse	1,30	0,0	20,5	13,8	20,5	39,5	0,0	808,5	544,4	808,5
Boventraverse	1,38	0,0	21,1	14,2	21,1	50,7	0,0	1068,8	719,8	1068,8
Total		0,0	152,5	158,7	152,5		0,0	4840,5	4756,4	4840,5

Resulting loads from mast construction incl. Antenna without conductors level foundation (char. Value)

Load / wind direction	F_x	F_y	F_z	M_x	M_y	M_z
	[kN]	[kN]	[kN]	[kNm]	[kNm]	[kNm]
Permanente belasting	0	0	250	0	0	0
Windrichting 0°	201	0	0	0	6653	0
Windrichting 45°	152	152	0	4841	4841	0
Windrichting 90°	0	159	0	4756	0	0
Windrichting 135°	-152	152	0	4841	-4841	0

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Project: KIJ-GT
Tower: S+6 II
Number: 10

Intermediate results for conductor loads

Conductors back

Circuit	Geleider	Diameter [mm]	A [mm²]	G [N/m]	E [N/mm²]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Conductors ahead

Circuit	Geleider	Diameter [mm]	A [mm²]	G [N/m]	E [N/mm²]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Vertical load back

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Vertical load ahead

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	[N/m]	[N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Insulators

Conductor	$G_{isolator}$ [kN]	Number -	$F_{v,iso}$ [kN]	Length [m]	Wind surf. [m²]	Wind heigth [m]	Pressure [kN/m²]	Drag factor [-]	$F_{h,iso}$ [kN]
380ct1f1	2,00	1	2	4,3	1,0	36,85	1,27	1,2	1,53
380ct1f2	2,00	1	2	4,3	1,0	36,85	1,27	1,2	1,53
380ct1f3	2,00	1	2	4,3	1,0	48,15	1,37	1,2	1,64
380ct2f1	2,00	1	2	4,3	1,0	36,85	1,27	1,2	1,53
380ct2f2	2,00	1	2	4,3	1,0	36,85	1,27	1,2	1,53
380ct2f3	2,00	1	2	4,3	1,0	48,15	1,37	1,2	1,64
bl1	0,10	1	0,1	0,5	0,1	50,05	1,38	1,2	0,08
bl2	0,10	1	0,1	0,5	0,1	50,05	1,38	1,2	0,08

Project: KIJ-GT
Tower: S+6 II
Number: 10

Wind load back

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	27,1	1,17	0,58	0,55	1,05	28,25	59,9	56,9	46,9	113,4	107,8
380ct1f2	27,1	1,17	0,58	0,55	1,05	28,25	59,9	56,9	46,9	113,4	107,8
380ct1f3	38,4	1,29	0,60	0,57	1,02	28,25	67,2	63,8	46,9	131,1	124,5
380ct2f1	27,1	1,17	0,58	0,55	1,05	28,25	59,9	56,9	46,9	113,4	107,8
380ct2f2	27,1	1,17	0,58	0,55	1,05	28,25	59,9	56,9	46,9	113,4	107,8
380ct2f3	38,4	1,29	0,60	0,57	1,02	28,25	67,2	63,8	46,9	131,1	124,5
bl1	42,7	1,32	0,61	0,58	1,15	22,24	20,7	19,6	41,5	40,3	38,3
bl2	42,7	1,32	0,61	0,58	1,15	22,13	20,6	19,6	41,4	40,3	38,2

Wind load ahead

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	23,1	1,11	0,56	0,53	1,07	28,25	56,6	53,8	46,9	105,8	100,6
380ct1f2	23,1	1,11	0,56	0,53	1,07	28,25	56,6	53,8	46,9	105,8	100,6
380ct1f3	34,4	1,25	0,59	0,57	1,03	28,25	64,8	61,6	46,9	125,3	119,1
380ct2f1	23,1	1,11	0,56	0,53	1,07	28,25	56,6	53,8	46,9	105,8	100,6
380ct2f2	23,1	1,11	0,56	0,53	1,07	28,25	56,6	53,8	46,9	105,8	100,6
380ct2f3	34,4	1,25	0,59	0,57	1,03	28,25	64,8	61,6	46,9	125,3	119,1
bl1	38,9	1,29	0,60	0,57	1,15	22,24	20,0	19,0	41,5	38,9	36,9
bl2	38,9	1,29	0,60	0,57	1,16	22,13	20,0	19,0	41,4	38,8	36,8

Conductor loads		Auteur:	TBR
		Versie:	v11.3

Starting points

Consequence class Afkeur CC2-0
Reference period 30 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,05	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,05	0,00	1,12	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,12	0,00	0,0
ULS 3	Wind+ice	-5°	1,05	1,05	0,00	0,34	0,97	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,05	0,00	0,34	0,97	0,0
ULS 4	Cold+wind	-20°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,05	0,00	0,22	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,05	1,05	1,20	0,22	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,05	1,05	0,00	0,22	0,00	0,0
ULS 7	Permanent	10°	1,15	1,15	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,05	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,05	1,05	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,05	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,05	1,05	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,05	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,05	1,05	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,05	1,05	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	0,94	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,28	0,88	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,19	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	4
Number of load combinations for ULS	36
Number of load combinations for SPLS	0
Number of load combinations for SLS	11
Number of concentrated loads	376

Project: KIJ-GT
Tower: S+6 II
Number: 10

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-31,6	31,6	4,2	4,3	4,9	5,6
bl2	-31,6	31,6	4,2	4,3	4,9	5,6
380ct1f1	-113,5	113,5	12,9	12,8	14,6	17,2
380ct1f2	-113,5	113,5	12,9	12,8	14,6	17,2
380ct1f3	-116,6	116,6	14,4	14,6	14,6	17,3
380ct2f1	-113,5	113,5	12,9	12,8	14,6	17,2
380ct2f2	-113,5	113,5	12,9	12,8	14,6	17,2
380ct2f3	-116,6	116,6	14,4	14,6	14,6	17,3

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	391,0	395,2	391,0
bl2	391,0	395,9	391,0
380ct1f1	390,6	393,5	390,6
380ct1f2	390,6	393,5	390,6
380ct1f3	390,6	393,7	390,6
380ct2f1	390,6	393,5	390,6
380ct2f2	390,6	393,5	390,6
380ct2f3	390,6	393,7	390,6

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	415,2	393,6
bl2	415,2	393,9
380ct1f1	403,0	392,1
380ct1f2	403,0	392,1
380ct1f3	405,9	392,8
380ct2f1	403,0	392,1
380ct2f2	403,0	392,1
380ct2f3	405,9	392,8

Envelop of weight span over all combinations (incl. 0,9 combinations)		
For all conductors		Wind / Weight span ratio
Max. weight span	422,1 m	1,152 -
Min. weight span	388,6 m	1,060 -

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Project: KIJ-GT
Tower: S+6 II
Number: 10

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	15,0	8,5	8,1	-31,9	31,7
bl2	15,0	8,5	8,1	-31,9	31,8
380ct1f1	51,3	25,7	31,8	-114,1	112,9
380ct1f2	51,3	25,7	31,8	-114,1	112,9
380ct1f3	51,3	29,0	31,9	-117,1	116,1
380ct2f1	51,3	25,7	31,8	-114,1	112,9
380ct2f2	51,3	25,7	31,8	-114,1	112,9
380ct2f3	51,3	29,0	31,9	-117,1	116,1

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	0,0	0,0	4,0	-15,0	15,0
bl2	0,0	0,0	4,0	-15,0	15,0
380ct1f1	0,0	0,0	19,9	-64,2	64,2
380ct1f2	0,0	0,0	19,9	-64,2	64,2
380ct1f3	0,0	0,0	19,9	-64,2	64,2
380ct2f1	0,0	0,0	19,9	-64,2	64,2
380ct2f2	0,0	0,0	19,9	-64,2	64,2
380ct2f3	0,0	0,0	19,9	-64,2	64,2

1 **Control uplift SLS-wind**

Combinatie	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	1,8	2,2
	bl2	1,8	2,2
	380ct1f1	9,2	10,8
	380ct1f2	9,2	10,8
	380ct1f3	9,2	10,8
	380ct2f1	9,2	10,8
	380ct2f2	9,2	10,8
	380ct2f3	9,2	10,8

Project: KIJ-GT
Tower: S+6 II
Number: 10

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		0	178	138	7689	0	0
ULS 1a_0,9_90		0	178	138	7689	0	0
ULS 3_90		0	99	206	4286	0	0
ULS 3_0,9_90		0	99	206	4286	0	0
SLS 7		0	0	127	0	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

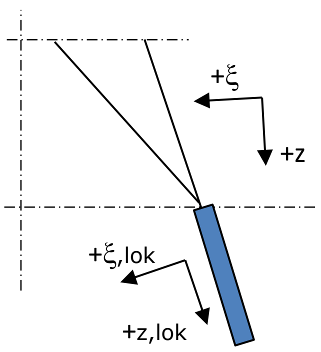
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	356	401	13035	0	0
ULS 3_90	0	152	468	5890	0	0
SLS 7	0	0	377	0	0	0

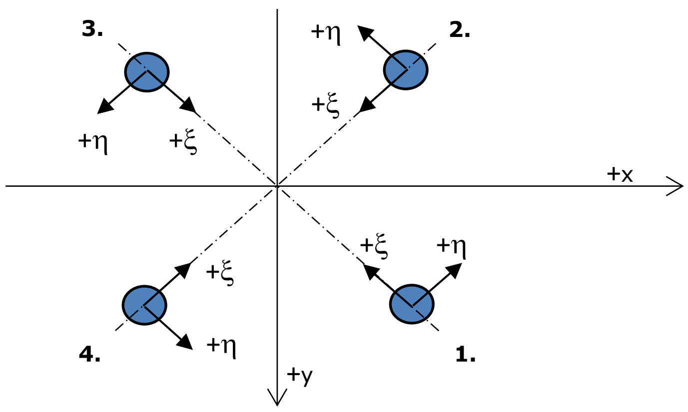
Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	356	401	**13035**	0	0
ULS 1a_0	228	0	396	0	**7599**	0
ULS 5a Ba 21	51	0	377	-129	1977	**806**
ULS 1a_45	173	262	398	**9380**	**5527**	0

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg





Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_45	158	141	**855**	12	-211	-40	872
2	ULS 1a_0	77	-96	**484**	14	-122	-25	494
3	ULS 7	-22	-22	**108**	0	-30	-9	111
4	ULS 1a_135	-158	141	**855**	-12	-211	-40	872

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	0	0	0	0
2	ULS 1a_0,9_0,9_135	-121	104	**-671**	12	159	25	-684
3	ULS 1a_0,9_0,9_45	121	104	**-671**	-12	159	25	-684
4	ULS 1a_0,9_0,9_0	40	-60	**-300**	-14	71	10	-306

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_90	151	109	761	**30**	-184	-31	776
2	ULS 5a Ba 21	12	-59	201	**33**	-51	-10	205
3	ULS 5a Ba 21	-28	22	1	**35**	-4	-4	1
4	ULS 5a Ba 21	16	19	-12	**25**	-2	-5	-13

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	ULS 5a Ba 10	12	59	201	**-33**	-51	-10	205
2	ULS 5a Ba 10	51	-18	188	**-23**	-49	-11	192
3	ULS 1a_90	111	69	-561	**-30**	128	15	-572
4	ULS 5a Ba 10	-28	-22	1	**-35**	-4	-4	1

Project: KIJ-GT
Tower: S+6 II
Number: 10

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	**0**	0	0	0
2	ULS 1a_0,9_0,9_135	-121	104	**-671**	**12**	159	25	-684
3	ULS 1a_0,9_0,9_45	121	104	**-671**	**-12**	159	25	-684
4	ULS 1a_0,9_0,9_0	40	-60	**-300**	**-14**	71	10	-306

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	19	19	94	0	-27	-8	96
2	SLS 7	19	-19	94	0	-27	-8	96
3	SLS 7	-19	-19	94	0	-27	-8	96
4	SLS 7	-19	19	94	0	-27	-8	96

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_45	158	141	**855**	12	-211	-40	872
Max. tension	ULS 1a_0,9_0,9_45	121	104	**-671**	-12	159	25	-684
Max. pos. torsie	ULS 5a Ba 21	-28	22	1	**35**	-4	-4	1
Max. neg. torsie	ULS 5a Ba 10	-28	-22	1	**-35**	-4	-4	1
Comb. tension+torsie	ULS 1a_0,9_0,9_45	121	104	**-671**	**-12**	159	25	-684

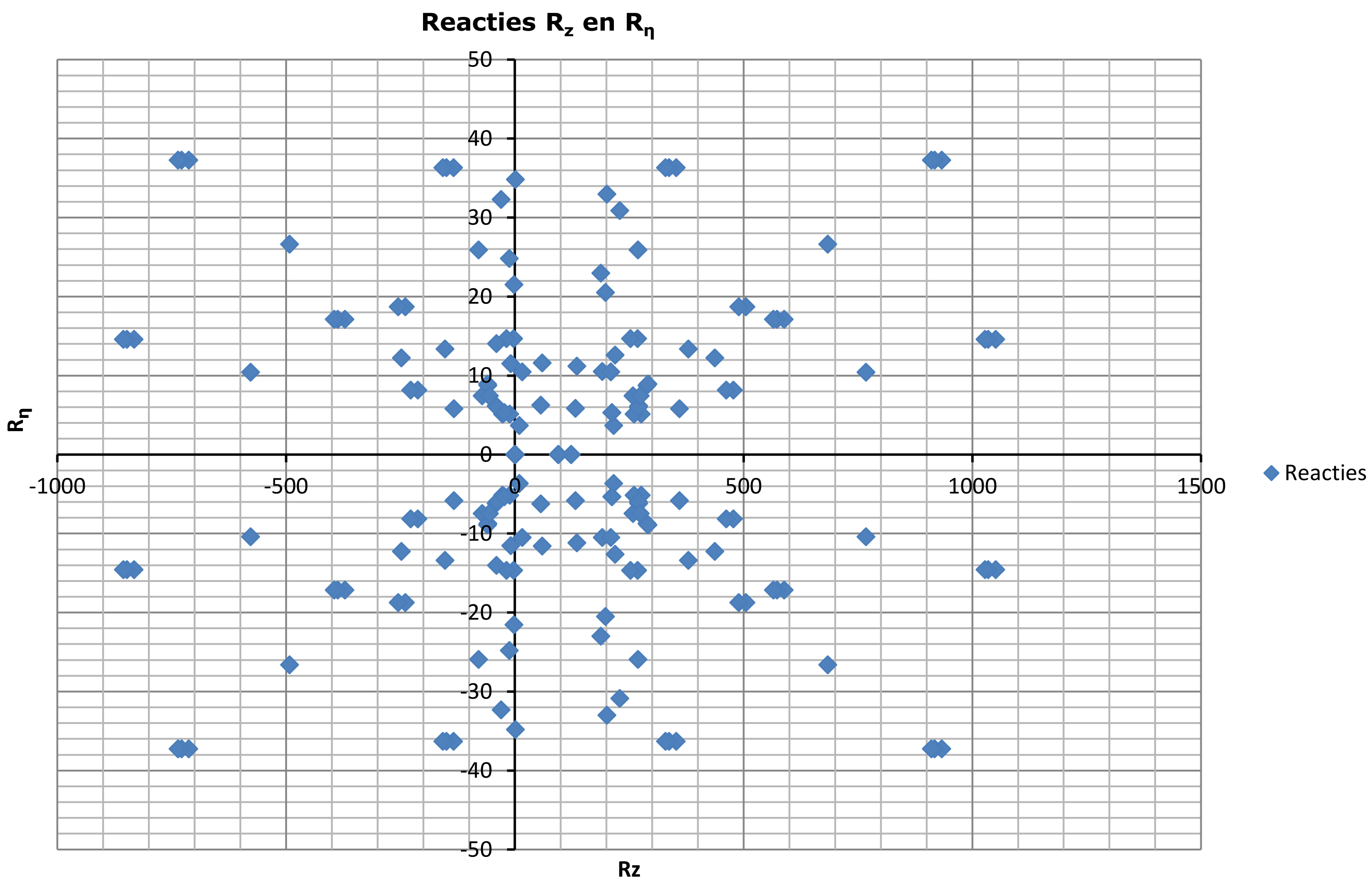
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	19	19	**94**	0	-27	-8	96
2	SLS 1a_135	-97	83	**-540**	10	127	19	-550
3	SLS 1a_45	97	83	**-540**	-10	127	19	-550
4	SLS 1a_0	29	-45	**-229**	-12	53	7	-234

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_45	134	121	**729**	10	-180	-34	743
2	SLS 1a_0	67	-83	**418**	12	-106	-22	426
3	SLS 7	-19	-19	**94**	0	-27	-8	96
4	SLS 1a_135	-134	121	**729**	-10	-180	-34	743

Project: KIJ-GT
Tower: S+6 II
Number: 10



Project: KIJ-GT
Tower: S+6 II
Number: 10

Auteur: TBR
Versie: v11.3

Conductor loads

Starting points
Consequence class Verbouw CC2
Reference period 50 jaar

ULS	(strength)	**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,15	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,40	0,00	0,0
ULS 3	Wind+ice	-5°	1,15	1,15	0,00	0,42	1,30	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,15	0,00	0,42	1,30	0,0
ULS 4	Cold+wind	-20°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,15	0,00	0,28	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,15	1,15	1,30	0,28	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 7	Permanent	10°	1,30	1,30	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS	(strength, for angle towers: absence of conductors)			γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,15	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,15	1,15	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,15	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,15	1,15	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,15	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,15	1,15	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,15	1,15	0,0	0,24	0,0	0,0
SLS	(deformations, fatigue, EDS)							
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	1,00	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,30	1,00	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	4
Number of load combinations for ULS	36
Number of load combinations for SPLS	0
Number of load combinations for SLS	11
Number of concentrated loads	376

Project: KIJ-GT
Tower: S+6 II
Number: 10

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-37,1	37,1	5,2	5,3	5,3	6,1
bl2	-37,1	37,1	5,2	5,3	5,3	6,1
380ct1f1	-132,2	132,2	16,1	15,9	17,2	20,3
380ct1f2	-132,2	132,2	16,1	15,9	17,2	20,3
380ct1f3	-136,0	136,0	18,0	18,2	17,2	20,3
380ct2f1	-132,2	132,2	16,1	15,9	17,2	20,3
380ct2f2	-132,2	132,2	16,1	15,9	17,2	20,3
380ct2f3	-136,0	136,0	18,0	18,2	17,2	20,3

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	391,0	395,4	391,0
bl2	391,0	396,1	391,0
380ct1f1	390,6	393,6	390,6
380ct1f2	390,6	393,6	390,6
380ct1f3	390,6	393,8	390,6
380ct2f1	390,6	393,6	390,6
380ct2f2	390,6	393,6	390,6
380ct2f3	390,6	393,8	390,6

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	418,6	392,8
bl2	418,6	393,1
380ct1f1	405,2	391,6
380ct1f2	405,2	391,6
380ct1f3	408,5	392,4
380ct2f1	405,2	391,6
380ct2f2	405,2	391,6
380ct2f3	408,5	392,4

Envelop of weight span over all combinations (incl. 0,9 combinations)		
For all conductors		Wind / Weight span ratio
Max. weight span	431,5 m	1,177 -
Min. weight span	388,3 m	1,059 -

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Project: KIJ-GT
Tower: S+6 II
Number: 10

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	15,0	10,6	8,9	-37,5	36,7
bl2	15,0	10,5	8,9	-37,5	36,7
380ct1f1	51,3	32,0	37,5	-133,0	131,5
380ct1f2	51,3	32,0	37,5	-133,0	131,5
380ct1f3	51,3	36,2	37,6	-136,7	135,4
380ct2f1	51,3	32,0	37,5	-133,0	131,5
380ct2f2	51,3	32,0	37,5	-133,0	131,5
380ct2f3	51,3	36,2	37,6	-136,7	135,4

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	0,0	0,0	4,0	-15,0	15,0
bl2	0,0	0,0	4,0	-15,0	15,0
380ct1f1	0,0	0,0	19,9	-64,2	64,2
380ct1f2	0,0	0,0	19,9	-64,2	64,2
380ct1f3	0,0	0,0	19,9	-64,2	64,2
380ct2f1	0,0	0,0	19,9	-64,2	64,2
380ct2f2	0,0	0,0	19,9	-64,2	64,2
380ct2f3	0,0	0,0	19,9	-64,2	64,2

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	1,8	2,2
	bl2	1,8	2,2
	380ct1f1	9,2	10,8
	380ct1f2	9,2	10,8
	380ct1f3	9,2	10,9
	380ct2f1	9,2	10,8
	380ct2f2	9,2	10,8
	380ct2f3	9,2	10,9

Project: KIJ-GT
Tower: S+6 II
Number: 10

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		0	221	152	9577	0	0
ULS 1a_0,9_90		0	221	152	9577	0	0
ULS 3_90		0	123	243	5338	0	0
ULS 3_0,9_90		0	123	243	5338	0	0
SLS 7		0	0	127	0	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

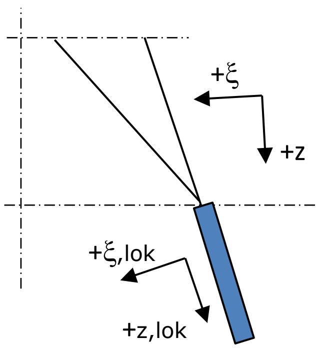
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	444	440	16236	0	0
ULS 3_90	0	190	531	7336	0	0
SLS 7	0	0	377	0	0	0

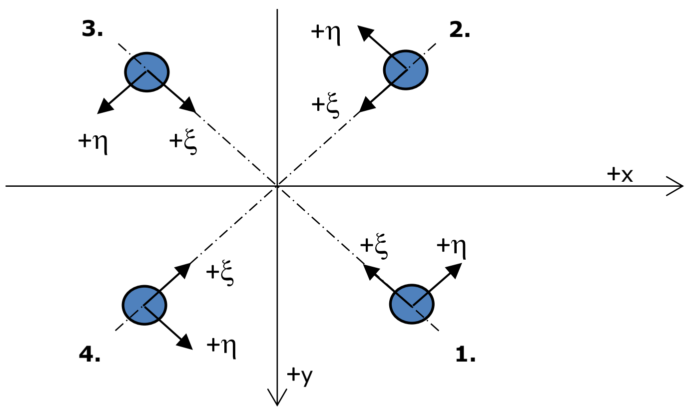
Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	444	440	**16236**	0	0
ULS 1a_0	284	0	434	0	**9465**	0
ULS 5a Ba 21	51	0	377	-129	1977	**806**
ULS 1a_45	216	327	436	**11683**	**6883**	0

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg





Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_45	193	173	**1050**	15	-259	-48	1071
2	ULS 1a_0	93	-117	**588**	17	-148	-30	600
3	ULS 7	-24	-24	**123**	0	-34	-10	125
4	ULS 1a_135	-193	173	**1050**	-15	-259	-48	1071

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	0	0	0	0
2	ULS 1a_0,9_0,9_135	-155	134	**-856**	15	204	32	-873
3	ULS 1a_0,9_0,9_45	155	134	**-856**	-15	204	32	-873
4	ULS 1a_0,9_0,9_0	54	-78	**-395**	-17	94	15	-403

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_90	185	133	933	**37**	-225	-38	952
2	ULS 1a_90	-142	89	-713	**37**	163	20	-728
3	ULS 5a Ba 21	-28	22	1	**35**	-4	-4	1
4	ULS 5a Ba 21	16	19	-12	**25**	-2	-5	-13

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	ULS 5a Ba 10	12	59	201	**-33**	-51	-10	205
2	ULS 5a Ba 10	51	-18	188	**-23**	-49	-11	192
3	ULS 1a_90	142	89	-713	**-37**	163	20	-728
4	ULS 1a_90	-185	133	933	**-37**	-225	-38	952

Project: KIJ-GT
Tower: S+6 II
Number: 10

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	**0**	0	0	0
2	ULS 1a_0,9_0,9_135	-155	134	**-856**	**15**	204	32	-873
3	ULS 1a_0,9_0,9_45	155	134	**-856**	**-15**	204	32	-873
4	ULS 1a_0,9_0,9_0	54	-78	**-395**	**-17**	94	15	-403

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	19	19	94	0	-27	-8	96
2	SLS 7	19	-19	94	0	-27	-8	96
3	SLS 7	-19	-19	94	0	-27	-8	96
4	SLS 7	-19	19	94	0	-27	-8	96

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_45	193	173	**1050**	15	-259	-48	1071
Max. tension	ULS 1a_0,9_0,9_45	155	134	**-856**	-15	204	32	-873
Max. pos. torsie	ULS 1a_90	185	133	933	**37**	-225	-38	952
Max. neg. torsie	ULS 1a_90	-185	133	933	**-37**	-225	-38	952
Comb. tension+torsie	ULS 1a_0,9_0,9_45	155	134	**-856**	**-15**	204	32	-873

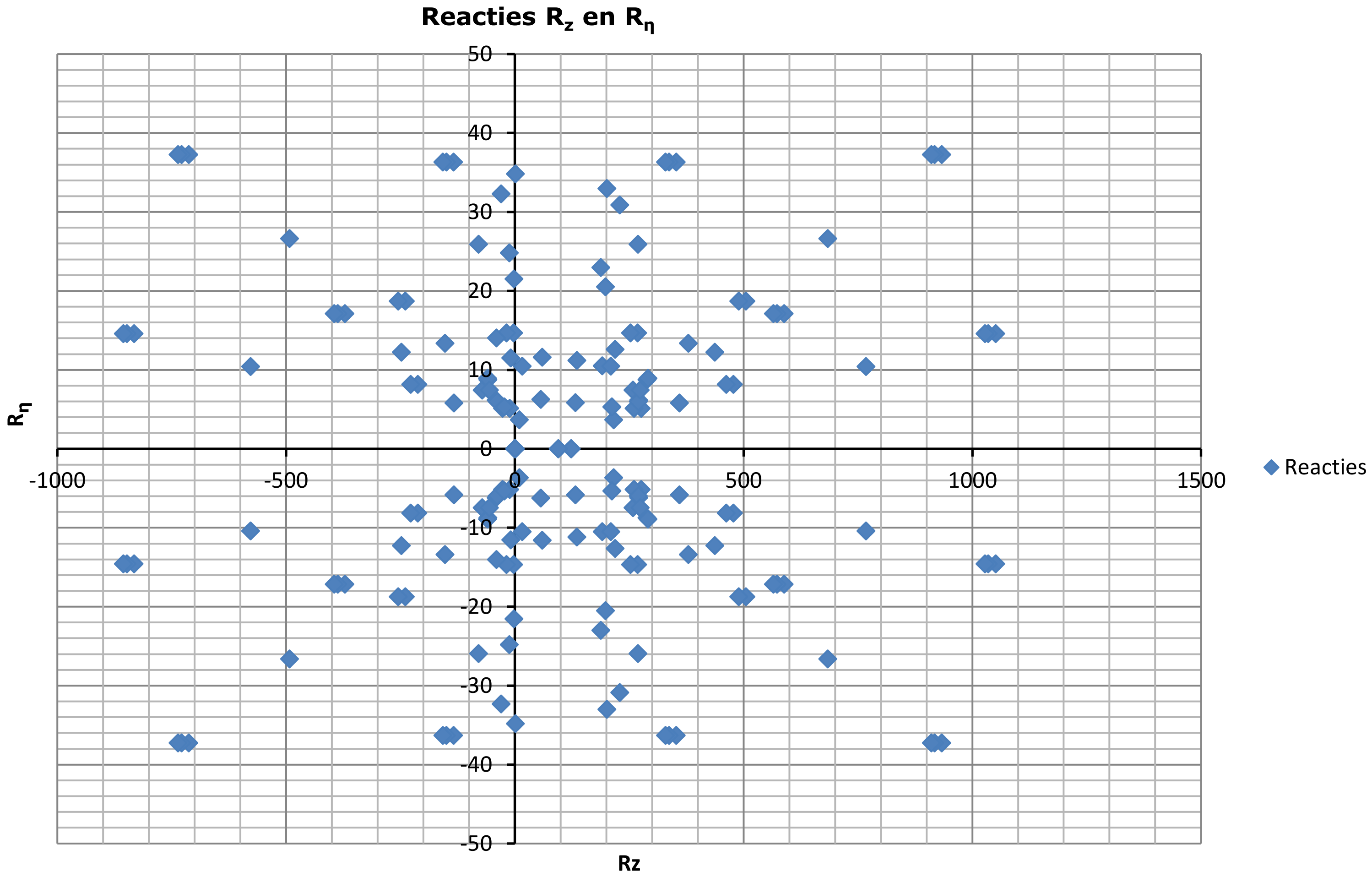
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	19	19	**94**	0	-27	-8	96
2	SLS 1a_135	-104	89	**-578**	10	136	20	-589
3	SLS 1a_45	104	89	**-578**	-10	136	20	-589
4	SLS 1a_0	32	-49	**-248**	-12	58	8	-253

Maximum compression load - SLS

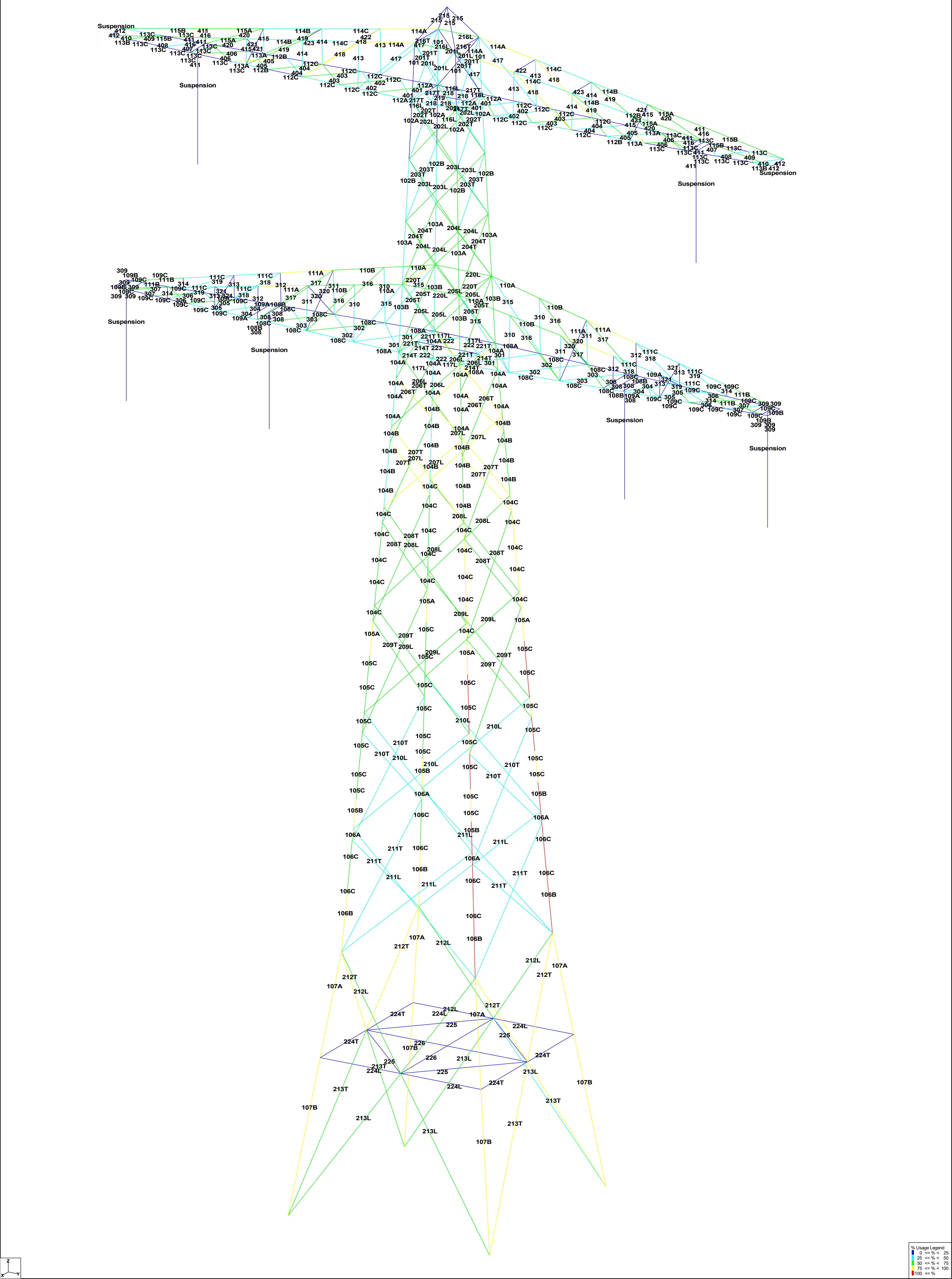
Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_45	141	127	**767**	10	-190	-36	782
2	SLS 1a_0	70	-87	**437**	12	-111	-23	446
3	SLS 7	-19	-19	**94**	0	-27	-8	96
4	SLS 1a_135	-141	127	**767**	-10	-190	-36	782

Project: KIJ-GT
Tower: S+6 II
Number: 10



APPENDIX B PLS-TOWER OUTPUT

DNV GL Nederlands BV, Project: "S+6 (hv) ini"
Tower Version 16.12, 13:34:43 Tuesday, 14 April, 2020
Undeformed geometry displayed



Assessment of groups for initial mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+6
Mast 10

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compression)	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)	Exceedance (Tens)
101	Leg Vierde TSNSTUK	90x90x8	S235	5M20-5.6t	1.00	1.00	1.00	146	**-40.8**	ULS 5a Ba 22	112.9	294.0	432.0	0.36		**0.0**		269.1	294.0	392.7	0.00	
102A	Leg Vierde TSNSTUK	90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	76	**-63.4**	ULS 1a_45	251.3	338.9	414.7	0.25		**18.5**	ULS 1a_0,9_0,9_45	252.5	338.9	297.7	0.07	
102B	Leg Vierde TSNSTUK	90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	79	**-131.2**	ULS 1a_45	245.5	338.9	414.7	0.53		**82.2**	ULS 1a_0,9_0,9_45	252.5	338.9	354.5	0.33	
103A	Leg Derde TSNSTUK	100x100x12	S235	4M24-5.6t	0.50	0.50	0.50	73	**-186.0**	ULS 1a_45	418.8	338.9	622.1	0.55		**135.3**	ULS 1a_0,9_0,9_45	426.6	338.9	531.7	0.40	
103B	Leg Derde TSNSTUK	100x100x12	S235	6M24-5.6t	0.50	0.50	0.50	79	**-227.9**	ULS 1a_45	401.2	508.3	933.1	0.57		**138.1**	ULS 1a_0,9_0,9_45	426.6	508.3	781.6	0.32	
104A	Leg Tweede TSNSTUK	150x150x12	S235	6M24-5.6t	1.55	1.19	0.99	40	**-336.2**	ULS 1a_45	763.4	508.3	933.1	0.66		**222.7**	ULS 1a_0,9_0,9_45	740.3	508.3	797.5	0.44	
104C	Leg Tweede TSNSTUK	150x150x12	S235	8M24-5.6t	3.79	3.99	3.16	75	**-623.2**	ULS 1a_45	630.8	677.8	1244.2	0.99		**477.6**	ULS 1a_0,9_0,9_45	740.3	677.8	1063.4	0.70	
104B	Leg Tweede TSNSTUK	150x150x12	S235		1.90	1.90	1.59	66	**-481.1**	ULS 1a_45	672.3	0.0	0.0	0.72		**345.0**	ULS 1a_0,9_0,9_45	817.8	0.0	0.0	0.42	
105A	Leg Eerste TSNSTUK	150x150x14	S235	8M24-5.6t	1.74	1.81	1.45	76	**-666.0**	ULS 1a_45	722.2	677.8	1451.5	0.98		**519.2**	ULS 1a_0,9_0,9_45	851.7	677.8	1240.6	0.77	
105C	Leg Eerste TSNSTUK	150x150x14	S235		1.90	1.77	1.47	77	**-738.9**	ULS 1a_45	720.3	0.0	0.0	1.03	knik	**592.4**	ULS 1a_0,9_0,9_45	943.3	0.0	0.0	0.63	
105B	Leg Eerste TSNSTUK	150x150x14	S235	8M24-5.6t	1.19	2.10	0.99	62	**-741.2**	ULS 1a_45	794.1	677.8	1451.5	1.09	afschuiving	**590.9**	ULS 1a_0,9_0,9_45	851.7	677.8	1240.6	0.87	
106A	Leg Eerste TSNSTUK	150x150x14	S235	8M24-5.6t	6.09	5.57	4.64	79	**-795.9**	ULS 1a_45	706.6	677.8	1451.5	1.17	knik, afschuiving	**639.7**	ULS 1a_0,9_0,9_45	851.7	677.8	1240.6	0.94	
106C	Leg Eerste TSNSTUK	150x150x14	S235		1.48	1.35	1.13	81	**-832.7**	ULS 1a_45	698.6	0.0	0.0	1.19	knik	**676.6**	ULS 1a_0,9_0,9_45	943.3	0.0	0.0	0.72	
106B	Leg Eerste TSNSTUK	150x150x14	S235	10M24-5.6t	0.64	1.20	0.54	69	**-834.6**	ULS 1a_45	757.3	839.3	1814.4	1.10	knik	**675.3**	ULS 1a_0,9_0,9_45	851.7	839.3	1550.8	0.80	
107A	Leg Broekstuk	160x160x15#	S235	10M24-5.6t	0.33	0.33	0.33	50	**-776.5**	ULS 1a_45	978.7	839.3	1944.0	0.93		**641.4**	ULS 1a_0,9_0,9_45	1008.5	839.3	1661.5	0.76	
107B	Leg Broekstuk	160x160x15#	S235	10M24-5.6t	0.25	0.25	0.25	57	**-780.1**	ULS 1a_45	949.1	839.3	1944.0	0.93		**638.1**	ULS 1a_0,9_0,9_45	1008.5	839.3	1661.5	0.76	
108A	Onderregel eerste dwarsarm	150x100x16	S235	11M24-5.6t	1.00	0.50	0.50	54	**-306.2**	ULS 5a Ba 10	782.9	931.9	2281.0	0.39		**139.1**	ULS 5a Ba 21	767.8	931.9	1384.2	0.18	
108C	Onderregel eerste dwarsarm	150x100x16	S235		1.00	0.50	0.50	56	**-281.4**	ULS 5a Ba 21	773.8	0.0	0.0	0.36		**127.9**	ULS 5a Ba 10	891.6	0.0	0.0	0.14	
108B	Onderregel eerste dwarsarm	150x100x16	S235	6M24-5.6t	4.78	1.00	1.00	47	**-209.9**	ULS 5a Ba 10	809.2	508.3	1244.2	0.41		**115.8**	ULS 5a Ba 21	767.8	508.3	1063.4	0.23	
109A	Onderregel eerste dwarsarm	120x120x13	S235	6M24-5.6t	1.64	1.00	1.00	61	**-194.6**	ULS 5a Ba 21	597.1	508.3	1010.9	0.38		**100.8**	ULS 5a Ba 21	602.4	508.3	864.0	0.20	
109C	Onderregel eerste dwarsarm	120x120x13	S235		1.71	1.29	1.00	66	**-162.2**	ULS 5a Ba 21	578.1	0.0	0.0	0.28		**77.2**	ULS 5a Ba 10	705.0	0.0	0.0	0.11	
109B	Onderregel eerste dwarsarm	120x120x13	S235		1.00	1.00	1.00	13	**-1.0**	ULS 5a Ba 10	705.0	0.0	0.0	0.00		**1.0**	ULS 5a Ba 21	705.0	0.0	0.0	0.00	
110A	Bovenregel eerste dwarsarm	80x80x10	S235	3M24-5.6t	1.00	2.00	1.00	205	**0.0**		79.3	254.2	388.8	0.00		**136.3**	ULS 3_90	196.6	254.2	323.8	0.69	
110B	Bovenregel eerste dwarsarm	80x80x10	S235	3M20-5.6t	1.00	2.00	1.00	204	**0.0**		79.9	176.4	324.0	0.00		**120.5**	ULS 3_0	206.0	176.4	261.8	0.68	
111A	Bovenregel eerste dwarsarm	70x70x7	S235	3M20-5.6t	1.00	2.84	1.00	343	**0.0**		22.6	176.4	226.8	0.00		**95.8**	ULS 3_0	125.5	176.4	183.3	0.76	
111C	Bovenregel eerste dwarsarm	70x70x7	S235		1.00	3.23	1.00	343	**0.0**		22.6	0.0	0.0	0.00		**91.7**	ULS 3_0	220.9	0.0	0.0	0.42	
111B	Bovenregel eerste dwarsarm	70x70x7	S235	3M20-5.6t	1.00	2.00	1.00	232	**0.0**		41.4	176.4	226.8	0.00		**83.3**	ULS 3_0	125.5	176.4	155.3	0.66	
112A	Onderregel tweede dwarsarm	150x150x14	S235	9M24-5.6t	1.50	1.00	1.00	62	**-309.6**	ULS 5a Ba 12	792.6	762.5	1633.0	0.41		**171.4**	ULS 5a Ba 22	851.7	762.5	990.9	0.22	
112C	Onderregel tweede dwarsarm	150x150x14	S235		3.00	2.00	1.00	59	**-281.0**	ULS 5a Ba 12	805.5	0.0	0.0	0.35		**148.5**	ULS 5a Ba 22	943.3	0.0	0.0	0.16	
112B	Onderregel tweede dwarsarm	150x150x14	S235	6M24-5.6t	2.55	1.64	1.00	61	**-144.9**	ULS 5a Ba 12	796.1	508.3	1088.6	0.29		**34.8**	ULS 5a Ba 22	851.7	508.3	930.5	0.07	
113A	Onderregel tweede dwarsarm	120x120x11	S235	6M24-5.6t	4.00	2.57	1.00	77	**-132.9**	ULS 5a Ba 12	458.4	508.3	855.4	0.29		**46.0**	ULS 5a Ba 22	513.2	508.3	731.1	0.09	
113C	Onderregel tweede dwarsarm	120x120x11	S235	2M16-5.6t	2.22	1.00	1.00	109	**-30.7**	ULS 6a_90 Ah Ct1	333.3	75.4	190.1	0.41		**23.5**	ULS 5a Ba 1	599.7	0.0	0.0	0.04	
113B	Onderregel tweede dwarsarm	120x120x11	S235	2M16-5.6t	4.44	1.00	1.00	109	**-31.2**	ULS 6a_90 Ah Ct1	333.3	75.4	190.1	0.41		**0.0**		429.4	75.4	190.1	0.00	
114A	Bovenregel tweede dwarsarm	100x65x9*	S235	4M20-5.6t	1.00	1.00	1.00	204	**0.0**		78.6	235.2	388.8	0.00		**112.7**	ULS 3_45	144.1	235.2	266.2	0.78	
114C	Bovenregel tweede dwarsarm	100x65x9*	S235		1.00	1.00	1.00	204	**0.0**		78.6	0.0	0.0	0.00		**98.4**	ULS 3_90	332.5	0.0	0.0	0.30	
114B	Bovenregel tweede dwarsarm	100x65x9*	S235	3M20-5.6t	1.00	1.00	1.00	204	**0.0**		78.6	176.4	291.6	0.00		**77.0**	ULS 3_135	172.4	176.4	199.6	0.45	
115A	Bovenregel tweede dwarsarm	60x60x5	S235	2M16-5.6t	1.00	2.43	1.00	379	**0.0**		11.8	75.4	86.4	0.00		**30.8**	ULS 6a_90 Ah Ct2	98.8	75.4	56.0	0.55	
115B	Bovenregel tweede dwarsarm	60x60x5	S235	2M16-5.6t	1.00	1.70	1.00	379	**0.0**		11.8	75.4	86.4	0.00		**30.8**	ULS 6a_90 Ah Ct1	65.9	75.4	56.0	0.55	
201L	Diagonaal vierde tussenstuk	70x70x7	S235	1M24-5.6t	0.52	0.52	0.52	127	**-23.1**	ULS 5a Ba 22	76.0	84.7	90.7	0.30		**16.0**	ULS 5a Ba 22	88.7	84.7	64.2	0.25	
201T	Diagonaal vierde tussenstuk	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	178	**-11.0**	ULS 5a Ba 22	25.8	37.7	43.2	0.43		**5.3**	ULS 5a Ba 22	37.4	37.7	22.0	0.24	
202L	Diagonaal vierde tussenstuk	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	93	**-110.9**	ULS 5a Ba 12	208.2	169.4	207.4	0.65		**116.5**	ULS 5a Ba 22	181.4	169.4	177.2	0.69	
202T	Diagonaal vierde tussenstuk	100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	93	**-124.4**	ULS 5a Ba 12	256.9	254.2	388.8	0.49		**123.5**	ULS 5a Ba 22	261.1	254.2	332.3	0.49	
203L	Diagonaal vierde tussenstuk	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	98	**-104.9**	ULS 5a Ba 22	198.7	169.4	207.4	0.62		**98.8**	ULS 5a Ba 12	181.4	169.4	177.2	0.58	
203T	Diagonaal vierde tussenstuk	100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	99	**-110.6**	ULS 5a Ba 22	245.1	254.2	388.8	0.45		**111.2**	ULS 5a Ba 12	261.1	254.2	332.3	0.44	
204L	Diagonaal derde tussenstuk	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	103	**-88.0**	ULS 5a Ba 12	191.1	169.4	207.4	0.52		**93.4**	ULS 5a Ba 22	181.4	169.4	177.2	0.55	
204T	Diagonaal derde tussenstuk	100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	104	**-99.4**	ULS 5a Ba 12	235.6	169.4	259.2	0.59		**98.2**	ULS 5a Ba 22	224.3	169.4	221.5	0.58	
205L	Diagonaal derde tussenstuk	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	111	**-92.8**	ULS 5a Ba 12	178.0	169.4	207.4	0.55		**90.9**	ULS 5a Ba 22	181.4	169.4	177.2	0.54	
205T	Diagonaal derde tussenstuk	100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	112	**-100.2**	ULS 5a Ba 12	219.4	169.4	259.2	0.59		**80.8**	ULS 5a Ba 22	224.3	169.4	221.5	0.48	
206L	Diagonaal tweede tussenstuk	100x75x8	S235	2M24-5.6t	0.54	0.27	0.27	79	**-95.5**	ULS 5a Ba 10	192.7	169.4	207.4	0.56		**90.2**	ULS 5a Ba 21	112.0	169.4	116.0	0.81	
206T	Diagonaal tweede tussenstuk	100x75x9	S235	2M24-5.6t	0.53	0.27	0.27	75	**-94.2**	ULS 5a Ba 10	221.4	169.4	233.3	0.56		**96.2**	ULS 5a Ba 10	119.9	169.4	130.6	0.80	
207L	Diagonaal tweede tussenstuk	100x75x7	S235	2M24-5.6t	0.54	0.27	0.27	88	**-78.2**	ULS 5a Ba 21	157.3	169.4	181.4	0.50		**80.8**	ULS 5a Ba 10	98.2	169.4	101.5	0.82	
207T	Diagonaal tweede tussenstuk	100x75x8	S235	2M24-5.6t	0.54	0.27	0.27	89	**-89.6**	ULS 5a Ba 21	177.6	169.4	207.4	0.53		**87.7**	ULS 5a Ba 10	110.7	169.4	116.0	0.79	
208L	Diagonaal tweede tussenstuk	100x75x7	S235	2M24-5.6t	0.54	0.27	0.27	104	**-72.8**	ULS 5a Ba 10	137.7	169.4	181.4	0.53		**70.4**	ULS 5a Ba 21	100.4	169.4	101.5	0.70	
208T	Diagonaal tweede tussenstuk	100x75x8	S235	2M24-5.6t	0.54	0.27	0.27	105	**-80.2**	ULS 5a Ba 10	155.3	169.4	207.4	0.52		**80.9**	ULS 5a Ba 21	113.2	169.4	116.0	0.71	
209L	Diagonaal eerste tussenstuk	100x75x7	S235	2M20-5.6t	0.53	0.27	0.27	116	**-60.5**	ULS 5a Ba 21	126.6	117.6	151.2	0.51		**61.5**	ULS 5a Ba 10	115.4	117.6	106.9	0.58	
209T	Diagonaal eerste tussenstuk	100x75x9	S235	2M20-5.6t	0.54	0.27	0.27	120	**-70.7**	ULS 5a Ba 21	150.9	117.6	194.4	0.60		**69.5**	ULS 5a Ba 10	146.1	117.6	137.5	0.59	
210L	Diagonaal eerste tussenstuk	100x75x8	S235	2M20-5.6t	0.53	0.27	0.27	127	**-53.0**	ULS 5a Ba 10	129.5	117.6	172.8	0.45		**51.7**	ULS 5a Ba 21	130.1	117.6	104.7	0.49	
210T	Diagonaal eerste tussenstuk	100x75x9	S235	2M20-5.6t	0.53	0.27	0.27	125	**-57.2**	ULS 5a Ba 10	146.6	117.6	194.4	0.49		**57.4**	ULS 5a Ba 21	137.6	117.6	117.8	0.49	
211L	Diagonaal eerste tussenstuk	100x75x8	S235	2M20-5.6t	0.53	0.27	0.27	139	**-48.7**	ULS 1a_0,9_0,9_90	117.1	117.6	172.8	0.42		**49.8**	ULS 1a_90	127.0	117.6	104.7	0.48	
211T	Diagonaal eerste tussenstuk	100x75x9	S235	2M20-5.6t	0.53	0.27	0.27	136	**-50.3**	ULS 5a Ba 21	134.3	117.6	194.4	0.43		**49.4**	ULS 5a Ba 10	135.9	117.6	117.8	0.42	
212L	Diagonaal broekstuk	130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	139	**-67.1**	ULS 5a Ba 10	131.3	117.6	172.8	0.57		**49.3**	ULS 5a Ba 21	113.0	117.6	82.8	0.60	
212T	Diagonaal broekstuk	130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	139	**-90.3**	ULS 1a_90	131.3	117.6	172.8	0.77		**77.5**	ULS 1a_0,9_0,9_90	113.0	117.6	82.8	0.94	
213L	Diagonaal broekstuk	90x90x9	S235	2M20-5.6t	0.33	0.25	0.25	122	**-68.8**	ULS 5a Ba 10	161.1	117.6	194.4	0.58		**47.0**	ULS 5a Ba 21	186.1	117.6	157.1	0.40	
213T	Diagonaal broekstuk	90x90x9	S235	2M20-5.6t	0.33	0.25	0.25	122	**-92.5**	ULS 1a_90	161.1	117.6	194.4	0.79		**75.9**	ULS 1a_0,9_0,9_90	186.1	117.6	157.1	0.65	
214T	Diagonaal tweede tussenstuk	100x75x9	S235	2M24-5.6t	1.00	0.52	0.52	64	**-100.3**	ULS 5a Ba 10	240.8	169.4	233.3	0.59		**97.2**	ULS 5a Ba 10	140.7	169.4	186.5	0.69	
215	Top	100x100x6	S235	2M16-5.6t	1.00	1.00	1.00	105	**-8.1**	ULS 5a Ba 12	142.1	75.4	103.7	0.11		**8.0**	ULS 5a Ba 12	144.1	75.4	76.8	0.11	
216L	Tweede dwarsarm in tower	80x80x8	S235	4M20-5.6t	1.00	1.00	1.00	128	**0.0**		122.6	235.2	345.6	0.00		**121.9**	ULS 3_0	168.3	235.2	244.4	0.72	
216T	Tweede dwarsarm in tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	206	**-1.8**	ULS 5a Ba 22	21.0	37.7	43.2	0.09		**0.0**	ULS 5a Ba 22	37.4	37.7	22.0	0.00	
217T	Tweede dwarsarm in tower	100x75x7	S235	4M24-5.6t	2.00	1.00	1.00	68	**-49.1**	ULS 5a Ba 22	183.5	338.9	362.9	0.27		**64.0**	ULS 5a Ba 22	261.3	338.9	290.1	0.24	
218	Tweede dwarsarm in tower	80x80x8	S235	2M24-5.6t	1.00	1.00	1.00	98	**-76.9**	ULS 5a Ba 12	158.2	169.4	207.4	0.49		**76.9**	ULS 5a Ba 12	206.0	169.4	159.5	0.48	
219	Tweede dwarsarm in tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	223	**-0.3**	ULS 3_135	18.7	37.7	43.2	0.02		**0.0**		37.4	37.7	22.0	0.00	
116L	Tweede dwarsarm in tower	150x100x12	S235	9M24-5.6t	2.00	1.00	1.00	50	**-254.5**	ULS 5a Ba 22	602.5	762.5	1399.7	0.42		**95.6**	ULS 5a Ba 22	582.2	762.5	849.4	0.16	
220L	Eerste dwarsarm in tower	80x80x10	S235	3M24-5.6t	1.00	1.00	1.00	179	**0.0**		100.3	254.2	388.8	0.00		**149.0**	ULS 3_0	207.7	254.2	299.1	0.72	
220T	Eerste dwarsarm in tower	70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	202	**-29.0**	ULS 1a_0,9_0,9_90	36.3	58.8	64.8	0.80		**36.5**	ULS 1a_90	82.9	58.8	52.4	0.70	
221T	Eerste dwarsarm in tower	100x75x7	S235	4M24-5.6t	1.00	1.00	1.00	94	**-43.0**	ULS 5a Ba 22	157.6	338.9	362.9	0.27		**68.7**	ULS 5a Ba 12	214.1	338.9	290.1	0.32	
222	Eerste dwarsarm in tower	100x100x8	S235	2M24-5.6t	1.00	1.00	1.00	108	**-75.7**	ULS 5a Ba 10	182.9	169.4	207.4	0.45		**76.0**	ULS 5a Ba 10	208.1	169.4	177.2	0.45	
223	Eerste dwarsarm in tower	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	309	**-0.6**	ULS 3_0	11.3	37.7	43.2	0.05		**0.0**		37.4	37.7	22.0	0.00	
117L	Eerste dwarsarm in tower	150x100x16	S235	11M24-5.6t	2.00	1.00	1.00	70	**-249.7**	ULS 5a Ba 10	714.3	931.9	2281.0	0.35		**69.7**	ULS 5a Ba 10	767.8	931.9	1384.2	0.09	
224L	Onderstuk in tower	70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	287	**-3.7**	ULS 1a_90	24.1	37.7	51.8	0.15		**1.0**	ULS 1a_0,9_0,9_45	89.9	37.7	38.4	0.03	
224T	Onderstuk in tower	70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	287	**-3.4**	ULS 1a_45	24.1	37.7	51.8	0.14		**1.2**	ULS 1a_0,9_0,9_0	89.9	37.7	38.4	0.03	
225	Onderstuk in tower	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	306	**-1.6**	ULS 1a_135	11.9	37.7	43.2	0.13		**2.9**	ULS 1a_0,9_0,9_45	60.5	37.7	26.7	0.11	
226	Onderstuk in tower	100x50x6	S235	1M16-5.6t	0.50	0.50	0.50	368	**-0.4**	ULS 1a_90	15.3	37.7	51.8	0.03		**0.0**		44.9	37.7	22.0	0.00	
301	Diagonaal onderregel eerste dwarsarm	70x70x7	S235	1M20-5.6t	0.52	0.52	0.52	140	**-24.1**	ULS 5a Ba 20	68.1	58.8	75.6	0.41		**22.3**	ULS 5a Ba 11	96.8	58.8	53.5	0.42	
302	Diagonaal onderregel eerste dwarsarm	70x70x7	S235	1M20-5.6t	0.54	0.54	0.54	138	**-27.2**	ULS 5a Ba 11	69.0	58.8	75.6	0.46		**29.6**	ULS 5a Ba 20	96.8	58.8	53.5	0.55	
303	Diagonaal onderregel eerste dwarsarm	70x70x7	S235	1M24-5.6t	0.54	0.54	0.54	119	**-33.4**	ULS 5a Ba 20	80.7	84.7	90.7	0.41		**30.4**	ULS 5a Ba 11	88.7	84.7	44.9	0.68	
304	Diagonaal onderregel eerste dwarsarm	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	102	**-18.1**	ULS 5a Ba 21	57.9	58.8	54.0	0.34		**17.7**	ULS 5a Ba 21	54.7	58.8	37.0	0.48	
305	Diagonaal onderregel eerste dwarsarm	60x60x5	S235	1M20-5.6t	0.54	0.54	0.54	112	**-24.7**	ULS 5a Ba 10	52.9	58.8	54.0	0.47		**24.5**	ULS 5a Ba 10	54.7	58.8	37.0	0.66	

DNV·GL

Assessment of groups for initial mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+6
Mast 10

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compression)	Buckling	Shear (Comp)	:aring (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	:hear (Tens)	earing (Tens)	U.C. (Tens)	Exceedance (Tens)
306	Diagonaal onderregel eerste dwarsarm	75x50x5	S235	1M24-5.6t	0.55	0.55	0.55	112	**-30.3**	ULS 5a Ba 10	53.3	84.7	64.8	0.57		**30.7**	ULS 5a Ba 10	70.6	84.7	41.4	0.74	
307	Diagonaal onderregel eerste dwarsarm	75x50x7	S235	1M24-5.6t	0.54	0.54	0.54	87	**-32.9**	ULS 5a Ba 21	86.9	84.7	90.7	0.39		**31.6**	ULS 5a Ba 21	98.8	84.7	58.0	0.54	
308	Dwarsligger onderregel eerste dwarsarm	HEB160	S235		2.00	2.00	2.00	50	**-26.0**	ULS 5a Ba 20	918.5	0.0	0.0	0.03		**25.4**	ULS 5a Ba 11	1276.1	0.0	0.0	0.02	
309	Dwarsligger onderregel eerste dwarsarm	HEB160	S235		2.00	2.00	2.00	26	**-25.8**	ULS 5a Ba 21	1021.6	0.0	0.0	0.03		**25.8**	ULS 5a Ba 10	1276.1	0.0	0.0	0.02	
310	Verticaal eerste dwarsarm	70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	185	**-14.3**	ULS 3_45	41.1	58.8	64.8	0.35		**0.0**		82.9	58.8	39.3	0.00	
311	Verticaal eerste dwarsarm	70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	148	**-15.4**	ULS 3_135	54.9	58.8	64.8	0.28		**0.0**		82.9	58.8	39.3	0.00	
312	Verticaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	154	**-3.1**	ULS 1a_0	31.0	37.7	43.2	0.10		**0.0**		37.4	37.7	18.4	0.00	
313	Verticaal eerste dwarsarm	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-2.7**	ULS 1a_0	59.5	37.7	43.2	0.07		**0.0**		37.4	37.7	18.4	0.00	
314	Verticaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	53	**-1.1**	ULS 3_90	63.5	37.7	43.2	0.03		**0.0**		37.4	37.7	18.4	0.00	
315	Tussen diagonaal eerste dwarsarm	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	332	**0.0**		12.1	58.8	54.0	0.00		**17.4**	ULS 3_135	54.7	58.8	37.0	0.47	
316	Tussen diagonaal eerste dwarsarm	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	298	**0.0**		14.4	58.8	54.0	0.00		**23.6**	ULS 3_45	54.7	58.8	37.0	0.64	
317	Tussen diagonaal eerste dwarsarm	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	332	**0.0**		12.6	75.4	86.4	0.00		**31.5**	ULS 3_135	52.4	75.4	44.1	0.71	
318	Tussen diagonaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	274	**0.0**		13.7	37.7	43.2	0.00		**6.5**	ULS 1a_0	37.4	37.7	22.0	0.30	
319	Tussen diagonaal eerste dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	269	**0.0**		14.0	37.7	43.2	0.00		**9.4**	ULS 3_0	37.4	37.7	22.0	0.43	
320	Dwars diagonaal eerste dwarsarm	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	180	**-1.3**	ULS 1a_0	22.7	20.2	32.4	0.06		**1.2**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.06	
321	Dwars diagonaal eerste dwarsarm	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	115	**-1.1**	ULS 1a_0	38.2	20.2	32.4	0.06		**1.0**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.05	
401	Diagonaal onderregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	123	**-21.1**	ULS 5a Ba 22	48.3	58.8	54.0	0.44		**19.5**	ULS 5a Ba 12	54.7	58.8	37.0	0.53	
402	Diagonaal onderregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	118	**-23.3**	ULS 5a Ba 12	50.4	58.8	54.0	0.46		**24.1**	ULS 5a Ba 22	54.7	58.8	37.0	0.65	
403	Diagonaal onderregel tweede dwarsarm	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	117	**-27.0**	ULS 5a Ba 22	51.0	58.8	54.0	0.53		**26.5**	ULS 5a Ba 12	54.7	58.8	37.0	0.72	
404	Diagonaal onderregel tweede dwarsarm	60x60x6	S235	1M20-5.6t	0.52	0.52	0.52	106	**-29.1**	ULS 5a Ba 12	66.4	58.8	64.8	0.49		**28.4**	ULS 5a Ba 22	65.7	58.8	44.4	0.64	
405	Diagonaal onderregel tweede dwarsarm	70x70x6	S235	1M24-5.6t	0.52	0.52	0.52	90	**-32.7**	ULS 5a Ba 22	89.0	84.7	77.8	0.42		**34.9**	ULS 5a Ba 12	76.0	84.7	44.0	0.79	
406	Diagonaal onderregel tweede dwarsarm	75x50x7	S235	1M24-5.6t	0.52	0.52	0.52	111	**-40.8**	ULS 5a Ba 12	74.5	84.7	90.7	0.55		**36.9**	ULS 5a Ba 22	98.8	84.7	58.0	0.64	
407	Diagonaal onderregel tweede dwarsarm	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	137	**-4.2**	ULS 1a_0,9_135	43.1	37.7	43.2	0.11		**14.5**	ULS 5a Ba 1	60.5	37.7	32.0	0.45	
408	Diagonaal onderregel tweede dwarsarm	60x60x5	S235	1M16-8.8t	1.00	1.00	1.00	126	**-16.3**	ULS 5a Ba 1	47.0	60.3	43.2	0.38		**3.3**	ULS 1a_135	60.5	60.3	32.0	0.10	
409	Diagonaal onderregel tweede dwarsarm	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	122	**-3.0**	ULS 1a_135	48.9	37.7	43.2	0.08		**17.5**	ULS 5a Ba 1	60.5	37.7	32.0	0.55	
410	Diagonaal onderregel tweede dwarsarm	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	117	**-17.6**	ULS 5a Ba 1	50.8	37.7	43.2	0.47		**2.3**	ULS 1a_0,9_0,9_135	60.5	37.7	32.0	0.07	
411	Dwarsligger onderregel tweede dwarsarr	HEB160	S235		2.00	2.00	2.00	32	**-25.9**	ULS 5a Ba 22	995.4	0.0	0.0	0.03		**25.6**	ULS 5a Ba 12	1276.1	0.0	0.0	0.02	
412	Dwarsligger onderregel tweede dwarsarr	HEB160	S235		2.00	2.00	2.00	25	**-1.3**	ULS 1a_0,9_0,9_135	1025.6	0.0	0.0	0.00		**13.9**	ULS 5a Ba 1	1276.1	0.0	0.0	0.01	
413	Verticaal tweede dwarsarm	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**-9.1**	ULS 3_0	30.7	37.7	43.2	0.30		**0.0**		60.5	37.7	26.7	0.00	
414	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	168	**-10.0**	ULS 3_0	27.8	37.7	43.2	0.36		**0.0**		37.4	37.7	18.4	0.00	
415	Verticaal tweede dwarsarm	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	107	**-12.0**	ULS 3_0	55.1	37.7	43.2	0.32		**0.0**		37.4	37.7	22.0	0.00	
416	Verticaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	70	**-0.6**	ULS 6a_90 Ah Ct1	58.8	37.7	43.2	0.02		**0.0**		37.4	37.7	18.4	0.00	
417	Tussen diagonaal tweede dwarsarm	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	325	**0.0**		12.6	37.7	43.2	0.00		**14.6**	ULS 3_0	60.5	37.7	32.0	0.46	
418	Tussen diagonaal tweede dwarsarm	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	361	**0.0**		8.8	37.7	43.2	0.00		**18.2**	ULS 3_0	37.4	37.7	22.0	0.83	
419	Tussen diagonaal tweede dwarsarm	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	334	**0.0**		12.4	75.4	86.4	0.00		**26.4**	ULS 3_0	56.2	75.4	44.1	0.60	
420	Tussen diagonaal tweede dwarsarm	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	259	**0.0**		26.8	117.6	129.6	0.00		**50.5**	ULS 3_135	77.4	117.6	88.7	0.65	
421	Dwars diagonaal tweede dwarsarm	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	111	**-1.7**	ULS 1a_0,9_0,9_0	39.6	20.2	32.4	0.08		**1.6**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.08	
422	Dwarsligger bovenregel tweede dwarsarr	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	187	**0.0**	ULS 1a_45	24.0	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00	

DNV·GL

Assessment of groups for strengthened mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+6
Mast 10

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	ompression	Load Case (Compres	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)
101	Leg Vierde TSN	90x90x8	S235	5M20-5.6t	1.00	1.00	1.00	146	-40.8	ULS 5a Ba 22	112.9	294.0	432.0	0.36		0.0		269.1	294.0	392.7	0.00
102A	Leg Vierde TSN	90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	76	-63.4	ULS 1a_45	251.3	338.9	414.7	0.25		18.5	ULS 1a_0,9_0,9_45	252.5	338.9	297.7	0.07
102B	Leg Vierde TSN	90x90x8	S235	4M24-5.6t	0.50	0.50	0.50	79	-131.2	ULS 1a_45	245.5	338.9	414.7	0.53		82.2	ULS 1a_0,9_0,9_45	252.5	338.9	354.5	0.33
103A	Leg Derde TSN	100x100x12	S235	4M24-5.6t	0.50	0.50	0.50	73	-186.0	ULS 1a_45	418.8	338.9	622.1	0.55		135.3	ULS 1a_0,9_0,9_45	426.6	338.9	531.7	0.40
103B	Leg Derde TSN	100x100x12	S235	6M24-5.6t	0.50	0.50	0.50	79	-227.9	ULS 1a_45	401.2	508.3	933.1	0.57		138.1	ULS 1a_0,9_0,9_45	426.6	508.3	781.6	0.32
104A	Leg Tweede TS	150x150x12	S235	6M24-5.6t	1.55	1.19	0.99	40	-336.2	ULS 1a_45	763.4	508.3	933.1	0.66		222.7	ULS 1a_0,9_0,9_45	740.3	508.3	797.5	0.44
104C	Leg Tweede TS	150x150x12	S235	8M24-5.6t	**2.14**	**2.14**	**1.37**	33	-623.2	ULS 1a_45	784.4	677.8	1244.2	0.92		477.6	ULS 1a_0,9_0,9_45	740.3	677.8	1063.4	0.70
104B	Leg Tweede TS	150x150x12	S235		1.90	1.90	1.59	66	-481.1	ULS 1a_45	672.3	0.0	0.0	0.72		345.0	ULS 1a_0,9_0,9_45	817.8	0.0	0.0	0.42
105A	Leg Eerste TSN	150x150x14	S235	8M24-5.6t	**0.98**	**0.98**	**0.63**	33	-666.0	ULS 1a_45	903.2	677.8	1451.5	0.98		519.2	ULS 1a_0,9_0,9_45	851.7	677.8	1240.6	0.77
105C	Leg Eerste TSN	150x150x14	S235		**2.00**	**2.00**	**1.28**	31	-740.4	ULS 1a_45	911.7	0.0	0.0	0.81		592.4	ULS 1a_0,9_0,9_45	943.3	0.0	0.0	0.63
105B	Leg Eerste TSN	150x150x14	S235	**8M24-8.8t**	**1.04**	**1.04**	**0.66**	31	-741.2	ULS 1a_45	912.0	1084.4	1451.5	0.81		590.9	ULS 1a_0,9_0,9_45	851.7	1084.4	1240.6	0.69
106A	Leg Eerste TSN	150x150x14	S235	**8M24-8.8t**	**3.35**	**3.35**	**2.15**	37	-795.9	ULS 1a_45	891.1	1084.4	1451.5	0.89		639.7	ULS 1a_0,9_0,9_45	851.7	1084.4	1240.6	0.75
106C	Leg Eerste TSN	150x150x14	S235		**0.81**	**0.81**	**0.52**	37	-832.7	ULS 1a_45	889.7	0.0	0.0	0.94		676.6	ULS 1a_0,9_0,9_45	943.3	0.0	0.0	0.72
106B	Leg Eerste TSN	150x150x14	S235	10M24-5.6t	0.64	**0.64**	**0.41**	37	-834.6	ULS 1a_45	890.1	839.3	1814.4	0.99		675.3	ULS 1a_0,9_0,9_45	851.7	839.3	1550.8	0.80
107A	Leg Broekstuk	160x160x15#	S235	10M24-5.6t	0.33	0.33	0.33	50	-776.5	ULS 1a_45	978.7	839.3	1944.0	0.93		641.4	ULS 1a_0,9_0,9_45	1008.5	839.3	1661.5	0.76
107B	Leg Broekstuk	160x160x15#	S235	10M24-5.6t	0.25	0.25	0.25	57	-780.1	ULS 1a_45	949.1	839.3	1944.0	0.93		638.1	ULS 1a_0,9_0,9_45	1008.5	839.3	1661.5	0.76
108A	Onderregel eers	150x100x16	S235	11M24-5.6t	1.00	0.50	0.50	54	-306.2	ULS 5a Ba 10	782.9	931.9	2281.0	0.39		139.1	ULS 5a Ba 21	767.8	931.9	1384.2	0.18
108C	Onderregel eers	150x100x16	S235		1.00	0.50	0.50	56	-281.4	ULS 5a Ba 21	773.8	0.0	0.0	0.36		127.9	ULS 5a Ba 10	891.6	0.0	0.0	0.14
108B	Onderregel eers	150x100x16	S235	6M24-5.6t	4.78	1.00	1.00	47	-209.9	ULS 5a Ba 10	809.2	508.3	1244.2	0.41		115.8	ULS 5a Ba 21	767.8	508.3	1063.4	0.23
109A	Onderregel eers	120x120x13	S235	6M24-5.6t	1.64	1.00	1.00	61	-194.6	ULS 5a Ba 21	597.1	508.3	1010.9	0.38		100.8	ULS 5a Ba 21	602.4	508.3	864.0	0.20
109C	Onderregel eers	120x120x13	S235		1.71	1.29	1.00	66	-162.2	ULS 5a Ba 21	578.1	0.0	0.0	0.28		77.2	ULS 5a Ba 10	705.0	0.0	0.0	0.11
109B	Onderregel eers	120x120x13	S235		1.00	1.00	1.00	13	-1.0	ULS 5a Ba 10	705.0	0.0	0.0	0.00		1.0	ULS 5a Ba 21	705.0	0.0	0.0	0.00
110A	Bovenregel eers	80x80x10	S235	3M24-5.6t	1.00	2.00	1.00	205	0.0		79.3	254.2	388.8	0.00		136.3	ULS 3_90	196.6	254.2	323.8	0.69
110B	Bovenregel eers	80x80x10	S235	3M20-5.6t	1.00	2.00	1.00	204	0.0		79.9	176.4	324.0	0.00		120.5	ULS 3_0	206.0	176.4	261.8	0.68
111A	Bovenregel eers	70x70x7	S235	3M20-5.6t	1.00	2.84	1.00	343	0.0		22.6	176.4	226.8	0.00		95.8	ULS 3_0	125.5	176.4	183.3	0.76
111C	Bovenregel eers	70x70x7	S235		1.00	3.23	1.00	343	0.0		22.6	0.0	0.0	0.00		91.7	ULS 3_0	220.9	0.0	0.0	0.42
111B	Bovenregel eers	70x70x7	S235	3M20-5.6t	1.00	2.00	1.00	232	0.0		41.4	176.4	226.8	0.00		83.3	ULS 3_0	125.5	176.4	155.3	0.66
112A	Onderregel twe	150x150x14	S235	9M24-5.6t	1.50	1.00	1.00	62	-309.6	ULS 5a Ba 12	792.6	762.5	1633.0	0.41		171.4	ULS 5a Ba 22	851.7	762.5	990.9	0.22
112C	Onderregel twe	150x150x14	S235		3.00	2.00	1.00	59	-281.0	ULS 5a Ba 12	805.5	0.0	0.0	0.35		148.5	ULS 5a Ba 22	943.3	0.0	0.0	0.16
112B	Onderregel twe	150x150x14	S235	6M24-5.6t	2.55	1.64	1.00	61	-144.9	ULS 5a Ba 12	796.1	508.3	1088.6	0.29		34.8	ULS 5a Ba 22	851.7	508.3	930.5	0.07
113A	Onderregel twe	120x120x11	S235	6M24-5.6t	4.00	2.57	1.00	77	-132.9	ULS 5a Ba 12	458.4	508.3	855.4	0.29		46.0	ULS 5a Ba 22	513.2	508.3	731.1	0.09
113C	Onderregel twe	120x120x11	S235	2M16-5.6t	2.22	1.00	1.00	109	-30.7	ULS 6a_90 Ah Ct1	333.3	75.4	190.1	0.41		23.5	ULS 5a Ba 1	599.7	0.0	0.0	0.04
113B	Onderregel twe	120x120x11	S235	2M16-5.6t	4.44	1.00	1.00	109	-31.2	ULS 6a_90 Ah Ct1	333.3	75.4	190.1	0.41		0.0		429.4	75.4	190.1	0.00
114A	Bovenregel twe	100x65x9*	S235	4M20-5.6t	1.00	1.00	1.00	204	0.0		78.6	235.2	388.8	0.00		112.7	ULS 3_45	144.1	235.2	266.2	0.78
114C	Bovenregel twe	100x65x9*	S235		1.00	1.00	1.00	204	0.0		78.6	0.0	0.0	0.00		98.4	ULS 3_90	332.5	0.0	0.0	0.30
114B	Bovenregel twe	100x65x9*	S235	3M20-5.6t	1.00	1.00	1.00	204	0.0		78.6	176.4	291.6	0.00		77.0	ULS 3_135	172.4	176.4	199.6	0.45
115A	Bovenregel twe	60x60x5	S235	2M16-5.6t	1.00	2.43	1.00	379	0.0		11.8	75.4	86.4	0.00		30.8	ULS 6a_90 Ah Ct2	98.8	75.4	56.0	0.55
115B	Bovenregel twe	60x60x5	S235	2M16-5.6t	1.00	1.70	1.00	379	0.0		11.8	75.4	86.4	0.00		30.8	ULS 6a_90 Ah Ct1	65.9	75.4	56.0	0.55
201L	Diagonaal vierd	70x70x7	S235	1M24-5.6t	0.52	0.52	0.52	127	-23.1	ULS 5a Ba 22	76.0	84.7	90.7	0.30		16.0	ULS 5a Ba 22	88.7	84.7	64.2	0.25
201T	Diagonaal vierd	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	178	-11.0	ULS 5a Ba 22	25.8	37.7	43.2	0.43		5.3	ULS 5a Ba 22	37.4	37.7	22.0	0.24
202L	Diagonaal vierd	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	93	-110.9	ULS 5a Ba 12	208.2	169.4	207.4	0.65		116.5	ULS 5a Ba 22	181.4	169.4	177.2	0.69
202T	Diagonaal vierd	100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	93	-124.4	ULS 5a Ba 12	256.9	254.2	388.8	0.49		123.5	ULS 5a Ba 22	261.1	254.2	332.3	0.49
203L	Diagonaal vierd	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	98	-104.9	ULS 5a Ba 22	198.7	169.4	207.4	0.62		98.8	ULS 5a Ba 12	181.4	169.4	177.2	0.58
203T	Diagonaal vierd	100x100x10	S235	3M24-5.6t	0.52	0.52	0.52	99	-110.6	ULS 5a Ba 22	245.1	254.2	388.8	0.45		111.2	ULS 5a Ba 12	261.1	254.2	332.3	0.44
204L	Diagonaal derde	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	103	-88.0	ULS 5a Ba 12	191.1	169.4	207.4	0.52		93.4	ULS 5a Ba 22	181.4	169.4	177.2	0.55
204T	Diagonaal derde	100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	104	-99.4	ULS 5a Ba 12	235.6	169.4	259.2	0.59		98.2	ULS 5a Ba 22	224.3	169.4	221.5	0.58
205L	Diagonaal derde	100x100x8	S235	2M24-5.6t	0.52	0.52	0.52	111	-92.8	ULS 5a Ba 12	178.0	169.4	207.4	0.55		90.9	ULS 5a Ba 22	181.4	169.4	177.2	0.54
205T	Diagonaal derde	100x100x10	S235	2M24-5.6t	0.52	0.52	0.52	112	-100.2	ULS 5a Ba 12	219.4	169.4	259.2	0.59		80.8	ULS 5a Ba 22	224.3	169.4	221.5	0.48
206L	Diagonaal twee	100x75x8	S235	2M24-5.6t	0.54	0.27	0.27	79	-95.5	ULS 5a Ba 10	192.7	169.4	207.4	0.56		90.2	ULS 5a Ba 21	112.0	169.4	116.0	0.81
206T	Diagonaal twee	100x75x9	S235	2M24-5.6t	0.53	0.27	0.27	75	-94.2	ULS 5a Ba 10	221.4	169.4	233.3	0.56		96.2	ULS 5a Ba 10	119.9	169.4	130.6	0.80
207L	Diagonaal twee	100x75x7	S235	2M24-5.6t	0.54	0.27	0.27	88	-78.2	ULS 5a Ba 21	157.3	169.4	181.4	0.50		80.8	ULS 5a Ba 10	98.2	169.4	101.5	0.82
207T	Diagonaal twee	100x75x8	S235	2M24-5.6t	0.54	0.27	0.27	89	-89.6	ULS 5a Ba 21	177.6	169.4	207.4	0.53		87.7	ULS 5a Ba 10	110.7	169.4	116.0	0.79
208L	Diagonaal twee	100x75x7	S235	2M24-5.6t	0.54	0.27	0.27	104	-72.8	ULS 5a Ba 10	137.7	169.4	181.4	0.53		70.4	ULS 5a Ba 21	100.4	169.4	101.5	0.70
208T	Diagonaal twee	100x75x8	S235	2M24-5.6t	0.54	0.27	0.27	105	-80.2	ULS 5a Ba 10	155.3	169.4	207.4	0.52		80.9	ULS 5a Ba 21	113.2	169.4	116.0	0.71
209L	Diagonaal eerst	100x75x7	S235	2M20-5.6t	0.53	0.27	0.27	116	-60.5	ULS 5a Ba 21	126.6	117.6	151.2	0.51		61.5	ULS 5a Ba 10	115.4	117.6	106.9	0.58
209T	Diagonaal eerst	100x75x9	S235	2M20-5.6t	0.54	0.27	0.27	120	-70.7	ULS 5a Ba 21	150.9	117.6	194.4	0.60		69.5	ULS 5a Ba 10	146.1	117.6	137.5	0.59
210L	Diagonaal eerst	100x75x8	S235	2M20-5.6t	0.53	0.27	0.27	127	-53.0	ULS 5a Ba 10	129.5	117.6	172.8	0.45		51.7	ULS 5a Ba 21	130.1	117.6	104.7	0.49
210T	Diagonaal eerst	100x75x9	S235	2M20-5.6t	0.53	0.27	0.27	125	-57.2	ULS 5a Ba 10	146.6	117.6	194.4	0.49		57.4	ULS 5a Ba 21	137.6	117.6	117.8	0.49
211L	Diagonaal eerst	100x75x8	S235	2M20-5.6t	0.53	0.27	0.27	139	-48.7	ULS 1a_0,9_0,9_90	117.1	117.6	172.8	0.42		49.8	ULS 1a_90	127.0	117.6	104.7	0.48
211T	Diagonaal eerst	100x75x9	S235	2M20-5.6t	0.53	0.27	0.27	136	-50.3	ULS 5a Ba 21	134.3	117.6	194.4	0.43		49.4	ULS 5a Ba 10	135.9	117.6	117.8	0.42
212L	Diagonaal broek	130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	139	-67.1	ULS 5a Ba 10	131.3	117.6	172.8	0.57		49.3	ULS 5a Ba 21	113.0	117.6	82.8	0.60
212T	Diagonaal broek	130x65x8	S235	2M20-5.6t	1.00	0.33	0.33	139	-90.3	ULS 1a_90	131.3	117.6	172.8	0.77		77.5	ULS 1a_0,9_0,9_90	113.0	117.6	82.8	0.94
213L	Diagonaal broek	90x90x9	S235	2M20-5.6t	0.33	0.25	0.25	122	-68.8	ULS 5a Ba 10	161.1	117.6	194.4	0.58		47.0	ULS 5a Ba 21	186.1	117.6	157.1	0.40
213T	Diagonaal broek	90x90x9	S235	2M20-5.6t	0.33	0.25	0.25	122	-92.5	ULS 1a_90	161.1	117.6	194.4	0.79		75.9	ULS 1a_0,9_0,9_90	186.1	117.6	157.1	0.65
214T	Diagonaal twee	100x75x9	S235	2M24-5.6t	1.00	0.52	0.52	64	-100.3	ULS 5a Ba 10	240.8	169.4	233.3	0.59		97.2	ULS 5a Ba 10	140.7	169.4	186.5	0.69
215	Top	100x100x6	S235	2M16-5.6t	1.00	1.00	1.00	105	-8.1	ULS 5a Ba 12	142.1	75.4	103.7	0.11		8.0	ULS 5a Ba 12	144.1	75.4	76.8	0.11
216L	Tweede dwarsa	80x80x8	S235	4M20-5.6t	1.00	1.00	1.00	128	0.0		122.6	235.2	345.6	0.00		121.9	ULS 3_0	168.3	235.2	244.4	0.72
216T	Tweede dwarsa	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	206	-1.8	ULS 5a Ba 22	21.0	37.7	43.2	0.09		0.0	ULS 5a Ba 22	37.4	37.7	22.0	0.00
217T	Tweede dwarsa	100x75x7	S235	4M24-5.6t	2.00	1.00	1.00	68	-49.1	ULS 5a Ba 22	183.5	338.9	362.9	0.27		64.0	ULS 5a Ba 22	261.3	338.9	290.1	0.24
218	Tweede dwarsa	80x80x8	S235	2M24-5.6t	1.00	1.00	1.00	98	-76.9	ULS 5a Ba 12	158.2	169.4	207.4	0.49		76.9	ULS 5a Ba 12	206.0	169.4	159.5	0.48
219	Tweede dwarsa	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	223	-0.3	ULS 3_135	18.7	37.7	43.2	0.02		0.0		37.4	37.7	22.0	0.00
116L	Tweede dwarsa	150x100x12	S235	9M24-5.6t	2.00	1.00	1.00	50	-254.5	ULS 5a Ba 22	602.5	762.5	1399.7	0.42		95.6	ULS 5a Ba 22	582.2	762.5	849.4	0.16
220L	Eerste dwarsarr	80x80x10	S235	3M24-5.6t	1.00	1.00	1.00	179	0.0		100.3	254.2	388.8	0.00		149.0	ULS 3_0	207.7	254.2	299.1	0.72
220T	Eerste dwarsarr	70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	202	-29.0	ULS 1a_0,9_0,9_90	36.3	58.8	64.8	0.80		36.5	ULS 1a_90	82.9	58.8	52.4	0.70
221T	Eerste dwarsarr	100x75x7	S235	4M24-5.6t	1.00	1.00	1.00	94	-43.0	ULS 5a Ba 22	157.6	338.9	362.9	0.27		68.7	ULS 5a Ba 12	214.1	338.9	290.1	0.32
222	Eerste dwarsarr	100x100x8	S235	2M24-5.6t	1.00	1.00	1.00	108	-75.7	ULS 5a Ba 10	182.9	169.4	207.4	0.45		76.0	ULS 5a Ba 10	208.1	169.4	177.2	0.45
223	Eerste dwarsarr	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	309	-0.6	ULS 3_0	11.3	37.7	43.2	0.05		0.0		37.4	37.7	22.0	0.00
117L	Eerste dwarsarr	150x100x16	S235	11M24-5.6t	2.00	1.00	1.00	70	-249.7	ULS 5a Ba 10	714.3	931.9	2281.0	0.35		69.7	ULS 5a Ba 10	767.8	931.9	1384.2	0.09
224L	Onderstuk in to	70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	287	-3.7	ULS 1a_90	24.1	37.7	51.8	0.15		1.0	ULS 1a_0,9_0,9_45	89.9	37.7	38.4	0.03
224T	Onderstuk in to	70x70x6	S235	1M16-5.6t	1.00	1.00	1.00	287	-3.4	ULS 1a_45	24.1	37.7	51.8	0.14		1.2	ULS 1a_0,9_0,9_0	89.9	37.7	38.4	0.03
225	Onderstuk in to	60x60x5	S235	1M16-5.6t	1.00	0.50	0.50	306	-1.6	ULS 1a_135	11.9	37.7	43.2	0.13		2.9	ULS 1a_0,9_0,9_45	60.5	37.7	26.7	0.11

DNV·GL

Assessment of groups for strengthened mast (afkeur level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+6
Mast 10

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	mpression	Load Case (Compres	Buckling	Shear (Comp)	earing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	hear (Tens)	earing (Tens)	U.C. (Tens)
226	Onderstuk in to	100x50x6	S235	1M16-5.6t	0.50	0.50	0.50	368	**-0.4**	ULS 1a_90	15.3	37.7	51.8	0.03		**0.0**		44.9	37.7	22.0	0.00
301	Diagonaal onde	70x70x7	S235	1M20-5.6t	0.52	0.52	0.52	140	**-24.1**	ULS 5a Ba 20	68.1	58.8	75.6	0.41		**22.3**	ULS 5a Ba 11	96.8	58.8	53.5	0.42
302	Diagonaal onde	70x70x7	S235	1M20-5.6t	0.54	0.54	0.54	138	**-27.2**	ULS 5a Ba 11	69.0	58.8	75.6	0.46		**29.6**	ULS 5a Ba 20	96.8	58.8	53.5	0.55
303	Diagonaal onde	70x70x7	S235	1M24-5.6t	0.54	0.54	0.54	119	**-33.4**	ULS 5a Ba 20	80.7	84.7	90.7	0.41		**30.4**	ULS 5a Ba 11	88.7	84.7	44.9	0.68
304	Diagonaal onde	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	102	**-18.1**	ULS 5a Ba 21	57.9	58.8	54.0	0.34		**17.7**	ULS 5a Ba 21	54.7	58.8	37.0	0.48
305	Diagonaal onde	60x60x5	S235	1M20-5.6t	0.54	0.54	0.54	112	**-24.7**	ULS 5a Ba 10	52.9	58.8	54.0	0.47		**24.5**	ULS 5a Ba 10	54.7	58.8	37.0	0.66
306	Diagonaal onde	75x50x5	S235	1M24-5.6t	0.55	0.55	0.55	112	**-30.3**	ULS 5a Ba 10	53.3	84.7	64.8	0.57		**30.7**	ULS 5a Ba 10	70.6	84.7	41.4	0.74
307	Diagonaal onde	75x50x7	S235	1M24-5.6t	0.54	0.54	0.54	87	**-32.9**	ULS 5a Ba 21	86.9	84.7	90.7	0.39		**31.6**	ULS 5a Ba 21	98.8	84.7	58.0	0.54
308	Dwarsligger onc	HEB160	S235		2.00	2.00	2.00	50	**-26.0**	ULS 5a Ba 20	918.5	0.0	0.0	0.03		**25.4**	ULS 5a Ba 11	1276.1	0.0	0.0	0.02
309	Dwarsligger onc	HEB160	S235		2.00	2.00	2.00	26	**-25.8**	ULS 5a Ba 21	1021.6	0.0	0.0	0.03		**25.8**	ULS 5a Ba 10	1276.1	0.0	0.0	0.02
310	Verticaal eerste	70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	185	**-14.3**	ULS 3_45	41.1	58.8	64.8	0.35		**0.0**		82.9	58.8	39.3	0.00
311	Verticaal eerste	70x70x6	S235	1M20-5.6t	1.00	1.00	1.00	148	**-15.4**	ULS 3_135	54.9	58.8	64.8	0.28		**0.0**		82.9	58.8	39.3	0.00
312	Verticaal eerste	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	154	**-3.1**	ULS 1a_0	31.0	37.7	43.2	0.10		**0.0**		37.4	37.7	18.4	0.00
313	Verticaal eerste	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**-2.7**	ULS 1a_0	59.5	37.7	43.2	0.07		**0.0**		37.4	37.7	18.4	0.00
314	Verticaal eerste	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	53	**-1.1**	ULS 3_90	63.5	37.7	43.2	0.03		**0.0**		37.4	37.7	18.4	0.00
315	Tussen diagona	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	332	**0.0**		12.1	58.8	54.0	0.00		**17.4**	ULS 3_135	54.7	58.8	37.0	0.47
316	Tussen diagona	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	298	**0.0**		14.4	58.8	54.0	0.00		**23.6**	ULS 3_45	54.7	58.8	37.0	0.64
317	Tussen diagona	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	332	**0.0**		12.6	75.4	86.4	0.00		**31.5**	ULS 3_135	52.4	75.4	44.1	0.71
318	Tussen diagona	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	274	**0.0**		13.7	37.7	43.2	0.00		**6.5**	ULS 1a_0	37.4	37.7	22.0	0.30
319	Tussen diagona	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	269	**0.0**		14.0	37.7	43.2	0.00		**9.4**	ULS 3_0	37.4	37.7	22.0	0.43
320	Dwars diagonaa	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	180	**-1.3**	ULS 1a_0	22.7	20.2	32.4	0.06		**1.2**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.06
321	Dwars diagonaa	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	115	**-1.1**	ULS 1a_0	38.2	20.2	32.4	0.06		**1.0**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.05
401	Diagonaal onde	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	123	**-21.1**	ULS 5a Ba 22	48.3	58.8	54.0	0.44		**19.5**	ULS 5a Ba 12	54.7	58.8	37.0	0.53
402	Diagonaal onde	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	118	**-23.3**	ULS 5a Ba 12	50.4	58.8	54.0	0.46		**24.1**	ULS 5a Ba 22	54.7	58.8	37.0	0.65
403	Diagonaal onde	60x60x5	S235	1M20-5.6t	0.52	0.52	0.52	117	**-27.0**	ULS 5a Ba 22	51.0	58.8	54.0	0.53		**26.5**	ULS 5a Ba 12	54.7	58.8	37.0	0.72
404	Diagonaal onde	60x60x6	S235	1M20-5.6t	0.52	0.52	0.52	106	**-29.1**	ULS 5a Ba 12	66.4	58.8	64.8	0.49		**28.4**	ULS 5a Ba 22	65.7	58.8	44.4	0.64
405	Diagonaal onde	70x70x6	S235	1M24-5.6t	0.52	0.52	0.52	90	**-32.7**	ULS 5a Ba 22	89.0	84.7	77.8	0.42		**34.9**	ULS 5a Ba 12	76.0	84.7	44.0	0.79
406	Diagonaal onde	75x50x7	S235	1M24-5.6t	0.52	0.52	0.52	111	**-40.8**	ULS 5a Ba 12	74.5	84.7	90.7	0.55		**36.9**	ULS 5a Ba 22	98.8	84.7	58.0	0.64
407	Diagonaal onde	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	137	**-4.2**	ULS 1a_0,9_135	43.1	37.7	43.2	0.11		**14.5**	ULS 5a Ba 1	60.5	37.7	32.0	0.45
408	Diagonaal onde	60x60x5	S235	1M16-8.8t	1.00	1.00	1.00	126	**-16.3**	ULS 5a Ba 1	47.0	60.3	43.2	0.38		**3.3**	ULS 1a_135	60.5	60.3	32.0	0.10
409	Diagonaal onde	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	122	**-3.0**	ULS 1a_135	48.9	37.7	43.2	0.08		**17.5**	ULS 5a Ba 1	60.5	37.7	32.0	0.55
410	Diagonaal onde	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	117	**-17.6**	ULS 5a Ba 1	50.8	37.7	43.2	0.47		**2.3**	ULS 1a_0,9_0,9_135	60.5	37.7	32.0	0.07
411	Dwarsligger onc	HEB160	S235		2.00	2.00	2.00	32	**-25.9**	ULS 5a Ba 22	995.4	0.0	0.0	0.03		**25.6**	ULS 5a Ba 12	1276.1	0.0	0.0	0.02
412	Dwarsligger onc	HEB160	S235		2.00	2.00	2.00	25	**-1.3**	ULS 1a_0,9_0,9_135	1025.6	0.0	0.0	0.00		**13.9**	ULS 5a Ba 1	1276.1	0.0	0.0	0.01
413	Verticaal tweed	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	180	**-9.1**	ULS 3_0	30.7	37.7	43.2	0.30		**0.0**		60.5	37.7	26.7	0.00
414	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	168	**-10.0**	ULS 3_0	27.8	37.7	43.2	0.36		**0.0**		37.4	37.7	18.4	0.00
415	Verticaal tweed	75x50x5	S235	1M16-5.6t	1.00	1.00	1.00	107	**-12.0**	ULS 3_0	55.1	37.7	43.2	0.32		**0.0**		37.4	37.7	22.0	0.00
416	Verticaal tweed	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	70	**-0.6**	ULS 6a_90 Ah Ct1	58.8	37.7	43.2	0.02		**0.0**		37.4	37.7	18.4	0.00
417	Tussen diagona	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	325	**0.0**		12.6	37.7	43.2	0.00		**14.6**	ULS 3_0	60.5	37.7	32.0	0.46
418	Tussen diagona	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	361	**0.0**		8.8	37.7	43.2	0.00		**18.2**	ULS 3_0	37.4	37.7	22.0	0.83
419	Tussen diagona	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	334	**0.0**		12.4	75.4	86.4	0.00		**26.4**	ULS 3_0	56.2	75.4	44.1	0.60
420	Tussen diagona	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	259	**0.0**		26.8	117.6	129.6	0.00		**50.5**	ULS 3_135	77.4	117.6	88.7	0.65
421	Dwars diagonaa	45x45x5	S235	1M12-5.6t	0.52	0.52	0.52	111	**-1.7**	ULS 1a_0,9_0,9_0	39.6	20.2	32.4	0.08		**1.6**	ULS 1a_0,9_0,9_0	37.4	20.2	23.7	0.08
422	Dwarsligger bov	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	187	**0.0**	ULS 1a_45	24.0	37.7	43.2	0.00		**0.0**		37.4	37.7	22.0	0.00
423	423	**50x50x5**	S235	1M16-5.6t	1.00	1.00	1.00	168	**0.0**	ULS 1a_90	27.7	37.7	43.2	0.00		**0.0**		0.0	37.4	22.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00
0	0	**0**	S		0.00	0.00	0.00	0	**0.0**		0.0	0.0	0.0	0.00		**0.0**		0.0	0.0	0.0	0.00

Assessment of groups for strengthened mast (verbouw level)

Date: 30-11-20
Author: TBR
Version: 1.0

KIJ-GT380
S+6
Mast 10

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	ımpression	Load Case (Compres:	Buckling	Shear (Comp)	ɛaring (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	ɜhear (Tens)	ɛearing (Tens)	U.C. (Tens)
104C	Leg Tweede TSI	150x150x12	S235	8M24-5.6t	**2.14**	**2.14**	**1.37**	33	**-734.2**	ULS 1a_90	784.4	677.8	1244.2	1.08		**643.2**	ULS 1a_0,9_0,9_45	740.3	677.8	1063.4	0.95
105A	Leg Eerste TSN!	150x150x14	S235	8M24-5.6t	**0.98**	**0.98**	**0.63**	33	**-771.6**	ULS 1a_45	903.2	677.8	1451.5	1.14		**699.1**	ULS 1a_45	851.7	677.8	1240.6	1.03
105C	Leg Eerste TSN!	150x150x14	S235		**2.00**	**2.00**	**1.28**	31	**-845.4**	ULS 1a_135	911.7	0.0	0.0	0.93		**800.1**	ULS 1a_45	943.3	0.0	0.0	0.85
105B	Leg Eerste TSN!	150x150x14	S235	**8M24-8.8t**	**1.04**	**1.04**	**0.66**	31	**-845.6**	ULS 1a_135	912.0	1084.4	1451.5	0.93		**798.1**	ULS 1a_45	851.7	1084.4	1240.6	0.94
106A	Leg Eerste TSN!	150x150x14	S235	**8M24-8.8t**	**3.35**	**3.35**	**2.15**	37	**-920.4**	ULS 1a_45	891.1	1084.4	1451.5	1.03	(1)	**862.9**	ULS 1a_45	851.7	1084.4	1240.6	1.01
106C	Leg Eerste TSN!	150x150x14	S235		**0.81**	**0.81**	**0.52**	37	**-959.6**	ULS 1a_135	889.7	0.0	0.0	1.08		**913.0**	ULS 1a_45	943.3	0.0	0.0	0.97
106B	Leg Eerste TSN!	150x150x14	S235	10M24-5.6t	0.64	**0.64**	**0.41**	37	**-961.0**	ULS 1a_135	890.1	839.3	1814.4	1.15		**911.3**	ULS 1a_45	851.7	839.3	1550.8	1.09

(1) Redundants (knikverkorters) have been added to groups 104 to 106. The redundants are checked separately in Appendix C.
The exceeding of compression strength is not relevant, since the main leg itself does not need to be checked for verbouw level.

APPENDIX C REDUNDANT MEMBERS CHECK

Knikverkorters initial construction (afkeur)

Date: 2020-12-01
Author: Muhammed Khan
Version: 1.8

KIJ-GT
S+6
10

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Net Section Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type
488	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	0.86	0	98	9.8	0.21	44.1	20.2	27.7	38.9	0.57	0.49	
3486	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.87	71	215	9.8	0.00	17.7	20.2	27.7	38.9	0.57	0.55	
3483	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.89	0	217	9.8	0.47	17.4	20.2	27.7	38.9	0.57	0.83	
482	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.38	48	245	9.8	0.00	16.3	20.2	27.7	44.6	0.72	0.60	
481	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.82	0	290	9.8	0.71	12.5	20.2	27.7	44.6	0.72	0.98	
480	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	3.12	44	321	9.8	0.00	10.6	20.2	27.7	44.6	0.72	0.92	
500	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	3.10	33	319	9.8	0.00	10.7	20.2	27.7	44.6	0.72	0.91	
478	Onderstuk	Enkele staaf	L50.5	S235	M12	5.6	2.51	0	258	9.8	0.63	15.0	20.2	27.7	44.6	0.72	0.87	
477	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	2.12	48	244	9.8	0.00	14.7	20.2	27.7	38.9	0.57	0.67	
476	Onderstuk	Enkele staaf	L45.5	S235	M12	5.6	1.20	0	138	9.8	0.30	31.7	20.2	27.7	38.9	0.57	0.52	
493	Pootverband	Enkele staaf	L50.5	S235	M16	5.6	1.69	0	174	1.6	0.42	26.5	37.7	30.3	31.7	0.72	0.59	
492	Pootverband	Enkele staaf	L50.5	S235	M16	5.6	2.84	73	292	1.6	0.00	12.4	37.7	30.3	31.7	0.72	0.13	
491	Pootverband	Kniksteun en verticale steun	L50.5	S235	M16	5.6	3.59	0	237	1.6	0.45	14.2	37.7	30.3	31.7	0.54	0.86	
490	Pootverband	Enkele staaf	L60.5	S235	M16	5.6	3.14	57	267	1.6	0.00	17.3	37.7	32.0	60.5	1.05	0.09	
475	Tussenschot	Kniksteun en verticale steun	L60.5	S235	M16	5.6	5.48	0	299	1.6	0.69	12.3	37.7	32.0	60.5	0.81	0.88	
474	Tussenschot	Kruisende staaf halverwege	L100.50.6	S235	M16	5.6	7.87	0	370	0.3	0.98	15.2	37.7	36.4	38.0	3.24	0.30	
446	1e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.46	0	168	8.9	0.37	24.9	20.2	27.7	38.9	0.57	0.64	
440	1e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	2.00	47	230	8.9	0.00	16.0	20.2	27.7	38.9	0.57	0.55	
428	1e tussenstuk	Enkele staaf	L50.5	S235	M12	5.6	2.99	0	307	8.9	0.75	11.4	20.2	27.7	44.6	0.72	1.04	Bending
441	1e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.98	38	227	8.9	0.00	16.3	20.2	27.7	38.9	0.57	0.55	
434	1e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.92	45	221	8.9	0.00	17.0	20.2	27.7	38.9	0.57	0.52	
427	1e tussenstuk	Enkele staaf	L50.5	S235	M12	5.6	3.10	0	319	8.9	0.78	10.7	20.2	27.7	44.6	0.72	1.08	Bending
435	1e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.91	36	219	8.9	0.00	17.2	20.2	27.7	38.9	0.57	0.52	
433	2e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.25	0	144	9.1	0.31	30.2	20.2	27.7	38.9	0.57	0.55	
442	2e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.84	49	211	9.1	0.00	18.1	20.2	27.7	38.9	0.57	0.50	
430	2e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	2.64	0	303	9.1	0.66	10.4	20.2	27.7	38.9	0.57	1.15	Bending
443	2e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.79	58	206	9.1	0.00	18.9	20.2	27.7	38.9	0.57	0.48	
45	2e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.66	51	191	9.1	0.00	21.0	20.2	27.7	38.9	0.57	0.45	
48	2e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	2.32	0	266	9.1	0.58	12.8	20.2	27.7	38.9	0.57	1.01	Bending
44	2e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.60	41	184	9.1	0.00	22.1	20.2	27.7	38.9	0.57	0.45	
346	2e tussenstuk	Kruisende staaf halverwege	L100.50.6	S235	M16	5.6	6.80	0	320	9.1	0.85	19.4	37.7	36.4	38.0	3.24	0.47	
436	2e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.77	46	203	9.1	0.00	19.2	20.2	27.7	38.9	0.57	0.47	
429	2e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	2.78	0	319	9.1	0.70	9.6	20.2	27.7	38.9	0.57	1.21	Bending
437	2e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.75	37	201	9.1	0.00	19.5	20.2	27.7	38.9	0.57	0.47	
56	2e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.71	51	196	9.1	0.00	20.1	20.2	27.7	38.9	0.57	0.45	
59	2e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	2.37	0	272	9.1	0.59	12.4	20.2	27.7	38.9	0.57	1.04	Bending
55	2e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.65	42	190	9.1	0.00	21.1	20.2	27.7	38.9	0.57	0.45	
80	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.49	52	171	7.9	0.00	24.3	20.2	27.7	38.9	0.57	0.39	
83	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	2.02	0	232	7.9	0.51	15.8	20.2	27.7	38.9	0.57	0.88	
79	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.42	42	163	7.9	0.00	25.8	20.2	27.7	38.9	0.57	0.39	
78	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.25	51	144	7.9	0.00	30.2	20.2	27.7	38.9	0.57	0.39	
82	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.76	0	202	7.9	0.44	19.3	20.2	27.7	38.9	0.57	0.77	
77	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.19	41	137	7.9	0.00	32.0	20.2	27.7	38.9	0.57	0.39	
76	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.13	53	130	7.9	0.00	33.9	20.2	27.7	38.9	0.57	0.39	
81	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.53	0	176	7.9	0.38	23.4	20.2	27.7	38.9	0.57	0.67	
75	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.06	43	122	7.9	0.00	36.2	20.2	27.7	38.9	0.57	0.39	
96	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.50	52	172	7.9	0.00	24.0	20.2	27.7	38.9	0.57	0.39	
99	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	2.06	0	237	7.9	0.52	15.3	20.2	27.7	38.9	0.57	0.90	
95	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.43	42	164	7.9	0.27	25.6	20.2	27.7	38.9	0.6	0.47	
94	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.26	50	145	7.9	0.20	29.9	20.2	27.7	38.9	0.6	0.39	
98	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.80	0	207	7.9	0.45	18.7	20.2	27.7	38.9	0.6	0.79	
93	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.21	40	139	7.9	0.23	31.4	20.2	27.7	38.9	0.6	0.41	
92	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.05	46	120	7.9	0.18	36.8	20.2	27.7	38.9	0.6	0.39	
97	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.60	0	183	7.9	0.40	22.1	20.2	27.7	38.9	0.57	0.70	
91	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	1.01	37	116	7.9	0.00	38.0	20.2	27.7	38.9	0.57	0.39	
90	3e tussenstuk	Enkele staaf	L45.5	S235	M12	5.6	0.96	42	110	7.9	0.00	39.9	20.2	27.7	38.9	0.57	0.39	

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Knikverkorters adjusted construction (verbouw)

Date: 2020-12-01
Author: Muhammed Khan
Version: 1.8

KIJ-GT

S+6
10

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness (-)	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Block Tearing Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type	Mitigation
428	1e tussenstul	Enkele staaf	**L65.6**	**S355**	M12	**8.8**	2.99	0	236	**8.9**	**0.97**	29.6	32.3	45.2	181.1	2.20	0.44		Profile exchanged
427	1e tussenstul	Enkele staaf	**L65.6**	**S355**	M12	**8.8**	3.10	0	244	**8.9**	**1.01**	28.0	32.3	45.2	181.1	2.20	0.46		Profile exchanged
430	2e tussenstul	Enkele staaf	**L55.6**	**S355**	M12	**8.8**	2.64	0	246	**9.1**	**0.86**	23.1	32.3	45.2	134.1	1.56	0.55		Profile exchanged
48	2e tussenstul	Enkele staaf	**L50.5**	**S355**	M12	**8.8**	2.32	0	238	**9.1**	**0.75**	18.6	32.3	37.7	92.1	1.08	0.70		Profile exchanged
429	2e tussenstul	Enkele staaf	**L60.6**	**S355**	M12	**8.8**	2.78	0	238	**9.1**	**0.9**	26.8	32.3	45.2	157.6	1.9	0.48		Profile exchanged
59	2e tussenstul	Enkele staaf	**L50.5**	**S355**	M12	**8.8**	2.37	0	244	**9.1**	**0.8**	18.0	32.3	37.7	92.1	1.1	0.71		Profile exchanged
6001	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.55	0	159	**8.9**	0.50	34.1	60.3	43.6	51.0	1.08	0.46		Profile added
6002	2e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.36	0	140	**9.1**	**0.4**	40.7	60.3	43.6	51.0	1.1	0.41		Profile added
6003	2e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.20	0	123	**9.1**	0.39	47.7	60.3	43.6	51.0	1.08	0.36		Profile added
6004	2e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.20	0	123	**9.1**	**0.39**	47.7	60.3	43.6	51.0	1.08	0.36		Profile added
6005	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.55	0	159	**8.9**	0.50	34.1	60.3	43.6	51.0	1.08	0.46		Profile added
6006	1e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.55	0	159	**8.9**	0.50	34.1	60.3	43.6	51.0	1.08	0.46		Profile added
6007	2e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.40	0	144	**9.1**	0.46	39.2	60.3	43.6	51.0	1.08	0.42		Profile added
6008	2e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.40	0	144	**9.1**	0.46	39.2	60.3	43.6	51.0	1.08	0.42		Profile added
6009	2e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.23	0	126	**9.1**	**0.40**	46.3	60.3	43.6	51.0	1.08	0.37		Profile added
6010	2e tussenstul	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.23	0	126	**9.1**	**0.40**	46.3	60.3	43.6	51.0	1.08	0.37		Profile added

Comment

1) Pos numbers 6001 to 6010 are new added redundants

APPENDIX D ANCHOR CHECKS AND OTHER CALCULATIONS

ANCHORS S+6 II

The tower is connected to the pile cap of the foundation via anchor rods.

Anchors

The tower legs are connected to the foundation with a foot plate 320x520x38 mm and four anchor rods with diameter 38 mm. The thickness and dimensions have been verified by field investigation[1].

The anchor rods are connected to a horizontal rod "schieter" which allows for distribution of the tensile force to the concrete.

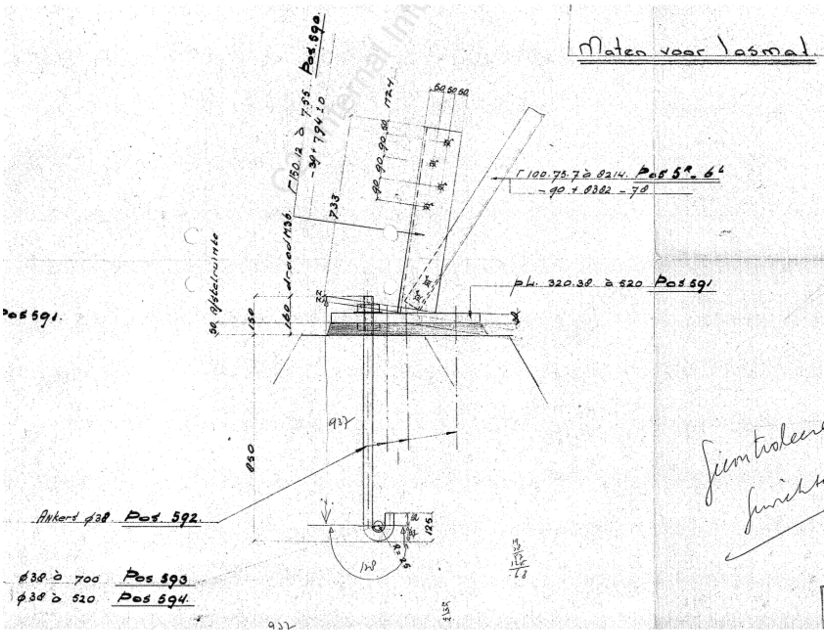

Figure 1 Anchor detail

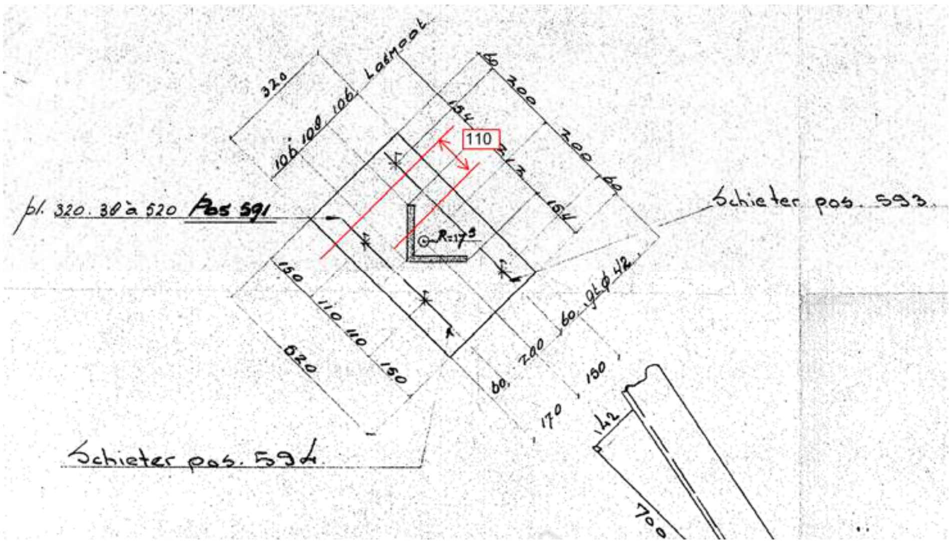

Figure 2 Foot plate with schematisation of effective width and leverage arm

[1] Rapport Bejan Bouw en Betontechniek d.d. 4-11-2020; 200152A-003 Krimpen aan den IJssel - Geertruidenberg v1.0.pdf

Loads

The loads coming from the tower are based on S+6 II structure number 10 in wind zone II and can be seen in Table 1.

Table 1 Foundation loads wind zone II for tower 10

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_45	158	141	**855**	12	-211	-40	872
Max. tension	ULS 1a_0,9_0,9_45	121	104	**-671**	-12	159	25	-684
Max. pos. torsie	ULS 5a Ba 21	-28	22	1	**35**	-4	-4	1
Max. neg. torsie	ULS 5a Ba 10	-28	-22	1	**-35**	-4	-4	1
Comb. tension+torsie	ULS 1a_0,9_0,9_45	121	104	**-671**	**-12**	159	25	-684

Foot plate and anchors

The strength of the foot plate will be determined with the eccentricity of 110 mm shown in Figure 2. The effective width is equal to half of the foot plate, 160 mm.

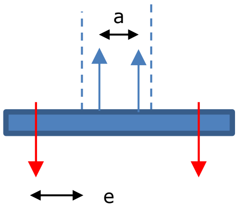

Figure 3 Scheme for check of foot plate

e: 110 mm

In the spreadsheet the anchor bolts and foot plate have been checked. The concrete strength is assumed to be equal or more than C20/25. This assumption is higher than what would be derived for old designation K225 but has been verified with concrete cylinder tests. Refer to aforementioned investigation. The foot plate is embedded in concrete. The anchor bolts will not be loaded by bending.

Check

See output of spreadsheet: the anchor fulfills the requirement, but the foot plate has insufficient capacity:

Tower 35: U.C. = 168 / 123 = 1,36 ≥ 1,00 Not ok

The foot plate needs to be strengthened. This can be done with additional vertical stiffeners that will be positioned to the tower leg. See Figure 4.

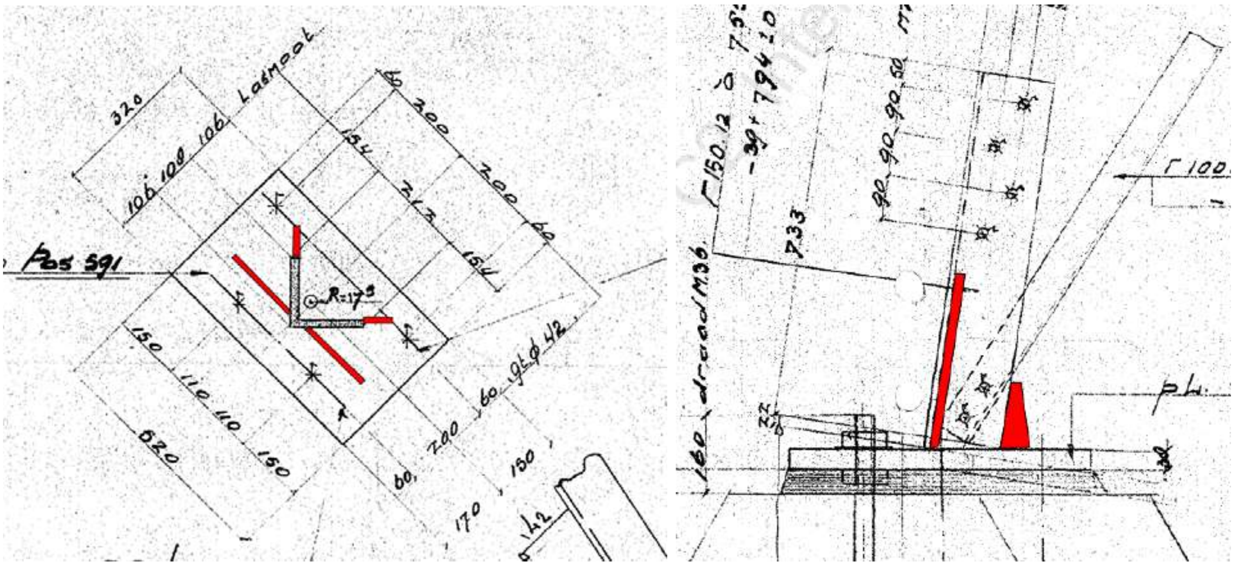

Figure 4 Stiffeners

For the detail-engineering the loads for tower 10 for verbouw load should be used.

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Project: Krimpen - Geertruidenberg 380 | Date: 30-11-2020 | Version: 2.6

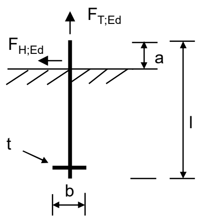
Anchors

NEN-EN 1992-1-1 and 1993-1-8 with NA
CUR-BmS 10

Subject:	**S+6 II**	**Checks:**		
		Anchor bolt to tension	1,36	**not OK**
		Anchor bolt to shear	0,64	**OK**
		Dowel ("schieter")	1,07	**not OK**

Inputs

Anchor diameter		**M38**	
Achor quality		**4.6**	
Thread		Cut	
Anchor length	l =	900	mm
Anchor length above concrete	a =	110	mm



Load on anchor group

T: the external tension force on the anchor group

Tension force	T =	**673**	kN
Shear force	$F_{H,Ed}$ =	**211**	kN
Number of anchors for tension		4	
Number of anchors for shear		4	
$F_{T;Ed} = T / n$ =		168,3	kN
$F_{v;Ed} = F_{H,Ed} / n$ =		52,8	kN

Anchor properties

d_b =	38,00	mm
$A_{b;s}$ =	910	mm^2
f_{yb} =	240	N/mm^2
f_{ub} =	400	
γ_{Mb}	1,25	-
$\alpha_{red;2}$	0,85	-
$\alpha_b = 0,44 - 0,0003 f_{yb}$ =	0,37	-

Capacity per anchor

$F_{T;Rd} = 0,9\alpha_{red;2} f_{ub} A_s / g_{M2}$ =	**200,6**	kN
$F_{v;Rd} = \alpha_b f_{ub} A_s / g_{Mb}$ =	**82,0**	kN

Foot plate

$F_{t,Rd}$: the tensile force in the anchors when yielding of foot plate is reached.

Steel material		**S235**	
Thickness	t =	38	mm
Width	b_{ef} =	160	mm
Leverage arm	m =	110	mm
$M_{pl,Rd} = 1/4 b_{ef} t_p^2 f_{yd}$ =		13,6	kNm
$F_{t,Rd} = M_{pl,Rd} / m$ =		123,4	kN

Check of dowel ("schieter")

$$\frac{\sigma_b'}{f_{cd}} = \frac{30,4}{40,0} = 0,76 \quad \text{OK}$$

$$\frac{F_{T,Ed}}{F_{v;Rd}} = \frac{168}{157} = 1,07 \quad \text{not OK}$$

Capacity of concrete

Concrete strength	**C20/25**	
f_{ck} =	20	N/mm^2
k_b =	3	-
γ_{Mc} =	1,5	-
$f_{cd} = f_{ck} k_b / \gamma_{Mc}$ =	40	MPa

Dowel

Diameter	d_S =	**38**	mm
Length	b =	**220**	mm
Spread	$c = t\sqrt{(f_{yd} / 3f_{jd})}$ =	54	mm
Effective length	$b_{eff} = \min(b; d+2c)$	145	mm
Cross section	$A_S = \pi/4\ d_S^2$ =	1134	mm^2
Distributed load	$q = F_{T,Ed} / b_{eff}$ =	1157	kN/m
Concrete pressure	$\sigma_b' = q / d_S$ =	30,4	MPa
Shear stress in dowel			
Load	$F_{T,Ed}$ =	168	kN
Allowable	$F_{v,Rd} = f_{yd} / \sqrt{3} \times A_s$ =	157	kN

Capacity of foot plate

$$\frac{F_{T,Ed}}{F_{t;Rd}} = \frac{168,3}{123,4} = 1,36 \quad \text{not OK}$$

Capacity of anchor for tension

$$\frac{F_{T,Ed}}{F_{T;Rd}} = \frac{168,3}{200,6} = 0,84 \quad \text{OK}$$

Check foot plate for tension

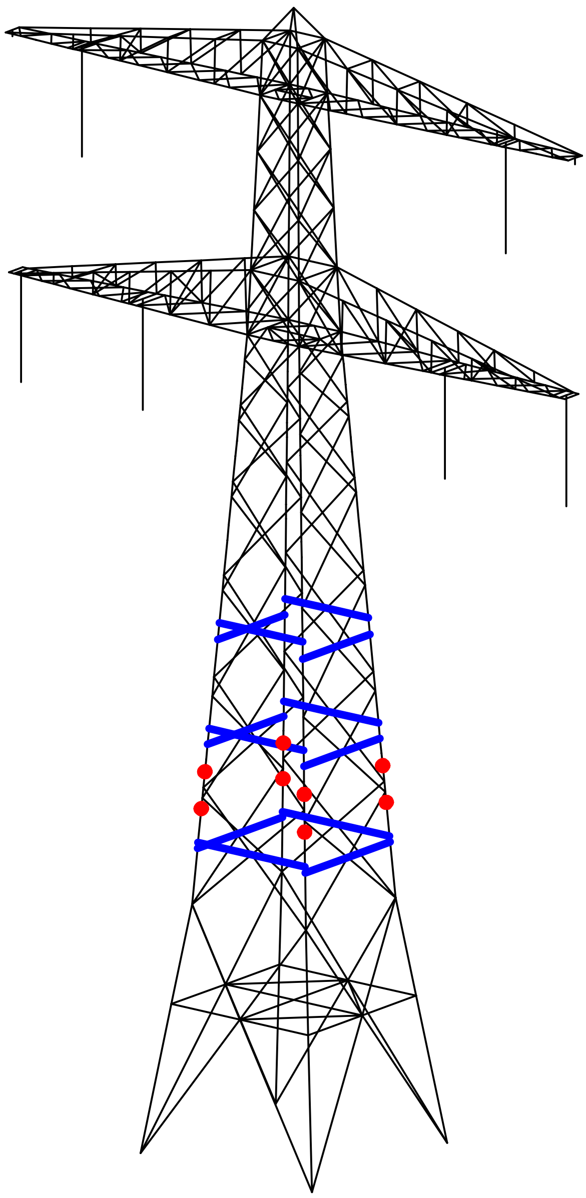
$$\frac{T}{n \times F_{t;Rd}} = \frac{673,0}{493,6} = 1,36 \quad \text{not OK}$$

Check anchor for shear

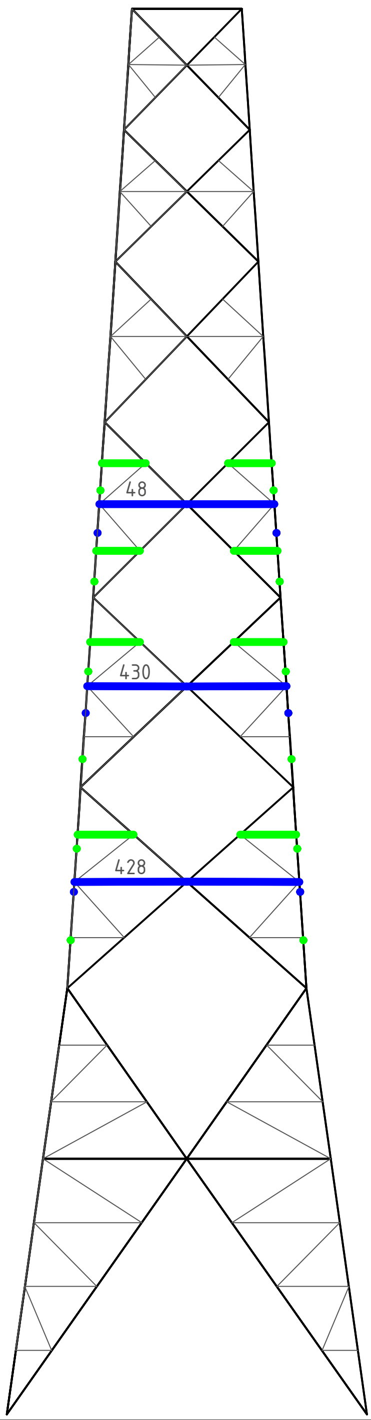
$$\frac{F_{v,Ed}}{F_{v;Rd}} = \frac{52,8}{82,0} = 0,64 \quad \text{OK}$$

APPENDIX E DRAWINGS

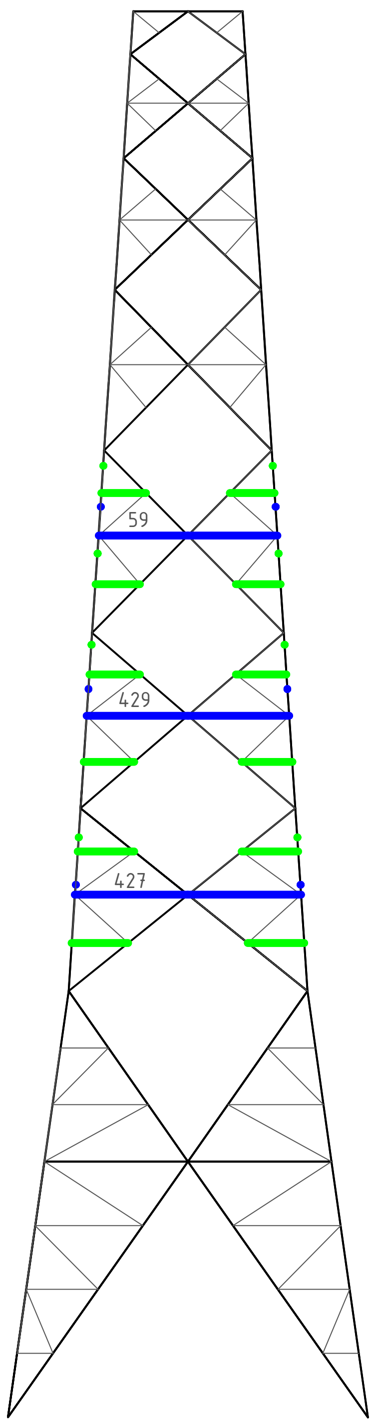
Initial Profiles and Bolts					Final Profiles and Bolts			
Group label	Profile type (ini)	Profile size (ini)	Steel quality (ini)	Bolt size and quality (ini)	Profile type (new)	Profile size (new)	Steel quality (new)	Bolt size and quality (new)
427	EA	L50x5	S235 t<=40	M12-5.6t-NEN2012	EA	L65x6	S355 t<=40	M12-8.8t-NEN2012
428	EA	L50x5	S235 t<=40	M12-5.6t-NEN2012	EA	L65x6	S355 t<=40	M12-8.8t-NEN2012
429	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L60x6	S355 t<=40	M12-8.8t-NEN2012
430	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L55x6	S355 t<=40	M12-8.8t-NEN2012
48	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L50x5	S355 t<=40	M12-8.8t-NEN2012
59	EA	L45x5	S235 t<=40	M12-5.6t-NEN2012	EA	L50x5	S355 t<=40	M12-8.8t-NEN2012



Overview



Front view



Side view

Notes and legend:

- New redundants according to drawing
- Size for new redundants is L50x50x5
- Other changes according to the table
- All changes are symmetrical unless otherwise indicated
- Material quality t = 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

Profile exchanged
New redundant
Bolt exchanged

01	25-11-2020	Version 2.0 - Profile exchange added
00	22-4-2020	Version 1.0

DNV·GL

Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-004

Design state: FINAL | Scale: -

Drawn by: MuK 25-11-2020 | Units: m

Checked by: TBR 25-11-2020 | Project no: 10166260

Approved by: JHu 25-11-2020 | Company: TenneT

Description: Modifications overview for mast type S+6 Mast 10

Revision: 01

Format: A2

DNV GL Energy & Sustainability, Utrechtseweg 310, 6812 AR Arnhem, tel: +31 26 3 56 91 11, www.dnvgl.com

OVER DNV GL

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Bijlage 18 Rapportage Mastconstructie S+95 & S+95 T

DNV·GL

"TOETSING EN HERONTWERP MASTEN EN FUNDATIES BBB380"

KIJ-GT380 – Rapportage mast S+95 & S+95T

TenneT TSO B.V.

Meridian doc. nr.: 002.589.40 0916506
Rapport nr.: 21-1095 Rev.0
Datum: 2021-07-06

Projectnaam:	"Toetsing en herontwerp masten en fundaties BBB380"	DNV GL - Energy
		Energy Advisory
Rapport titel:	KIJ-GT380 – Rapportage mast S+95 & S+95T	Postbus 9035
Klant:	TenneT TSO B.V.	6800 ET ARNHEM
Contactpersoon:	[redacted]	
Datum:	2021-07-06	
Project nr.:	10166260	[redacted]
Organisatie unit:	TDT	[redacted]
Meridian doc.nr.:	002.589.40 0916506	
Rapport nr.:	21-1095 Rev.0	

Geschreven door: Beoordeeld door: Goedgekeurd door:

[redacted]

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☒ Geen distributie (vertrouwelijk)

Trefwoorden:

Versie	Datum	Reden voor uitgave	Auteur	Beoordeeld	Goedgekeurd
0	2021-07-06	Eerste uitgave	[redacted]		

DNV GL Netherlands B.V.

Inhoud

1 INLEIDING

1.1 Inleiding

Om in de toekomst meer elektriciteit te kunnen transporteren is het noodzakelijk om naast de nieuwbouw van verbindingen bestaande hoogspanningsverbindingen aan te passen zodat er een grotere transportcapaciteit mogelijk wordt gemaakt.

Om die reden is de opdrachtgever (OG) voornemens de bestaande 380 kV-koppelnetring op te waarderen. Het opwaarderen van de bestaande verbindingen valt onder het programma "Beter benutten bestaande 380 kV-ring" en omvat de volgende deelprojecten:

- Opwaardering 380 kV-verbinding Lelystad – Ens (LLS-ENS380)
- Opwaardering 380 kV-verbinding Diemen – Lelystad (DIM-LLS380)
- Opwaardering 380 kV-verbinding Rilland – Zandvliet (RLL-ZVL380)
- Opwaardering 380 kV-verbinding Krimpen aan den IJssel - Geertruidenberg (KIJ-GT380)
- Opwaardering 380 kV-verbinding Ens - Zwolle (ENS-ZL380)
- Opwaardering 380 kV-verbinding Maasbracht - Eindhoven (MBT-EHV380)

Om te komen tot een DO waarmee de werkzaamheden kunnen worden gestart is door TenneT aan DNV GL opdracht verstrekt voor de volgende onderdelen:

1. In eerste fase het opstellen en creëren van:

1.1 E-studie deel 1

1.2 Uitgangspuntenrapporten ten behoeve van de constructieve analyse van masten en fundaties

1.3 Sonderingmodellen

1.4 Fundatiemodellen

1.5 Mastmodellen

2. In tweede fase de uitvoering van de DO-fase bevattende:

2.1 Toetsing conform het uitgangspuntenrapport van de bestaande fundaties

2.2 Globale specificatie van benodigde fundatieversterkingen ten behoeve van aanbesteding

2.3 Toetsing conform het uitgangspuntenrapport van de bestaande masten

2.4 Globale specificatie van benodigde mastversterkingen ten behoeve van aanbesteding

2.5 E-studie deel 2

In deze studie wordt voor de lijn Krimpen aan den IJssel - Geertruidenberg de controle van de mastconstructie van masttypen S+95 en S+95T gerapporteerd.

Inhoudelijk is de Nederlandse versie van de rapportage ongewijzigd ten opzichte van de Engelse versie. Om deze reden zijn de bijlagen in dit rapport één op één overgenomen uit de Engelse versie. Hierdoor wijkt het revisienummer van de bijlagen af van het revisienummer van de rapportage. Bijlage G is nieuw toegevoegd.

1.2 Doelstelling en scope van dit rapport

Het doel van deze studie is om te bepalen of de in dit rapport beschreven bestaande mast geschikt is om te worden uitgerust met de ACCCZ-Warsaw geleider.

Nadat de wijzigingen zijn toegepast dient aantoonbaar geverifieerd te worden dat het systeem voldoet aan de vigerende eisen.

1.3 Relatie overige documenten

1.3.1 Verificatie & validatie plan

De door TenneT aangeleverde set met eisen is beoordeeld op relevantie en voor de relevante eisen is aangegeven in welk document wordt aangetoond dat er aan de eis wordt voldaan. De resultaten hiervan zijn opgenomen in het rapport "Verificatie & Validatieplan 380 kV verbinding Krimpen aan den IJssel - Geertruidenberg" [1].

1.3.2 E-studie deel 1

In de rapportage "KIJ-GT380 - E-studie deel 1" [2] is bepaald welke aanpassingen benodigd zijn om de ACCCZ Warsaw geleider toe te passen binnen de verbinding Krimpen aan den IJssel - Geertruidenberg. Uit de E-studie volgen geen zaken die relevant zijn voor de constructie van masttype S+95.

1.3.3 Uitgangspunten rapport

De uitgangspunten op basis waarvan de berekeningen in deze rapportage zijn uitgevoerd zijn opgenomen in het rapport "Uitgangspuntenrapport 380kV verbinding Krimpen aan den IJssel - Geertruidenberg" [3]

1.3.4 Haalbaarheidsstudie

De eerste controleberekening van dit masttype toonde dat met de gangbare eisen vanuit het PVE-lijnen een groot aantal verzwaringen benodigd zou zijn. De omvang en de uitvoerbaarheid daarvan was de reden om een haalbaarheidsstudie uit te voeren naar de mogelijke alternatieve oplossingen voor dit masttype. De resultaten zijn in onderstaand document beschreven:

- DNV GL 20-1581 20-1581 DNV GL TenneT memo rev.3 PVA S+95

1.3.5 Documenten TNO

Voortvloeiend uit de haalbaarheidsstudie heeft TNO twee studies uitgevoerd die gerelateerd zijn aan de kruisingsmasten van KIJ-GT. De eerste studie bevat een risicobeoordeling over de toepassing van gevolgklasse CC2-0 in combinatie met een referentieperiode van 15 jaar in plaats van 30 jaar in de nabijheid van stedelijk gebied. De tweede studie gaat over de toepassing van de windrichtingsfactor c_{dir}:

- TNO 20210 R10305 Beoordeling individueel risico draagmasten Lekkruising;
- TNO 20210 M10197 Briefrapport Toepassing van windrichtingsafhankelijke stuwdruk (cdir).

Deze zijn als Appendix bij dit rapport gevoegd.

2 EISEN

In onderstaande Tabel 1 zijn de eisen opgenomen die binnen deze rapportage worden getoetst.

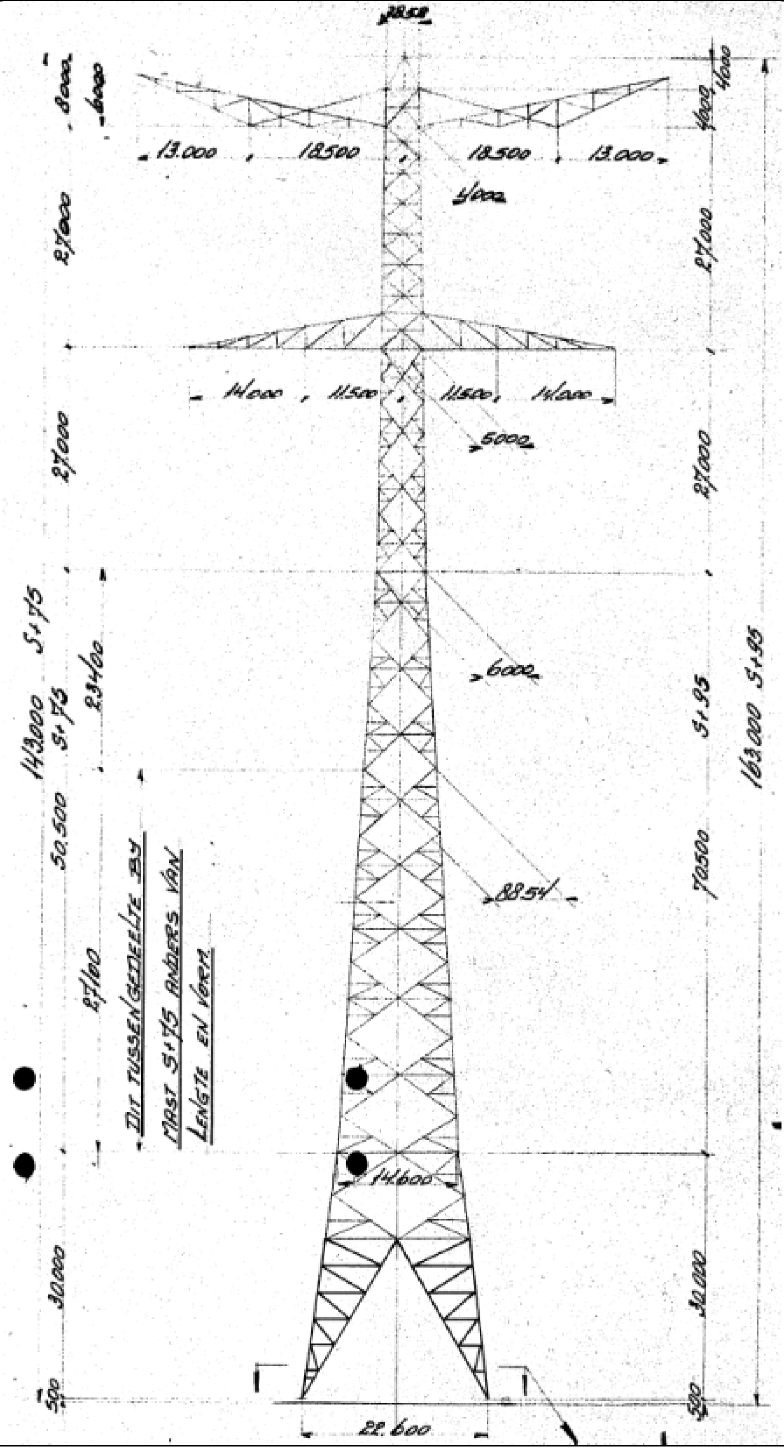
Tabel 1 Relevante eisen

Eis Id	Titel	Eis Tekst	Bewijsvoering
BO Eis: H2.7-6	Omgeving, beperkings factoren	Het ontwerp dient geverifieerd te worden op de uitvoerbaarheid.	Tabel 6
PVE.05.001 5.14	Masten	Aanwijzingen t.a.v. klimvoorziening en valbeveiliging: Huidige klimweg blijft gehandhaafd en zal voldoen aan de eisen zoals opgenomen in de NEN 1060:1977. Valbeveiliging is/zal worden uitgevoerd in het type "latch way". Indien staaldelen in de nabijheid (aangrenzend profiel) van de klimweg gewijzigd worden, dient geverifieerd te worden dat de klimvoorziening in overeenstemming is met de NEN 1060:1977.	Tabel 6

3 BEREKENINGEN

3.1 Mastbeeld

Het mastbeeld op basis van de Asset-data is weergegeven in Figuur 3-1.



Figuur 3-1 Mastbeeld

	
Mast 12	*Mast 13*
	
Detail INP-profielen	*Overgang van INP naar XEA-kruisvormig profiel*

Figuur 3-2 Afbeeldingen van mast 12 en 13

3.2 Mastenlijst

In deze rapportage worden masttypen S+95 en S+95T getoetst. De geometrie en de constructie van de masttypen S+95 en S+95T komen met elkaar overeen, alleen beschikt de mast van het type S+95T over een extra telecominstallatie.

Bij de masten is rekening gehouden met verhoogde windbelasting als gevolg van een hogere aangrenzende mast (hoger is een negatieve waarde). De wind en weight span van de verschillende masten zijn in Tabel 2 weergegeven.

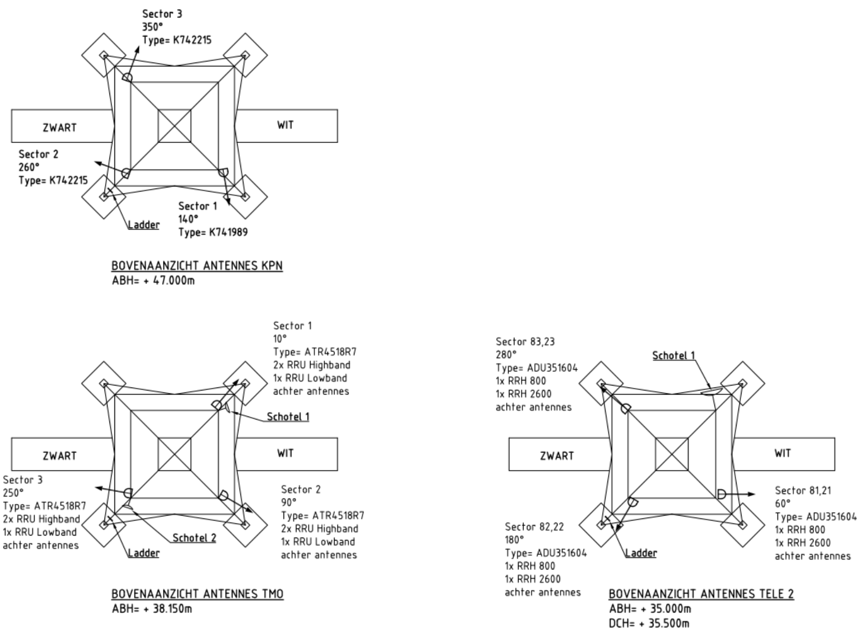
Tabel 2 Mastnummers

Mastnummer	Masttype	Maatgevend mastnummer	Wind span (m)	Weight span (m)	Hoogteverschil
12	S+95	12	573	1166	77.1
13	S+95T	13	647	1012	64.7

3.3 Telecominstallatie

Mast 13 bevat meerdere telecominstallaties. Installaties van TMO, KPN en Tele2 zijn aanwezig op hoogtes van 35,0, 38,15 en 47 m en bestaan uit drie antennes, op elke stijl één.

Het exacte gewicht en wind oppervlak zijn niet te herleiden uit de asset-gegevens. Een redelijke schatting is uitgevoerd; doordat de providers relatief laag in de constructie aanwezig zijn is de invloed op de uitkomst van de berekening zeer beperkt. In Figuur 3-3 is de positie aangegeven.



Figuur 3-3 Telecominstallatie mast 13

3.4 Uitgangspunten berekening

De berekening is uitgevoerd op basis van de uitgangspunten zoals opgenomen in het uitgangspuntenrapport [3]. Hierin is een volledig overzicht opgenomen van de belastingcombinaties en toegepaste belastingfactoren.

Voor masttype S+95 is de referentieperiode gereduceerd van 30 jaar naar 15 jaar[1] om een betere overeenkomst te krijgen met de betrouwbaarheid van het oorspronkelijke ontwerp.

Tabel 3 Uitgangspunten berekening

Algemeen	Norm	NEN-EN50341-2-15:2019
	Windgebied	II
	Terreincategorie	II (onbebouwde omgeving)
	Reductiefactor cdir	1,00
Situatie initieel	Gevolgklasse	CC2-0
	Betrouwbaarheidsniveau	Afkeur CC2-0
	Referentieperiode	15 jaar
Situatie na aanpassingen	Gevolgklasse	CC2
	Betrouwbaarheidsniveau	Verbouw
	Referentieperiode	50 jaar

3.5 Proces stappen

Het proces van het bepalen van eventueel benodigde verstevigingen bestaat uit de volgende stappen:

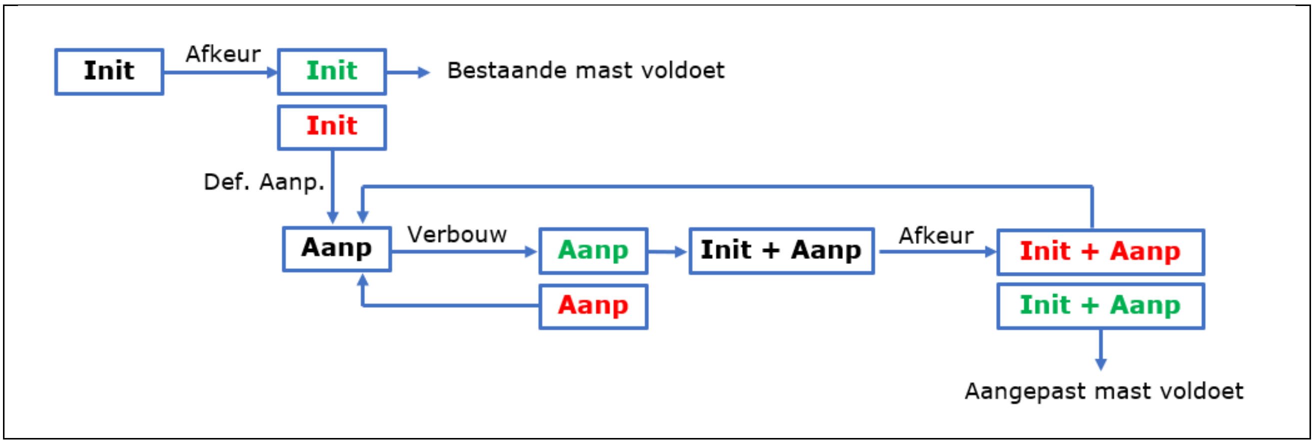
Stap 1: Toets bestaande (Init) mast op Afkeur

Stap 2: Definiëren benodigde aanpassingen indien initiële mast niet voldoet aan toets op Afkeur (Def. Aanp.)

Stap 3: Het toetsen van (alleen) de uitgewerkte aanpassingen (Aanp) op Verbouw

Stap 4: Het opnieuw toetsen van de complete mast inclusief aanpassingen (Initi + Aanp) op Afkeur

Het hierboven omschreven proces is in Figuur 3-4 weergegeven.



Figuur 3-4 Proces diagram

[1] Zie TNO rapport 2021 R10305

3.6 Geleiderbelastingen

De berekening is uitgevoerd met het geleiderbelastingenprogramma van DNV GL. In Appendix A zijn de resultaten van de geleiderbelastingen samengevat.

3.7 Reacties op de fundering

De oplegreacties op de fundering worden ontleend aan de uitvoer van het geleiderbelastingenprogramma, zie ook Appendix A.

3.8 Modellering

Op basis van de as-built tekeningen is de mast in PLS-TOWER ingevoerd en in softwarepakket AxisVM. De hoofdelementen zijn gemodelleerd. Niet-dragende profielen als knikverkorters zijn weggelaten in PLS-TOWER en worden separaat getoetst. De profielen inclusief de boutverbindingen zijn in PLS-TOWER ingevoerd en getoetst.

In AxisVM is detailstudie verricht naar de stabiliteit van de randstijl en naar het effect van benodigde versterkingen en verstijvingen.

De geleiderbelastingen vanuit het geleiderbelastingenprogramma zijn als invoer voor de belastingen gebruikt. De reductiefactor c_{dir} op windbelastingen is niet in de berekening betrokken omdat asymmetrisch versterken van de doorsnede van de randstijl in de constructie niet als wenselijk werd gezien.

Diagonalen in voor- en achtervlak respectievelijk de twee zijvlakken zijn samengenomen in een groep en de toetsing wordt per staafgroep uitgevoerd. In geval dat een element uit een groep is overbelast, geldt dit voor alle elementen uit de betreffende groep. Controle van de schetsplaten en andere detailverbindingen valt buiten de scope.

3.9 Dynamische factor

Conform NEN-EN 50341-2 moet de dynamische factor c_d worden berekend voor masten hoger dan 60m. Aan de hand van AxisVM is de eigenfrequentie van de mast bepaald, waarna de procedure uit NEN-EN 50341-2-15 is gevolgd. Uit de procedure voor de S+95 blijkt er een dynamische factor van 1,02 moet worden toegepast, voor berekening zie Appendix D.

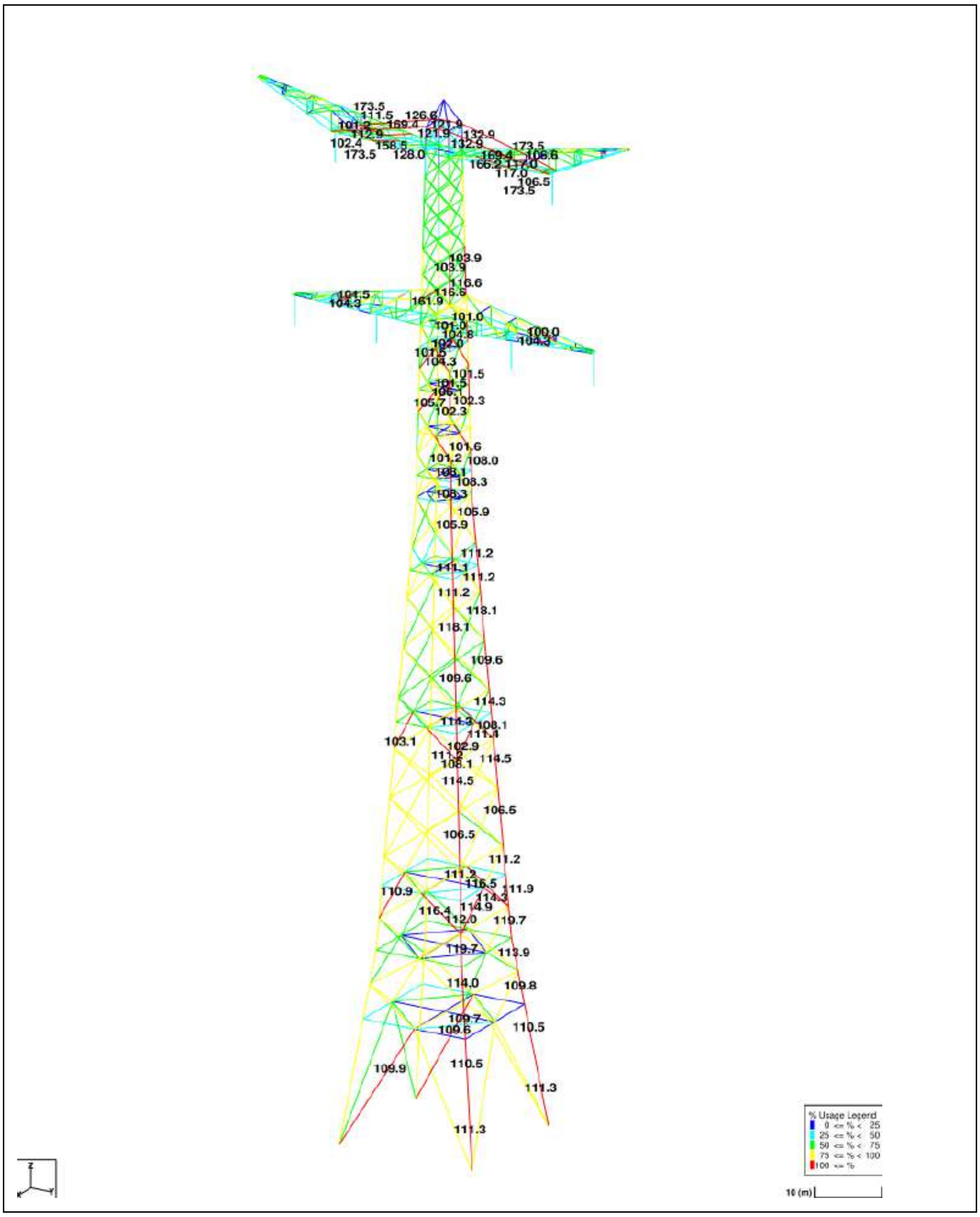
4 TOETSING MAST

4.1 Inleiding

Voor het globale model van de mast is PLS-TOWER gehanteerd. Hierin zijn de gegevens verwerkt die volgen uit de berekeningen aan de stabiliteit van de randstijl (Appendix F) en de sterkte van boutverbindingen (Appendix D). Via aangepaste kniklengte-factoren in PLS-TOWER is de torsieknik-capaciteit ingevoerd. Berekening van mast 12 en 13 is gelijk genomen en gebaseerd op de zwaarst belaste mast 13 (S+95 T).

4.2 Resultaat PLS-TOWER

Het resultaat van de controle van masttype S+95 T met belastingen op afkeurniveau en referentieperiode 15 jaar is weergegeven in Figuur 4-1.



Figuur 4-1 Resultaat PLS-TOWER S+95

De resultaten van de controles van profielen, knikverkorters en ankers randstijl zijn opgenomen in Tabel 4.

Tabel 4 Samenvatting controle

Controle van	Beoordeling		Referentie
Profielen		Voldoen niet	Figuur 4-1 Appendix D
Knikverkorters		Voldoen niet	Appendix C
Ankers en voetplaat	Voldoen		Appendix D

De berekening van masttype S+95 toont aan dat ruime overschrijdingen aanwezig zijn op de sterkte van de constructie. Deze zijn van grotere omvang dan vergelijkbaar masttype S+75. Het verschil wordt toegeschreven aan de locatie van masttype S+95 in windgebied II. De windbelasting op de constructie wordt verder vergroot door de omvang van hulpbordessen en andere onderdelen.

5 AANPASSINGEN

5.1 Inleiding

In dit hoofdstuk worden de mastverzwaringen beschreven die volgen uit de studie, zodat de aangepaste constructie voldoet aan het afkeurniveau en de verzwaarde onderdelen aan verbouwniveau. Voor niet aangepaste onderdelen waar knikverkorters of andere steunen worden toegevoegd, blijft het afkeurniveau van toepassing. Een aantal van de overschrijdingen op de sterkte van de constructie is overeenkomstig met wat bij andere masttypes optreedt. Deze overschrijdingen zijn met de volgende set van maatregelen op te lossen:

- Het lokaal versterken met platen van verbindingen met onvoldoende capaciteit op netto-doorsnede;
- het uitwisselen van diagonalen in boven en ondertraverses, door exemplaren met grotere doorsnede en hogere staalsoort;
- het uitwisselen van bouten in meerdere profielen;
- het uitwisselen van bestaande knikverkorters door exemplaren van zwaarder profiel of grotere boutdoorsnede;
- het versterken van verbindingen tussen kruisende diagonalen en randstijlen in de mast.

De overschrijding op de drukcapaciteit van de randstijl die is gevonden over een groot gedeelte van de hoogte van het mastlichaam is te hoog om op te lossen met het toevoegen van knikverkorters. Dit geldt zeker voor de kruisprofielen uit hoekstaal. Een separate studie is uitgevoerd naar de stabiliteit van de kruisvormige profielen van INP-profiel en hoekstaal en de optimale oplossing om deze te versterken. De studie is opgenomen in Appendix F. De randstijlen van de mast worden op de volgende wijze verzwaard:

- het uitwisselen van bouten voor exemplaren met kwaliteit 8.8;
- het aanbrengen van strippen van 20 of 25 mm dikte op de bestaande flenzen van de randstijlen uit INP- en hoekstaal;
- het toevoegen van kniksteunen waarmee de torsiestabiliteit van de randstijl wordt verhoogd;
- het aanbrengen van koppelplaten tussen de flenzen van de INP-profielen waarmee de torsiestijfheid van het profiel wordt vergroot.

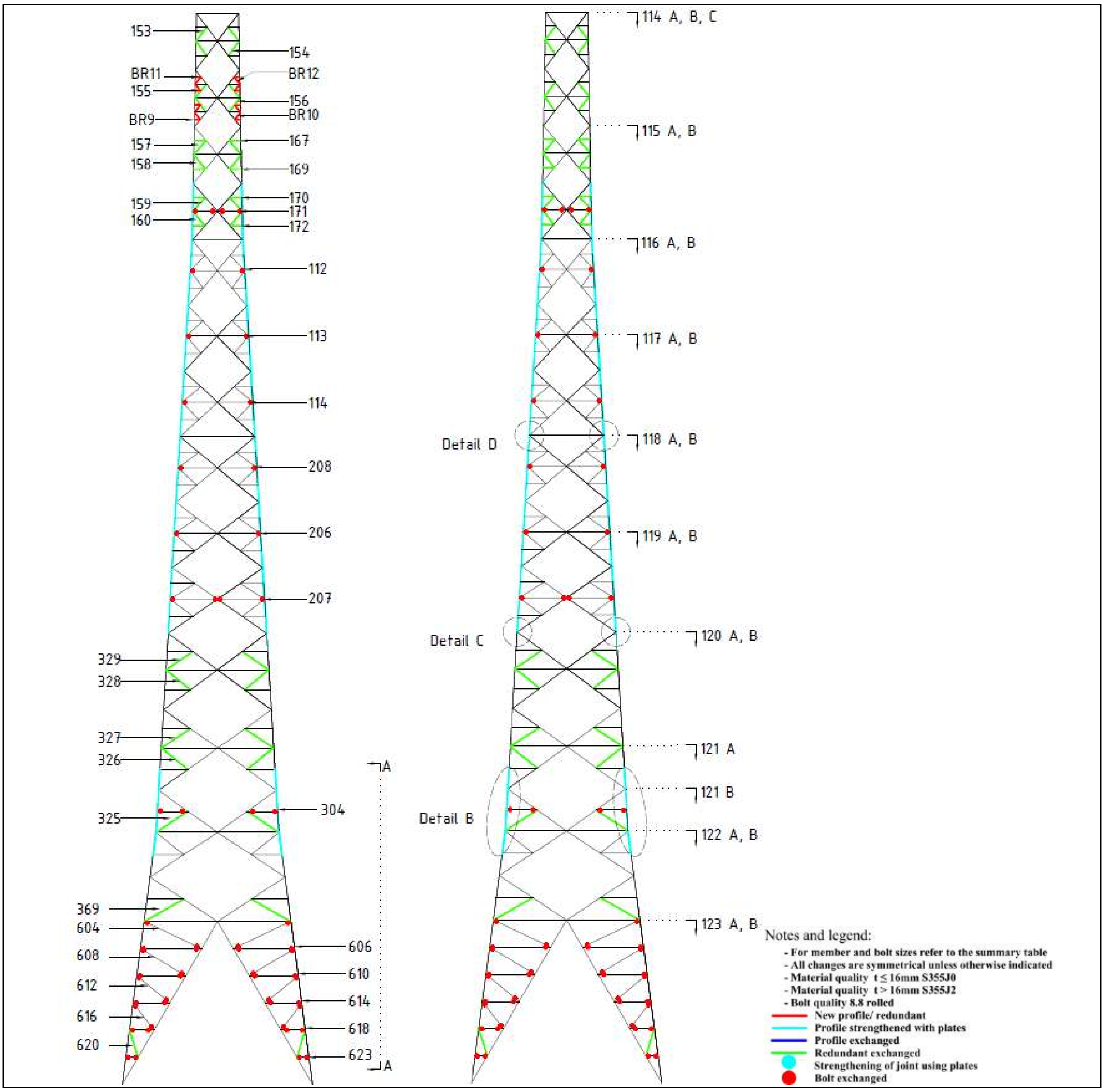
Het betreft een aandachtspunt dat de aanwezigheid van waarschuwingslichten, platforms of andere obstakels het aanbrengen van de aanpassingen kunnen bemoeilijken. Het is noodzakelijk dat er een haalbaarheidsstudie wordt uitgevoerd vóór de uitvoering van dit project.

5.2 Aanpassingen

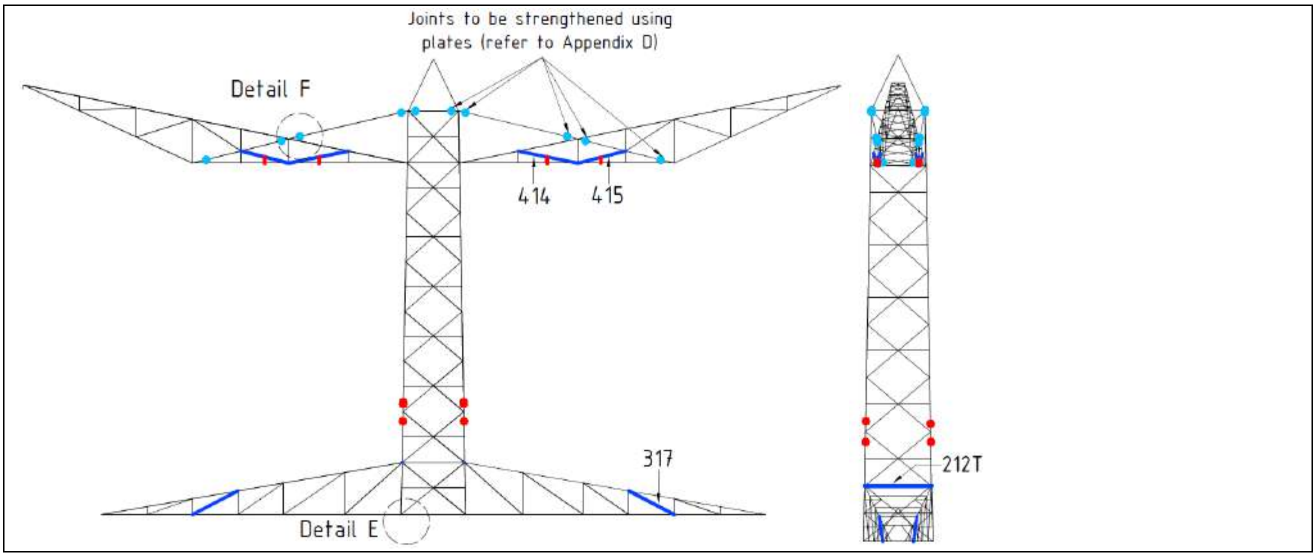
In deze paragraaf wordt nader ingegaan op de voorgestelde verzwaringen aan de constructie.

5.2.1 Overzicht van verzwaringen aan profielen

Conform berekening, zie Appendix B, moet de constructie worden aangepast, zoals weergegeven in Figuur 5-1 en Figuur 5-2 voor de betreffende masten. Voor afmetingen profielen en bouten, zie Appendix E.



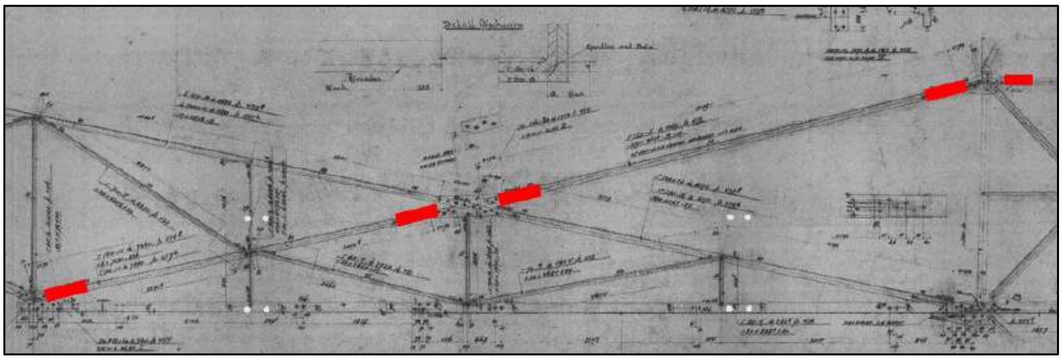
Figuur 5-1 Aanpassingen aan mastlichaam. Voor volledig overzicht zie Appendix E



Figuur 5-2 Benodigde aanpassingen aan de traversen

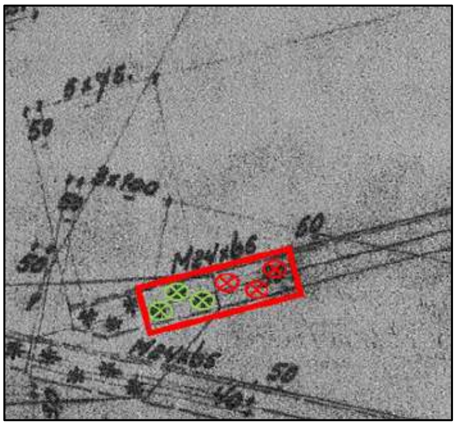
5.2.2 Verhogen capaciteit nettodoorsnede

Voor masttype S+95 is aanpassing benodigd om de trekstaven die de boventraverse aan het mastlichaam verbinden te verzwaren. De aanpassingen zijn nodig om de capaciteit van de netto doorsnede te verhogen door het toevoegen van staalplaten met een dikte van 10 mm. In Figuur 5-3 zijn de posities van de platen weergegeven.



Figuur 5-3 Posities waarvoor een hogere capaciteit benodigd is

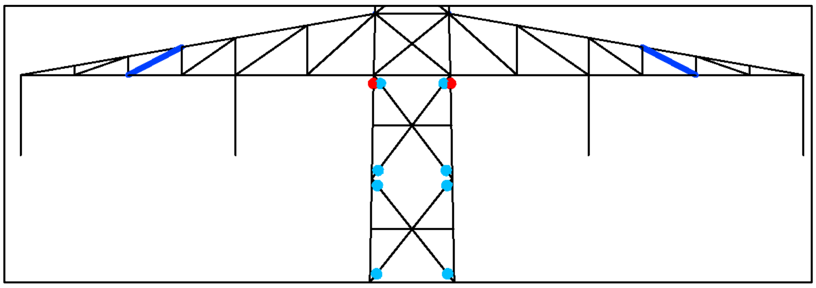
Bij elke verbinding zijn reeds 6 bouten aanwezig, 3 van deze 6 bouten worden gebruikt om de nieuwe plaat aan te verbinden en 3 nieuwe bouten worden toegevoegd. Voor principe, zie Figuur 5-4. De nieuwe bouten zijn in het rood weergegeven en de bestaande bouten in het groen.



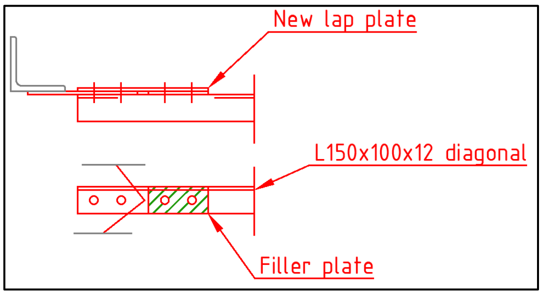
Figuur 5-4 Verbinding van de plaat aan de bestaande staaf

Voor relevante berekening van de sterkte van de platen, zie Appendix D.

Bij een aantal van de diagonalen in het mastlichaam is een gelijksoortige aanpassing vereist aan de kruisende diagonalen in het mastlichaam beneden de ondertraverse. De locaties van deze aanpassingen zijn aangegeven in Figuur 5-5, in Figuur 5-6 is het principe weergegeven.



Figuur 5-5 Aanpassingen diagonalen mastlichaam



Figuur 5-6 Voorstel voor versterken van diagonalen met overlappende verbinding

5.2.3 Versterken van randstijlen

Vanwege de complexiteit van de samengestelde randstijl is met een eindige elementen model de volgende aspecten onderzocht:

- Torsieknikstabiliteit;
- gecombineerde spanningen door buiging en axiaalkracht;
- flexibele ondersteuning van de randstijl vanuit de diagonalen.

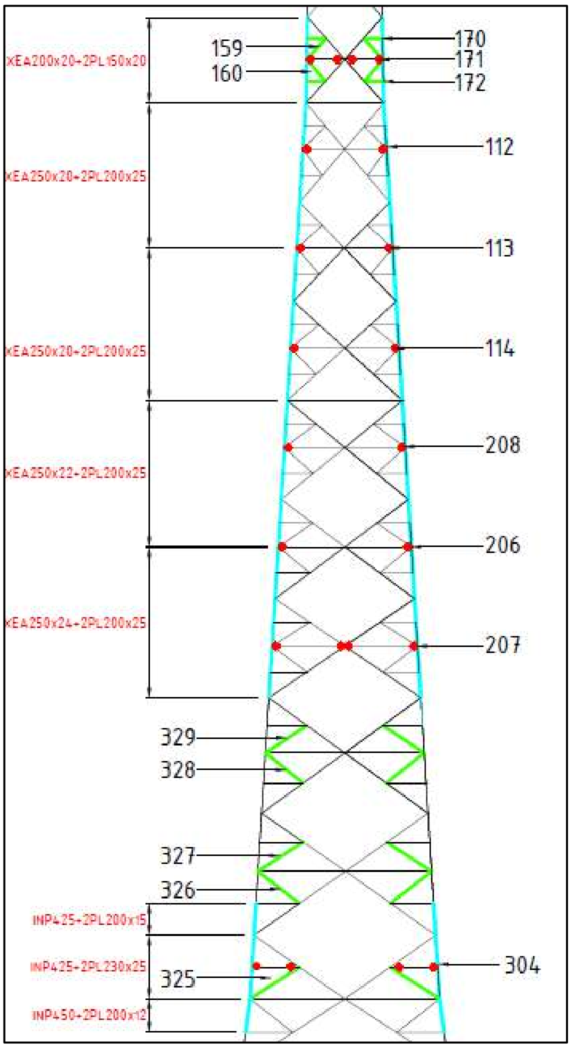
De studie van de AxisVM analyse toont dat de volgende modificaties benodigd zijn:

- versterken van de randstijlen met platen van 20 of 25 mm dikte vanaf de ondertraverse groep 115 tot en met groep 119 en inclusief de groepen 121A, 122A en 122B;
- het aanbrengen van extra diagonale profielen om de randstijl tegen rotatie te steunen;
- het aanbrengen van koppelplaten tussen de flenzen om de torsiestijfheid te verhogen.

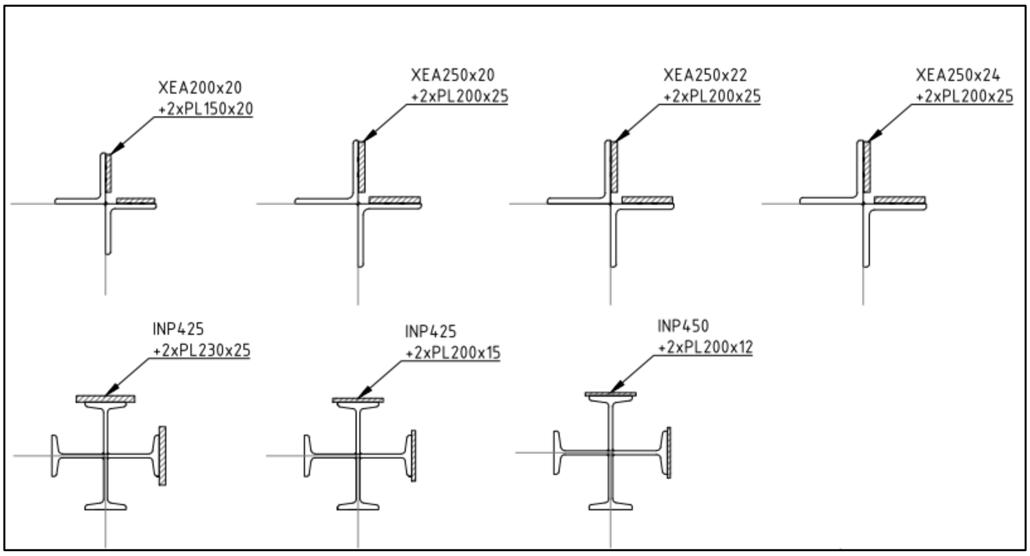
Gedetailleerde informatie is opgenomen in Appendix F.

Knikverkorters moeten minimaal een knikcapaciteit hebben van 1% van de knikcapaciteit van de randstijl. Over een groot gedeelte van de mast hebben de knikverkorters deze sterkte niet. Deze knikverkorters moeten vervangen worden door staven met een grotere doorsnede, omdat de knikcontrole veelal maatgevend is. Zie de groen gekleurde staven in Figuur 5-1 en Figuur 5-7.

De profielen met de platen als versterking zijn weergegeven in Figuur 5-6 en Figuur 5-7. De bestaande doorsnedes die versterkt worden met platen zijn gedimensioneerd op de belasting op basis van verbouwniveau. Hierdoor valt de doorsnede relatief zwaar uit ten opzichte van het relatief geringe tekort bij afkeurniveau.



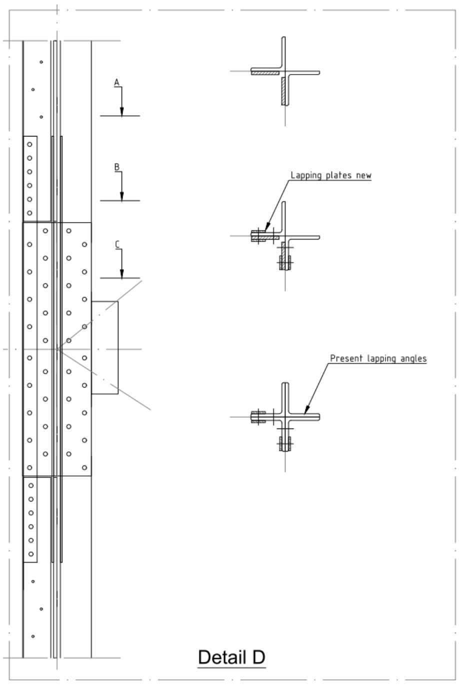
Figuur 5-7 Posities waarvoor een hogere capaciteit benodigd is



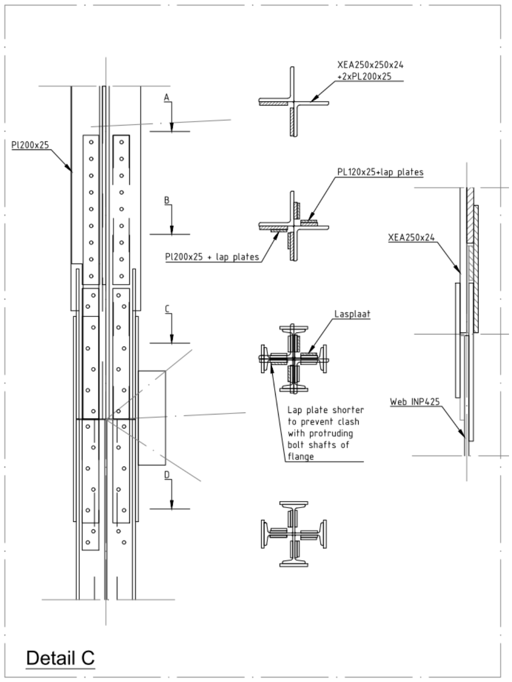
Figuur 5-8 Verzwaarde doorsneden van de randstijl

5.2.4 Verbindingen randstijl

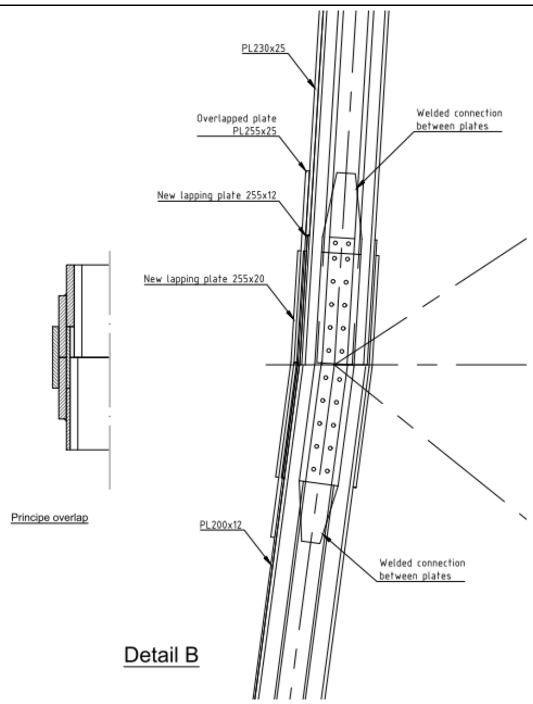
De belangrijkste verbindingen in de randstijl zijn op detailniveau beschouwd om de haalbaarheid (passen) van de verbinding te bepalen. In Appendix D zijn de details nader beschouwd. In Figuur 5-9 zijn de details samengevat.



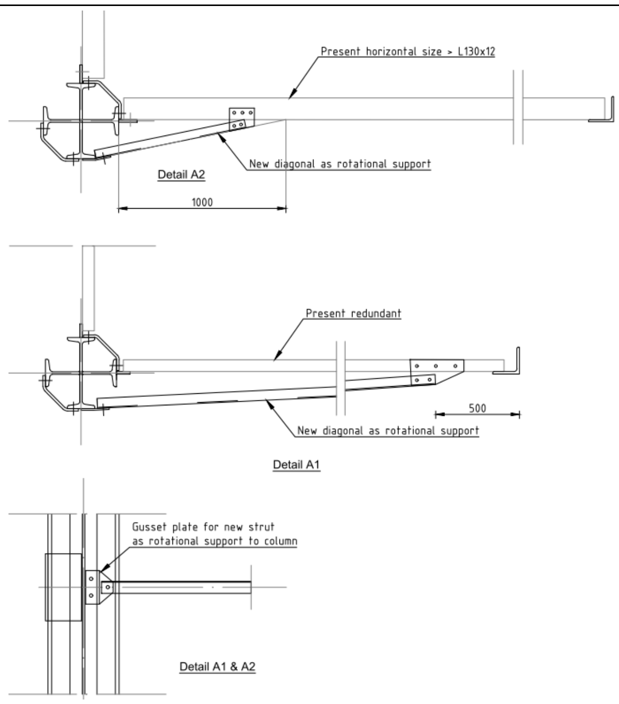
Splice joint between reinforced cruciform angle sections.



Transition of reinforced cruciform angle section to INP-section.



Transition of INP425 to INP450 section

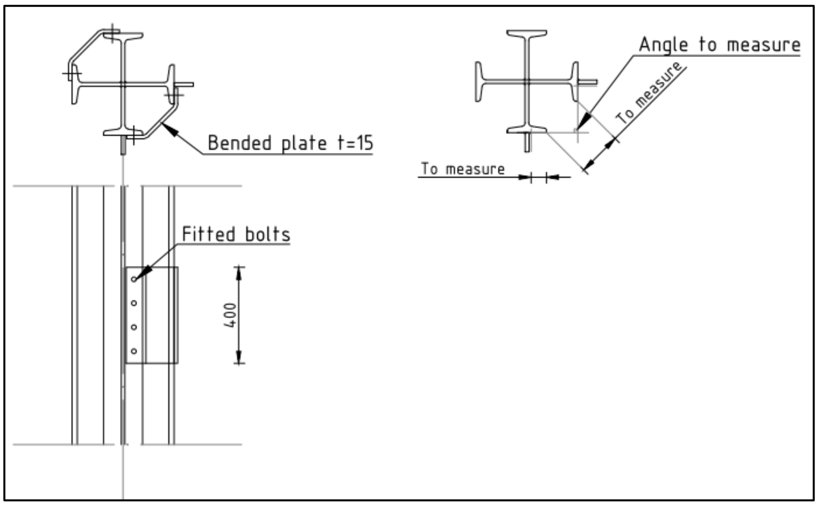


Rotational supports

Figuur 5-9 Versterking van verbinding randstijl

5.2.5 Koppelplaten

Het detail van de koppelplaten tegen twee van de vier flenzen van het INP-profiel is in Figuur 5-10 opgenomen. In de basis moeten deze koppelplaten ter plaatse van iedere knikverkorter in de constructie worden aangebracht. In het zwaarst belaste gedeelte van de randstijl, nabij de hellingsverandering op 30 m hoogte, moeten twee paar platen tussen iedere steun aanwezig zijn. Zie verder Appendix E.



Figuur 5-10 Koppelplaten tegen de INP450 en INP425-profielen

5.2.6 Gewicht benodigde profielen

Een overzicht van het nettogewicht van de profielen die nodig zijn voor de aanpassingen zijn weergegeven in Tabel 5. Het gewicht van eventueel benodigde schetsplaten is niet meegenomen.

Tabel 5 Gewichten profielen voor aanpassingen

Staaf-groep	Profiel	Materiaal	Bouten	Profiel nw.	Materiaal nw.	Bouten nw.	Maatregel	Nr	Lengte (m)	Gewicht (kg)
118A	XEA 250.22	S235	36M30-5.6t	XEA250.22+ PL200x25	S235 (staaf) S355 (platen)	36M30-8.8t	Versterkt met platen	8	7.85	2464.90
118B	XEA 250.22	S235	36M30-5.6t	XEA250.22+ PL200x25	S235 (staaf) S355 (platen)	36M30-8.8t	Versterkt met platen	8	3.75	1177.50
119A	XEA 250.24	S235	36M30-5.6t	XEA250.24+ PL200x25	S235 (staaf) S355 (platen)	36M30-8.8t	Versterkt met platen	8	4.10	1287.40
119B	XEA 250.24	S235	68M24-5.6t	XEA250.24+ PL200x25	S235 (staaf) S355 (platen)	68M24-8.8t	Versterkt met platen	8	7.85	2464.90
120A	INP 425	S235	68M24-5.6t	INP 425	S235	68M24-8.8t	Bout uitgewisseld			
120B	INP 425	S235	56M24-5.6t	INP 425	S235	56M24-8.8t	Bout uitgewisseld			
121A	INP 425	S235	56M24-5.6t	INP 425	S235	56M24-8.8t	Bout uitgewisseld			
121B	INP 425	S235	64M24-5.6t	INP425+PL2 30x25	S235 (staaf) S355 (platen)	64M24-8.8t	Versterkt met platen	8	10.29	2709.03
122A	INP 450	S235	56M24-5.6t	INP 450	S235	56M24-8.8t	Bout uitgewisseld			
122B	INP 450	S235	56M24-5.6t	INP 450	S235	56M24-8.8t	Bout uitgewisseld			
123A	INP 450	S235	56M24-5.6t	INP 450	S235	56M24-8.8t	Bout uitgewisseld			
123B	INP 450	S235	56M24-5.6t	INP 450	S235	56M24-8.8t	Bout uitgewisseld			
245L	L150.10	S235	1M30-5.6t	L150.10	S235	1M30-8.8t	Bout uitgewisseld			
245T	L150.10	S235	1M30-5.6t	L150.10	S235	1M30-8.8t	Bout uitgewisseld			
250L	L160.15	S235	2M24-5.6t	L160.15	S235	2M24-8.8t	Bout uitgewisseld			
250T	L160.15	S235	2M24-5.6t	L160.15	S235	2M24-8.8t	Bout uitgewisseld			
256LB	L150.10	S235	2M24-5.6t	L150.10	S235	2M24-8.8t	Bout uitgewisseld			
414	L70.7	S235	1M16-5.6t	DBL L70.7	S235 bestaand S355 nieuw	1M16-8.8t	Profiel toegevoegd aan bestaand	4	4.80	142.39
415	L65.7	S235	1M16-5.6t	DBL L65.7	S235 bestaand S355 nieuw	1M16-8.8t	Profiel toegevoegd aan bestaand	4	3.90	107.54
108B	L180.16	S235	12M24-5.6t	L180.16	S235	12M24-8.8t	Bout uitgewisseld			
109A	L200.20	S235	8M30-5.6t	L200.20	S235	8M30-8.8t	Bout uitgewisseld			
212T	L80.8	S235	2M20-5.6t	L100.10	S355	2M20-8.8t	Profiel uitgewisseld	2	4.80	145.73
317	L60.6	S235	1M16-5.6t	L60.6	S355	1M16-8.8t	Profiel uitgewisseld	4	3.96	86.32
114A	L250.22	S235	18M30-5.6t	L250.22	S235	18M30-5.6t	Knikverkorter toegevoegd			
114B	L250.22	S235	14M30-5.6t	L250.22	S235	14M30-8.8t	Bout uitgewisseld			
114C	L250.22	S235		L250.22	S235		Knikverkorter toegevoegd			
216L	L150.100.12	S235	2M30-5.6t	L150.100.12	S235	2M30-8.8t	Verbinding versterkt			
217L	L150.100.12	S235	2M30-5.6t	L150.100.12	S235	2M30-8.8t	Verbinding versterkt			
224L	L150.100.12	S235	2M30-5.6t	L150.100.12	S235	2M30-8.8t	Bout uitgewisseld			
115A	XEA200.20	S235	28M30-5.6t	XEA200.20+ PL150x20	S235 (staaf) S355 (platen)	28M30-8.8t	Versterkt met platen	8	6.80	1281.12
116A	XEA250.20	S235	28M30-5.6t	XEA250.20+ PL200x25	S235 (staaf) S355 (platen)	28M30-8.8t	Versterkt met platen	8	7.85	2464.90
116B	XEA250.20	S235	32M30-5.6t	XEA250.20+ PL200x25	S235 (staaf) S355 (platen)	32M30-8.8t	Versterkt met platen	8	3.65	1146.10
117A	XEA250.20	S235	32M30-5.6t	XEA250.20+ PL200x25	S235 (staaf) S355 (platen)	32M30-8.8t	Versterkt met platen	8	4.25	1334.50
117B	XEA250.20	S235	36M30-5.6t	XEA250.20+ PL200x25	S235 (staaf) S355 (platen)	36M30-8.8t	Versterkt met platen	8	7.85	2464.90
623	L65.7	S235	1M20-5.6t	L65.7	S235	1M20-8.8t	Bout uitgewisseld			
620	L80.8	S235	1M20-5.6t	L80.8	S355	1M20-8.8t	Profiel uitgewisseld	8	3.09	243.24
618	L100.8	S235	1M20-5.6t	L100.8	S235	1M20-8.8t	Bout uitgewisseld			
616	L100.10	S235	1M20-5.6t	L100.10	S235	1M20-8.8t	Bout uitgewisseld			
614	L110.10	S235	1M20-5.6t	L110.10	S235	1M20-8.8t	Bout uitgewisseld			
612	L110.10	S235	1M20-5.6t	L110.10	S235	1M20-8.8t	Bout uitgewisseld			
610	L130.12	S235	1M20-5.6t	L130.12	S235	1M20-8.8t	Bout uitgewisseld			
608	L120.11	S235	1M20-5.6t	L120.11	S235	1M20-8.8t	Bout uitgewisseld			
606	L150.10	S235	1M20-5.6t	L150.10	S235	1M20-8.8t	Bout uitgewisseld			
604	L150.10	S235	1M20-5.6t	L150.10	S235	1M20-8.8t	Bout uitgewisseld			
369	L100.10	S235	1M24-5.6t	L120.10	S355	1M24-8.8t	Profiel uitgewisseld	8	5.01	743.88
325	L100.8	S235	1M20-5.6t	L100.10	S355	1M20-8.8t	Profiel uitgewisseld	8	4.25	522.24
304	L100.10	S235	1M20-5.6t	L100.10	S235	1M20-8.8t	Bout uitgewisseld			
326	L80.8	S235	1M16-5.6t	L100.10	S355	1M20-8.8t	Profiel uitgewisseld	8	3.77	463.26
327	L80.8	S235	1M20-5.6t	L100.10	S355	1M20-8.8t	Profiel uitgewisseld	8	3.87	475.55
328	L70.7	S235	1M20-5.6t	L100.8	S355	1M20-8.8t	Profiel uitgewisseld	8	3.49	346.21
329	L70.7	S235	1M20-5.6t	L100.8	S355	1M20-8.8t	Profiel uitgewisseld	8	3.58	355.14
207	L120.11	S235	1M20-5.6t	L120.11	S235	1M20-8.8t	Bout uitgewisseld			
206	L120.11	S235	1M20-5.6t	L120.11	S235	1M20-8.8t	Bout uitgewisseld			
208	L110.10	S235	1M20-5.6t	L110.10	S235	1M20-8.8t	Bout uitgewisseld			

Staaf-groep	Profiel	Materiaal	Bouten	Profiel nw.	Materiaal nw.	Bouten nw.	Maatregel	Nr	Lengte (m)	Gewicht (kg)
114	L100.8	S235	1M20-5.6t	L100.8	S235	1M20-8.8t	Bout uitgewisseld			
113	L100.8	S235	1M20-5.6t	L100.8	S235	1M20-8.8t	Bout uitgewisseld			
112	L100.8	S235	1M20-5.6t	L100.8	S235	1M20-8.8t	Bout uitgewisseld			
172	L60.6	S235	1M16-5.6t	L60.6	S355	1M16-8.8t	Profiel uitgewisseld	8	1.38	61.03
160	L50.5	S235	1M16-5.6t	L60.8	S355	1M16-8.8t	Profiel uitgewisseld	8	2.12	122.51
171	L80.8	S235	1M16-5.6t	L80.8	S235	1M16-8.8t	Bout uitgewisseld			
159	L50.5	S235	1M16-5.6t	L60.8	S355	1M16-8.8t	Profiel uitgewisseld	8	2.19	126.55
170	L60.6	S235	1M16-5.6t	L60.6	S355	1M16-8.8t	Profiel uitgewisseld	8	1.38	61.03
169	L50.5	S235	1M16-5.6t	L55.6	S355	1M16-8.8t	Profiel uitgewisseld	8	1.32	53.31
158	L50.5	S235	1M16-5.6t	L60.8	S355	1M16-8.8t	Profiel uitgewisseld	8	2.08	120.19
157	L50.5	S235	1M16-5.6t	L60.8	S355	1M16-8.8t	Profiel uitgewisseld	8	2.14	123.66
167	L50.5	S235	1M16-5.6t	L55.6	S355	1M16-8.8t	Profiel uitgewisseld	8	1.30	52.38
156	L50.5	S235	1M16-5.6t	L60.8	S355	1M16-8.8t	Profiel uitgewisseld	8	2.03	117.30
155	L50.5	S235	1M16-5.6t	L60.6	S355	1M16-8.8t	Profiel uitgewisseld	8	2.07	91.72
154	L50.5	S235	1M16-5.6t	L55.6	S355	1M16-8.8t	Profiel uitgewisseld	8	2.00	80.77
153	L50.5	S235	1M16-5.6t	L60.6	S355	1M16-8.8t	Profiel uitgewisseld	8	2.07	91.54
BR9				L50.5	S355	1M16-8.8t	Profiel toegevoegd	8	0.69	21.20
BR10				L50.5	S355	1M16-8.8t	Profiel toegevoegd	8	1.11	34.10
BR11				L50.5	S355	1M16-8.8t	Profiel toegevoegd	8	0.67	20.58
BR12				L50.5	S355	1M16-8.8t	Profiel toegevoegd	8	1.05	32.26
RS1				L60.6	S355	1M16-8.8t	Profiel toegevoegd	4	0.98	21.67
RS2				L70.7	S355	1M16-8.8t	Profiel toegevoegd	4	2.42	72.79
RS3				L80.6	S355	1M16-8.8t	Profiel toegevoegd	4	3.87	115.76
RS4				L80.6	S355	1M16-8.8t	Profiel toegevoegd	4	3.16	94.52
RS5				L80.6	S355	1M16-8.8t	Profiel toegevoegd	4	3.16	94.52
RS6				L70.7	S355	1M16-8.8t	Profiel toegevoegd	4	2.88	86.63
RS7				L70.7	S355	1M16-8.8t	Profiel toegevoegd	4	2.88	86.63
RS8				L60.6	S355	1M16-8.8t	Profiel toegevoegd	4	2.57	56.83
RS9				L60.6	S355	1M16-8.8t	Profiel toegevoegd	4	2.57	56.83
RS10				L50.5	S355	1M16-8.8t	Profiel toegevoegd	60	1.00	230.40
Koppel platen (INP 450)				Plaat t=15 mm	S355			88		1554.30
Koppel platen (INP 425)				Plaat t=15 mm	S355			120		1978.20
								582	**159.85**	**28085.97**

5.3 Eisen verificatie

De verificatie van de van toepassing zijnde eisen is uitgevoerd in onderstaande Tabel 6.

Tabel 6 Verificatie eisen

Eis Id	Eis Tekst	Ja	Nee	N.v.t.	toelichting
BO Eis: H2.7-6	Aanpassingen uitvoerbaar?	X			De toe te voegen staalonderdelen zijn met geboute verbindingen te bevestigen. Dit is een bewezen methode.
PVE.05.001 5.14	Staaldelen in nabijheid van klimweg gewijzigd?	X			De wijzigingen in de nabijheid van de klimweg (knikverkorters) zijn in te passen zonder negatieve invloed op de begaanbaarheid.
	klimvoorziening nog in overeenstemming is met de NEN 1060:1964?			X	Geen wijzigingen

6 REFERENTIES

[1] „002.589.40 0817486 - 20-0473 - Verificatie & validatieplan 380kV verbinding Krimpen aan de IJssel - Geertruidenberg”.

[2] „002.589.40 0808624 - 20-0472 - E-studie deel 1 380kV verbinding Krimpen aan de IJssel - Geertruidenberg”.

[3] „002.589.40 0808629 - 20-0345 - Uitgangspuntenrapport 380kV verbinding Krimpen aan de IJssel - Geertruidenberg”.

APPENDIX A GELEIDERBELASTINGEN

Content

Data

Norm	NEN-EN50341-2-15:2019
Initial	
Consequence class	CC2-0
Reliability level	Afkeur
Reference period	15 jaar
After adjustment	
Consequence class	CC2
Reliability level	Verbouw
Reference period	50 jaar
Wind zone	II
Wind speed	27 m/s
Terrain categorie	II
Reduction factor Cdir	1,00
Ice region	B
Tower type	Steunmast
Tower height	162,5 m
Max. Span	701 m
Line angle	180°
Catenary	1400 m
Wind span	569 m
EDS Weight span	895 m
Min. Weight span	811 m
Max. Weight span	1680 m

ISSUE	DATE	REVISION	CHK'D	APP'D
0.0	2021-04-06			

Client: TenneT Taking power further

DNV·GL

Title:

Berekening masttype S+95 II

JOB No.	-	DATE	-
DRAWN	-	CHKD	-
DESIGN	-	APPD	-

Document name:

KIJ-GT_S+95 II_12_Report.pdf

Project number:

Project client number:

0.0

Project: KIJ-GT
Tower: S+95 II
Number: 12

Conductor loads

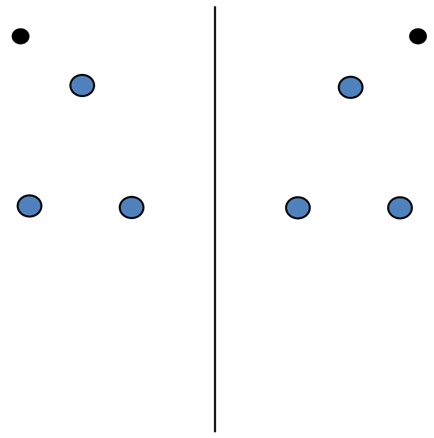
Auteur: TBR
Versie: v11.7

General

Description	S+95 II
Tower type	Steunmast
Number of circuits	2
Configuration	2-circuit-donau
Number of earth wires	2

Starting points

Norm	NEN-EN50341-2-15:2019
Consequence class	CC2-0
Reliability level initial	Afkeur CC2-0
Reference period intial	15 jaar
Consequence class modified	CC2
Reliability level modified	Verbouw
Reference period modified	50 jaar
Wind zone	II
Wind speed (m/s)	27,0 m/s
Terrain category	II
Reduction factor c_{dir}	1,00
Ice region phase conductor	B
Ice region earth conductor	B



Configuratie geleiders

Conductors back

Description	Voltage	Conductor Back	Bundle Ba	Ice region	Additional weight	Additional diameter	Catenary P_{back}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Conductors ahead

Description	Voltage	Conductor Ahead	Bundle Ah	Ice region	Additional weight	Additional diameter	Catenary P_{ahead}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Insulators *(1)*

Description	Suspension	Weight [kN]	Length [m]	Wind area [m^2]
Circuit 1	Halfverankering	3,00	4,30	1,50
Circuit 2	Halfverankering	3,00	4,30	1,50
Bliksemdraad 1	Vast (Bliksemdraad)	0,20	0,30	0,10
Bliksemdraad 2	Vast (Bliksemdraad)	0,20	0,30	0,10

1. Properties apply to the entire isolator set

Suspension height and position in mast

Circuits	Designation	Number	Suspension height	Attach point	Position in tower Horizontal distance
Circuit 1	10	380ct1f1	123,7 m	128,0 m	25,5 m
Circuit 1	11	380ct1f2	123,7 m	128,0 m	11,5 m
Circuit 1	12	380ct1f3	150,7 m	155,0 m	18,5 m
Circuit 2	20	380ct2f1	123,7 m	128,0 m	-11,5 m
Circuit 2	21	380ct2f2	123,7 m	128,0 m	-25,5 m
Circuit 2	22	380ct2f3	150,7 m	155,0 m	-18,5 m
Bliksemdraad 1	1	bl1	160,7 m	161,0 m	31,5 m
Bliksemdraad 2	3	bl2	160,7 m	161,0 m	-31,5 m

Project: KIJ-GT
Tower: S+95 II
Number: 12

Height adjustment adjacent masts (wind and weight span adjustment)

	Back	Ahead	
Height increase for wind pressure	0,0 m	0,0 m	(positive: higher)
Height decrease for vertical load	0,0 m	0,0 m	(negative: decrease, more weight span)

Decrease: Niet in 0,9EG-combinaties

Height difference adjacent tower and change of direction with respect to Line direction

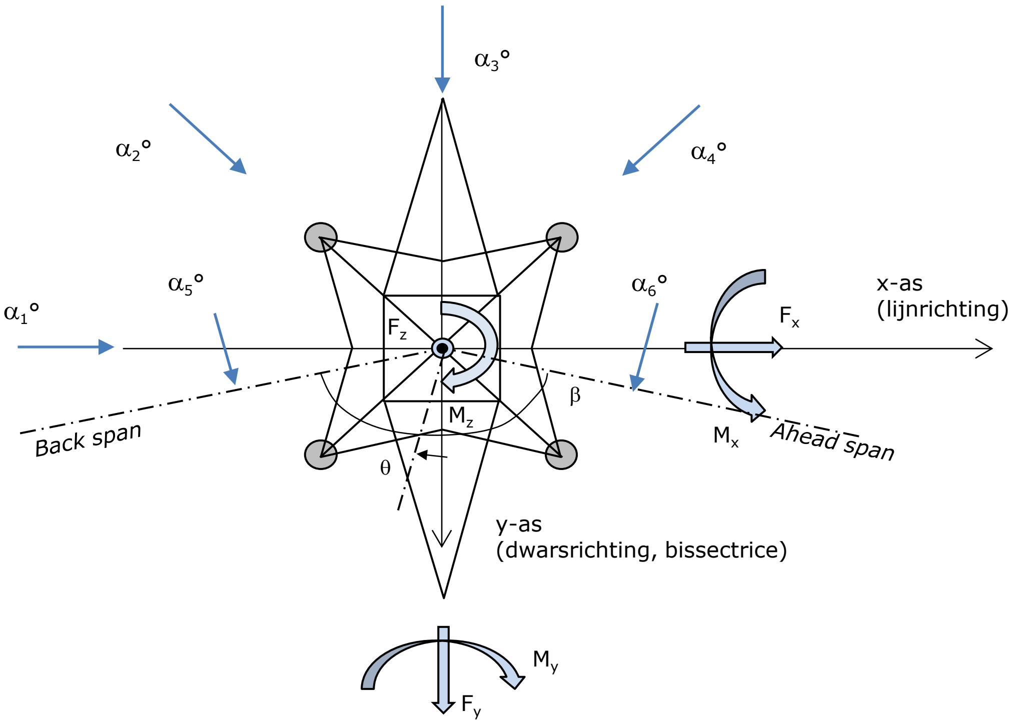
			Hoogteverschil		Richtingsverandering	
Circuits	Aanduiding	Nummer	Δh_back	Δh_ahead	Δy_back	Δy_ahead
Circuit 1	10	380ct1f1	-76,9	-0,4 m	8,0	0,0 m
Circuit 1	11	380ct1f2	-76,9	-0,4 m	2,0	0,0 m
Circuit 1	12	380ct1f3	-91,9	-0,4 m	5,0	0,0 m
Circuit 2	20	380ct2f1	-76,9	-0,4 m	-2,0	0,0 m
Circuit 2	21	380ct2f2	-76,9	-0,4 m	-8,0	0,0 m
Circuit 2	22	380ct2f3	-91,9	-0,4 m	-5,0	0,0 m
Bliksemdraad 1	1	bl1	-94,6	-0,4 m	13,0	0,0 m
Bliksemdraad 2	3	bl2	-94,6	-0,4 m	-13,0	0,0 m

Line and tower data

		Back	Ahead
		436,0	701,0 m
Ruling span $\sqrt{(\Sigma L^3/\Sigma L)}$		552,7	552,7 m
Line angle	β	180 °	
Tower orientation with respect to bis	θ	0 °	
Section length		2418	2418 m
Height bottom of tower to ground level		0,5 m	
Wind directions considered	α_1	0 °	
Wind directions according to:	α_2	45 °	
Geleiderbelastingen	α_3	90 °	
	α_4	135 °	
	α_5	- °	
	α_6	- °	

Wind directions apply to the main direction of mast construction, not to the bisector.

Windrichtingen en positieve richtingen belastingen



Considered number of wind directions	
1a	4
3	4
4	1
6	1
Overig	1

Project: KIJ-GT
Tower: S+95 II
Number: 12

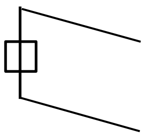
Absence of conductors

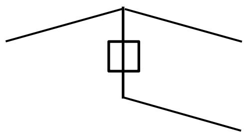
		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	380ct1f1	1	0	1	0	0,8	0
Circuit 1	380ct1f2	1	0	1	0	0,8	0
Circuit 1	380ct1f3	1	0	1	0	0,8	0
Circuit 2	380ct2f1	0	1	1	0	0,8	0
Circuit 2	380ct2f2	0	1	1	0	0,8	0
Circuit 2	380ct2f3	0	1	1	0	0,8	0
Bliksemdraad 1	bl1	1	0	1	0	1	0
Bliksemdraad 2	bl2	0	1	1	0	1	0

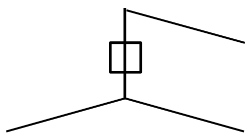
Load situations SPLS

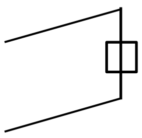
Considered situations SPLS: SPLS for suspension tower not applicable

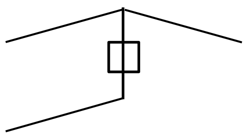
Principle of load situations:

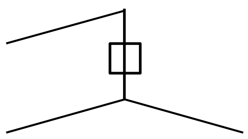

1. Ba All cts


2. Ba ct1


3. Ba ct2


4. Ah All cts

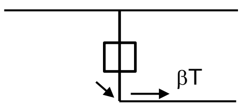

5. Ah ct1


6. Ah ct2

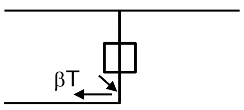
Load situation 5a. Conductor failure

Considered situations conductor failure 5a: 1 and 2, all possible situations

Principle of load situations:



1. Ba



2. Ah

Project: KIJ-GT
Tower: S+95 II
Number: 12

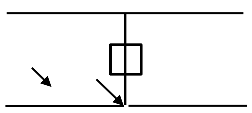
Load situations LC6. Construction and maintenance
Under 6a, the load due to the presence of a line verhicle or line bicycle in combination with point load on the traverse is assesed.
Combination 6b does not contain any loads in conductor or on traverse. This combination has been added to be able to combine with separate control platforms, etc. The situations are applied in ULS and in every SPLS situation (in case of angle tower).

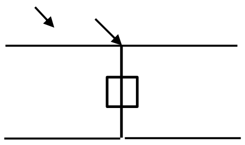
	Phase	Earth
Line vehicle	3,0 kN	2,0 kN
Concentrated load cross arm	1,0 kN	1,0 kN

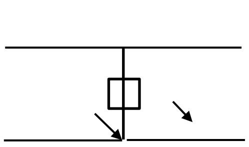
Beschouwde situaties bouw- en onderhoud 6a: 1 t/m 4, alle mogelijke situaties.

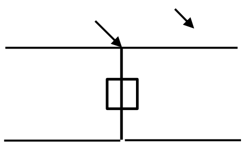
Presence line vehicle: Circuit, belasting tegelijk aanwezig in alle geleiders per circuit.

Principle of load situations:


1. Ba Ct1


2. Ba Ct2


3. Ah Ct1


4. Ah Ct2

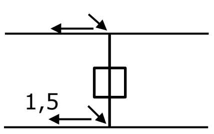
Load situations 8. Galloping as a static load

Conductor		
Suspension tower phase	0,866 W	1,5 W
Suspension tower earth	1,5 EDS	1,5 W
Strain tower phase and earth	1,5 EDS	1,5 W

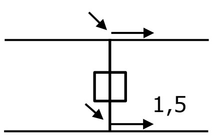
Considered situations galloping 8: None (existing structure)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principle of load situations:



1. Ba



2. Ah

Load combination 8. Galloping as a dynamic load
Only applies to tension towers
Load consists of EDS tensile load in one of the conductors on one side of the tower
Can be converted by user to fatigue spectrum via the load spectrum of table 4.11 / NL.1

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Project: KIJ-GT
Tower: S+95 II
Number: 12

Tower structure

Properties

Tower type	Steunmast	
Tower designation	S+95 II	
Base plate w.r.t. ground level	0,5	m
Tower height w.r.t. base plate	162,5	m
Tower self weight	2500,0	kN

Width and slope at foundation	x-ri.	y-ri.	
Leg spread	22,60	22,60	m
Inclination of main leg	0,133	0,133	-
Horizontal force factor	1,1	1,1	-

Calculation Wind load

Dynamic factor G_T	1,02
Wind load diagonally to tower body proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Wind load diagonally on traverse proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Magnification factor diagonal wind to tower body	(1+0,2sin^2(2phi))
Magnification factor diagonal wind to cross arm	(1+0,2sin^2(2phi))
Magnification factor wind parallel to perpendicular to cross a	0,4

Properties mast sections longitudinal direction (front view, yz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	30,00	22,60	14,60	30,00	0,133	558,00	63,60	0,11	3,33
Middenstuk 1	65,58	14,60	10,26	35,58	0,061	442,26	73,04	0,17	3,09
Middenstuk 2	100,50	10,26	6,00	34,92	0,061	283,90	64,60	0,23	2,81
Bovenstuk 1	127,50	6,00	5,00	27,00	0,019	148,50	37,92	0,26	2,70
Bovenstuk 2	158,50	5,00	3,83	31,00	0,019	136,87	29,28	0,21	2,87
Topstuk	162,50	3,83		4,00		7,66	1,40	0,18	3,01
Ondertraverse	127,50	23,00		4,00		46,00	10,29	0,22	2,83
Boventraverse	154,50	29,50		6,00		88,50	14,56	0,16	3,09

Properties tower sections transversal direction (side view, xz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	30,00	22,60	14,60	30,00	0,133	558,00	63,60	0,11	3,33
Middenstuk 1	65,58	14,60	10,26	35,58	0,061	442,26	73,04	0,17	3,09
Middenstuk 2	100,50	10,26	6,00	34,92	0,061	283,90	64,60	0,23	2,81
Bovenstuk 1	127,50	6,00	5,00	27,00	0,019	148,50	37,92	0,26	2,70
Bovenstuk 2	158,50	5,00	3,83	31,00	0,019	136,87	29,28	0,21	2,87
Topstuk	162,50	3,83		4,00		7,66	1,40	0,18	3,01
Ondertraverse	127,50	23,00		4,00		46,00	10,29	0,22	2,83
Boventraverse	154,50	29,50		6,00		88,50	14,56	0,16	3,09

Note: Surface transverse direction is reduced in calculation.

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Project: KIJ-GT
Tower: S+95 II
Number: 12

Wind surface feeders telecom installations

Part	A (m^2/m)	Factor	Δh	A_1
Broekstuk 1				
Middenstuk 1				
Middenstuk 2				
Bovenstuk 1				
Bovenstuk 2				

Input antennas

Description	A (m^2)	h (m)	C_f (m)
Antenne 1			
Schotel			
Schotel			

Tower section loads longitudinal (x-direction) per wind direction

Description	p_w	F_{x1}	F_{x2}	F_{x3}	F_{x4}	h_{ef}	M_{y1}	M_{y2}	M_{y3}	M_{y4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,97	206,7	175,4	0,0	-175,4	15,0	3100,9	2631,2	0,0	-2631,2
Middenstuk 1	1,36	307,3	260,8	0,0	-260,8	47,8	14685,9	12461,4	0,0	-12461,4
Middenstuk 2	1,57	284,8	241,6	0,0	-241,6	83,0	23647,8	20065,8	0,0	-20065,8
Bovenstuk 1	1,69	173,2	147,0	0,0	-147,0	114,0	19748,7	16757,3	0,0	-16757,3
Bovenstuk 2	1,78	149,5	126,9	0,0	-126,9	143,0	21384,8	18145,6	0,0	-18145,6
Topstuk	1,83	7,7	6,5	0,0	-6,5	160,5	1232,2	1045,6	0,0	-1045,6
Ondertraverse	1,74	101,2	60,1	0,0	-60,1	128,8	13038,4	7744,4	0,0	-7744,4
Boventraverse	1,82	163,4	97,0	0,0	-97,0	156,5	25566,1	15185,5	0,0	-15185,5
Totaal		1393,8	1115,4	0,0	-1115,4		122404,8	94036,8	0,0	-94036,8

Tower section loads transversal (y-direction) per wind direction

Description	p_w	F_{y1}	F_{y2}	F_{y3}	F_{x4}	h_{ef}	M_{x1}	M_{x2}	M_{x3}	M_{x4}
	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[m]	[kNm]	[kNm]	[kNm]	[kNm]
Broekstuk 1	0,97	0,0	175,4	206,7	175,4	15,0	0,0	2631,2	3100,9	2631,2
Middenstuk 1	1,36	0,0	260,8	307,3	260,8	47,8	0,0	12461,4	14685,9	12461,4
Middenstuk 2	1,57	0,0	241,6	284,8	241,6	83,0	0,0	20065,8	23647,8	20065,8
Bovenstuk 1	1,69	0,0	147,0	173,2	147,0	114,0	0,0	16757,3	19748,7	16757,3
Bovenstuk 2	1,78	0,0	126,9	149,5	126,9	143,0	0,0	18145,6	21384,8	18145,6
Topstuk	1,83	0,0	6,5	7,7	6,5	160,5	0,0	1045,6	1232,2	1045,6
Ondertraverse	1,74	0,0	60,1	40,5	60,1	128,8	0,0	7744,4	5215,3	7744,4
Boventraverse	1,82	0,0	97,0	65,3	97,0	156,5	0,0	15185,5	10226,4	15185,5
Total		0,0	1115,4	1235,1	1115,4		0,0	94036,8	99242,1	94036,8

Resulting loads from mast construction incl. Antenna without conductors level foundation (char. Value)

Load / wind direction	F_x	F_y	F_z	M_x	M_y	M_z
	[kN]	[kN]	[kN]	[kNm]	[kNm]	[kNm]
Permanente belasting	0	0	2500	0	0	0
Windrichting 0°	1394	0	0	0	124853	0
Windrichting 45°	1115	1115	0	95918	95918	0
Windrichting 90°	0	1235	0	101227	0	0
Windrichting 135°	-1115	1115	0	95918	-95918	0

Project: KIJ-GT
Tower: S+95 II
Number: 12

Intermediate results for conductor loads

Conductors back

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Conductors ahead

Circuit	Geleider	Diameter [mm]	A [mm^2]	G [N/m]	E [N/mm^2]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Vertical load back

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Vertical load ahead

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	[N/m]	[N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Insulators

Conductor	$G_{isolator}$ [kN]	Number -	$F_{v,iso}$ [kN]	Length [m]	Wind surf. [m^2]	Wind heigth [m]	Pressure [kN/m^2]	Drag factor [-]	$F_{h,iso}$ [kN]
380ct1f1	3,00	1	3	4,3	1,5	126,35	1,73	1,2	3,11
380ct1f2	3,00	1	3	4,3	1,5	126,35	1,73	1,2	3,11
380ct1f3	3,00	1	3	4,3	1,5	153,35	1,81	1,2	3,25
380ct2f1	3,00	1	3	4,3	1,5	126,35	1,73	1,2	3,11
380ct2f2	3,00	1	3	4,3	1,5	126,35	1,73	1,2	3,11
380ct2f3	3,00	1	3	4,3	1,5	153,35	1,81	1,2	3,25
bl1	0,20	1	0,2	0,3	0,1	161,35	1,83	1,2	0,22
bl2	0,20	1	0,2	0,3	0,1	161,35	1,83	1,2	0,22

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Project: KIJ-GT
Tower: S+95 II
Number: 12

Wind load back

Conductor	Height wind [m]	Pressure [kN/m²]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	74,4	1,53	0,62	0,57	0,97	28,25	77,4	71,4	46,9	159,8	147,4
380ct1f2	74,4	1,53	0,62	0,57	0,97	28,25	77,4	71,4	46,9	159,8	147,4
380ct1f3	93,9	1,61	0,64	0,59	0,95	28,25	82,5	76,0	46,9	173,7	160,1
380ct2f1	74,4	1,53	0,62	0,57	0,97	28,25	77,4	71,4	46,9	159,8	147,4
380ct2f2	74,4	1,53	0,62	0,57	0,97	28,25	77,4	71,4	46,9	159,8	147,4
380ct2f3	93,9	1,61	0,64	0,59	0,95	28,25	82,5	76,0	46,9	173,7	160,1
bl1	103,3	1,65	0,64	0,59	1,09	22,24	25,8	23,7	41,5	53,0	48,8
bl2	103,3	1,65	0,64	0,59	1,09	22,13	25,7	23,7	41,4	52,9	48,7

Wind load ahead

Conductor	Height wind [m]	Pressure [kN/m²]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	94,7	1,62	0,64	0,59	0,95	28,25	82,7	76,2	46,9	174,3	160,6
380ct1f2	94,7	1,62	0,64	0,59	0,95	28,25	82,7	76,2	46,9	174,3	160,6
380ct1f3	121,7	1,72	0,66	0,60	0,92	28,25	88,1	81,2	46,9	190,0	175,0
380ct2f1	94,7	1,62	0,64	0,59	0,95	28,25	82,7	76,2	46,9	174,3	160,6
380ct2f2	94,7	1,62	0,64	0,59	0,95	28,25	82,7	76,2	46,9	174,3	160,6
380ct2f3	121,7	1,72	0,66	0,60	0,92	28,25	88,1	81,2	46,9	190,0	175,0
bl1	133,7	1,75	0,66	0,61	1,07	22,24	27,7	25,5	41,5	57,9	53,3
bl2	133,7	1,75	0,66	0,61	1,08	22,13	27,6	25,4	41,4	57,7	53,2

Project: KIJ-GT
Tower: S+95 II
Number: 12

Conductor loads

Auteur: TBR
Versie: v11.7

Starting points

Consequence class Afkeur CC2-0
Reference period 15 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,05	1,05	0,00	1,02	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,05	0,00	1,02	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,02	0,00	0,0
ULS 3	Wind+ice	-5°	1,05	1,05	0,00	0,31	0,79	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,05	0,00	0,31	0,79	0,0
ULS 4	Cold+wind	-20°	1,05	1,05	0,00	0,20	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,05	0,00	0,20	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,05	1,05	1,20	0,20	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,05	1,05	0,00	0,20	0,00	0,0
ULS 7	Permanent	10°	1,15	1,15	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS	(strength, for angle towers: absence of conductors)			γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,05	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,05	1,05	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,05	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,05	1,05	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,05	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,05	1,05	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,05	1,05	0,0	0,24	0,0	0,0
SLS	(deformations, fatigue, EDS)							
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	0,87	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,26	0,71	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,17	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,17	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	4
Number of load combinations for ULS	44
Number of load combinations for SPLS	0
Number of load combinations for SLS	11
Number of concentrated loads	440

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Project: KIJ-GT
Tower: S+95 II
Number: 12

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-37,2	37,4	6,9	10,0	11,0	7,4
380ct1f1	-120,0	120,3	21,0	31,1	37,3	26,4
380ct1f2	-120,2	120,3	19,3	31,1	37,4	26,4
380ct1f3	-125,3	125,5	21,4	33,2	41,9	26,4
380ct2f1	-120,4	120,3	18,3	31,1	37,4	26,4
380ct2f2	-120,6	120,3	16,7	31,1	37,3	26,4
380ct2f3	-125,7	125,5	18,6	33,2	41,9	26,4
bl2	-37,6	37,4	4,8	10,0	11,0	7,4

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	894,9	937,1	894,9
380ct1f1	816,3	836,0	816,3
380ct1f2	816,3	836,1	816,3
380ct1f3	864,5	889,4	864,5
380ct2f1	816,3	836,1	816,3
380ct2f2	816,3	836,0	816,3
380ct2f3	864,5	889,4	864,5
bl2	894,9	941,3	894,9

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	1322,8	982,5
380ct1f1	1001,7	858,2
380ct1f2	1001,8	858,3
380ct1f3	1107,4	922,7
380ct2f1	1001,8	858,3
380ct2f2	1001,7	858,2
380ct2f3	1107,4	922,7
bl2	1322,9	984,7

Envelop of weight span over all combinations (incl. 0,9 combinations) For all conductors		Wind / Weight span ratio
Max. weight span	1432,0 m	2,519 -
Min. weight span	814,7 m	1,433 -

Project: KIJ-GT
Tower: S+95 II
Number: 12

Maximum values back + ahead span / **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	15,0	16,9	17,0	-36,4	38,5
380ct1f1	51,3	52,1	63,7	-117,8	122,9
380ct1f2	51,3	50,5	63,7	-117,8	122,9
380ct1f3	51,3	54,6	68,3	-122,7	128,3
380ct2f1	51,3	49,4	63,7	-117,8	122,9
380ct2f2	51,3	47,8	63,7	-117,8	122,9
380ct2f3	51,3	51,8	68,3	-122,7	128,3
bl2	15,0	14,7	17,0	-36,4	38,4

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	0,0	0,4	9,2	-15,0	15,0
380ct1f1	0,0	1,2	40,4	-64,2	64,2
380ct1f2	0,0	0,3	40,4	-64,2	64,2
380ct1f3	0,0	0,7	42,6	-64,2	64,2
380ct2f1	0,0	-0,3	40,4	-64,2	64,2
380ct2f2	0,0	-1,2	40,4	-64,2	64,2
380ct2f3	0,0	-0,7	42,6	-64,2	64,2
bl2	0,0	-0,4	9,1	-15,0	15,0

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	6,0	3,6
	380ct1f1	23,7	17,6
	380ct1f2	23,7	17,6
	380ct1f3	26,2	17,6
	380ct2f1	23,7	17,6
	380ct2f2	23,7	17,6
	380ct2f3	26,2	17,6
	bl2	6,0	3,6

Project: KIJ-GT
Tower: S+95 II
Number: 12

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		0	338	347	47138	13	36
ULS 1a_0,9_90		0	338	347	47138	13	36
ULS 3_90		0	207	426	28879	13	23
ULS 3_0,9_90		0	207	426	28879	13	23
SLS 7		0	0	265	0	6	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

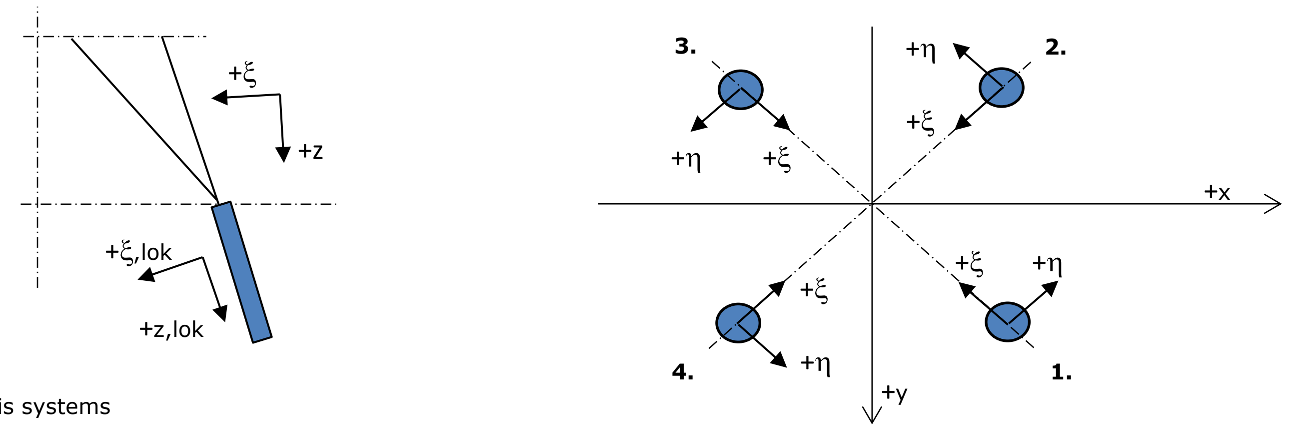
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	1597	2972	150361	13	36
ULS 3_90	0	585	3051	59846	13	23
SLS 7	0	0	2765	0	6	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	1597	2972	**150361**	13	36
ULS 1a_0	1427	0	2903	0	**128058**	0
ULS 5a Ah 21	-51	0	2757	441	-6565	**1309**
ULS 1a_0,9_0,9_135	-1141	1310	2514	**121990**	**-98317**	18

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_45	788	754	**5604**	24	-1090	-34	5703
2	ULS 1a_0	463	-522	**3559**	42	-697	-25	3622
3	ULS 5a Ah 12	-104	-137	**872**	-23	-171	-7	888
4	ULS 1a_135	-788	754	**5605**	-24	-1091	-34	5704

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	0	0	0	0
2	ULS 1a_0,9_0,9_135	-589	554	**-4245**	25	808	8	-4320
3	ULS 1a_0,9_0,9_45	588	555	**-4244**	-24	808	8	-4319
4	ULS 1a_0,9_0,9_0	265	-324	**-2211**	-42	417	0	-2250

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_0,9_0,9_135	203	101	1152	**72**	-215	3	1173
2	ULS 1a_45	-3	-99	210	**72**	-68	-28	214
3	ULS 1a_0	250	309	-2107	**42**	395	-2	-2144
4	ULS 5a Ah 21	-101	137	844	**26**	-168	-9	859

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	ULS 1a_0,9_0	449	508	3465	**-42**	-677	-24	3526
2	ULS 5a Ah 10	104	-65	554	**-27**	-120	-15	564
3	ULS 1a_0,9_0,9_135	18	-83	105	**-72**	-46	-26	107
4	ULS 1a_45	-217	116	1253	**-72**	-236	1	1275

Project: KIJ-GT
Tower: S+95 II
Number: 12

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	**0**	0	0	0
2	ULS 1a_0,9_0,9_135	-589	554	**-4245**	**25**	808	8	-4320
3	ULS 1a_0,9_0,9_45	588	555	**-4244**	**-24**	808	8	-4319
4	ULS 1a_0,9_0,9_0	265	-324	**-2211**	**-42**	417	0	-2250

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	101	101	691	0	-143	-13	704
2	SLS 7	101	-101	691	0	-143	-13	704
3	SLS 7	-101	-101	691	0	-143	-13	703
4	SLS 7	-101	101	691	0	-143	-13	703

Envelope of load combinations for all of the legs

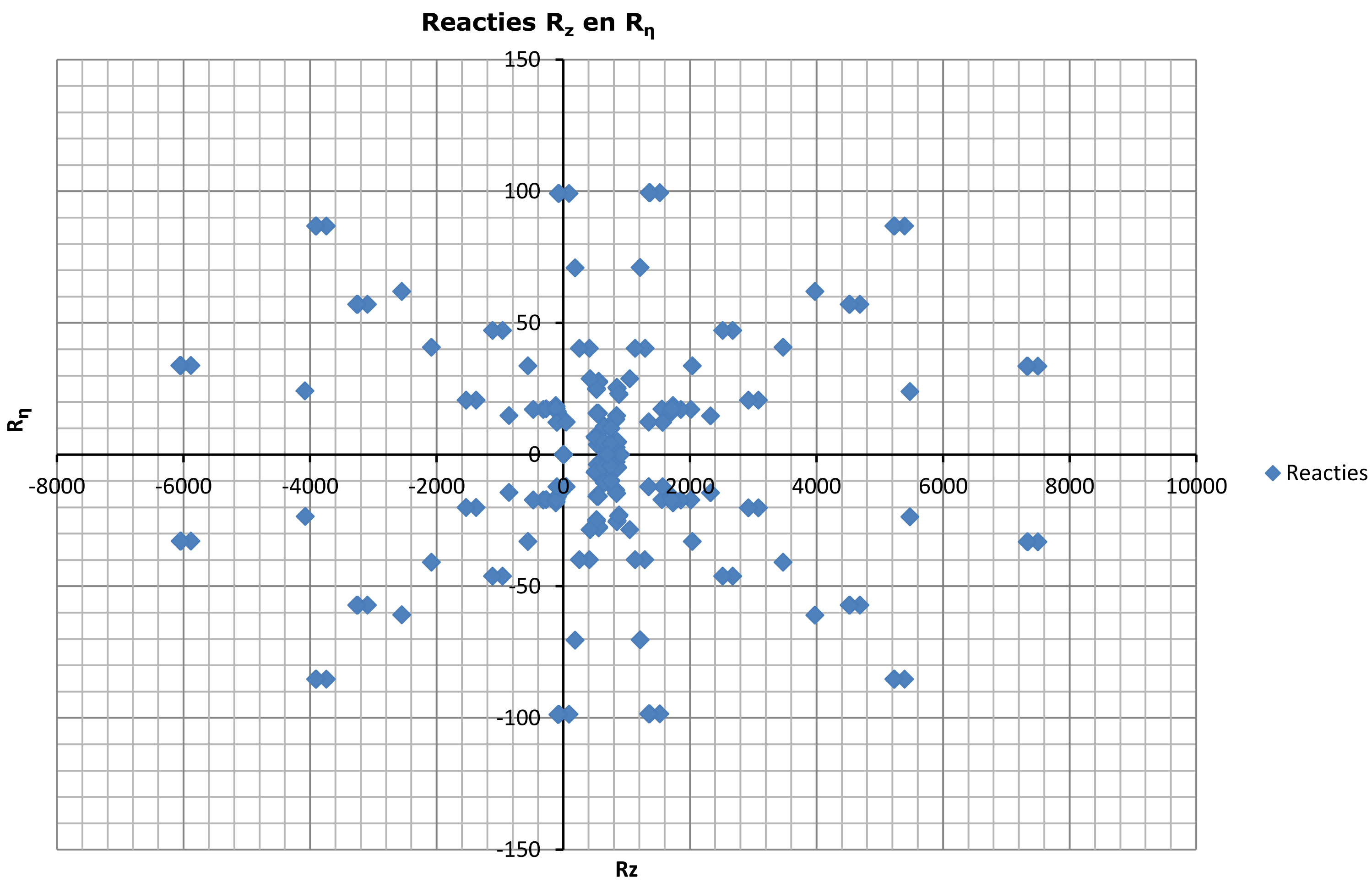
Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_135	-788	754	**5605**	-24	-1091	-34	5704
Max. tension	ULS 1a_0,9_0,9_135	-589	554	**-4245**	25	808	8	-4320
Max. pos. torsie	ULS 1a_0,9_0,9_135	203	101	1152	**72**	-215	3	1173
Max. neg. torsie	ULS 1a_0,9_0,9_135	18	-83	105	**-72**	-46	-26	107
Comb. tension+torsie	ULS 1a_0,9_0,9_135	-589	554	**-4245**	**25**	808	8	-4320

Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	101	101	**691**	0	-143	-13	704
2	SLS 1a_135	-477	447	**-3445**	21	653	4	-3505
3	SLS 1a_45	476	447	**-3443**	-20	653	4	-3504
4	SLS 1a_0	202	-252	**-1715**	-35	320	-3	-1746

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_45	681	651	**4835**	21	-942	-30	4920
2	SLS 1a_0	404	-454	**3098**	35	-607	-23	3153
3	SLS 7	-101	-101	**691**	0	-143	-13	703
4	SLS 1a_135	-680	651	**4836**	-20	-942	-30	4921


Reacties R_z en R_η
150
100
50
0
-50
-100
-150
-8000
-6000
-4000
-2000
0
2000
4000
6000
8000
10000
R_η
Rz
Reacties

DNV·GL

Project: KIJ-GT
Tower: S+95 II
Number: 12

Conductor loads		Auteur:	TBR
		Versie:	v11.7

Starting points

Consequence class	Verbouw CC2
Reference period	50 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,15	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,40	0,00	0,0
ULS 3	Wind+ice	-5°	1,15	1,15	0,00	0,42	1,30	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,15	0,00	0,42	1,30	0,0
ULS 4	Cold+wind	-20°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,15	0,00	0,28	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,15	1,15	1,30	0,28	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 7	Permanent	10°	1,30	1,30	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,15	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,15	1,15	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,15	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,15	1,15	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,15	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,15	1,15	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,15	1,15	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	1,00	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,30	1,00	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	4
Number of load combinations for ULS	44
Number of load combinations for SPLS	0
Number of load combinations for SLS	11
Number of concentrated loads	440

Project: KIJ-GT
Tower: S+95 II
Number: 12

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-47,9	48,2	9,4	13,7	14,1	8,1
380ct1f1	-152,5	152,9	28,5	42,7	47,3	33,3
380ct1f2	-152,8	152,9	26,5	42,7	47,3	33,3
380ct1f3	-159,8	160,1	29,2	45,5	53,2	33,3
380ct2f1	-153,1	152,9	25,2	42,7	47,3	33,3
380ct2f2	-153,3	152,9	23,2	42,7	47,3	33,3
380ct2f3	-160,4	160,1	25,7	45,5	53,2	33,3
bl2	-48,4	48,2	6,6	13,7	14,1	8,1

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	894,9	945,2	894,9
380ct1f1	816,3	838,9	816,3
380ct1f2	816,3	838,9	816,3
380ct1f3	864,5	893,2	864,5
380ct2f1	816,3	838,9	816,3
380ct2f2	816,3	838,9	816,3
380ct2f3	864,5	893,2	864,5
bl2	894,9	949,4	894,9

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	1454,2	976,6
380ct1f1	1070,1	858,6
380ct1f2	1070,3	858,6
380ct1f3	1195,2	923,9
380ct2f1	1070,3	858,6
380ct2f2	1070,1	858,6
380ct2f3	1195,2	923,9
bl2	1454,6	978,8

Envelop of weight span over all combinations (incl. 0,9 combinations)

For all conductors		Wind / Weight span ratio
Max. weight span	1680,0 m	2,955 -
Min. weight span	811,3 m	1,427 -

Project: KIJ-GT
Tower: S+95 II
Number: 12

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	15,0	23,1	22,1	-46,8	49,5
380ct1f1	51,3	71,3	80,7	-149,4	156,5
380ct1f2	51,3	69,2	80,7	-149,4	156,5
380ct1f3	51,3	74,8	86,5	-156,2	164,0
380ct2f1	51,3	67,9	80,7	-149,4	156,5
380ct2f2	51,3	65,9	80,7	-149,4	156,5
380ct2f3	51,3	71,2	86,5	-156,2	164,0
bl2	15,0	20,3	22,1	-46,8	49,5

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	0,0	0,4	9,2	-15,0	15,0
380ct1f1	0,0	1,2	40,4	-64,2	64,2
380ct1f2	0,0	0,3	40,4	-64,2	64,2
380ct1f3	0,0	0,7	42,6	-64,2	64,2
380ct2f1	0,0	-0,3	40,4	-64,2	64,2
380ct2f2	0,0	-1,2	40,4	-64,2	64,2
380ct2f3	0,0	-0,7	42,6	-64,2	64,2
bl2	0,0	-0,4	9,1	-15,0	15,0

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	6,0	3,6
	380ct1f1	23,8	17,6
	380ct1f2	23,8	17,6
	380ct1f3	26,3	17,6
	380ct2f1	23,8	17,6
	380ct2f2	23,8	17,6
	380ct2f3	26,3	17,6
	bl2	6,1	3,6

Project: KIJ-GT
Tower: S+95 II
Number: 12

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		0	464	406	64716	17	50
ULS 1a_0,9_90		0	464	406	64716	17	50
ULS 3_90		0	284	540	39648	16	31
ULS 3_0,9_90		0	284	540	39648	16	31
SLS 7		0	0	265	0	6	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

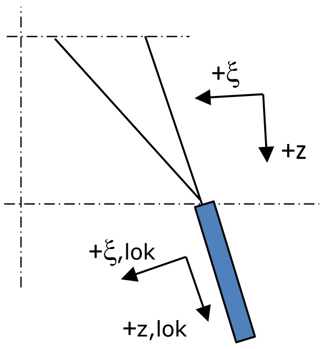
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	2193	3281	206433	17	50
ULS 3_90	0	802	3415	82164	16	31
SLS 7	0	0	2765	0	6	0

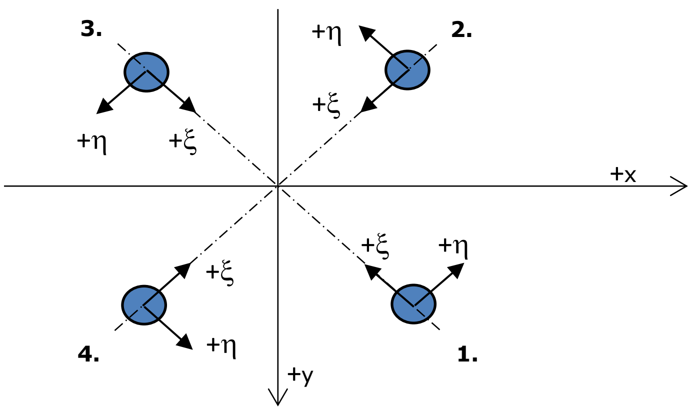
Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	2193	3281	**206433**	17	50
ULS 1a_0	1959	0	3179	0	**175811**	0
ULS 5a Ah 21	-51	0	2757	441	-6565	**1309**
ULS 1a_0,9_0,9_135	-1567	1799	2531	**167489**	**-134983**	25

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg





Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_45	1053	1005	**7493**	34	-1455	-42	7625
2	ULS 1a_0	606	-687	**4684**	57	-914	-31	4767
3	ULS 7	-132	-132	**898**	0	-186	-17	914
4	ULS 1a_135	-1053	1006	**7495**	-33	-1456	-42	7628

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	0	0	0	0
2	ULS 1a_0,9_0,9_135	-843	795	**-6059**	34	1158	15	-6166
3	ULS 1a_0,9_0,9_45	842	795	**-6056**	-33	1157	15	-6163
4	ULS 1a_0,9_0,9_0	398	-479	**-3267**	-57	621	4	-3325

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_0,9_0,9_135	245	104	1352	**99**	-247	8	1376
2	ULS 1a_45	-34	-107	88	**99**	-51	-35	89
3	ULS 1a_0	373	454	-3095	**57**	585	1	-3149
4	ULS 5a Ah 21	-101	137	844	**26**	-168	-9	859

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	ULS 1a_0	606	687	4684	**-57**	-915	-31	4767
2	ULS 5a Ah 10	104	-65	554	**-27**	-120	-15	564
3	ULS 1a_0,9_0,9_135	59	-81	-86	**-99**	-16	-32	-88
4	ULS 1a_45	-269	130	1520	**-98**	-282	5	1546

Project: KIJ-GT
Tower: S+95 II
Number: 12

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	**0**	0	0	0
2	ULS 1a_0,9_0,9_135	-843	795	**-6059**	**34**	1158	15	-6166
3	ULS 1a_0,9_0,9_45	842	795	**-6056**	**-33**	1157	15	-6163
4	ULS 1a_0,9_0,9_0	398	-479	**-3267**	**-57**	621	4	-3325

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	101	101	691	0	-143	-13	704
2	SLS 7	101	-101	691	0	-143	-13	704
3	SLS 7	-101	-101	691	0	-143	-13	703
4	SLS 7	-101	101	691	0	-143	-13	703

Envelope of load combinations for all of the legs

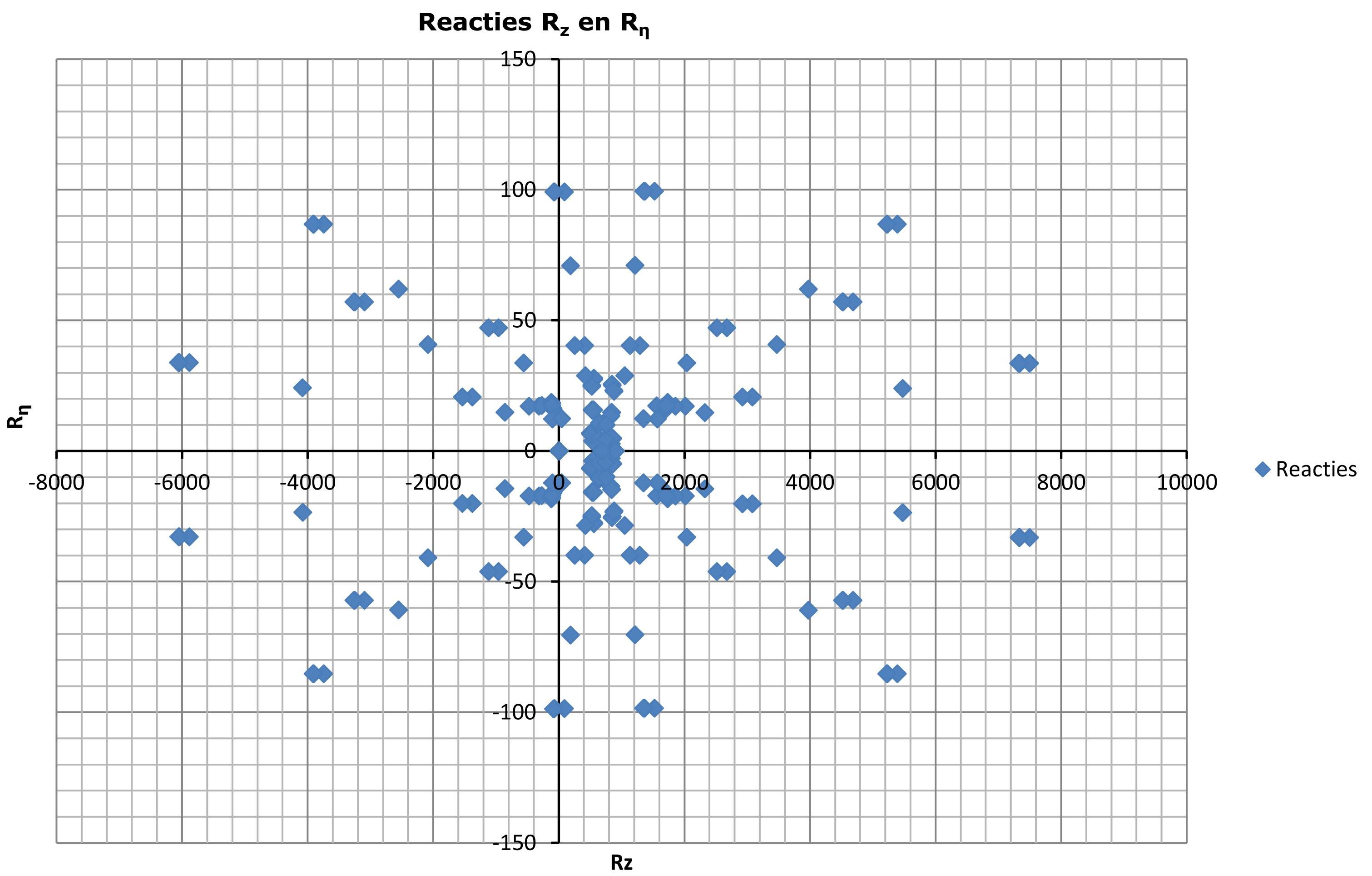
Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_135	-1053	1006	**7495**	-33	-1456	-42	7628
Max. tension	ULS 1a_0,9_0,9_135	-843	795	**-6059**	34	1158	15	-6166
Max. pos. torsie	ULS 1a_0,9_0,9_135	245	104	1352	**99**	-247	8	1376
Max. neg. torsie	ULS 1a_0,9_0,9_135	59	-81	-86	**-99**	-16	-32	-88
Comb. tension+torsie	ULS 1a_0,9_0,9_135	-843	795	**-6059**	**34**	1158	15	-6166

Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	101	101	**691**	0	-143	-13	704
2	SLS 1a_135	-566	532	**-4083**	24	776	6	-4155
3	SLS 1a_45	565	532	**-4081**	-23	776	6	-4153
4	SLS 1a_0	248	-306	**-2087**	-41	392	-1	-2124

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_45	770	736	**5475**	24	-1065	-33	5572
2	SLS 1a_0	451	-509	**3470**	41	-679	-25	3531
3	SLS 7	-101	-101	**691**	0	-143	-13	703
4	SLS 1a_135	-770	737	**5477**	-24	-1065	-33	5573


Reacties R_z en R_η
150
100
50
0
-50
-100
-150
-8000
-6000
-4000
-2000
0
2000
4000
6000
8000
10000
R_η
Rz
Reacties

Content

ISSUE	DATE	REVISION	CHK'D	APP'D
0.0	2021-04-06			

Client: TenneT Taking power further

DNV·GL

Data

Norm	NEN-EN50341-2-15:2019
Initial	
Consequence class	CC2-0
Reliability level	Afkeur
Reference period	15 jaar
After adjustment	
Consequence class	CC2
Reliability level	Verbouw
Reference period	50 jaar
Wind zone	II
Wind speed	27 m/s
Terrain categorie	II
Reduction factor Cdir	1,00
Ice region	B
Tower type	Steunmast
Tower height	162,5 m
Max. Span	701 m
Line angle	180°
Catenary	1400 m
Wind span	645 m
EDS Weight span	837 m
Min. Weight span	795 m
Max. Weight span	1299 m

Title:

Berekening masttype S+95 II T

JOB No.	-	DATE	-
DRAWN	-	CHKD	-
DESIGN	-	APPD	-

Document name:

KIJ-GT_S+95 II T_13_Report.pdf

Project number:

Project client number:

0.0

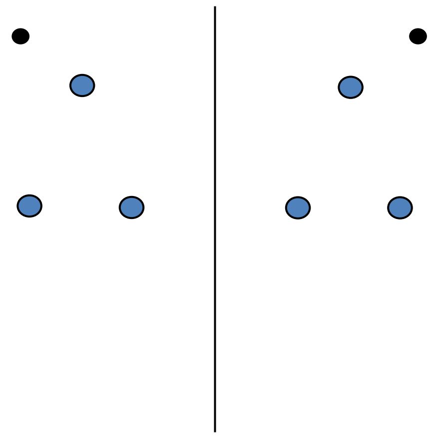
Project: KIJ-GT
Tower: S+95 II T
Number: 13

Conductor loads

Auteur: TBR
Versie: v11.7

General

Description	S+95 II T
Tower type	Steunmast
Number of circuits	2
Configuration	2-circuit-donau
Number of earth wires	2



Configuratie geleiders

Starting points

Norm	NEN-EN50341-2-15:2019
Consequence class	CC2-0
Reliability level initial	Afkeur CC2-0
Reference period intial	15 jaar
Consequence class modified	CC2
Reliability level modified	Verbouw
Reference period modified	50 jaar
Wind zone	II
Wind speed (m/s)	27,0 m/s
Terrain category	II
Reduction factor c_{dir}	1,00
Ice region phase conductor	B
Ice region earth conductor	B

Conductors back

Description	Voltage	Conductor Back	Bundle Ba	Ice region	Additional weight	Additional diameter	Catenary P_{back}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Conductors ahead

Description	Voltage	Conductor Ahead	Bundle Ah	Ice region	Additional weight	Additional diameter	Catenary P_{ahead}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Insulators *(1)*

Description	Suspension	Weight [kN]	Length [m]	Wind area [m^2]
Circuit 1	Halfverankering	3,00	4,30	1,50
Circuit 2	Halfverankering	3,00	4,30	1,50
Bliksemdraad 1	Vast (Bliksemdraad)	0,20	0,30	0,10
Bliksemdraad 2	Vast (Bliksemdraad)	0,20	0,30	0,10

1. Properties apply to the entire isolator set

Suspension height and position in mast

Circuits	Designation	Number	Suspension height	Attach point	Position in tower Horizontal distance
Circuit 1	21	380ct1f1	123,7 m	128,0 m	25,5 m
Circuit 1	20	380ct1f2	123,7 m	128,0 m	11,5 m
Circuit 1	22	380ct1f3	150,7 m	155,0 m	18,5 m
Circuit 2	11	380ct2f1	123,7 m	128,0 m	-11,5 m
Circuit 2	10	380ct2f2	123,7 m	128,0 m	-25,5 m
Circuit 2	12	380ct2f3	150,7 m	155,0 m	-18,5 m
Bliksemdraad 1	3	bl1	160,7 m	161,0 m	31,5 m
Bliksemdraad 2	1	bl2	160,7 m	161,0 m	-31,5 m

Project: KIJ-GT
Tower: S+95 II T
Number: 13

Height adjustment adjacent masts	(wind and weight span adjustment)		
	Back	Ahead	
Height increase for wind pressure	0,0 m	0,0 m	(positive: higher)
Height decrease for vertical load	0,0 m	0,0 m	(negative: decrease, more weight span)
Decrease: Niet in 0,9EG-combinaties			

Height difference adjacent tower and change of direction with respect to Line direction

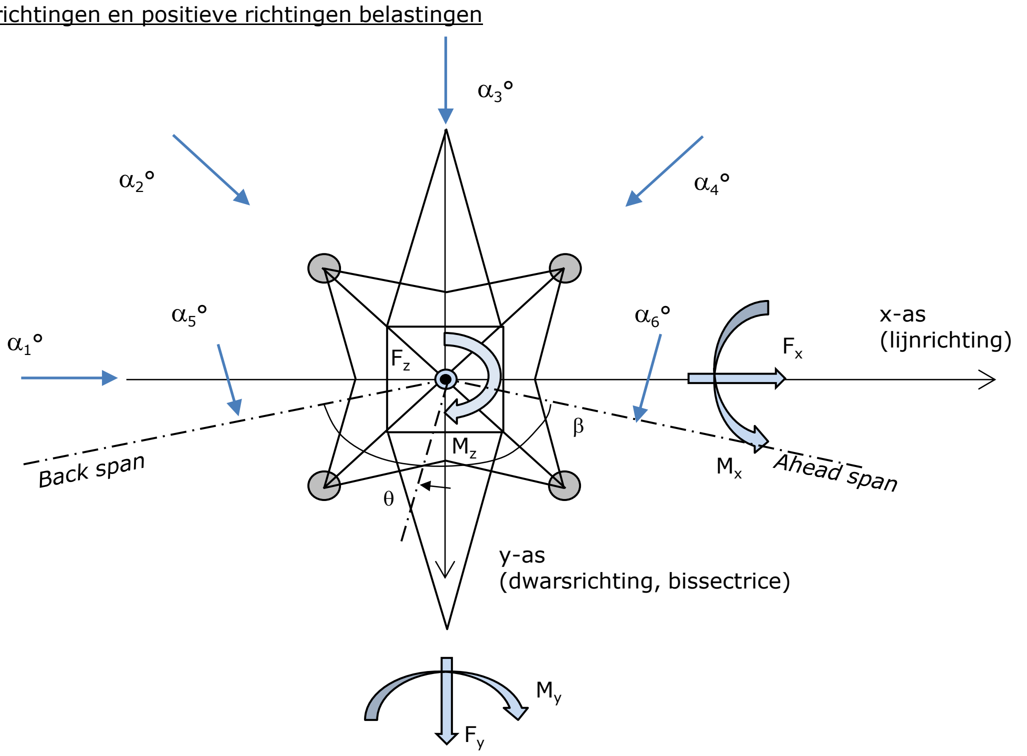
			Hoogteverschil		Richtingsverandering	
Circuits	Aanduiding	Nummer	Δh_back	Δh_ahead	Δy_back	Δy_ahead
Circuit 1	21	380ct1f1	0,4	-65,0 m	0,0	5,0 m
Circuit 1	20	380ct1f2	0,4	-65,0 m	0,0	1,0 m
Circuit 1	22	380ct1f3	0,4	-75,5 m	0,0	3,0 m
Circuit 2	11	380ct2f1	0,4	-65,0 m	0,0	-1,0 m
Circuit 2	10	380ct2f2	0,4	-65,0 m	0,0	-5,0 m
Circuit 2	12	380ct2f3	0,4	-75,5 m	0,0	-3,0 m
Bliksemdraad 1	3	bl1	0,4	-75,6 m	0,0	8,5 m
Bliksemdraad 2	1	bl2	0,4	-75,6 m	0,0	-8,5 m

Line and tower data

		Back	Ahead
		701,0	589,0 m
Ruling span $\sqrt{(\Sigma L^3/\Sigma L)}$		552,7	552,7 m
Line angle	β	180 °	
Tower orientation with respect to bis	θ	0 °	
Section length		2418	2418 m
Height bottom of tower to ground level		0,5 m	
Wind directions considered	α_1	0 °	
Wind directions according to:	α_2	45 °	
Geleiderbelastingen	α_3	90 °	
	α_4	135 °	
	α_5	- °	
	α_6	- °	

Wind directions apply to the main direction of mast construction, not to the bisector.

Windrichtingen en positieve richtingen belastingen



Considered number of wind directions	
1a	4
3	4
4	1
6	1
Overig	1

Project: KIJ-GT
Tower: S+95 II T
Number: 13

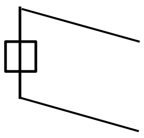
Absence of conductors

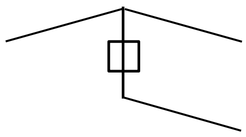
		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	380ct1f1	1	0	1	0	0,8	0
Circuit 1	380ct1f2	1	0	1	0	0,8	0
Circuit 1	380ct1f3	1	0	1	0	0,8	0
Circuit 2	380ct2f1	0	1	1	0	0,8	0
Circuit 2	380ct2f2	0	1	1	0	0,8	0
Circuit 2	380ct2f3	0	1	1	0	0,8	0
Bliksemdraad 1	bl1	1	0	1	0	1	0
Bliksemdraad 2	bl2	0	1	1	0	1	0

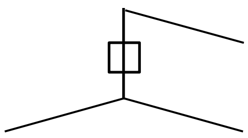
Load situations SPLS

Considered situations SPLS: SPLS for suspension tower not applicable

Principle of load situations:


1. Ba All cts


2. Ba ct1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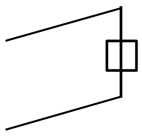
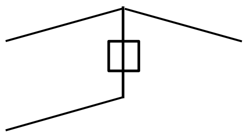
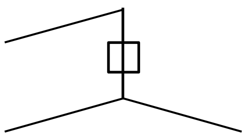

4. Ah All cts

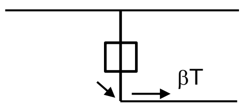

5. Ah ct1


6. Ah ct2

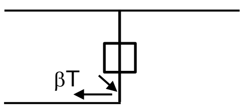
Load situation 5a. Conductor failure

Considered situations conductor failure 5a: 1 and 2, all possible situations

Principle of load situations:



1. Ba



2. Ah

Load situations LC6. Construction and maintenance

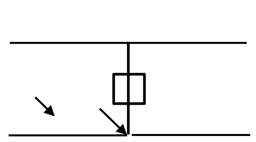
Under 6a, the load due to the presence of a line verhicle or line bicycle in combination with point load on the traverse is assesed.
Combination 6b does not contain any loads in conductor or on traverse. This combination has been added to be able to combine with separate control platforms, etc. The situations are applied in ULS and in every SPLS situation (in case of angle tower).

	Phase	Earth
Line vehicle	3,0 kN	2,0 kN
Concentrated load cross arm	1,0 kN	1,0 kN

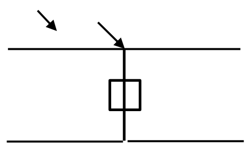
Beschouwde situaties bouw- en onderhoud 6a: 1 t/m 4, alle mogelijke situaties.

Presence line vehicle: Circuit, belasting tegelijk aanwezig in alle geleiders per circuit.

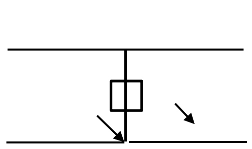
Principle of load situations:



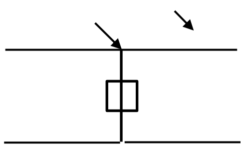
1. Ba Ct1



2. Ba Ct2



3. Ah Ct1



4. Ah Ct2

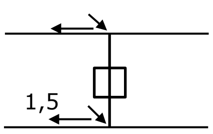
Load situations 8. Galloping as a static load

Conductor		
Suspension tower phase	0,866 W	1,5 W
Suspension tower earth	1,5 EDS	1,5 W
Strain tower phase and earth	1,5 EDS	1,5 W

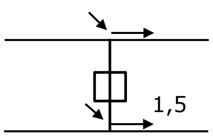
Considered situations galloping 8: None (existing structure)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principle of load situations:



1. Ba



2. Ah

Load combination 8. Galloping as a dynamic load

Only applies to tension towers
Load consists of EDS tensile load in one of the conductors on one side of the tower
Can be converted by user to fatigue spectrum via the load spectrum of table 4.11 / NL.1

Project: KIJ-GT
Tower: S+95 II T
Number: 13

Tower structure

Properties

Tower type	Steunmast		
Tower designation	S+95 II T		
Base plate w.r.t. ground level	0,5	m	
Tower height w.r.t. base plate	162,5	m	
Tower self weight	2500,0	kN	

Width and slope at foundation	x-ri.	y-ri.	
Leg spread	22,60	22,60	m
Inclination of main leg	0,133	0,133	-
Horizontal force factor	1,1	1,1	-

Calculation Wind load

Dynamic factor G_T	1,02
Wind load diagonally to tower body proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Wind load diagonally on traverse proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Magnification factor diagonal wind to tower body	(1+0,2sin^2(2phi))
Magnification factor diagonal wind to cross arm	(1+0,2sin^2(2phi))
Magnification factor wind parallel to perpendicular to cross a	0,4

Properties mast sections longitudinal direction (front view, yz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	30,00	22,60	14,60	30,00	0,133	558,00	66,21	0,12	3,31
Middenstuk 1	65,58	14,60	10,26	35,58	0,061	442,26	73,77	0,17	3,08
Middenstuk 2	100,50	10,26	6,00	34,92	0,061	283,90	65,38	0,23	2,80
Bovenstuk 1	127,50	6,00	5,00	27,00	0,019	148,50	33,73	0,23	2,82
Bovenstuk 2	158,50	5,00	3,83	31,00	0,019	136,87	33,26	0,24	2,75
Topstuk	162,50	3,83		4,00		7,66	1,40	0,18	3,01
Ondertraverse	127,50	23,00		4,00		46,00	14,30	0,31	2,50
Boventraverse	154,50	29,50		6,00		88,50	17,60	0,20	2,94

Properties tower sections transversal direction (side view, xz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	30,00	22,60	14,60	30,00	0,133	558,00	66,21	0,12	3,31
Middenstuk 1	65,58	14,60	10,26	35,58	0,061	442,26	73,77	0,17	3,08
Middenstuk 2	100,50	10,26	6,00	34,92	0,061	283,90	65,38	0,23	2,80
Bovenstuk 1	127,50	6,00	5,00	27,00	0,019	148,50	33,73	0,23	2,82
Bovenstuk 2	158,50	5,00	3,83	31,00	0,019	136,87	33,26	0,24	2,75
Topstuk	162,50	3,83		4,00		7,66	1,40	0,18	3,01
Ondertraverse	127,50	23,00		4,00		46,00	14,30	0,31	2,50
Boventraverse	154,50	29,50		6,00		88,50	17,60	0,20	2,94

Note: Surface transverse direction is reduced in calculation.

Project: KIJ-GT
Tower: S+95 II T
Number: 13

Wind surface feeders telecom installations

Part	A (m^2/m)	Factor	Δh	A_1
Broekstuk 1	0,08	1,00	30,0	2,4
Middenstuk 1				
Middenstuk 2				
Bovenstuk 1				
Bovenstuk 2				

Input antennas

Description	A (m^2)	h (m)	C_f (m)
Antenne 1	3,75	40	1,5
Schotel			
Schotel			

Tower section loads longitudinal (x-direction) per wind direction

Description	p_w [kN/m^2]	F_{x1} [kN]	F_{x2} [kN]	F_{x3} [kN]	F_{x4} [kN]	h_{ef} [m]	M_{y1} [kNm]	M_{y2} [kNm]	M_{y3} [kNm]	M_{y4} [kNm]
Broekstuk 1	0,97	213,7	181,3	0,0	-181,3	15,0	3205,2	2719,7	0,0	-2719,7
Middenstuk 1	1,36	309,6	262,7	0,0	-262,7	47,8	14796,4	12555,2	0,0	-12555,2
Middenstuk 2	1,57	287,1	243,6	0,0	-243,6	83,0	23837,1	20226,4	0,0	-20226,4
Bovenstuk 1	1,69	160,6	136,3	0,0	-136,3	114,0	18305,5	15532,7	0,0	-15532,7
Bovenstuk 2	1,78	162,8	138,1	0,0	-138,1	143,0	23277,0	19751,2	0,0	-19751,2
Topstuk	1,83	7,7	6,5	0,0	-6,5	160,5	1233,7	1046,8	0,0	-1046,8
Ondertraverse	1,74	124,1	73,7	0,0	-73,7	128,8	15982,3	9493,0	0,0	-9493,0
Boventraverse	1,82	187,6	111,4	0,0	-111,4	156,5	29362,3	17440,3	0,0	-17440,3
Totaal		1453,1	1153,6	0,0	-1153,6		129999,4	98765,3	0,0	-98765,3

Tower section loads transversal (y-direction) per wind direction

Description	p_w [kN/m^2]	F_{y1} [kN]	F_{y2} [kN]	F_{y3} [kN]	F_{x4} [kN]	h_{ef} [m]	M_{x1} [kNm]	M_{x2} [kNm]	M_{x3} [kNm]	M_{x4} [kNm]
Broekstuk 1	0,97	0,0	181,3	213,7	181,3	15,0	0,0	2719,7	3205,2	2719,7
Middenstuk 1	1,36	0,0	262,7	309,6	262,7	47,8	0,0	12555,2	14796,4	12555,2
Middenstuk 2	1,57	0,0	243,6	287,1	243,6	83,0	0,0	20226,4	23837,1	20226,4
Bovenstuk 1	1,69	0,0	136,3	160,6	136,3	114,0	0,0	15532,7	18305,5	15532,7
Bovenstuk 2	1,78	0,0	138,1	162,8	138,1	143,0	0,0	19751,2	23277,0	19751,2
Topstuk	1,83	0,0	6,5	7,7	6,5	160,5	0,0	1046,8	1233,7	1046,8
Ondertraverse	1,74	0,0	73,7	49,6	73,7	128,8	0,0	9493,0	6392,9	9493,0
Boventraverse	1,82	0,0	111,4	75,0	111,4	156,5	0,0	17440,3	11744,9	17440,3
Total		0,0	1153,6	1266,1	1153,6		0,0	98765,3	102792,6	98765,3

Resulting loads from mast construction incl. Antenna without conductors level foundation (char. Value)

Load / wind direction	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
Permanente belasting	0	0	2500	0	0	0
Windrichting 0°	1460	0	0	0	132898	0
Windrichting 45°	1159	1159	0	100952	100952	0
Windrichting 90°	0	1273	0	105147	0	0
Windrichting 135°	-1159	1159	0	100952	-100952	0

Project: KIJ-GT
Tower: S+95 II T
Number: 13

Intermediate results for conductor loads

Conductors back

Circuit	Geleider	Diameter [mm]	A [mm²]	G [N/m]	E [N/mm²]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Conductors ahead

Circuit	Geleider	Diameter [mm]	A [mm²]	G [N/m]	E [N/mm²]	αT [-]
Circuit 1	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Circuit 2	ACCCZ-Warsaw	27,7	571,0	14,98	62700	1,88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21,8	281,1	9,81	75000	1,89E-05
Bliksemdraad 2	OPGW 226	21,7	264,0	9,80	81000	2,30E-05

Vertical load back

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Vertical load ahead

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	[N/m]	[N/m]
Circuit 1	3	2	45,8	B	4+0,2d	9,5	28,6
Circuit 2	3	2	45,8	B	4+0,2d	9,5	28,6
Bliksemdraad 1	1	2	10,0	B	4+0,2d	8,4	8,4
Bliksemdraad 2	1	2	10,0	B	4+0,2d	8,3	8,3

Insulators

Conductor	$G_{isolator}$ [kN]	Number -	$F_{v,iso}$ [kN]	Length [m]	Wind surf. [m²]	Wind heigth [m]	Pressure [kN/m²]	Drag factor [-]	$F_{h,iso}$ [kN]
380ct1f1	3,00	1	3	4,3	1,5	126,35	1,73	1,2	3,11
380ct1f2	3,00	1	3	4,3	1,5	126,35	1,73	1,2	3,11
380ct1f3	3,00	1	3	4,3	1,5	153,35	1,81	1,2	3,25
380ct2f1	3,00	1	3	4,3	1,5	126,35	1,73	1,2	3,11
380ct2f2	3,00	1	3	4,3	1,5	126,35	1,73	1,2	3,11
380ct2f3	3,00	1	3	4,3	1,5	153,35	1,81	1,2	3,25
bl1	0,20	1	0,2	0,3	0,1	161,35	1,83	1,2	0,22
bl2	0,20	1	0,2	0,3	0,1	161,35	1,83	1,2	0,22

Project: KIJ-GT
Tower: S+95 II T
Number: 13

Wind load back

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	95,2	1,62	0,63	0,59	0,95	28,25	81,5	76,3	46,9	172,0	160,8
380ct1f2	95,2	1,62	0,63	0,59	0,95	28,25	81,5	76,3	46,9	172,0	160,8
380ct1f3	122,2	1,72	0,65	0,60	0,92	28,25	86,9	81,2	46,9	187,5	175,2
380ct2f1	95,2	1,62	0,63	0,59	0,95	28,25	81,5	76,3	46,9	172,0	160,8
380ct2f2	95,2	1,62	0,63	0,59	0,95	28,25	81,5	76,3	46,9	172,0	160,8
380ct2f3	122,2	1,72	0,65	0,60	0,92	28,25	86,9	81,2	46,9	187,5	175,2
bl1	134,1	1,75	0,65	0,61	1,07	22,24	27,3	25,5	41,5	57,1	53,3
bl2	134,1	1,75	0,65	0,61	1,08	22,13	27,3	25,5	41,4	56,9	53,2

Wind load ahead

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	71,1	1,51	0,61	0,57	0,97	28,25	75,3	70,5	46,9	154,9	145,0
380ct1f2	71,1	1,51	0,61	0,57	0,97	28,25	75,3	70,5	46,9	154,9	145,0
380ct1f3	92,8	1,61	0,63	0,59	0,95	28,25	81,0	75,8	46,9	170,5	159,4
380ct2f1	71,1	1,51	0,61	0,57	0,97	28,25	75,3	70,5	46,9	154,9	145,0
380ct2f2	71,1	1,51	0,61	0,57	0,97	28,25	75,3	70,5	46,9	154,9	145,0
380ct2f3	92,8	1,61	0,63	0,59	0,95	28,25	81,0	75,8	46,9	170,5	159,4
bl1	104,1	1,65	0,64	0,59	1,09	22,24	25,4	23,8	41,5	52,3	48,9
bl2	104,1	1,65	0,64	0,59	1,09	22,13	25,4	23,7	41,4	52,2	48,8

Project: KIJ-GT
Tower: S+95 II T
Number: 13

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Conductor loads		Auteur: TBR Versie: v11.7

Starting points

Consequence class	Afkeur CC2-0
Reference period	15 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,05	1,05	0,00	1,02	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,05	0,00	1,02	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,02	0,00	0,0
ULS 3	Wind+ice	-5°	1,05	1,05	0,00	0,31	0,79	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,05	0,00	0,31	0,79	0,0
ULS 4	Cold+wind	-20°	1,05	1,05	0,00	0,20	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,05	0,00	0,20	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,05	1,05	1,20	0,20	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,05	1,05	0,00	0,20	0,00	0,0
ULS 7	Permanent	10°	1,15	1,15	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,05	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,05	1,05	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,05	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,05	1,05	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,05	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,05	1,05	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,05	1,05	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	0,87	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,26	0,71	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,17	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,17	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	4
Number of load combinations for ULS	44
Number of load combinations for SPLS	0
Number of load combinations for SLS	11
Number of concentrated loads	440

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Project: KIJ-GT
Tower: S+95 II T
Number: 13

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-37,5	37,4	9,9	8,3	7,4	10,0
380ct1f1	-119,9	119,7	30,7	25,2	26,3	35,1
380ct1f2	-119,9	119,9	30,7	24,4	26,3	35,1
380ct1f3	-125,4	125,3	32,7	26,6	26,3	37,5
380ct2f1	-119,9	119,9	30,7	24,0	26,3	35,1
380ct2f2	-119,9	120,1	30,7	23,3	26,3	35,1
380ct2f3	-125,4	125,5	32,7	25,4	26,3	37,5
bl2	-37,5	37,6	9,9	7,2	7,4	10,0

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	836,6	861,4	836,6
380ct1f1	798,5	810,6	798,5
380ct1f2	798,5	810,6	798,5
380ct1f3	823,5	838,5	823,5
380ct2f1	798,5	810,6	798,5
380ct2f2	798,5	810,6	798,5
380ct2f3	823,5	838,5	823,5
bl2	836,6	863,8	836,6

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	1088,5	888,2
380ct1f1	911,1	823,6
380ct1f2	911,1	823,7
380ct1f3	969,2	858,3
380ct2f1	911,1	823,7
380ct2f2	911,1	823,6
380ct2f3	969,2	858,3
bl2	1088,5	889,5

Envelop of weight span over all combinations (incl. 0,9 combinations) For all conductors		Wind / Weight span ratio
Max. weight span	1152,7 m	1,787 -
Min. weight span	797,5 m	1,236 -

Project: KIJ-GT
Tower: S+95 II T
Number: 13

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	15,0	18,1	15,4	-38,5	36,5
380ct1f1	51,3	55,9	61,3	-123,0	116,8
380ct1f2	51,3	55,1	61,3	-123,0	116,8
380ct1f3	51,3	59,3	63,8	-128,4	122,4
380ct2f1	51,3	54,8	61,3	-123,0	116,8
380ct2f2	51,3	54,0	61,3	-123,0	116,8
380ct2f3	51,3	58,1	63,8	-128,4	122,4
bl2	15,0	17,1	15,4	-38,5	36,5

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	0,0	0,2	8,6	-15,0	15,0
380ct1f1	0,0	0,5	39,6	-64,2	64,2
380ct1f2	0,0	0,1	39,6	-64,2	64,2
380ct1f3	0,0	0,3	40,7	-64,2	64,2
380ct2f1	0,0	-0,1	39,6	-64,2	64,2
380ct2f2	0,0	-0,5	39,6	-64,2	64,2
380ct2f3	0,0	-0,3	40,7	-64,2	64,2
bl2	0,0	-0,2	8,6	-15,0	15,0

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	3,6	5,2
	380ct1f1	17,5	22,6
	380ct1f2	17,5	22,6
	380ct1f3	17,5	23,9
	380ct2f1	17,5	22,6
	380ct2f2	17,5	22,6
	380ct2f3	17,5	23,9
	bl2	3,6	5,2

Project: KIJ-GT
Tower: S+95 II T
Number: 13

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		0	372	311	51997	-3	-22
ULS 1a_0,9_90		0	372	311	51997	-3	-22
ULS 3_90		0	228	403	31877	-3	-14
ULS 3_0,9_90		0	228	403	31877	-3	-14
SLS 7		0	0	257	0	-1	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

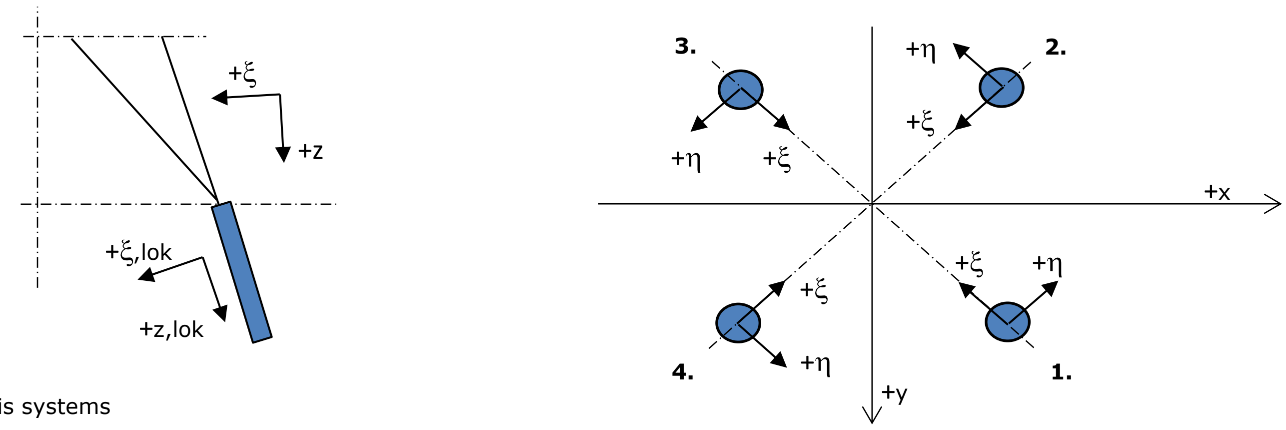
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	1671	2936	159218	-3	-22
ULS 3_90	0	618	3028	64044	-3	-14
SLS 7	0	0	2757	0	-1	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	1671	2936	**159218**	-3	-22
ULS 1a_0,9_0,9_0	1494	0	2482	0	**136254**	0
ULS 5a Ba 10	51	0	2749	423	6570	**-1309**
ULS 1a_0,9_0,9_135	-1185	1372	2497	**129518**	**-103466**	-11

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_45	823	785	**5881**	27	-1137	-28	5985
2	ULS 1a_0	480	-548	**3738**	48	-727	-22	3804
3	ULS 5a Ah 22	-104	-137	**872**	-23	-171	-6	887
4	ULS 1a_135	-823	785	**5882**	-27	-1137	-28	5985

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	0	0	0	0
2	ULS 1a_0,9_0,9_135	-625	587	**-4530**	27	857	3	-4610
3	ULS 1a_0,9_0,9_45	625	587	**-4530**	-27	857	3	-4610
4	ULS 1a_0,9_0,9_0	283	-351	**-2394**	-48	448	-3	-2436

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_0,9_0,9_135	215	99	1201	**82**	-222	4	1222
2	ULS 1a_45	-17	-99	151	**82**	-58	-30	154
3	ULS 1a_0,9_0,9_0	283	351	-2394	**48**	448	-3	-2436
4	ULS 5a Ah 10	-101	137	845	**25**	-168	-9	860

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	ULS 1a_0,9_0,9_0	465	533	3635	**-48**	-705	-20	3699
2	ULS 5a Ah 21	104	-65	554	**-28**	-120	-15	564
3	ULS 1a_0,9_0,9_135	32	-84	48	**-83**	-37	-28	49
4	ULS 1a_45	-231	114	1303	**-83**	-244	2	1326

Project: KIJ-GT
Tower: S+95 II T
Number: 13

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	**0**	0	0	0
2	ULS 1a_0,9_0,9_135	-625	587	**-4530**	**27**	857	3	-4610
3	ULS 1a_0,9_0,9_45	625	587	**-4530**	**-27**	857	3	-4610
4	ULS 1a_0,9_0,9_0	283	-351	**-2394**	**-48**	448	-3	-2436

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	101	101	689	0	-143	-13	701
2	SLS 7	101	-101	689	0	-143	-13	701
3	SLS 7	-101	-101	689	0	-143	-13	701
4	SLS 7	-101	101	689	0	-143	-13	701

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_135	-823	785	**5882**	-27	-1137	-28	5985
Max. tension	ULS 1a_0,9_0,9_135	-625	587	**-4530**	27	857	3	-4610
Max. pos. torsie	ULS 1a_0,9_0,9_135	215	99	1201	**82**	-222	4	1222
Max. neg. torsie	ULS 1a_0,9_0,9_135	32	-84	48	**-83**	-37	-28	49
Comb. tension+torsie	ULS 1a_0,9_0,9_45	625	587	**-4530**	**-27**	857	3	-4610

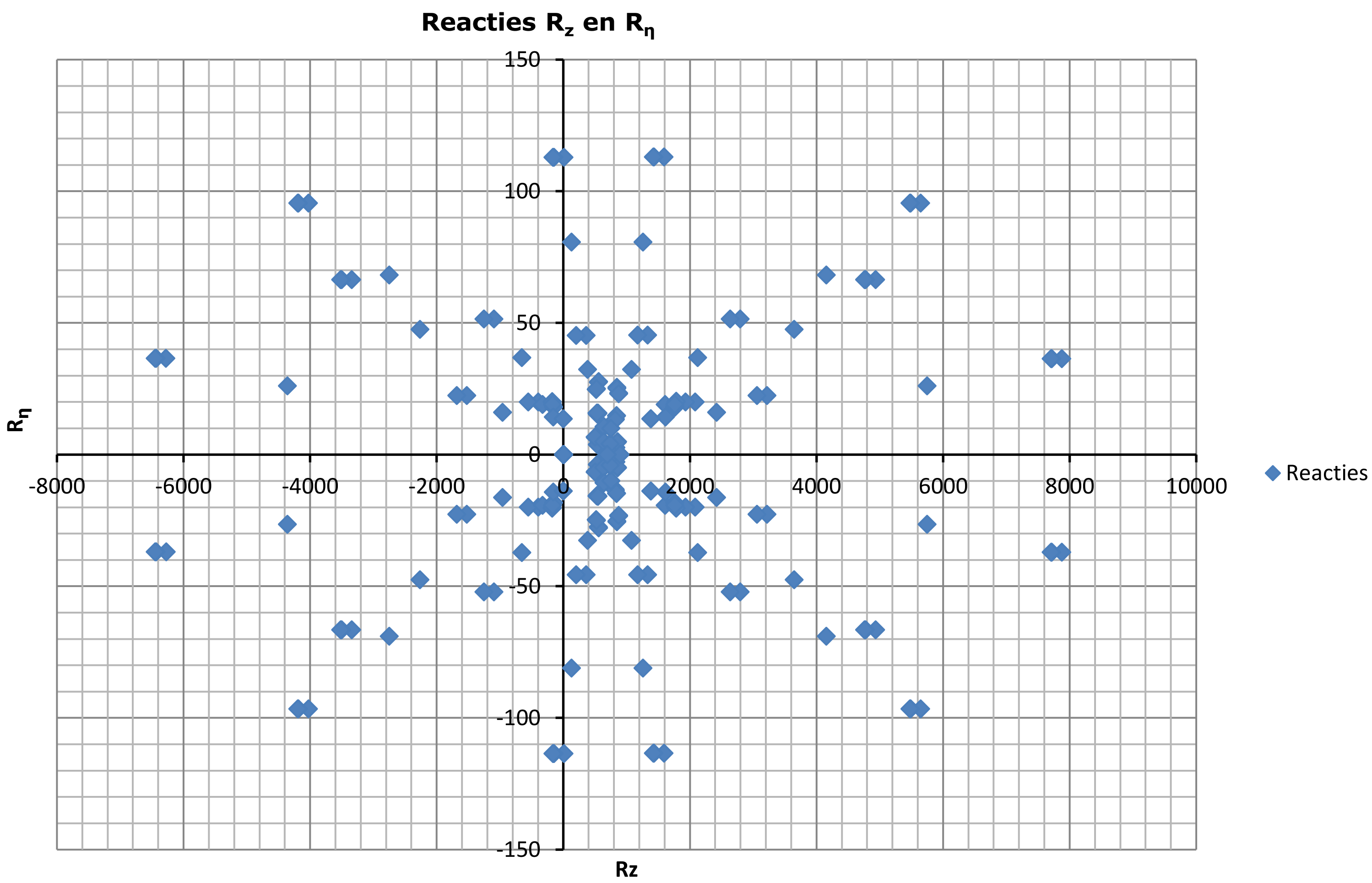
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	101	101	**689**	0	-143	-13	701
2	SLS 1a_135	-507	475	**-3687**	23	695	-1	-3752
3	SLS 1a_45	507	475	**-3686**	-23	695	-1	-3751
4	SLS 1a_0	216	-274	**-1871**	-41	347	-6	-1904

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_45	710	678	**5070**	23	-982	-26	5159
2	SLS 1a_0	418	-477	**3250**	41	-633	-20	3307
3	SLS 7	-101	-101	**689**	0	-143	-13	701
4	SLS 1a_135	-710	678	**5070**	-23	-982	-26	5160

Project: KIJ-GT
Tower: S+95 II T
Number: 13



Project: KIJ-GT
Tower: S+95 II T
Number: 13

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Conductor loads

Auteur: TBR
Versie: v11.7

Starting points

Consequence class — Verbouw CC2
Reference period — 50 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1,15	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0,90	1,15	0,00	1,40	0,00	0,0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0,90	0,90	0,00	1,40	0,00	0,0
ULS 3	Wind+ice	-5°	1,15	1,15	0,00	0,42	1,30	0,0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0,90	1,15	0,00	0,42	1,30	0,0
ULS 4	Cold+wind	-20°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0,90	1,15	0,00	0,28	0,00	0,0
ULS 5a	Torsional loads	10°	1,00	1,00	1,00	0,00	0,00	1,0
ULS 5b	Longitudinal loads	10°	1,00	1,00	0,00	0,00	0,00	1,0
ULS 6	Construction + maintenance	5°	1,15	1,15	1,30	0,28	0,00	0,0
ULS 6_0,9	Construction + maintenance	5°	1,15	1,15	0,00	0,28	0,00	0,0
ULS 7	Permanent	10°	1,30	1,30	0,00	0,00	0,00	0,0
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1,15	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	1,15	0,0	0,78	0,00	0,0
SPLS 3	Wind+ice	-5°	1,15	1,15	0,0	0,36	0,34	0,0
SPLS 3_0,9	Wind+ice 0,9	-5°	0,90	1,15	0,0	0,36	0,34	0,0
SPLS 4	Cold+wind	-20°	1,15	1,15	0,0	0,24	0,00	0,0
SPLS 4_0,9	Cold+wind 0,9	-20°	0,90	1,15	0,0	0,24	0,00	0,0
SPLS 6	Maintenance	5°	1,15	1,15	1,2	0,24	0,0	0,0
SPLS 6_0,9	Maintenance	5°	1,15	1,15	0,0	0,24	0,0	0,0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1,00	1,00	0,0	1,00	0,0	0,0
SLS 3	Wind+ice	-5°	1,00	1,00	0,0	0,30	1,00	0,0
SLS 4	Wind	-20°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 6	Maintenance	5°	1,00	1,00	0,0	0,20	0,0	0,0
SLS 7	EDS, no wind	10°	1,00	1,00	0,0	0,00	0,0	0,0

Number of wind directions	4
Number of load combinations for ULS	44
Number of load combinations for SPLS	0
Number of load combinations for SLS	11
Number of concentrated loads	440

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Project: KIJ-GT
Tower: S+95 II T
Number: 13

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-48,3	48,1	13,6	11,3	8,1	12,1
380ct1f1	-152,3	152,1	42,2	34,5	33,2	44,4
380ct1f2	-152,3	152,3	42,2	33,5	33,2	44,4
380ct1f3	-160,0	159,8	44,9	36,5	33,2	47,5
380ct2f1	-152,3	152,4	42,2	33,0	33,2	44,4
380ct2f2	-152,3	152,6	42,2	32,0	33,2	44,4
380ct2f3	-160,0	160,2	44,9	34,9	33,2	47,5
bl2	-48,2	48,4	13,5	10,0	8,1	12,1

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	836,6	866,2	836,6
380ct1f1	798,5	812,3	798,5
380ct1f2	798,5	812,3	798,5
380ct1f3	823,5	840,8	823,5
380ct2f1	798,5	812,3	798,5
380ct2f2	798,5	812,3	798,5
380ct2f3	823,5	840,8	823,5
bl2	836,6	868,7	836,6

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	1165,7	884,8
380ct1f1	952,9	823,8
380ct1f2	952,9	823,8
380ct1f3	1021,9	859,0
380ct2f1	952,9	823,8
380ct2f2	952,9	823,8
380ct2f3	1021,9	859,0
bl2	1166,0	886,0

Envelop of weight span over all combinations (incl. 0,9 combinations) For all conductors		Wind / Weight span ratio
Max. weight span	1298,6 m	2,013 -
Min. weight span	795,4 m	1,233 -

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Project: KIJ-GT
Tower: S+95 II T
Number: 13

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	15,0	24,9	20,0	-49,6	46,9
380ct1f1	51,3	76,7	77,5	-156,6	148,0
380ct1f2	51,3	75,7	77,5	-156,6	148,1
380ct1f3	51,3	81,4	80,7	-164,1	155,9
380ct2f1	51,3	75,2	77,5	-156,6	148,1
380ct2f2	51,3	74,2	77,5	-156,6	148,0
380ct2f3	51,3	79,8	80,7	-164,1	155,9
bl2	15,0	23,5	20,0	-49,6	46,9

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	0,0	0,2	8,6	-15,0	15,0
380ct1f1	0,0	0,5	39,6	-64,2	64,2
380ct1f2	0,0	0,1	39,6	-64,2	64,2
380ct1f3	0,0	0,3	40,7	-64,2	64,2
380ct2f1	0,0	-0,1	39,6	-64,2	64,2
380ct2f2	0,0	-0,5	39,6	-64,2	64,2
380ct2f3	0,0	-0,3	40,7	-64,2	64,2
bl2	0,0	-0,2	8,6	-15,0	15,0

1 **Control uplift SLS-wind**

Combinatie:	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	3,6	5,3
	380ct1f1	17,5	22,7
	380ct1f2	17,5	22,7
	380ct1f3	17,5	24,0
	380ct2f1	17,5	22,7
	380ct2f2	17,5	22,7
	380ct2f3	17,5	24,0
	bl2	3,6	5,3

Project: KIJ-GT
Tower: S+95 II T
Number: 13

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		0	511	357	71388	-4	-30
ULS 1a_0,9_90		0	511	357	71388	-4	-30
ULS 3_90		0	313	512	43765	-4	-19
ULS 3_0,9_90		0	313	512	43765	-4	-19
SLS 7		0	0	257	0	-1	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

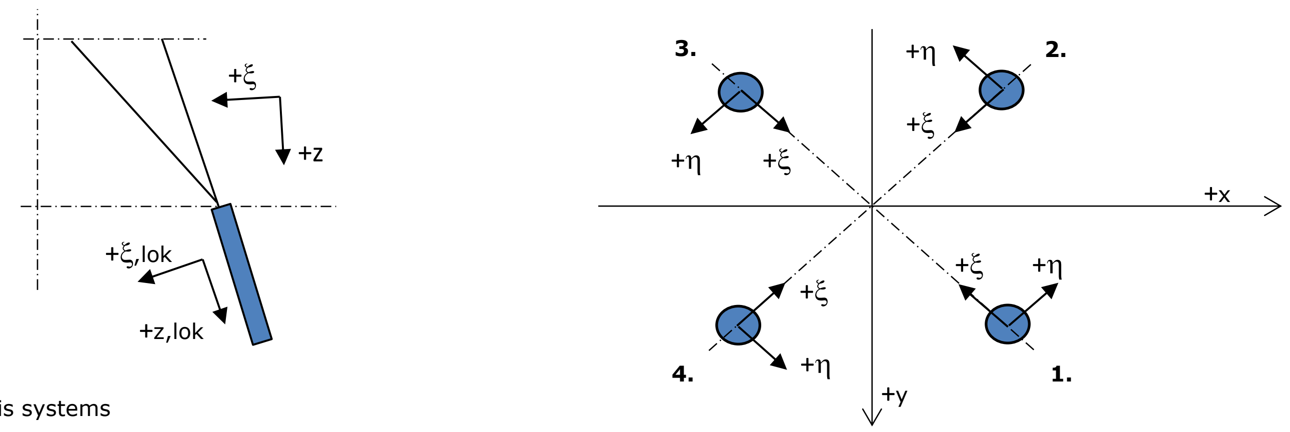
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	2294	3232	218594	-4	-30
ULS 3_90	0	848	3387	87927	-4	-19
SLS 7	0	0	2757	0	-1	0

Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	0	2294	3232	**218594**	-4	-30
ULS 1a_0,9_0,9_0	2052	0	2482	0	**187065**	0
ULS 5a Ba 10	51	0	2749	423	6570	**-1309**
ULS 1a_0,9_0,9_135	-1627	1884	2507	**177820**	**-142050**	-15

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_45	1101	1049	**7874**	36	-1520	-35	8013
2	ULS 1a_0	629	-723	**4931**	67	-956	-26	5018
3	ULS 7	-131	-131	**896**	0	-186	-17	912
4	ULS 1a_135	-1101	1049	**7875**	-37	-1520	-35	8013

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	0	0	0	0
2	ULS 1a_0,9_0,9_135	-892	840	**-6450**	37	1225	8	-6564
3	ULS 1a_0,9_0,9_45	892	840	**-6449**	-37	1224	8	-6563
4	ULS 1a_0,9_0,9_0	422	-516	**-3518**	-67	663	0	-3580

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 1a_0,9_0,9_135	262	102	1418	**113**	-257	10	1443
2	ULS 1a_45	-53	-107	7	**113**	-38	-37	7
3	ULS 1a_0,9_0,9_0	422	516	-3518	**67**	663	0	-3580
4	ULS 5a Ah 10	-101	137	845	**25**	-168	-9	860

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	ULS 1a_0,9_0,9_0	604	698	4759	**-67**	-921	-23	4843
2	ULS 5a Ah 21	104	-65	554	**-28**	-120	-15	564
3	ULS 1a_0,9_0,9_135	78	-82	-165	**-113**	-3	-34	-167
4	ULS 1a_45	-287	127	1589	**-113**	-293	7	1617

Project: KIJ-GT
Tower: S+95 II T
Number: 13

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	-	0	0	**0**	**0**	0	0	0
2	ULS 1a_0,9_0,9_135	-892	840	**-6450**	**37**	1225	8	-6564
3	ULS 1a_0,9_0,9_45	892	840	**-6449**	**-37**	1224	8	-6563
4	ULS 1a_0,9_0,9_0	422	-516	**-3518**	**-67**	663	0	-3580

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	101	101	689	0	-143	-13	701
2	SLS 7	101	-101	689	0	-143	-13	701
3	SLS 7	-101	-101	689	0	-143	-13	701
4	SLS 7	-101	101	689	0	-143	-13	701

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_135	-1101	1049	**7875**	-37	-1520	-35	8013
Max. tension	ULS 1a_0,9_0,9_135	-892	840	**-6450**	37	1225	8	-6564
Max. pos. torsie	ULS 1a_0,9_0,9_135	262	102	1418	**113**	-257	10	1443
Max. neg. torsie	ULS 1a_0,9_0,9_135	78	-82	-165	**-113**	-3	-34	-167
Comb. tension+torsie	ULS 1a_0,9_0,9_45	892	840	**-6449**	**-37**	1224	8	-6563

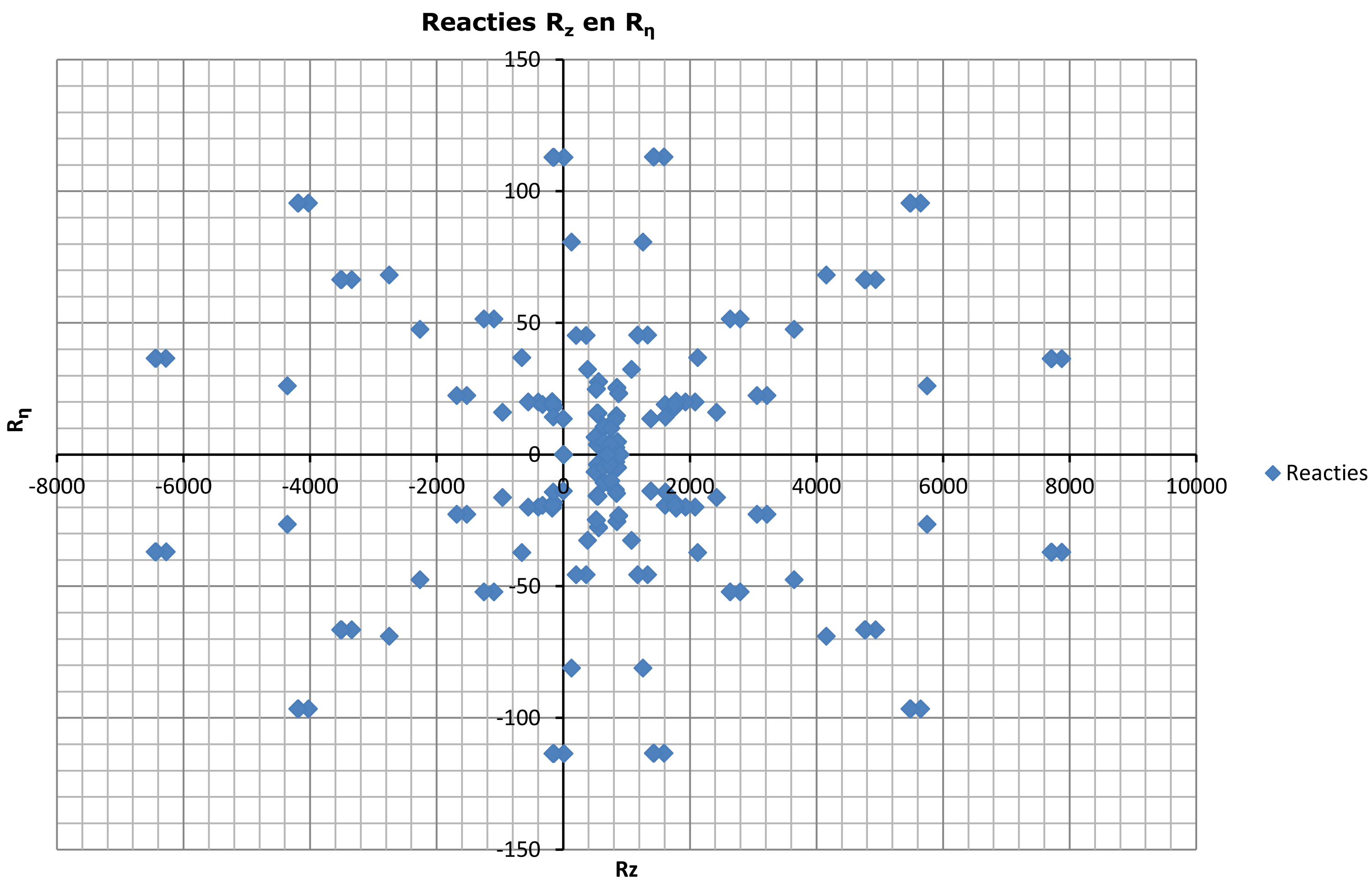
Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	101	101	**689**	0	-143	-13	701
2	SLS 1a_135	-601	564	**-4362**	26	824	1	-4439
3	SLS 1a_45	601	564	**-4362**	-26	824	1	-4438
4	SLS 1a_0	265	-332	**-2267**	-48	423	-5	-2307

Maximum compression load - SLS

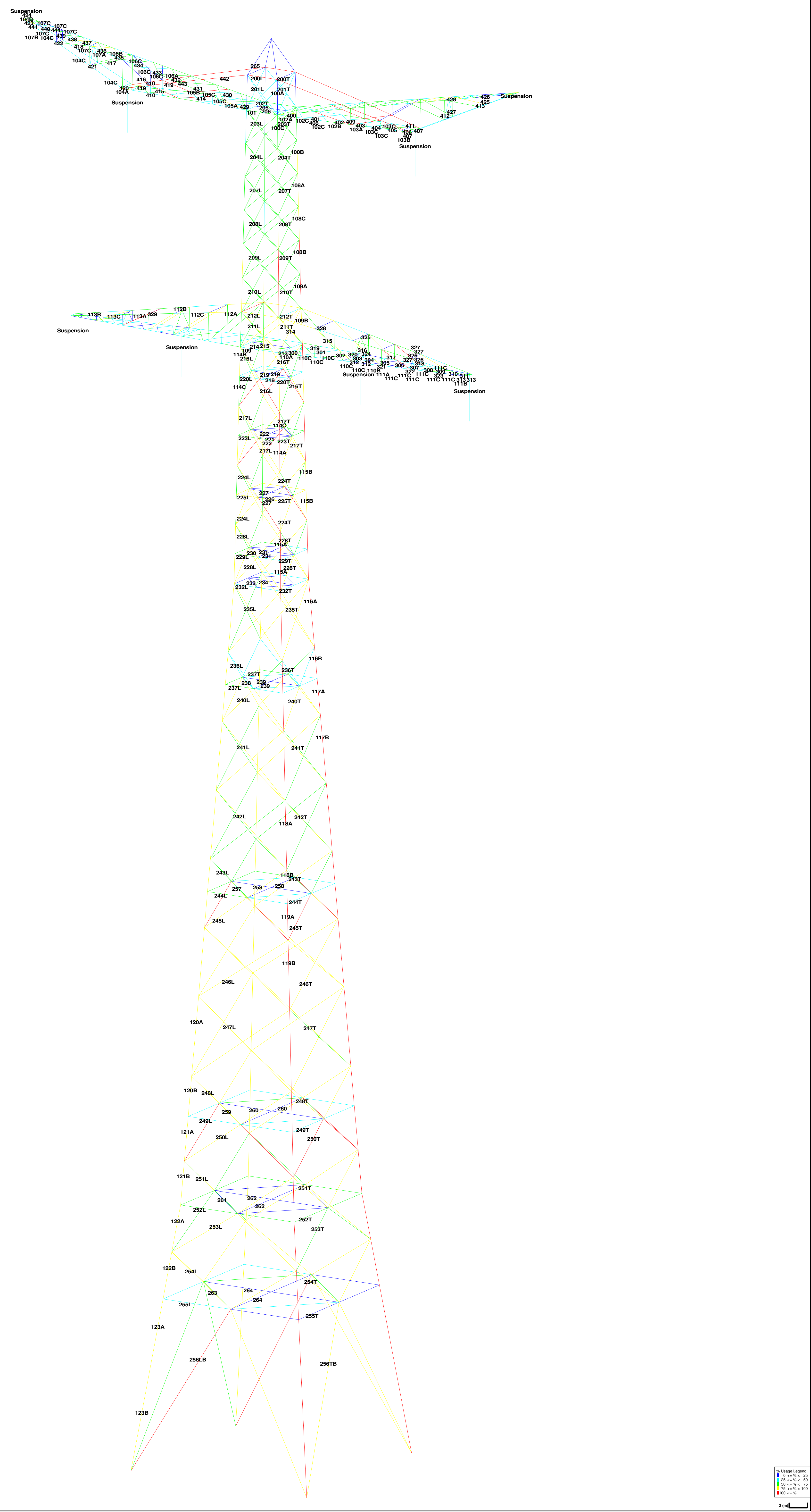
Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_45	804	767	**5747**	26	-1111	-28	5848
2	SLS 1a_0	467	-535	**3645**	48	-709	-21	3710
3	SLS 7	-101	-101	**689**	0	-143	-13	701
4	SLS 1a_135	-804	767	**5747**	-26	-1111	-27	5849

Project: KIJ-GT
Tower: S+95 II T
Number: 13



APPENDIX B UITVOER PLS-TOWER

DNV GL Nederlands BV, Project: "S+95 (hv) ini"
Tower Version 16.73, 09:36:54 vrijdag 9 april 2021
Undeformed geometry displayed



DNV·GL

Assessment of groups for initial mast (afkeur level)

Date	9-4-2021
Author	MKh
Version	1.0

KIJ-GT380
S+95
12

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
118A	Vijfde TSNSTK - Main member	250x250x22	S235	36M30-5.6t	0.25	0.25	0.66	54	**-4653.4**	ULS 1a_135	4246.0	4503.7	12830.4	1.10	knik, afschuiving	**3894.8**	ULS 1a_0,9_0,9_45	4747.5	4503.7	10368.0	0.86	
118B	Vijfde TSNSTK - Main member	250x250x22	S235	36M30-5.6t	0.50	0.50	1.39	54	**-4847.1**	ULS 1a_135	4239.9	4503.7	12830.4	1.14	knik, afschuiving	**4054.7**	ULS 1a_0,9_0,9_45	4747.5	4503.7	10368.0	0.90	
119A	Vierde TSNSTK - Main member* 24	250x250x24	S235	36M30-5.6t	0.50	0.50	1.17	50	**-4867.6**	ULS 1a_135	4715.3	4503.7	13996.8	1.08	knik, afschuiving	**4033.6**	ULS 1a_0,9_0,9_45	5560.4	4503.7	11310.5	0.90	
119B	Vierde TSNSTK - Main member* 24	250x250x24	S235	36M30-5.6t	0.25	0.25	0.61	50	**-5158.0**	ULS 1a_45	4719.6	4503.7	13996.8	1.15	knik, afschuiving	**4249.6**	ULS 1a_0,9_0,9_135	5560.4	4503.7	11310.5	0.94	
120A	Derde TSNSTK - Main member* INP425	INP 425	S235	36M24-5.6t	0.25	0.25	0.78	59	**-5442.7**	ULS 1a_135	5109.7	5723.4	7138.4	1.07	knik	**4508.9**	ULS 1a_0,9_0,9_45	6417.5	5723.4	6101.2	0.79	
120B	Derde TSNSTK - Main member* INP425	INP 425	S235	36M24-5.6t	0.50	0.50	1.57	59	**-5668.2**	ULS 1a_45	5096.5	5723.4	7138.4	1.11	knik	**4669.9**	ULS 1a_0,9_0,9_135	6417.5	5723.4	6101.2	0.82	
121A	Tweede TSNSTK - Main member* INP425	INP 425	S235	36M24-5.6t	0.50	0.50	1.42	59	**-5698.2**	ULS 1a_45	5089.4	5723.4	7138.4	1.12	knik	**4638.7**	ULS 1a_0,9_0,9_135	6417.5	5723.4	6101.2	0.81	
121B	Tweede TSNSTK - Main member* INP425	INP 425	S235	36M24-5.6t	0.50	0.50	1.43	59	**-6101.3**	ULS 1a_45	5095.0	5723.4	7138.4	1.20	knik, afschuiving	**4942.6**	ULS 1a_0,9_0,9_135	6417.5	5723.4	6101.2	0.86	
122A	Eerste TSNSTK - Main member	INP 450	S235	36M24-5.6t	0.50	0.50	1.55	65	**-6199.9**	ULS 1a_45	5440.8	5723.4	7558.3	1.14	knik, afschuiving	**4977.9**	ULS 1a_0,9_0,9_135	7183.8	5723.4	6460.1	0.87	
122B	Eerste TSNSTK - Main member	INP 450	S235	36M24-5.6t	0.50	0.50	1.55	65	**-5971.8**	ULS 1a_135	5440.8	5723.4	7558.3	1.10	knik, afschuiving	**4700.9**	ULS 1a_0,9_0,9_135	7183.8	5723.4	6460.1	0.82	
123A	Broekstuk - Main member	INP 450	S235	36M24-5.6t	0.33	0.33	0.85	65	**-6008.0**	ULS 1a_135	5437.9	5723.4	7558.3	1.10	knik, afschuiving	**4653.9**	ULS 1a_0,9_0,9_135	7183.8	5723.4	6460.1	0.81	
123B	Broekstuk - Main member	INP 450	S235	36M24-5.6t	0.33	0.33	0.85	66	**-6035.5**	ULS 1a_135	5424.0	5723.4	7558.3	1.11	knik, afschuiving	**4633.3**	ULS 1a_0,9_0,9_135	7183.8	5723.4	6460.1	0.81	
242L	Vijfde TSNSTK - CD 1 front	150x100x12	S235	1M30-5.6t	0.55	0.27	0.27	152	**-115.8**	ULS 1a_90	161.4	134.6	194.4	0.86		**100.9**	ULS 1a_0,9_90	231.6	134.6	157.1	0.75	
242T	Vijfde TSNSTK - CD 1 side	150x100x12	S235	1M30-5.6t	0.55	0.27	0.27	152	**-100.6**	ULS 1a_0	161.4	134.6	194.4	0.75		**89.4**	ULS 1a_0,9_0	231.6	134.6	157.1	0.66	
243L	Vijfde TSNSTK - Diag fr 1 above horiz	150x100x10	S235	1M30-5.6t	1.00	0.52	0.52	148	**-91.7**	ULS 1a_0,9_90	148.5	134.6	162.0	0.68		**99.4**	ULS 1a_90	193.0	134.6	130.9	0.76	
243T	Vijfde TSNSTK - Diag si 1 above horiz	150x100x10	S235	1M30-5.6t	1.00	0.52	0.52	148	**-82.3**	ULS 1a_0,9_0	148.5	134.6	162.0	0.61		**88.9**	ULS 1a_135	193.0	134.6	130.9	0.68	
244L	Vierde TSNSTK - Horizontal front	120x120x11	S235	1M20-5.6t	1.00	1.00	1.00	218	**-30.6**	ULS 1a_0,9_0,9_45	115.4	58.8	118.8	0.52		**22.7**	ULS 1a_0,9_135	310.5	58.8	96.0	0.39	
244T	Vierde TSNSTK - Horizontal side	120x120x11	S235	1M20-5.6t	1.00	1.00	1.00	218	**-30.9**	ULS 1a_0,9_0,9_45	115.4	58.8	118.8	0.53		**22.8**	ULS 1a_0,9_135	310.5	58.8	96.0	0.39	
245L	Vierde TSNSTK - Diag fr 1 below horiz	150x150x10	S235	1M30-5.6t	1.00	0.52	0.52	146	**-149.9**	ULS 1a_90	157.9	134.6	162.0	1.11	afschuiving	**123.9**	ULS 1a_0,9_0,9_90	337.0	134.6	130.9	0.95	
245T	Vierde TSNSTK - Diag si 1 below horiz	150x150x10	S235	1M30-5.6t	1.00	0.52	0.52	146	**-138.8**	ULS 1a_0	157.9	134.6	162.0	1.03	afschuiving	**111.3**	ULS 1a_0,9_0,9_0	337.0	134.6	130.9	0.85	
246L	Vierde TSNSTK - CD 1 front	150x150x12	S235	1M30-5.6t	0.55	0.27	0.27	164	**-120.1**	ULS 1a_0,9_0,9_90	165.0	134.6	194.4	0.89		**129.8**	ULS 1a_90	404.4	134.6	157.1	0.96	
246T	Vierde TSNSTK - CD 1 side	150x150x12	S235	1M30-5.6t	0.55	0.27	0.27	164	**-108.5**	ULS 1a_0,9_0,9_0	165.0	134.6	194.4	0.81		**122.2**	ULS 1a_0	404.4	134.6	157.1	0.91	
247L	Derde TSNSTK - CD 1 front	150x150x16	S235	2M24-5.6t	0.55	0.27	0.27	184	**-144.4**	ULS 1a_90	279.5	169.4	414.7	0.85		**127.8**	ULS 1a_0,9_0,9_90	565.4	169.4	344.4	0.75	
247T	Derde TSNSTK - CD 1 side	150x150x16	S235	2M24-5.6t	0.55	0.27	0.27	184	**-137.9**	ULS 1a_45	279.5	169.4	414.7	0.81		**117.4**	ULS 1a_0,9_0,9_0	565.4	169.4	344.4	0.69	
248L	Derde TSNSTK - Diag fr 1 above horiz	150x150x16	S235	2M24-5.6t	1.00	0.52	0.52	173	**-133.8**	ULS 1a_0,9_135	302.7	169.4	414.7	0.79		**141.6**	ULS 1a_45	565.4	169.4	344.4	0.84	
248T	Derde TSNSTK - Diag si 1 above horiz	150x150x16	S235	2M24-5.6t	1.00	0.52	0.52	173	**-130.3**	ULS 1a_0,9_135	302.7	169.4	414.7	0.77		**139.9**	ULS 1a_45	565.4	169.4	344.4	0.83	
249L	Tweede TSNSTK - Horizontal front	150x150x10	S235	1M24-5.6t	1.00	1.00	1.00	227	**-36.8**	ULS 1a_0,9_0,9_135	125.1	84.7	129.6	0.43		**32.1**	ULS 1a_45	357.1	84.7	110.8	0.38	
249T	Tweede TSNSTK - Horizontal side	150x150x10	S235	1M24-5.6t	1.00	1.00	1.00	223	**-37.4**	ULS 1a_0,9_0,9_45	128.2	84.7	129.6	0.44		**32.2**	ULS 1a_135	357.1	84.7	110.8	0.38	
250L	Tweede TSNSTK - Diag fr 1 below horiz	160x160x15	S235	2M24-5.6t	1.00	0.52	0.52	175	**-197.4**	ULS 1a_90	304.1	169.4	388.8	1.17	afschuiving	**154.1**	ULS 1a_0,9_0,9_45	578.5	169.4	332.3	0.91	
250T	Tweede TSNSTK - Diag si 1 below horiz	160x160x15	S235	2M24-5.6t	1.00	0.52	0.52	177	**-194.7**	ULS 1a_45	300.0	169.4	388.8	1.15	afschuiving	**151.3**	ULS 1a_0,9_0,9_135	578.5	169.4	332.3	0.89	
251L	Tweede TSNSTK - Diag fr 2 above horiz	160x160x15	S235	2M24-5.6t	1.00	0.52	0.52	175	**-117.6**	ULS 1a_0,9_0,9_90	303.4	169.4	388.8	0.69		**148.3**	ULS 1a_90	578.5	169.4	332.3	0.88	
251T	Tweede TSNSTK - Diag si 2 above horiz	160x160x15	S235	2M24-5.6t	1.00	0.52	0.52	175	**-111.7**	ULS 1a_0,9_0,9_0	303.4	169.4	388.8	0.66		**145.9**	ULS 1a_0	578.5	169.4	332.3	0.86	
252L	Eerste TSNSTK - Horizontal front	250x250x22	S235	4M30-5.6t	1.00	1.00	1.00	148	**-387.8**	ULS 1a_45	897.2	538.6	1425.6	0.72		**285.9**	ULS 1a_0,9_0,9_135	1494.6	538.6	960.0	0.53	
252T	Eerste TSNSTK - Horizontal side	250x250x22	S235	4M30-5.6t	1.00	1.00	1.00	148	**-387.6**	ULS 1a_135	897.2	538.6	1425.6	0.72		**285.9**	ULS 1a_0,9_0,9_45	1494.6	538.6	960.0	0.53	
253L	Eerste TSNSTK - Diag fr 2 below horiz	180x180x16	S235	2M24-5.6t	1.00	0.52	0.52	175	**-146.0**	ULS 1a_90	361.1	169.4	414.7	0.86		**137.8**	ULS 1a_90	896.8	169.4	354.5	0.81	
253T	Eerste TSNSTK - Diag si 2 below horiz	180x180x16	S235	2M24-5.6t	1.00	0.52	0.52	175	**-102.2**	ULS 1a_0	361.1	169.4	414.7	0.60		**97.5**	ULS 1a_0	896.8	169.4	354.5	0.58	
254L	Eerste TSNSTK - Diag fr 1 above horiz	180x180x16	S235	2M24-5.6t	1.00	0.52	0.52	175	**-155.2**	ULS 1a_90	361.1	169.4	414.7	0.92		**150.2**	ULS 1a_0,9_0,9_135	896.8	169.4	354.5	0.89	
254T	Eerste TSNSTK - Diag si 1 above horiz	180x180x16	S235	2M24-5.6t	1.00	0.52	0.52	175	**-135.6**	ULS 1a_45	361.1	169.4	414.7	0.80		**150.7**	ULS 1a_0,9_0,9_135	896.8	169.4	354.5	0.89	
255L	Broekstuk - Horizontal front	180x180x16	S235	2M24-5.6t	1.00	1.00	1.00	247	**-60.3**	ULS 1a_135	231.7	169.4	414.7	0.36		**25.1**	ULS 1a_0,9_45	692.4	169.4	354.5	0.15	
255T	Broekstuk - Horizontal side	180x180x16	S235	2M24-5.6t	1.00	1.00	1.00	247	**-60.5**	ULS 1a_45	231.7	169.4	414.7	0.36		**25.2**	ULS 1a_0,9_135	692.4	169.4	354.5	0.15	
256LB	Broekstuk - Lower part	150x150x10	S235	2M24-5.6t	0.17	0.25	0.17	127	**-186.3**	ULS 1a_90	290.1	169.4	259.2	1.10	afschuiving	**133.9**	ULS 1a_0,9_90	431.8	169.4	221.5	0.79	
256TB	Broekstuk - Lower part	150x150x10	S235	2M24-5.6t	0.17	0.25	0.17	127	**-139.0**	ULS 1a_45	290.1	169.4	259.2	0.82		**95.0**	ULS 1a_0,9_135	431.8	169.4	221.5	0.56	
257	Vierde TSNSTK - Diag A-A	100x100x8	S235	1M20-5.6t	1.00	1.00	1.00	370	**-10.1**	ULS 1a_135	27.1	58.8	86.4	0.37		**21.6**	ULS 1a_0,9_45	179.7	58.8	69.8	0.37	
258	Vierde TSNSTK - CD A-A	80x80x8	S235	1M20-5.6t	1.00	0.50	0.50	422	**-0.5**	ULS 7	15.2	58.8	86.4	0.03		**0.0**		133.6	58.8	69.8	0.00	
259	Tweede TSNSTK - Diag B-B	100x100x8	S235	1M20-5.6t	1.00	1.00	1.00	487	**-11.6**	ULS 1a_135	17.0	58.8	86.4	0.68		**17.5**	ULS 1a_0,9_135	179.7	58.8	69.8	0.30	
260	Tweede TSNSTK - CD B-B	100x100x8	S235	1M20-5.6t	1.00	0.50	0.50	437	**-0.9**	ULS 7	18.2	58.8	86.4	0.05		**0.0**		179.7	58.8	69.8	0.00	
261	Eerste TSNSTK - Diag C-C*	UNP200	S235	3M20-5.6t	1.00	1.00	1.00	482	**-8.2**	ULS 1a_90	44.3	176.4	275.4	0.18		**17.9**	ULS 1a_0,9_135	347.3	176.4	222.5	0.10	
262	Eerste TSNSTK - CD C-C	100x100x8	S235	2M20-5.6t	1.00	0.50	0.50	477	**-0.5**	ULS 7	21.5	117.6	172.8	0.02		**0.0**		277.0	117.6	139.6	0.00	
263	Broekstuk - Diag D-D	100x100x8	S235	1M20-5.6t	1.00	0.50	0.50	403	**-13.1**	ULS 1a_135	20.7	58.8	86.4	0.63		**15.8**	ULS 1a_0,9_45	179.7	58.8	69.8	0.27	
264	Broekstuk - CD D-D	100x100x8	S235	1M20-5.6t	1.00	0.50	0.50	569	**-2.4**	ULS 7	11.7	58.8	86.4	0.21		**0.0**		179.7	58.8	69.8	0.00	
100A	BVNSTK - Main Member	150x150x10	S235	6M24-5.6t	0.52	0.52	0.52	70	**-120.7**	ULS 1a_90	550.6	508.3	777.6	0.24		**0.0**		624.7	508.3	664.6	0.00	
100B	BVNSTK - Main Member	150x150x10	S235	6M24-5.6t	0.52	0.52	0.52	67	**-488.3**	ULS 1a_135	563.0	508.3	777.6	0.96		**267.0**	ULS 1a_0,9_0,9_135	624.7	508.3	664.6	0.53	
100C	BVNSTK - Main Member	150x150x10	S235		0.52	0.52	0.52	67	**-283.8**	ULS 1a_135	563.0	0.0	0.0	0.50		**106.5**	ULS 1a_0,9_0,9_135	688.6	0.0	0.0	0.15	
200L	BVNSTK - first horiz from top front	120x120x11	S235	6M24-5.6t	1.00	1.00	1.00	164	**0.0**		190.2	506.7	855.4	0.00		**422.4**	ULS 3_135	346.4	506.7	677.1	1.22	nettodsn.
200T	BVNSTK - first horiz from top side	120x120x11	S235	2M20-5.6t	1.00	1.00	1.00	164	**-6.6**	ULS 1a_0,9_90	190.2	117.6	237.6	0.06		**6.4**	ULS 1a_90	360.5	117.6	237.6	0.05	
201L	BVNSTK - CD 1 from top front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	124	**-34.0**	ULS 1a_0,9_0,9_135	263.5	169.4	285.1	0.20		**66.7**	ULS 1a_135	306.2	169.4	243.7	0.39	
201T	BVNSTK - CD 1 from top side	120x120x11	S235	1M24-5.6t	1.00	0.52	0.52	153	**-41.1**	ULS 1a_45	165.0	84.7	142.6	0.49		**0.0**		297.8	84.7	121.8	0.00	
101	BVNSTK - lower horiz lower CA front	200x200x18	S235	14M24-5.6t	1.00	2.00	1.00	65	**-737.9**	ULS 1a_0	1338.3	1066.2	3265.9	0.69		**61.4**	ULS 1a_0,9_0,9_0	1548.5	1066.2	2623.9	0.06	
202T	BVNSTK - lower horiz lower CA side	100x100x8	S235	4M20-5.6t	1.00	2.00	1.00	131	**-13.2**	ULS 5a Ah 22	143.1	235.2	345.6	0.09		**77.1**	ULS 5a Ah 22	310.5	235.2	279.3	0.33	
203L	BVNSTK - CD 2 from top front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	123	**-113.7**	ULS 1a_90	265.5	169.4	285.1	0.67		**76.3**	ULS 1a_0,9_0,9_90	291.2	169.4	229.3	0.45	
203T	BVNSTK - CD 2 from top side	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	123	**-90.5**	ULS 5a Ba 12	265.5	169.4	285.1	0.53		**101.3**	ULS 5a Ah 22	291.2	169.4	229.3	0.60	
204L	BVNSTK - CD 3 from top front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	125	**-77.9**	ULS 1a_0,9_0,9_90	260.7	169.4	285.1	0.46		**111.8**	ULS 1a_90	291.2	169.4	229.3	0.66	
204T	BVNSTK - CD 3 from top side	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	125	**-96.5**	ULS 5a Ah 22	260.7	169.4	285.1	0.57		**86.9**	ULS 5a Ba 12	291.2	169.4	229.3	0.51	
205	BVNSTK - Diaphragm diagonal	110x110x10	S235	2M20-5.6t	1.00	1.00	1.00	131	**-54.8**	ULS 5a Ah 22	205.7	117.6	216.0	0.47		**56.3**	ULS 5a Ba 22	262.5	117.6	174.5	0.48	
206	BVNSTK - Diaphragm horiz	70x70x7	S235	1M20-5.6t	1.00	1.00	1.00	294	**-1.7**	ULS 3_90	23.9	58.8	75.6	0.07		**0.0**		76.6	58.8	51.8	0.00	
400	Tweede DWSRM - CD under 1	80x80x8	S235	1M20-5.6t	0.53	0.53	0.53	167	**-18.3**	ULS 5a Ah 22	71.4	58.8	86.4	0.31		**14.3**	ULS 5a Ba 12	110.6	58.8	69.8	0.24	
401	Tweede DWSRM - CD under 2	80x80x8	S235	1M20-5.6t	0.53	0.53	0.53	155	**-17.8**	ULS 5a Ba 12	78.4	58.8	86.4	0.30		**21.8**	ULS 5a Ah 22	110.6	58.8	69.8	0.37	
402	Tweede DWSRM - CD under 3	80x80x8	S235	1M20-5.6t	0.53	0.53	0.53	147	**-24.1**	ULS 5a Ah 12	84.2	58.8	86.4	0.41		**21.5**	ULS 5a Ba 12	110.6	58.8	69.8	0.37	
403	Tweede DWSRM - CD under 4	80x80x8	S235	1M20-5.6t	0.53	0.53	0.53	118	**-23.0**	ULS 5a Ba 12	107.3	58.8	86.4	0.39		**21.9**	ULS 5a Ah 22	110.6	58.8	69.8	0.37	
404	Tweede DWSRM - CD under 5	80x80x8	S235	1M20-5.6t	0.53	0.53	0.53	111	**-21.5**	ULS 5a Ah 22	113.3	58.8	86.4	0.37		**29.5**	ULS 5a Ba 12	110.6	58.8	69.8	0.50	
405	Tweede DWSRM - CD under 6	80x80x8	S235	1M20-5.6t	0.53	0.53	0.53	108	**-37.9**	ULS 5a Ba 12	116.1	58.8	86.4	0.65		**21.9**	ULS 5a Ah 22	110.6	58.8	69.8	0.37	
406	Tweede DWSRM - CD under 7	80x80x8	S235	1M20-5.6t	0.52	0.52	0.52	82	**-38.0**	ULS 5a Ba 12	142.3	58.8	86.4	0.65		**8.8**	ULS 5a Ah 22	110.6	58.8	69.8	0.15	
407	Tweede DWSRM - Horiz 1&2 under	HEB200	S235	2M20-5.6t	2.00	2.00	2.00	41	**-10.8**	ULS 5a Ah 22	1434.3	117.6	324.0	0.09		**41.9**	ULS 5a Ba 12	1626.6	117.6	0.0	0.36	
408	Tweede DWSRM - front vert 1	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	**0.0**		50.7	37.7	43.2	0.00		**6.6**	ULS 1a_0	37.4	37.7	22.0	0.30	
409	Tweede DWSRM - front vert 2	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	191	**0.0**		23.4	37.7	43.2	0.00		**14.9**	ULS 7	37.4	37.7	22.0	0.68	
410	Tweede DWSRM - front vert 3	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	171	**-6.3**	ULS 1a_135	30.4	37.7	43.2	0.21		**9.2**	ULS 1a_45	37.4	37.7	22.0	0.42	
411	Tweede DWSRM - front vert 4	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	287	**-13.3**	ULS 1a_45	18.3	37.7	51.8	0.73		**0.0**		55.3	37.7	33.6	0.00	
412	Tweede DWSRM - front vert 5	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	231	**-12.0**	ULS 1a_0	17.7	37.7	43.2	0.68		**0.0**		37.4	37.7	22.0	0.00	
413	Tweede DWSRM - front vert 6	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	114	**-7.6**	ULS 7	43.2	37.7	43.2	0.20		**0.0**		37.4	37.7	22.0	0.00	
102A	Tweede DWSRM - Main member 1	200x200x18	S235	14M24-5.6t	1.00	1.46	1.00	80	**-493.5**	ULS 1a_0	1211.0	1066.2	3265.9	0.46		**0.0**		1548.5	1066.2	2791.4	0.00	
102B	Tweede DWSRM - Main member 1	200x200x18	S235	8M24-5.6t	1.00	1.53	1.00	77	**-466.4**	ULS 3_135	1237.8	677.8	1866.2	0.69		**0.0**		1548.5	677.8	1595.1	0.00	
102C	Tweede DWSRM - Main member 1	200x200x18	S235		1.89	2.89	1.00	75	**-476.8**	ULS 1a_0	1257.1	0.0	0.0	0.38		**0.0**		1623.9	0.0	0.0	0.00	
103A	Tweede DWSRM - Main member 2	180x180x16	S235	8M24-5.6t	1.00	1.82	1.00	67	**-449.9**	ULS 3_135	1063.9	677.8	1658.9	0.66		**0.0**		1220.3	677.8	1417.8	0.00	
103B	Tweede DWSRM - Main member 2	180x180x16	S235	7M24-5.6t	3.10	1.00	1.00	68	**-433.1**	ULS 3_90	1055.4	574.5	1451.5	0.75		**0.0**		828.7	574.5	1343.7	0.00	
103C	Tweede DWSRM - Main member 2	180x180x16	S235		5.59	10.37	1.00	68	**-449.9**	ULS 3_135	1055.8	0.0	0.0	0.43		**0.0**		1301.9	0.0	0.0	0.00	
414	Tweede DWSRM - front diag 1	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	344	**-31.4**	ULS 1a_0	18.6	37.7	60.5	1.69	knik	**0.0**		84.7	37.7	44.8	0.00	

DNV·GL

Assessment of groups for initial mast (afkeur level)

Date 9-4-2021
Author MKh
Version 1.0

KIJ-GT380
S+95
12

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
415	Tweede DWSRM - front diag 2	65x65x7	S235	1M16-5.6t	1.00	1.00	1.00	301	-37.1	ULS 7	21.4	37.7	60.5	1.73	knik	0.0		84.7	37.7	44.8	0.00	
416	Tweede DWSRM - front diag 3	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	328	0.0		20.1	37.7	60.5	0.00		0.0	ULS 1a_0	84.7	37.7	44.8	0.00	
417	Tweede DWSRM - front diag 4	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	333	0.0		19.5	37.7	60.5	0.00		22.2	ULS 1a_135	84.7	37.7	44.8	0.59	
418	Tweede DWSRM - front diag 5	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	325	0.0		20.3	37.7	60.5	0.00		29.0	ULS 1a_0	84.7	37.7	44.8	0.77	
419	Tweede DWSRM - main diag front	120x120x11	S235	6M24-5.6t	1.00	1.00	1.00	164	0.0		189.7	506.7	855.4	0.00		405.4	ULS 3_90	346.4	506.7	677.1	1.17	nettodsn.
420	Tweede DWSRM - raised horiz under 1	75x50x6	S235	1M16-5.6t	1.00	1.00	1.00	189	-17.3	ULS 1a_0,9_90	35.4	37.7	51.8	0.49		6.8	ULS 1a_0,9_0,9_90	44.9	37.7	41.4	0.18	
421	Tweede DWSRM - raised horiz under 2	75x50x6	S235	1M16-5.6t	1.00	1.00	1.00	155	0.0		45.9	37.7	51.8	0.00		0.6	ULS 1a_90	44.9	37.7	39.7	0.02	
422	Tweede DWSRM - raised horiz under 3	75x50x6	S235	1M16-5.6t	1.00	1.00	1.00	119	0.0		60.9	37.7	51.8	0.00		0.8	ULS 1a_135	44.9	37.7	34.4	0.02	
423	Tweede DWSRM - raised horiz under 4	75x50x6	S235	1M16-5.6t	1.00	1.00	1.00	87	-0.1	ULS 1a_0,9_0,9_90	74.7	37.7	51.8	0.00		1.6	ULS 1a_0,9_0,9_90	44.9	37.7	31.7	0.05	
104A	Tweede DWSRM - main member raised	150x150x10	S235	2M24-5.6t	1.00	19.90	1.00	103	-106.0	ULS 1a_135	413.3	169.4	259.2	0.63		0.0		343.1	169.4	208.5	0.00	
104B	Tweede DWSRM - main member raised	150x150x10	S235	2M24-5.6t	1.00	9.78	1.00	102	-74.2	ULS 1a_135	416.7	169.4	259.2	0.44		0.0		431.8	169.4	221.5	0.00	
104C	Tweede DWSRM - main member raised	150x150x10	S235		1.00	1.00	1.00	164	-91.5	ULS 1a_135	191.7	0.0	0.0	0.48		0.0		688.6	0.0	0.0	0.00	
424	Tweede DWSRM - horiz at end of raised	HEB160	S235	2M16-5.6t	2.00	2.00	2.00	22	-8.7	ULS 5a Ba 3	1077.2	75.4	138.2	0.12		6.3	ULS 5a Ah 3	1296.6	75.4	11.9	0.53	
425	Tweede DWSRM - raised DS A-A diag	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	132	-5.3	ULS 1a_45	37.2	37.7	43.2	0.14		3.4	ULS 1a_0,9_45	37.4	37.7	22.0	0.15	
426	Tweede DWSRM - raised DS A-A horiz	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	70	-1.4	ULS 1a_0,9_0	69.2	37.7	43.2	0.04		1.5	ULS 1a_0	37.4	37.7	22.0	0.07	
427	Tweede DWSRM - raised DS B-B diag	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	247	-4.2	ULS 5a Ah 22	16.1	37.7	43.2	0.26		2.2	ULS 5a Ah 22	37.4	37.7	22.0	0.10	
428	Tweede DWSRM - raised DS B-B horiz	50x50x5	S235	1M16-5.6t	1.00	2.00	1.00	120	-5.4	ULS 1a_135	43.6	37.7	43.2	0.14		0.0		37.4	37.7	22.0	0.00	
429	Tweede DWSRM - CD top 1	65x65x7	S235	1M16-5.6t	0.53	0.53	0.53	208	-19.0	ULS 1a_0,9_0,9_0	37.4	37.7	60.5	0.51		21.3	ULS 1a_0	84.7	37.7	44.8	0.57	
430	Tweede DWSRM - CD top 2	65x65x7	S235	1M16-5.6t	0.53	0.53	0.53	196	-20.5	ULS 1a_0	40.9	37.7	60.5	0.55		18.2	ULS 1a_0,9_0,9_0	84.7	37.7	44.8	0.48	
431	Tweede DWSRM - CD top 3	65x65x7	S235	1M16-5.6t	0.53	0.53	0.53	188	-17.8	ULS 1a_0,9_0,9_0	43.2	37.7	60.5	0.47		20.1	ULS 1a_0	84.7	37.7	44.8	0.53	
432	Tweede DWSRM - CD top 4	60x60x6	S235	1M16-5.6t	0.53	0.53	0.53	175	-17.2	ULS 1a_0,9_0,9_0	37.8	37.7	51.8	0.46		20.1	ULS 1a_0	55.3	37.7	33.6	0.60	
433	Tweede DWSRM - CD top 5	60x60x6	S235	1M16-5.6t	0.53	0.53	0.53	162	-18.9	ULS 1a_0	41.8	37.7	51.8	0.50		15.6	ULS 1a_0,9_0,9_0	55.3	37.7	33.6	0.46	
434	Tweede DWSRM - CD top 6	60x60x6	S235	1M16-5.6t	0.53	0.53	0.53	161	-15.3	ULS 1a_0,9_0,9_0	42.0	37.7	51.8	0.41		19.3	ULS 1a_0	55.3	37.7	33.6	0.58	
435	Tweede DWSRM - CD top 7	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	180	-20.3	ULS 1a_0	25.4	37.7	43.2	0.80		15.4	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.70	
436	Tweede DWSRM - CD top 8	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	148	-13.5	ULS 1a_0,9_0,9_0	32.6	37.7	43.2	0.41		18.6	ULS 1a_0	37.4	37.7	22.0	0.85	
437	Tweede DWSRM - CD top 9	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	147	-13.5	ULS 1a_0,9_0,9_0	32.8	37.7	43.2	0.41		17.3	ULS 1a_0	37.4	37.7	22.0	0.79	
438	Tweede DWSRM - CD top 10	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	124	-16.2	ULS 1a_0	39.8	37.7	43.2	0.43		12.2	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.55	
439	Tweede DWSRM - diag top "CD"	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	106	-10.9	ULS 1a_0,9_0,9_0	46.0	37.7	43.2	0.29		15.4	ULS 1a_0	37.4	37.7	22.0	0.70	
440	Tweede DWSRM - CD top 11	50x50x5	S235	1M16-5.6t	0.54	0.54	0.54	115	-11.7	ULS 5a Ba 3	42.8	37.7	43.2	0.31		8.6	ULS 5a Ah 3	37.4	37.7	22.0	0.39	
441	Tweede DWSRM - CD top 12	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	103	-10.2	ULS 5a Ah 3	47.4	37.7	43.2	0.27		14.3	ULS 5a Ba 3	37.4	37.7	22.0	0.65	
442	Tweede DWSRM - Main diag from tower	120x120x11	S235	6M24-5.6t	1.00	1.00	1.00	401	0.0		48.7	506.7	855.4	0.00		460.4	ULS 3_90	346.4	506.7	677.1	1.33	nettodsn.
443	Tweede DWSRM - diag top "CD"	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	260	-13.0	ULS 3_90	21.3	37.7	51.8	0.61		0.0		55.3	37.7	33.6	0.00	
105A	Tweede DWSRM - Main member top 1	130x130x12	S235	6M24-5.6t	1.00	1.47	1.00	124	-252.1	ULS 1a_0	310.9	506.7	933.1	0.81		248.5	ULS 1a_0,9_0	410.9	506.7	738.6	0.60	
105B	Tweede DWSRM - Main member top 1	130x130x12	S235	6M24-5.6t	1.50	1.00	1.00	123	-182.7	ULS 1a_0,9_0,9_0	308.4	508.3	933.1	0.59		228.4	ULS 1a_0	615.9	508.3	797.5	0.45	
105C	Tweede DWSRM - Main member top 1	130x130x12	S235		3.12	2.05	1.00	116	-224.8	ULS 1a_0	312.3	0.0	0.0	0.72		255.4	ULS 1a_0	705.0	0.0	0.0	0.36	
106A	Tweede DWSRM - Main member top 2	100x100x10	S235	7M24-5.6t	1.00	1.48	1.00	130	-115.6	ULS 1a_0,9_0,9_0	188.5	593.0	907.2	0.61		258.8	ULS 1a_0	362.9	593.0	775.4	0.71	
106B	Tweede DWSRM - Main member top 2	100x100x10	S235	4M24-5.6t	1.00	1.77	1.00	145	-49.2	ULS 1a_0,9_0,9_0	157.6	338.9	518.4	0.31		169.7	ULS 1a_135	362.9	338.9	443.1	0.50	
106C	Tweede DWSRM - Main member top 2	100x100x10	S235		2.02	3.23	1.00	126	-90.5	ULS 1a_0,9_0,9_0	185.0	0.0	0.0	0.49		237.6	ULS 1a_0	451.2	0.0	0.0	0.53	
107A	Tweede DWSRM - Main member top 3	100x75x7	S235	4M20-5.6t	2.31	1.00	1.00	139	-29.2	ULS 1a_0,9_0,9_45	102.5	235.2	302.4	0.29		143.6	ULS 1a_135	228.6	235.2	302.4	0.63	
107B	Tweede DWSRM - Main member top 3	100x75x7	S235	2M16-5.6t	2.86	1.00	1.00	138	0.0		103.6	75.4	121.0	0.00		70.3	ULS 1a_135	196.1	75.4	121.0	0.93	
107C	Tweede DWSRM - Main member top 3	100x75x7	S235		2.17	1.00	1.00	142	-19.3	ULS 5a Ah 3	100.0	0.0	0.0	0.19		94.6	ULS 1a_135	279.7	0.0	0.0	0.34	
444	Tweede DWSRM - diag top "CD"	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	131	-8.2	ULS 1a_0,9_0,9_0	37.3	37.7	43.2	0.22		11.9	ULS 1a_0	37.4	37.7	22.0	0.54	
108A	Elfde TSNSTK - Main member	180x180x16	S235	8M24-5.6t	0.51	0.51	0.51	55	-660.0	ULS 1a_135	1135.8	677.8	1658.9	0.97		452.7	ULS 1a_0,9_0,9_135	1220.3	677.8	1417.8	0.67	
108B	Elfde TSNSTK - Main member	180x180x16	S235	12M24-5.6t	0.51	0.51	0.51	56	-1038.4	ULS 1a_135	1127.4	999.7	2488.3	1.04	afschuiving	817.0	ULS 1a_0,9_0,9_135	1220.3	999.7	2126.8	0.82	
108C	Elfde TSNSTK - Main member	180x180x16	S235		0.51	0.51	0.51	55	-865.3	ULS 1a_135	1135.8	0.0	0.0	0.76		619.4	ULS 1a_0,9_0,9_135	1301.9	0.0	0.0	0.48	
207L	Elfde TSNSTK - CD 1 front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	127	-115.4	ULS 1a_90	255.9	169.4	285.1	0.68		82.4	ULS 1a_0,9_0,9_90	306.2	169.4	236.8	0.49	
207T	Elfde TSNSTK - CD 1 side	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	127	-83.3	ULS 5a Ba 12	255.9	169.4	285.1	0.49		91.9	ULS 5a Ah 22	306.2	169.4	236.8	0.54	
208L	Elfde TSNSTK - CD 2 front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	130	-83.0	ULS 1a_0,9_0,9_90	251.2	169.4	285.1	0.49		115.1	ULS 1a_90	306.2	169.4	236.8	0.68	
208T	Elfde TSNSTK - CD 2 side	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	130	-91.9	ULS 1a_0	251.2	169.4	285.1	0.54		83.6	ULS 1a_0,9_0,9_0	306.2	169.4	236.8	0.49	
209L	Elfde TSNSTK - CD 3 front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	133	-118.8	ULS 1a_90	243.6	169.4	285.1	0.70		82.9	ULS 1a_0,9_0,9_90	306.2	169.4	236.8	0.49	
209T	Elfde TSNSTK - CD 3 side	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	133	-85.6	ULS 1a_0,9_0,9_0	243.6	169.4	285.1	0.51		93.1	ULS 1a_0	306.2	169.4	236.8	0.55	
109A	Tiende TSNSTK - Main member	200x200x20	S235	8M30-5.6t	0.52	0.52	0.52	52	-1255.8	ULS 1a_135	1590.7	1077.1	2592.0	1.17	afschuiving	979.8	ULS 1a_0,9_0,9_135	1638.1	1077.1	2094.5	0.91	
109B	Tiende TSNSTK - Main member	200x200x20	S235	12M30-5.6t	0.52	0.52	0.52	53	-1453.7	ULS 1a_45	1580.5	1588.8	3888.0	0.92		1026.0	ULS 1a_0,9_0,9_135	1638.1	1588.8	3194.2	0.65	
210L	Tiende TSNSTK - CD 1 front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	136	-84.9	ULS 1a_0,9_0,9_90	238.9	169.4	285.1	0.50		123.4	ULS 1a_90	306.2	169.4	236.8	0.73	
210T	Tiende TSNSTK - CD 1 side	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	136	-98.9	ULS 1a_0	238.9	169.4	285.1	0.58		89.2	ULS 1a_0,9_0,9_0	306.2	169.4	236.8	0.53	
211L	Tiende TSNSTK - CD 2 front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	140	-139.2	ULS 1a_0,9_0,9_45	230.6	169.4	285.1	0.82		161.4	ULS 1a_45	306.2	169.4	236.8	0.95	
211T	Tiende TSNSTK - CD 2 side	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	140	-144.6	ULS 1a_135	230.6	169.4	285.1	0.85		104.7	ULS 1a_0,9_0,9_45	306.2	169.4	236.8	0.62	
212L	Tiende TSNSTK - upper horiz lower CA fr	150x150x10	S235	7M24-5.6t	1.00	1.00	1.00	162	0.0		222.3	578.2	907.2	0.00		384.2	ULS 3_0	420.0	578.2	778.3	0.91	
212T	Tiende TSNSTK - upper horiz lower CA si	80x80x8	S235	2M20-5.6t	1.00	1.00	1.00	308	-59.0	ULS 1a_90	36.4	117.6	172.8	1.62	knik	41.9	ULS 1a_0,9_0,9_90	212.5	117.6	139.6	0.36	
109	Tiende TSNSTK - lower horiz lower CA fr	200x200x18	S235	12M24-5.6t	1.00	2.00	1.00	82	-431.0	ULS 3_0	1194.7	906.5	2799.4	0.48		0.0		1548.5	906.5	2392.6	0.00	
213	Tiende TSNSTK - lower horiz lower CA si	110x110x10	S235	4M20-5.6t	1.00	2.00	1.00	148	-10.2	ULS 5a Ah 21	168.8	235.2	432.0	0.06		86.2	ULS 5a Ah 21	433.4	235.2	349.1	0.37	
214	Tiende TSNSTK - Diaphragm diagonal	130x130x12	S235	2M20-5.6t	1.00	1.00	1.00	139	-60.8	ULS 5a Ba 21	272.8	117.6	259.2	0.52		62.7	ULS 5a Ba 21	379.7	117.6	209.5	0.53	
215	Tiende TSNSTK - Diaphragm horiz	80x80x8	S235	1M20-5.6t	1.00	1.00	1.00	321	-2.2	ULS 3_90	27.3	58.8	86.4	0.08		0.0		133.6	58.8	69.8	0.00	
300	Eerste DWSRM - CD under 1	100x100x8	S235	1M20-5.6t	0.53	0.53	0.53	146	-21.3	ULS 5a Ah 20	106.2	58.8	86.4	0.36		19.2	ULS 5a Ba 11	179.7	58.8	69.8	0.33	
301	Eerste DWSRM - CD under 2	100x100x8	S235	1M20-5.6t	0.53	0.53	0.53	136	-20.9	ULS 5a Ah 11	116.1	58.8	86.4	0.36		26.6	ULS 5a Ba 20	179.7	58.8	69.8	0.45	
302	Eerste DWSRM - CD under 3	100x100x8	S235	1M20-5.6t	0.53	0.53	0.53	128	-32.8	ULS 5a Ba 20	123.5	58.8	86.4	0.56		22.6	ULS 5a Ah 11	179.7	58.8	69.8	0.38	
303	Eerste DWSRM - CD under 4	100x100x8	S235	1M20-5.6t	0.52	0.52	0.52	99	-27.4	ULS 5a Ba 11	157.9	58.8	86.4	0.47		17.4	ULS 5a Ah 20	179.7	58.8	69.8	0.30	
304	Eerste DWSRM - CD under 5	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	163	-16.5	ULS 1a_135	52.2	58.8	75.6	0.32		12.2	ULS 1a_0,9_0,9_0	86.7	58.8	59.5	0.21	
305	Eerste DWSRM - CD under 6	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	147	-13.2	ULS 1a_0,9_0,9_0	59.5	58.8	75.6	0.23		14.7	ULS 1a_0	86.7	58.8	59.5	0.25	
306	Eerste DWSRM - CD under 7	65x65x7	S235	1M20-5.6t	0.54	0.54	0.54	138	-14.3	ULS 1a_0	64.1	58.8	75.6	0.24		13.7	ULS 1a_0,9_0,9_0	86.7	58.8	59.5	0.23	
307	Eerste DWSRM - CD under 8	65x65x7	S235	1M20-5.6t	0.54	0.54	0.54	126	-14.6	ULS 5a Ah 10	70.4	58.8	75.6	0.25		16.5	ULS 5a Ba 10	86.7	58.8	59.5	0.28	
308	Eerste DWSRM - CD under 9	60x60x6	S235	1M20-5.6t	0.54	0.54	0.54	115	-17.7	ULS 5a Ba 10	61.4	58.8	64.8	0.30		17.3	ULS 5a Ah 10	65.7	58.8	44.4	0.39	
309	Eerste DWSRM - CD under 10	60x60x6	S235	1M20-5.6t	0.55	0.55	0.55	108	-21.7	ULS 5a Ah 10	65.5	58.8	64.8	0.37		23.3	ULS 5a Ba 10	65.7	58.8	44.4	0.53	
310	Eerste DWSRM - CD under 11	65x65x7	S235	2M20-5.6t	0.56	0.56	0.56	95	-31.9	ULS 5a Ba 21	114.4	117.6	151.2	0.28		26.1	ULS 5a Ah 21	99.4	117.6	104.2	0.26	
311	Eerste DWSRM - CD under 12	65x65x7	S235	1M20-5.6t	0.55	0.55	0.55	72	-36.1	ULS 5a Ba 21	105.7	58.8	75.6	0.61		20.9	ULS 5a Ah 21	86.7	58.8	59.5	0.36	
312	Eerste DWSRM - 1st & 2nd horiz under	HEB240	S235	2M20-5.6t	2.00	2.00	2.00	56	-18.5	ULS 5a Ah 11	1771.8	117.6	367.2	0.16		32.9	ULS 5a Ba 11	2249.6	117.6	0.0	0.28	
313	Eerste DWSRM - 3rd & 4th horiz under	HEB200	S235	2M20-5.6t	2.00	2.00	2.00	20	-20.9	ULS 5a Ah 10	1583.1	117.6	324.0	0.18		31.5	ULS 5a Ba 10	1626.6	117.6	0.0	0.27	
314	Eerste DWSRM - front diag 1	65x65x7	S235	2M20-5.6t	1.00	1.00	1.00	475	0.0		12.4	117.6	151.2	0.00		70.4	ULS 3_135	99.4	117.6	119.1	0.71	
315	Eerste DWSRM - front diag 2	65x65x7	S235	2M20-5.6t	1.00	1.00	1.00	450	0.0		13.6	117.6	151.2	0.00		93.0	ULS 3_0	99.4	117.6	119.1	0.94	
316	Eerste DWSRM - front diag 3	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	364	0.0		12.4	37.7	51.8	0.00		34.5	ULS 1a_0	72.6	37.7	38.4	0.92	
317	Eerste DWSRM - front diag 4	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	338	0.0		14.0	37.7	51.8	0.00		39.3	ULS 1a_0	72.6	37.7	38.4	1.04	afschuiving, stuik
318	Eerste DWSRM - front diag 5	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	317	0.0		15.5	37.7	51.8	0.00		36.9	ULS 7	72.6	37.7	38.4	0.98	
319	Eerste DWSRM - front vert 1	100x100x8	S235	1M20-5.6t	1.00	1.00	1.00	165	-42.1	ULS 3_0	91.7	58.8	86.4	0.72		0.0		179.7	58.8	69.8	0.00	
320	Eerste DWSRM - front vert 2	75x50x6	S235	1M16-5.6t	1.00	1.00	1.00	225	-16.8	ULS 7	27.8	37.7	51.8	0.61		0.0		44.9	37.7	26.5	0.00	
321	Eerste DWSRM - front vert 3	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	188	-14.4	ULS 1a_0	23.9	37.7	43.2	0.60		0.0		37.4	37.7	22.0	0.00	
322	Eerste DWSRM - front vert 4	75x50x6	S235	1M16-5.6t	1.00	1.00	1.00	112	-8.9	ULS 1a_135	63.5	37.7	51.8	0.24		0.0		44.9	37.7	26.5	0.00	
323	Eerste DWSRM - front vert 5	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	63	-3.6	ULS 3_90	60.9	37.7	43.2	0.10		0.0		37.4	37.7	22.0	0.00	

DNV·GL

Assessment of groups for initial mast (afkeur level)

Date 9-4-2021
Author MKh
Version 1.0

KIJ-GT380
S+95
12

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
324	Eerste DWSRM - Doorsnede A-A diag	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	306	**-7.0**	ULS 1a_0	11.5	37.7	43.2	0.61		**4.7**	ULS 1a_0,9_0	37.4	37.7	22.0	0.21	
325	Eerste DWSRM - Doorsnede A-A horiz top	50x50x5	S235	1M16-5.6t	1.00	2.00	1.00	219	**-2.8**	ULS 1a_0	20.7	37.7	43.2	0.13		**2.6**	ULS 1a_0,9_0	37.4	37.7	22.0	0.12	
326	Eerste DWSRM - Doorsnede B-B diag	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	156	**-8.3**	ULS 1a_0	30.6	37.7	43.2	0.27		**3.7**	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.17	
327	Eerste DWSRM - Doorsnede B-B horiz top	50x50x5	S235	1M16-5.6t	1.00	2.49	1.00	142	**-2.3**	ULS 1a_0,9_0,9_0	36.2	37.7	43.2	0.06		**2.1**	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.10	
110A	Eerste DWSRM - Main member bottom 1	200x200x18	S235	12M24-5.6t	1.00	1.70	1.00	71	**-511.6**	ULS 1a_135	1289.1	906.5	2799.4	0.56		**0.0**		1548.5	906.5	2392.6	0.00	
110B	Eerste DWSRM - Main member bottom 1	200x200x18	S235	8M24-5.6t	2.53	1.40	1.00	57	**-336.3**	ULS 5a Ba 21	1398.2	677.8	1866.2	0.50		**7.9**	ULS 5a Ah 21	1548.5	677.8	1595.1	0.01	
110C	Eerste DWSRM - Main member bottom 1	200x200x18	S235		2.42	1.40	1.00	71	**-500.6**	ULS 1a_135	1289.3	0.0	0.0	0.39		**19.7**	ULS 5a Ah 21	1623.9	0.0	0.0	0.01	
111A	Eerste DWSRM - Main member bottom 1	160x160x15	S235	8M24-5.6t	3.53	6.36	1.00	72	**-311.8**	ULS 5a Ba 21	869.0	677.8	1555.2	0.46		**32.5**	ULS 5a Ah 21	1008.5	677.8	1329.2	0.05	
111B	Eerste DWSRM - Main member bottom 1	160x160x15	S235		2.89	1.00	1.00	72	**-197.2**	ULS 3_90	869.3	0.0	0.0	0.23		**0.0**		1097.7	0.0	0.0	0.00	
111C	Eerste DWSRM - Main member bottom 1	160x160x15	S235		1.80	1.00	1.00	72	**-297.8**	ULS 5a Ba 21	869.1	0.0	0.0	0.34		**26.9**	ULS 5a Ah 21	1097.7	0.0	0.0	0.02	
112A	Eerste DWSRM - Main member top 1	130x130x12	S235	6M24-5.6t	1.00	1.00	1.00	178	**0.0**		200.4	504.1	933.1	0.00		**362.0**	ULS 3_90	422.8	504.1	796.6	0.86	
112B	Eerste DWSRM - Main member top 1	130x130x12	S235	5M24-5.6t	1.00	1.00	1.00	140	**0.0**		270.4	423.6	777.6	0.00		**259.4**	ULS 3_90	615.9	423.6	664.6	0.61	
112C	Eerste DWSRM - Main member top 1	130x130x12	S235		1.00	1.00	1.00	187	**0.0**		188.2	0.0	0.0	0.00		**285.8**	ULS 3_90	705.0	0.0	0.0	0.41	
113A	Eerste DWSRM - Main member top 1	110x110x10	S235	5M24-5.6t	1.00	1.00	1.00	165	**0.0**		156.1	423.6	648.0	0.00		**232.8**	ULS 3_135	412.6	423.6	553.8	0.56	
113B	Eerste DWSRM - Main member top 1	110x110x10	S235	5M24-5.6t	2.00	1.00	1.00	212	**0.0**		106.2	423.6	648.0	0.00		**198.4**	ULS 3_135	291.3	423.6	553.8	0.68	
113C	Eerste DWSRM - Main member top 1	110x110x10	S235		2.00	1.00	1.00	212	**0.0**		106.2	0.0	0.0	0.00		**198.1**	ULS 3_135	496.3	0.0	0.0	0.40	
328	Eerste DWSRM - Horiz top 1	65x50x5	S235	1M16-5.6t	1.00	1.00	1.00	380	**-0.2**	ULS 1a_90	9.2	37.7	43.2	0.02		**0.0**		60.5	37.7	32.0	0.00	
329	Eerste DWSRM - Horiz top 2	65x50x5	S235	1M16-5.6t	1.00	1.00	1.00	255	**-0.1**	ULS 1a_90	17.5	37.7	43.2	0.00		**0.0**		60.5	37.7	32.0	0.00	
114A	Negende TSNSTK - Main member	250x250x22	S235	18M30-5.6t	0.52	0.52	0.52	36	**-2412.2**	ULS 1a_45	2358.2	2423.5	6415.2	1.02	knik	**1903.1**	ULS 1a_0,9_0,9_45	2373.8	2423.5	4626.7	0.80	
114B	Negende TSNSTK - Main member	250x250x22	S235	14M30-5.6t	0.52	0.52	0.52	35	**-1903.4**	ULS 1a_45	2373.4	1885.0	4989.6	1.01	afschuiving	**1426.7**	ULS 1a_0,9_0,9_45	2373.8	1885.0	4032.0	0.76	
114C	Negende TSNSTK - Main member	250x250x22	S235		0.52	0.52	0.52	35	**-2409.3**	ULS 1a_45	2373.0	0.0	0.0	1.02	knik	**1906.8**	ULS 1a_0,9_0,9_45	2493.4	0.0	0.0	0.76	
216L	Negende TSNSTK - Diag fr 1 above horiz	150x100x12	S235	2M30-5.6t	1.00	0.51	0.51	103	**-282.1**	ULS 1a_90	355.4	269.3	388.8	1.05	afschuiving	**255.3**	ULS 1a_0,9_0,9_90	250.2	269.3	314.2	1.02	nettodsn.
216T	Negende TSNSTK - Diag si 1 above horiz	150x100x12	S235	2M30-5.6t	1.00	0.51	0.51	103	**-200.8**	ULS 1a_0	355.4	269.3	388.8	0.75		**198.0**	ULS 1a_0	250.2	269.3	314.2	0.79	
217L	Negende TSNSTK - Diag fr 2 above horiz	150x100x12	S235	2M30-5.6t	1.00	0.51	0.51	104	**-261.6**	ULS 1a_90	350.2	269.3	388.8	0.97		**265.4**	ULS 1a_90	250.2	269.3	314.2	1.06	nettodsn.
217T	Negende TSNSTK - Diag si 2 above horiz	150x100x12	S235	2M30-5.6t	1.00	0.51	0.51	104	**-207.2**	ULS 1a_0	350.2	269.3	388.8	0.77		**191.3**	ULS 1a_0,9_0,9_0	250.2	269.3	314.2	0.76	
218	Negende TSNSTK - Diaphragm K diag	70x70x7	S235	2M16-5.6t	1.00	1.00	1.00	266	**-11.3**	ULS 5a Ah 21	35.0	75.4	121.0	0.32		**11.2**	ULS 5a Ah 21	109.4	75.4	89.6	0.15	
219	Negende TSNSTK - Diaphragm K CD	100x50x6	S235	3M16-5.6t	0.50	0.50	0.50	239	**-0.4**	ULS 1a_90	38.0	113.0	155.5	0.01		**0.1**	ULS 1a_0,9_90	90.2	113.0	100.9	0.00	
220L	Negende TSNSTK - Diaphragm K horiz fr	65x65x7	S235	1M16-5.6t	1.00	1.00	1.00	203	**-17.9**	ULS 1a_0,9_45	43.6	37.7	60.5	0.47		**16.9**	ULS 1a_135	94.8	37.7	44.8	0.45	
220T	Negende TSNSTK - Diaphragm K horiz si	65x65x7	S235	1M16-5.6t	1.00	1.00	1.00	203	**-14.5**	ULS 1a_0,9_0,9_135	43.6	37.7	60.5	0.39		**18.8**	ULS 1a_45	94.8	37.7	44.8	0.50	
221	Negende TSNSTK - Diaphragm L diag	70x70x7	S235	2M16-5.6t	1.00	1.00	1.00	279	**-1.9**	ULS 1a_0	32.5	75.4	121.0	0.06		**4.8**	ULS 1a_45	109.4	75.4	89.6	0.06	
222	Negende TSNSTK - Diaphragm L CD	100x50x6	S235	3M16-5.6t	0.50	0.50	0.50	251	**-0.2**	ULS 1a_90	35.4	113.0	155.5	0.01		**0.3**	ULS 1a_90	90.2	113.0	100.9	0.00	
223L	Negende TSNSTK - Diaphragm L horiz fr	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	198	**-21.9**	ULS 1a_0,9_0,9_135	49.1	37.7	60.5	0.58		**20.5**	ULS 1a_45	104.8	37.7	44.8	0.54	
223T	Negende TSNSTK - Diaphragm L horiz si	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	198	**-21.6**	ULS 1a_0,9_0,9_45	49.1	37.7	60.5	0.57		**19.8**	ULS 1a_135	104.8	37.7	44.8	0.52	
224L	Achtste TSNSTK - Diag fr 1 above horiz	150x100x12	S235	2M30-5.6t	1.00	0.51	0.51	106	**-273.5**	ULS 1a_90	345.0	269.3	388.8	1.02	afschuiving	**256.0**	ULS 1a_0,9_0,9_90	348.4	269.3	314.2	0.95	
224T	Achtste TSNSTK - Diag si 1 above horiz	150x100x12	S235	2M30-5.6t	1.00	0.51	0.51	106	**-205.1**	ULS 1a_0	345.0	269.3	388.8	0.76		**204.5**	ULS 1a_0	348.4	269.3	314.2	0.76	
225L	Achtste TSNSTK - Diaphragm M horiz fr	75x75x7#	S235	1M16-5.6t	1.00	1.00	1.00	191	**-29.2**	ULS 1a_0,9_0,9_135	55.7	37.7	60.5	0.77		**28.3**	ULS 1a_45	114.9	37.7	44.8	0.75	
225T	Achtste TSNSTK - Diaphragm M horiz si	75x75x7#	S235	1M16-5.6t	1.00	1.00	1.00	191	**-28.7**	ULS 1a_0,9_0,9_135	55.7	37.7	60.5	0.76		**28.9**	ULS 1a_90	114.9	37.7	44.8	0.77	
226	Achtste TSNSTK - Diaphragm M diag	70x70x7	S235	2M16-5.6t	1.00	1.00	1.00	292	**-2.5**	ULS 1a_90	30.2	75.4	121.0	0.08		**5.6**	ULS 1a_45	109.4	75.4	89.6	0.07	
227	Achtste TSNSTK - Diaphragm M CD	100x50x6	S235	3M16-5.6t	0.50	0.50	0.50	263	**-0.4**	ULS 1a_90	33.0	113.0	155.5	0.01		**0.1**	ULS 1a_0,9_90	90.2	113.0	100.9	0.00	
228L	Achtste TSNSTK - Diag fr 2 above horiz	150x150x10	S235	2M30-5.6t	1.00	0.51	0.51	99	**-260.6**	ULS 1a_90	353.4	269.3	324.0	0.97		**253.3**	ULS 1a_0,9_90	347.2	269.3	261.8	0.97	
228T	Achtste TSNSTK - Diag si 2 above horiz	150x150x10	S235	2M30-5.6t	1.00	0.51	0.51	99	**-213.5**	ULS 1a_45	353.4	269.3	324.0	0.79		**198.8**	ULS 1a_0,9_0,9_135	347.2	269.3	261.8	0.76	
229L	Achtste TSNSTK - Diaphragm N horiz fr	80x80x8	S235	1M16-5.6t	1.00	1.00	1.00	188	**-22.9**	ULS 1a_0,9_0,9_135	61.0	37.7	69.1	0.61		**15.1**	ULS 1a_0,9_135	142.8	37.7	51.2	0.40	
229T	Achtste TSNSTK - Diaphragm N horiz si	80x80x8	S235	1M16-5.6t	1.00	1.00	1.00	188	**-23.2**	ULS 1a_0,9_0,9_45	61.0	37.7	69.1	0.62		**14.9**	ULS 1a_0,9_90	142.8	37.7	51.2	0.39	
230	Achtste TSNSTK - Diaphragm N diag	70x70x7	S235	2M16-5.6t	1.00	1.00	1.00	305	**-2.7**	ULS 1a_135	28.2	75.4	121.0	0.10		**6.7**	ULS 1a_135	109.4	75.4	89.6	0.09	
231	Achtste TSNSTK - Diaphragm N CD	100x50x6	S235	3M16-5.6t	0.50	0.50	0.50	274	**-0.3**	ULS 1a_90	30.8	113.0	155.5	0.01		**0.4**	ULS 1a_0,9_90	75.4	113.0	100.9	0.01	
115A	Achtste TSNSTK - Main member	200x200x20	S235	28M30-5.6t	0.52	0.52	1.05	47	**-3452.0**	ULS 1a_45	3186.4	3628.5	9072.0	1.08	knik	**2888.4**	ULS 1a_0,9_0,9_135	3607.3	0.0	0.0	0.80	
115B	Achtste TSNSTK - Main member	200x200x20	S235		0.50	0.50	0.50	22	**-2975.7**	ULS 1a_45	3556.9	0.0	0.0	0.84		**2439.0**	ULS 1a_0,9_0,9_135	3607.3	0.0	0.0	0.68	
116A	Zevende TSNSTK - Main member	250x250x20	S235	28M30-5.6t	0.25	0.25	0.74	60	**-3844.0**	ULS 1a_45	3729.7	3628.5	9072.0	1.06	knik, afschuiving	**3249.5**	ULS 1a_0,9_0,9_135	4683.2	3628.5	7330.9	0.90	
116B	Zevende TSNSTK - Main member	250x250x20	S235	32M30-5.6t	0.50	0.50	1.60	60	**-4150.0**	ULS 1a_135	3732.8	4075.1	10368.0	1.11	knik, afschuiving	**3480.6**	ULS 1a_0,9_0,9_45	4683.2	4075.1	8378.2	0.85	
117A	Zesde TSNSTK - Main member	250x250x20	S235	32M30-5.6t	0.50	0.50	1.36	59	**-4166.3**	ULS 1a_135	3745.4	4075.1	10368.0	1.11	knik, afschuiving	**3462.1**	ULS 1a_0,9_0,9_45	4683.2	4075.1	8378.2	0.85	
117B	Zesde TSNSTK - Main member	250x250x20	S235	36M30-5.6t	0.25	0.25	0.74	60	**-4404.8**	ULS 1a_135	3729.7	4503.7	11664.0	1.18	knik	**3657.2**	ULS 1a_0,9_0,9_45	4341.1	4503.7	9425.5	0.84	
232L	Zevende TSNSTK - Doorsnede B-B horiz f	100x100x8	S235	2M20-5.6t	1.00	2.00	1.00	196	**-39.4**	ULS 1a_0,9_0	86.6	117.6	172.8	0.45		**23.1**	ULS 1a_0	190.7	117.6	139.6	0.20	
232T	Zevende TSNSTK - Doorsnede B-B horiz s	100x100x8	S235	2M20-5.6t	1.00	2.00	1.00	196	**-43.1**	ULS 1a_0,9_90	86.6	117.6	172.8	0.50		**27.8**	ULS 1a_90	190.7	117.6	139.6	0.24	
233	Zevende TSNSTK - Doorsnede B-B diag	75x75x7#	S235	1M20-5.6t	1.00	1.00	1.00	289	**-3.8**	ULS 1a_90	26.8	58.8	75.6	0.14		**8.8**	ULS 1a_135	106.8	58.8	61.1	0.15	
234	Zevende TSNSTK - Doorsnede B-B horiz i	80x80x8	S235	1M20-5.6t	1.00	1.00	1.00	385	**0.0**	ULS 1a_0	20.2	58.8	86.4	0.00		**0.0**	ULS 1a_0,9_0,9_90	133.6	58.8	69.8	0.00	
235L	Zevende TSNSTK - CD 1 front	150x100x10	S235	1M30-5.6t	0.55	0.27	0.27	127	**-125.7**	ULS 1a_135	163.7	134.6	162.0	0.93		**101.9**	ULS 1a_0,9_0,9_45	193.0	134.6	130.9	0.78	
235T	Zevende TSNSTK - CD 1 side	150x100x10	S235	1M30-5.6t	0.55	0.27	0.27	127	**-113.4**	ULS 1a_135	163.7	134.6	162.0	0.84		**94.7**	ULS 1a_0,9_0,9_45	193.0	134.6	130.9	0.72	
236L	Zevende TSNSTK - Diag fr 1 above horiz	130x90x10	S235	2M24-5.6t	1.00	0.52	0.52	135	**-75.5**	ULS 1a_0,9_0,9_90	197.0	169.4	259.2	0.45		**90.0**	ULS 1a_90	194.6	169.4	221.5	0.53	
236T	Zevende TSNSTK - Diag si 1 above horiz	130x90x10	S235	2M24-5.6t	1.00	0.52	0.52	137	**-64.2**	ULS 5a Ba 10	194.1	169.4	259.2	0.38		**77.6**	ULS 5a Ah 10	194.6	169.4	221.5	0.46	
237L	Zevende TSNSTK - Doorsnede A-A horiz f	100x100x8	S235	1M20-5.6t	1.00	1.00	1.00	186	**-34.8**	ULS 1a_0,9_0,9_45	87.9	58.8	86.4	0.59		**24.1**	ULS 1a_135	179.7	58.8	69.8	0.41	
237T	Zevende TSNSTK - Doorsnede A-A horiz s	100x100x8	S235	1M20-5.6t	1.00	1.00	1.00	186	**-34.7**	ULS 1a_0,9_0,9_135	87.9	58.8	86.4	0.59		**24.6**	ULS 1a_45	179.7	58.8	69.8	0.42	
238	Zevende TSNSTK - Doorsnede A-A diag	80x80x8	S235	1M20-5.6t	1.00	1.00	1.00	331	**-8.8**	ULS 1a_135	25.9	58.8	86.4	0.34		**18.2**	ULS 1a_0,9_45	133.6	58.8	69.8	0.31	
239	Zevende TSNSTK - Doorsnede A-A CD	70x70x7	S235	1M20-5.6t	1.00	0.50	0.50	349	**-0.4**	ULS 7	15.8	58.8	75.6	0.03		**0.0**		96.8	58.8	61.1	0.00	
240L	Zesde TSNSTK - Diag fr 1 below horiz	150x100x10	S235	1M30-5.6t	1.00	0.52	0.52	140	**-131.1**	ULS 1a_90	157.6	134.6	162.0	0.97		**119.6**	ULS 1a_0,9_90	193.0	134.6	130.9	0.91	
240T	Zesde TSNSTK - Diag si 1 below horiz	150x100x10	S235	1M30-5.6t	1.00	0.52	0.52	138	**-111.5**	ULS 1a_0	159.4	134.6	162.0	0.83		**100.1**	ULS 1a_0,9_0	193.0	134.6	130.9	0.76	
241L	Zesde TSNSTK - CD 1 front	150x100x10	S235	1M30-5.6t	0.55	0.27	0.27	143	**-104.5**	ULS 1a_0,9_90	145.1	134.6	162.0	0.78		**106.5**	ULS 1a_90	193.0	134.6	130.9	0.81	
241T	Zesde TSNSTK - CD 1 side	150x100x10	S235	1M30-5.6t	0.55	0.27	0.27	143	**-89.9**	ULS 1a_0,9_0	145.1	134.6	162.0	0.67		**91.8**	ULS 1a_135	193.0	134.6	130.9	0.70	
275L	Vijfde TSNSTK - Doorsnede A-A horiz fr	120x120x11	S235	1M30-5.6t	1.00	1.00	1.00	377	**0.0**		43.3	134.6	178.2	0.00		**0.0**	ULS 1a_0	275.6	134.6	144.0	0.00	
275T	Vijfde TSNSTK - Doorsnede A-A horiz si	120x120x11	S235	1M30-5.6t	1.00	1.00	1.00	377	**0.0**		43.3	134.6	178.2	0.00		**0.0**	ULS 1a_0	275.6	134.6	144.0	0.00	
265	Top*	120x120x11	S235		1.00	1.00	1.00	206	**-15.7**	ULS 5a Ba 12	139.5	0.0	0.0	0.11		**15.0**	ULS 5a Ba 12	599.7	0.0	0.0	0.03	

DNV·GL

Assessment of groups for strengthened mast (afkeur level)

Date 9-4-2021
Author MKh
Version 1.0

KIJ-GT380
S+95
12

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)	Opm.2
118A	Vijfde TSNSTK - Main member	250x250x22+PL200x25	S235	36M30-8.8t	0.25	0.25	0.50	40	-4668.4	ULS 1a_135	6717.9	7205.9	12830.4	0.69		3866.6	ULS 1a_0,9_0,9_45	7329.7	7205.9	10368.0	0.54	
118B	Vijfde TSNSTK - Main member	250x250x22+PL200x25	S235	36M30-8.8t	0.50	0.50	1.00	38	-4883.8	ULS 1a_135	6775.5	7205.9	12830.4	0.72		4029.2	ULS 1a_0,9_0,9_45	7329.7	7205.9	10368.0	0.56	
119A	Vierde TSNSTK - Main member* 24	250x250x24+PL200x25	S235	36M30-8.8t	0.50	0.50	1.00	42	-4908.5	ULS 1a_135	7047.0	7205.9	13996.8	0.70		4004.5	ULS 1a_0,9_0,9_45	8142.5	7205.9	11310.5	0.56	
119B	Vierde TSNSTK - Main member* 24	250x250x24+PL200x25	S235	36M30-8.8t	0.25	0.25	0.50	40	-5194.3	ULS 1a_45	7109.2	7205.9	13996.8	0.73		4212.3	ULS 1a_0,9_0,9_135	8142.5	7205.9	11310.5	0.58	
120A	Derde TSNSTK - Main member* INP425	INP 425	S235	36M24-8.8t	0.25	0.25	0.51	38	-5496.0	ULS 1a_135	5715.8	9157.4	7138.4	0.96		4478.6	ULS 1a_0,9_0,9_45	6417.5	9157.4	6101.2	0.73	
120B	Derde TSNSTK - Main member* INP425	INP 425	S235	36M24-5.6t	0.50	0.50	0.90	34	-5709.9	ULS 1a_45	5831.7	5723.4	7138.4	1.00		4634.9	ULS 1a_0,9_0,9_135	6417.5	5723.4	6101.2	0.81	
121A	Tweede TSNSTK - Main member* INP425	INP 425	S235	36M24-8.8t	0.50	0.50	0.81	34	-5741.1	ULS 1a_45	5832.9	9157.4	7138.4	0.98		4603.1	ULS 1a_0,9_0,9_135	6417.5	9157.4	6101.2	0.75	
121B	Tweede TSNSTK - Main member* INP425	INP425+PL230x25	S235	36M24-8.8t	0.50	0.50	0.87	34	-6161.2	ULS 1a_45	8382.4	9157.4	9331.2	0.74		4911.9	ULS 1a_0,9_0,9_135	9303.7	9157.4	7975.4	0.62	
122A	Eerste TSNSTK - Main member	INP 450	S235	36M24-8.8t	0.50	0.50	1.00	42	-6260.3	ULS 1a_45	6265.5	9157.4	7558.3	1.00		4945.2	ULS 1a_0,9_0,9_135	7183.8	9157.4	6460.1	0.77	
122B	Eerste TSNSTK - Main member	INP 450	S235	36M24-8.8t	0.50	0.50	1.16	49	-6019.7	ULS 1a_135	6050.8	9157.4	7558.3	0.99		4662.9	ULS 1a_0,9_0,9_135	7183.8	9157.4	6460.1	0.72	
123A	Broekstuk - Main member	INP 450	S235	36M24-8.8t	0.33	0.33	0.62	48	-6055.8	ULS 1a_135	6089.9	9157.4	7558.3	0.99		4616.0	ULS 1a_0,9_0,9_135	7183.8	9157.4	6460.1	0.71	
123B	Broekstuk - Main member	INP 450	S235	36M24-8.8t	0.33	0.33	0.62	47	-6083.3	ULS 1a_135	6094.5	9157.4	7558.3	1.00		4595.4	ULS 1a_0,9_0,9_135	7183.8	9157.4	6460.1	0.71	
242L	Vijfde TSNSTK - CD 1 front	150x100x12	S235	1M30-5.6t	0.55	0.27	0.27	152	-118.3	ULS 1a_90	161.4	134.6	194.4	0.88		101.0	ULS 1a_0,9_90	231.6	134.6	157.1	0.75	
242T	Vijfde TSNSTK - CD 1 side	150x100x12	S235	1M30-5.6t	0.55	0.27	0.27	152	-103.2	ULS 1a_0	161.4	134.6	194.4	0.77		89.2	ULS 1a_0,9_0,9_0	231.6	134.6	157.1	0.66	
243L	Vijfde TSNSTK - Diag fr 1 above horiz	150x100x10	S235	1M30-5.6t	1.00	0.52	0.52	148	-91.4	ULS 1a_0,9_90	148.5	134.6	162.0	0.68		103.3	ULS 1a_90	193.0	134.6	130.9	0.79	
243T	Vijfde TSNSTK - Diag si 1 above horiz	150x100x10	S235	1M30-5.6t	1.00	0.52	0.52	148	-81.8	ULS 1a_0,9_0	148.5	134.6	162.0	0.61		92.4	ULS 1a_0	193.0	134.6	130.9	0.71	
244L	Vierde TSNSTK - Horizontal front	120x120x11	S235	1M20-5.6t	1.00	1.00	1.00	218	-28.4	ULS 1a_0,9_0,9_45	115.4	58.8	118.8	0.48		24.3	ULS 1a_0,9_135	310.5	58.8	96.0	0.41	
244T	Vierde TSNSTK - Horizontal side	120x120x11	S235	1M20-5.6t	1.00	1.00	1.00	218	-28.8	ULS 1a_0,9_0,9_45	115.4	58.8	118.8	0.49		24.5	ULS 1a_0,9_135	310.5	58.8	96.0	0.42	
245L	Vierde TSNSTK - Diag fr 1 below horiz	150x150x10	S235	1M30-8.8t	1.00	0.52	0.52	146	-152.0	ULS 1a_90	157.9	215.4	162.0	0.96		123.3	ULS 1a_0,9_0,9_90	337.0	215.4	130.9	0.94	
245T	Vierde TSNSTK - Diag si 1 below horiz	150x150x10	S235	1M30-8.8t	1.00	0.52	0.52	146	-140.7	ULS 1a_0	157.9	215.4	162.0	0.89		110.7	ULS 1a_0,9_0,9_0	337.0	215.4	130.9	0.85	
246L	Vierde TSNSTK - CD 1 front	150x150x12	S235	1M30-5.6t	0.55	0.27	0.27	164	-120.7	ULS 1a_0,9_0,9_90	165.0	134.6	194.4	0.90		131.7	ULS 1a_90	404.4	134.6	157.1	0.98	
246T	Vierde TSNSTK - CD 1 side	150x150x12	S235	1M30-5.6t	0.55	0.27	0.27	164	-109.1	ULS 1a_0,9_0,9_0	165.0	134.6	194.4	0.81		124.0	ULS 1a_0	404.4	134.6	157.1	0.92	
247L	Derde TSNSTK - CD 1 front	150x150x16	S235	2M24-5.6t	0.55	0.27	0.27	184	-145.1	ULS 1a_90	279.5	169.4	414.7	0.86		129.5	ULS 1a_0,9_90	565.4	169.4	344.4	0.76	
247T	Derde TSNSTK - CD 1 side	150x150x16	S235	2M24-5.6t	0.55	0.27	0.27	184	-141.3	ULS 1a_45	279.5	169.4	414.7	0.83		121.0	ULS 1a_0,9_135	565.4	169.4	344.4	0.71	
248L	Derde TSNSTK - Diag fr 1 above horiz	150x150x16	S235	2M24-5.6t	1.00	0.52	0.52	173	-140.8	ULS 1a_0,9_135	302.7	169.4	414.7	0.83		144.3	ULS 1a_135	565.4	169.4	344.4	0.85	
248T	Derde TSNSTK - Diag si 1 above horiz	150x150x16	S235	2M24-5.6t	1.00	0.52	0.52	173	-137.5	ULS 1a_0,9_135	302.7	169.4	414.7	0.81		142.8	ULS 1a_45	565.4	169.4	344.4	0.84	
249L	Tweede TSNSTK - Horizontal front	150x150x10	S235	1M24-5.6t	1.00	1.00	1.00	227	-35.4	ULS 1a_0,9_0,9_135	125.1	84.7	129.6	0.42		30.3	ULS 1a_45	357.1	84.7	110.8	0.36	
249T	Tweede TSNSTK - Horizontal side	150x150x10	S235	1M24-5.6t	1.00	1.00	1.00	223	-35.9	ULS 1a_0,9_0,9_45	128.2	84.7	129.6	0.42		30.3	ULS 1a_135	357.1	84.7	110.8	0.36	
250L	Tweede TSNSTK - Diag fr 1 below horiz	160x160x15#	S235	2M24-8.8t	1.00	0.52	0.52	175	-204.9	ULS 1a_135	304.1	271.1	388.8	0.76		156.5	ULS 1a_0,9_0,9_45	578.5	271.1	332.3	0.58	
250T	Tweede TSNSTK - Diag si 1 below horiz	160x160x15#	S235	2M24-8.8t	1.00	0.52	0.52	177	-202.4	ULS 1a_45	300.0	271.1	388.8	0.75		153.8	ULS 1a_0,9_0,9_135	578.5	271.1	332.3	0.57	
251L	Tweede TSNSTK - Diag fr 2 above horiz	160x160x15#	S235	2M24-5.6t	1.00	0.52	0.52	175	-115.7	ULS 1a_0,9_0,9_45	303.4	169.4	388.8	0.68		148.4	ULS 1a_90	578.5	169.4	332.3	0.88	
251T	Tweede TSNSTK - Diag si 2 above horiz	160x160x15#	S235	2M24-5.6t	1.00	0.52	0.52	175	-113.4	ULS 1a_0,9_0,9_135	303.4	169.4	388.8	0.67		146.3	ULS 1a_0	578.5	169.4	332.3	0.86	
252L	Eerste TSNSTK - Horizontal front	250x250x22#	S235	4M30-5.6t	1.00	1.00	1.00	148	-385.3	ULS 1a_45	897.2	538.6	1425.6	0.72		280.5	ULS 1a_0,9_0,9_135	1494.6	538.6	960.0	0.52	
252T	Eerste TSNSTK - Horizontal side	250x250x22#	S235	4M30-5.6t	1.00	1.00	1.00	148	-385.1	ULS 1a_135	897.2	538.6	1425.6	0.72		280.5	ULS 1a_0,9_0,9_45	1494.6	538.6	960.0	0.52	
253L	Eerste TSNSTK - Diag fr 2 below horiz	180x180x16#	S235	2M24-5.6t	1.00	0.52	0.52	175	-141.7	ULS 1a_90	361.1	169.4	414.7	0.84		135.1	ULS 1a_90	896.8	169.4	354.5	0.80	
253T	Eerste TSNSTK - Diag si 2 below horiz	180x180x16#	S235	2M24-5.6t	1.00	0.52	0.52	175	-103.2	ULS 1a_135	361.1	169.4	414.7	0.61		99.8	ULS 1a_45	896.8	169.4	354.5	0.59	
254L	Eerste TSNSTK - Diag fr 1 above horiz	180x180x16#	S235	2M24-5.6t	1.00	0.52	0.52	175	-157.1	ULS 1a_90	361.1	169.4	414.7	0.93		154.0	ULS 1a_0,9_0,9_135	896.8	169.4	354.5	0.91	
254T	Eerste TSNSTK - Diag si 1 above horiz	180x180x16#	S235	2M24-5.6t	1.00	0.52	0.52	175	-143.7	ULS 1a_45	361.1	169.4	414.7	0.85		154.1	ULS 1a_0,9_0,9_135	896.8	169.4	354.5	0.91	
255L	Broekstuk - Horizontal front	180x180x16#	S235	2M24-5.6t	1.00	1.00	1.00	247	-59.9	ULS 1a_135	231.7	169.4	414.7	0.35		25.6	ULS 1a_0,9_45	692.4	169.4	354.5	0.15	
255T	Broekstuk - Horizontal side	180x180x16#	S235	2M24-5.6t	1.00	1.00	1.00	247	-60.1	ULS 1a_45	231.7	169.4	414.7	0.35		25.8	ULS 1a_0,9_135	692.4	169.4	354.5	0.15	
256LB	Broekstuk - Lower part	150x150x10	S235	2M24-8.8t	0.17	0.25	0.17	127	-187.0	ULS 1a_90	290.1	271.1	259.2	0.72		132.5	ULS 1a_0,9_90	431.8	271.1	221.5	0.60	
256TB	Broekstuk - Lower part	150x150x10	S235	2M24-5.6t	0.17	0.25	0.17	127	-143.3	ULS 1a_45	290.1	169.4	259.2	0.85		96.5	ULS 1a_0,9_135	431.8	169.4	221.5	0.57	
257	Vierde TSNSTK - Diag A-A	100x100x8	S235	1M20-5.6t	1.00	1.00	1.00	370	-12.1	ULS 1a_135	27.1	58.8	86.4	0.45		19.7	ULS 1a_0,9_45	179.7	58.8	69.8	0.33	
258	Vierde TSNSTK - CD A-A	80x80x8	S235	1M20-5.6t	1.00	0.50	0.50	422	-0.6	ULS 7	15.2	58.8	86.4	0.04		0.0		133.6	58.8	69.8	0.00	
259	Tweede TSNSTK - Diag B-B	100x100x8	S235	1M20-5.6t	1.00	1.00	1.00	487	-12.0	ULS 1a_135	17.0	58.8	86.4	0.71		17.1	ULS 1a_0,9_45	179.7	58.8	69.8	0.29	
260	Tweede TSNSTK - CD B-B	100x100x8	S235	1M20-5.6t	1.00	0.50	0.50	437	-0.9	ULS 7	18.2	58.8	86.4	0.05		0.0		179.7	58.8	69.8	0.00	
261	Eerste TSNSTK - Diag C-C*	UNP200	S235	3M20-5.6t	1.00	1.00	1.00	482	-8.6	ULS 1a_90	44.3	176.4	275.4	0.19		18.3	ULS 1a_0,9_135	347.3	176.4	222.5	0.10	
262	Eerste TSNSTK - CD C-C	100x100x8	S235	2M20-5.6t	1.00	0.50	0.50	477	-0.5	ULS 7	21.4	117.6	172.8	0.02		0.0		277.0	117.6	139.6	0.00	
263	Broekstuk - Diag D-D	100x100x8	S235	1M20-5.6t	1.00	0.50	0.50	403	-13.1	ULS 1a_135	20.7	58.8	86.4	0.63		15.8	ULS 1a_0,9_45	179.7	58.8	69.8	0.27	
264	Broekstuk - CD D-D	100x100x8	S235	1M20-5.6t	1.00	0.50	0.50	569	-2.4	ULS 7	11.7	58.8	86.4	0.21		0.0		179.7	58.8	69.8	0.00	
100A	BVNSTK - Main Member	150x150x10	S235	6M24-5.6t	0.52	0.52	0.52	70	-121.7	ULS 1a_90	550.6	508.3	777.6	0.24		0.0		624.7	508.3	664.6	0.00	
100B	BVNSTK - Main Member	150x150x10	S235	6M24-5.6t	0.52	0.52	0.52	67	-487.0	ULS 1a_135	563.0	508.3	777.6	0.96		263.2	ULS 1a_0,9_0,9_135	624.7	508.3	664.6	0.52	
100C	BVNSTK - Main Member	150x150x10	S235		0.52	0.52	0.52	67	-284.3	ULS 1a_135	563.0	0.0	0.0	0.51		104.8	ULS 1a_0,9_0,9_135	688.6	0.0	0.0	0.15	
200L	BVNSTK - first horiz from top front	120x120x11	S235	6M24-5.6t	1.00	1.00	1.00	164	0.0		190.2	506.7	855.4	0.00		426.6	ULS 3_135	346.4	506.7	677.1	0.72	
200T	BVNSTK - first horiz from top side	120x120x11	S235	2M20-5.6t	1.00	1.00	1.00	164	-6.7	ULS 1a_0,9_90	190.2	117.6	237.6	0.06		6.4	ULS 1a_90	360.5	117.6	237.6	0.05	
201L	BVNSTK - CD 1 from top front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	124	-33.7	ULS 1a_0,9_0,9_135	263.5	169.4	285.1	0.20		66.5	ULS 1a_135	306.2	169.4	243.7	0.39	
201T	BVNSTK - CD 1 from top side	120x120x11	S235	1M24-5.6t	1.00	0.52	0.52	153	-41.4	ULS 1a_45	164.2	84.7	142.6	0.49		0.0		297.8	84.7	121.8	0.00	
101	BVNSTK - lower horiz lower CA front	200x200x18	S235	14M24-5.6t	1.00	2.00	1.00	65	-738.4	ULS 1a_0	1338.3	1066.2	3265.9	0.69		53.1	ULS 1a_0,9_0,9_0	1548.5	1066.2	2623.9	0.05	
202T	BVNSTK - lower horiz lower CA side	100x100x8	S235	4M20-5.6t	1.00	2.00	1.00	131	-12.7	ULS 5a Ah 22	143.1	235.2	345.6	0.09		77.5	ULS 5a Ah 22	310.5	235.2	279.3	0.33	
203L	BVNSTK - CD 2 from top front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	123	-113.5	ULS 1a_90	265.5	169.4	285.1	0.67		76.0	ULS 1a_0,9_0,9_90	291.2	169.4	229.3	0.45	
203T	BVNSTK - CD 2 from top side	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	123	-90.6	ULS 5a Ba 12	265.5	169.4	285.1	0.53		101.1	ULS 5a Ah 22	291.2	169.4	229.3	0.60	
204L	BVNSTK - CD 3 from top front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	125	-77.6	ULS 1a_0,9_0,9_90	260.7	169.4	285.1	0.46		111.6	ULS 1a_90	291.2	169.4	229.3	0.66	
204T	BVNSTK - CD 3 from top side	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	125	-96.3	ULS 5a Ah 22	260.7	169.4	285.1	0.57		87.0	ULS 5a Ba 12	291.2	169.4	229.3	0.51	
205	BVNSTK - Diaphragm diagonal	110x110x10	S235	2M20-5.6t	1.00	1.00	1.00	131	-54.8	ULS 5a Ah 22	205.7	117.6	216.0	0.47		56.3	ULS 5a Ba 22	262.5	117.6	174.5	0.48	
206	BVNSTK - Diaphragm horiz	70x70x7	S235	1M20-5.6t	1.00	1.00	1.00	294	-1.8	ULS 3_90	23.9	58.8	75.6	0.07		0.0		76.6	58.8	51.8	0.00	
400	Tweede DWSRM - CD under 1	80x80x8	S235	1M20-5.6t	0.53	0.53	0.53	167	-18.3	ULS 5a Ah 22	71.4	58.8	86.4	0.31		14.3	ULS 5a Ba 12	110.6	58.8	69.8	0.24	
401	Tweede DWSRM - CD under 2	80x80x8	S235	1M20-5.6t	0.53	0.53	0.53	155	-17.8	ULS 5a Ba 12	78.4	58.8	86.4	0.30		21.8	ULS 5a Ah 22	110.6	58.8	69.8	0.37	
402	Tweede DWSRM - CD under 3	80x80x8	S235	1M20-5.6t	0.53	0.53	0.53	147	-24.1	ULS 5a Ah 12	84.2	58.8	86.4	0.41		21.4	ULS 5a Ba 12	110.6	58.8	69.8	0.36	
403	Tweede DWSRM - CD under 4	80x80x8	S235	1M20-5.6t	0.53	0.53	0.53	118	-23.1	ULS 5a Ba 12	107.3	58.8	86.4	0.39		21.8	ULS 5a Ah 22	110.6	58.8	69.8	0.37	
404	Tweede DWSRM - CD under 5	80x80x8	S235	1M20-5.6t	0.53	0.53	0.53	111	-21.5	ULS 5a Ah 22	113.3	58.8	86.4	0.37		29.5	ULS 5a Ba 12	110.6	58.8	69.8	0.50	
405	Tweede DWSRM - CD under 6	80x80x8	S235	1M20-5.6t	0.53	0.53	0.53	108	-38.0	ULS 5a Ba 12	116.1	58.8	86.4	0.65		21.9	ULS 5a Ah 22	110.6	58.8	69.8	0.37	
406	Tweede DWSRM - CD under 7	80x80x8	S235	1M20-5.6t	0.52	0.52	0.52	82	-38.1	ULS 5a Ba 12	142.3	58.8	86.4	0.65		8.7	ULS 5a Ah 22	110.6	58.8	69.8	0.15	
407	Tweede DWSRM - Horiz 1&2 under	HEB200	S235	2M20-5.6t	2.00	2.00	2.00	41	-10.7	ULS 5a Ah 22	1434.3	117.6	324.0	0.09		42.0	ULS 5a Ba 12	1626.6	117.6	0.0	0.36	
408	Tweede DWSRM - front vert 1	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	95	0.0		50.7	37.7	43.2	0.00		7.3	ULS 1a_0	37.4	37.7	22.0	0.33	
409	Tweede DWSRM - front vert 2	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	191	0.0		23.4	37.7	43.2	0.00		15.2	ULS 7	37.4	37.7	22.0	0.69	
410	Tweede DWSRM - front vert 3	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	171	-6.6	ULS 1a_135	30.4	37.7	43.2	0.22		9.8	ULS 1a_45	37.4	37.7	22.0	0.45	
411	Tweede DWSRM - front vert 4	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	287	-13.5	ULS 1a_135	18.3	37.7	51.8	0.74		0.0		55.3	37.7	33.6	0.00	
412	Tweede DWSRM - front vert 5	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	231	-12.1	ULS 1a_0	17.7	37.7	43.2	0.68		0.0		37.4	37.7	22.0	0.00	
413	Tweede DWSRM - front vert 6	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	114	-7.8	ULS 7	43.2	37.7	43.2	0.21		0.0		37.4	37.7	22.0	0.00	
102A	Tweede DWSRM - Main member 1	200x200x18	S235	14M24-5.6t	1.00	1.46	1.00	80	-495.7	ULS 1a_0	1211.0	1066.2	3265.9	0.46		0.0		1548.5	1066.2	2791.4	0.00	
102B	Tweede DWSRM - Main member 1	200x200x18	S235	8M24-5.6t	1.00	1.53	1.00	77	-469.2	ULS 3_135	1237.8	677.8	1866.2	0.69		0.0		1548.5	677.8	1595.1	0.00	
102C	Tweede DWSRM - Main member 1	200x200x18	S235		1.89	2.89	1.00	75	-479.2	ULS 1a_0	1257.1	0.0	0.0	0.38		0.0		1623.9	0.0	0.0	0.00	
103A	Tweede DWSRM - Main member 2	180x180x16#	S235	8M24-5.6t	1.00	1.82	1.00	67	-452.4	ULS 3_135	1063.9	677.8	1658.9	0.67		0.0		1220.3	677.8	1417.8	0.00	

DNV·GL

Assessment of groups for strengthened mast (afkeur level)

Date 9-4-2021
Author MKh
Version 1.0

KIJ-GT380
S+95
12

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)	Opm.2
103B	Tweede DWSRM - Main member 2	180x180x16#	S235	7M24-5.6t	3.10	1.00	1.00	68	-436.0	ULS 3_90	1055.4	574.5	1451.5	0.76		0.0		828.7	574.5	1343.7	0.00	
103C	Tweede DWSRM - Main member 2	180x180x16#	S235		5.59	10.37	1.00	68	-452.6	ULS 3_135	1055.8	0.0	0.0	0.43		0.0		1301.9	0.0	0.0	0.00	
414	Tweede DWSRM - front diag 1	**70x70x7(11,0.17)**	S235	**1M16-8.8t**	1.00	1.00	1.00	221	-34.0	ULS 1a_0	76.4	60.3	121.0	0.56		0.0		209.7	60.3	89.6	0.00	
415	Tweede DWSRM - front diag 2	**65x65x7(11,0.17)**	S235	**1M16-8.8t**	1.00	1.00	1.00	193	-39.6	ULS 7	84.6	60.3	121.0	0.66		0.0		189.5	60.3	89.6	0.00	
416	Tweede DWSRM - front diag 3	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	328	0.0		20.1	37.7	60.5	0.00		0.0	ULS 1a_0	84.7	37.7	44.8	0.00	
417	Tweede DWSRM - front diag 4	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	333	0.0		19.5	37.7	60.5	0.00		22.6	ULS 1a_135	84.7	37.7	44.8	0.60	
418	Tweede DWSRM - front diag 5	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	325	0.0		20.3	37.7	60.5	0.00		29.2	ULS 1a_0	84.7	37.7	44.8	0.78	
419	Tweede DWSRM - main diag front	120x120x11	S235	6M24-5.6t	1.00	1.00	1.00	164	0.0		189.7	506.7	855.4	0.00		409.5	ULS 3_90	346.4	506.7	677.1	0.69	
420	Tweede DWSRM - raised horiz under 1	75x50x6	S235	1M16-5.6t	1.00	1.00	1.00	189	-17.7	ULS 1a_0,9_90	35.4	37.7	51.8	0.50		7.1	ULS 1a_0,9_0,9_90	44.9	37.7	41.4	0.19	
421	Tweede DWSRM - raised horiz under 2	75x50x6	S235	1M16-5.6t	1.00	1.00	1.00	155	0.0		45.9	37.7	51.8	0.00		0.6	ULS 1a_90	44.9	37.7	39.7	0.02	
422	Tweede DWSRM - raised horiz under 3	75x50x6	S235	1M16-5.6t	1.00	1.00	1.00	119	0.0		60.9	37.7	51.8	0.00		0.8	ULS 1a_135	44.9	37.7	34.4	0.02	
423	Tweede DWSRM - raised horiz under 4	75x50x6	S235	1M16-5.6t	1.00	1.00	1.00	87	-0.3	ULS 1a_0,9_0,9_90	74.7	37.7	51.8	0.01		1.6	ULS 1a_0,9_0,9_90	44.9	37.7	31.7	0.05	
104A	Tweede DWSRM - main member raised	150x150x10	S235	2M24-5.6t	1.00	19.90	1.00	103	-107.3	ULS 1a_135	413.3	169.4	259.2	0.63		0.0		343.1	169.4	208.5	0.00	
104B	Tweede DWSRM - main member raised	150x150x10	S235	2M24-5.6t	1.00	9.78	1.00	102	-74.7	ULS 1a_135	416.7	169.4	259.2	0.44		0.0		431.8	169.4	221.5	0.00	
104C	Tweede DWSRM - main member raised	150x150x10	S235		1.00	**1.01**	1.00	152	-107.0	ULS 1a_135	221.6	0.0	0.0	0.48		0.0		688.6	0.0	0.0	0.00	
424	Tweede DWSRM - horiz at end of raised	HEB160	S235	2M16-5.6t	2.00	2.00	2.00	22	-8.7	ULS 5a Ba 3	1077.2	75.4	138.2	0.12		6.3	ULS 5a Ah 3	1296.6	75.4	11.9	0.53	
425	Tweede DWSRM - raised DS A-A diag	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	132	-5.2	ULS 1a_45	37.2	37.7	43.2	0.14		3.2	ULS 1a_0,9_45	37.4	37.7	22.0	0.15	
426	Tweede DWSRM - raised DS A-A horiz	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	70	-1.4	ULS 1a_0,9_0	69.2	37.7	43.2	0.04		1.5	ULS 1a_0	37.4	37.7	22.0	0.07	
427	Tweede DWSRM - raised DS B-B diag	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	247	-4.2	ULS 5a Ah 22	16.1	37.7	43.2	0.26		2.1	ULS 5a Ah 22	37.4	37.7	22.0	0.10	
428	Tweede DWSRM - raised DS B-B horiz	50x50x5	S235	1M16-5.6t	1.00	2.00	1.00	120	-5.4	ULS 1a_135	43.6	37.7	43.2	0.14		0.0		37.4	37.7	22.0	0.00	
429	Tweede DWSRM - CD top 1	65x65x7	S235	1M16-5.6t	0.53	0.53	0.53	208	-18.8	ULS 1a_0,9_0,9_0	37.4	37.7	60.5	0.50		21.2	ULS 1a_0	84.7	37.7	44.8	0.56	
430	Tweede DWSRM - CD top 2	65x65x7	S235	1M16-5.6t	0.53	0.53	0.53	196	-20.4	ULS 1a_0	40.9	37.7	60.5	0.54		18.0	ULS 1a_0,9_0,9_0	84.7	37.7	44.8	0.48	
431	Tweede DWSRM - CD top 3	65x65x7	S235	1M16-5.6t	0.53	0.53	0.53	188	-17.6	ULS 1a_0,9_0,9_0	43.2	37.7	60.5	0.47		20.0	ULS 1a_0	84.7	37.7	44.8	0.53	
432	Tweede DWSRM - CD top 4	60x60x6	S235	1M16-5.6t	0.53	0.53	0.53	175	-17.0	ULS 1a_0,9_0,9_0	37.8	37.7	51.8	0.45		20.0	ULS 1a_0	55.3	37.7	33.6	0.59	
433	Tweede DWSRM - CD top 5	60x60x6	S235	1M16-5.6t	0.53	0.53	0.53	162	-18.8	ULS 1a_0	41.8	37.7	51.8	0.50		15.4	ULS 1a_0,9_0,9_0	55.3	37.7	33.6	0.46	
434	Tweede DWSRM - CD top 6	60x60x6	S235	1M16-5.6t	0.53	0.53	0.53	161	-15.1	ULS 1a_0,9_0,9_0	42.0	37.7	51.8	0.40		19.2	ULS 1a_0	55.3	37.7	33.6	0.57	
435	Tweede DWSRM - CD top 7	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	180	-20.1	ULS 1a_0	25.4	37.7	43.2	0.79		15.1	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.69	
436	Tweede DWSRM - CD top 8	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	148	-13.3	ULS 1a_0,9_0,9_0	32.6	37.7	43.2	0.41		18.5	ULS 1a_0	37.4	37.7	22.0	0.84	
437	Tweede DWSRM - CD top 9	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	147	-13.4	ULS 1a_0,9_0,9_0	32.8	37.7	43.2	0.41		17.2	ULS 1a_0	37.4	37.7	22.0	0.78	
438	Tweede DWSRM - CD top 10	50x50x5	S235	1M16-5.6t	0.53	0.53	0.53	124	-16.0	ULS 1a_0	39.8	37.7	43.2	0.43		12.0	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.55	
439	Tweede DWSRM - diag top "CD"	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	106	-10.7	ULS 1a_0,9_0,9_0	46.0	37.7	43.2	0.28		15.3	ULS 1a_0	37.4	37.7	22.0	0.69	
440	Tweede DWSRM - CD top 11	50x50x5	S235	1M16-5.6t	0.54	0.54	0.54	115	-11.7	ULS 5a Ba 3	42.8	37.7	43.2	0.31		8.5	ULS 5a Ah 3	37.4	37.7	22.0	0.39	
441	Tweede DWSRM - CD top 12	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	103	-10.2	ULS 5a Ah 3	47.4	37.7	43.2	0.27		14.3	ULS 5a Ba 3	37.4	37.7	22.0	0.65	
442	Tweede DWSRM - Main diag from tower	120x120x11	S235	6M24-5.6t	1.00	1.00	1.00	401	0.0		48.7	506.7	855.4	0.00		465.0	ULS 3_90	346.4	506.7	677.1	0.78	
443	Tweede DWSRM - diag top "CD"	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	260	-13.1	ULS 3_90	21.3	37.7	51.8	0.62		0.0		55.3	37.7	33.6	0.00	
105A	Tweede DWSRM - Main member top 1	130x130x12#	S235	6M24-5.6t	1.00	1.47	1.00	124	-250.4	ULS 1a_0	310.9	506.7	933.1	0.81		244.4	ULS 1a_0,9_0	410.9	506.7	738.6	0.59	
105B	Tweede DWSRM - Main member top 1	130x130x12#	S235	6M24-5.6t	1.50	1.00	1.00	123	-180.2	ULS 1a_0,9_0,9_0	308.4	508.3	933.1	0.58		226.9	ULS 1a_0	615.9	508.3	797.5	0.45	
105C	Tweede DWSRM - Main member top 1	130x130x12#	S235		3.12	2.05	1.00	116	-223.4	ULS 1a_0	312.3	0.0	0.0	0.72		253.7	ULS 1a_0	705.0	0.0	0.0	0.36	
106A	Tweede DWSRM - Main member top 2	100x100x10	S235	7M24-5.6t	1.00	1.48	1.00	130	-112.7	ULS 1a_0,9_0,9_0	188.5	593.0	907.2	0.60		258.2	ULS 1a_0	362.9	593.0	775.4	0.71	
106B	Tweede DWSRM - Main member top 2	100x100x10	S235	4M24-5.6t	1.00	1.77	1.00	145	-47.4	ULS 1a_0,9_0,9_0	157.6	338.9	518.4	0.30		169.6	ULS 1a_135	362.9	338.9	443.1	0.50	
106C	Tweede DWSRM - Main member top 2	100x100x10	S235		2.02	3.23	1.00	126	-87.8	ULS 1a_0,9_0,9_0	185.0	0.0	0.0	0.47		237.4	ULS 1a_0	451.2	0.0	0.0	0.53	
107A	Tweede DWSRM - Main member top 3	100x75x7	S235	4M20-5.6t	2.31	1.00	1.00	139	-27.8	ULS 1a_0,9_0,9_45	102.5	235.2	302.4	0.27		143.6	ULS 1a_135	228.6	235.2	302.4	0.63	
107B	Tweede DWSRM - Main member top 3	100x75x7	S235	2M16-5.6t	2.86	1.00	1.00	138	0.0		103.6	75.4	121.0	0.00		70.4	ULS 1a_135	196.1	75.4	121.0	0.93	
107C	Tweede DWSRM - Main member top 3	100x75x7	S235		2.17	1.00	1.00	142	-18.9	ULS 5a Ah 3	100.0	0.0	0.0	0.19		94.3	ULS 1a_135	279.7	0.0	0.0	0.34	
444	Tweede DWSRM - diag top "CD"	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	131	-8.1	ULS 1a_0,9_0,9_0	37.3	37.7	43.2	0.22		11.8	ULS 1a_0	37.4	37.7	22.0	0.54	
108A	Elfde TSNSTK - Main member	180x180x16#	S235	8M24-5.6t	0.51	0.51	0.51	55	-658.2	ULS 1a_135	1135.8	677.8	1658.9	0.97		449.0	ULS 1a_0,9_0,9_135	1220.3	677.8	1417.8	0.66	
108B	Elfde TSNSTK - Main member	180x180x16#	S235	**12M24-8.8t**	0.51	0.51	0.51	56	-1034.7	ULS 1a_135	1127.4	1599.5	2488.3	0.92		811.6	ULS 1a_0,9_0,9_135	1220.3	1599.5	2126.8	0.67	
108C	Elfde TSNSTK - Main member	180x180x16#	S235		0.51	0.51	0.51	55	-861.8	ULS 1a_135	1135.8	0.0	0.0	0.76		613.5	ULS 1a_0,9_0,9_135	1301.9	0.0	0.0	0.47	
207L	Elfde TSNSTK - CD 1 front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	127	-115.2	ULS 1a_90	255.9	169.4	285.1	0.68		82.1	ULS 1a_0,9_0,9_90	306.2	169.4	236.8	0.48	
207T	Elfde TSNSTK - CD 1 side	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	127	-83.5	ULS 5a Ba 12	255.9	169.4	285.1	0.49		91.7	ULS 5a Ah 22	306.2	169.4	236.8	0.54	
208L	Elfde TSNSTK - CD 2 front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	130	-82.7	ULS 1a_0,9_0,9_90	251.2	169.4	285.1	0.49		114.9	ULS 1a_90	306.2	169.4	236.8	0.68	
208T	Elfde TSNSTK - CD 2 side	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	130	-91.0	ULS 1a_0	251.2	169.4	285.1	0.54		83.1	ULS 1a_0,9_0,9_0	306.2	169.4	236.8	0.49	
209L	Elfde TSNSTK - CD 3 front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	133	-118.6	ULS 1a_90	243.6	169.4	285.1	0.70		82.5	ULS 1a_0,9_0,9_90	306.2	169.4	236.8	0.49	
209T	Elfde TSNSTK - CD 3 side	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	133	-85.1	ULS 1a_0,9_0,9_0	243.6	169.4	285.1	0.50		92.2	ULS 1a_0	306.2	169.4	236.8	0.54	
109A	Tiende TSNSTK - Main member	200x200x20	S235	**8M30-8.8t**	0.52	0.52	0.52	52	-1250.1	ULS 1a_135	1590.7	1723.4	2592.0	0.79		971.7	ULS 1a_0,9_0,9_135	1638.1	1723.4	2094.5	0.59	
109B	Tiende TSNSTK - Main member	200x200x20	S235	12M30-5.6t	0.52	0.52	0.52	53	-1447.0	ULS 1a_45	1580.5	1588.8	3888.0	0.92		1015.8	ULS 1a_0,9_0,9_135	1638.1	1588.8	3194.2	0.64	
210L	Tiende TSNSTK - CD 1 front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	136	-84.5	ULS 1a_0,9_0,9_90	238.9	169.4	285.1	0.50		123.2	ULS 1a_90	306.2	169.4	236.8	0.73	
210T	Tiende TSNSTK - CD 1 side	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	136	-97.9	ULS 1a_0	238.9	169.4	285.1	0.58		88.7	ULS 1a_0,9_0,9_0	306.2	169.4	236.8	0.52	
211L	Tiende TSNSTK - CD 2 front	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	140	-138.0	ULS 1a_0,9_0,9_45	230.6	169.4	285.1	0.81		160.0	ULS 1a_45	306.2	169.4	236.8	0.94	
211T	Tiende TSNSTK - CD 2 side	120x120x11	S235	2M24-5.6t	0.52	0.52	0.52	140	-146.0	ULS 1a_135	230.6	169.4	285.1	0.86		108.5	ULS 1a_0,9_0,9_45	306.2	169.4	236.8	0.64	
212L	Tiende TSNSTK - upper horiz lower CA fr	150x150x10	S235	7M24-5.6t	1.00	1.00	1.00	162	0.0		222.3	578.2	907.2	0.00		384.1	ULS 3_0	420.0	578.2	778.3	0.91	
212T	Tiende TSNSTK - upper horiz lower CA si	**100x100x10**	**S355**	**2M20-8.8t**	1.00	1.00	**0.85**	209	-65.9	ULS 1a_90	113.9	188.2	294.0	0.58		46.1	ULS 1a_0,9_0,9_90	466.5	188.2	237.6	0.24	
109	Tiende TSNSTK - lower horiz lower CA fr	200x200x18	S235	12M24-5.6t	1.00	2.00	1.00	82	-428.1	ULS 3_0	1194.7	906.5	2799.4	0.47		0.0		1548.5	906.5	2392.6	0.00	
213	Tiende TSNSTK - lower horiz lower CA si	110x110x10	S235	4M20-5.6t	1.00	2.00	1.00	148	-13.2	ULS 1a_0,9_0,9_90	168.8	235.2	432.0	0.08		91.8	ULS 1a_90	433.4	235.2	349.1	0.39	
214	Tiende TSNSTK - Diaphragm diagonal	130x130x12#	S235	2M20-5.6t	1.00	1.00	1.00	139	-60.8	ULS 5a Ba 21	272.8	117.6	259.2	0.52		62.7	ULS 5a Ba 21	379.7	117.6	209.5	0.53	
215	Tiende TSNSTK - Diaphragm horiz	80x80x8	S235	1M20-5.6t	1.00	1.00	1.00	321	-2.2	ULS 3_90	27.3	58.8	86.4	0.08		0.0		133.6	58.8	69.8	0.00	
300	Eerste DWSRM - CD under 1	100x100x8	S235	1M20-5.6t	0.53	0.53	0.53	146	-21.3	ULS 5a Ah 20	106.2	58.8	86.4	0.36		19.2	ULS 5a Ba 11	179.7	58.8	69.8	0.33	
301	Eerste DWSRM - CD under 2	100x100x8	S235	1M20-5.6t	0.53	0.53	0.53	136	-20.9	ULS 5a Ah 11	116.1	58.8	86.4	0.36		26.6	ULS 5a Ba 20	179.7	58.8	69.8	0.45	
302	Eerste DWSRM - CD under 3	100x100x8	S235	1M20-5.6t	0.53	0.53	0.53	128	-32.8	ULS 5a Ba 20	123.5	58.8	86.4	0.56		22.6	ULS 5a Ah 11	179.7	58.8	69.8	0.38	
303	Eerste DWSRM - CD under 4	100x100x8	S235	1M20-5.6t	0.52	0.52	0.52	99	-27.4	ULS 5a Ba 11	157.9	58.8	86.4	0.47		17.4	ULS 5a Ah 20	179.7	58.8	69.8	0.30	
304	Eerste DWSRM - CD under 5	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	163	-16.4	ULS 1a_135	52.2	58.8	75.6	0.31		12.2	ULS 1a_0,9_0,9_0	86.7	58.8	59.5	0.21	
305	Eerste DWSRM - CD under 6	65x65x7	S235	1M20-5.6t	0.53	0.53	0.53	147	-13.2	ULS 1a_0,9_0,9_0	59.5	58.8	75.6	0.22		14.6	ULS 1a_0	86.7	58.8	59.5	0.25	
306	Eerste DWSRM - CD under 7	65x65x7	S235	1M20-5.6t	0.54	0.54	0.54	138	-14.2	ULS 1a_0	64.1	58.8	75.6	0.24		13.6	ULS 1a_0,9_0,9_0	86.7	58.8	59.5	0.23	
307	Eerste DWSRM - CD under 8	65x65x7	S235	1M20-5.6t	0.54	0.54	0.54	126	-14.6	ULS 5a Ah 10	70.4	58.8	75.6	0.25		16.5	ULS 5a Ba 10	86.7	58.8	59.5	0.28	
308	Eerste DWSRM - CD under 9	60x60x6	S235	1M20-5.6t	0.54	0.54	0.54	115	-17.7	ULS 5a Ba 10	61.4	58.8	64.8	0.30		17.3	ULS 5a Ah 10	65.7	58.8	44.4	0.39	
309	Eerste DWSRM - CD under 10	60x60x6	S235	1M20-5.6t	0.55	0.55	0.55	108	-21.7	ULS 5a Ah 10	65.5	58.8	64.8	0.37		23.3	ULS 5a Ba 10	65.7	58.8	44.4	0.53	
310	Eerste DWSRM - CD under 11	65x65x7	S235	2M20-5.6t	0.56	0.56	0.56	95	-31.9	ULS 5a Ba 21	114.4	117.6	151.2	0.28		26.1	ULS 5a Ah 21	99.4	117.6	104.2	0.26	
311	Eerste DWSRM - CD under 12	65x65x7	S235	1M20-5.6t	0.55	0.55	0.55	72	-36.1	ULS 5a Ba 21	105.7	58.8	75.6	0.61		20.9	ULS 5a Ah 21	86.7	58.8	59.5	0.36	
312	Eerste DWSRM - 1st & 2nd horiz under	HEB240	S235	2M20-5.6t	2.00	2.00	2.00	56	-18.5	ULS 5a Ah 11	1771.8	117.6	367.2	0.16		32.9	ULS 5a Ba 20	2249.6	117.6	0.0	0.28	
313	Eerste DWSRM - 3rd & 4th horiz under	HEB200	S235	2M20-5.6t	2.00	2.00	2.00	20	-20.9	ULS 5a Ah 10	1583.1	117.6	324.0	0.18		31.5	ULS 5a Ba 10	1626.6	117.6	0.0	0.27	
314	Eerste DWSRM - front diag 1	65x65x7	S235	2M20-5.6t	1.00	1.00	1.00	475	0.0		12.4	117.6	151.2	0.00		70.4	ULS 3_135	99.4	117.6	119.1	0.71	
315	Eerste DWSRM - front diag 2	65x65x7	S235	2M20-5.6t	1.00	1.00	1.00	450	0.0		13.6	117.6	151.2	0.00		93.0	ULS 3_0	99.4	117.6	119.1	0.94	
316	Eerste DWSRM - front diag 3	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	364	0.0		12.4	37.7	51.8	0.00		34.6	ULS 1a_0	72.6	37.7	38.4	0.92	
317	Eerste DWSRM - front diag 4	60x60x6	**S355**	**1M16-8.8t**	1.00	1.00	1.00	338	0.0		15.0	60.3	70.6	0.00		39.3	ULS 1a_0	98.8	60.3	52.3	0.75	

DNV·GL

Assessment of groups for strengthened mast (afkeur level)

Date	9-4-2021
Author	MKh
Version	1.0

KIJ-GT380
S+95
12

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)	Opm.2
318	Eerste DWSRM - front diag 5	60x60x6	S235	1M16-5.6t	1.00	1.00	1.00	317	**0.0**		15.5	37.7	51.8	0.00		**36.9**	ULS 7	72.6	37.7	38.4	0.98	
319	Eerste DWSRM - front vert 1	100x100x8	S235	1M20-5.6t	1.00	1.00	1.00	165	**-42.2**	ULS 3_0	91.7	58.8	86.4	0.72		**0.0**		179.7	58.8	69.8	0.00	
320	Eerste DWSRM - front vert 2	75x50x6	S235	1M16-5.6t	1.00	1.00	1.00	225	**-16.8**	ULS 7	27.8	37.7	51.8	0.61		**0.0**		44.9	37.7	26.5	0.00	
321	Eerste DWSRM - front vert 3	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	188	**-14.4**	ULS 1a_0	23.9	37.7	43.2	0.60		**0.0**		37.4	37.7	22.0	0.00	
322	Eerste DWSRM - front vert 4	75x50x6	S235	1M16-5.6t	1.00	1.00	1.00	112	**-8.9**	ULS 1a_135	63.5	37.7	51.8	0.24		**0.0**		44.9	37.7	26.5	0.00	
323	Eerste DWSRM - front vert 5	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	63	**-3.6**	ULS 3_90	60.9	37.7	43.2	0.10		**0.0**		37.4	37.7	22.0	0.00	
324	Eerste DWSRM - Doorsnede A-A diag	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	306	**-7.0**	ULS 1a_0	11.5	37.7	43.2	0.61		**4.6**	ULS 1a_0,9_0	37.4	37.7	22.0	0.21	
325	Eerste DWSRM - Doorsnede A-A horiz top	50x50x5	S235	1M16-5.6t	1.00	2.00	1.00	219	**-2.7**	ULS 1a_0	20.7	37.7	43.2	0.13		**2.6**	ULS 1a_0,9_0	37.4	37.7	22.0	0.12	
326	Eerste DWSRM - Doorsnede B-B diag	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	156	**-8.3**	ULS 1a_0	30.6	37.7	43.2	0.27		**3.7**	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.17	
327	Eerste DWSRM - Doorsnede B-B horiz top	50x50x5	S235	1M16-5.6t	1.00	2.49	1.00	142	**-2.2**	ULS 1a_0,9_0,9_0	36.2	37.7	43.2	0.06		**2.1**	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.09	
110A	Eerste DWSRM - Main member bottom 1	200x200x18	S235	12M24-5.6t	1.00	1.70	1.00	71	**-510.7**	ULS 1a_135	1289.1	906.5	2799.4	0.56		**0.0**		1548.5	906.5	2392.6	0.00	
110B	Eerste DWSRM - Main member bottom 1	200x200x18	S235	8M24-5.6t	2.53	1.40	1.00	57	**-336.3**	ULS 5a Ba 21	1398.2	677.8	1866.2	0.50		**7.8**	ULS 5a Ah 21	1548.5	677.8	1595.1	0.01	
110C	Eerste DWSRM - Main member bottom 1	200x200x18	S235		2.42	1.40	1.00	71	**-500.3**	ULS 1a_135	1289.3	0.0	0.0	0.39		**19.7**	ULS 5a Ah 21	1623.9	0.0	0.0	0.01	
111A	Eerste DWSRM - Main member bottom 1	160x160x15#	S235	8M24-5.6t	3.53	6.36	1.00	72	**-311.8**	ULS 5a Ba 21	869.0	677.8	1555.2	0.46		**32.5**	ULS 5a Ah 21	1008.5	677.8	1329.2	0.05	
111B	Eerste DWSRM - Main member bottom 1	160x160x15#	S235		2.89	1.00	1.00	72	**-197.2**	ULS 3_90	869.3	0.0	0.0	0.23		**0.0**		1097.7	0.0	0.0	0.00	
111C	Eerste DWSRM - Main member bottom 1	160x160x15#	S235		1.80	1.00	1.00	72	**-297.8**	ULS 5a Ba 21	869.1	0.0	0.0	0.34		**26.9**	ULS 5a Ah 21	1097.7	0.0	0.0	0.02	
112A	Eerste DWSRM - Main member top 1	130x130x12#	S235	6M24-5.6t	1.00	1.00	1.00	178	**0.0**		200.4	504.1	933.1	0.00		**362.2**	ULS 3_90	422.8	504.1	796.6	0.86	
112B	Eerste DWSRM - Main member top 1	130x130x12#	S235	5M24-5.6t	1.00	1.00	1.00	140	**0.0**		270.4	423.6	777.6	0.00		**259.5**	ULS 3_90	615.9	423.6	664.6	0.61	
112C	Eerste DWSRM - Main member top 1	130x130x12#	S235		1.00	1.00	1.00	187	**0.0**		188.2	0.0	0.0	0.00		**285.9**	ULS 3_90	705.0	0.0	0.0	0.41	
113A	Eerste DWSRM - Main member top 1	110x110x10	S235	5M24-5.6t	1.00	1.00	1.00	165	**0.0**		156.1	423.6	648.0	0.00		**232.8**	ULS 3_135	412.6	423.6	553.8	0.56	
113B	Eerste DWSRM - Main member top 1	110x110x10	S235	5M24-5.6t	2.00	1.00	1.00	212	**0.0**		106.2	423.6	648.0	0.00		**198.4**	ULS 3_135	291.3	423.6	553.8	0.68	
113C	Eerste DWSRM - Main member top 1	110x110x10	S235		2.00	1.00	1.00	212	**0.0**		106.2	0.0	0.0	0.00		**198.1**	ULS 3_135	496.3	0.0	0.0	0.40	
328	Eerste DWSRM - Horiz top 1	65x50x5	S235	1M16-5.6t	1.00	1.00	1.00	380	**-0.1**	ULS 1a_90	9.2	37.7	43.2	0.01		**0.0**		60.5	37.7	32.0	0.00	
329	Eerste DWSRM - Horiz top 2	65x50x5	S235	1M16-5.6t	1.00	1.00	1.00	255	**-0.1**	ULS 1a_90	17.5	37.7	43.2	0.00		**0.0**		60.5	37.7	32.0	0.00	
114A	Negende TSNSTK - Main member	250x250x22#	S235	18M30-5.6t	0.52	**0.26**	**0.26**	23	**-2416.7**	ULS 1a_45	2472.3	2423.5	6415.2	1.00		**1901.4**	ULS 1a_0,9_0,9_45	2373.8	2423.5	4626.7	0.80	
114B	Negende TSNSTK - Main member	250x250x22#	S235	**14M30-8.8t**	0.52	0.52	0.52	35	**-1880.2**	ULS 1a_45	2373.4	3015.9	4989.6	0.79		**1406.2**	ULS 1a_0,9_0,9_45	2373.8	3015.9	4032.0	0.59	
114C	Negende TSNSTK - Main member	250x250x22#	S235		0.52	**0.26**	**0.26**	22	**-2413.9**	ULS 1a_45	2481.2	0.0	0.0	0.97		**1905.2**	ULS 1a_0,9_0,9_45	2493.4	0.0	0.0	0.76	
216L	Negende TSNSTK - Diag fr 1 above horiz	150x100x12	S235	**2M30-8.8t**	1.00	0.51	0.51	103	**-282.1**	ULS 1a_90	355.4	861.7	388.8	0.79		**253.6**	ULS 1a_0,9_0,9_90	417.0	861.7	314.2	0.61	
216T	Negende TSNSTK - Diag si 1 above horiz	150x100x12	S235	2M30-5.6t	1.00	0.51	0.51	103	**-200.2**	ULS 1a_0	355.4	269.3	388.8	0.74		**195.6**	ULS 1a_0	250.2	269.3	314.2	0.78	
217L	Negende TSNSTK - Diag fr 2 above horiz	150x100x12	S235	**2M30-8.8t**	1.00	0.51	0.51	104	**-259.7**	ULS 1a_90	350.2	861.7	388.8	0.74		**265.4**	ULS 1a_90	417.0	861.7	314.2	0.64	
217T	Negende TSNSTK - Diag si 2 above horiz	150x100x12	S235	2M30-5.6t	1.00	0.51	0.51	104	**-204.9**	ULS 1a_0	350.2	269.3	388.8	0.76		**190.8**	ULS 1a_0,9_0,9_0	250.2	269.3	314.2	0.76	
218	Negende TSNSTK - Diaphragm K diag	70x70x7	S235	2M16-5.6t	1.00	1.00	1.00	266	**-11.3**	ULS 5a Ah 21	35.0	75.4	121.0	0.32		**11.2**	ULS 5a Ah 21	109.4	75.4	89.6	0.15	
219	Negende TSNSTK - Diaphragm K CD	100x50x6	S235	3M16-5.6t	0.50	0.50	0.50	239	**-0.4**	ULS 1a_90	38.0	113.0	155.5	0.01		**0.1**	ULS 1a_0,9_90	90.2	113.0	100.9	0.00	
220L	Negende TSNSTK - Diaphragm K horiz fr	65x65x7	S235	1M16-5.6t	1.00	1.00	1.00	203	**-17.2**	ULS 1a_0,9_45	43.6	37.7	60.5	0.46		**16.2**	ULS 1a_135	94.8	37.7	44.8	0.43	
220T	Negende TSNSTK - Diaphragm K horiz si	65x65x7	S235	1M16-5.6t	1.00	1.00	1.00	203	**-13.9**	ULS 1a_0,9_0,9_135	43.6	37.7	60.5	0.37		**18.3**	ULS 1a_45	94.8	37.7	44.8	0.48	
221	Negende TSNSTK - Diaphragm L diag	70x70x7	S235	2M16-5.6t	1.00	1.00	1.00	279	**-1.9**	ULS 1a_0	32.5	75.4	121.0	0.06		**4.7**	ULS 1a_45	109.4	75.4	89.6	0.06	
222	Negende TSNSTK - Diaphragm L CD	100x50x6	S235	3M16-5.6t	0.50	0.50	0.50	251	**-0.2**	ULS 1a_90	35.4	113.0	155.5	0.00		**0.2**	ULS 1a_0,9_90	90.2	113.0	100.9	0.00	
223L	Negende TSNSTK - Diaphragm L horiz fr	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	198	**-22.5**	ULS 1a_0,9_0,9_45	49.1	37.7	60.5	0.60		**21.1**	ULS 1a_45	104.8	37.7	44.8	0.56	
223T	Negende TSNSTK - Diaphragm L horiz si	70x70x7	S235	1M16-5.6t	1.00	1.00	1.00	198	**-22.2**	ULS 1a_0,9_0,9_45	49.1	37.7	60.5	0.59		**20.5**	ULS 1a_135	104.8	37.7	44.8	0.54	
224L	Achtste TSNSTK - Diag fr 1 above horiz	150x100x12	S235	**2M30-8.8t**	1.00	0.51	0.51	106	**-274.7**	ULS 1a_90	345.0	430.8	388.8	0.80		**254.4**	ULS 1a_0,9_0,9_90	348.4	430.8	314.2	0.81	
224T	Achtste TSNSTK - Diag si 1 above horiz	150x100x12	S235	2M30-5.6t	1.00	0.51	0.51	106	**-205.8**	ULS 1a_0	345.0	269.3	388.8	0.76		**202.2**	ULS 1a_0	348.4	269.3	314.2	0.75	
225L	Achtste TSNSTK - Diaphragm M horiz fr	75x75x7#	S235	1M16-5.6t	1.00	1.00	1.00	191	**-28.7**	ULS 1a_0,9_0,9_135	55.7	37.7	60.5	0.76		**29.0**	ULS 1a_45	114.9	37.7	44.8	0.77	
225T	Achtste TSNSTK - Diaphragm M horiz si	75x75x7#	S235	1M16-5.6t	1.00	1.00	1.00	191	**-28.3**	ULS 1a_0,9_0,9_135	55.7	37.7	60.5	0.75		**29.6**	ULS 1a_90	114.9	37.7	44.8	0.78	
226	Achtste TSNSTK - Diaphragm M diag	70x70x7	S235	2M16-5.6t	1.00	1.00	1.00	292	**-2.5**	ULS 1a_90	30.2	75.4	121.0	0.08		**5.6**	ULS 1a_45	109.4	75.4	89.6	0.07	
227	Achtste TSNSTK - Diaphragm M CD	100x50x6	S235	3M16-5.6t	0.50	0.50	0.50	263	**-0.2**	ULS 1a_90	33.0	113.0	155.5	0.01		**0.0**	ULS 1a_0,9_90	90.2	113.0	100.9	0.00	
228L	Achtste TSNSTK - Diag fr 2 above horiz	150x150x10	S235	2M30-5.6t	1.00	0.51	0.51	99	**-260.0**	ULS 1a_90	353.4	269.3	324.0	0.97		**254.0**	ULS 1a_0,9_90	347.2	269.3	261.8	0.97	
228T	Achtste TSNSTK - Diag si 2 above horiz	150x150x10	S235	2M30-5.6t	1.00	0.51	0.51	99	**-210.7**	ULS 1a_0	353.4	269.3	324.0	0.78		**192.9**	ULS 1a_0,9_0,9_0	347.2	269.3	261.8	0.74	
229L	Achtste TSNSTK - Diaphragm N horiz fr	80x80x8	S235	1M16-5.6t	1.00	1.00	1.00	188	**-21.3**	ULS 1a_0,9_0,9_45	61.0	37.7	69.1	0.56		**16.4**	ULS 1a_0,9_135	142.8	37.7	51.2	0.43	
229T	Achtste TSNSTK - Diaphragm N horiz si	80x80x8	S235	1M16-5.6t	1.00	1.00	1.00	188	**-21.7**	ULS 1a_45	61.0	37.7	69.1	0.57		**15.2**	ULS 1a_0,9_135	142.8	37.7	51.2	0.40	
230	Achtste TSNSTK - Diaphragm N diag	70x70x7	S235	2M16-5.6t	1.00	1.00	1.00	305	**-2.4**	ULS 1a_0	28.2	75.4	121.0	0.09		**6.1**	ULS 1a_135	109.4	75.4	89.6	0.08	
231	Achtste TSNSTK - Diaphragm N CD	100x50x6	S235	3M16-5.6t	0.50	0.50	0.50	274	**-0.2**	ULS 1a_90	30.8	113.0	155.5	0.01		**0.3**	ULS 1a_0,9_90	75.4	113.0	100.9	0.00	
115A	Achtste TSNSTK - Main member	**200x200x20+PL150x20**	S235	**28M30-8.8t**	**0.50**	**0.50**	**0.50**	22	**-3454.7**	ULS 1a_45	4955.6	5805.7	9072.0	0.70		**2885.1**	ULS 1a_0,9_0,9_135	5013.3	0.0	0.0	0.58	
115B	Achtste TSNSTK - Main member	200x200x20	S235		0.50	0.50	0.50	22	**-2947.9**	ULS 1a_45	3556.9	0.0	0.0	0.83		**2411.0**	ULS 1a_0,9_0,9_135	3607.3	0.0	0.0	0.67	
116A	Zevende TSNSTK - Main member	**250x250x20+PL200x25**	S235	**28M30-8.8t**	0.25	0.25	0.50	40	**-3841.4**	ULS 1a_45	6326.6	5805.7	9072.0	0.66		**3240.8**	ULS 1a_0,9_0,9_135	7275.2	5805.7	7330.9	0.56	
116B	Zevende TSNSTK - Main member	**250x250x20+PL200x25**	S235	**32M30-8.8t**	0.50	0.50	1.00	37	**-4146.9**	ULS 1a_135	6416.9	6520.2	10368.0	0.65		**3456.1**	ULS 1a_0,9_0,9_45	7275.2	6520.2	8378.2	0.53	
117A	Zesde TSNSTK - Main member	**250x250x20+PL200x25**	S235	**32M30-8.8t**	0.50	0.50	1.00	43	**-4167.7**	ULS 1a_135	6233.1	6520.2	10368.0	0.67		**3433.9**	ULS 1a_0,9_0,9_45	7275.2	6520.2	8378.2	0.53	
117B	Zesde TSNSTK - Main member	**250x250x20+PL200x25**	S235	**36M30-8.8t**	0.25	0.25	0.50	40	**-4427.4**	ULS 1a_135	6326.6	7205.9	11664.0	0.70		**3636.7**	ULS 1a_0,9_0,9_45	6933.1	7205.9	9425.5	0.52	
232L	Zevende TSNSTK - Doorsnede B-B horiz fr	100x100x8	S235	2M20-5.6t	1.00	2.00	1.00	196	**-45.3**	ULS 1a_0,9_0	86.6	117.6	172.8	0.52		**36.5**	ULS 1a_0	190.7	117.6	139.6	0.31	
232T	Zevende TSNSTK - Doorsnede B-B horiz si	100x100x8	S235	2M20-5.6t	1.00	2.00	1.00	196	**-50.0**	ULS 1a_0,9_90	86.6	117.6	172.8	0.58		**44.3**	ULS 1a_90	190.7	117.6	139.6	0.38	
233	Zevende TSNSTK - Doorsnede B-B diag	75x75x7#	S235	1M20-5.6t	1.00	1.00	1.00	289	**-4.0**	ULS 1a_45	26.8	58.8	75.6	0.15		**8.0**	ULS 1a_0,9_135	106.8	58.8	61.1	0.14	
234	Zevende TSNSTK - Doorsnede B-B horiz in	80x80x8	S235	1M20-5.6t	1.00	1.00	1.00	385	**0.0**	ULS 1a_0	20.2	58.8	86.4	0.00		**0.0**	ULS 1a_0,9_0,9_90	133.6	58.8	69.8	0.00	
235L	Zevende TSNSTK - CD 1 front	150x100x10	S235	1M30-5.6t	0.55	0.27	0.27	127	**-125.9**	ULS 1a_135	163.7	134.6	162.0	0.94		**95.9**	ULS 1a_0,9_0,9_45	193.0	134.6	130.9	0.73	
235T	Zevende TSNSTK - CD 1 side	150x100x10	S235	1M30-5.6t	0.55	0.27	0.27	127	**-113.7**	ULS 1a_135	163.7	134.6	162.0	0.84		**88.7**	ULS 1a_0,9_0,9_45	193.0	134.6	130.9	0.68	
236L	Zevende TSNSTK - Diag fr 1 above horiz	130x90x10	S235	2M24-5.6t	1.00	0.52	0.52	135	**-76.0**	ULS 1a_0,9_0,9_90	197.0	169.4	259.2	0.45		**92.7**	ULS 1a_90	194.6	169.4	221.5	0.55	
236T	Zevende TSNSTK - Diag si 1 above horiz	130x90x10	S235	2M24-5.6t	1.00	0.52	0.52	137	**-63.1**	ULS 5a Ba 10	194.1	169.4	259.2	0.37		**78.7**	ULS 5a Ah 10	194.6	169.4	221.5	0.46	
237L	Zevende TSNSTK - Doorsnede A-A horiz fr	100x100x8	S235	1M20-5.6t	1.00	1.00	1.00	186	**-31.4**	ULS 1a_0,9_0,9_45	87.9	58.8	86.4	0.53		**26.1**	ULS 1a_135	179.7	58.8	69.8	0.44	
237T	Zevende TSNSTK - Doorsnede A-A horiz si	100x100x8	S235	1M20-5.6t	1.00	1.00	1.00	186	**-31.4**	ULS 1a_0,9_0,9_135	87.9	58.8	86.4	0.53		**26.6**	ULS 1a_45	179.7	58.8	69.8	0.45	
238	Zevende TSNSTK - Doorsnede A-A diag	80x80x8	S235	1M20-5.6t	1.00	1.00	1.00	331	**-10.7**	ULS 1a_135	25.9	58.8	86.4	0.41		**16.2**	ULS 1a_0,9_45	133.6	58.8	69.8	0.27	
239	Zevende TSNSTK - Doorsnede A-A CD	70x70x7	S235	1M20-5.6t	1.00	0.50	0.50	349	**-0.5**	ULS 7	15.8	58.8	75.6	0.03		**0.0**		96.8	58.8	61.1	0.00	
240L	Zesde TSNSTK - Diag fr 1 below horiz	150x100x10	S235	1M30-5.6t	1.00	0.52	0.52	140	**-133.5**	ULS 1a_90	157.6	134.6	162.0	0.99		**118.0**	ULS 1a_0,9_90	193.0	134.6	130.9	0.90	
240T	Zesde TSNSTK - Diag si 1 below horiz	150x100x10	S235	1M30-5.6t	1.00	0.52	0.52	138	**-113.6**	ULS 1a_0	159.4	134.6	162.0	0.84		**98.8**	ULS 1a_0,9_0	193.0	134.6	130.9	0.75	
241L	Zesde TSNSTK - CD 1 front	150x100x10	S235	1M30-5.6t	0.55	0.27	0.27	143	**-103.7**	ULS 1a_0,9_90	145.1	134.6	162.0	0.77		**110.5**	ULS 1a_90	193.0	134.6	130.9	0.84	
241T	Zesde TSNSTK - CD 1 side	150x100x10	S235	1M30-5.6t	0.55	0.27	0.27	143	**-89.5**	ULS 1a_0,9_0	145.1	134.6	162.0	0.66		**94.5**	ULS 1a_0	193.0	134.6	130.9	0.72	
275L	Vijfde TSNSTK - Doorsnede A-A horiz fr	120x120x11	S235	1M30-5.6t	1.00	1.00	1.00	377	**0.0**		43.3	134.6	178.2	0.00		**0.0**	ULS 1a_0	275.6	134.6	144.0	0.00	
275T	Vijfde TSNSTK - Doorsnede A-A horiz si	120x120x11	S235	1M30-5.6t	1.00	1.00	1.00	377	**0.0**		43.3	134.6	178.2	0.00		**0.0**	ULS 1a_0	275.6	134.6	144.0	0.00	
265	Top*	120x120x11	S235		1.00	1.00	1.00	206	**-15.7**	ULS 5a Ba 12	139.5	0.0	0.0	0.11		**15.0**	ULS 5a Ba 12	599.7	0.0	0.0	0.03	

Notes:

1) Groups 200L, 419 and 442 which were failing under net section capacity (afkeur) were strengthened using a plate. In the tower model an override value was used to represent the increased net section capacity so no change highlighted in this table. For details of the plate calculations refer to Appendix D.
2) Groups 216L and 217L failed due to net section capacity at the afkeur level and were strengthened using a plate so no change is recorded in this table. For details of the plate calculation refer to Appendix D.

Assessment of groups for strengthened mast (verbouw level)

Date	9-4-2021
Author	MKh
Version	1.0

KIJ-GT380
S+95
12

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)	Opm.2
118A	Vijfde TSNSTK - Main member	**250x250x22+PL200x25**	S235	**36M30-8.8t**	0.25	0.25	**0.50**	40	**-6332.8**	ULS 1a_135	6717.9	7205.9	12830.4	0.94		**5474.9**	ULS 1a_0,9_0,9_45	7329.7	7205.9	10368.0	0.76	
118B	Vijfde TSNSTK - Main member	**250x250x22+PL200x25**	S235	**36M30-8.8t**	0.50	0.50	**1.00**	38	**-6622.6**	ULS 1a_135	6775.5	7205.9	12830.4	0.98		**5709.4**	ULS 1a_0,9_0,9_45	7329.7	7205.9	10368.0	0.79	
119A	Vierde TSNSTK - Main member* 24	**250x250x24+PL200x25**	S235	**36M30-8.8t**	0.50	0.50	**1.00**	42	**-6649.3**	ULS 1a_135	7047.0	7205.9	13996.8	0.94		**5683.8**	ULS 1a_0,9_0,9_45	8142.5	7205.9	11310.5	0.79	
119B	Vierde TSNSTK - Main member* 24	**250x250x24+PL200x25**	S235	**36M30-8.8t**	0.25	0.25	**0.50**	40	**-7029.5**	ULS 1a_45	7109.2	7205.9	13996.8	0.99		**5985.7**	ULS 1a_0,9_0,9_135	8142.5	7205.9	11310.5	0.83	
120A	Derde TSNSTK - Main member* INP425	INP 425	S235	**36M24-8.8t**	0.25	0.25	**0.51**	38	**-7441.7**	ULS 1a_135	5715.8	9157.4	7138.4	1.30	(8)	**6359.8**	ULS 1a_0,9_0,9_45	6417.5	9157.4	6101.2	1.04	
120B	Derde TSNSTK - Main member* INP425	INP 425	S235	36M24-5.6t	0.50	0.50	**0.90**	34	**-7724.7**	ULS 1a_45	5831.7	5723.4	7138.4	1.35	(8)	**6588.6**	ULS 1a_0,9_0,9_135	6417.5	5723.4	6101.2	1.15	
121A	Tweede TSNSTK - Main member* INP425	INP 425	S235	**36M24-8.8t**	0.50	0.50	**0.81**	34	**-7758.4**	ULS 1a_45	5832.9	9157.4	7138.4	1.33	(8)	**6555.3**	ULS 1a_0,9_0,9_135	6417.5	9157.4	6101.2	1.07	
121B	Tweede TSNSTK - Main member* INP425	**INP425+PL230x25**	S235	**36M24-8.8t**	0.50	0.50	**0.87**	34	**-8318.1**	ULS 1a_45	8382.4	9157.4	9331.2	0.99		**7005.7**	ULS 1a_0,9_0,9_135	9303.7	9157.4	7975.4	0.88	
122A	Eerste TSNSTK - Main member	INP 450	S235	**36M24-8.8t**	0.50	0.50	**1.00**	42	**-8447.4**	ULS 1a_45	6265.5	9157.4	7558.3	1.35	(8)	**7061.4**	ULS 1a_0,9_0,9_135	7183.8	9157.4	6460.1	1.09	
122B	Eerste TSNSTK - Main member	INP 450	S235	**36M24-8.8t**	0.50	0.50	**1.16**	49	**-8122.2**	ULS 1a_135	6050.8	9157.4	7558.3	1.34	(8)	**6672.5**	ULS 1a_0,9_0,9_135	7183.8	9157.4	6460.1	1.03	
123A	Broekstuk - Main member	INP 450	S235	**36M24-8.8t**	0.33	0.33	**0.62**	48	**-8164.6**	ULS 1a_135	6089.9	9157.4	7558.3	1.34	(8)	**6619.5**	ULS 1a_0,9_0,9_135	7183.8	9157.4	6460.1	1.02	
123B	Broekstuk - Main member	INP 450	S235	**36M24-8.8t**	0.33	0.33	**0.62**	47	**-8195.1**	ULS 1a_135	6094.5	9157.4	7558.3	1.34	(8)	**6599.6**	ULS 1a_0,9_0,9_135	7183.8	9157.4	6460.1	1.02	
245L	Vierde TSNSTK - Diag fr 1 below horiz	150x150x10	S235	**1M30-8.8t**	1.00	0.52	0.52	146	**-205.1**	ULS 1a_90	157.9	215.4	162.0	1.30	(4)	**174.9**	ULS 1a_0,9_0,9_90	337.0	215.4	130.9	1.34	(5)
245T	Vierde TSNSTK - Diag si 1 below horiz	150x150x10	S235	**1M30-8.8t**	1.00	0.52	0.52	146	**-189.8**	ULS 1a_0	157.9	215.4	162.0	1.20	(4)	**157.7**	ULS 1a_0,9_0,9_0	337.0	215.4	130.9	1.20	(5)
250L	Tweede TSNSTK - Diag fr 1 below horiz	160x160x15#	S235	**2M24-8.8t**	1.00	0.52	0.52	175	**-274.8**	ULS 1a_135	304.1	271.1	388.8	1.01	(7)	**225.7**	ULS 1a_0,9_0,9_45	578.5	271.1	332.3	0.83	(5)
250T	Tweede TSNSTK - Diag si 1 below horiz	160x160x15#	S235	**2M24-8.8t**	1.00	0.52	0.52	177	**-271.3**	ULS 1a_45	300.0	271.1	388.8	1.00	(7)	**222.2**	ULS 1a_0,9_0,9_135	578.5	271.1	332.3	0.82	(5)
256LB	Broekstuk - Lower part	150x150x10	S235	**2M24-8.8t**	0.17	0.25	0.17	127	**-250.4**	ULS 1a_90	290.1	271.1	259.2	0.97		**191.4**	ULS 1a_0,9_90	431.8	271.1	221.5	0.86	
200L	BVNSTK - first horiz from top front	120x120x11	S235	6M24-5.6t	1.00	1.00	1.00	164	**0.0**		190.2	506.7	855.4	0.00		**499.8**	ULS 3_135	346.4	506.7	677.1	0.84	
414	Tweede DWSRM - front diag 1	**70x70x7(11,0.17)**	S235	**1M16-8.8t**	1.00	1.00	1.00	221	**-40.3**	ULS 1a_0	76.4	60.3	121.0	0.67		**0.0**		209.7	60.3	89.6	0.00	
415	Tweede DWSRM - front diag 2	**65x65x7(11,0.17)**	S235	**1M16-8.8t**	1.00	1.00	1.00	193	**-44.8**	ULS 7	84.6	60.3	121.0	0.74		**0.0**		189.5	60.3	89.6	0.00	
419	Tweede DWSRM - main diag front	120x120x11	S235	6M24-5.6t	1.00	1.00	1.00	164	**0.0**		189.7	506.7	855.4	0.00		**484.5**	ULS 3_90	346.4	506.7	677.1	0.82	
442	Tweede DWSRM - Main diag from tower	120x120x11	S235	6M24-5.6t	1.00	1.00	1.00	401	**0.0**		48.7	506.7	855.4	0.00		**546.9**	ULS 3_90	346.4	506.7	677.1	0.92	
108B	Elfde TSNSTK - Main member	180x180x16#	S235	**12M24-8.8t**	0.51	0.51	0.51	56	**-1398.3**	ULS 1a_135	1127.4	1599.5	2488.3	1.24	(4)	**1158.1**	ULS 1a_0,9_0,9_135	1220.3	1599.5	2126.8	0.95	
109A	Tiende TSNSTK - Main member	200x200x20	S235	**8M30-8.8t**	0.52	0.52	0.52	52	**-1687.3**	ULS 1a_135	1590.7	1723.4	2592.0	1.06	(4)	**1389.1**	ULS 1a_0,9_0,9_135	1638.1	1723.4	2094.5	0.85	(5)
212T	Tiende TSNSTK - upper horiz lower CA si	**100x100x10**	**S355**	**2M20-8.8t**	1.00	1.00	**0.85**	209	**-88.1**	ULS 1a_90	113.9	188.2	294.0	0.77		**66.6**	ULS 1a_0,9_0,9_90	466.5	188.2	237.6	0.35	
317	Eerste DWSRM - front diag 4	60x60x6	**S355**	**1M16-8.8t**	1.00	1.00	1.00	338	**0.0**		15.0	60.3	70.6	0.00		**45.3**	ULS 1a_0	98.8	60.3	52.3	0.87	
114A	Negende TSNSTK - Main member	250x250x22#	S235	18M30-5.6t	0.52	**0.26**	**0.26**	23	**-3263.7**	ULS 1a_45	2472.3	2423.5	6415.2	1.35	(6)	**2713.5**	ULS 1a_0,9_0,9_45	2373.8	2423.5	4626.7	1.14	
114B	Negende TSNSTK - Main member	250x250x22#	S235	**14M30-8.8t**	0.52	0.52	0.52	35	**-2531.3**	ULS 1a_45	2373.4	3015.9	4989.6	1.07	(4)	**2021.6**	ULS 1a_0,9_0,9_45	2373.8	3015.9	4032.0	0.85	(5)
114C	Negende TSNSTK - Main member	250x250x22#	S235		0.52	**0.26**	**0.26**	22	**-3260.7**	ULS 1a_45	2481.2	0.0	0.0	1.31	(6)	**2717.7**	ULS 1a_0,9_0,9_45	2493.4	0.0	0.0	1.09	
216L	Negende TSNSTK - Diag fr 1 above horiz	150x100x12	S235	**2M30-8.8t**	1.00	0.51	0.51	103	**-385.1**	ULS 1a_90	355.4	861.7	388.8	1.08	(3)	**353.3**	ULS 1a_0,9_0,9_90	417.0	861.7	314.2	0.85	
217L	Negende TSNSTK - Diag fr 2 above horiz	150x100x12	S235	**2M30-8.8t**	1.00	0.51	0.51	104	**-359.4**	ULS 1a_90	350.2	861.7	388.8	1.03	(3)	**364.8**	ULS 1a_90	417.0	861.7	314.2	0.87	
224L	Achtste TSNSTK - Diag fr 1 above horiz	150x100x12	S235	**2M30-8.8t**	1.00	0.51	0.51	106	**-376.0**	ULS 1a_90	345.0	430.8	388.8	1.09	(4)	**353.0**	ULS 1a_0,9_0,9_90	348.4	430.8	314.2	1.12	
115A	Achtste TSNSTK - Main member	**200x200x20+PL150x20**	S235	28M30-8.8t	**0.50**	**0.50**	**0.50**	22	**-4692.1**	ULS 1a_45	4955.6	5805.7	9072.0	0.95		**4078.0**	ULS 1a_0,9_0,9_135	5013.3	0.0	0.0	0.81	
116A	Zevende TSNSTK - Main member	**250x250x20+PL200x25**	S235	28M30-8.8t	0.25	0.25	**0.50**	40	**-5222.1**	ULS 1a_45	6326.6	5805.7	9072.0	0.90		**4575.6**	ULS 1a_0,9_0,9_135	7275.2	5805.7	7330.9	0.79	
116B	Zevende TSNSTK - Main member	**250x250x20+PL200x25**	S235	32M30-8.8t	0.50	0.50	**1.00**	37	**-5629.4**	ULS 1a_135	6416.9	6520.2	10368.0	0.88		**4889.3**	ULS 1a_0,9_0,9_45	7275.2	6520.2	8378.2	0.75	
117A	Zesde TSNSTK - Main member	**250x250x20+PL200x25**	S235	32M30-8.8t	0.50	0.50	**1.00**	43	**-5651.9**	ULS 1a_135	6233.1	6520.2	10368.0	0.91		**4865.9**	ULS 1a_0,9_0,9_45	7275.2	6520.2	8378.2	0.75	
117B	Zesde TSNSTK - Main member	**250x250x20+PL200x25**	S235	36M30-8.8t	0.25	0.25	**0.50**	40	**-6003.6**	ULS 1a_135	6326.6	7205.9	11664.0	0.95		**5154.5**	ULS 1a_0,9_0,9_45	6933.1	7205.9	9425.5	0.74	

Notes:

1) Groups 200L, 419 and 442 which were failing under net section capacity (afkeur) were strengthened using a plate. In the tower model an override value was used to represent the increased net section capacity so no change highlighted in this table. For details of the plate calculations refer to Appendix D.
2) Groups 216L and 217L failed due to net section capacity at the afkeur level and were strengthened using a plate so no change is recorded in this table. For details of the plate calculation refer to Appendix D.
3) Failed in tension at the afkeur level. Compression failure not relevant.
4) Failed in shear under compression at the afkeur level but failing in buckling at the verbouw level. Failure not relevant.
5) Failure at the afkeur level was under compression. Failure not relevant.
6) New redundant members added. The member itself does not need to fulfil the verbouw loads.
7) Less than 1.5% exceedance is acceptable
8) Group has localised strengthening. Fulfilment of verbouw loads is not required.

APPENDIX C TOETSING KNIKVERKORTERS

Knikverkorters initial structure (afkeur)

Date: 2021-04-07
Author: M Khan
Version: 1.8

KIJ-GT
S+95
Masts 12 and 13

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Net Section Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type	Notes
623	Onderstuk	Enkele staaf	L65.7	S235	M20	5.6	1.18	0	93	**60.5**	**0.29**	93.0	58.8	59.0	76.6	1.69	1.03	Bolt Bearing	
620	Onderstuk	Enkele staaf	L80.8	S235	M20	5.6	3.09	77	198	**60.5**	**0.00**	56.8	58.8	69.8	133.6	2.95	1.07	Buckling Bolt	
618	Onderstuk	Enkele staaf	L100.8	S235	M20	5.6	2.62	0	133	**60.5**	**0.65**	118.8	58.8	69.8	179.7	4.76	1.03	Bolt	
616	Onderstuk	Enkele staaf	L100.10	S235	M20	5.6	3.79	54	194	**60.5**	**0.00**	91.4	58.8	87.3	224.6	5.79	1.03	Bolt	
614	Onderstuk	Enkele staaf	L110.10	S235	M20	5.6	4.07	0	189	**60.5**	**1.02**	104.5	58.8	87.3	253.4	7.07	1.03	Bolt	
612	Onderstuk	Enkele staaf	L110.10	S235	M20	5.6	4.79	40	222	**60.5**	**0.00**	82.8	58.8	87.3	253.4	7.07	1.03	Bolt	
610	Onderstuk	Enkele staaf	L130.12	S235	M20	5.6	5.52	0	217	**60.5**	**1.38**	121.8	58.8	104.7	442.4	11.85	1.03	Bolt	
608	Onderstuk	Enkele staaf	L120.11	S235	M20	5.6	5.99	31	254	**60.5**	**0.00**	81.3	58.8	96.0	310.5	9.27	1.03	Bolt	
606	Onderstuk	Enkele staaf	L150.10	S235	M20	5.6	6.89	0	232	**60.5**	**1.72**	107.3	58.8	87.3	368.6	14.71	1.03	Bolt	
604	Onderstuk	Enkele staaf	L150.10	S235	M20	5.6	7.22	25	243	**60.5**	**1.64**	100.0	58.8	87.3	368.6	14.71	1.03	Bolt	
65	Pootverband	Enkele staaf	L65.7	S235	M20	5.6	2.88	0	229	**2.9**	**0.72**	32.7	58.8	59.0	76.6	1.69	0.43		
62	Pootverband	Enkele staaf	L110.10	S235	M20	5.6	5.68	76	263	**2.9**	**0.00**	64.1	58.8	87.3	253.4	7.07	0.05		
64	Pootverband	Kniksteun en verticale steun	L65.7	S235	M20	5.6	5.90	0	301	**2.9**	**0.74**	18.2	58.8	59.0	76.6	1.25	0.61		
61	Pootverband	Enkele staaf	L120.11	S235	M20	5.6	6.19	63	263	**2.9**	**0.00**	77.2	58.8	96.0	310.5	9.27	0.05		
63	Pootverband	Kniksteun en verticale steun	L80.8	S235	M20	5.6	8.98	0	370	**2.9**	**1.12**	18.8	58.8	69.8	133.6	2.20	0.53		
60	Pootverband	Enkele staaf	L130.12	S235	M20	5.6	6.94	50	272	**2.9**	**0.00**	86.1	58.8	104.7	442.4	11.85	0.05		
70	Tussenschot D-D	Kniksteun en verticale steun	L100.8	S235	M20	5.6	11.84	0	384	**2.3**	**1.48**	22.3	58.8	69.8	179.7	3.63	0.42		
71	Tussenschot D-D	Kruisende staaf halverwege	L100.8	S235	M20	5.6	16.88	0	548	**2.3**	**2.11**	12.5	58.8	69.8	179.7	4.76	0.44		
369	1e Tussenstuk	Enkele staaf	L100.10	S235	M24	5.6	5.01	33	256	**62.5**	**0.00**	60.6	84.7	110.8	213.1	5.79	1.03	Buckling	
367	1e Tussenstuk	Enkele staaf	L110.10	S235	M24	5.6	4.08	0	189	**62.5**	**1.02**	104.2	84.7	110.8	241.9	7.07	0.74		
364	1e Tussenstuk	Enkele staaf	L100.10	S235	M24	5.6	3.37	0	172	**62.5**	**0.84**	107.1	84.7	110.8	213.1	5.79	0.74		
362	1e Tussenstuk	Enkele staaf	L100.8	S235	M24	5.6	3.84	43	195	**62.5**	**0.00**	73.2	84.7	88.6	170.5	4.76	0.85		
73	Tussenschot C-C	Enkele staaf	L100.10	S235	M20	5.6	9.38	0	480	**9.0**	2.35	21.5	58.8	87.3	224.6	5.8	0.42		
74	Tussenschot C-C	Kruisende staaf halverwege	L100.8	S235	M20	5.6	13.92	0	452	**9.0**	**1.74**	17.2	58.8	69.8	179.7	4.76	0.52		
325	2e Tussenstuk	Enkele staaf	L100.8	S235	M20	5.6	4.25	36	216	**83.5**	**0.00**	63.3	58.8	69.8	179.7	4.76	1.42	Buckling Bolt Bearing	
304	2e Tussenstuk	Enkele staaf	L100.10	S235	M20	5.6	3.31	0	169	**83.5**	**0.83**	109.7	58.8	87.3	224.6	5.79	1.42	Bolt	
307	2e Tussenstuk	Enkele staaf	L100.8	S235	M20	5.6	3.07	0	156	**58.3**	**0.77**	98.4	58.8	69.8	179.7	4.76	0.99		
326	2e Tussenstuk	Enkele staaf	L80.8	S235	M16	5.6	3.77	41	242	**58.3**	**0.00**	42.4	37.7	51.2	142.8	2.95	1.55	Buckling Bolt Bearing	
332	2e Tussenstuk	Enkele staaf	L150.10	S235	M24	5.6	6.44	0	217	**58.3**	**1.61**	118.7	84.7	110.8	357.1	14.71	0.69		
75	Tussenschot B-B	Enkele staaf	L100.8	S235	M20	5.6	9.03	0	459	**1.3**	2.26	18.8	58.8	69.8	179.7	4.8	0.47		
76	Tussenschot B-B	Kruisende staaf halverwege	L100.8	S235	M20	5.6	13.03	0	423	**1.3**	1.63	19.1	58.8	69.8	179.7	4.8	0.34		
327	3e Tussenstuk	Enkele staaf	L80.8	S235	M20	5.6	3.87	37	248	**58.3**	**0.00**	40.8	58.8	69.8	133.6	2.95	1.43	Buckling	
310	3e Tussenstuk	Enkele staaf	L100.8	S235	M20	5.6	3.09	0	157	**58.3**	**0.77**	97.6	58.8	69.8	179.7	4.76	0.99		
313	3e Tussenstuk	Enkele staaf	L100.8	S235	M20	5.6	2.86	0	145	**55.3**	**0.72**	107.3	58.8	69.8	179.7	4.76	0.94		
328	3e Tussenstuk	Enkele staaf	L70.7	S235	M20	5.6	3.49	40	256	**55.3**	**0.00**	29.8	58.8	61.1	96.8	1.98	1.86	Buckling	
341	3e Tussenstuk	Enkele staaf	L130.12	S235	M20	5.6	5.64	0	221	**55.3**	**1.41**	118.0	58.8	104.7	442.4	11.9	0.94		
329	3e Tussenstuk	Enkele staaf	L70.7	S235	M20	5.6	3.58	36	262	**55.3**	**0.00**	28.6	58.8	61.1	96.8	2.0	1.93	Buckling	
316	3e Tussenstuk	Enkele staaf	L100.8	S235	M20	5.6	2.81	0	143	**55.3**	0.70	109.6	58.8	69.8	179.7	4.8	0.94		

DNV·GL

Knikverkorters initial structure (afkeur)

Date: 2021-04-07
Author: M Khan
Version: 1.8

KIJ-GT
S+95
Masts 12 and 13

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slender ness	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Net Section Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type	Notes
209	4e Tussenstuk	Enkele staaf	L100.8	S235	M20	5.6	2.68	0	136	**0.0**	**0.67**	115.7	58.8	69.8	179.7	4.8	0.14		
216	4e Tussenstuk	Enkele staaf	L70.7	S235	M20	5.6	3.18	37	233	**0.0**	**0.00**	34.3	58.8	61.1	96.8	2.0	0.00		
207	4e Tussenstuk	Enkele staaf	L120.11	S235	M20	5.6	5.22	0	222	**71.3**	**1.31**	99.9	58.8	96.0	310.5	9.3	1.21	Bolt	
215	4e Tussenstuk	Enkele staaf	L70.7	S235	M20	5.6	3.30	35	242	**0.0**	**0.00**	32.4	58.8	61.1	96.8	2.0	0.00		
232	4e Tussenstuk	Enkele staaf	L100.8	S235	M20	5.6	2.60	0	132	**0.0**	**0.65**	119.7	58.8	69.8	179.7	4.8	0.14		
211	4e Tussenstuk	Enkele staaf	L80.8	S235	M20	5.6	2.45	0	157	**0.0**	**0.61**	77.3	58.8	69.8	133.6	3.0	0.21		
220	4e Tussenstuk	Enkele staaf	L60.6	S235	M20	5.6	2.92	44	250	**0.0**	**0.00**	22.7	58.8	47.5	48.4	1.2	0.00		
206	4e Tussenstuk	Enkele staaf	L120.11	S235	M20	5.6	4.84	0	205	**66.9**	1.21	111.5	58.8	96.0	310.5	9.3	1.14	Bolt	
77	Tussenschot A-A	Enkele staaf	L100.8	S235	M20	5.6	6.86	0	348	**1.2**	**1.72**	30.0	58.8	69.8	179.7	4.8	0.36		
78	Tussenschot A-A	Kruisende staaf halverwege	L80.8	S235	M20	5.6	9.97	0	411	**1.2**	**1.25**	15.9	58.8	69.8	133.6	3.0	0.42		
219	5e Tussenstuk	Enkele staaf	L60.6	S235	M20	5.6	2.98	39	255	**0.0**	**0.00**	22.0	58.8	47.5	48.4	1.2	0.00		
212	5e Tussenstuk	Enkele staaf	L80.8	S235	M20	5.6	2.42	0	155	**0.0**	**0.60**	78.7	58.8	69.8	133.6	3.0	0.20		
213	5e Tussenstuk	Enkele staaf	L80.8	S235	M20	5.6	2.21	0	142	**0.0**	**0.55**	87.6	58.8	69.8	133.6	3.0	0.19		
218	5e Tussenstuk	Enkele staaf	L60.6	S235	M20	5.6	2.89	42	247	**0.0**	**0.00**	23.1	58.8	47.5	48.4	1.2	0.00		
208	5e Tussenstuk	Enkele staaf	L110.10	S235	M20	5.6	4.84	0	224	**66.9**	**1.21**	81.6	58.8	87.3	253.4	7.1	1.14	Bolt	
217	5e Tussenstuk	Enkele staaf	L60.6	S235	M20	5.6	2.97	40	254	**0.0**	**0.00**	22.1	58.8	47.5	48.4	1.2	0.00		
214	5e Tussenstuk	Enkele staaf	L80.8	S235	M20	5.6	2.10	0	135	**0.0**	**0.53**	92.9	58.8	69.8	133.6	3.0	0.18		
110	5e Tussenstuk	Enkele staaf	L120.11	S235	M30	5.6	8.32	0	353	**0.0**	**2.08**	48.0	134.6	156.0	275.6	9.3	0.22		Not structural
119	6e Tussenstuk	Enkele staaf	L70.7	S235	M20	5.6	1.97	0	144	**0.0**	0.49	65.5	58.8	61.1	96.8	2.0	0.25		
126	6e Tussenstuk	Enkele staaf	L60.6	S235	M20	5.6	2.72	46	233	**0.0**	0.00	25.3	58.8	47.5	48.4	1.2	0.00		
114	6e Tussenstuk	Enkele staaf	L100.8	S235	M20	5.6	3.88	0	197	**62.5**	0.97	72.1	58.8	69.8	179.7	4.8	1.06	Bolt	
125	6e Tussenstuk	Enkele staaf	L60.6	S235	M20	5.6	2.78	41	238	**0.0**	0.00	24.5	58.8	47.5	48.4	1.2	0.00		
120	6e Tussenstuk	Enkele staaf	L70.7	S235	M20	5.6	1.95	0	143	**0.0**	0.49	66.3	58.8	61.1	96.8	2.0	0.25		
121	6e Tussenstuk	Enkele staaf	L65.7	S235	M20	5.6	1.65	0	131	**0.0**	0.41	67.8	58.8	59.0	76.6	1.7	0.24		
130	6e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	2.48	57	255	**0.0**	0.00	15.3	37.7	30.3	31.7	0.7	0.00		
113	6e Tussenstuk	Enkele staaf	L100.8	S235	M20	5.6	3.43	0	174	**62.5**	0.86	85.4	58.8	69.8	179.7	4.8	1.06	Bolt	
116	Tussenschot A-A	Enkele staaf	L80.8	S235	M20	5.6	4.89	0	314	**0.9**	**1.22**	28.2	58.8	69.8	133.6	3.0	0.41		
118	Tussenschot A-A	Kruisende staaf halverwege	L70.7	S235	M20	5.6	7.02	0	331	**0.9**	**0.88**	17.1	58.8	61.1	96.8	2.0	0.44		
129	7e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	2.42	46	249	**0.0**	**0.00**	15.9	37.7	30.3	31.7	0.7	0.00		
122	7e Tussenstuk	Enkele staaf	L65.7	S235	M20	5.6	1.73	0	137	**0.0**	**0.43**	64.3	58.8	59.0	76.6	1.7	0.26		
124	7e Tussenstuk	Enkele staaf	L60.6	S235	M20	5.6	1.48	0	127	**0.0**	**0.37**	55.8	58.8	47.5	48.4	1.2	0.30		
128	7e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	2.41	56	248	**0.0**	**0.00**	16.0	37.7	30.3	31.7	0.7	0.00		
112	7e Tussenstuk	Enkele staaf	L100.8	S235	M20	5.6	2.94	0	149	**62.5**	**0.74**	103.8	58.8	69.8	179.7	4.8	1.06	Bolt	
127	7e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	2.33	47	239	**0.0**	**0.00**	16.8	37.7	30.3	31.7	0.7	0.00		
123	7e Tussenstuk	Enkele staaf	L60.6	S235	M20	5.6	1.49	0	127	**0.0**	**0.37**	55.4	58.8	47.5	48.4	1.2	0.30		
117	Tussenschot B-B	Enkele staaf	L75.7	S235	M20	5.6	3.91	0	267	**0.9**	**0.98**	30.0	58.8	61.1	96.8	2.3	0.43		
115-1	Tussenschot B-B	Enkele staaf	L80.8	S235	M20	5.6	5.74	0	368	**0.9**	**1.44**	21.7	58.8	69.8	133.6	3.0	0.49		
172	8e Tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	1.38	0	118	**47.0**	**0.35**	60.0	37.7	38.4	72.6	1.2	1.25	Bolt Bearing	

Knikverkorters initial structure (afkeur)

Date: 2021-04-07
Author: M Khan
Version: 1.8

KIJ-GT
S+95
Masts 12 and 13

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Net Section Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type	Notes
160	8e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	2.12	54	218	**47.0**	**0.00**	19.4	37.7	30.3	31.7	0.7	2.43	Buckling Bolt Bearing Net sectio	
171	8e Tussenstuk	Enkele staaf	L80.8	S235	M16	5.6	2.67	0	171	**47.0**	**0.67**	69.2	37.7	51.2	142.8	3.0	1.25	Bolt	
159	8e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	2.19	29	225	**47.0**	**0.48**	18.5	37.7	30.3	31.7	0.7	2.55	Buckling Bolt Bearing Net sectio	
170	8e Tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	1.38	0	118	**47.0**	**0.35**	60.0	37.7	38.4	72.6	1.2	1.25	Bolt Bearing	
169	8e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.32	0	136	**35.4**	**0.33**	36.0	37.7	30.3	31.7	0.7	1.17	Bearing Net section	
158	8e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	2.08	51	214	**35.4**	**0.00**	19.9	37.7	30.3	31.7	0.7	1.78	Buckling Bearing Net section	
182	8e Tussenstuk	Enkele staaf	L75.7	S235	M16	5.6	2.58	0	176	**35.4**	**0.65**	54.9	37.7	44.8	104.8	2.3	0.94		
157	8e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	2.14	50	220	**35.4**	**0.00**	19.1	37.7	30.3	31.7	0.7	1.85	Buckling Bearing Net section	
167	8e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.30	0	133	**35.4**	**0.32**	36.7	37.7	30.3	31.7	0.7	1.17	Bearing Net section	
166	9e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.20	0	123	**24.0**	**0.30**	39.9	37.7	30.3	31.7	0.7	0.79		
156	9e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	2.03	55	209	**24.0**	**0.00**	20.6	37.7	30.3	31.7	0.7	1.16	Buckling	
165	9e Tussenstuk	Enkele staaf	L70.7	S235	M16	5.6	2.42	0	177	**24.0**	**0.60**	50.7	37.7	44.8	104.8	2.0	0.64		
155	9e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	2.07	51	213	**24.0**	**0.00**	20.0	37.7	30.3	31.7	0.7	1.20	Buckling	
164	9e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.22	0	125	**24.0**	**0.31**	39.2	37.7	30.3	31.7	0.7	0.79		
163	9e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.18	0	121	**24.0**	**0.29**	40.7	37.7	30.3	31.7	0.7	0.79		
154	9e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	2.00	55	205	**24.0**	**0.00**	21.1	37.7	30.3	31.7	0.7	1.14	Buckling	
162	9e Tussenstuk	Enkele staaf	L65.7	S235	M16	5.6	2.29	0	182	**24.0**	**0.57**	45.2	37.7	44.8	84.7	1.7	0.64		
153	9e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	2.07	53	213	**24.0**	**0.00**	20.0	37.7	30.3	31.7	0.7	1.20	Buckling	
161	9e Tussenstuk	Enkele staaf	L50.5	S235	M16	5.6	1.16	0	119	**24.0**	**0.29**	41.3	37.7	30.3	31.7	0.7	0.79		
12	Tussenschot N	Enkele staaf	L70.7	S235	M16	5.6	3.86	0	283	**0.6**	**0.97**	25.5	37.7	44.8	104.8	2.0	0.49		
8	Tussenschot N	Kruisende staaf halverwege	L100.50.6	S235	M16	5.6	5.75	0	271	**0.6**	**0.72**	25.4	37.7	36.4	38.0	3.2	0.22		
11	Tussenschot M	Enkele staaf	L70.7	S235	M16	5.6	3.63	0	266	**0.6**	**0.91**	28.0	37.7	44.8	104.8	2.0	0.46		
6	Tussenschot M	Kruisende staaf halverwege	L100.50.6	S235	M16	5.6	5.53	0	260	**0.6**	**0.69**	26.9	37.7	36.4	38.0	3.2	0.21		
10	Tussenschot L	Enkele staaf	L70.7	S235	M16	5.6	3.45	0	253	**0.5**	**0.86**	30.3	37.7	44.8	104.8	2.0	0.44		
3	Tussenschot L	Kruisende staaf halverwege	L100.50.6	S235	M16	5.6	5.28	0	248	**0.5**	**0.66**	28.9	37.7	36.4	38.0	3.2	0.20		
9	Tussenschot K	Enkele staaf	L70.7	S235	M16	5.6	3.28	0	240	**0.4**	**0.82**	32.7	37.7	44.8	104.8	2.0	0.41		
2	Tussenschot K	Kruisende staaf halverwege	L100.50.6	S235	M16	5.6	5.02	0	236	**0.4**	**0.63**	31.2	37.7	36.4	38.0	3.2	0.19		
41	10e Tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	2.20	0	188	**15.9**	**0.55**	34.4	37.7	38.4	72.6	1.2	0.46		
40	10e Tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	2.13	0	182	**15.9**	**0.53**	35.9	37.7	38.4	72.6	1.2	0.44		
39	11e Tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	2.08	0	178	**11.4**	**0.52**	37.1	37.7	38.4	72.6	1.2	0.42		
38	11e Tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	2.01	0	172	**11.4**	**0.50**	38.8	37.7	38.4	72.6	1.2	0.40		
37	11e Tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	1.94	0	166	**11.4**	**0.49**	40.5	37.7	38.4	72.6	1.2	0.39		
11-1	12e Tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	1.89	0	162	**5.6**	**0.47**	41.9	37.7	38.4	72.6	1.2	0.38		
10-1	12e Tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	1.82	0	156	**5.6**	**0.46**	44.0	37.7	38.4	72.6	1.2	0.37		
9-1	12e Tussenstuk	Enkele staaf	L60.6	S235	M16	5.6	1.76	0	151	**5.6**	**0.44**	45.8	37.7	38.4	72.6	1.2	0.35		

<u>**Knikverkorters adjusted structure (verbouw)**</u>

Date: 2021-04-07
Author: M Khan
Version: 1.8

KIJ-GT

S+95

Masts 12 and 13

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness (-)	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Block Tearing Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type	Mitigation
623	Onderstuk	Enkele staaf	L65.7	S235	M20	**8.8**	1.18	0	93	**60.5**	**0.38**	93.0	94.1	61.1	76.6	1.69	0.99		Bolt exchanged
620	Onderstuk	Enkele staaf	L80.8	**S355**	M20	**8.8**	3.09	77	198	**60.5**	**0.00**	63.4	94.1	95.0	213.2	4.46	0.95		Profile exchanged
618	Onderstuk	Enkele staaf	L100.8	S235	M20	**8.8**	2.62	0	133	**60.5**	**0.85**	118.8	94.1	69.8	248.8	4.76	0.87		Bolt exchanged
616	Onderstuk	Enkele staaf	L100.10	S235	M20	**8.8**	3.79	54	194	**60.5**	**0.00**	91.4	94.1	87.3	311.0	5.79	0.69		Bolt exchanged
614	Onderstuk	Enkele staaf	L110.10	S235	M20	**8.8**	4.07	0	189	**60.5**	**1.32**	104.5	94.1	87.3	368.6	7.07	0.69		Bolt exchanged
612	Onderstuk	Enkele staaf	L110.10	S235	M20	**8.8**	4.79	40	222	**60.5**	**0.00**	82.8	94.1	87.3	368.6	7.07	0.73		Bolt exchanged
610	Onderstuk	Enkele staaf	L130.12	S235	M20	**8.8**	5.52	0	217	**60.5**	**1.79**	121.8	94.1	104.7	580.6	11.85	0.64		Bolt exchanged
608	Onderstuk	Enkele staaf	L120.11	S235	M20	**8.8**	5.99	31	254	**60.5**	**0.00**	81.3	94.1	96.0	468.9	9.27	0.74		Bolt exchanged
606	Onderstuk	Enkele staaf	L150.10	S235	M20	**8.8**	6.89	0	232	**60.5**	**2.24**	107.3	94.1	87.3	599.0	14.71	0.69		Bolt exchanged
604	Onderstuk	Enkele staaf	L150.10	S235	M20	**8.8**	7.22	25	243	**60.5**	**2.13**	100.0	94.1	87.3	599.0	14.71	0.69		Bolt exchanged
369	1e Tussenstuk	Enkele staaf	**L120.10**	**S355**	M24	**8.8**	5.01	33	211	**62.5**	**0.00**	108.9	135.6	150.8	525.3	12.83	0.57		Profile exchanged
325	2e Tussenstuk	Enkele staaf	**L100.10**	**S355**	M20	**8.8**	4.25	36	218	**83.5**	**0.00**	85.8	94.1	118.8	423.4	8.75	0.97		Profile exchanged
304	2e Tussenstuk	Enkele staaf	L100.10	S235	M20	**8.8**	3.31	0	169	**83.5**	**1.08**	109.7	94.1	87.3	311.0	5.79	0.96		Bolt exchanged
326	2e Tussenstuk	Enkele staaf	**L100.10**	**S355**	**M20**	**8.8**	3.77	41	193	**58.3**	**0.00**	103.1	94.1	118.8	423.4	8.75	0.62		Profile exchanged
327	3e Tussenstuk	Enkele staaf	**L100.10**	**S355**	M20	**8.8**	3.87	37	198	**58.3**	**0.0**	99.1	94.1	118.8	423.4	8.8	0.62		Profile exchanged
328	3e Tussenstuk	Enkele staaf	**L100.8**	**S355**	M20	**8.8**	3.49	40	177	**55.3**	**0.0**	94.4	94.1	95.0	338.7	7.2	0.59		Profile exchanged
329	3e Tussenstuk	Enkele staaf	**L100.8**	**S355**	M20	**8.8**	3.58	36	182	**55.3**	**0.0**	90.9	94.1	95.0	338.7	7.19	0.61		Profile exchanged
207	4e Tussenstuk	Enkele staaf	L120.11	S235	M20	**8.8**	5.22	0	222	**71.3**	**1.7**	99.9	94.1	96.0	468.9	9.27	0.76		Bolt exchanged
206	4e Tussenstuk	Enkele staaf	L120.11	S235	M20	**8.8**	4.84	0	205	**66.9**	**1.6**	111.5	94.1	96.0	468.9	9.3	0.71		Bolt exchanged
208	5e Tussenstuk	Enkele staaf	L110.10	S235	M20	**8.8**	4.84	0	224	**66.9**	**1.57**	81.6	94.1	87.3	368.6	7.07	0.82		Bolt exchanged
114	6e Tussenstuk	Enkele staaf	L100.8	S235	M20	**8.8**	3.88	0	197	**62.5**	**1.26**	72.1	94.1	69.8	248.8	4.76	0.90		Bolt exchanged
113	6e Tussenstuk	Enkele staaf	L100.8	S235	M20	**8.8**	3.43	0	174	**62.5**	**1.11**	85.4	94.1	69.8	248.8	4.76	0.90		Bolt exchanged
112	7e Tussenstuk	Enkele staaf	L100.8	S235	M20	**8.8**	2.94	0	149	**62.5**	**0.96**	103.8	94.1	69.8	248.8	4.76	0.90		Bolt exchanged
172	8e Tussenstuk	Enkele staaf	L60.6	**S355**	M16	**8.8**	1.38	0	118	**47.0**	**0.45**	72.3	60.3	52.3	98.8	1.88	0.90		Profile exchanged
160	8e Tussenstuk	Enkele staaf	**L60.8**	**S355**	M16	**8.8**	2.12	54	183	**47.0**	**0.00**	52.6	60.3	69.7	131.7	2.45	0.89		Profile exchanged
171	8e Tussenstuk	Enkele staaf	L80.8	S235	M16	**8.8**	2.67	0	171	**47.0**	**0.87**	69.2	60.3	51.2	188.9	2.95	0.92		Bolt exchanged
159	8e Tussenstuk	Enkele staaf	**L60.8**	**S355**	M16	**8.8**	2.19	29	189	**47.0**	**0.62**	50.1	60.3	69.7	131.7	2.45	0.94		Profile exchanged
170	8e Tussenstuk	Enkele staaf	L60.6	**S355**	M16	**8.8**	1.38	0	118	**47.0**	**0.45**	72.3	60.3	52.3	98.8	1.88	0.90		Profile exchanged
169	8e Tussenstuk	Enkele staaf	**L55.6**	**S355**	M16	**8.8**	1.32	0	123	**35.4**	**0.43**	62.7	60.3	52.3	75.3	1.56	0.68		Profile exchanged
158	8e Tussenstuk	Enkele staaf	**L60.8**	**S355**	M16	**8.8**	2.08	51	179	**35.4**	**0.00**	54.1	60.3	69.7	131.7	2.45	0.65		Profile exchanged
157	8e Tussenstuk	Enkele staaf	**L60.8**	**S355**	M16	**8.8**	2.14	50	184	**35.4**	**0.00**	51.9	60.3	69.7	131.7	2.45	0.68		Profile exchanged
167	8e Tussenstuk	Enkele staaf	**L55.6**	**S355**	M16	**8.8**	1.30	0	121	**35.4**	**0.42**	64.1	60.3	52.3	75.3	1.56	0.68		Profile exchanged
156	9e Tussenstuk	Enkele staaf	**L60.8**	**S355**	M16	**8.8**	2.03	55	175	**24.0**	**0.00**	56.1	60.3	69.7	131.7	2.45	0.43		Profile exchanged
155	9e Tussenstuk	Enkele staaf	**L60.6**	**S355**	M16	**8.8**	2.07	51	177	**24.0**	**0.00**	42.0	60.3	52.3	98.8	1.88	0.57		Profile exchanged
154	9e Tussenstuk	Enkele staaf	**L55.6**	**S355**	M16	**8.8**	2.00	55	187	**24.0**	**0.00**	35.6	60.3	52.3	75.3	1.56	0.67		Profile exchanged
153	9e Tussenstuk	Enkele staaf	**L60.6**	**S355**	M16	**8.8**	2.07	53	177	**24.0**	**0.00**	42.1	60.3	52.3	98.8	1.88	0.57		Profile exchanged
BR9	5e Tussenstuk	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	0.69	0	71	**24.0**	0.22	81.4	60.3	43.6	51.0	1.08	0.55		Profile added
BR10	5e Tussenstuk	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.11	50	114	**24.0**	0.00	52.3	60.3	43.6	51.0	1.08	0.55		Profile added
BR11	5e Tussenstuk	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	0.67	0	69	**24.0**	0.22	82.6	60.3	43.6	51.0	1.08	0.55		Profile added

Knikverkorters adjusted structure (verbouw)

Date: 2021-04-07
Author: M Khan
Version: 1.8

KIJ-GT

S+95

Masts 12 and 13

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness (-)	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Block Tearing Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type	Mitigation
BR12	5e Tussenstuk	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.05	50	108	**24.0**	0.00	55.7	60.3	43.6	51.0	1.08	0.55		Profile added
RS1	Onderstuk	Enkele staaf	**L60.6**	**S355**	**M16**	**8.8**	0.98	0	84	**31.0**	0.32	102.9	60.3	52.3	98.8	1.88	0.59		Profile added
RS2	Onderstuk	Enkele staaf	**L70.7**	**S355**	**M16**	**8.8**	2.42	0	177	**31.0**	0.79	57.2	60.3	61.0	170.1	2.99	0.54		Profile added
RS3	1e Tussenstuk	Enkele staaf	**L80.6**	**S355**	**M16**	**8.8**	3.87	0	246	**31.0**	1.26	34.4	60.3	52.3	192.9	3.40	0.90		Profile added
RS4	1e Tussenstuk	Enkele staaf	**L80.6**	**S355**	**M16**	**8.8**	3.16	0	201	**42.0**	1.03	47.2	60.3	52.3	192.9	3.40	0.89		Profile added
RS5	2e Tussenstuk	Enkele staaf	**L80.6**	**S355**	**M16**	**8.8**	3.16	0	201	**42.0**	1.03	47.2	60.3	52.3	192.9	3.40	0.89		Profile added
RS6	2e Tussenstuk	Enkele staaf	**L70.7**	**S355**	**M16**	**8.8**	2.88	0	211	**29.5**	0.94	44.0	60.3	61.0	170.1	2.99	0.67		Profile added
RS7	3e Tussenstuk	Enkele staaf	**L70.7**	**S355**	**M16**	**8.8**	2.88	0	211	**29.5**	0.94	44.0	60.3	61.0	170.1	2.99	0.67		Profile added
RS8	3e Tussenstuk	Enkele staaf	**L60.6**	**S355**	**M16**	**8.8**	2.57	0	220	**28.0**	0.84	30.4	60.3	52.3	98.8	1.88	0.92		Profile added
RS9	3e Tussenstuk	Enkele staaf	**L60.6**	**S355**	**M16**	**8.8**	2.57	0	220	**28.0**	0.84	30.4	60.3	52.3	98.8	1.88	0.92		Profile added
RS10	Onder- 3e tusser	Enkele staaf	**L50.5**	**S355**	**M16**	**8.8**	1.00	0	103	**30.3**	0.33	58.8	60.3	43.6	51.0	1.08	0.69		Profile added

Notes

1) Members BR9 to BR12 are new redundant members. Refer to Appendix E.
2) Members RS1 to RS10 are new redundant members. Refer to Appendix E.

APPENDIX D TOETSING ANKERS & OVERIGE BEREKENINGEN

DNV·GL

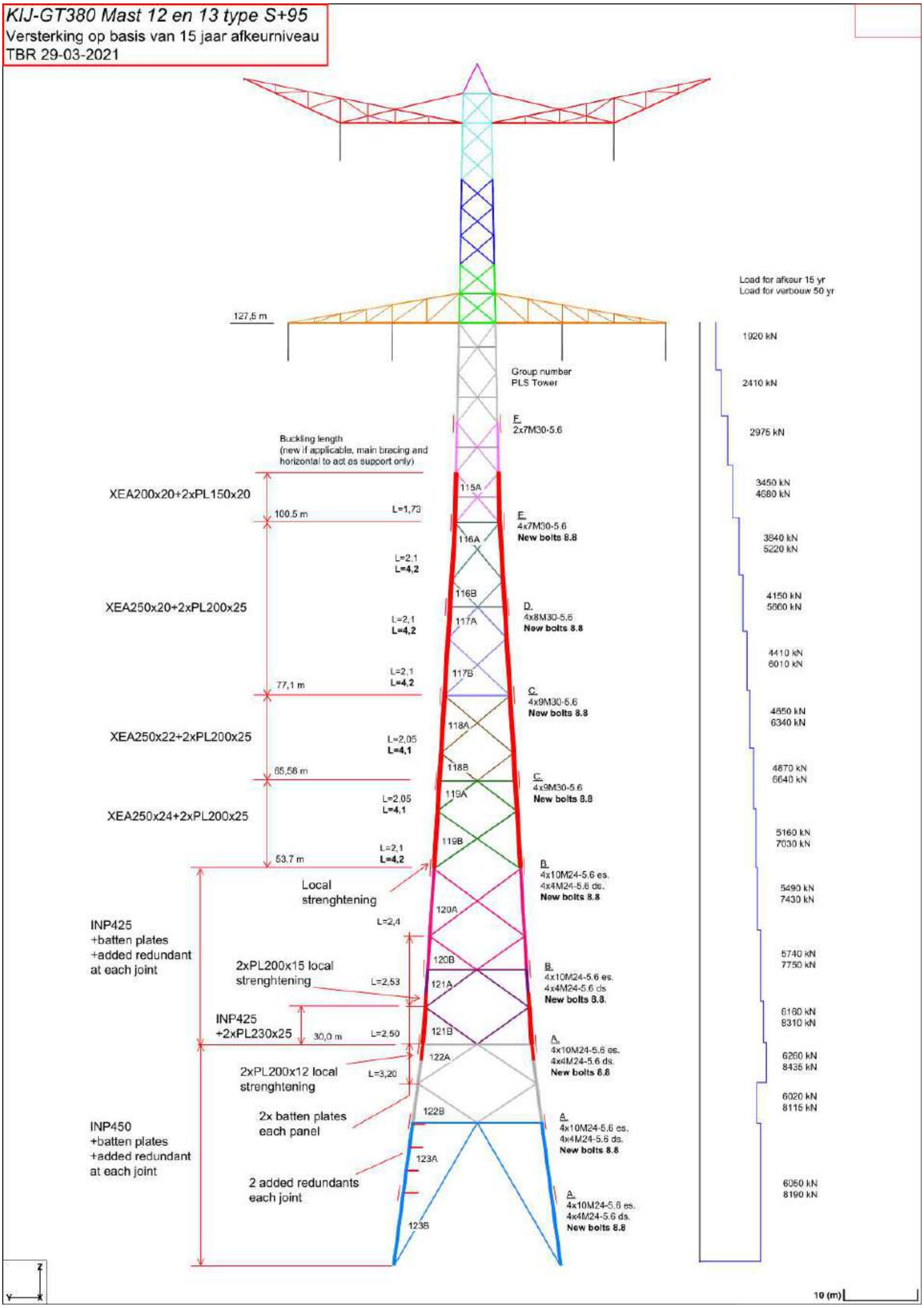
CAPACITY AND CONNECTIONS OF MAIN LEG

Contents

1 SPLICE CONNECTIONS

The main leg of the structure is composed of cruciform sections of XEA and INP-sections over a large part of the height of the structure. In this appendix the capacity of these sections will be looked at in more detail then the software package of AxisVM offers.

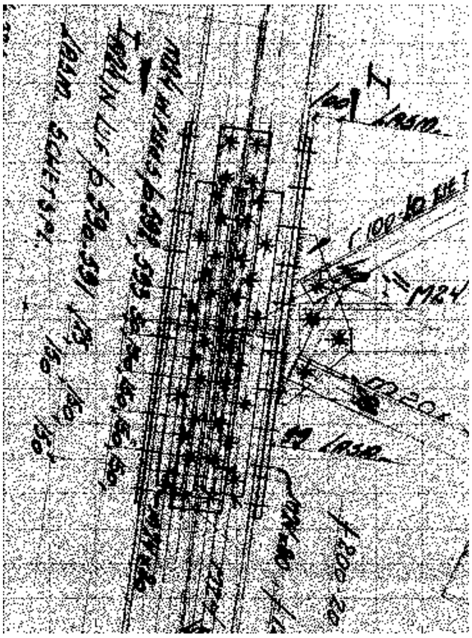
At first the bolted connection in the INP-main members will be checked since this type of section is not offered by the software package PLS-TOWER. The buckling capacity of the main leg with INP-sections is checked in Appendix F. After that, the buckling capacity and the strength of the connections of the XEA-sections will be checked.



Figuur 1 Scheme of lower part tower S+95 with bolted connections and profiles

1.1 Bolted splice INP450 (A)

The flanges 170x24,3 mm are connected with one plate of 200x20 cross section. The web with thickness 16,2 mm is connected with two plates 120x16 mm cross section. In total 72 shear planes exist for the bolts M24-5.6.



Figuur 2 Splice connection INP450

The capacity of the two plate connections within the connection will be determined with a spreadsheet.

M24-5.6: $F_{v,Rd}$ = 84,7 kN. Due to the length of the connection, the bolts in the flange are considered 95% effective (see spreadsheet).

The results for the capacity of the plate connections from the spreadsheet are used to determine total capacity of all the four flanges and the web.

Compression capacity:

Flanges:	4 x 805 =	3219 kN
Web:	4 x 678 =	2710 kN
Total:		5928 kN

Tension capacity:

Flanges:	4 x 767 =	3070 kN
Web:	4 x 678 =	2710 kN
Total:		5780 kN

The bolt capacity is with a slight difference decisive.

INP450 gross section:	29152 mm2

$F_{b,Rd}$ = 29152 x 235 = 6850 kN.

Net section of INP450 for tension

INP450 gross section:	29152 mm2
Holes in flange: - 4 x 2 x 26 x 24,3 =	-5054 mm2
Holes in web: - 4 x 26 x 16,2 =	-1685 mm2
Total:	22413 mm2

$F_{t,Rd}$ = 0,9 x 22413 x 360 / 1,25 = 5809 kN.

Conclusion: for compression the strength of the connection is equal to 5928 kN. The ratio between compression and tension force is such that tension capacity is not relevant.

Capacity with bolts exchanged to 8.8 quality.

Compression capacity:

Flanges:	4 x 940 =	3760 kN
Web:	4 x 777 =	3108 kN
Total:		6868 kN

Tension capacity:

Flanges:	4 x 767 =	3070 kN
Web:	4 x 777 =	3108 kN
Total:		6178 kN

With 8.8 class bolts, the bolts are not decisive anymore, but gross and net section are.

Flensverbinding met strip 200x20 en 10M24-5.6 enkelsnedig

Capaciteit strip met boutverbinding

Volgens NEN-EN 1993-1-1+C2 en 1993-1-8 met NB

Belasting	$F_{t,Ed}$ =	**765** kN	
Resultaat			
Sterkte van de verbinding			
Boutverbinding:	UC. =	**0,95**	**OK**
Nettodoorsnede:	UC. =	**1,00**	**OK**

Stripgegevens

Breedte	b =	**200** mm
Dikte	t =	**20** mm
Dubbele of enkele strip:		**Enkel**
Factor	a =	1
Staalsoort		**S235**
Schetsplaat		
Dikte schetsplaat	t_{pl} =	**24,3** mm
Staalsoort		**S235**
Treksterkte	f_u =	360 N/mm²

Vervormingscapaciteit

Voorwaarde: $N_{pl;Rd}$ / $N_{u;Rd}$ < 1,00 — 1,23 => Nee

Doorsnede strip

A_{bruto} = b x t =	4000 mm²
A_{net} = (b - nd_g)t =	2960 mm²
f_u =	360 N/mm²
γ_{m0} =	1,00 -
γ_{m2} =	1,25 -
$N_{u;Rd}$ = a x 0,9 x A_{net} x f_u / γ_{m2} =	**767** kN
Vloeien van brutodoorsnede	
$N_{pl;Rd}$ = a x A x f_y / γ_{m0} =	**940** kN

Boutgegevens en -configuratie

Boutdiameter		**M24**	
Boutkwaliteit		**5.6**	
Fabricage draad		Gerold	
Aantal schuifvlakken per bout		1	
Boutdiameter	d_b =	24 mm	
Boutgatdiameter	d_0 =	26 mm	
Aantal boutrijen	n =	**5**	
Aantal dwarsrijen	m =	**2**	
Eindafstand	e_1 =	40 mm	Ok
Tussenafstand	p_1 =	150 mm	Ok
Tussenafstand haaks	p_2 =	90 mm	Ok
Eindafstand haaks	e_2 =	55 mm	Ok

Stuik strip

Factor f_{ub} / f_u =		2,13
		1,00
Eindbout	$\alpha_d = e_1 / 3d_0$ =	0,51
	$k_1 = 2{,}8e_2 / d_0 - 1{,}7$ =	4,22
	$k_1 = 1{,}4p_2 / d_0 - 1{,}7$ =	3,15
	k_1 =	2,50
$F_{b;Rd}$ = a x $k_1 \alpha_b f_u$ d t / γ_{M2} =		177 kN
Tussenbt	$\alpha_d = p_1 / 3d_0 - {}^1/_4$ =	1,67
	$k_1 = 2{,}8e_2 / d_0 - 1{,}7$ =	4,22
	$k_1 = 1{,}4p_2 / d_0 - 1{,}7$ =	3,15
	k_1 =	2,50
$F_{b;Rd}$ = a x $k_1 \alpha_b f_u$ d t / γ_{M2} =		346 kN

Afschuiving bouten

Afschuifdoorsnede door:		Schacht
Factor boutkwaliteit	α_v =	0,60 -
Factor fabricage	α_{red} =	1,00 -
Oppervlakte	$A_{b;s}$ =	353 mm²
Treksterkte	$f_{u;b}$ =	500 N/mm²
$F_{v;Rd} = \alpha_v A_{b;s} f_{u;b} \alpha_{red;2} / \gamma_{M2}$ =		85 kN
Lengte verbinding:		600 mm
Reductie β_l = 1 - (L_j - 15d) / 200d		0,95

Boutrij	$F_{v,Rd}$	Schuif-vlakken	Beta	Bouten $F_{v;Rd}$	Strip $F_{v,Rd}$	Schtsplt $F_{v,Rd}$	Min.	Toets
1	84,7	1	0,95	80,5	177,2	419,9	80,5	elastisch
2	84,7	1	0,95	80,5	345,6	419,9	80,5	elastisch
3	84,7	1	0,95	80,5	345,6	419,9	80,5	elastisch
4	84,7	1	0,95	80,5	345,6	419,9	80,5	elastisch
5	84,7	1	0,95	80,5	345,6	215,3	80,5	elastisch
6	0,0	1	0,95	0,0	0,0	0,0	0,0	
7	0,0	1	0,95	0,0	0,0	0,0	0,0	
8	0,0	1	0,95	0,0	0,0	0,0	0,0	

ΣF_{Rd} = 402,4 kN

Min. F_{Rd} = 80,5 kN

Resultaat boutverbinding

Elastisch $\frac{F_{v,Ed}}{\min. F_{v,Rd}} = \frac{76{,}5}{80} = 0{,}95$ ***OK***

Plastisch $\frac{F_{t,Ed}}{\Sigma F_{Rd}} = \frac{765{,}0}{402{,}4 \times 2} = 0{,}95$ ***NVT***

Lijfverbinding met strippen 120x16 en 4M24-5.6 dubbelsnedig

Capaciteit strip met boutverbinding

Volgens NEN-EN 1993-1-1+C2 en 1993-1-8 met NB

Stripgegevens

Breedte	b =	120	mm
Dikte	t =	16	mm
Dubbele of enkele strip:		Dubbel	
Factor	a =	2	
Staalsoort		S235	
Schetsplaat			
Dikte schetsplaat	t_{pl} =	16,2	mm
Staalsoort		S235	
Treksterkte	f_u =	360	N/mm^2

Doorsnede strip

$A_{bruto} = b \times t$ =	1920	mm^2
$A_{net} = (b - nd_g)t$ =	1504	mm^2
f_u =	360	N/mm^2
γ_{m0} =	1,00	-
γ_{m2} =	1,25	-
$N_{u;Rd} = a \times 0{,}9 \times A_{net} \times f_u / \gamma_{m2}$ =	**780**	kN
Vloeien van brutodoorsnede		
$N_{pl;Rd} = a \times A \times f_y / \gamma_{m0}$ =	**902**	kN

Stuik strip

Factor f_{ub} / f_u =		2,13	
		1,00	
Eindbout	$\alpha_d = e_1 / 3d_0$ =	0,64	
	$k_1 = 2{,}8e_2 / d_0 - 1{,}7$ =	4,76	
	$k_1 = 1{,}4p_2 / d_0 - 1{,}7$ =	2,50	
	k_1 =	2,50	
$F_{b;Rd} = a \times k_1\alpha_b f_u\, d\, t / \gamma_{M2}$ =		354	kN
Tussenbt	$\alpha_d = p_1 / 3d_0 - {}^1/_4$ =	0,71	
	$k_1 = 2{,}8e_2 / d_0 - 1{,}7$ =	4,76	
	$k_1 = 1{,}4p_2 / d_0 - 1{,}7$ =	2,50	
	k_1 =	2,50	
$F_{b;Rd} = a \times k_1\alpha_b f_u\, d\, t / \gamma_{M2}$ =		393	kN

Belasting	$F_{t,Ed}$ =	678	kN
Resultaat			
Sterkte van de verbinding			
Boutverbinding:	UC. =	**1,00**	**OK**
Nettodoorsnede:	UC. =	**0,87**	**OK**

Vervormingscapaciteit

Voorwaarde: $N_{pl;Rd} / N_{u;Rd} < 1{,}00$ 1,16 => Nee

Boutgegevens en -configuratie

Boutdiameter		M24		
Boutkwaliteit		5.6		
Fabricage draad		Gerold		
Aantal schuifvlakken per bout		2		
Boutdiameter	d_b =	24	mm	
Boutgatdiameter	d_0 =	26	mm	
Aantal boutrijen	n =	4		
Aantal dwarsrijen	m =	1		
Eindafstand	e_1 =	50	mm	Ok
Tussenafstand	p_1 =	75	mm	Ok
Tussenafstand haaks	p_2 =	0	mm	Ok
Eindafstand haaks	e_2 =	60	mm	Ok

Afschuiving bouten

Afschuifdoorsnede door:		Schacht	
Factor boutkwaliteit	α_v =	0,60	-
Factor fabricage	α_{red} =	1,00	-
Oppervlakte	$A_{b;s}$ =	353	mm^2
Treksterkte	$f_{u;b}$ =	500	N/mm^2
$F_{v;Rd} = \alpha_v A_{b;s} f_{u;b} \alpha_{red;2} / \gamma_{M2}$ =		85	kN
Lengte verbinding:		225	mm
Reductie $\beta_l = 1 - (L_j - 15d) / 200d$		1,00	

Boutrij	$F_{v,Rd}$	Schuif-vlakken	Beta	Bouten $F_{v;Rd}$	Strip $F_{v,Rd}$	Schtsplt $F_{v,Rd}$	Min.	Toets
1	84,7	2	1,00	169,4	354,5	199,2	169,4	elastisch
2	84,7	2	1,00	169,4	393,5	199,2	169,4	elastisch
3	84,7	2	1,00	169,4	393,5	199,2	169,4	elastisch
4	84,7	2	1,00	169,4	393,5	179,4	169,4	elastisch
5	0,0	2	1,00	0,0	0,0	0,0	0,0	
6	0,0	2	1,00	0,0	0,0	0,0	0,0	
7	0,0	2	1,00	0,0	0,0	0,0	0,0	
8	0,0	2	1,00	0,0	0,0	0,0	0,0	

ΣF_{Rd} = 677,8 kN

Min. F_{Rd} = 169,4 kN

Resultaat boutverbinding

Elastisch $\dfrac{F_{v,Ed}}{\text{min. } F_{v,Rd}} = \dfrac{169{,}5}{169} = 1{,}00$ ***OK***

Plastisch $\dfrac{F_{t,Ed}}{\Sigma F_{Rd}} = \dfrac{678{,}0}{677{,}8 \times 1} = 1{,}00$ ***NVT***

Flensverbinding met strip 200x20 en **10M24-8.8** enkelsnedig

Capaciteit strip met boutverbinding

Volgens NEN-EN 1993-1-1+C2 en 1993-1-8 met NB

Stripgegevens

Breedte	b =	**200**	mm
Dikte	t =	**20**	mm
Dubbele of enkele strip:		**Enkel**	
Factor	a =	1	
Staalsoort		**S235**	
Schetsplaat			
Dikte schetsplaat	t_{pl} =	**24,3**	mm
Staalsoort		**S235**	
Treksterkte	f_u =	360	N/mm^2

Belasting	$F_{t,Ed}$ =	**765**	kN
Resultaat			
Sterkte van de verbinding			
Boutverbinding:	UC. =	**0,59**	**OK**
Nettodoorsnede:	UC. =	**1,00**	**OK**

Vervormingscapaciteit

Voorwaarde: $N_{pl;Rd}$ / $N_{u;Rd}$ < 1,00 1,23 => Nee

Doorsnede strip

A_{bruto} = b x t =	4000	mm^2
A_{net} = (b - nd_g)t =	2960	mm^2
f_u =	360	N/mm^2
γ_{m0} =	1,00	-
γ_{m2} =	1,25	-
$N_{u;Rd}$ = a x 0,9 x A_{net} x f_u / γ_{m2} =	**767**	kN
Vloeien van brutodoorsnede		
$N_{pl;Rd}$ = a x A x f_y / γ_{m0} =	**940**	kN

Stuik strip

Factor f_{ub} / f_u =		3,40
		1,00
Eindbout	α_d = e_1 / $3d_0$ =	0,51
	k_1 = $2{,}8e_2$ / d_0 - 1,7 =	4,22
	k_1 = $1{,}4p_2$ / d_0 - 1,7 =	3,15
	k_1 =	2,50
$F_{b;Rd}$ = a x $k_1 \alpha_b f_u$ d t / γ_{M2} =		177 kN
Tussenbt	α_d = p_1 / $3d_0$ - $^1/_4$ =	1,67
	k_1 = $2{,}8e_2$ / d_0 - 1,7 =	4,22
	k_1 = $1{,}4p_2$ / d_0 - 1,7 =	3,15
	k_1 =	2,50
$F_{b;Rd}$ = a x $k_1 \alpha_b f_u$ d t / γ_{M2} =		346 kN

Boutgegevens en -configuratie

Boutdiameter		**M24**		
Boutkwaliteit		**8.8**		
Fabricage draad		Gerold		
Aantal schuifvlakken per bout		1		
Boutdiameter	d_b =	24	mm	
Boutgatdiameter	d_0 =	26	mm	
Aantal boutrijen	n =	**5**		
Aantal dwarsrijen	m =	**2**		
Eindafstand	e_1 =	40	mm	Ok
Tussenafstand	p_1 =	150	mm	Ok
Tussenafstand haaks	p_2 =	90	mm	Ok
Eindafstand haaks	e_2 =	55	mm	Ok

Afschuiving bouten

Afschuifdoorsnede door:		Schacht	
Factor boutkwaliteit	α_v =	0,60	-
Factor fabricage	α_{red} =	1,00	-
Oppervlakte	$A_{b;s}$ =	353	mm^2
Treksterkte	$f_{u;b}$ =	800	N/mm^2
$F_{v;Rd}$ = $\alpha_v A_{b;s} f_{u;b} \alpha_{red;2}$ / γ_{M2} =		136	kN
Lengte verbinding:		600	mm
Reductie β_l = 1 - (L_j - 15d) / 200d		0,95	

Boutrij	$F_{v,Rd}$	Schuif-vlakken	Beta	Bouten $F_{v;Rd}$	Strip $F_{v,Rd}$	Schtsplt $F_{v,Rd}$	Min.	Toets
1	135,6	1	0,95	128,8	177,2	419,9	128,8	elastisch
2	135,6	1	0,95	128,8	345,6	419,9	128,8	elastisch
3	135,6	1	0,95	128,8	345,6	419,9	128,8	elastisch
4	135,6	1	0,95	128,8	345,6	419,9	128,8	elastisch
5	135,6	1	0,95	128,8	345,6	215,3	128,8	elastisch
6	0,0	1	0,95	0,0	0,0	0,0	0,0	
7	0,0	1	0,95	0,0	0,0	0,0	0,0	
8	0,0	1	0,95	0,0	0,0	0,0	0,0	

ΣF_{Rd} = 643,9 kN

Min. F_{Rd} = 128,8 kN

Resultaat boutverbinding

Elastisch $\frac{F_{v,Ed}}{\min. F_{v,Rd}} = \frac{76{,}5}{129}$ = 0,59 ***OK***

Plastisch $\frac{F_{t,Ed}}{\Sigma F_{Rd}} = \frac{765{,}0}{643{,}9 \times 2}$ = 0,59 ***NVT***

Lijfverbinding met strippen 120x16 en **4M24-8.8** dubbelsnedig

Capaciteit strip met boutverbinding

Volgens NEN-EN 1993-1-1+C2 en 1993-1-8 met NB

Belasting	$F_{t,Ed}$ =	777 kN
Resultaat		
Sterkte van de verbinding		
Boutverbinding:	UC. =	**1,00 OK**
Nettodoorsnede:	UC. =	**1,00 OK**

Stripgegevens

Breedte	b =	**120** mm
Dikte	t =	**16** mm
Dubbele of enkele strip:		**Dubbel**
Factor	a =	2
Staalsoort		**S235**
Schetsplaat		
Dikte schetsplaat	t_{pl} =	**16,2** mm
Staalsoort		**S235**
Treksterkte	f_u =	360 N/mm^2

Vervormingscapaciteit

Voorwaarde: $N_{pl;Rd}$ / $N_{u;Rd}$ < 1,00   1,16   => Nee

Doorsnede strip

A_{bruto} = b x t =	1920 mm^2
A_{net} = (b - nd_g)t =	1504 mm^2
f_u =	360 N/mm^2
γ_{m0} =	1,00 -
γ_{m2} =	1,25 -
$N_{u;Rd}$ = a x 0,9 x A_{net} x f_u / γ_{m2} =	**780** kN
Vloeien van brutodoorsnede	
$N_{pl;Rd}$ = a x A x f_y / γ_{m0} =	**902** kN

Boutgegevens en -configuratie

Boutdiameter		**M24**	
Boutkwaliteit		**8.8**	
Fabricage draad		Gerold	
Aantal schuifvlakken per bout		2	
Boutdiameter	d_b =	24 mm	
Boutgatdiameter	d_0 =	26 mm	
Aantal boutrijen	n =	**4**	
Aantal dwarsrijen	m =	**1**	
Eindafstand	e_1 =	50 mm	Ok
Tussenafstand	p_1 =	75 mm	Ok
Tussenafstand haaks	p_2 =	0 mm	Ok
Eindafstand haaks	e_2 =	60 mm	Ok

Stuik strip

Factor f_{ub} / f_u =		3,40
		1,00
Eindbout	$\alpha_d = e_1 / 3d_0$ =	0,64
	$k_1 = 2{,}8e_2 / d_0 - 1{,}7$ =	4,76
	$k_1 = 1{,}4p_2 / d_0 - 1{,}7$ =	2,50
	k_1 =	2,50
$F_{b;Rd} = a \times k_1 \alpha_b f_u\, d\, t / \gamma_{M2}$ =		354 kN
Tussenbt	$\alpha_d = p_1 / 3d_0 - {}^1/_4$ =	0,71
	$k_1 = 2{,}8e_2 / d_0 - 1{,}7$ =	4,76
	$k_1 = 1{,}4p_2 / d_0 - 1{,}7$ =	2,50
	k_1 =	2,50
$F_{b;Rd} = a \times k_1 \alpha_b f_u\, d\, t / \gamma_{M2}$ =		393 kN

Afschuiving bouten

Afschuifdoorsnede door:		Schacht
Factor boutkwaliteit	α_v =	0,60 -
Factor fabricage	α_{red} =	1,00 -
Oppervlakte	$A_{b;s}$ =	353 mm^2
Treksterkte	$f_{u;b}$ =	800 N/mm^2
$F_{v;Rd} = \alpha_v A_{b;s} f_{u;b} \alpha_{red;2} / \gamma_{M2}$ =		136 kN
Lengte verbinding:		225 mm
Reductie $\beta_l = 1 - (L_j - 15d) / 200d$		1,00

Boutrij	$F_{v,Rd}$	Schuif-vlakken	Beta	Bouten $F_{v;Rd}$	Strip $F_{v,Rd}$	Schtsplt $F_{v,Rd}$	Min.	Toets
1	135,6	2	1,00	271,1	354,5	199,2	199,2	plastisch
2	135,6	2	1,00	271,1	393,5	199,2	199,2	plastisch
3	135,6	2	1,00	271,1	393,5	199,2	199,2	plastisch
4	135,6	2	1,00	271,1	393,5	179,4	179,4	plastisch
5	0,0	2	1,00	0,0	0,0	0,0	0,0	
6	0,0	2	1,00	0,0	0,0	0,0	0,0	
7	0,0	2	1,00	0,0	0,0	0,0	0,0	
8	0,0	2	1,00	0,0	0,0	0,0	0,0	
						ΣF_{Rd} =	777,0 kN	
						Min. F_{Rd} =	179,4 kN	

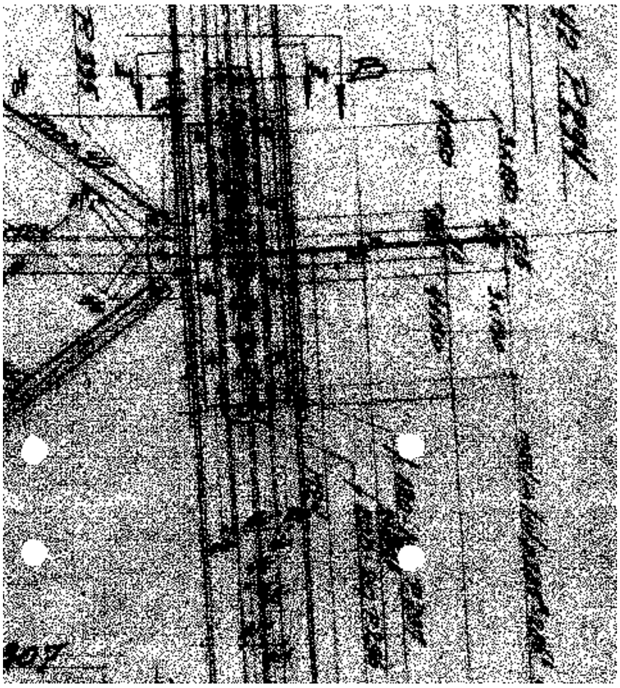
Resultaat boutverbinding

Elastisch $\frac{F_{v,Ed}}{\min. F_{v,Rd}} = \frac{194{,}3}{179} = 1{,}08$ ***Niet OK***

Plastisch $\frac{F_{t,Ed}}{\Sigma F_{Rd}} = \frac{777{,}0}{777{,}0 \times 1} = 1{,}00$ ***OK***

1.2 Bolted splice INP425 (B)

The splice joint is similar to the INP450 joint, plates and bolts are the same. The only difference is the thickness of the flange and web.



This means the gross section and net section will be slightly less, since the cross section of INP425 is smaller.

INP425 gross section:	26400 mm2
$F_{b,Rd}$ = 26400 x 235 =	6204 kN.

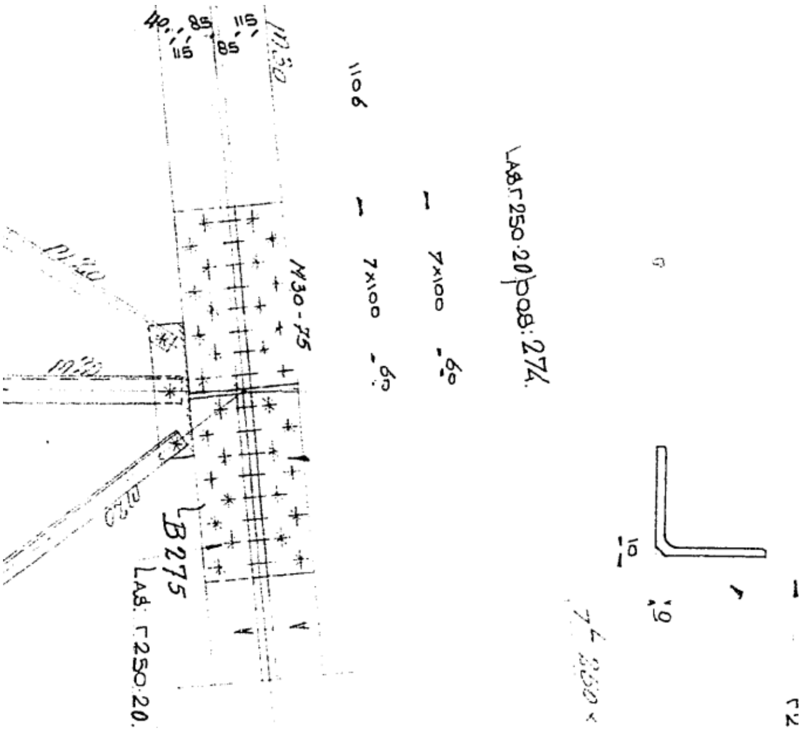
Net section of INP425 for tension

INP425 gross section:	26400 mm2
Holes in flange: -4 x 2 x 26 x 23 =	-4780 mm2
Holes in web: -4 x 26 x 15,3 =	-1591 mm2
Total:	20030 mm2
$F_{t,Rd}$ = 0,9 x 20029 x 360 / 1,25 =	5190 kN.

1.3 Calculations for XEA-profiles

The buckling strength of XEA-profiles is governed by torsional buckling. The resistance will be determined with a spreadsheet. The spreadsheet is also capable to check the connection, as a verification to the calculation included in PLS-TOWER. The resulting buckling capacity is used in PLS-TOWER model of the initial structure to check the main leg.

Splice connections are single lap with an angle that is connected to the back of the leg-profiles.



Figuur 3 Splice connection XEA 250x250x20

Five XEA-cross sections have been calculated with the spreadsheet.

- XEA250x250x24 connection (C) L_{buc} = 2,05 m (group 119B)
- XEA250x250x22 connection (C) L_{buc} = 2,05 m (group 118A)
- XEA250x250x20 connection (C) L_{buc} = 2,10 m (group 117A)
- XEA250x250x20 connection (D) L_{buc} = 2,10 m (group 117A)
- XEA200x200x20 connection (E) L_{buc} = 1,73 m (group 115A)

The loads for afkeurlevel of Figuur 1 have been used.

See results of spreadsheet summarized below: all of the XEA-members have insufficient torsional buckling capacity. This also holds for the L-profile directly above the last XEA-profile.

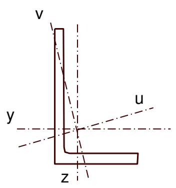
Section	Group	Lbuc	Connection	Load	Capacity	U.C.
XEA250x250x24	119B	2,1	C	5160	4720	1,09
XEA250x250x22	118A	2,05	C	4860	4253	1,14
XEA250x250x20	117A	2,1	C	4410	3707	1,19
XEA250x250x20	117A	2,1	D	4150	3707	1,12
XEA200x200x20	115A	1,73	E	3450	3180	1,08
L250x250x22	114A	1,73	F	2410	2323	1,04

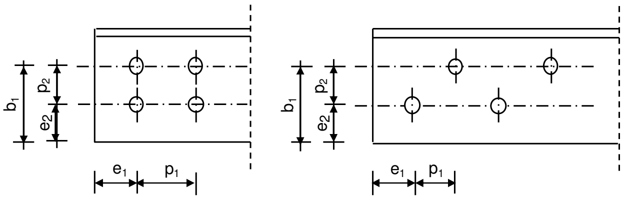
Angle check

NEN-EN 1993-1-1 and EN 1993-3-1

Datum: 2021-03-29
Auteur: TBR
Versie: 2,9

Member name	**Group 119B**	***Conclusion***			
Section	**XEA 250x250x24**	U.C.	(compression)	**1,09**	**Not OK**
		U.C.	(tension)	**0,85**	**< 1,0 OK**





Steel grade		**S235**		
Member loads				
Compressive force	N_{Ed} =	**5160**	kN	
Tensile force		**-4128**	kN	
Crossing diagonal loads				
Applicable:		**No**		
Min. tensile force diagonal 2		**1**	kN	
Max. comp. force diagonal 1		**1**	kN	
Position crossing diagonal y-axis		1,00	m	
Construction loads				
Vertical construction load		**1,0**	kN	
Member angle to horizontal		**0**	°	
Bending around axis		y-axis		
Geometry				
System length y-axis	$L_{y,buc}$ =	2,10	m	
System length z-axis	$L_{z,buc}$ =	2,10	m	
System length v-axis	$L_{v,buc}$ =	2,10	m	
System length x-axis	$L_{tk,buc}$ =	2,10	m	
Member type		**Leg**		
Type bracing		Non staggered		
End conditions				
Begin		Continuous		
End		Continuous		
Restraint code TOWER		C4		

Bolted connection				
Bolt type		M30		
Bolt class		5.6		
Number of bolts per leg		9		(36 totaal)
Shearplane through		Thread		
Boltpattern		Zigzag		
Boltpattern (leg-member only)		Staggered		
End distance	e_1 =	60	mm	Ok
Separation distance //	p_1 =	100	mm	Ok
Separation distance ⊥	p_2 =	115	mm	Ok
End distance ⊥	e_2 =	60	mm	Ok
Double strap or single strap		Single		
Tie plate	b_p =	230	mm	OK
	t_p =	24	mm	OK
	e_2 =	40	mm	OK
A		23036	mm^2	
G		184,3	kg/m	
Partial safety factor	$\gamma_{f;Q}$ =	1,50		
Material factors	γ_{M0} =	1,00		
	γ_{M1} =	1,00		
	γ_{M2} =	1,25		
Shear strength bolt	$F_{v;b;Rd}$ =	134,6	kN	
Slenderness	λ_{max} = L / i	22	-	
Allowed:		120		**OK**
Bending due to vertical construction load				
$M_{y,Ed}$ = 1/4 F_{Ed} L_{pr} =		0,79	kNm	
U.C. =		**0,00**	**< 1,00 OK**	

Results stability

		$\lambda_{eff,rel}$	λ_{eff}	$\lambda_{eff,mod}$	χ_{buc}	η	$N_{b,Rd} = \eta\chi A f_y / \gamma_{M1}$	
$L_{y,buc}$ =	2,10 m	0,21	1,00 l	0,21	0,99	1	5385	0,96
$L_{z,buc}$ =	2,10 m	0,21	1,00 l	0,21	0,99	1	5385	0,96
$L_{v,buc}$ =	2,10 m	0,23	0,10+0,80	0,23	0,99	1	5352	0,96
$L_{tk,buc}$ =	2,10 m	0,53			0,87	1	4722	1,09

Bolted connection

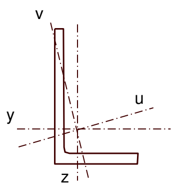
Compression		F_{Rd} (kN)	U.C.		Tension		F_{Rd} (kN)	U.C.	
Cross section angle	$F_{u;Rd}$ =	5413	0,95		*Net section angle*	$F_{u;Rd}$ =	5147	0,80	
Cross section tie plate	$F_{u;Rd}$ =	5189	0,99		*Net section tie plate*	$F_{u;Rd}$ =	4902	0,84	
Shear strength	$F_{v;Rd}$ =	4847	1,06		*Block shear*	$F_{u;Rd}$ =	11445	0,36	
Bearing strength	$F_{b;Rd}$ =	14185	0,36		*Shear strength*	$F_{v;Rd}$ =	4847	0,85	
Combined effect	$F_{v;Rd}$ =	4847	1,06	elastisch	*Bearing strength*	$F_{b;Rd}$ =	13461	0,31	
					Combined effect	$F_{v;Rd}$ =	4847	0,85	elastisch

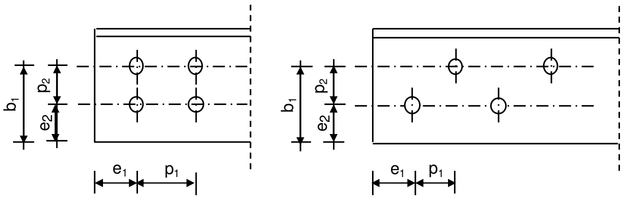
Angle check

NEN-EN 1993-1-1 and EN 1993-3-1

Datum:	2021-03-29
Auteur:	TBR
Versie:	2,9

Member name	**Group 118B**	***Conclusion***			
Section	**XEA 250x250x22**	U.C.	(compression)	**1,15**	**Not OK**
		U.C.	(tension)	**0,82**	**< 1,0 OK**





Steel grade		**S235**	
Member loads			
Compressive force	N_{Ed} =	**4870**	kN
Tensile force		**-3896**	kN
Crossing diagonal loads			
Applicable:		**No**	
Min. tensile force diagonal 2		**1**	kN
Max. comp. force diagonal 1		**1**	kN
Position crossing diagonal y-axis		1,00	m
Construction loads			
Vertical construction load		**1,0**	kN
Member angle to horizontal		**0**	°
Bending around axis		y-axis	
Geometry			
System length y-axis	$L_{y,buc}$ =	2,05	m
System length z-axis	$L_{z,buc}$ =	2,05	m
System length v-axis	$L_{v,buc}$ =	2,05	m
System length x-axis	$L_{tk,buc}$ =	2,05	m
Member type		**Leg**	
Type bracing		Non staggered	
End conditions			
Begin		Continuous	
End		Continuous	
Restraint code TOWER		C4	

Bolted connection

Bolt type		M30		
Bolt class		5.6		
Number of bolts per leg		9		(36 totaal)
Shearplane through		Thread		
Boltpattern		Zigzag		
Boltpattern (leg-member only)		Staggered		
End distance	e_1 =	60	mm	Ok
Separation distance //	p_1 =	100	mm	Ok
Separation distance ⊥	p_2 =	115	mm	Ok
End distance ⊥	e_2 =	60	mm	Ok
Double strap or single strap		Single		
Tie plate	b_p =	230	mm	OK
	t_p =	24	mm	OK
	e_2 =	40	mm	OK
A		21220	mm^2	
G		169,8	kg/m	
Partial safety factor	$\gamma_{f;Q}$ =	1,50		
Material factors	γ_{M0} =	1,00		
	γ_{M1} =	1,00		
	γ_{M2} =	1,25		
Shear strength bolt	$F_{v;b;Rd}$ =	134,6	kN	
Slenderness	λ_{max} = L / i	21	-	
Allowed:		120		**OK**

Bending due to vertical construction load

$M_{y,Ed}$ = 1/4 F_{Ed} L_{pr} =	0,77	kNm	
U.C. =	**0,00**		**< 1,00 OK**

Results stability

		$\lambda_{eff,rel}$	λ_{eff}	$\lambda_{eff,mod}$	χ_{buc}	η	$N_{b,Rd} = \eta\chi A f_y / \gamma_{M1}$	
$L_{y,buc}$ =	2,05 m	0,21	1,00 l	0,21	1,00	1	4967	0,98
$L_{z,buc}$ =	2,05 m	0,21	1,00 l	0,21	1,00	1	4967	0,98
$L_{v,buc}$ =	2,05 m	0,23	0,10+0,80	0,23	0,99	1	4940	0,99
$L_{tk,buc}$ =	2,05 m	0,57			0,85	1	4253	1,15

Bolted connection

Compression		F_{Rd} (kN)	U.C.	
Cross section angle	$F_{u;Rd}$ =	4987	0,98	
Cross section tie plate	$F_{u;Rd}$ =	5189	0,94	
Shear strength	$F_{v;Rd}$ =	4847	1,00	
Bearing strength	$F_{b;Rd}$ =	13003	0,37	
Combined effect	$F_{v;Rd}$ =	4847	1,00	elastisch

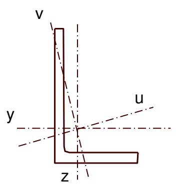
Tension		F_{Rd} (kN)	U.C.	
Net section angle	$F_{u;Rd}$ =	4739	0,82	
Net section tie plate	$F_{u;Rd}$ =	4902	0,79	
Block shear	$F_{u;Rd}$ =	10491	0,37	
Shear strength	$F_{v;Rd}$ =	4847	0,80	
Bearing strength	$F_{b;Rd}$ =	12710	0,31	
Combined effect	$F_{v;Rd}$ =	4847	0,80	elastisch

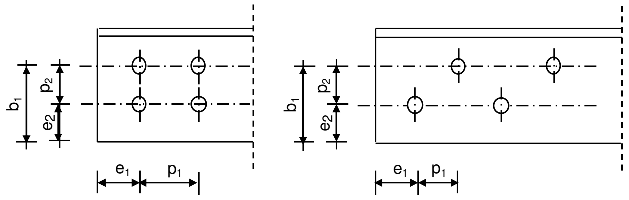
Angle check

NEN-EN 1993-1-1 and EN 1993-3-1

Datum: 2021-03-29
Auteur: TBR
Versie: 2,9

Member name	**Group 117A**	**Conclusion**	
Section	**XEA 250x250x20**	U.C. (compression)	**1,19** **Not OK**
		U.C. (tension)	**0,81** **< 1,0 OK**





Steel grade **S235**

Member loads

Compressive force N_{Ed} = **4410** kN
Tensile force **-3528** kN

Crossing diagonal loads

Applicable: **No**
Min. tensile force diagonal 2 **1** kN
Max. comp. force diagonal 1 **1** kN
Position crossing diagonal y-axis 1,00 m

Construction loads

Vertical construction load **1,0** kN
Member angle to horizontal **0** °
Bending around axis y-axis

Geometry

System length y-axis $L_{y,buc}$ = 2,10 m
System length z-axis $L_{z,buc}$ = 2,10 m
System length v-axis $L_{v,buc}$ = 2,10 m
System length x-axis $L_{tk,buc}$ = 2,10 m
Member type **Leg**
Type bracing Non staggered

End conditions

Begin Continuous
End Continuous
Restraint code TOWER C4

Bolted connection

Bolt type M30
Bolt class 5.6
Number of bolts per leg 9 (36 totaal)
Shearplane through Thread
Boltpattern Zigzag
Boltpattern (leg-member only) Staggered

End distance e_1 = 60 mm Ok
Separation distance // p_1 = 100 mm Ok
Separation distance | p_2 = 115 mm Ok
End distance ┘ e_2 = 60 mm Ok
Double strap or single strap Single
Tie plate b_p = 230 mm OK
t_p = 24 mm OK
e_2 = 40 mm OK

A 19388 mm^2
G 155,1 kg/m
Partial safety factor $\gamma_{f;Q}$ = 1,50
Material factors γ_{M0} = 1,00
γ_{M1} = 1,00
γ_{M2} = 1,25
Shear strength bolt $F_{v;b;Rd}$ = 134,6 kN

Slenderness λ_{max} = L / i 22 -
Allowed: 120 **OK**

Bending due to vertical construction load

$M_{y,Ed}$ = 1/4 F_{Ed} L_{pr} = 0,79 kNm
U.C. = **0,00** **< 1,00 OK**

Results stability

		$\lambda_{eff,rel}$	λ_{eff}	$\lambda_{eff,mod}$	χ_{buc}	η	$N_{b,Rd} = \eta\chi A f_y / \gamma_{M1}$	
$L_{y,buc}$ =	2,10 m	0,22	1,00 l	0,22	0,99	1	4530	0,97
$L_{z,buc}$ =	2,10 m	0,22	1,00 l	0,22	0,99	1	4530	0,97
$L_{v,buc}$ =	2,10 m	0,23	0,10+0,80	0,23	0,99	1	4507	0,98
$L_{tk,buc}$ =	2,10 m	0,65			0,81	1	3707	1,19

Bolted connection

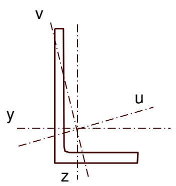
Compression		F_{Rd} (kN)	U.C.	
Cross section angle	$F_{u;Rd}$ =	4556	0,97	
Cross section tie plate	$F_{u;Rd}$ =	5189	0,85	
Shear strength	$F_{v;Rd}$ =	4847	0,91	
Bearing strength	$F_{b;Rd}$ =	11821	0,37	
Combined effect	$F_{v;Rd}$ =	4847	0,91	elastisch

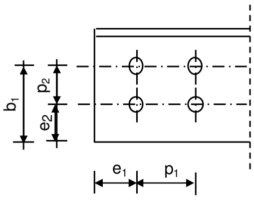
Tension		F_{Rd} (kN)	U.C.	
Net section angle	$F_{u;Rd}$ =	4329	0,81	
Net section tie plate	$F_{u;Rd}$ =	4902	0,72	
Block shear	$F_{u;Rd}$ =	9538	0,37	
Shear strength	$F_{v;Rd}$ =	4847	0,73	
Bearing strength	$F_{b;Rd}$ =	11555	0,31	
Combined effect	$F_{v;Rd}$ =	4847	0,73	elastisch

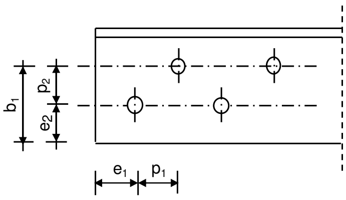
Angle check NEN-EN 1993-1-1 and EN 1993-3-1

Datum:	2021-03-29
Auteur:	TBR
Versie:	2,9

Member name	**Group 116B**	***Conclusion***			
Section	**XEA 250x250x20**	U.C.	(compression)	**1,12**	**Not OK**
		U.C.	(tension)	**0,77**	**< 1,0 OK**







Steel grade		**S235**	
Member loads			
Compressive force	N_{Ed} =	**4150**	kN
Tensile force		**-3320**	kN
Crossing diagonal loads			
Applicable:		**No**	
Min. tensile force diagonal 2		**1**	kN
Max. comp. force diagonal 1		**1**	kN
Position crossing diagonal y-axis		1,00	m
Construction loads			
Vertical construction load		**1,0**	kN
Member angle to horizontal		**0**	°
Bending around axis		y-axis	
Geometry			
System length y-axis	$L_{y,buc}$ =	2,10	m
System length z-axis	$L_{z,buc}$ =	2,10	m
System length v-axis	$L_{v,buc}$ =	2,10	m
System length x-axis	$L_{tk,buc}$ =	2,10	m
Member type		**Leg**	
Type bracing		Non staggered	
End conditions			
Begin		Continuous	
End		Continuous	
Restraint code TOWER		C4	

Bolted connection				
Bolt type		M30		
Bolt class		5.6		
Number of bolts per leg		8		(32 totaal)
Shearplane through		Thread		
Boltpattern		Zigzag		
Boltpattern (leg-member only)		Staggered		
End distance	e_1 =	60	mm	Ok
Separation distance //	p_1 =	100	mm	Ok
Separation distance ∣	p_2 =	115	mm	Ok
End distance ┘	e_2 =	60	mm	Ok
Double strap or single strap		Single		
Tie plate	b_p =	230	mm	OK
	t_p =	24	mm	OK
	e_2 =	40	mm	OK
A		19388	mm^2	
G		155,1	kg/m	
Partial safety factor	$\gamma_{f;Q}$ =	1,50		
Material factors	γ_{M0} =	1,00		
	γ_{M1} =	1,00		
	γ_{M2} =	1,25		
Shear strength bolt	$F_{v;b;Rd}$ =	134,6	kN	
Slenderness	λ_{max} = L / i	22	-	
Allowed:		120		**OK**
Bending due to vertical construction load				
$M_{y,Ed}$ = 1/4 F_{Ed} L_{pr} =		0,79	kNm	
U.C. =		**0,00**	**< 1,00 OK**	

Results stability

		$\lambda_{eff,rel}$	λ_{eff}	$\lambda_{eff,mod}$	χ_{buc}	η	$N_{b,Rd} = \eta\chi A f_y / \gamma_{M1}$	
$L_{y,buc}$ =	2,10 m	0,22	1,00 l	0,22	0,99	1	4530	0,92
$L_{z,buc}$ =	2,10 m	0,22	1,00 l	0,22	0,99	1	4530	0,92
$L_{v,buc}$ =	2,10 m	0,23	0,10+0,80	0,23	0,99	1	4507	0,92
$L_{tk,buc}$ =	2,10 m	0,65			0,81	1	3707	1,12

Bolted connection

Compression		F_{Rd} (kN)	U.C.	
Cross section angle	$F_{u;Rd}$ =	4556	0,91	
Cross section tie plate	$F_{u;Rd}$ =	5189	0,80	
Shear strength	$F_{v;Rd}$ =	4308	0,96	
Bearing strength	$F_{b;Rd}$ =	10508	0,39	
Combined effect	$F_{v;Rd}$ =	4308	0,96	elastisch

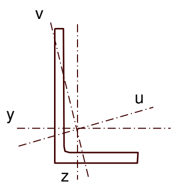
Tension		F_{Rd} (kN)	U.C.	
Net section angle	$F_{u;Rd}$ =	4329	0,77	
Net section tie plate	$F_{u;Rd}$ =	4902	0,68	
Block shear	$F_{u;Rd}$ =	8452	0,39	
Shear strength	$F_{v;Rd}$ =	4308	0,77	
Bearing strength	$F_{b;Rd}$ =	10241	0,32	
Combined effect	$F_{v;Rd}$ =	4308	0,77	elastisch

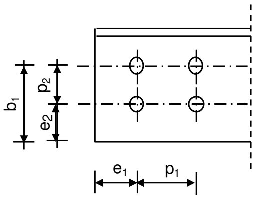
Angle check

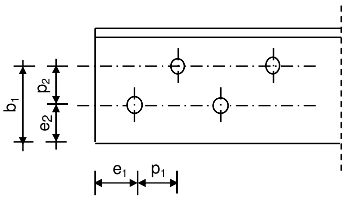
NEN-EN 1993-1-1 and EN 1993-3-1

Datum:	2021-03-29
Auteur:	TBR
Versie:	2,9

Member name	Group 115A	***Conclusion***			
Section	XEA 200x200x20	U.C.	(compression)	**1,08**	**Not OK**
		U.C.	(tension)	**0,85**	**< 1,0 OK**







Steel grade		**S235**	
Member loads			
Compressive force	N_{Ed} =	**3450**	kN
Tensile force		**-2760**	kN
Crossing diagonal loads			
Applicable:		**No**	
Min. tensile force diagonal 2		**1**	kN
Max. comp. force diagonal 1		**1**	kN
Position crossing diagonal y-axis		1,00	m
Construction loads			
Vertical construction load		**1,0**	kN
Member angle to horizontal		**0**	°
Bending around axis		y-axis	
Geometry			
System length y-axis	$L_{y,buc}$ =	1,73	m
System length z-axis	$L_{z,buc}$ =	1,73	m
System length v-axis	$L_{v,buc}$ =	1,73	m
System length x-axis	$L_{tk,buc}$ =	1,73	m
Member type		**Leg**	
Type bracing		Non staggered	
End conditions			
Begin		Continuous	
End		Continuous	
Restraint code TOWER		C4	

Bolted connection				
Bolt type		M30		
Bolt class		5.6		
Number of bolts per leg		7		(28 totaal)
Shearplane through		Thread		
Boltpattern		Zigzag		
Boltpattern (leg-member only)		Staggered		
End distance	e_1 =	60	mm	Ok
Separation distance //	p_1 =	100	mm	Ok
Separation distance ⊥	p_2 =	65	mm	Ok
End distance ⊥	e_2 =	60	mm	Ok
Double strap or single strap		Single		
Tie plate	b_p =	190	mm	OK
	t_p =	20	mm	OK
	e_2 =	40	mm	OK
A		15350	mm^2	
G		122,8	kg/m	
Partial safety factor	$\gamma_{f;Q}$ =	1,50		
Material factors	γ_{M0} =	1,00		
	γ_{M1} =	1,00		
	γ_{M2} =	1,25		
Shear strength bolt	$F_{v;b;Rd}$ =	134,6	kN	
Slenderness	λ_{max} = L / i	23	-	
Allowed:		120		**OK**
Bending due to vertical construction load				
$M_{y,Ed}$ = 1/4 F_{Ed} L_{pr} =		0,65	kNm	
U.C. =		**0,01**	**< 1,00 OK**	

Results stability

		$\lambda_{eff,rel}$	λ_{eff}	$\lambda_{eff,mod}$	χ_{buc}	η	$N_{b,Rd} = \eta\chi A f_y / \gamma_{M1}$	
$L_{y,buc}$ =	1,73 m	0,22	1,00 l	0,22	0,99	1	3580	0,96
$L_{z,buc}$ =	1,73 m	0,22	1,00 l	0,22	0,99	1	3580	0,96
$L_{v,buc}$ =	1,73 m	0,24	0,10+0,80	0,24	0,99	1	3556	0,97
$L_{tk,buc}$ =	1,73 m	0,51			0,88	1	3180	1,08

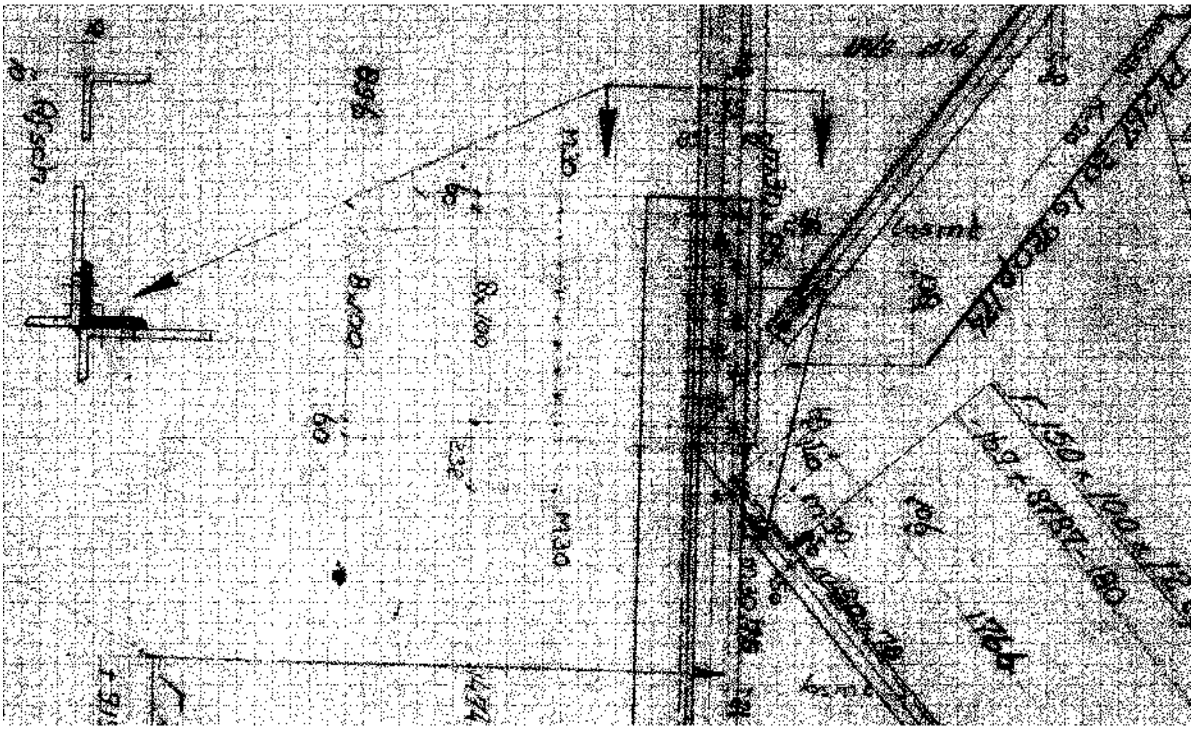
Bolted connection

Compression		F_{Rd} (kN)	U.C.	
Cross section angle	$F_{u;Rd}$ =	3607	0,96	
Cross section tie plate	$F_{u;Rd}$ =	3572	0,97	
Shear strength	$F_{v;Rd}$ =	3770	0,92	
Bearing strength	$F_{b;Rd}$ =	9194	0,38	
Combined effect	$F_{v;Rd}$ =	3770	0,92	elastisch

Tension		F_{Rd} (kN)	U.C.	
Net section angle	$F_{u;Rd}$ =	3294	0,84	
Net section tie plate	$F_{u;Rd}$ =	3256	0,85	
Block shear	$F_{u;Rd}$ =	7149	0,39	
Shear strength	$F_{v;Rd}$ =	3770	0,73	
Bearing strength	$F_{b;Rd}$ =	8590	0,32	
Combined effect	$F_{v;Rd}$ =	3770	0,73	elastisch

1.4 Connection (F)

The transition from XEA to EA-section is given additional attention. The increased force from the diagonal is not transferred by the lapping connection, so the bolted connection in the XEA-member does not need to be checked here.



Figuur 4 Transition from XEA200x200x20 to EA 250x250x22

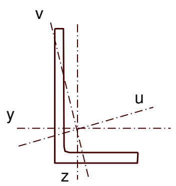
The result of the spreadsheet shows that buckling capacity is insufficient.

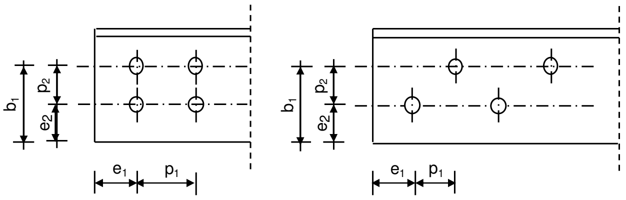
Angle check

NEN-EN 1993-1-1 and EN 1993-3-1

Datum:	2021-03-29
Auteur:	TBR
Versie:	2,9

Member name	**Group 114A**	***Conclusion***			
Section	**L250x22**	U.C.	(compression)	**1,04**	**Not OK**
		U.C.	(tension)	**0,82**	**< 1,0 OK**





Steel grade **S235**

Member loads

Compressive force	N_{Ed} =	**2410**	kN
Tensile force		**-1928**	kN

Crossing diagonal loads

Applicable:	**No**	
Min. tensile force diagonal 2	**1**	kN
Max. comp. force diagonal 1	**1**	kN
Position crossing diagonal y-axis	1,00	m

Construction loads

Vertical construction load	**1,0**	kN
Member angle to horizontal	**0**	°
Bending around axis	y-axis	

Geometry

System length y-axis	$L_{y,buc}$ =	1,73	m
System length z-axis	$L_{z,buc}$ =	1,73	m
System length v-axis	$L_{v,buc}$ =	1,73	m
System length x-axis	$L_{tk,buc}$ =	1,73	m
Member type		**Leg**	
Type bracing		Non staggered	

End conditions

Begin	Continuous
End	Continuous
Restraint code TOWER	C4

Bolted connection

Bolt type		M30		
Bolt class		5.6		
Number of bolts per leg		9		(18 totaal)
Shearplane through		Thread		
Boltpattern		Zigzag		
Boltpattern (leg-member only)		Staggered		
End distance	e_1 =	60	mm	Ok
Separation distance //	p_1 =	100	mm	Ok
Separation distance ⊥	p_2 =	65	mm	Ok
End distance ⊥	e_2 =	60	mm	Ok
Double strap or single strap		Single		
Tie plate	b_p =	240	mm	OK
	t_p =	22	mm	OK
	e_2 =	40	mm	OK

A		10559	mm^2
G		84,5	kg/m
Partial safety factor	$\gamma_{f;Q}$ =	1,50	
Material factors	γ_{M0} =	1,00	
	γ_{M1} =	1,00	
	γ_{M2} =	1,25	
Shear strength bolt	$F_{v;b;Rd}$ =	134,6	kN

Slenderness	λ_{max} = L / i	35	-
Allowed:		120	**OK**

Bending due to vertical construction load

$M_{y,Ed}$ = 1/4 F_{Ed} L_{pr} =	0,65	kNm
U.C. =	**0,01**	**< 1,00 OK**

Results stability

		$\lambda_{eff,rel}$	λ_{eff}	$\lambda_{eff,mod}$	χ_{buc}	η	$N_{b,Rd} = \eta\chi A f_y / \gamma_{M1}$	
$L_{y,buc}$ =	1,73 m	0,24	1,00 l	0,24	0,99	1	2446	0,99
$L_{z,buc}$ =	1,73 m	0,24	1,00 l	0,24	0,99	1	2446	0,99
$L_{v,buc}$ =	1,73 m	0,37	0,10+0,80	0,37	0,94	1	2323	1,04
$L_{tk,buc}$ =	- m	-			-	-	-	0,00

Bolted connection

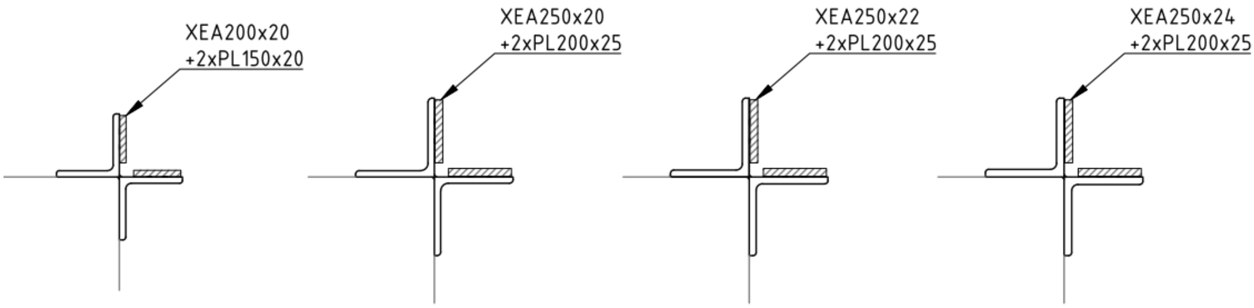
Compression		F_{Rd} (kN)	U.C.	
Cross section angle	$F_{u;Rd}$ =	2481	0,97	
Cross section tie plate	$F_{u;Rd}$ =	2482	0,97	
Shear strength	$F_{v;Rd}$ =	2424	0,99	
Bearing strength	$F_{b;Rd}$ =	6502	0,37	
Combined effect	$F_{v;Rd}$ =	2424	0,99	elastisch

Tension		F_{Rd} (kN)	U.C.	
Net section angle	$F_{u;Rd}$ =	2361	0,82	
Net section tie plate	$F_{u;Rd}$ =	2361	0,82	
Block shear	$F_{u;Rd}$ =	4929	0,39	
Shear strength	$F_{v;Rd}$ =	2424	0,80	
Bearing strength	$F_{b;Rd}$ =	6169	0,31	
Combined effect	$F_{v;Rd}$ =	2424	0,80	elastisch

2 REINFORCED SECTIONS

2.1 XEA-sections

The XEA-sections have too high over-utilisations to overcome by adding additional redundants. The solution that will be adopted is to retrofit the main leg with additional plates.



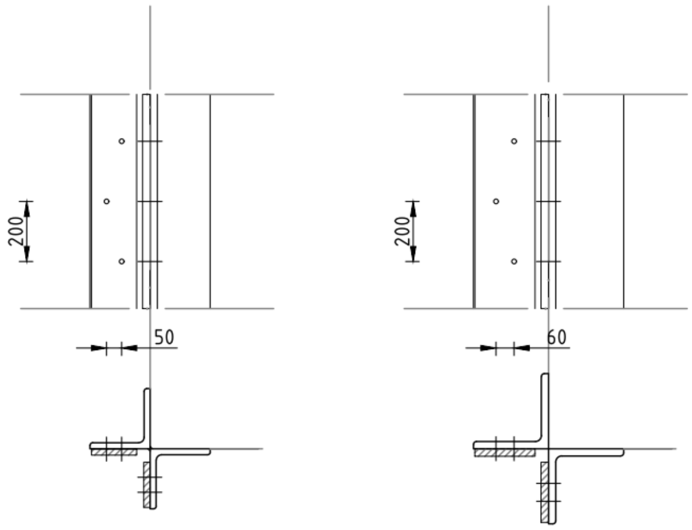
Figuur 5 Reinforced sections

For reason of continuity of forces, the entire height of the structure with XEA-sections needs to be modified with plates, except the top panel with XEA200x20 section.

The modified members have to fulfill the load level for verbouw 50 yrs.

With the same approach as before for the non-strengthened section, a composed section was chosen and calculated to have sufficient capacity for verbouw. All material is assumed to be S235, since it is coupled with existing material S235.

The section properties of the modified section have been determined with AxisVM. Refer to Appendix F. To increase the torsional moment of inertia, the plates need to be connected with bolt rows in a zig-zag pattern. To prevent corrosion, the bolt spacing should not be more than 200 mm.



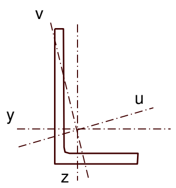
Figuur 6 principle of continuous bolted connection, left XEA200, right for XEA250

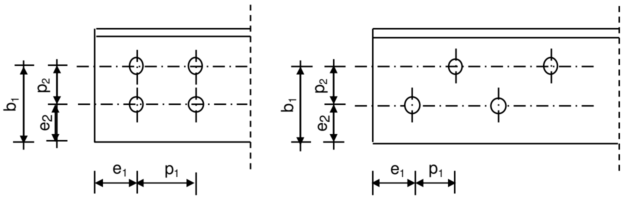
The spreadsheet output is provided after this page. Detailed study of the connections is not included since it is beyond the scope of this report.

Angle check — *NEN-EN 1993-1-1 and EN 1993-3-1*

Datum:	2021-03-29
Auteur:	TBR
Versie:	2,9

Member name	**Group 119B**	***Conclusion***				
Section	**XEA 250x24+PL200x25 bu**	U.C.	(compression)	**1,00**	**< 1,0 OK**	
		U.C.	(tension)	**0,73**	**< 1,0 OK**	





Steel grade		**S235**		
Member loads				
Compressive force	N_{Ed} =	**7030**	kN	
Tensile force		**-5624**	kN	
Crossing diagonal loads				
Applicable:		**No**		
Min. tensile force diagonal 2		**1**	kN	
Max. comp. force diagonal 1		**1**	kN	
Position crossing diagonal y-axis		1,00	m	
Construction loads				
Vertical construction load		**1,0**	kN	
Member angle to horizontal		**0**	°	
Bending around axis		y-axis		
Geometry				
System length y-axis	$L_{y,buc}$ =	4,10	m	
System length z-axis	$L_{z,buc}$ =	4,10	m	
System length v-axis	$L_{v,buc}$ =	4,10	m	
System length x-axis	$L_{tk,buc}$ =	2,05	m	
Member type		**Leg**		
Type bracing		Non staggered		
End conditions				
Begin		Continuous		
End		Continuous		
Restraint code TOWER		C4		

Bolted connection				
Bolt type		M30		
Bolt class		8.8		
Number of bolts per leg		9		(36 totaal)
Shearplane through		Thread		
Boltpattern		Zigzag		
Boltpattern (leg-member only)		Staggered		
End distance	e_1 =	60	mm	Ok
Separation distance //	p_1 =	100	mm	Ok
Separation distance ⊥	p_2 =	115	mm	Ok
End distance ⊥	e_2 =	60	mm	Ok
Double strap or single strap		Double		
Tie plate	b_p =	230	mm	OK
	t_p =	24	mm	OK
	e_2 =	40	mm	OK
A		32998	mm^2	
G		264,0	kg/m	
Partial safety factor	$\gamma_{f;Q}$ =	1,50		
Material factors	γ_{M0} =	1,00		
	γ_{M1} =	1,00		
	γ_{M2} =	1,25		
Shear strength bolt	$F_{v;b;Rd}$ =	215,4	kN	
Slenderness	λ_{max} = L / i	42	-	
Allowed:		120		**OK**
Bending due to vertical construction load				
$M_{y,Ed}$ = 1/4 F_{Ed} L_{pr} =		1,54	kNm	
U.C. =		**0,00**	**< 1,00 OK**	

Results stability

		$\lambda_{eff,rel}$	λ_{eff}	$\lambda_{eff,mod}$	χ_{buc}	η	$N_{b,Rd} = \eta\chi A f_y / \gamma_{M1}$	
$L_{y,buc}$ =	4,10 m	0,42	1,00 l	0,42	0,92	1	7115	0,99
$L_{z,buc}$ =	4,10 m	0,42	1,00 l	0,42	0,92	1	7115	0,99
$L_{v,buc}$ =	4,10 m	0,44	0,10+0,80	0,44	0,91	1	7046	1,00
$L_{tk,buc}$ =	2,05 m	0,42			0,92	1	7129	0,99

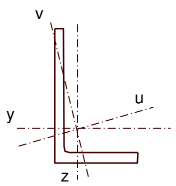
Bolted connection

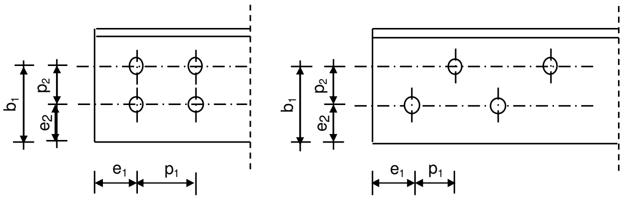
Compression		F_{Rd} (kN)	U.C.		Tension		F_{Rd} (kN)	U.C.	
Cross section angle	$F_{u;Rd}$ =	7755	0,91		*Net section angle*	$F_{u;Rd}$ =	7729	0,73	
Cross section tie plate	$F_{u;Rd}$ =	10378	0,68		*Net section tie plate*	$F_{u;Rd}$ =	9804	0,57	
Shear strength	$F_{v;Rd}$ =	15511	0,45		*Block shear*	$F_{u;Rd}$ =	11445	0,49	
Bearing strength	$F_{b;Rd}$ =	14185	0,50		*Shear strength*	$F_{v;Rd}$ =	15511	0,36	
Combined effect	$F_{v;Rd}$ =	14185	0,50	plastisch	*Bearing strength*	$F_{b;Rd}$ =	13866	0,41	
					Combined effect	$F_{v;Rd}$ =	13866	0,41	plastisch

Angle check NEN-EN 1993-1-1 and EN 1993-3-1

Datum: 2021-03-29
Auteur: TBR
Versie: 2,9

Member name	Group 118B	***Conclusion***			
Section	XEA 250x22+PL200x25 bu	U.C.	(compression)	**0,99**	**< 1,0 OK**
		U.C.	(tension)	**0,72**	**< 1,0 OK**





Steel grade		**S235**	
Member loads			
Compressive force	N_{Ed} =	**6615**	kN
Tensile force		**-5292**	kN
Crossing diagonal loads			
Applicable:		**No**	
Min. tensile force diagonal 2		**1**	kN
Max. comp. force diagonal 1		**1**	kN
Position crossing diagonal y-axis		1,00	m
Construction loads			
Vertical construction load		**1,0**	kN
Member angle to horizontal		**0**	°
Bending around axis		y-axis	
Geometry			
System length y-axis	$L_{y,buc}$ =	4,10	m
System length z-axis	$L_{z,buc}$ =	4,10	m
System length v-axis	$L_{v,buc}$ =	4,10	m
System length x-axis	$L_{tk,buc}$ =	2,05	m
Member type		**Leg**	
Type bracing		Non staggered	
End conditions			
Begin		Continuous	
End		Continuous	
Restraint code TOWER		C4	

Bolted connection				
Bolt type		M30		
Bolt class		8.8		
Number of bolts per leg		9		(36 totaal)
Shearplane through		Thread		
Boltpattern		Zigzag		
Boltpattern (leg-member only)		Staggered		
End distance	e_1 =	60	mm	Ok
Separation distance //	p_1 =	100	mm	Ok
Separation distance ⊥	p_2 =	115	mm	Ok
End distance ⊥	e_2 =	60	mm	Ok
Double strap or single strap		Double		
Tie plate	b_p =	230	mm	OK
	t_p =	22	mm	OK
	e_2 =	40	mm	OK
A		31182	mm^2	
G		249,5	kg/m	
Partial safety factor	$\gamma_{f;Q}$ =	1,50		
Material factors	γ_{M0} =	1,00		
	γ_{M1} =	1,00		
	γ_{M2} =	1,25		
Shear strength bolt	$F_{v;b;Rd}$ =	215,4	kN	
Slenderness	λ_{max} = L / i	42	-	
Allowed:		120		**OK**
Bending due to vertical construction load				
$M_{y,Ed}$ = 1/4 F_{Ed} L_{pr} =		1,54	kNm	
U.C. =		**0,00**	**< 1,00 OK**	

Results stability

		$\lambda_{eff,rel}$	λ_{eff}	$\lambda_{eff,mod}$	χ_{buc}	η	$N_{b,Rd} = \eta\chi Af_y / \gamma_{M1}$	
$L_{y,buc}$ =	4,10 m	0,42	1,00 l	0,42	0,92	1	6718	0,98
$L_{z,buc}$ =	4,10 m	0,42	1,00 l	0,42	0,92	1	6718	0,98
$L_{v,buc}$ =	4,10 m	0,44	0,10+0,80	0,44	0,91	1	6657	0,99
$L_{tk,buc}$ =	2,05 m	0,43			0,91	1	6684	0,99

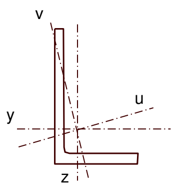
Bolted connection

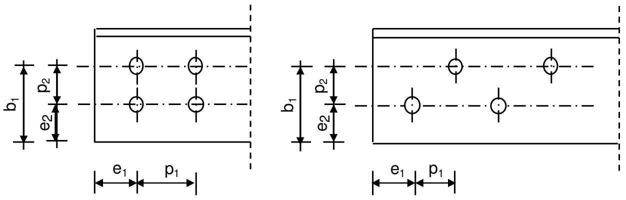
Compression		F_{Rd} (kN)	U.C.		Tension		F_{Rd} (kN)	U.C.	
Cross section angle	$F_{u;Rd}$ =	7328	0,90		*Net section angle*	$F_{u;Rd}$ =	7321	0,72	
Cross section tie plate	$F_{u;Rd}$ =	9513	0,70		*Net section tie plate*	$F_{u;Rd}$ =	8987	0,59	
Shear strength	$F_{v;Rd}$ =	15511	0,43		*Block shear*	$F_{u;Rd}$ =	10491	0,50	
Bearing strength	$F_{b;Rd}$ =	13003	0,51		*Shear strength*	$F_{v;Rd}$ =	15511	0,34	
Combined effect	$F_{v;Rd}$ =	13003	0,51	plastisch	*Bearing strength*	$F_{b;Rd}$ =	12710	0,42	
					Combined effect	$F_{v;Rd}$ =	12710	0,42	plastisch

Angle check NEN-EN 1993-1-1 and EN 1993-3-1

Datum:	2021-03-29
Auteur:	TBR
Versie:	2,9

Member name	Group 117B	***Conclusion***			
Section	XEA 250x20+PL200x25 bu	U.C.	(compression)	**0,96**	< 1,0 OK
		U.C.	(tension)	**0,69**	< 1,0 OK





				Bolted connection			
Steel grade		**S235**		Bolt type		M30	
				Bolt class		8.8	
Member loads				Number of bolts per leg		9	(36 totaal)
Compressive force	N_{Ed} =	**6010**	kN	Shearplane through		Thread	
Tensile force		**-4808**	kN	Boltpattern		Zigzag	
				Boltpattern (leg-member only)		Staggered	
Crossing diagonal loads							
Applicable:		**No**		End distance	e_1 =	60 mm	Ok
Min. tensile force diagonal 2		**1**	kN	Separation distance //	p_1 =	100 mm	Ok
Max. comp. force diagonal 1		**1**	kN	Separation distance ⊥	p_2 =	115 mm	Ok
Position crossing diagonal y-axis		1,00	m	End distance ⊥	e_2 =	60 mm	Ok
				Double strap or single strap		Double	
Construction loads				Tie plate	b_p =	230 mm	OK
Vertical construction load		**1,0**	kN		t_p =	22 mm	OK
Member angle to horizontal		**0**	°		e_2 =	40 mm	OK
Bending around axis		y-axis					
				A		29388 mm^2	
Geometry				G		235,1 kg/m	
System length y-axis	$L_{y,buc}$ =	4,20	m	Partial safety factor	$\gamma_{f;Q}$ =	1,50	
System length z-axis	$L_{z,buc}$ =	4,20	m	Material factors	γ_{M0} =	1,00	
System length v-axis	$L_{v,buc}$ =	4,20	m		γ_{M1} =	1,00	
System length x-axis	$L_{tk,buc}$ =	2,10	m		γ_{M2} =	1,25	
Member type		**Leg**		*Shear strength bolt*	$F_{v;b;Rd}$ =	215,4 kN	
Type bracing		Non staggered					
				Slenderness	λ_{max} = L / i	43 -	
End conditions				Allowed:		120	**OK**
Begin		Continuous					
End		Continuous		***Bending due to vertical construction load***			
Restraint code TOWER		C4		$M_{y,Ed}$ = 1/4 F_{Ed} L_{pr} =		1,58 kNm	
				U.C. =		**0,01**	< 1,00 OK

Results stability

		$\lambda_{eff,rel}$	λ_{eff}	$\lambda_{eff,mod}$	χ_{buc}	η	$N_{b,Rd} = \eta\chi A f_y / \gamma_{M1}$	
$L_{y,buc}$ =	4,20 m	0,44	1,00 l	0,44	0,91	1	6294	0,95
$L_{z,buc}$ =	4,20 m	0,44	1,00 l	0,44	0,91	1	6294	0,95
$L_{v,buc}$ =	4,20 m	0,46	0,10+0,80	0,46	0,90	1	6238	0,96
$L_{tk,buc}$ =	2,10 m	0,45			0,91	1	6252	0,96

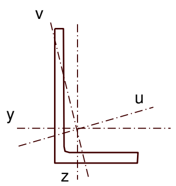
Bolted connection

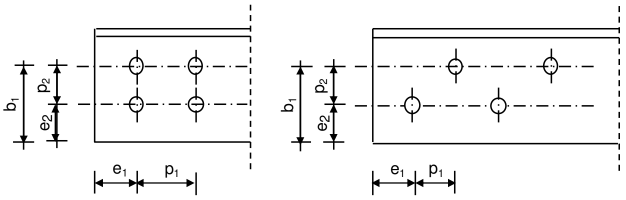
Compression		F_{Rd} (kN)	U.C.		Tension		F_{Rd} (kN)	U.C.	
Cross section angle	$F_{u;Rd}$ =	6906	0,87		*Net section angle*	$F_{u;Rd}$ =	6921	0,69	
Cross section tie plate	$F_{u;Rd}$ =	9513	0,63		*Net section tie plate*	$F_{u;Rd}$ =	8987	0,53	
Shear strength	$F_{v;Rd}$ =	15511	0,39		*Block shear*	$F_{u;Rd}$ =	9538	0,50	
Bearing strength	$F_{b;Rd}$ =	11821	0,51		*Shear strength*	$F_{v;Rd}$ =	15511	0,31	
Combined effect	$F_{v;Rd}$ =	11821	0,51	plastisch	*Bearing strength*	$F_{b;Rd}$ =	11555	0,42	
					Combined effect	$F_{v;Rd}$ =	11555	0,42	plastisch

Angle check NEN-EN1993-1-1 and EN1993-3-1

Datum: 2021-03-29
Auteur: TBR
Versie: 2,9

Member name	Group 115A	***Conclusion***			
Section	XEA 200x20+PL150x20 bu	U.C.	(compression)	**1,00**	**< 1,0 OK**
		U.C.	(tension)	**0,77**	**< 1,0 OK**





Steel grade **S235**

Member loads

Compressive force N_{Ed} = **4680** kN
Tensile force **-3744** kN

Crossing diagonal loads

Applicable: **No**
Min. tensile force diagonal 2 **1** kN
Max. comp. force diagonal 1 **1** kN
Position crossing diagonal y-axis 1,00 m

Construction loads

Vertical construction load **1,0** kN
Member angle to horizontal **0** °
Bending around axis y-axis

Geometry

System length y-axis $L_{y,buc}$ = 1,73 m
System length z-axis $L_{z,buc}$ = 1,73 m
System length v-axis $L_{v,buc}$ = 1,73 m
System length x-axis $L_{tk,buc}$ = 1,73 m
Member type **Leg**
Type bracing Non staggered

End conditions

Begin Continuous
End Continuous
Restraint code TOWER C4

Bolted connection

Bolt type M30
Bolt class 8.8
Number of bolts per leg 7 (28 totaal)
Shearplane through Thread
Boltpattern Zigzag
Boltpattern (leg-member only) Staggered

End distance	e_1 =	60	mm	Ok
Separation distance //	p_1 =	100	mm	Ok
Separation distance ∣	p_2 =	65	mm	Ok
End distance ⅃	e_2 =	60	mm	Ok
Double strap or single strap		Double		
Tie plate	b_p =	230	mm	OK
	t_p =	22	mm	OK
	e_2 =	40	mm	OK

A 21397 mm^2
G 171,2 kg/m

Partial safety factor $\gamma_{f;Q}$ = 1,50
Material factors γ_{M0} = 1,00
γ_{M1} = 1,00
γ_{M2} = 1,25
Shear strength bolt $F_{v;b;Rd}$ = 215,4 kN

Slenderness $\lambda_{max} = L / i$ 22 -
Allowed: 120 **OK**

Bending due to vertical construction load

$M_{y,Ed} = 1/4\ F_{Ed}\ L_{pr}$ = 0,65 kNm
U.C. = **0,00** **< 1,00 OK**

Results stability

		$\lambda_{eff,rel}$	λ_{eff}	$\lambda_{eff,mod}$	χ_{buc}	η	$N_{b,Rd} = \eta\chi A f_y / \gamma_{M1}$	
$L_{y,buc}$ =	1,73 m	0,22	1,00 l	0,22	0,99	1	4991	0,94
$L_{z,buc}$ =	1,73 m	0,22	1,00 l	0,22	0,99	1	4991	0,94
$L_{v,buc}$ =	1,73 m	0,23	0,10+0,80	0,23	0,99	1	4969	0,94
$L_{tk,buc}$ =	1,73 m	0,40			0,93	1	4658	1,00

Bolted connection

Compression		F_{Rd} (kN)	U.C.	
Cross section angle	$F_{u;Rd}$ =	5028	0,93	
Cross section tie plate	$F_{u;Rd}$ =	9513	0,49	
Shear strength	$F_{v;Rd}$ =	12064	0,39	
Bearing strength	$F_{b;Rd}$ =	9194	0,51	
Combined effect	$F_{v;Rd}$ =	9194	0,51	plastisch

Tension		F_{Rd} (kN)	U.C.	
Net section angle	$F_{u;Rd}$ =	4862	0,77	
Net section tie plate	$F_{u;Rd}$ =	8987	0,42	
Block shear	$F_{u;Rd}$ =	7149	0,52	
Shear strength	$F_{v;Rd}$ =	12064	0,31	
Bearing strength	$F_{b;Rd}$ =	8928	0,42	
Combined effect	$F_{v;Rd}$ =	8928	0,42	plastisch

The capacity of the L250x250x22 section of group 114A can be increased by adding redundants, one per panel. This is seen in the spreadsheet output below. The load level is for afkeurlevel.

Results of the calculations have been summarized in the table below.

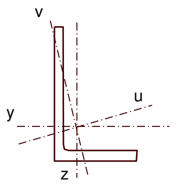
Section	Group	Lbuc	Connection	Load	Capacity	U.C.
XEA250x250x24	119B	4,1	C	7030	7129	0,99
XEA250x250x22	118A	4,1	C	6615	6683	0,99
XEA250x250x20	117A	4,2	C	6010	6252	0,96
XEA200x200x20	115A	1,73	E	4680	4658	1,00
L250x250x22	114A	0,85	F	2410	2481	0,97

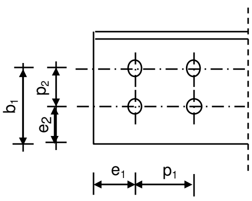
Angle check

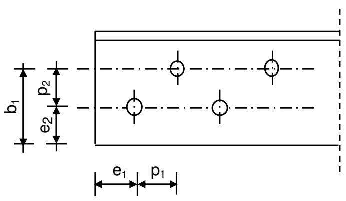
NEN-EN 1993-1-1 and EN 1993-3-1

Datum: 2021-03-29
Auteur: TBR
Versie: 2,9

Member name	**Group 114A**	***Conclusion***			
Section	**L250x22**	U.C.	(compression)	**0,97**	**< 1,0 OK**
		U.C.	(tension)	**0,82**	**< 1,0 OK**







Steel grade		**S235**	
Member loads			
Compressive force	N_{Ed} =	**2410**	kN
Tensile force		**-1928**	kN
Crossing diagonal loads			
Applicable:		**No**	
Min. tensile force diagonal 2		**1**	kN
Max. comp. force diagonal 1		**1**	kN
Position crossing diagonal y-axis		1,00	m
Construction loads			
Vertical construction load		**1,0**	kN
Member angle to horizontal		**0**	°
Bending around axis		y-axis	
Geometry			
System length y-axis	$L_{y,buc}$ =	0,85	m
System length z-axis	$L_{z,buc}$ =	0,85	m
System length v-axis	$L_{v,buc}$ =	0,85	m
System length x-asis	$L_{tk,buc}$ =	0,85	m
Member type		**Leg**	
Type bracing		Non staggered	
End conditions			
Begin		Continuous	
End		Continuous	
Restraint code TOWER		C4	

Bolted connection				
Bolt type		M30		
Bolt class		8.8		
Number of bolts per leg		9		(18 totaal)
Shearplane through		Thread		
Boltpattern		Zigzag		
Boltpattern (leg-member only)		Staggered		
End distance	e_1 =	60	mm	Ok
Separation distance //	p_1 =	100	mm	Ok
Separation distance ∣	p_2 =	65	mm	Ok
End distance ┘	e_2 =	60	mm	Ok
Double strap or single strap		Double		
Tie plate	b_p =	230	mm	OK
	t_p =	22	mm	OK
	e_2 =	40	mm	OK
A		10559	mm^2	
G		84,5	kg/m	
Partial safety factor	$\gamma_{f;Q}$ =	1,50		
Material factors	γ_{M0} =	1,00		
	γ_{M1} =	1,00		
	γ_{M2} =	1,25		
Shear strength bolt	$F_{v;b;Rd}$ =	215,4	kN	
Slenderness	λ_{max} = L / i	17	-	
Allowed:		120		**OK**
Bending due to vertical construction load				
$M_{y,Ed}$ = 1/4 F_{Ed} L_{pr} =		0,32	kNm	
U.C. =		**0,00**	**< 1,00 OK**	

Results stability

		$\lambda_{eff,rel}$	λ_{eff}	$\lambda_{eff,mod}$	χ_{buc}	η	$N_{b,Rd} = \eta\chi A f_y / \gamma_{M1}$	
$L_{y,buc}$ =	0,85 m	0,12	1,00 l	0,12	1,00	1	2481	0,97
$L_{z,buc}$ =	0,85 m	0,12	1,00 l	0,12	1,00	1	2481	0,97
$L_{v,buc}$ =	0,85 m	0,18	0,10+0,80	0,18	1,00	1	2481	0,97
$L_{tk,buc}$ =	- m	-			-	-	-	0,00

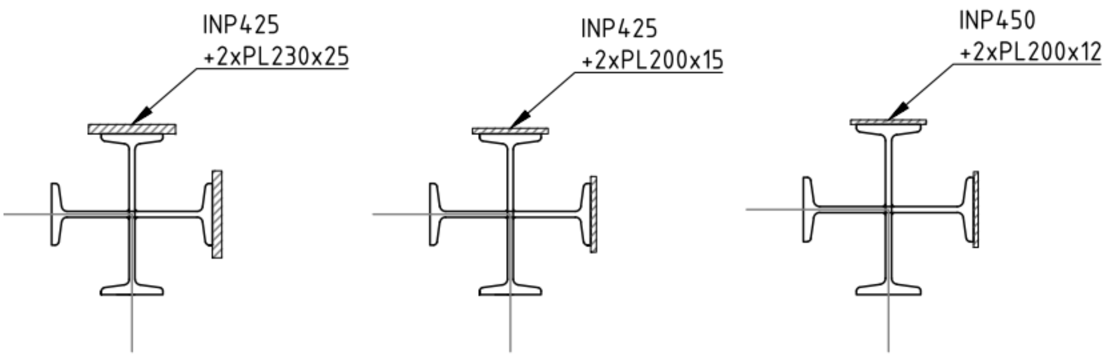
Bolted connection

Compression		F_{Rd} (kN)	U.C.	
Cross section angle	$F_{u;Rd}$ =	2481	0,97	
Cross section tie plate	$F_{u;Rd}$ =	4756	0,51	
Shear strength	$F_{v;Rd}$ =	7755	0,31	
Bearing strength	$F_{b;Rd}$ =	6502	0,37	
Combined effect	$F_{v;Rd}$ =	6502	0,37	plastisch

Tension		F_{Rd} (kN)	U.C.	
Net section angle	$F_{u;Rd}$ =	2361	0,82	
Net section tie plate	$F_{u;Rd}$ =	4493	0,43	
Block shear	$F_{u;Rd}$ =	4929	0,39	
Shear strength	$F_{v;Rd}$ =	7755	0,25	
Bearing strength	$F_{b;Rd}$ =	6355	0,30	
Combined effect	$F_{v;Rd}$ =	6355	0,30	plastisch

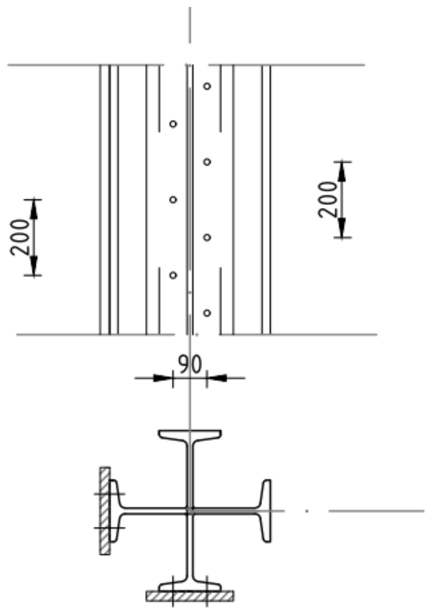
2.2 Reinforced section of INP425

The most heavily loaded part of the structure with section INP425 in the main leg (group 121B) has to be reinforced by adding plate material, see appendix F. In this section the check of the capacity is performed. Although the members directly below and above the INP425 member do not show overutilization, they have to be adjusted as well, to ascertain the continuous transfer of forces from non-reinforced to reinforced sections. These cross sections can be lighter since they do not have to comply to verbouwlevel.



Figuur 7 Reinforced INP425 sections

The load in the INP425 section of interest here is for verbouwlevel. The cross section properties of the section have been determined with AxisVM. The capacity is calculated below. The section is sufficient for verbouwlevel.



Figuur 8 Connection of plates to INP-members

Similarly to XEA-sections, the plates to INP-members should be connected with bolts with maximum spacing of 200 mm. Since two bolt rows exist, in both rows the distance should be less than 200 mm.

Onderwerp	Randstijl S+95	Toetsing		
Profiel	INP425x2+2PL230x25	U.C.	0,99	Voldoet

Normaalkracht

$N_{c;s;d}$ = 8310,0 kN

Staalsoort S235

Doorsnedeklasse: 1 Geldig

Gewicht 2,98 kN/m

Doorsnedegrootheden

I_y	I_z	I_v	A
$10^4 mm^4$	$10^4 mm^4$	$10^4 mm^4$	mm^4
65980	65980	61570	37974

I_t	I_{wa}
$10^4 mm^4$	mm^4
1499	3,32E+12

Geometrie

$l_{y;buc}$ =	2,50	m
$l_{z;buc}$ =	2,50	m
$l_{v;buc}$ =	2,50	m
l_{tk} =	2,50	m
Steun 1	Gaffel	
Steun 2	Gaffel	
Classificatie	Geschoord	

Doorsnedecapaciteit

$N_{pl;d} = A \times f_{y;d}$ = 8924 kN

Knikstabiliteit y-as

$\lambda_{y;rel} = l_{buc} / (i_y \times \lambda_{euler})$	0,20	-
$\chi_{y;buc}$ = (kromme b)	1,00	-
$N_{b,Rd} = \chi A f_y$ =	8918	kN
U.C.	**0,93**	Voldoet

Knikstabiliteit z-as

$\lambda_{z;rel} = l_{buc} / (i_z \times \lambda_{euler})$	0,20	-
$\chi_{z;buc}$ = (kromme b)	1,00	-
$N_{b,Rd} = \chi A f_y$ =	8918	kN
U.C.	**0,93**	Voldoet

Knikstabiliteit v-as

$\lambda_{z;rel} = l_{buc} / (i_z \times \lambda_{euler})$	0,21	-
$\lambda_{eff} = 0,10+0,80\ \lambda =$	0,27	-
$\chi_{z;buc}$ = (kromme b)	0,98	-
$N_{b,Rd} = \chi A f_y$ =	8710	kN
U.C.	**0,95**	Voldoet

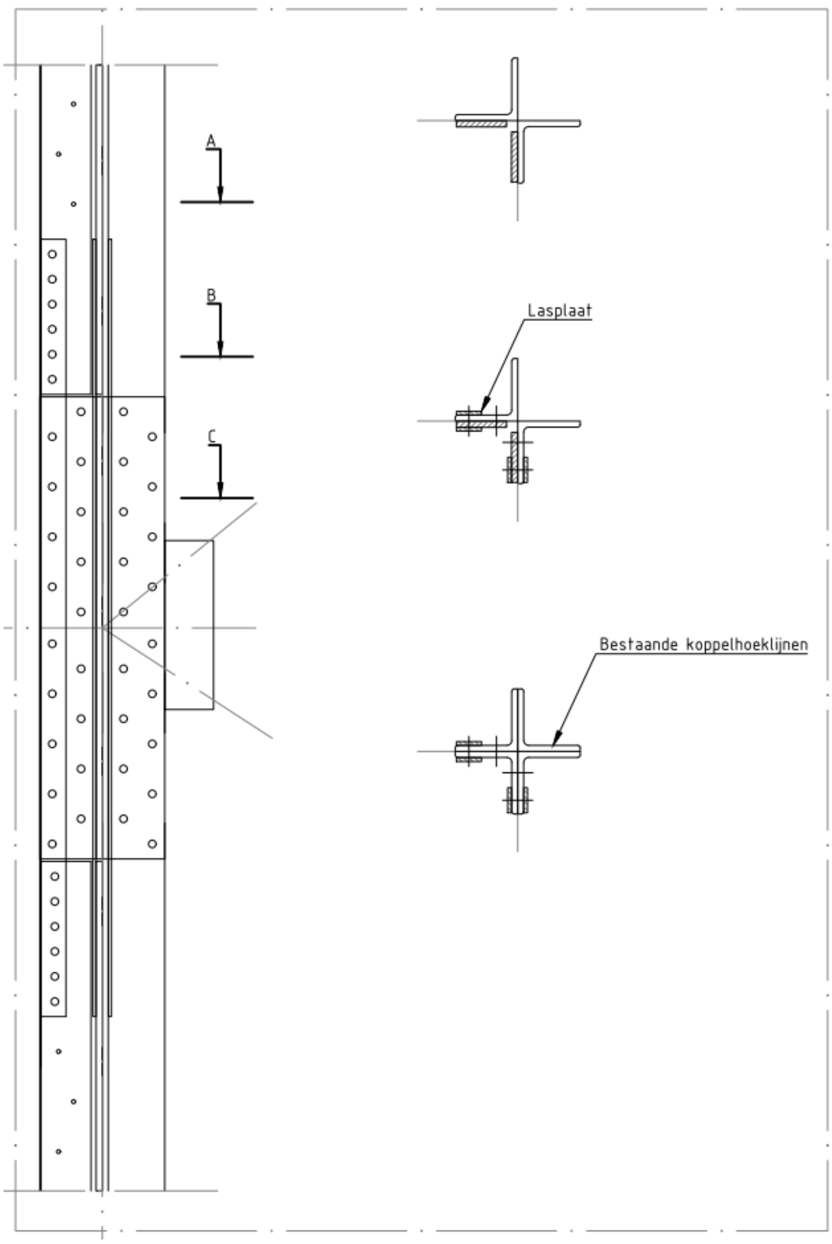
Torsieknikstabiliteit

$i_0^2 = i_y^2 + i_z^2 + y_0^2$ =	34750	mm^2
$\beta = 1 - y_0^2/i_0^2$ =	1,000	-
$F_{y;E} = \pi^2 EI_y / l_y^2$ =	218802	kN
$F_{t;E} = 1/i_0^2(G_d I_t + \pi^2 EI_{wa}/l_{t;buc})$ =	66658	kN
$F_{tk;E} = {}^1/_{2\beta}((F_{y;E}+F_{t;E})+\sqrt{(F_{y;E}+F_{t;E})^2-4\beta^2 F_{y;E}F_{t;E}})$		
$F_{tk;E}$ =	66658	kN
$\lambda_{tk;rel} = \sqrt{N_{Rd} / F_{tk;E}}$ =	0,37	-
$\chi_{z;buc}$ = (kromme b)	0,939	-
$N_{b,Rd} = \chi A f_y$ =	8383	kN
U.C.	**0,99**	Voldoet

2.3 Detail principles of the reinforced section

In this section explanation is given to the design principles of the retrofitted sections.

2.3.1 Splice joint XEA-sections



Figuur 9 Splice joint of XEA-profile

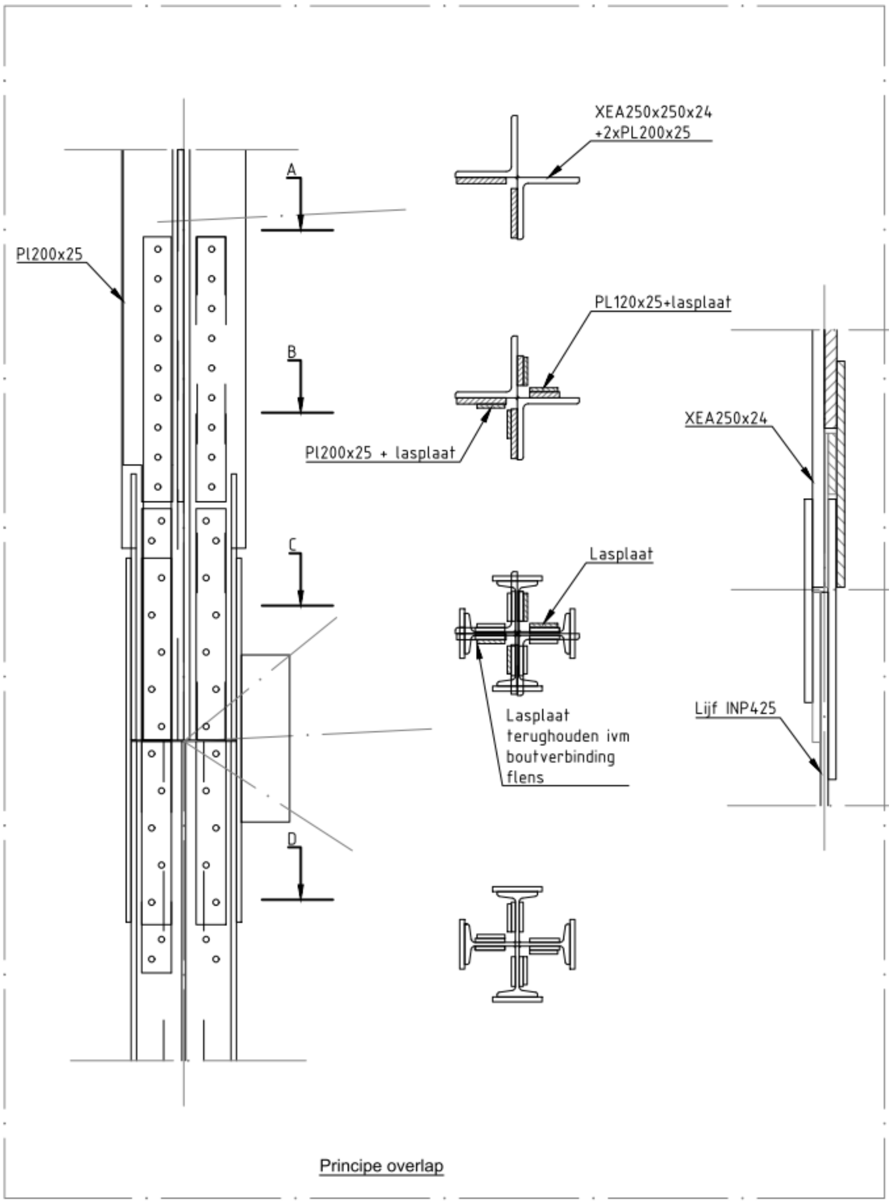
The plates in the XEA-retrofitted section should be coupled at the locations of the already present joints. Since the joints are equipped with M30-bolts, it is not possible to overlap both bolt rows with added lap plates of 25 mm thickness. It is proposed that the outer row is used with a double shear connection. In the connection the S355 strength can be used instead of the S235 in the check for stability. This allows to reduce the required cross section in the plate pairs. The center of gravity of the lap joint should coincide with center of gravity of the main section. This can be worked out further in detailing phase. The number of bolts should have more than adequate reserve to prevent slippage between plates as much as possible, since pre-tensioning is not possible.

2.3.2 Transition of XEA- to INP-section

At the height of 53,7 m the main leg changes to the INP-section. The INP does not need to be reinforced whereas the XEA-section on top of it is reinforced. This would cause an eccentric introduction of force on the INP-section if no measures would be taken to prevent this.

To solve this, the XEA-section is over the last 2 m before the INP starts, additionally reinforced at the otherwise unreinforced two inner flanges of the XEA-section. This results in a more centric distribution of force at the transition to INP-section. The additional plates will be coupled with plates that overlap and connect to the double shear lap plates of the web.

The joint itself does not have to fulfill the verbouw load level, which allows to reduce the cross section of the plates to currently present 113x16 in order to fit between the flanges and bolt shafts extending through the flange.

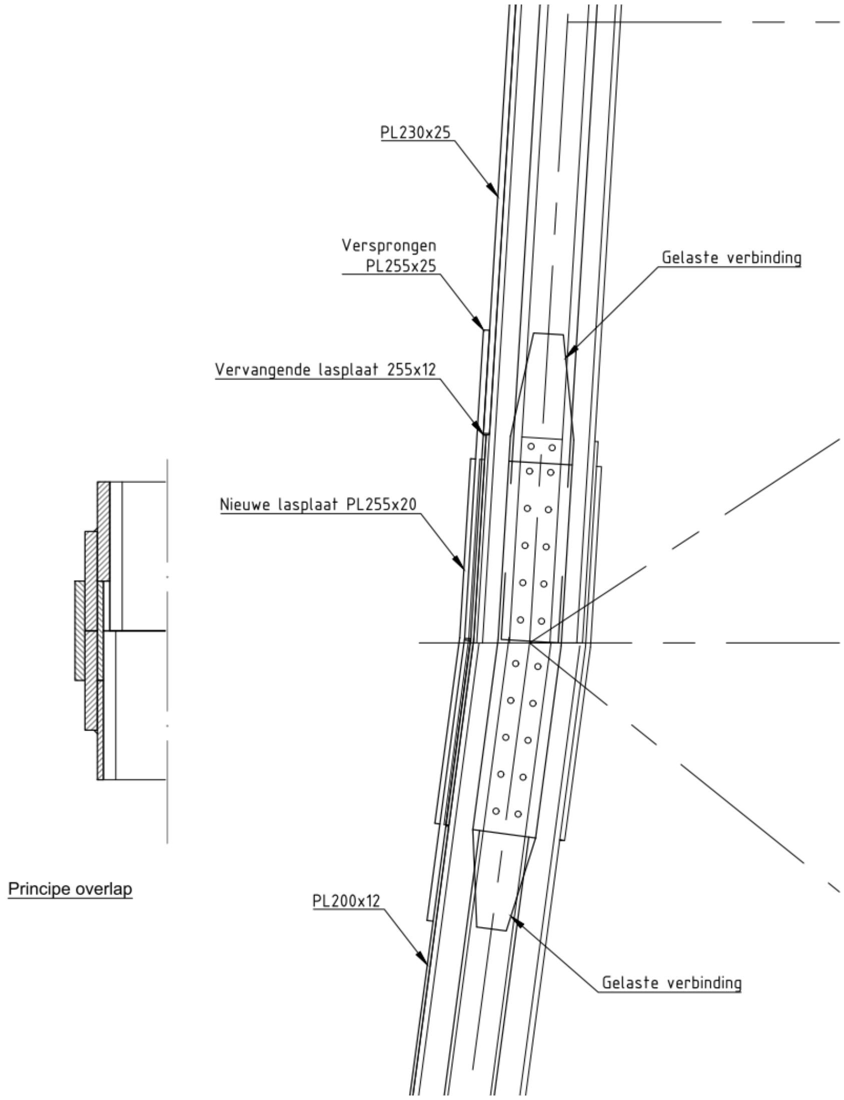


Figuur 10 Transition between XEA- and INP-section

2.3.3 Transition between INP425 and INP450

At the top of the hip structure at the inclination change, the section changes from INP425 to INP450. The INP425 section on top of the transition has to be reinforced with plates, whereas the section below it does not need to be changed, if strictly looked only at axial forces.

Alike the transition from XEA- to INP additional plates will be added in INP450 to smoothen out the difference of cross sections. The thickness of the plates is chosen in such a way that the height difference (12,5 mm each side) between INP425 and INP450 is overcome. To connect the plate with the actual lap plates, a second joint is needed. This joint should not cause any slippage between plates, otherwise the force flow towards the new plates is interrupted. Therefore, the connecting plates should be welded.



Figuur 11 Joint at transition between INP425 and INP450 section

The actual joint is composed of two plates, at the outside a plate of 255x20 (equal to present size), directly on the top of the flange is at the position of the 12 mm plate that is used to reinforce the INP450 section.

3 CONCLUSION

The main leg sections including their joints have been checked in this appendix for adequacy. The existing sections turn out to have insufficient capacity. For the joints, the bolted connections in XEA-sections and INP425 sections can be considered adequate. In the INP450 however, load level is slightly above their capacity.

Reinforced sections were developed since adding additional redundants did not increase capacity to the level needed. The reinforced sections are checked in the appendix showing that capacity is sufficient to full the design load of verbouwlevel. In the calculations the buckling length was used twice the distance between redundants, allowing for neglecting the insuffiency that is present in the strength of redundants. The one section of the main leg where redundant members were found to be useful, is included and turns out well.

As a third part of the appendix, the design ideas of the main joints in the reinforced tower leg were developed. In the detailing phase, these can be worked out further.

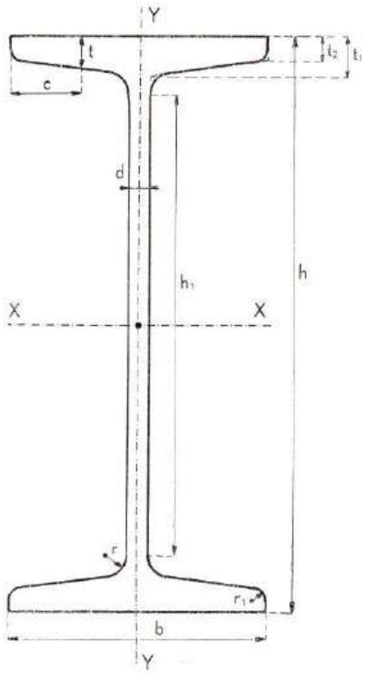
APPENDIX

- INP-Profiles
- AxisVM output of cross section propertie

Overgenomen uit “Gewalste profielen voor staalconstructies”

Min. van Verkeer en Waterstaat, 1949.

BALKSTAAL MET SMALLE FLENS



Benaderde waarden voor enkele profielgrootheden:

$F = b \cdot h - (b - d) \cdot (h - 2t)$

$I_x = {}^1/_{12} \{ b \cdot h^3 - (b - d) \cdot (h - 2t)^3 \}$

$I_y \; {}^1/_6 \, t \cdot b^3$

$i_x = 0{,}4\, h$

$i_y = 0{,}2\, b$

$k_x = 0{,}32\, h$

$k_y = 0{,}08\, b.$

WEST-EUROPESE BALKPROFIELEN MET SMALLE FLENS

(Duitse normaalprofielen)

De profielen worden aangeduid door het profielteken (I), de letters NP (Normaal Profiel) en een getal dat de hoogte van het profiel in cm aangeeft, bijv.:

I NP 20.

Bij profielen met afwijkende breedte-afmetingen wordt ook de lijfdikte vermeld.
Er bestaan vaste verhoudingen tussen de afmetingen van het normale profiel, n.l.:

$b = 0{,}40\ h + 10$ mm (voor $h \leq 250$ mm)
$d = 0{,}03\ h + 1{,}5$ mm (voor $h \leq 250$ mm)
$b = 0{,}30\ h + 35$ mm (voor $h \geq 250$ mm)
$d = 0{,}036\ h$ (voor $h \geq 250$ mm, uitgezonderd voor I NP 55)
$r = d$ $r_1 =$ ca $0{,}6\ d$ (uitgezonderd voor I NP 55)

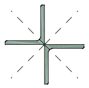
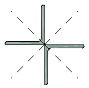
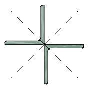
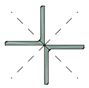
De helling van de binnenkant van de flens is 14% (= ca 1 : 7 = 7° 58′ 11″).
De gemiddelde dikte van de flens (t) wordt gewoonlijk gemeten op een afstand $c = \frac{1}{4}$ b. Met het oog op de te verwachten aanmaak van profielen met lijven, dunner en dikker dan die der normale profielen, is in deze tabellen hiervan afgeweken en de gemiddelde dikte t is aangegeven, gemeten op een afstand $\frac{1}{4}$ (b—d). Het verschil tussen beide waarden bedraagt 0,035 d.
De normale en gangbare profielen zijn aangegeven door gewone cijfers, de abnormale en weinig gangbare profielen zijn aangegeven door magere cijfers.

I NP	AFMETINGEN							F	G	x—x—as			y—y—as			I NP
	h	b	d	t	r	r_1	h_1			I_x	i_x	W_x	I_y	i_y	W_y	
8	**80**	**42**	**3,9**	**5,76**	**3,9**	**2,3**	**59**	**7,58**	**5,95**	**77,8**	**3,20**	**19,5**	**6,29**	**0,91**	**3,00**	**8**
8 max	80	47	8,9	5,76	3,9	2,3	59	11,58	9,09	99,1	2,93	24,8	9,17	0,89	3,90	8 max
9	90	46	4,2	6,15	4,2	2,5	67	9,00	7,07	117	3,61	26,0	8,78	1,00	3,82	9
9 max	90	51	9,2	6,15	4,2	2,5	67	13,5	10,6	147	3,30	32,7	12,4	0,96	4,87	9 max
10 min	100	49,5	4,0	6,64	4,5	2,7	75	10,1	7,95	166	4,05	33,2	11,8	1,08	4,75	10 min
10	**100**	**50**	**4,5**	**6,64**	**4,5**	**2,7**	**75**	**10,6**	**8,32**	**171**	**4,01**	**34,2**	**12,2**	**1,07**	**4,88**	**10**
10 max	100	55	9,5	6,64	4,5	2,7	75	15,6	12,2	212	3,69	42,3	16,6	1,03	6,06	10 max
11	110	54	4,8	7,03	4,8	2,9	83	12,3	9,66	239	4,41	43,5	16,2	1,15	6,00	11
11 max	110	59	9,8	7,03	4,8	2,9	83	17,8	14,0	294	4,06	53,4	21,7	1,10	7,35	11 max
12 min	120	57,3	4,4	7,52	5,1	3,1	92	13,3	10,5	317	4,87	52,8	20,5	1,24	7,17	12 min
12	**120**	**58**	**5,1**	**7,52**	**5,1**	**3,1**	**92**	**14,2**	**11,2**	**328**	**4,81**	**54,7**	**21,5**	**1,23**	**7,41**	**12**
12 max	120	63	10,1	7,52	5,1	3,1	92	20,2	15,9	400	4,45	66,7	28,3	1,19	8,98	12 max
13	130	62	5,4	7,91	5,4	3,2	100	16,1	12,6	436	5,20	67,1	27,5	1,31	8,87	13
13 max	130	67	10,4	7,91	5,4	3,2	100	22,6	17,7	528	4,83	81,2	35,6	1,25	10,6	13 max
14 min	140	65,2	4,9	8,40	5,7	3,4	109	17,1	13,4	554	5,69	79,2	33,7	1,40	10,3	14 min
14	**140**	**66**	**5,7**	**8,40**	**5,7**	**3,4**	**109**	**18,3**	**14,4**	**573**	**5,61**	**81,9**	**35,2**	**1,40**	**10,7**	**14**
14 max	140	71	10,7	8,40	5,7	3,4	109	25,3	19,9	686	5,21	98,0	44,8	1,33	12,7	14 max
15	150	70	6,0	8,79	6,0	3,6	117	20,4	16,0	735	6,00	98,0	43,9	1,47	12,5	15
15 max	150	75	11,0	8,79	6,0	3,6	117	27,9	21,9	875	5,60	117	55,3	1,41	14,8	15 max
16 min	160	73,1	5,4	9,28	6,3	3,8	125	21,4	16,8	903	6,50	113	52,4	1,57	14,3	16 min
16	**160**	**74**	**6,3**	**9,28**	**6,3**	**3,8**	**125**	**22,8**	**17,9**	**935**	**6,40**	**117**	**54,7**	**1,55**	**14,8**	**16**
16 max	160	79	11,3	9,28	6,3	3,8	125	30,8	24,2	1106	5,99	138	68,1	1,49	17,3	16 max
17	170	78	6,6	9,67	6,6	4,0	133	25,2	19,8	1167	6,80	137	66,6	1,63	17,1	17
17 max	170	83	11,6	9,67	6,6	4,0	133	33,7	26,5	1372	6,38	161	82,2	1,56	19,8	17 max
18 min	180	81	5,9	10,16	6,9	4,1	142	26,1	20,5	1395	7,32	155	77,9	1,73	19,2	18 min
18	**180**	**82**	**6,9**	**10,16**	**6,9**	**4,1**	**142**	**27,9**	**21,9**	**1446**	**7,20**	**161**	**81,3**	**1,71**	**19,8**	**18**
18 max	180	87	11,9	10,16	6,9	4,1	142	36,9	28,9	1689	6,77	188	99,5	1,64	22,8	18 max
19	190	86	7,2	10,55	7,2	4,3	150	30,6	24,0	1759	7,60	186	97,4	1,80	22,7	19
19 max	190	91	12,2	10,55	7,2	4,3	150	40,1	31,5	2045	7,14	215	118	1,71	26,0	19 max
20 min	200	88,9	6,4	11,04	7,5	4,5	159	31,2	24,5	2064	8,13	206	112	1,89	25,1	20 min
20	**200**	**90**	**7,5**	**11,04**	**7,5**	**4,5**	**159**	**33,5**	**26,3**	**2142**	**8,00**	**214**	**117**	**1,87**	**26,0**	**20**
20 max	200	95	12,5	11,04	7,5	4,5	159	43,5	34,1	2475	7,54	248	140	1,79	29,6	20 max

I NP	AFMETINGEN							F	G	x—x—as			y—y—as			I NP
	h	b	d	t	r	r_1	h_1			I_x	i_x	W_x	I_y	i_y	W_y	
21	210	94	7,8	11,43	7,8	4,7	167	36,4	28,6	2558	8,40	244	138	1,95	29,4	21
21 max	210	99	12,8	11,43	7,8	4,7	167	46,9	36,8	2945	7,92	280	164	1,87	33,2	21 max
22 min	220	96,9	7,0	11,92	8,1	4,9	175	37,1	29,1	2957	8,93	269	156	2,05	33,2	22 min
22	220	98	8,1	11,92	8,1	4,9	175	39,6	31,1	3060	8,80	278	162	2,02	33,1	22
22 max	220	103	13,1	11,92	8,1	4,9	175	50,6	39,7	3504	8,32	318	193	1,95	37,5	22 max
23	230	102	8,4	12,31	8,4	5,0	183	42,7	33,5	3605	9,21	314	189	2,10	37,1	23
23 max	230	107	13,4	12,31	8,4	5,0	183	54,2	42,5	4112	8,71	358	223	2,02	41,7	23 max
24 min	240	104,9	7,6	12,80	8,7	5,2	192	43,4	34,1	4112	9,73	343	212	2,21	40,5	24 min
24	240	106	8,7	12,80	8,7	5,2	192	46,1	36,2	4246	9,59	354	221	2,20	41,7	24
24 max	240	111	13,7	12,80	8,7	5,2	192	58,1	45,6	4822	9,11	402	259	2,11	46,4	24 max
25	250	110	9,0	13,29	9,0	5,4	200	49,7	39,0	4966	10,0	397	256	2,27	46,5	25
25 max	250	115	14,0	13,29	9,0	5,4	200	62,2	48,8	5617	9,50	449	300	2,19	52,2	25 max
26 min	260	111,8	8,2	13,77	9,4	5,6	208	50,2	39,4	5558	10,5	428	277	2,35	49,6	26 min
26	260	113	9,4	13,77	9,4	5,6	208	53,4	41,9	5744	10,4	442	288	2,32	51,0	26
26 max	260	118	14,4	13,77	9,4	5,6	208	66,3	52,1	6476	9,88	498	335	2,25	56,7	26 max
27	270	116	9,7	14,36	9,7	5,8	216	57,2	44,9	6630	10,8	491	326	2,40	56,2	27
27 max	270	121	14,7	14,36	9,7	5,8	216	70,7	55,5	7450	10,3	552	379	2,32	62,6	27 max
28 min	280	117,7	8,8	14,85	10,1	6,1	225	57,4	45,0	7337	11,3	524	350	2,47	59,4	28 min
28	280	119	10,1	14,85	10,1	6,1	225	61,1	48,0	7587	11,1	542	364	2,45	61,2	28
28 max	280	124	15,1	14,85	10,1	6,1	225	75,1	59,0	8502	10,6	607	420	2,36	67,8	28 max
29	290	122	10,4	15,34	10,4	6,3	233	64,9	51,0	8640	11,6	596	406	2,50	66,6	29
29 max	290	127	15,4	15,34	10,4	6,3	233	79,4	62,3	9656	11,0	665	465	2,42	73,2	29 max
30 min	300	123,6	9,4	15,82	10,8	6,5	241	64,8	50,9	9470	12,1	631	433	2,58	70,0	30 min
30	300	125	10,8	15,82	10,8	6,5	241	69,1	54,2	9800	11,9	653	451	2,56	72,2	30
30 max	300	130	15,8	15,82	10,8	6,5	241	84,1	66,0	10925	11,4	728	515	2,47	79,3	30 max
32 min	320	129,5	10,0	16,90	11,5	6,9	257	72,9	57,2	12084	12,9	755	533	2,70	82,3	32 min
32	320	131	11,5	16,90	11,5	6,9	257	77,8	61,1	12510	12,7	782	555	2,67	84,7	32
32 max	320	136	16,5	16,90	11,5	6,9	257	93,8	73,6	13875	12,2	867	633	2,60	93,0	32 max
34 min	340	135,4	10,6	17,87	12,2	7,3	274	81,2	63,8	15145	13,7	891	646	2,82	95,4	34 min
34	340	137	12,2	17,87	12,2	7,3	274	86,8	68,1	15695	13,5	923	674	2,80	98,4	34
34 max	340	142	17,2	17,87	12,2	7,3	274	104	81,5	17333	12,9	1020	770	2,72	108	34 max
36 min	360	141,2	11,2	19,05	13,0	7,8	290	90,5	71,0	18875	14,4	1049	782	2,94	111	36 min
36	360	143	13,0	19,05	13,0	7,8	290	97,1	76,2	19605	14,2	1089	818	2,90	114	36
36 max	360	148	18,0	19,05	13,0	7,8	290	115	90,4	21549	13,7	1197	924	2,83	125	36 max
38 min	380	147,1	11,8	20,02	13,7	8,2	306	99,8	78,3	23109	15,2	1216	931	3,06	127	38 min
38	380	149	13,7	20,02	13,7	8,2	306	107	84,0	24012	15,0	1264	975	3,02	131	38
38 max	380	154	18,7	20,02	13,7	8,2	306	126	98,9	26298	14,4	1384	1092	2,94	142	38 max
40 min	400	153	12,4	21,10	14,4	8,6	323	110	86,1	28106	16,0	1405	1106	3,18	145	40 min
40	400	155	14,4	21,10	14,4	8,6	323	118	92,6	29213	15,7	1461	1158	3,13	149	40
40 max	400	160	19,4	21,10	14,4	8,6	323	138	108	31880	15,2	1594	1295	3,06	162	40 max
42½ min	425	161	13,3	22,46	15,3	9,2	343	124	97,2	35645	17,0	1677	1375	3,33	171	42½ min
42½	425	163	15,3	22,46	15,3	9,2	343	132	104	36973	16,7	1740	1437	3,30	176	42½
42½ max	425	168	20,3	22,46	15,3	9,2	343	153	120	40172	16,2	1890	1600	3,23	191	42½ max
45 min	450	168	14,2	23,73	16,2	9,7	363	138	108	44271	17,9	1968	1654	3,46	197	45 min
45	450	170	16,2	23,73	16,2	9,7	363	147	115	45852	17,7	2037	1725	3,43	203	45
45 max	450	175	21,2	23,73	16,2	9,7	363	170	133	49649	17,1	2207	1915	3,36	219	45 max
47½ min	475	176	15,1	25,00	17,1	10,3	384	153	120	54619	18,9	2300	2005	3,62	228	47½ min
47½	475	178	17,1	25,00	17,1	10,3	384	163	128	56481	18,6	2378	2088	3,60	235	47½
47½ max	475	183	22,1	25,00	17,1	10,3	384	187	146	60946	18,1	2566	2300	3,51	252	47½ max
50 min	500	183	16,0	26,37	18,0	10,8	404	169	133	66563	19,8	2663	2384	3,75	261	50 min
50	500	185	18,0	26,37	18,0	10,8	404	180	141	68738	19,6	2750	2478	3,72	268	50
50 max	500	190	23,0	26,37	18,0	10,8	404	205	161	73946	19,0	2958	2728	3,65	287	50 max
55 min	550	198	17,0	29,34	19,8	11,9	444	201	158	96279	21,9	3501	3366	4,09	340	55 min
55	550	200	19,0	29,34	19,8	11,9	444	213	167	99184	21,6	3607	3488	4,02	349	55
55 max	550	205	24,0	29,34	19,8	11,9	444	241	189	106116	21,0	3858	3720	3,93	366	55 max
60	600	215	21,6	31,64	21,6	13,0	485	254	199	139000	23,4	4630	4670	4,30	434	60

11

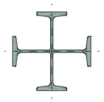
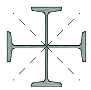
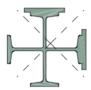
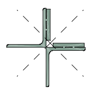
Profielen

	Naam	Tekening	Productie	Vorm	h [mm]	b [mm]	tw [mm]	tf [mm]	r_1 [mm]	r_2 [mm]	r_3 [mm]	Ax [mm^2]	Ay [mm^2]	Az [mm^2]
1	XEA L200x20		Ander	Eigen gedefinieerd	400,0	400,0	0	0	0	0	0	15349,90	6428,61	6428,51
2	XEA L250x20		Ander	Eigen gedefinieerd	500,0	500,0	0	0	0	0	0	19387,70	8119,15	8119,07
3	XEA L250x22		Ander	Eigen gedefinieerd	500,0	500,0	0	0	0	0	0	21219,70	8812,59	8812,60
4	XEA L250x24		Ander	Eigen gedefinieerd	500,0	500,0	0	0	0	0	0	23035,70	9485,77	9485,77

	Naam	Ix [mm^4]	Iy [mm^4]	Iz [mm^4]	Iyz [mm^4]	I_1 [mm^4]	I_2 [mm^4]	α [°]	Iω [mm^6]	$W_{1,el,t}$ [mm^3]	$W_{1,el,b}$ [mm^3]
1	XEA L200x20	2152964,000	1,06E+08	1,06E+08	−1,572E+07	1,218E+08	9,032E+07	45,00	2,975E+10	804103,200	804103,200
2	XEA L250x20	2747387,000	2,059E+08	2,059E+08	−2,455E+07	2,305E+08	1,814E+08	45,00	5,938E+10	1239425,000	1239425,000
3	XEA L250x22	3611307,000	2,272E+08	2,272E+08	−2,972E+07	2,569E+08	1,974E+08	45,00	7,811E+10	1371104,000	1371104,000
4	XEA L250x24	4635503,000	2,485E+08	2,485E+08	−3,539E+07	2,839E+08	2,131E+08	45,00	1,003E+11	1503799,000	1503799,000

	Naam	$W_{2,el,t}$ [mm^3]	$W_{2,el,b}$ [mm^3]	$W_{1,pl}$ [mm^3]	$W_{2,pl}$ [mm^3]	i_y [mm]	i_z [mm]	Hy [mm]	Hz [mm]	y_G [mm]	z_G [mm]	y_s [mm]	z_s [mm]	S.p.
1	XEA L200x20	638654,900	638654,900	1226168,000	1011961,000	83,1	83,1	400,0	400,0	200,0	200,0	0	0	1
2	XEA L250x20	1026019,000	1026019,000	1883722,000	1611360,000	103,1	103,1	500,0	500,0	250,0	250,0	0	0	1
3	XEA L250x22	1116918,000	1116918,000	2086977,000	1759861,000	103,5	103,5	500,0	500,0	250,0	250,0	0	0	1
4	XEA L250x24	1205463,000	1205463,000	2292314,000	1905783,000	103,9	103,9	500,0	500,0	250,0	250,0	0	0	1

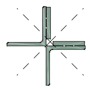
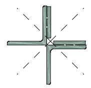
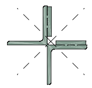
Profielen

	Naam	*Tekening*	*Productie*	*Vorm*	*h [mm]*	*b [mm]*	*tw [mm]*	*tf [mm]*	*r_1 [mm]*	*r_2 [mm]*	*r_3 [mm]*	*Ax [mm^2]*	*Ay [mm^2]*	*Az [mm^2]*
5	INP425		Ander	Eigen gedefinieerd	425,0	425,0	0	0	0	0	0	26474,12	6961,37	6961,31
6	INP450		Ander	Eigen gedefinieerd	450,0	450,0	0	0	0	0	0	29190,77	7773,54	7773,97
7	INP425+PL230x25		Ander	Eigen gedefinieerd	450,0	450,0	0	0	0	0	0	37974,11	7379,82	7387,21
8	XEA250x20+PL200x25 bu		Ander	Eigen gedefinieerd	500,0	500,0	0	0	0	0	0	29515,70	8222,01	8227,97

	Naam	*Ix [mm^4]*	*Iy [mm^4]*	*Iz [mm^4]*	*Iyz [mm^4]*	*I_1 [mm^4]*	*I_2 [mm^4]*	*α [°]*	*Iω [mm^6]*	*$W_{1,el,t}$ [mm^3]*	*$W_{1,el,b}$ [mm^3]*
5	INP425	4285422,000	3,871E+08	3,871E+08	0	3,871E+08	3,871E+08	0	1,119E+12	1821837,000	1821837,000
6	INP450	5169170,000	4,751E+08	4,751E+08	−480,779	4,751E+08	4,751E+08	45,00	1,483E+12	2167457,000	2167456,000
7	INP425+PL230x25	1,499E+07	6,598E+08	6,598E+08	−4,408E+07	7,039E+08	6,157E+08	45,00	3,32E+12	2823940,000	2823940,000
8	XEA250x20+PL200x25 bu	7512729,000	3,084E+08	3,084E+08	−2,556E+07	3,339E+08	2,828E+08	45,00	2,206E+11	1795847,000	1795847,000

	Naam	*$W_{2,el,t}$ [mm^3]*	*$W_{2,el,b}$ [mm^3]*	*$W_{1,pl}$ [mm^3]*	*$W_{2,pl}$ [mm^3]*	*i_y [mm]*	*i_z [mm]*	*Hy [mm]*	*Hz [mm]*	*y_G [mm]*	*z_G [mm]*	*y_s [mm]*	*z_s [mm]*	*S.p.*
5	INP425	1821837,000	1821837,000	2361893,000	2361893,000	120,9	120,9	425,0	425,0	212,5	212,5	0	0	1
6	INP450	2167435,000	2167468,000	3385217,000	3385212,000	127,6	127,6	450,0	450,0	225,0	225,0	0	0	1
7	INP425+PL230x25	3062193,000	2404521,000	4741041,000	4049625,000	131,8	131,8	450,0	450,0	246,6	246,6	−26,4	−26,4	1
8	XEA250x20+PL200x25 bu	1840364,000	1312765,000	2819536,000	2390326,000	102,2	102,2	500,0	500,0	277,3	277,3	−33,7	−33,7	1

Profielen

	Naam	Tekening	Productie	Vorm	h [mm]	b [mm]	tw [mm]	tf [mm]	r_1 [mm]	r_2 [mm]	r_3 [mm]	Ax [mm^2]	Ay [mm^2]	Az [mm^2]
9	XEA250x22+PL200x25 bu		Ander	Eigen gedefinieerd	500,0	500,0	0	0	0	0	0	31309,90	8884,14	8887,93
10	XEA250x24+PL200x25 bu		Ander	Eigen gedefinieerd	500,0	500,0	0	0	0	0	0	33125,90	9566,94	9570,99
11	XEA200x20+PL150x20 bu		Ander	Eigen gedefinieerd	400,0	400,0	0	0	0	0	0	21397,58	6524,58	6528,12

	Naam	Ix [mm^4]	Iy [mm^4]	Iz [mm^4]	Iyz [mm^4]	I_1 [mm^4]	I_2 [mm^4]	α [°]	Iω [mm^6]	$W_{1,el,t}$ [mm^3]	$W_{1,el,b}$ [mm^3]
9	XEA250x22+PL200x25 bu	8640465,000	3,32E+08	3,32E+08	−2,958E+07	3,616E+08	3,024E+08	45,00	2,562E+11	1921196,000	1921196,000
10	XEA250x24+PL200x25 bu	1E+07	3,544E+08	3,544E+08	−3,412E+07	3,885E+08	3,203E+08	45,00	3E+11	2049217,000	2049217,000
11	XEA200x20+PL150x20 bu	4514794,000	1,487E+08	1,487E+08	−1,519E+07	1,639E+08	1,336E+08	45,00	8,141E+10	1079665,000	1079665,000

	Naam	$W_{2,el,t}$ [mm^3]	$W_{2,el,b}$ [mm^3]	$W_{1,pl}$ [mm^3]	$W_{2,pl}$ [mm^3]	i_y [mm]	i_z [mm]	Hy [mm]	Hz [mm]	y_G [mm]	z_G [mm]	y_s [mm]	z_s [mm]	S.p.
9	XEA250x22+PL200x25 bu	1939783,000	1418213,000	3026721,000	2560065,000	103,0	103,0	500,0	500,0	275,8	275,8	−32,0	−32,0	1
10	XEA250x24+PL200x25 bu	2028705,000	1516444,000	3231897,000	2725759,000	103,4	103,4	500,0	500,0	274,4	274,4	−30,5	−30,5	1
11	XEA200x20+PL150x20 bu	1055723,000	796631,400	1695276,000	1428152,000	83,4	83,4	400,0	400,0	218,5	218,5	−23,4	−23,4	1

Naam: Doorsnede naam; **Productie:** Productieproces; **Vorm:** Profiel; **h:** Doorsnede hoogte; **b:** Doorsnede breedte; **tw:** Lijfdikte; **tf:** Flensdikte; **r_1, r_2, r_3:** Afrondingswaarde; **Ax:** Doorsnede-oppervlak; **Ay, Az:** Afschuivingsoppervlak; **Ix:** Torsietraagheidsmoment; **Iy, Iz:** Buigtraagheidsmoment; **Iyz:** Centrifugaal traagheidsmoment; **I_1, I_2:** Hoofdbuigtraagheidsmoment; **α:** Hoofdrichtingen; **Iω:** Krommingsconstante; **$W_{1,el,t}$, $W_{1,el,b}$, $W_{2,el,t}$, $W_{2,el,b}$:** Elasticiteit modulus; **$W_{1,pl}$, $W_{2,pl}$:** Plasticiteit modulus; **i_y, i_z:** Traagheidsstraal; **Hy:** Afmeting in lokale Y-richting; **Hz:** Afmeting in lokale Z-richting; **y_G:** Y-coördinaat van het zwaartepunt; **z_G:** Z-coördinaat van het zwaartepunt; **y_s:** Y-coördinaat van het afschuivingsmiddelpunt (torsie); **z_s:** Z-coördinaat van het afschuivingsmiddelpunt (torsie); **S.p.:** Spanningspunten;

NET SECTION CAPACITY IMPROVEMENT

Top cross arm

The improvement of net section capacity is required on the following members of the top cross arm of tower 12 and 13:

- P415
- P416/ 417
- P7

The figures below depict the locations where the net section modification is required and the proposed bolt arrangement. New bolts are depicted in red and existing bolts in green.

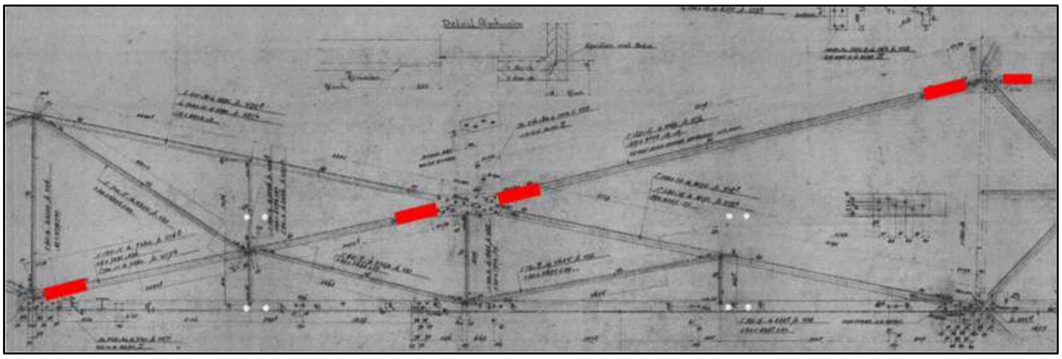


Figure D.1 Locations requiring net section capacity modification

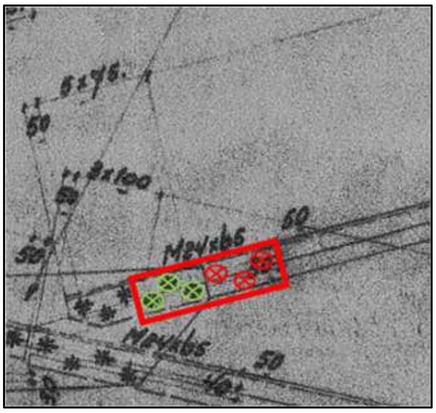


Figure D.2 Proposed positions of bolts for the net section capacity modification

Force in the member should ultimately be less than net section capacity of 346.4 kN:

Force in member P415 under afkeur loads = 493.84 kN

Assume plate dimensions are 120 mm width x 12 mm thick

Cross-sectional area of the plate = 1440 mm^2

Cross-sectional area of member P415 (over which the force acts) = (120 + 60) x 11 = 1980 mm^2

Total cross-sectional area = 1440 + 1980 = 3420 mm^2

Force on the plate = 1440/3420 x 493.84 = 207.93 kN

Force in the member = 493.84 – 207.93 = 285.91 < 346.40 kN **(member fulfils afkeur loads)**

Calculation of PLS Tower override value (afkeur):

1980/3420 x F = 346.40

F = 598.33 kN

Check bearing capacity of plate:

Assume end distance of last bolt = 50 mm, short edge distance of last bolt = 40 mm and S235 steel.

α_d = 50/(3 x 26) = 0.64 (end bolt), α_d = 150/(3 x 26) - 0.25 = 1.67 (inner bolt)

k_1 = min (2.8 x (40/26) – 1.7; 2.5) = 2.5

Bearing capacity = 2.5 x 0.64 x 360 x 24 x 12 / 1.25 = 132.71 kN > 207.93/3 = 69.31 kN **(plate has sufficient thickness)**

Total bearing cap = 132.71 x 3 = 398.13 kN

Check net section capacity of plate:

Assume similar bolt spacing as the member

A_{net1} = 120 x 12 – 26 x 12 = 1128 mm^2

A_{net2} = 120 x 12 – 2 x 26 x 12 + (75^2/ (4 x 30)) x 12 = 1378.5 mm^2

Net section capacity = 0.9 x 1128 x 360 / 1.25 = 292.38 kN > 207.93 kN **(net section capacity is sufficient)**

Check plate fulfils verbouw:

Force in the member due to verbouw loads = 562.8 kN

Force in the plate = 1440/3420 x 562.8 = 236.97 kN

236.97 < 292.38 & 398.13 **(plate fulfils verbouw)**

Crossing diagonals

Members P149 and P150 exhibit shear and net section failure at the afkeur level. To mitigate against failure, a strengthening proposal using a plate was developed. The figures below show the locations where the plates are to be installed. For detailed drawings of the joint, refer to Appendix E.

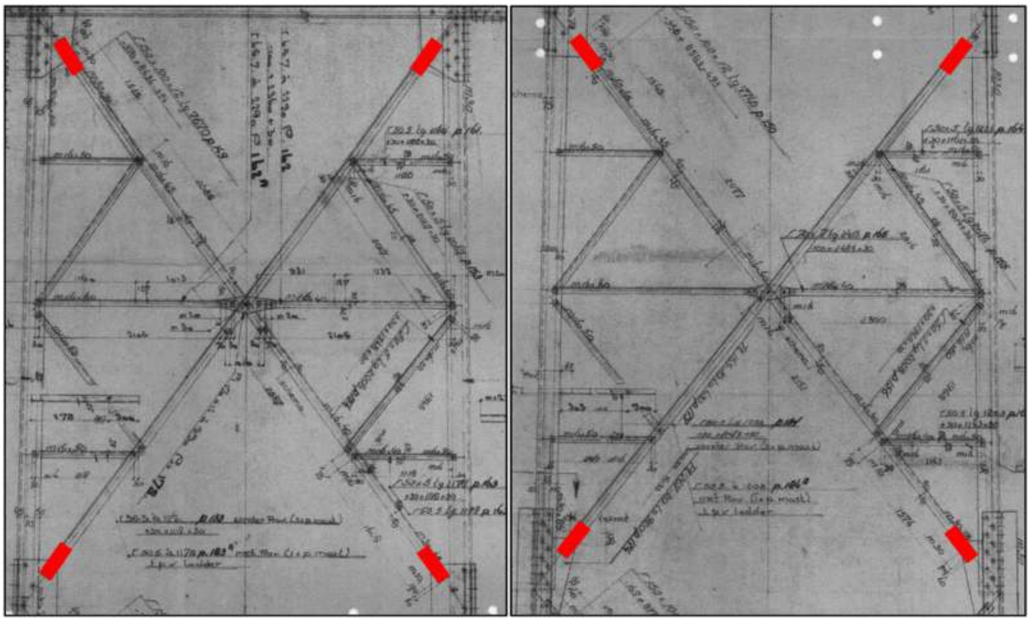


Figure D.3 Joints requiring strengthening on P149 (left) and P150 (right)

Table D.1 summarises the forces obtained from PLS Tower which were used to design the joint.

Table D.1 Forces on P149 and P150

Member label	Afkeur loads (kN)		Verbouw loads (kN)	
	Tension	Compression	Tension	Compression
P149	256	283	355	384
P150	266	262	364	361

Check shear capacity of the joint:

Capacity of 2 x M30-8.8 (double shear) = 215.42 x 4 = 861.68 kN > 384 kN (**shear capacity of joint is ok**)

Check force in the plate:

Maximum force in member under verbouw loads = 384 kN

Assume plate dimensions are 100 mm width x 12 mm thick

Cross-sectional area of the plate = 1200 mm^2

Cross-sectional area of member (over which the force acts) = (100 + 50) x 12 = 1800 mm^2

Total cross-sectional area = 1200 + 1800 = 3000 mm^2

Force on the plate = 1200/3000 x 384 = 153.6 kN

Check bearing capacity of the plate:

Assume bolt end distance on plate = 60 mm, bolt short edge distance on plate = 50 mm and S235 steel.

α_d = 60/(3 x 33) = 0.606 (end bolt), α_d = 100/(3 x 33) - 0.25 = 0.76 (inner bolt)

k_1 = min (2.8 x (50/33) – 1.7; 2.5) = 2.5

Bearing capacity = 2.5 x 0.606 x 360 x 30 x 12 / 1.25 = 157.1 kN > 153.6/2 kN **(bearing capacity is sufficient)**

Check net section capacity of the plate:

A_{net} = 1200 – 33 x 12 = 804 mm^2

Net section capacity = 0.9 x 804 x 360 / 1.25 = 208.40 kN> 153.6 kN **(net section capacity is sufficient)**

Check if member has sufficient net section capacity under afkeur loads:

Force in the member = 1800/3000 x 266 = 159.6 kN

Net section capacity of the member = 250.23 > 159.6 **(member has sufficient capacity)**

Calculate override value for PLS Tower:

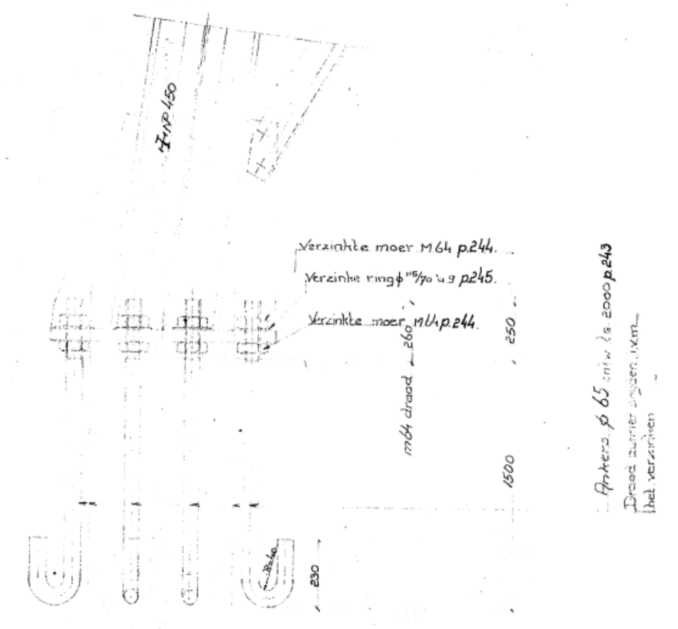
1800/3000 x F = 250.23

F = 417.05 kN

ANCHORS S+95

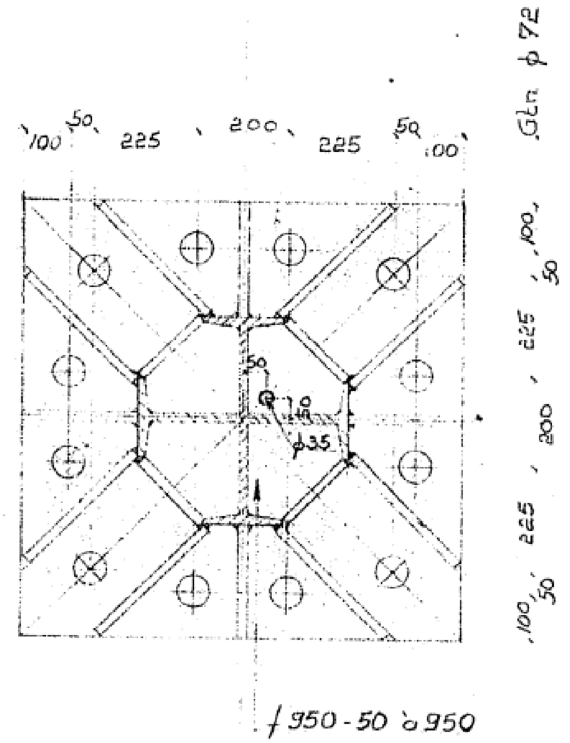
12 anchor bolts M64 have been applied. The figures below are used of tower structure S+95. The tower legs are connected to the foundation with a foot plate 950x950x50 mm and 12 anchors with diameter 65 mm.

De anchor rods are connected to a horizontal rod “schieter” which allows for distribution of the tensile force to the concrete.



Figuur 1 Anchor detail

Figuur 2 Picture of foot detail tower 49 (similar to tower 12 and 13)



Figuur 3 Voetplaat

Loads

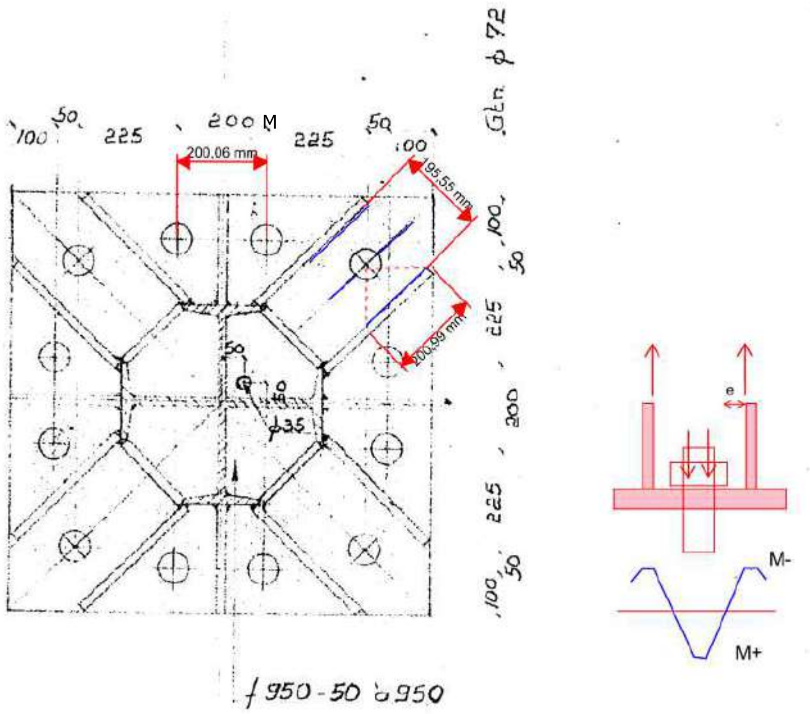
The loads coming from the tower are based on S+95 structure:

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	ULS 1a_135	-823	785	**5882**	-27	-1137	-28	5985
Max. tension	ULS 1a_0,9_0,9_135	-625	587	**-4530**	27	857	3	-4610
Max. pos. torsie	ULS 1a_0,9_0,9_135	215	99	1201	**82**	-222	4	1222
Max. neg. torsie	ULS 1a_0,9_0,9_135	32	-84	48	**-83**	-37	-28	49
Comb. tension+torsie	ULS 1a_0,9_0,9_45	625	587	**-4530**	**-27**	857	3	-4610

Foot plate and anchors

The strength of the foot plate will be determined assuming a set of horizontal yield lines across, one through the hole for the anchor, the second along the length of the stiffener. Refer to figure on next page.



Figuur 4 Scheme for check of foot plate

The eccentricity is taken as half of the half span between the stiffeners: 50 mm, since the bending moment changes sign halfway the distance between bolt and stiffener, refer to figure.

The effective width assuming a 45° spread used is equal to 200 mm.

In the spreadsheet the anchor bolts and foot plate have been checked. The concrete strength is assumed to be equal or more than C20/25. This assumption is higher than what would be derived for old designation K225 but has been verified by field investigation[1]. The foot plate is embedded in concrete. The anchor bolts will not be loaded by bending.

The footplate fulfills the required strength. The bending capacity of the foot plate has the highest utilisation. See the output:

U.C. = 378 / 588 = 0,82 ≤ 1,00 OK

Conclusion: The foot plates of tower structure S+95 have sufficient strength.

Compressive stress on concrete

The compressive stress directly below the footplate has additionally been checked.

Effective spread in the plate at each side of each stiffener:

$l_s = t\sqrt{(f_{y;d} / 3f'_{j;u;d})} = 50 \times \sqrt{(355 / 3 * 13,33)} = 148$ mm

The distance between stiffeners is 200 mm, which is far less than 2 x 148 mm, thus the effective spread lengths overlap. That means the complete surface area underneath the foot plate is effective.

The compression stress is equal to: $5882 / 0,95^2 \times 10^{-3} = 6,5$ N/mm^2

U.C. = 6,5 / 13,33 = 0,49 ≤ 1,00 OK

[1] Rapport Bejan Bouw en Betontechniek d.d. 4-11-2020; 200152A-003 Krimpen aan den IJssel - Geertruidenberg v1.0.pdf

Project:	Krimpen - Geertruidenberg 380	Date:	8-4-2021
		Version:	2.6

Anchors

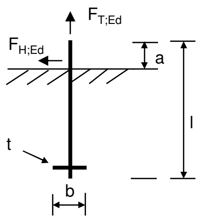
NEN-EN 1992-1-1 and 1993-1-8 with NA

CUR-BmS 10

Subject:	**S+95**	**Checks:**		
		Anchor bolt to tension	0,64	**OK**
		Anchor bolt to shear	0,35	**OK**
		Dowel ("schieter")	0,82	**OK**

Inputs

Anchor diameter		**M64**	
Achor quality		**4.6**	
Thread		Cut	
Anchor length	l =	1300	mm
Anchor length above concrete	a =	250	mm



Load on anchor group

T: the external tension force on the anchor group

Tension force	T =	**4530**	kN
Shear force	$F_{H,Ed}$ =	**1137**	kN
Number of anchors for tension		12	
Number of anchors for shear		12	
$F_{T;Ed} = T / n$ =		377,5	kN
$F_{v;Ed} = F_{H,Ed} / n$ =		94,8	kN

Anchor properties

d_b =	64,00	mm
$A_{b;s}$ =	2676	mm^2
f_{yb} =	240	N/mm^2
f_{ub} =	400	
γ_{Mb}	1,25	-
$\alpha_{red;2}$	0,85	-
$\alpha_b = 0{,}44 - 0{,}0003 f_{yb}$ =	0,37	-

Capacity per anchor

$F_{T;Rd} = 0{,}9\alpha_{red;2} f_{ub} A_s / g_{M2}$ =	**655,1**	kN
$F_{v;Rd} = \alpha_b f_{ub} A_s / g_{Mb}$ =	**267,9**	kN

Foot plate

$F_{t,Rd}$: the tensile force in the anchors when yielding of foot plate is reached.

Steel material		**S235**	
Thickness	t =	50	mm
Width	b_{ef} =	200	mm
Leverage arm	m =	50	mm
$M_{pl,Rd} = 1/4 b_{ef} t_p^2 f_{yd}$ =		29,4	kNm
$F_{t,Rd} = M_{pl,Rd} / m$ =		587,5	kN

Check of dowel ("schieter")

$$\frac{\sigma_b'}{f_{cd}} = \frac{23{,}3}{40{,}0} = 0{,}58$$ **OK**

$$\frac{F_{T,Ed}}{F_{v;Rd}} = \frac{378}{460} = 0{,}82$$ **OK**

Capacity of concrete

Concrete strength	**C20/25**	
f_{ck} =	20	N/mm^2
k_b =	3	-
γ_{Mc} =	1,5	-
$f_{cd} = f_{ck} k_b / \gamma_{Mc}$ =	40	MPa

Dowel

Diameter	d_S =	**65**	mm
Length	b =	**250**	mm
Spread	$c = t\sqrt{(f_{yd} / 3f_{jd})}$ =	92	mm
Effective length	$b_{eff} = \min(b; d+2c)$	249	mm
Cross section	$A_S = \pi/4\ d_S^2$ =	3318	mm^2
Distributed load	$q = F_{T,Ed} / b_{eff}$ =	1517	kN/m
Concrete pressure	$\sigma_b' = q / d_S$ =	23,3	MPa

Shear stress in dowel

Load	$F_{T,Ed}$ =	378	kN
Allowable	$F_{v,Rd} = f_{yd} / \sqrt{3} \times A_s$ =	460	kN

Capacity of foot plate

$$\frac{F_{T,Ed}}{F_{t;Rd}} = \frac{377{,}5}{587{,}5} = 0{,}64$$ **OK**

Capacity of anchor for tension

$$\frac{F_{T,Ed}}{F_{T;Rd}} = \frac{377{,}5}{655{,}1} = 0{,}58$$ **OK**

Check foot plate for tension

$$\frac{T}{n \times F_{t;Rd}} = \frac{4530{,}0}{7050{,}0} = 0{,}64$$ **OK**

Check anchor for shear

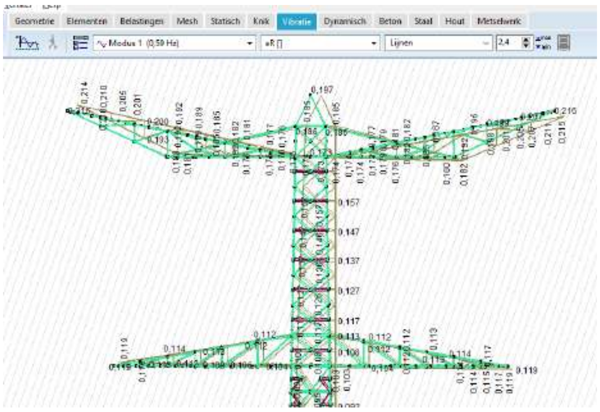
$$\frac{F_{v,Ed}}{F_{v;Rd}} = \frac{94{,}8}{267{,}9} = 0{,}35$$ **OK**

DYNAMIC FACTOR C_SC_D

The crossing towers S+75 and S+95 have heights exceeding 60 m. This is a limit from NEN-EN 50341-2-15 above which it should be investigated if the dynamic factor C_d exceeds a value of 1,0.

To use the method of NEN-EN 50431-2-15 the eigenfrequency needs to be known. The software AxisVM was used to calculate the first eigen modes of the towers.

The results are:



S+95

f_e = 0,59 Hz

The procedure of NEN-EN 50341-2-15 clause 4.4.3.1 is followed.

Average width is taken at the level of lower cross arm: 6,0 m.

Height of the tower for the turbulence intensity is taken at 60% of the height according to NEN-EN 1991-1-4 clause 6.3.1.

For resonance factor R^2 the following assumptions are used.

Logaritmic damping from NEN-EN 1991-1-4 Appendix F: “stalen Bruggen en vakwerktorens, bouten met hoge kwaliteit”: δ_s = 0,030.

Equivalent mass m_e is taken as mass per unit length. It is calculated by dividing the estimated total weight of the tower by the total height.

S+95: 250 ton / 162,5 = 1538 kg/m

S+75: 230 ton / 142,5 = 1615 kg/m

Factors K_y and K_z for parabolic deformation shape are used.

G_y = 1/2

G_z = 5/18

Drag coefficient is taken as the product of χ (solidity ratio) and C_t (drag factor taking into account the open lattice structure). C_f = 0,24 x 2,8 = 0,66.

Peak factor is set to 3,5 according to NEN-EN 50341-2-15.

Results

Bouwwerkfactor $c_s c_d$ Mast: S+95 II

$c_sc_d = 1 + 2\ k_p\ I_v(z_s)\ \sqrt{(B^2+R^2)} / 1+7I_v(z)$		**1,02**	-
k_p	piekfactor		
I_v	turbulentieintensiteit	0,161569	
B^2	achtergrondresponsiefactor, brengt het volleige gebrek aan correlatie in rekening		
R^2	resonantieresponsfactor		
z_s	referentiehoogte, temnminste gelijk aan zmin		

Piekfactor kp

$k_p = \sqrt{(2\ln(\nu T))} + 0{,}6 / \sqrt{(2\ln(\nu T))} \geq 3{,}5$		3,50	-
T =	600	s	
$\nu = n_1\sqrt{(R^2 / (B^2+R^2))} \geq 0{,}08$	0,44	-	

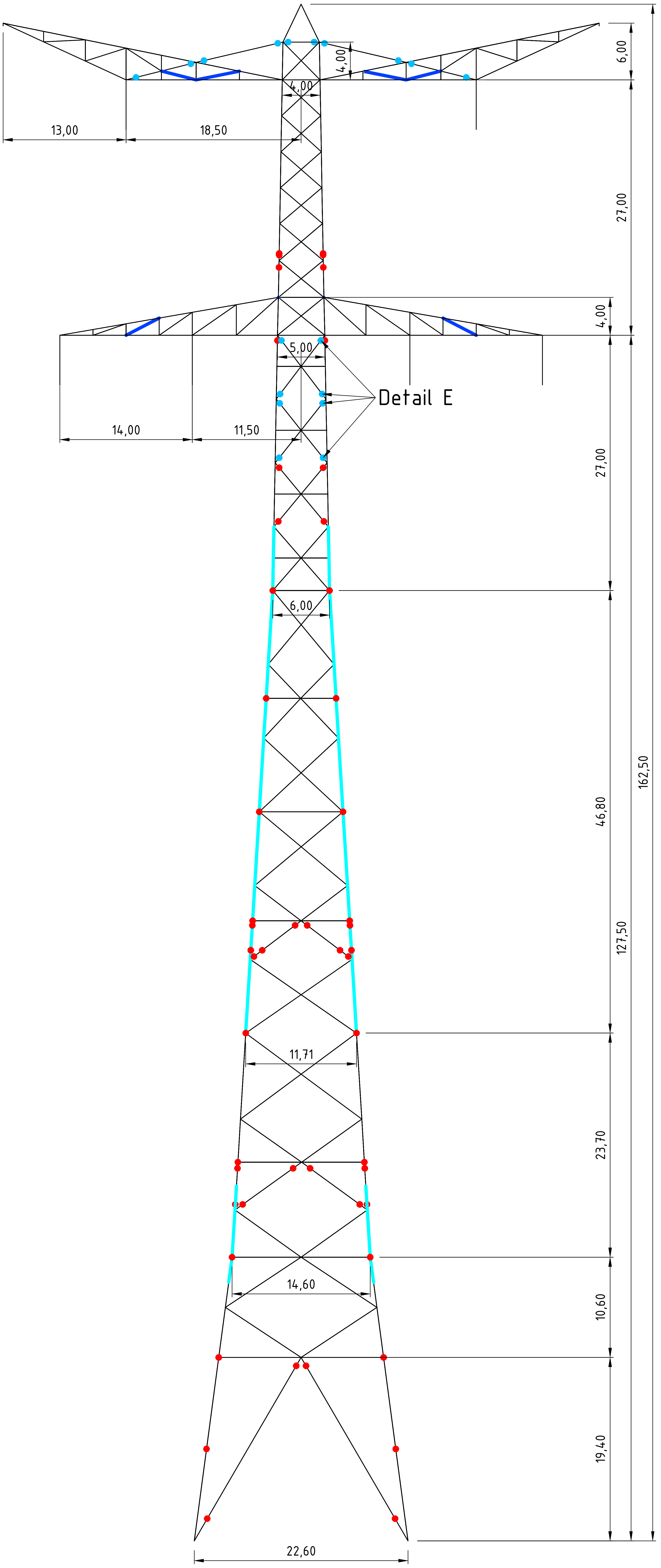
Achtergrondresponsiefactor B^2

b =	6,00	m	
d =	6,00	m	
h =	162,5	m	
z_s = h =	97,5		
$L(z_s) = L_t\ (z_s / z_t)^{\alpha}$	196,4	m	
L_t =	300	m	(referentielengteschaal)
z_t =	200	m	(referentiehoogte zmax)
$\alpha = 0{,}67 + 0{,}05\ln(z_0)$ =	0,59		
B^2 =	0,45		

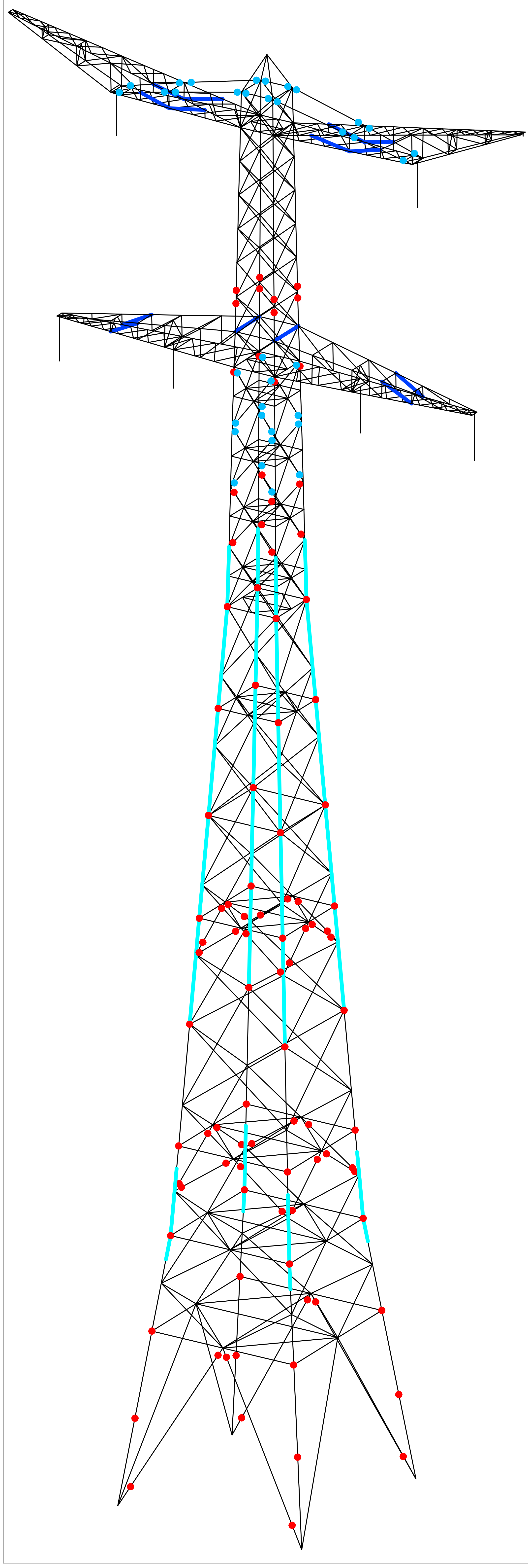
Resonantieresponsfactor R^2

$R^2 = \pi^2 / 2\delta \times S_LK_s$ =	0,5572	
$\delta = \delta_s + \delta_a + \delta_d$ =	0,05	
Type constructie	Stalen toren, bout met hoge weerstand	
δ_s =	0,03	
$\delta_a = c_f r b v_m(z_s) / 2n_1m_e$ =	0,01677	
c_f =	0,67	(krachtcoefficient windrichting)
n_1 =	0,59	(berekend AxisVM)
m_e	1538,5	(equivalente massa)
δ_d =	0,0	
S_L	0,0623019	(dimensieloze spectrale dichtheidsfunctie)
f_L =	3,2	
K_s	0,0848	(afmetingsreductiefunctie)
ψ_y =	1,1	
ψ_z =	36,6	
$c_y = c_z$ =	11,5	
G_y	0,50	
G_z	0,28	
K_y	1	
K_z	1,67	

APPENDIX E TEKENINGEN



Front View



3D View

Notes and legend:

- For member and bolt sizes refer to the summary table
- All changes are symmetrical unless otherwise indicated
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

New profile/ redundant
Profile strengthened with plates
Profile exchanged
Redundant exchanged
Strengthening of joint using plates
Bolt exchanged

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00	6-10-2020	Version 1.0

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Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-037

Design state: FINAL		Scale: -		
Drawn by: MuK	6-10-2020	Units: m		
Checked by: TBR	7-10-2020	Project no: 10166260		
Approved by: JHu	8-10-2020	Company: TenneT		

Description: Modifications overview for mast type S+95 (Mast 12 & 13)
Page 1 of 6

Revision: 00

Format: A2

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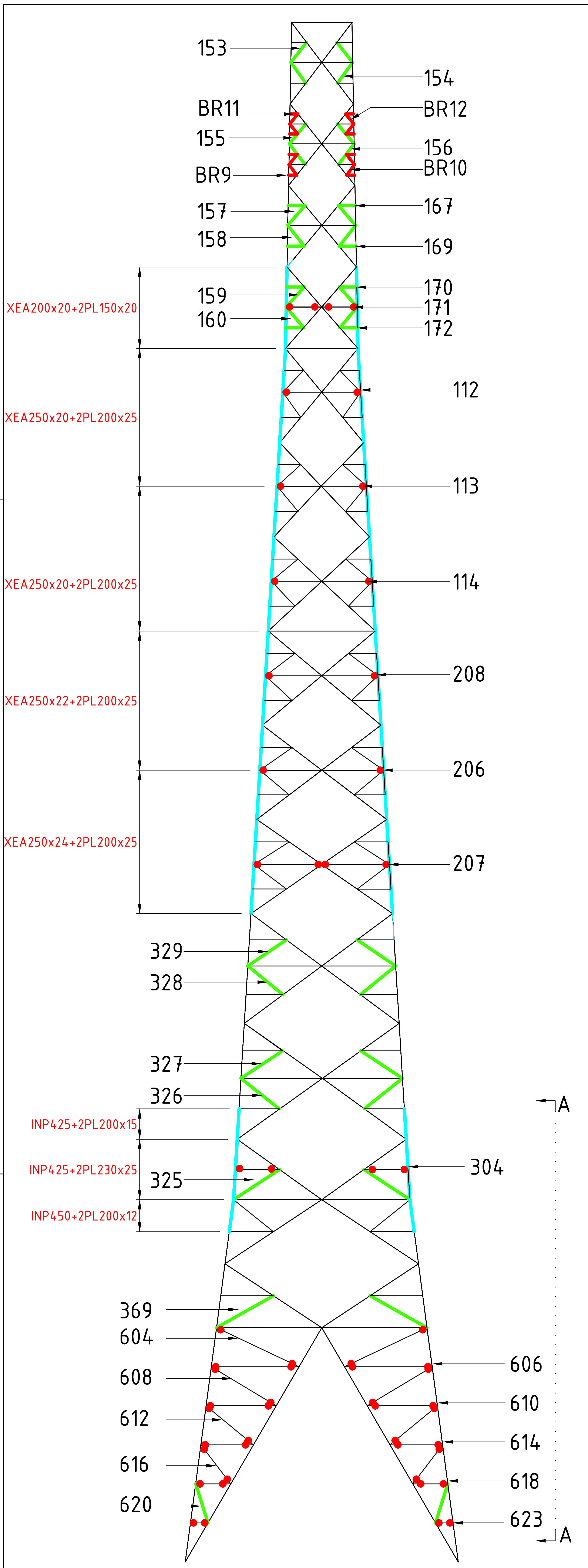
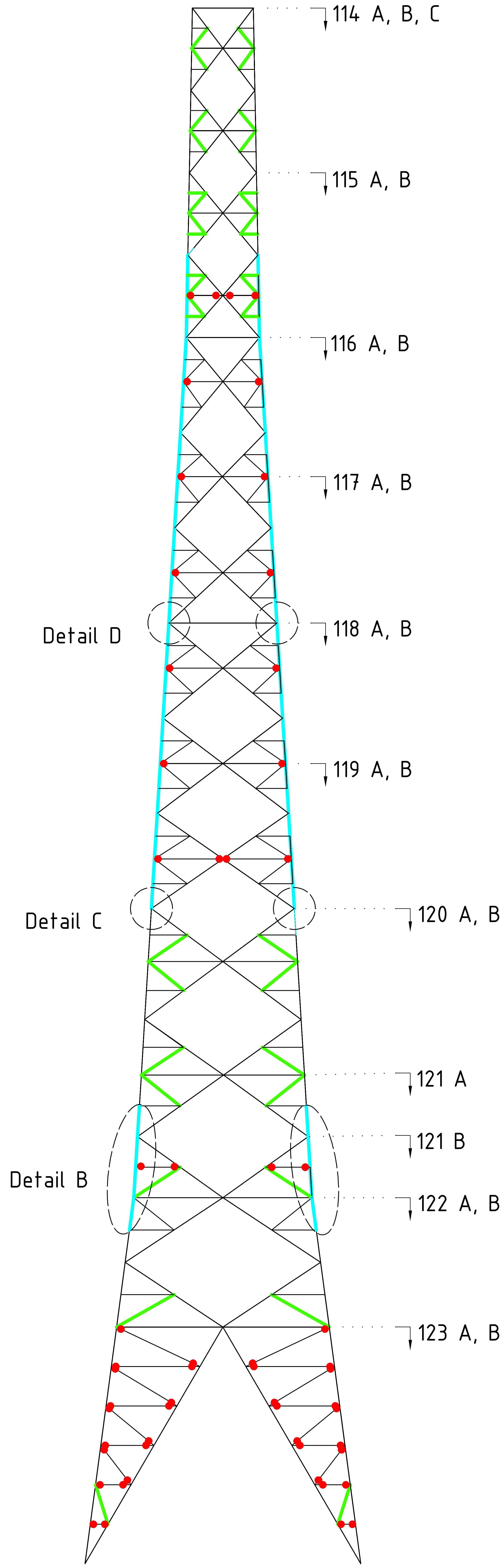


Front View



Side View

*For locations of bolt modifications on the legs and main diagonals, see overview drawings on page 1

Notes and legend:

- **For member and bolt sizes refer to the summary table**
- **All changes are symmetrical unless otherwise indicated**
- **Material quality t ≤ 16mm S355J0**
- **Material quality t > 16mm S355J2**
- **Bolt quality 8.8 rolled**

New profile/ redundant (red line)
Profile strengthened with plates (cyan line)
Profile exchanged (blue line)
Redundant exchanged (green line)
Strengthening of joint using plates (cyan dot)
Bolt exchanged (red dot)

01	7-4-2021	Version 2.0 - Loads calculated according to 15 year return period
00	6-10-2020	Version 1.0

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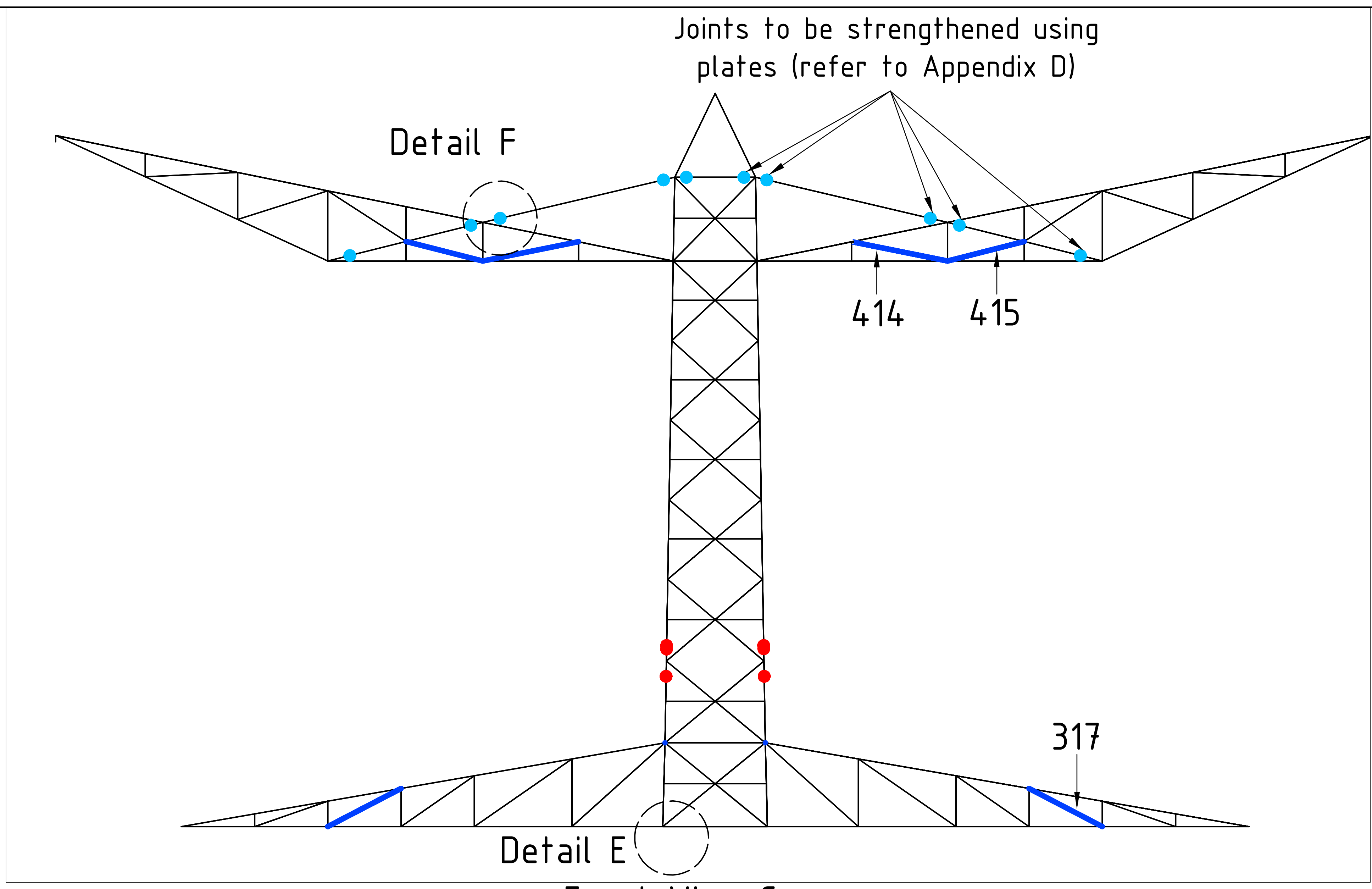
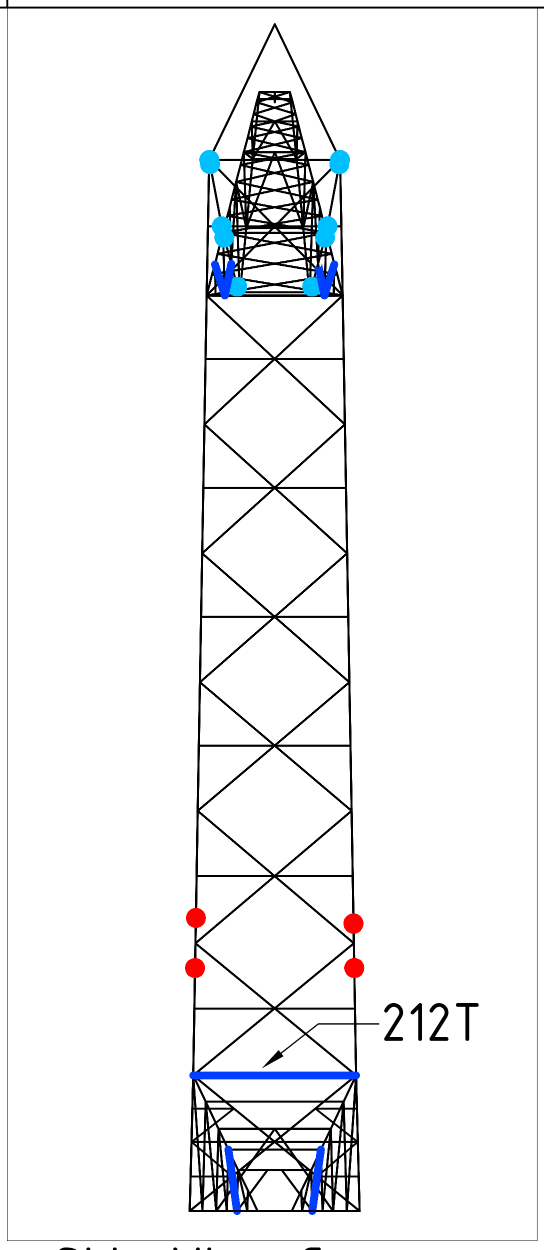
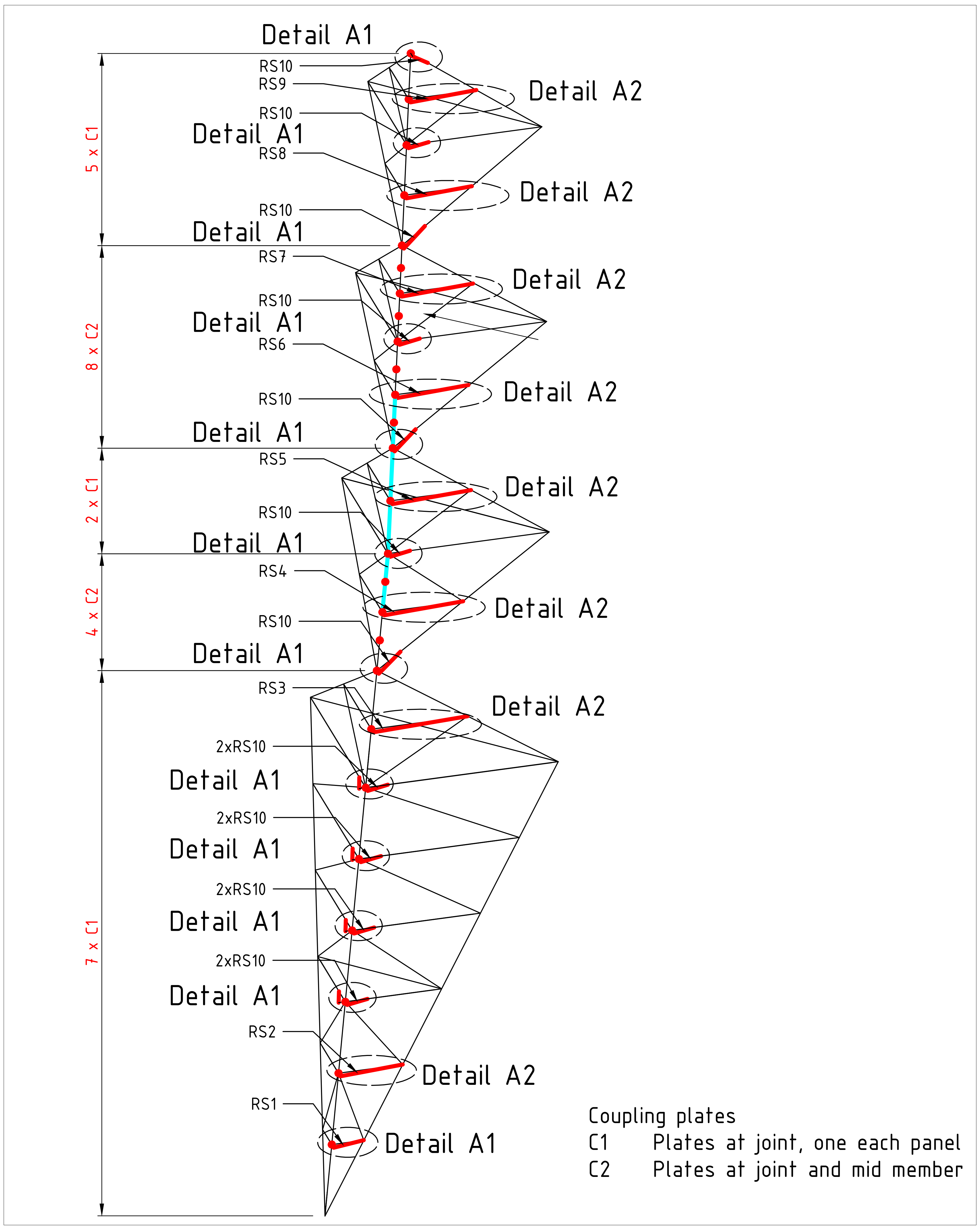
Projectname: Mast constructions KIJ - GT 380 kV			
Third angle projection:		Drawing no.: 10166260-037	
Design state: FINAL	Scale: -	Description: Modifications overview for mast type S+95 (Mast 12 & 13) Page 2 of 6	Revision: 00
Drawn by: MuK 6-10-2020	Units: m		
Checked by: TBR 7-10-2020	Project no: 10166260		Format: A2
Approved by: JHu 8-10-2020	Company: TenneT		



Front View Crossarms



Side View Crossarms



Section A-A: Lower Leg Section View

Notes and legend:

- For member and bolt sizes refer to the summary table
- All changes are symmetrical unless otherwise indicated
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

New profile/ redundant
Profile strengthened with plates
Profile exchanged
Redundant exchanged
Strengthening of joint using plates
Bolt exchanged

01	7-4-2021	Version 2.0 - Loads calculated according to 15 year return period
00	6-10-2020	Version 1.0

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Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-037

Design state: FINAL		Scale: -		
Drawn by: MuK	6-10-2020	Units: m	Description: Modifications overview for mast type S+95 (Mast 12 & 13) Page 3 of 6	Revision: 00
Checked by: TBR	7-10-2020	Project no: 10166260		Format: A2
Approved by: JHu	8-10-2020	Company: TenneT		

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Initial Profiles and Bolts					Final Profiles and Bolts			
Group label	Profile type (ini)	Profile size (ini)	Steel quality (ini)	Bolt size and quality (ini)	Profile type (new)	Profile size (new)	Steel quality (new)	Bolt size and quality (new)
118A	XEA	L250.22	S235	M30-5.6t	XEA +Plates	L250.22 + Plates	S235 (member), S355 (plates)	M30-8.8t
118B	XEA	L250.22	S235	M30-5.6t	XEA +Plates	L250.22 + Plates	S235 (member), S355 (plates)	M30-8.8t
119A	XEA	L250.24	S235	M30-5.6t	XEA +Plates	L250.24 + Plates	S235 (member), S355 (plates)	M30-8.8t
119B	XEA	L250.24	S235	M24-5.6t	XEA +Plates	L250.24 + Plates	S235 (member), S355 (plates)	M24-8.8t
121B	XEA	INP 425	S235	M24-5.6t	XEA +Plates	INP 425 + Plates	S235 (member), S355 (plates)	M24-8.8t
414	EA	L70.7	S235	M16-5.6t	DEA	L70.7	S235 (existing) S355 (new)	M16-8.8t
415	EA	L65.7	S235	M16-5.6t	DEA	L65.7	S235 (existing) S355 (new)	M16-8.8t
212T	EA	L80.8	S235	M20-5.6t	EA	L100.10	S355	M20-8.8t
317	EA	L60.6	S235	M16-5.6t	EA	L60.6	S355	M16-8.8t
114A	EA	L250.22	S235	M30-5.6t	EA	L250.22	S235	M30-5.6t
114C	EA	L250.22	S235		EA	L250.22	S235	
216L	UA	L150.100.12	S235	M30-5.6t	UA	L150.100.12	S235	M30-8.8t
217L	UA	L150.100.12	S235	M30-5.6t	UA	L150.100.12	S235	M30-8.8t
115A	XEA	L200.20	S235	M30-5.6t	XEA +Plates	L200.20 + Plates	S235 (member), S355 (plates)	M30-8.8t
116A	XEA	L250.20	S235	M30-5.6t	XEA +Plates	L250.20 + Plates	S235 (member), S355 (plates)	M30-8.8t
116B	XEA	L250.20	S235	M30-5.6t	XEA +Plates	L250.20 + Plates	S235 (member), S355 (plates)	M30-8.8t
117A	XEA	L250.20	S235	M30-5.6t	XEA +Plates	L250.20 + Plates	S235 (member), S355 (plates)	M30-8.8t
117B	XEA	L250.20	S235	M30-5.6t	XEA +Plates	L250.20 + Plates	S235 (member), S355 (plates)	M30-8.8t
620	EA	L80.8	S235	M20-5.6t	EA	L80.8	S355	M20-8.8t
369	EA	L100.10	S235	M24-5.6t	EA	L120.10	S355	M24-8.8t
325	EA	L100.8	S235	M20-5.6t	EA	L100.10	S355	M20-8.8t
326	EA	L80.8	S235	M16-5.6t	EA	L100.10	S355	M20-8.8t
327	EA	L80.8	S235	M20-5.6t	EA	L100.10	S355	M20-8.8t
328	EA	L70.7	S235	M20-5.6t	EA	L100.8	S355	M20-8.8t
329	EA	L70.7	S235	M20-5.6t	EA	L100.8	S355	M20-8.8t
172	EA	L60.6	S235	M16-5.6t	EA	L60.6	S355	M16-8.8t
160	EA	L50.5	S235	M16-5.6t	EA	L60.8	S355	M16-8.8t
159	EA	L50.5	S235	M16-5.6t	EA	L60.8	S355	M16-8.8t
170	EA	L60.6	S235	M16-5.6t	EA	L60.6	S355	M16-8.8t
169	EA	L50.5	S235	M16-5.6t	EA	L55.6	S355	M16-8.8t
158	EA	L50.5	S235	M16-5.6t	EA	L60.8	S355	M16-8.8t
157	EA	L50.5	S235	M16-5.6t	EA	L60.8	S355	M16-8.8t
167	EA	L50.5	S235	M16-5.6t	EA	L55.6	S355	M16-8.8t
156	EA	L50.5	S235	M16-5.6t	EA	L60.8	S355	M16-8.8t
155	EA	L50.5	S235	M16-5.6t	EA	L60.6	S355	M16-8.8t
154	EA	L50.5	S235	M16-5.6t	EA	L55.6	S355	M16-8.8t
153	EA	L50.5	S235	M16-5.6t	EA	L60.6	S355	M16-8.8t
BR9	EA				EA	L50.5	S355	M16-8.8t
BR10	EA				EA	L50.5	S355	M16-8.8t
BR11	EA				EA	L50.5	S355	M16-8.8t
BR12	EA				EA	L50.5	S355	M16-8.8t
RS1	EA				EA	L60.6	S355	M16-8.8t
RS2	EA				EA	L70.7	S355	M16-8.8t
RS3	EA				EA	L80.6	S355	M16-8.8t
RS4	EA				EA	L80.6	S355	M16-8.8t
RS5	EA				EA	L80.6	S355	M16-8.8t
RS6	EA				EA	L70.7	S355	M16-8.8t
RS7	EA				EA	L70.7	S355	M16-8.8t
RS8	EA				EA	L60.6	S355	M16-8.8t
RS9	EA				EA	L60.6	S355	M16-8.8t
RS10	EA				EA	L50.5	S355	M16-8.8t

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Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

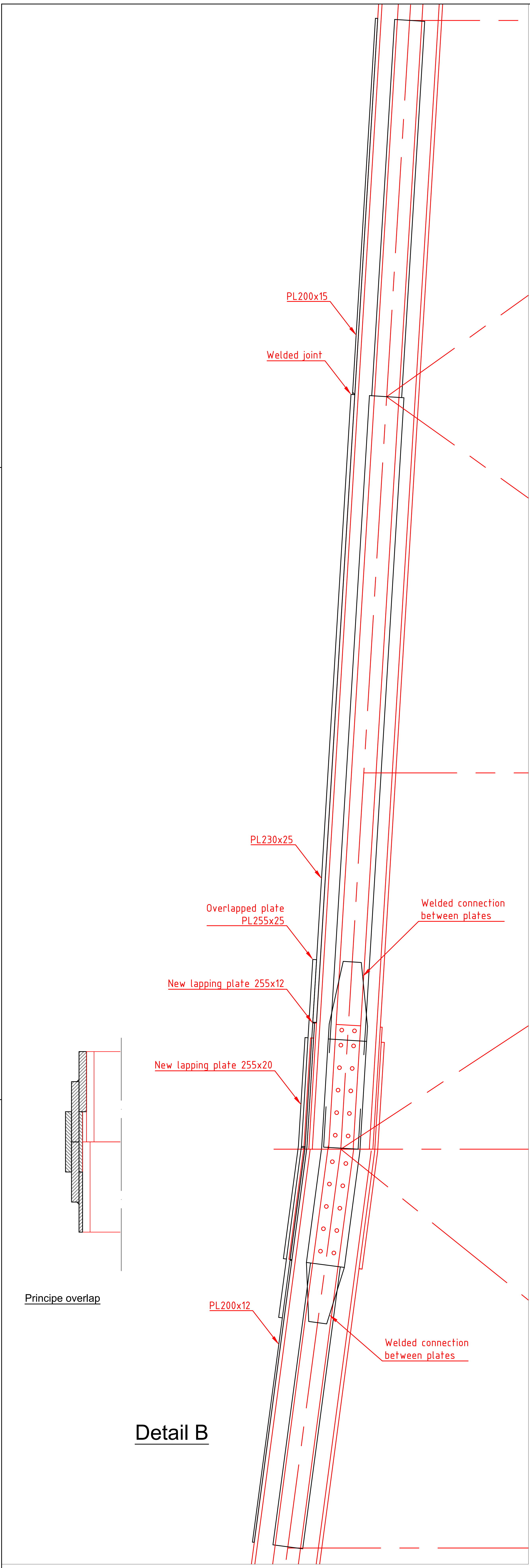
Drawing no.: 10166260-037

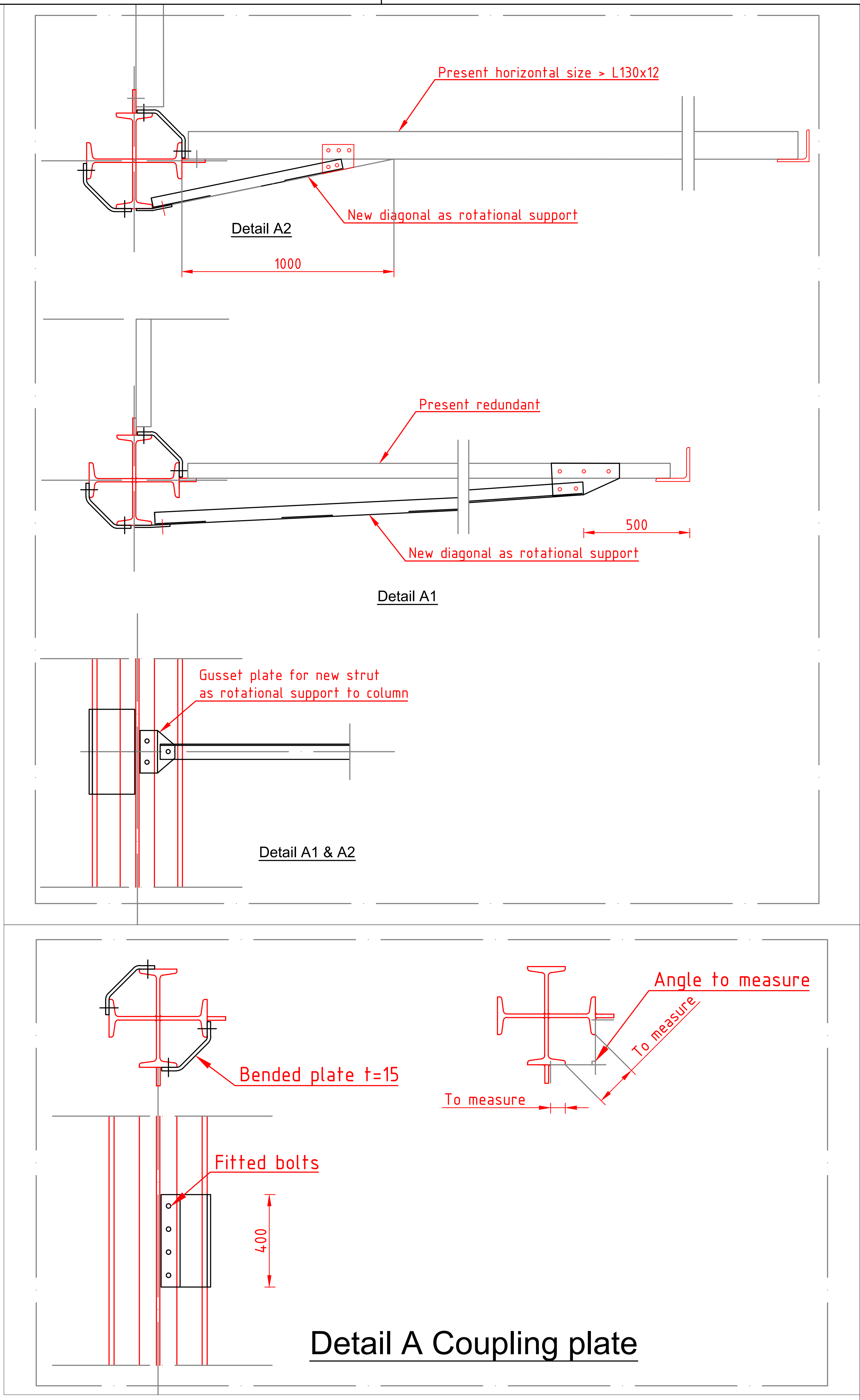
Design state: FINAL		Scale:	-
Drawn by: MuK	6-10-2020	Units:	m
Checked by: TBR	7-10-2020	Project no:	10166260
Approved by: JHu	8-10-2020	Company:	TenneT

Description: Modifications overview for mast type S+95 (Mast 12 & 13)

Revision: 00

Format: A2





01	7-4-2021	Version 2.0 - Loads calculated according to 15 year return period
00	6-10-2020	Version 1.0

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Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-037

Design state: FINAL		Scale:	-	
Drawn by: MuK	6-10-2020	Units:	m	
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Approved by: JHu	8-10-2020	Company:	TenneT	

Description: Modifications overview for mast type S+95 (Mast 12 & 13) Page 5 of 6

Revision: 00

Format: A2

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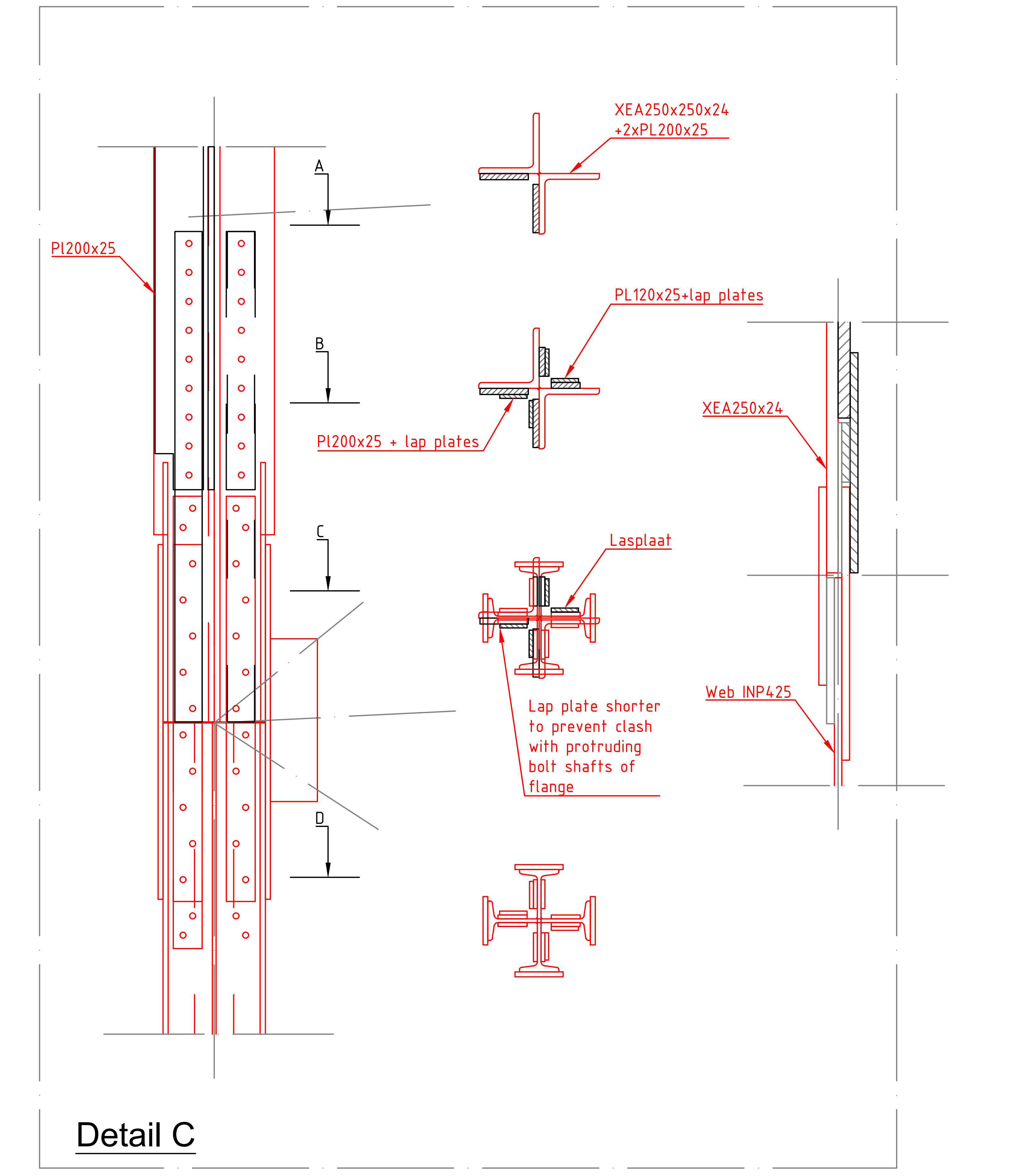

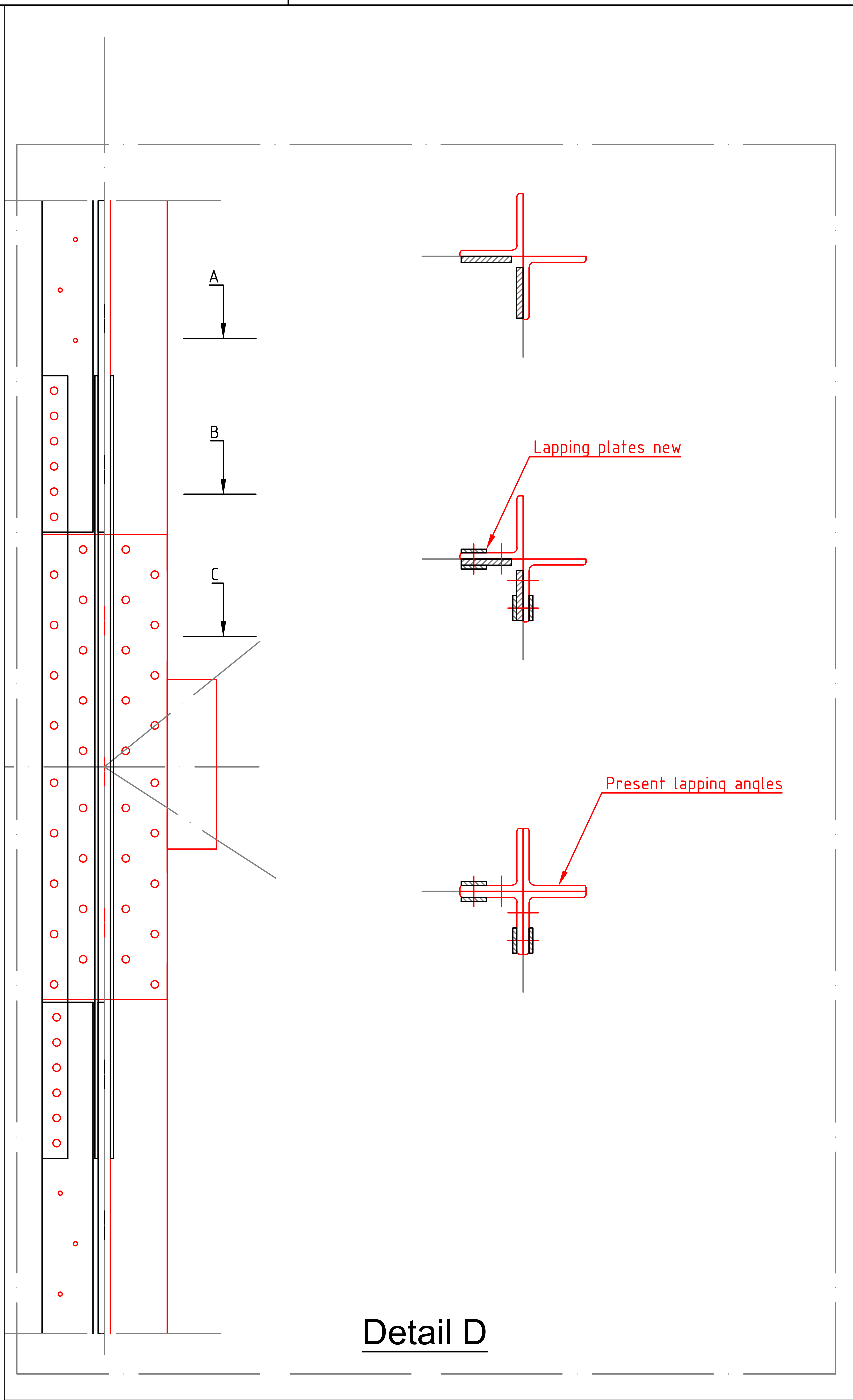

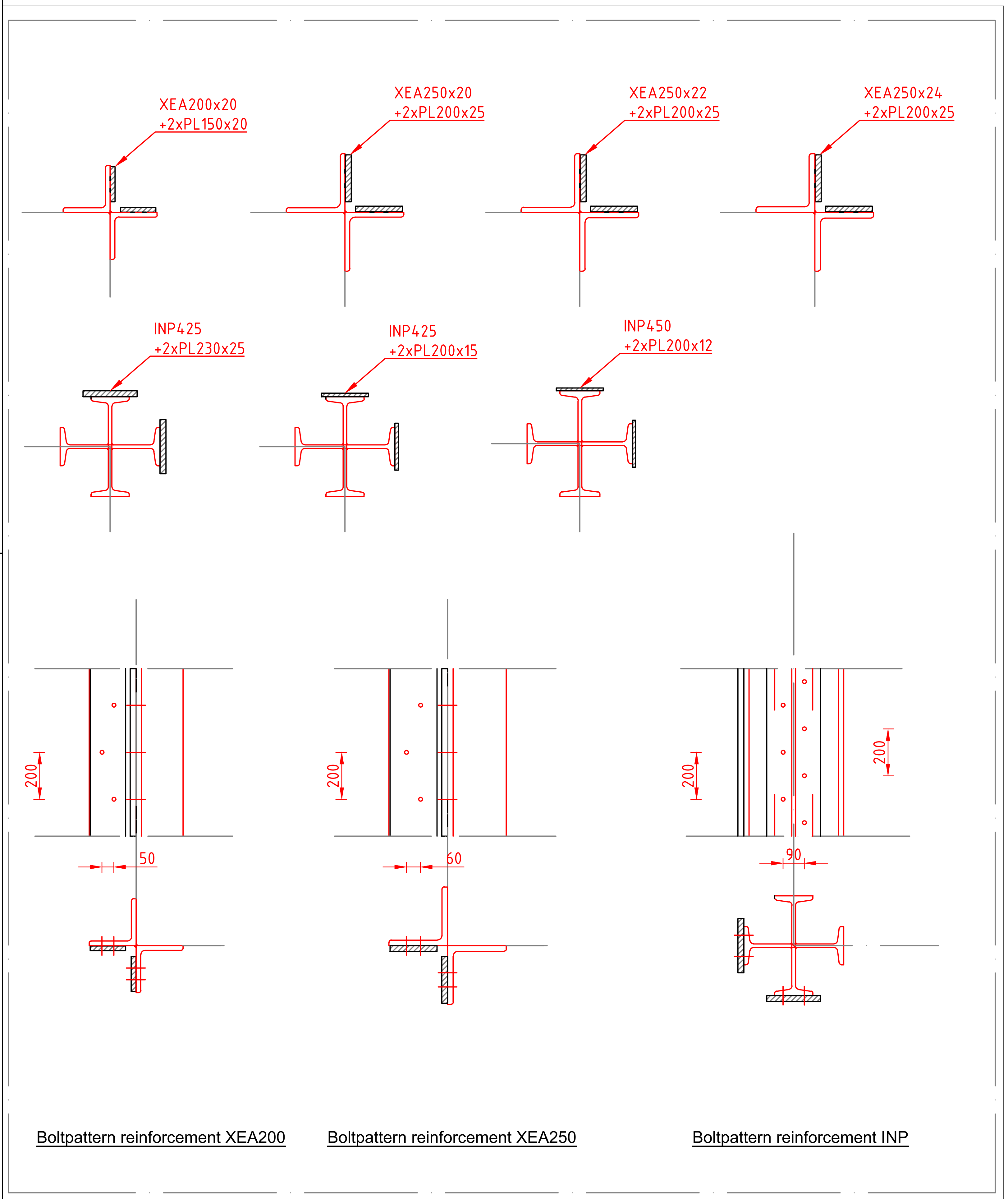

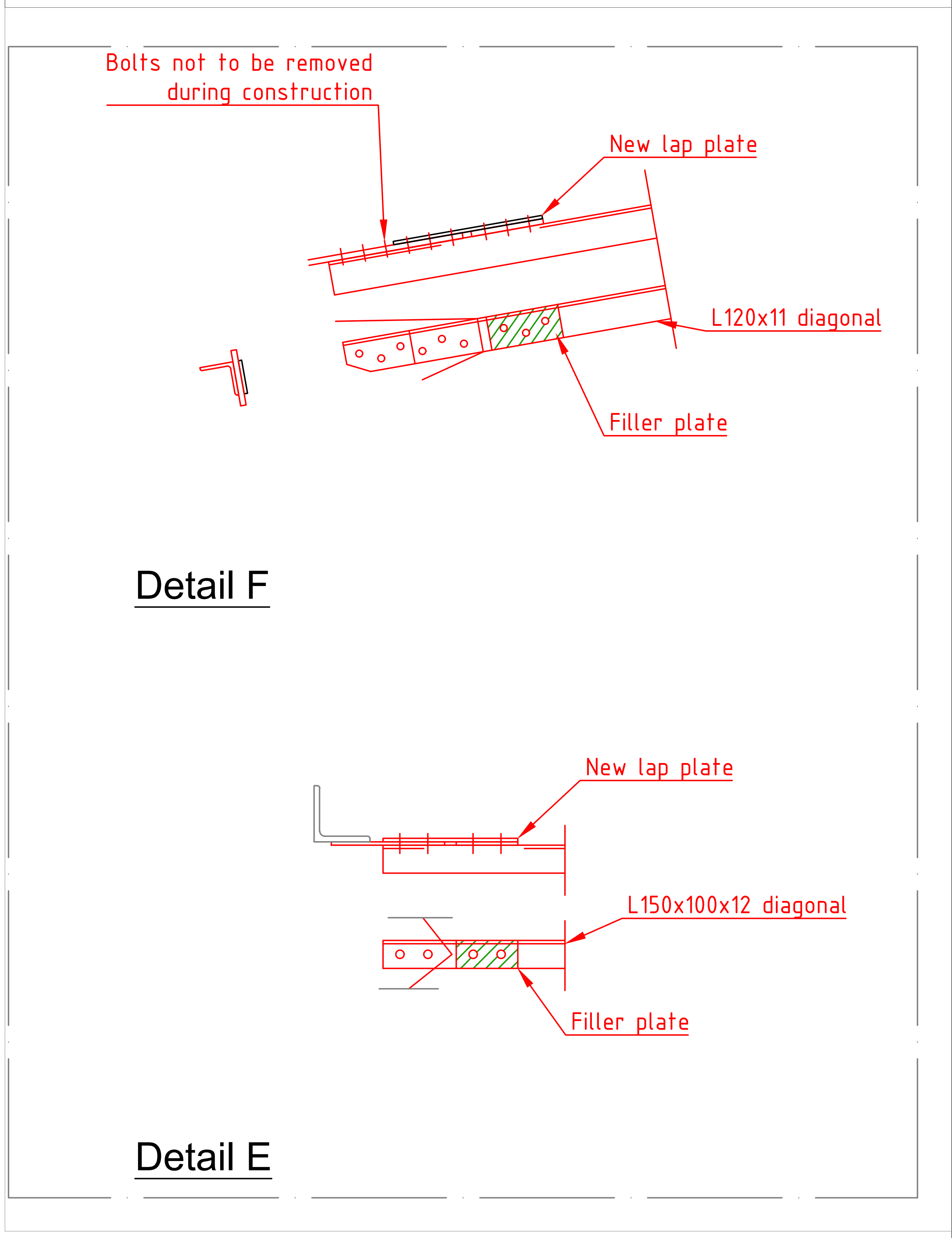

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00	6-10-2020	Version 1.0

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Projectname: Mast constructions KIJ - GT 380 kV			
Third angle projection:	Drawing no.: 10166260-037		
Design state: FINAL	Scale: -	Description: Modifications overview for mast type S+95 (Mast 12 & 13) Page 6 of 6	Revision: 00
Drawn by: MuK 6-10-2020	Units: m		
Checked by: TBR 7-10-2020	Project no: 10166260		Format: A2
Approved by: JHu 8-10-2020	Company: TenneT		

APPENDIX F AXIS VM STUDIE

BUCKLING STUDY OF TOWER LEG

Contents

1 INTRODUCTION

1.1 Scope

This report examines the buckling of the INP-cruciform section in the leg of the tower S+95. In the feasibility study of S+95, DNV GL report 20-1581, the main leg was found to have inadequate capacity against torsional buckling. Two causes were found for this:

- the INP-section as a cruciform is sensitive to torsional buckling. It was however designed for flexural buckling only, which leads to insufficient torsional buckling capacity.
- the support against rotation or warping of the cross section provided by the rest of the structure is ineffective, since it was solely designed to support against flexural buckling. This leads to further reduction of capacity.

The impact of the initially proposed strengthening measures was considered disproportional, since it meant to reinforce all the tower leg section with plates up to the height of the cross arm. Furthermore all of the redundant members needed to be exchanged. Assignment was given to DNV GL to investigate a more economical solution.

First of all, based upon TNO risk assessment, it was possible to reduce the load level to afkeurniveau 15 yr instead of 30 yr. Still however, significant over-utilisation occurred in the tower leg members. To increase the capacity of the main leg three modifications were proposed. In descending order of ease of construction:

- Reinforcing the INP-section with plates. This was proposed only at locations with load level above or nearby yield strength of steel material
- Coupling the flanges with plates to increase the torsional resistance
- adding supports against warping of the section.

After the calculations were performed, the solution would include all of the tree above measures. The reinforcing with plates was however only locally needed at the height of the inclination change, where the transition from INP450 to INP425 section takes place.

The goal of the study described in this appendix is to find the capacity for torsional buckling of the main leg after applying the three solutions above. At first the initial structure is included. In Chapter 2 the method of the study is described. In chapter 3 the results are presented.

1.2 Capacity of not-reinforced structure

The capacity of the main leg in the not-reinforced structure or initial structure was derived with the AxisVM-model to the stability in the feasibility study of S+95. The result of the AxisVM buckling study was the “n-value”, the ratio between load and theoretical buckling capacity. With a spreadsheet, the capacity based upon the n-value and the Eurocode buckling curves was derived. The output of spreadsheet is included on next pages. The results are summarised in table below and checked against afkeurlevel 15 yr. loads. It is clear that the structure has insufficient capacity. For explanation of “height” see Figure 2-1 next section.

Tabel 1 capacity of main leg in initial structure

Section	Height	n-value	Load	Capacity	U.C.
INP425	ID10-ID12	2,61	6000	5111	1,17
INP450	ID1-ID10	2,4	6000	5414	1,11

Torsieknik

Versie: 1.4

Onderwerp	**Randstijl S+95 (initial structure)**	***Toetsing***	
Profiel	**INP425x2 v1**	U.C.	**1.09** Voldoet niet

Normaalkracht

$N_{c;s;d}$ = **6000.0** kN

Staalsoort	**S235**	
Doorsnedeklasse:	**1**	Geldig
Gewicht	2.08	kN/m

Doorsnedegrootheden

I_y	I_z	I_v	A
10^4 mm^4	10^4 mm^4	10^4 mm^4	mm^4
38710	38710	38710	26474

I_t	I_{wa}
10^4 mm^4	mm^4
429	1.119E+12

Geometrie

$l_{y;buc}$ =	2.50	m
$l_{z;buc}$ =	2.50	m
$l_{v;buc}$ =	2.50	m
l_{tk} =	2.50	m
Steun 1	Gaffel	
Steun 2	Gaffel	
Classificatie	Geschoord	

Doorsnedecapaciteit

$N_{pl;d}$ = A x $f_{y;d}$ = 6221 kN

Knikstabiliteit y-as

$\lambda_{y;rel} = l_{buc} / (i_y \times \lambda_{euler})$	0.22	-
$\chi_{y;buc}$ = (kromme b)	0.99	-
$N_{b,Rd} = \chi A f_y$ =	6177	kN
U.C.	**0.97**	**Voldoet**

Knikstabiliteit z-as

$\lambda_{z;rel} = l_{buc} / (i_z \times \lambda_{euler})$	0.22	-
$\chi_{z;buc}$ = (kromme b)	0.99	-
$N_{b,Rd} = \chi A f_y$ =	6177	kN
U.C.	**0.97**	**Voldoet**

Knikstabiliteit v-as

$\lambda_{z;rel} = l_{buc} / (i_z \times \lambda_{euler})$	0.22	-
λ_{eff} = 0,10+0,80 λ =	0.28	-
$\chi_{z;buc}$ = (kromme b)	0.97	-
$N_{b,Rd} = \chi A f_y$ =	6052	kN
U.C.	**0.99**	**Voldoet**

Torsieknikstabiliteit

$i_0^2 = i_y^2 + i_z^2 + y_0^2$ =	29244	mm^2
$\beta = 1 - y_0^2/i_0^2$ =	1.000	-
$F_{y;E} = \pi^2 E I_y / l_y^2$ =	128370	kN
$F_{t;E} = 1/i_0^2(G_d I_t + \pi^2 E I_{wa}/l_{t;buc}^2)$ =	24570	kN
$F_{tk;E} = {}^1/_{2\beta}((F_{y;E}+F_{t;E})+\sqrt{(F_{y;E}+F_{t;E})^2-4\beta^2 F_{y;E}F_{t;E}})$		
$F_{tk;E}$ =	24570	kN
$\lambda_{tk;rel} = \sqrt{N_{Rd} / F_{tk;E}}$ =	0.50	-
$\chi_{z;buc}$ = (kromme b)	0.883	-
$N_{b,Rd} = \chi A f_y$ =	5492	kN
U.C.	**1.09**	Voldoet niet

Buckling length with FEM-software		
n-value	2.61	
N_{Ed} =	6000	kN
$N_{cr;E}$ = n x N_{Ed} =	15660	kN
$N_{pl,Rd}$ =	6221	kN
$\lambda_{rel} = \sqrt{N_{pl;Rd} / N_{cr;E}}$ =	0.63	-
χ_{buc} = (curve b)	0.82	-
$N_{b,Rd} = \chi A f_y / \gamma_{M1}$ =	**5111**	kN
U.C. =	1.17	Voldoet niet

Torsieknik

Versie: 1.4

Onderwerp	Randstijl S+95 (initial structure)	*Toetsing*		
Profiel	INP450x2 v1	U.C.	**1.02**	Voldoet niet

Normaalkracht

$N_{c;s;d}$ = **6000.0** kN

Staalsoort **S235**

Doorsnedeklasse: **1** Geldig

Gewicht 2.29 kN/m

Doorsnedegrootheden

I_y	I_z	I_v	A
10^4 mm^4	10^4 mm^4	10^4 mm^4	mm^4
47510	47510	47510	29191

I_t	I_{wa}
10^4 mm^4	mm^4
517	1.483E+12

Geometrie

$l_{y;buc}$ =	3.20	m
$l_{z;buc}$ =	3.20	m
$l_{v;buc}$ =	3.20	m
l_{tk} =	3.20	m
Steun 1	Gaffel	
Steun 2	Gaffel	
Classificatie	Geschoord	

Doorsnedecapaciteit

$N_{pl;d} = A \times f_{y;d}$ = 6860 kN

Knikstabiliteit y-as

$\lambda_{y;rel} = l_{buc} / (i_y \times \lambda_{euler})$	0.27	-
$\chi_{y;buc}$ = (kromme b)	0.98	-
$N_{b,Rd} = \chi A f_y$ =	6696	kN
U.C.	**0.90**	Voldoet

Knikstabiliteit z-as

$\lambda_{z;rel} = l_{buc} / (i_z \times \lambda_{euler})$	0.27	-
$\chi_{z;buc}$ = (kromme b)	0.98	-
$N_{b,Rd} = \chi A f_y$ =	6696	kN
U.C.	**0.90**	Voldoet

Knikstabiliteit v-as

$\lambda_{z;rel} = l_{buc} / (i_z \times \lambda_{euler})$	0.27	-
$\lambda_{eff} = 0,10+0,80\ \lambda =$	0.31	-
$\chi_{z;buc}$ = (kromme b)	0.96	-
$N_{b,Rd} = \chi A f_y$ =	6579	kN
U.C.	**0.91**	Voldoet

Torsieknikstabiliteit

$i_0^2 = i_y^2 + i_z^2 + y_0^2$ =	32551	mm^2
$\beta = 1 - y_0^2/i_0^2$ =	1.000	-
$F_{y;E} = \pi^2 E I_y / l_y^2$ =	96162	kN
$F_{t;E} = 1/i_0^2 (G_d I_t + \pi^2 E I_{wa} / l_{t;buc})$ =	22097	kN
$F_{tk;E} = {}^1/_{2\beta}((F_{y;E}+F_{t;E})+\sqrt{(F_{y;E}+F_{t;E})^2 - 4\beta^2 F_{y;E} F_{t;E}})$		
$F_{tk;E}$ =	22097	kN
$\lambda_{tk;rel} = \sqrt{N_{Rd} / F_{tk;E}}$ =	0.56	-
$\chi_{z;buc}$ = (kromme b)	0.858	-
$N_{b,Rd} = \chi A f_y$ =	5886	kN
U.C.	**1.02**	Voldoet niet

Buckling length with FEM-software		
n-value	2.4	
N_{Ed} =	6000	kN
$N_{cr;E} = n \times N_{Ed}$ =	14400	kN
$N_{pl,Rd}$ =	6860	kN
$\lambda_{rel} = \sqrt{N_{pl;Rd} / N_{cr;E}}$ =	0.69	-
χ_{buc} = (curve b)	0.79	-
$N_{b,Rd} = \chi A f_y / \gamma_{M1}$ =	**5414**	kN
U.C. =	1.11	Voldoet niet

2 MODEL

The model of the initial structure was expanded to the entire height of the tower section with INP-sections to investigate the stability after applying reinforcements and additional members and plates to support the tower leg.

2.1.1 Scheme

The main leg of the tower is modelled with shell elements in the software package AxisVM. The leg from level of foundation to 53,7 m of height was included in the model.

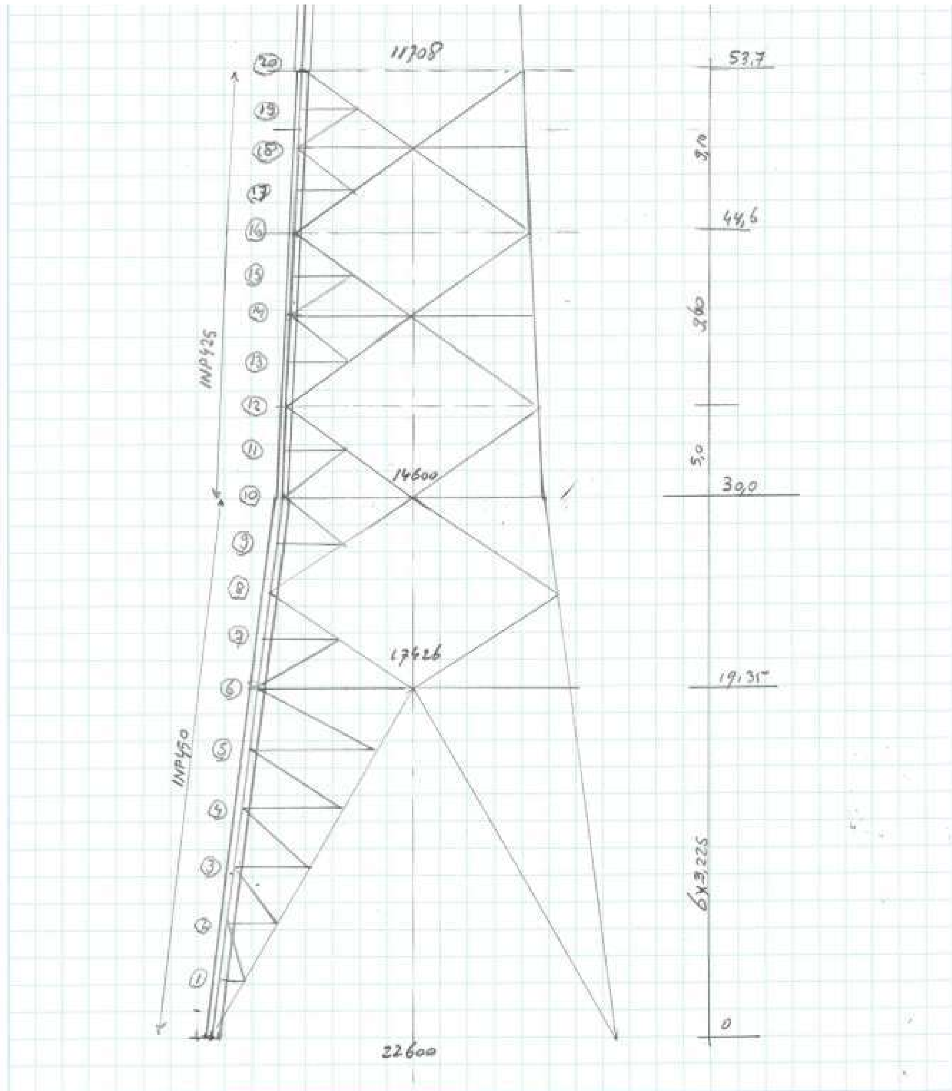


Figure 2-1 schematic of the tower leg for the study

Figure 1 shows the sketch of the S+95 tower. The segments of the INP 450 and 425 profiles between the redundant are marked in numbers 1 to 20 in the figure on the left.

The method of analysis is at first the n-value calculation offered by the software package AxisVM. Secondly linear-elastic calculations as well as physically and geometric nonlinear calculations were performed. The structure is modelled with shell elements.

2.2 Model of main leg

The INP profiles do not have constant flange thickness, see section properties in Appendix D. An equivalent cross-section is derived for the shell-elements with constant flange thickness as illustrated in figure 7. The area for the derived section is kept same as the area of the INP profiles.

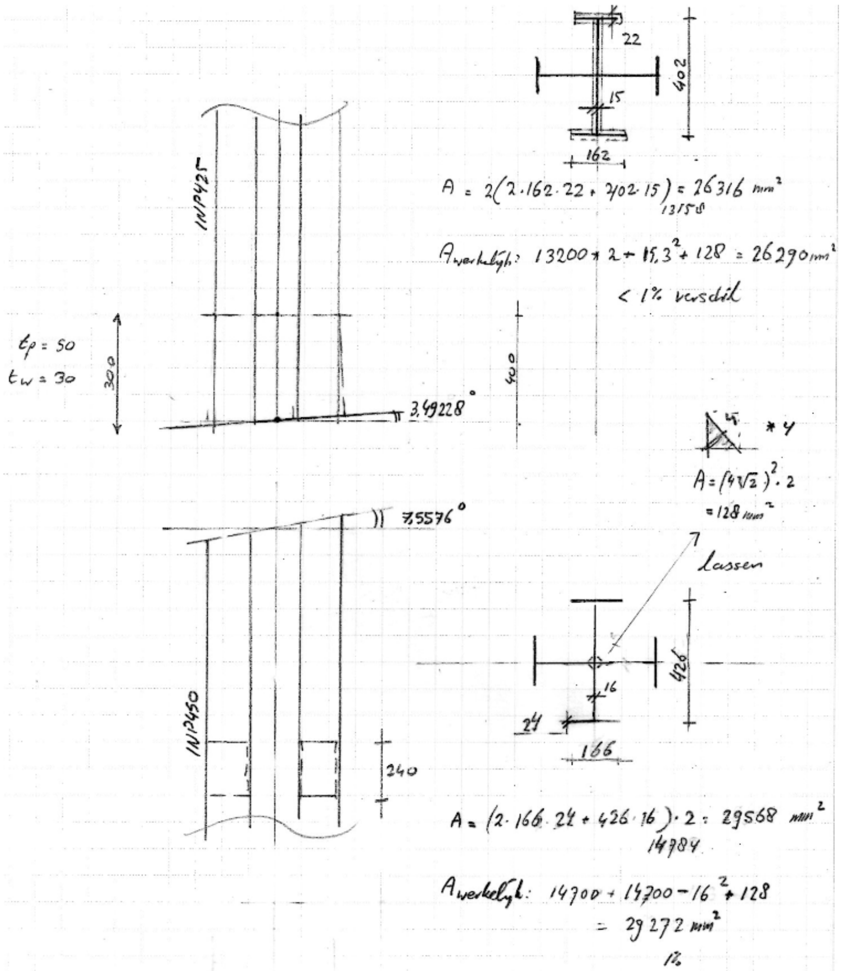


Figure 2-2 Equivalent cross-section for INP 425 and 450 profiles.

The geometry with different plate thickness used to construct the numerical model is shown in the figure 8. The center figure shows the zoomed in view of the hip of the tower leg. The change in slope occurs at this location. Additional plates for connecting the two segments are modelled with a thickness of 50 mm.

The reinforced section of INP425 has a combined thickness of 50 mm (the 230x25 translates into at least 28 mm of added thickness at a width of 162 mm). The INP425 and INP450 with respectively 15 and 12 mm added thickness are modelled as being 36 and 37 mm thick.

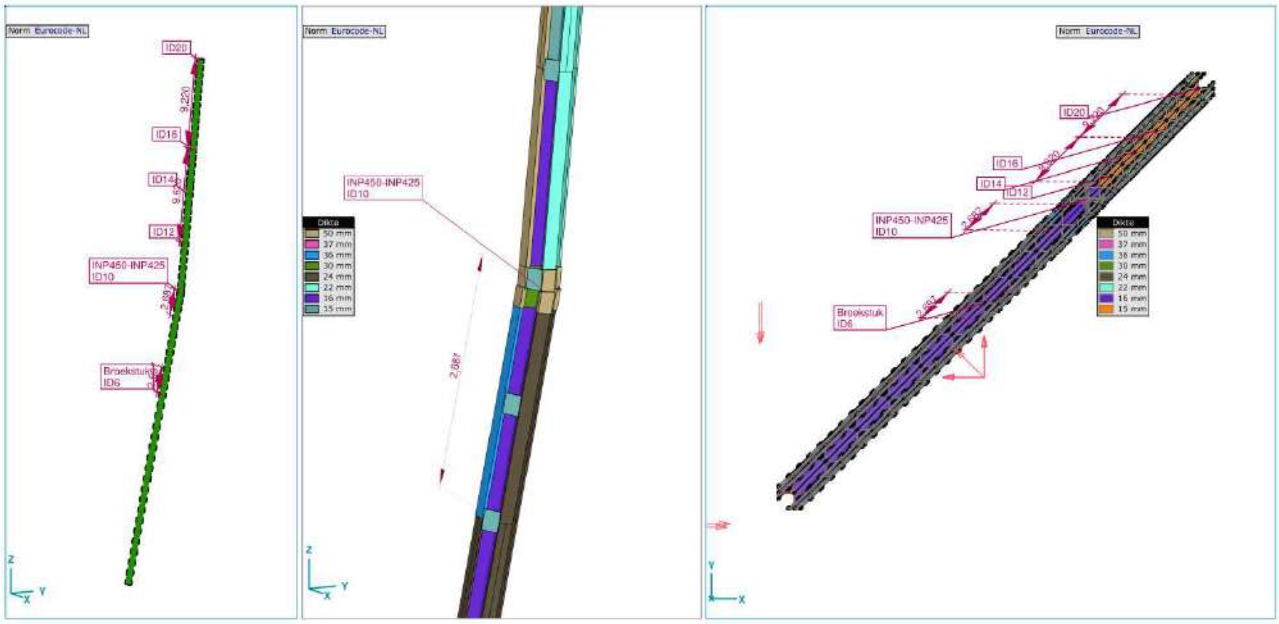


Figure 2-3 Geometry of the tower leg

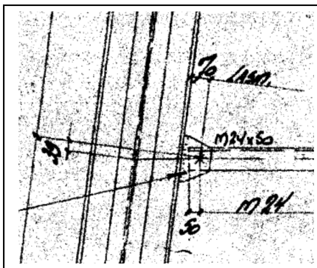
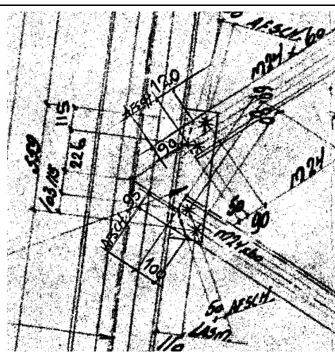
2.3 Support springs

An important part of the modelling is the supports provided to the main leg by the structure. Firstly, the boundary conditions at top and bottom.

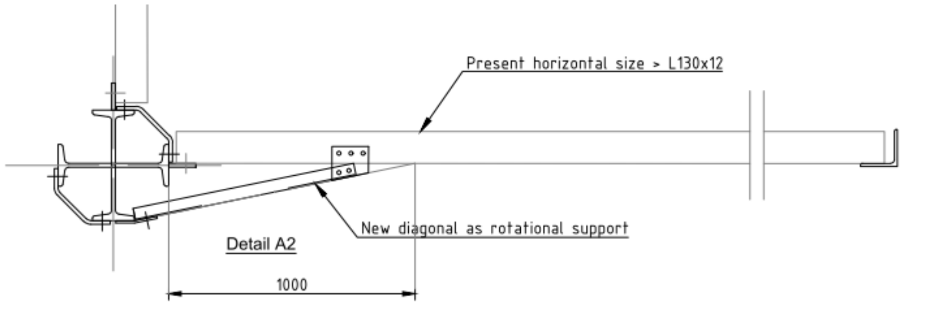
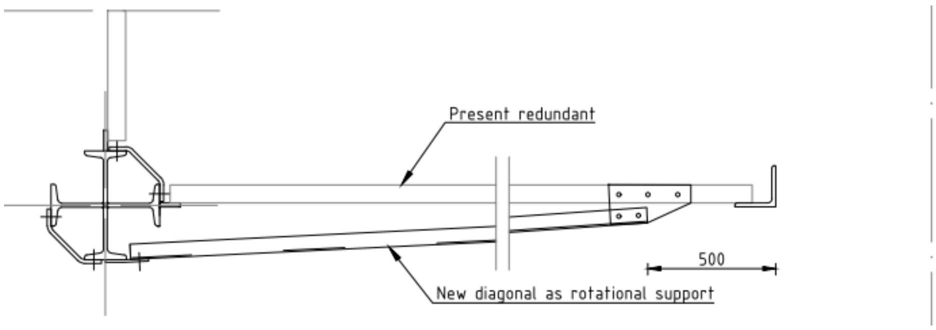
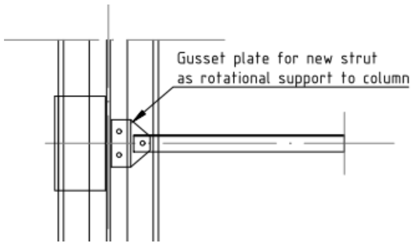
- the connection to the foundation. The main leg is considered fixed to translation and rotation for all the axes.
- the connection at top. The main leg is considered fixed here for horizontal translations. Rotations are free.

The existing connection of the leg with diagonals, horizontals and redundants via a welded plate is found to be inadequate as a support to warping of the section. These connections will be modified to smaller or larger extent, depending on the location in the structure and if one or two planes are modified. Four type of supports exist in the model:

1. the existing connection of the leg with diagonals, horizontals and redundants via a welded plate.

	
Connecting plate in existing situation for horizontal redundants	*Larger gusset plate for main diagonals*

2. the connection of diagonals, horizontals and redundants to the leg connected with an additional strut or support of short length. In this solution the flexural stiffness of the existing member will be activated, the relatively flexible connection with the plate is bypassed via the strut.
3. the addition of a second additional strut in the other plane to activate the bending stiffness of two horizontals instead of one.
4. the addition of an additional strut which extends to the diagonal of the primary bracing. This is the solution when the redundant brings insufficient gain in stiffness.

Solution 2 and 3: addition of a strut from main horizontal or diagonal. In solution 3, the strut is in both planes (front and side) of the tower.	
Solution 4 comprises a longer strut extending to the main diagonal. In this way no bending of the redundant will occur.	
The struts will be connected with a small gusset plate	

The redundant and the diagonals connected to the tower leg is simulated via support spring at their corresponding locations. The support springs are calculated in Table 2 to 5.

The adopted solution for each of the joints are tabulated below and shown in Figure 2-4.

Tabel 2 Solutions for increased stiffness of supports

ID	Main leg	Solution supports
1	INP450	2
2	INP450	2
3	INP450	4
4	INP450	4
5	INP450	4

6	INP450	4
7	INP450	2
8	INP450	3
9	INP450	2
10	INP450	3
11	INP425	2
12	INP425	3
13	INP425	2
14	INP425	3
15	INP425	2
16	INP425	3
17	INP425	2
18	INP425	3
19	INP425	2
20	INP425	3

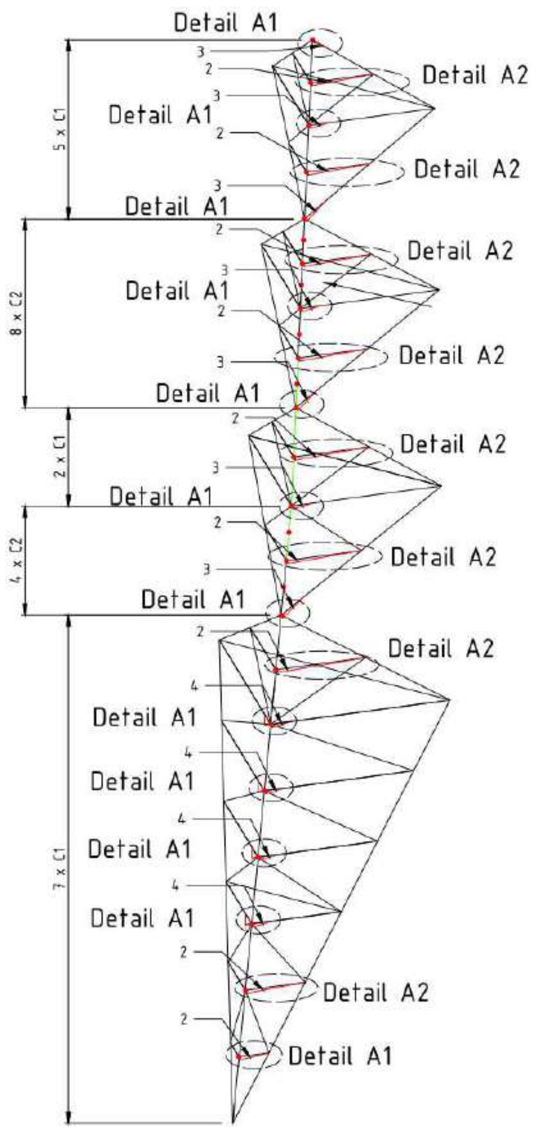


Figure 2-4 Visualisation of adopted solutions, refer to Appendix E

2.3.1 Solution 1

The supports are modelled as line supports over roughly the height of the plate (0,2 m). The lateral stiffness in the plane is given by Rx or Ry depending on the side of the section. The stiffness is chosen arbitrarily at 1 x 10^6 kN/m, the exact value is not important since global buckling of the column is investigated in PLS Tower already. The rotational support provided from connecting beams is modelled as the Rzz-value and needs to be determined first.

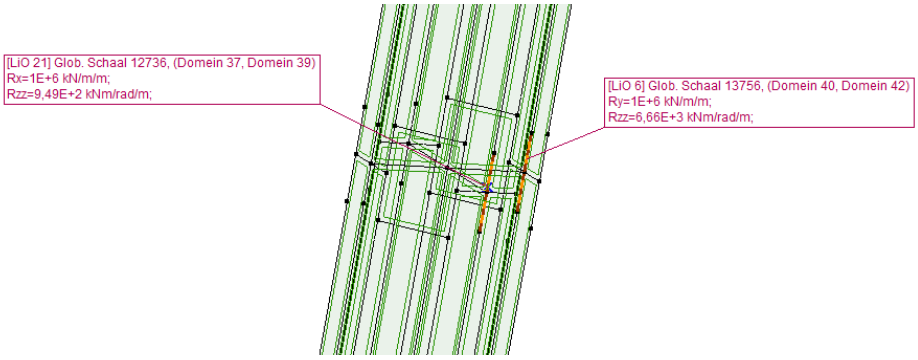


Figure 2-5 Line supports in the model

Each of the members that connect to the joint acts as a support to prevent rotation of the section to its length direction (local x-axis, global Z-axis). The rotational stiffness of the redundant and diagonals and their corresponding connecting plates are calculated as per equations below.

$$C_{beam} = \frac{4EI_1}{l_1 \cdot sin\theta_1}$$ Equation 1

$$C_{beams} = C_1 + C_2 + C_3$$ Equation 2

$$C_{plates} = \frac{EI}{l}$$ Equation 3

The node ID corresponding to table is used to identify the members associated with a joint in the tower leg. The stiffness of the redundant / diagonals in series add up in series, while the plate and beams are added in parallel as the sum of reciprocal values (equation 4).

$$\frac{1}{C_{rot}} = \frac{1}{c_{beams}} + \frac{1}{c_{plate}}$$ Equation 4

The equivalent rotational stiffness C_{rot} is applied as the K_{zz} in the axis VM models.

The axial and rotational stiffness of the individual redundant and diagonals connected to the tower leg are calculated in table 2. Bold profiles are exchanged profiles.

Table 1 Calculation of stiffness for redundant and diagonals

ID	Section 1	Moment of inertia (I) (mm4)	length (l) (m)	angle (alpha)	C (kNm/rad)
1	**L 80X 80X 8**	722397,8	1,452	82,5	414
2	**L 90X 90X 8**	1043715	3,418	24,9	108
2	L 100X100X8	1448264	2,904	107,5	400
3	L 100X100X10	1766604	4,094	44,7	255
3	L 110X110X10	2386800	4,356	97,5	456
4	L 110X110X10	2386800	5,104	57,8	332

4	L 130X130X12	4721381	5,809	107,5	651
5	L 120X120X11	3406132	6,29	66,3	417
5	L 150X150X10	6414133	7,261	97,5	736
6	L 150X150X10	6414133	7,569	72	677
6	L 150X150X10	6414133	8,713	97,5	613
6	**L 110X110X10**	2386800	5,32	129,2	292
7	L 110X110X10	2386800	4,155	107,5	460
8	L 180X180X16	17000000	9,626	63,8	1331
8	L 180X180X16	17000000	9,628	131,3	1114
9	L 100X100X10	1766604	3,65	97,5	403
10	L 100X100X8	1448264	4,245	58,5	244
10	L 250X250X22	62000000	7,3	97,5	7073
10	**L 100X100X10**	1766604	4,553	130,8	247
11	L 100X100X10	1766604	3,31	93,5	447
12	L 160X160X15	11000000	8,35	58	938
12	L 160X160X15	11000000	8,32	129	863
13	L 100X100X8	1448264	3,15	93,5	385
14	**L 100X100X10**	1766604	3,8	55,4	321
14	L 150X150X12	7368515	6,43	93,5	961
14	**L 100X100X10**	1766604	3,8	126	316
15	L 100X100X8	1448264	3,08	93,5	394
16	L 150X150X16	9496198	7,63	57,8	885
16	L 150X150X16	9496198	7,7	130,1	792
17	L 100X100X8	1448264	2,84	93,5	428
18	**L 100X100X8**	1448264	3,57	54	276
18	L 130X130X12	4721381	5,64	93,5	702
18	**L 100X100X8**	1448264	3,58	128	268
19	L 100X100X8	1448264	2,8	93,5	434
20	L 150X150X16	9496198	7	57	956
20	L 150X150X12	7368515	7	130	677

In the second table the stiffness of the plates can be seen. The plates are the weak point in the connection, even considering their small length. For the length the distance from flange to bolt was used.

ID	b(mm)	t(mm)	l(mm)	EI (kNm²)	EI/l (kNm)
1	150	10	60	2,63	43,8
2	260	10	70	4,55	65,0
3	260	10	70	4,55	65,0
4	260	10	70	4,55	65,0
5	260	10	70	4,55	65,0
6	560	12	100	16,93	169,3
7	370	8	70	3,32	47,4
8	660	12	97	19,96	205,8
9	200	8	70	1,79	25,6
10	690	16	80	49,46	618,2
11	200	8	62,5	1,79	28,7
12	640	16	144	45,88	318,6
13	200	8	62,5	1,79	28,7
14	390	16	80	27,96	349,4
15	200	8	62,5	1,79	28,7
16	660	16	144	47,31	328,5
17	200	8	62,5	1,79	28,7
18	355	10	70	6,21	88,8
19	200	8	62,5	1,79	28,7
20	675	16	112	48,38	432,0

The resulting rotational stiffness of the plates connecting redundant and diagonals connected to the tower leg is calculated in table 3. By division with the height of the line support, the Kzz-value is derived.

Table 2 Calculation of stiffness of connecting plates

ID	Cbeams,tot (kNm/rad)	Cplate (kNm/rad)	Cresult (kNm/rad)	Height of line support (m)	Kzz (kNm/m/rad)
1	414,3	43,8	39,6	0,200	198
2	507,5	65,0	57,6	0,200	288
3	711,3	65,0	59,6	0,200	298
4	983,5	65,0	61,0	0,200	305
5	1152,2	65,0	61,5	0,200	308
6	1582,1	169,3	153,0	0,200	765
7	460,2	47,4	42,9	0,200	215
8	2445,3	205,8	189,8	0,200	949
9	403,1	25,6	24,1	0,200	120
10	7564,3	618,2	571,5	0,200	2858
11	447,5	28,7	26,9	0,200	135
12	1801,5	318,6	270,7	0,200	1354
13	385,5	28,7	26,7	0,200	133
14	1598,2	349,4	286,7	0,200	1434
15	394,2	28,7	26,7	0,200	134
16	1677,1	328,5	274,7	0,200	1374
17	427,6	28,7	26,9	0,200	134
18	1245,3	88,8	82,8	0,200	414
19	433,7	28,7	26,9	0,200	134
20	1633,1	432,0	341,6	0,200	1708

All of the joints will be strengthened with additional supports. The above solution 1 values that represent the current structure, were only used at a certain joint if at only one of the faces an additional strut was applied.

2.3.2 Solution 2

In this case the weak plate and the existing member is completely bypassed by a long strut, thus increasing the rotational stiffness. The solution is modelled by adding a line support with flexural support perpendicular to flange surface.

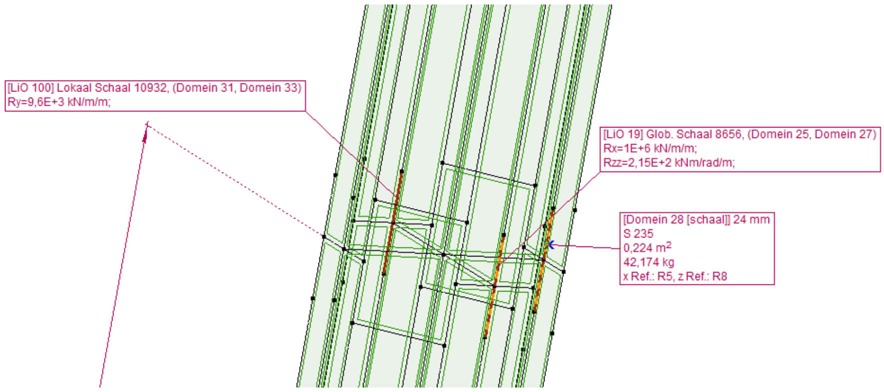


Figure 2-6 Modelling of the additional strut in solution 2

The solution brings additional stiffness, but cannot be considered infinitely stiff since it is still connected to the primary bracing loaded in bending. Alike solution 1, the resulting spring stiffness is composed of two springs acting in parallel, the axial stiffness of the strut and the spring stiffness of the primary bracing out of plane.

Tabel 3 Spring stiffnesses of primary bracing

ID	Primary member	Moment of inertia (I) (mm4)	length (l) (m)	k (kN/m)	C (kNm/rad)	a	Veerstijfheid k1 (kN/m)
1	L 150X150X10	6414133	3,6	1386	1,45	0,225	8943
2	L 150X150X10	6414133	3,6	1386	3,42	0,225	21051
7	L 180X180X16	17000000	9,18	222	4,16	0,225	4090
9	L 180X180X16	17000000	8,8	251	3,65	0,225	4079
11	L 160X160X15	11000000	8,16	204	3,31	0,212	3186
13	L 160X160X15	11000000	7,99	217	3,15	0,212	3230
15	L 150X150X16	9496198	7,695	210	3,08	0,212	3052
17	L 150X150X16	9496198	7,7	210	2,84	0,212	2809
19	L 150X150X12	7368515	7	217	2,80	0,212	2860

In the next step the axial stiffness is calculated of the strut (k2) and combined with the stiffness of the primary bracing (k1) into the resulting stiffness of strut and primary bracing. The K-value was used in the AxisVM model. Comparing k1 and k2 shows that bending of primary member is decisive.

ID	Section 1	Area (mm2)	length (l) (m)	k2 (kN/m)	k1 (kNm/rad)	Effectieve axiale stijfheid	Height of line support (m)	K-value (kN/m/m)
1	L 60X 60X 6	690,9	1,452	99924	8943	4,1E+03	0,2	2,1E+04
2	L 70X 70X 7	939,7	3,418	57736	21051	7,7E+03	0,2	3,9E+04
7	L 80X 80X 8	1226,8	4,155	62003	4090	1,9E+03	0,2	9,6E+03
9	L 70X 70X 7	939,7	3,65	54067	4079	1,9E+03	0,2	9,5E+03
11	L 70X 70X 7	939,7	3,31	59620	3186	1,5E+03	0,2	7,6E+03
13	L 70X 70X 7	939,7	3,15	62649	3230	1,5E+03	0,2	7,7E+03
15	L 70X 70X 7	939,7	3,08	64073	3052	1,5E+03	0,2	7,3E+03
17	L 70X 70X 7	939,7	2,84	69487	2809	1,3E+03	0,2	6,7E+03
19	L 70X 70X 7	939,7	2,8	70480	2860	1,4E+03	0,2	6,9E+03

2.3.3 Solution 3 and 4

In these solution the plate is bypassed, but with a relatively small strut only. It is applicable when the existing member is not too small in size. In situations when more stiffness is needed, members in both planes can be activated by using two struts (solution 4). The application of the struts in the model is similar to solution 1, with a rotational support.

Tabel 4 stiffnesses for solution 3 and 4

ID	Section	Moment of inertia (I) (mm4)	Length	Alpha	C (kNm/rad)	Height of line support (m)	K value (kNm/rad/m)
3	L 110X110X10	2386800	4,356	97,5	456	0,2	2282
4	L 130X130X12	2386800	5,809	107,5	329	0,2	1646
5	L 150X150X10	4721381	7,261	97,5	542	0,2	2708
6	L 150X150X10	6414133	8,713	97,5	613	0,2	3065
8	L 180X180X16	17000000	9,626	63,8	1331	0,2	6655
10	L 250X250X22	62000000	7,3	97,5	7073	0,2	35366
12	L 160X160X15	11000000	8,35	58	938	0,2	4692
14	L 150X150X12	7368515	6,43	93,5	961	0,2	4804
16	L 150X150X16	9496198	7,63	57,8	885	0,2	4423
18	L 130X130X12	4721381	5,64	93,5	702	0,2	3509
20	L 150X150X16	9496198	7	57	956	0,1	9557

The table shows that the stiffness values are considerately higher than solution 1. Especially when two struts are applied, resulting in both supports with increased stiffness.

2.4 Coupling plates

The torsional buckling mode is somewhat comparable to buckling over the weak axis of a single INP-section. That means the flanges bend in their plane, resulting in rotation at the supports. The bending can be reduced by coupling the flanges to another. This is the idea behind the coupling plates. The feasibility study showed that the plates are very effective, however the installing and construction of the plates in an existing structure is not straightforward. In order to be effective, plates are not allowed to have any slippage with the flange. This is hard to avoid when using bolted connections.

Pre-tensioned bolts have the disadvantage that the zinc and coating layer should be removed for effectiveness. In addition the tensioning of the bolts is hindered because flanges are not parallel but perpundicular to another. The only possible bolt types are injection bolts and fitted bolts. Since bolt holes will be drilled in-situ and holes can be chosen equal to bolt diameter, the best solution is considered to be the fitted bolts. Since play is not allowed it is of great importance that the dimensions of the INP-section should be measured beforehand and plates should match the actual dimension.

In the AxisVM model the heigth of the stiffeners was used as 240 mm. Since the effectiveness of the plate is highly dependent on the height, as a safety margin a height of 400 mm is proposed, with allows for application of 4 bolts instead of 3.

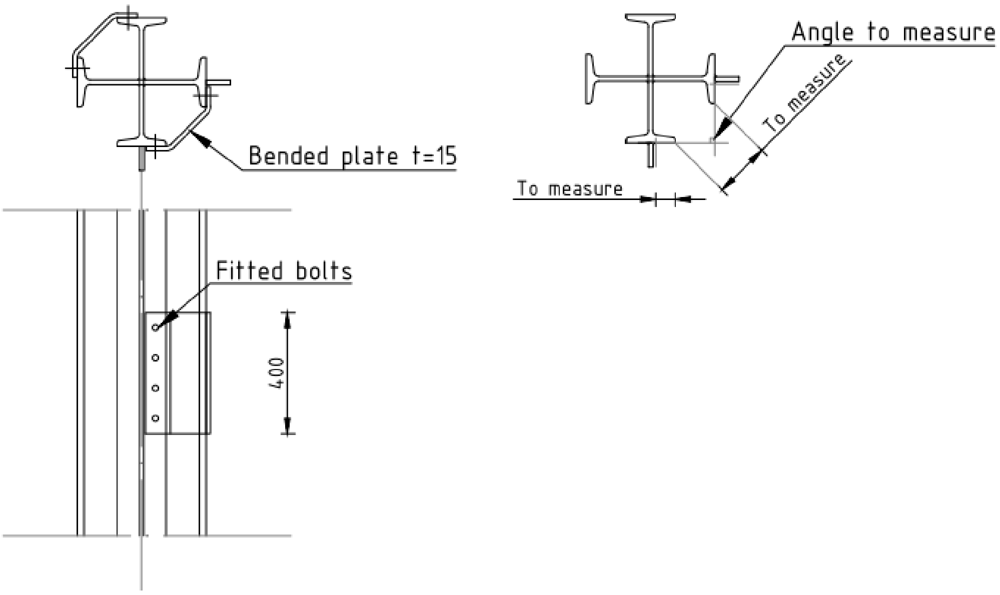


Figure 2-7 Solution with coupling plates

The feasibility study showed that coupling plates should be added at least at every joint in the structure, 2 for every joint. In the final study here, with actual spring stiffnesses, it has turned out that the part of the structure in the vicinity of the inclination change needs to be equipped with two pair of coupling plates each panel between the joints as can be seen in Figure 2-4.

The design of the connection between plate and flange should be done according to Eurocode 1993-1-1 section 6.4.3.1.

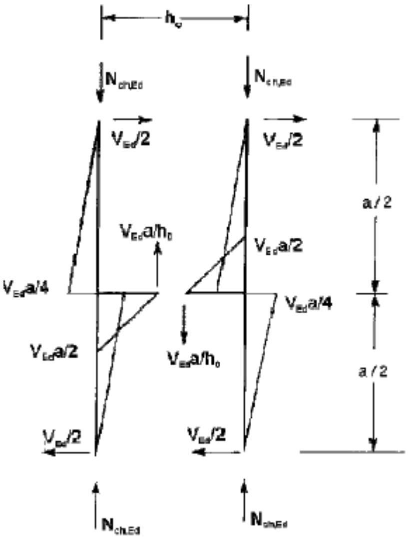


Figure 2-8 Eurocode figure for scheme of coupling plates

For the shear force acting to the ladder frame, the value 1% may be taken of the compression force in the total column, (2% of the flange force) (refer to construeren B of Overspannend staal).

With A_{fl} = 170x23=3910 mm^2 and stress level of 205 N/mm^2:

N_{Ed} = 205 x 3910 = 801 kN

V_{Ed} = 2% x 801 kN

With a = 3,2 m and h = 0,32 m, The shear force acting is equivalent to 3,2 / 0,32 x 1602 x 1% = 160 kN.

The bending moment on the pattern of the bolted connection with the flange is 160 x 0,5 x 0,32 = 25,4 kNm.

2.5 Loading

The loading applied on the tower leg is matched with the compression force seen in the PLS tower model for the design load with a return period of afkeurlevel 15 years. The load is applied as distributed line loads at each main joint. The distributed loads on the web and flange on the INP profiles are calculated in Table 4.

Table 3 calculation of distributed load in the flange and web of cruciform profile

Joint	∆N	N	Prof	Atot	Aweb	Lweb	qweb (kN/m)	Aflange	Lflange	qflange (kN/m)
20	5440	5440	INP425	26316	6030	402	**3101**	3564	162	**4548**
16	260	5700	INP425	26316	6030	402	**148**	3564	162	**217**
12	400	6100	INP425	26316	6030	402	**228**	3564	162	**334**
8	100	6200	INP450	29568	6816	426	**54**	3984	166	**81**
6	-230	5970	INP450	29568	6816	426	**-124**	3984	166	**-187**
3	80	6050	INP450	29568	6816	426	**43**	3984	166	**65**

The loads applied in the Axis VM model are shown in figure 9. The locations of load are applied at the locations marked in red and blue boxes. The locations of load is shown in zoomed view on the right. The thickness of the plates are also shown in figure 9.

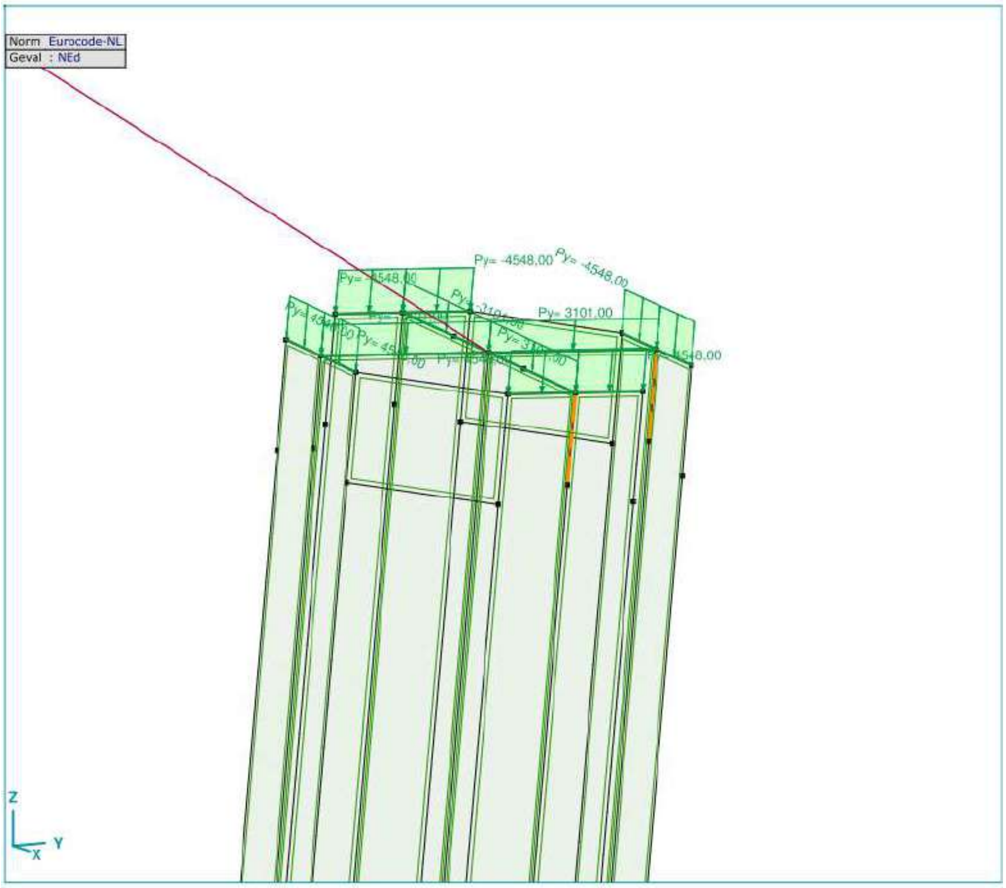


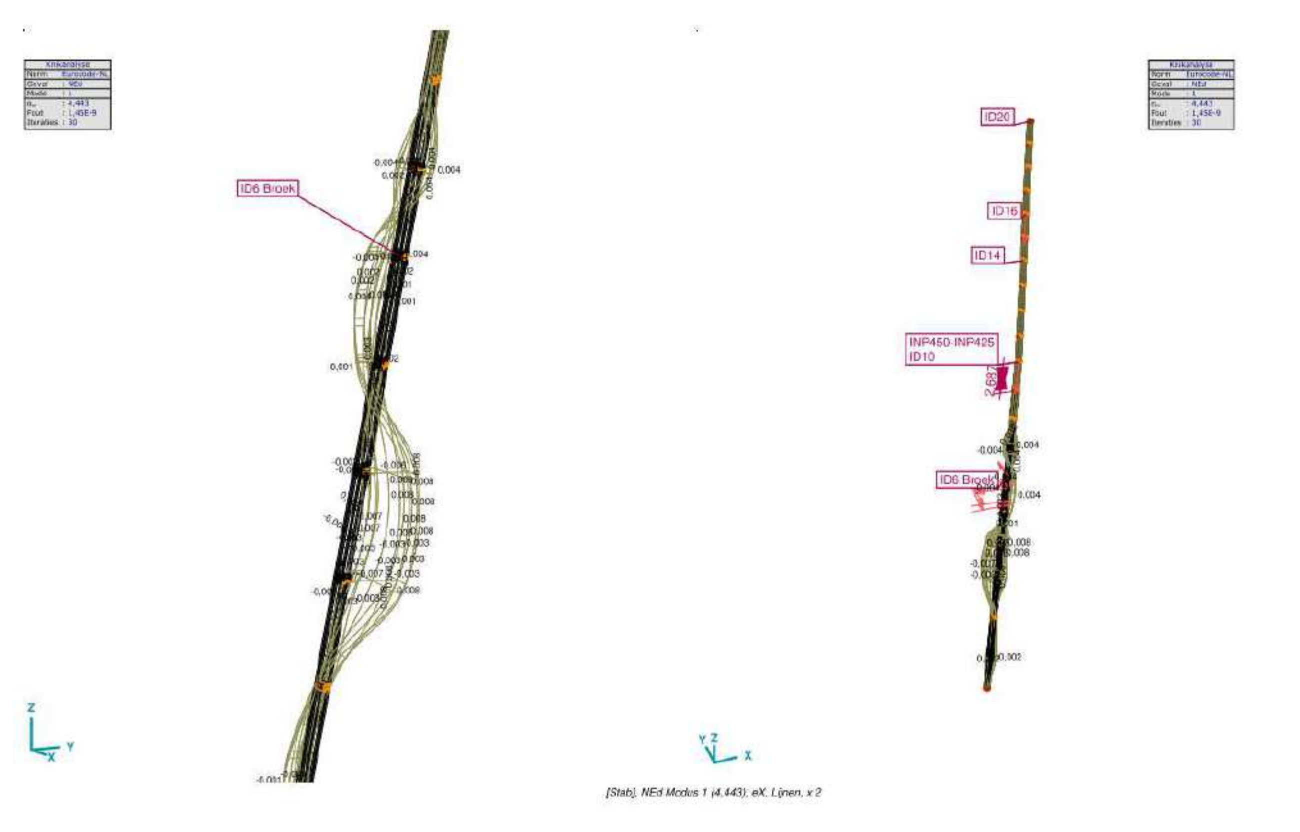
Figure 2-9 Distributed load applied on top of the structure

3 RESULTS

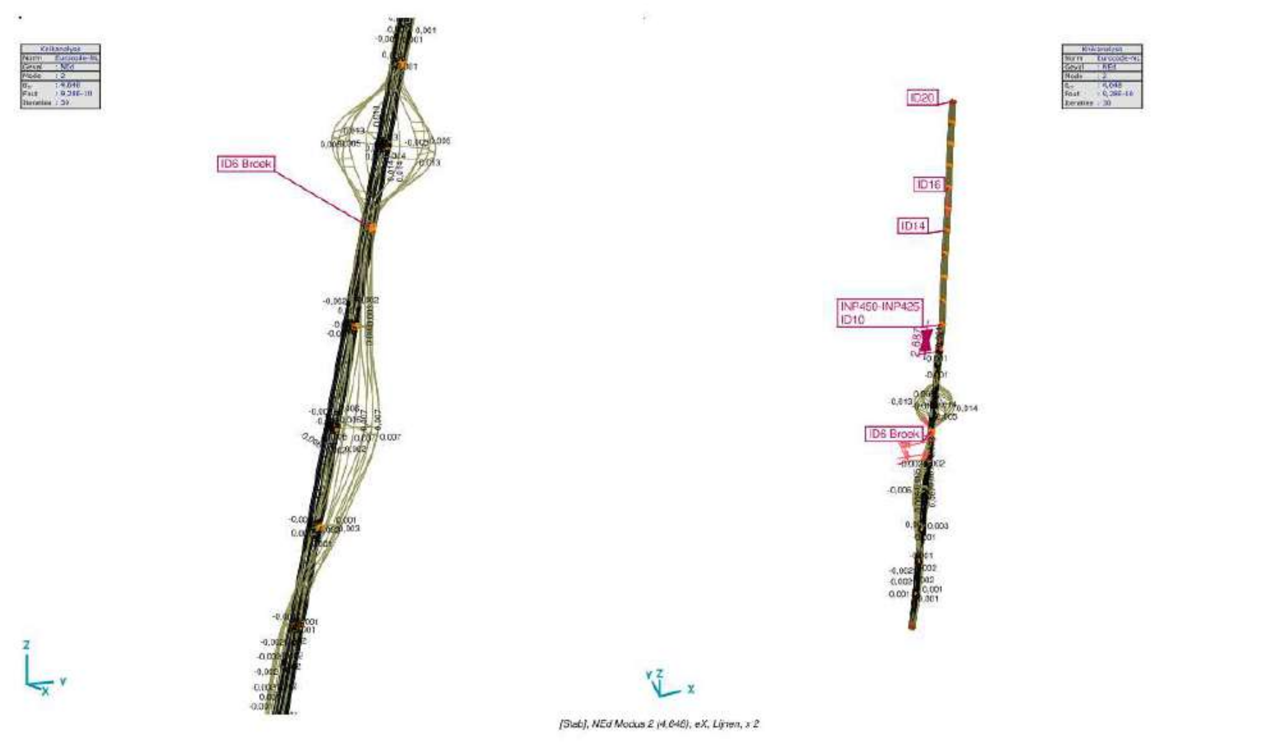
The result of the buckling analysis is the eigenvalue or n-value, the ratio between elastic capacity and load. Secondly the elastic stresses have been analysed to verify the stress level at the most critical section, the inclination change.

3.1 Buckling analysis

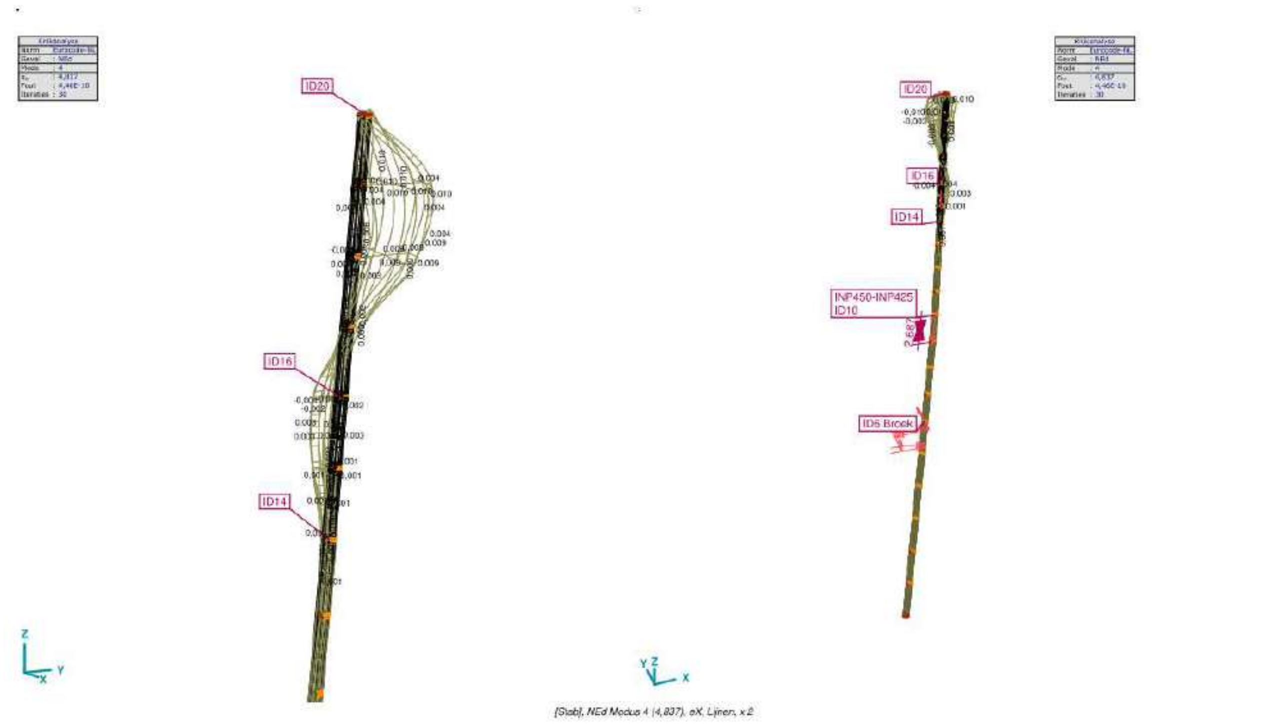
The first 15 buckling modes have been investigated in the AxisVM package. In ascending order, the most important ones will be looked at.



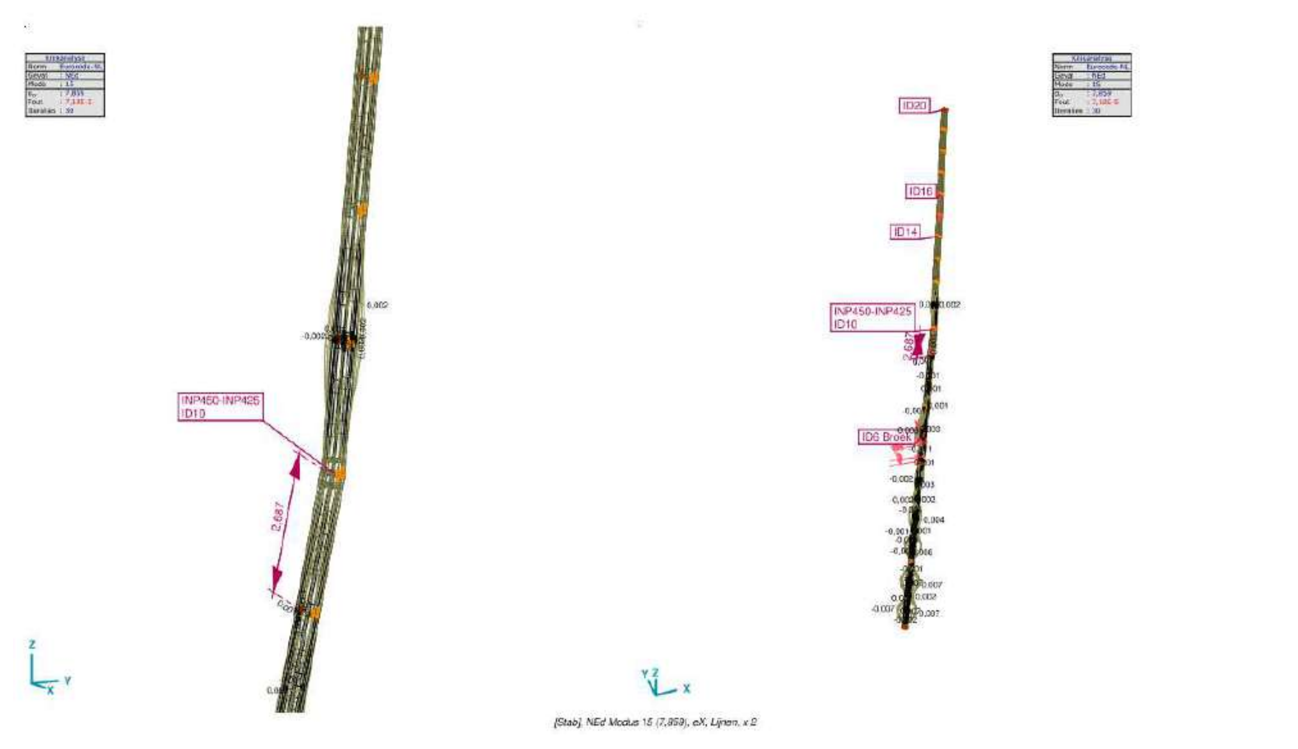
The first mode with n=4,44 occurs lower down in the structure with INP450-section. It is a combination of warping and lateral displacement.



The second mode with slightly higher n=4,64 occurs halfway the height of the broekstuk, with INP450-section. The buckling mode includes a purely torsional mode. The height of the deflected shape is more than the spacing of redundant, indicating the flexible supports.



The third mode is at the same location as the second, so not of interest. The fourth mode is at the top of the structure in the segment with INP425-sections. Its n-value is 4,84.



All of the higher modes occur in the INP450-leg. The final investigated mode shows the deflection at the reinforced part of the INP425 section. The n-value has increased to 7,8.

The buckling analysis shows that lowest n-value of 4,4 occurs in the not reinforced part of the main leg with INP450-section in the hip structure. The second mode of interest after this occurs at top, in the part with INP425-sections. The n-value is 4,8. No buckling mode was observed in the not-reinforced part of the INP425-structure with two coupling plates. The lower boundary for the n-value in that section is at least 7,8. The reinforced part with INP4250-section has a n-value of 7,8.

The n-value is a theoretical value, a second step is necessary to derive the buckling capacity according to Eurocode. This is done with a spreadsheet and included on following pages. The results are summarised in table below. The capacities have been input into PLS-TOWER for the “afk-model”.

Tabel 5 Capacities with Eurocode check

Section	Height	n-value	Load	Capacity	U.C.
INP425	ID16-ID20	4,8	5400	5530	0,98
INP425	ID12-ID16	> 7,8	5700	5825	0,98
INP425+PL230x25	ID10-ID12	7,8	8310	8365	0,99
INP450	ID1-ID10	4,44	6050	6050	1,00

Torsieknik

Versie: 1.4

Onderwerp	Randstijl S+95	*Toetsing*		
Profiel	INP450x2 v1	U.C.	1,00	Voldoet

Normaalkracht

$N_{c;s;d}$ = 6050,0 kN

Staalsoort S235

Doorsnedeklasse: 1 Geldig

Gewicht 2,29 kN/m

Doorsnedegrootheden

I_y	I_z	I_v	A
$10^4\,mm^4$	$10^4\,mm^4$	$10^4\,mm^4$	mm^4
47510	47510	47510	29191

I_t	I_{wa}
$10^4\,mm^4$	mm^4
517	1,483E+12

Geometrie

$l_{y;buc}$ =	3,20	m
$l_{z;buc}$ =	3,20	m
$l_{v;buc}$ =	3,20	m
l_{tk} =	3,20	m
Steun 1	Gaffel	
Steun 2	Gaffel	
Classificatie	Geschoord	

Doorsnedecapaciteit

$N_{pl;d} = A \times f_{y;d}$ = 6860 kN

Knikstabiliteit y-as

$\lambda_{y;rel} = l_{buc} / (i_y \times \lambda_{euler})$	0,27	-
$\chi_{y;buc}$ = (kromme b)	0,98	-
$N_{b,Rd} = \chi A f_y$ =	6696	kN
U.C.	**0,90**	Voldoet

Knikstabiliteit z-as

$\lambda_{z;rel} = l_{buc} / (i_z \times \lambda_{euler})$	0,27	-
$\chi_{z;buc}$ = (kromme b)	0,98	-
$N_{b,Rd} = \chi A f_y$ =	6696	kN
U.C.	**0,90**	Voldoet

Knikstabiliteit v-as

$\lambda_{z;rel} = l_{buc} / (i_z \times \lambda_{euler})$	0,27	-
$\lambda_{eff} = 0{,}10 + 0{,}80\ \lambda$ =	0,31	-
$\chi_{z;buc}$ = (kromme b)	0,96	-
$N_{b,Rd} = \chi A f_y$ =	6579	kN
U.C.	**0,92**	Voldoet

Torsieknikstabiliteit

$i_0^2 = i_y^2 + i_z^2 + y_0^2$ =	32551	mm^2
$\beta = 1 - y_0^2/i_0^2$ =	1,000	-
$F_{y;E} = \pi^2 E I_y / l_y^2$ =	96162	kN
$F_{t;E} = 1/i_0^2 (G_d I_t + \pi^2 E I_{wa} / l_{t;buc})$ =	22097	kN
$F_{tk;E} = {}^1/_{2\beta}((F_{y;E}+F_{t;E}) + \sqrt{(F_{y;E}+F_{t;E})^2 - 4\beta^2 F_{y;E} F_{t;E}})$		
$F_{tk;E}$ =	22097	kN
$\lambda_{tk;rel} = \sqrt{N_{Rd} / F_{tk;E}}$ =	0,56	-
$\chi_{z;buc}$ = (kromme b)	0,858	-
$N_{b,Rd} = \chi A f_y$ =	5886	kN
U.C.	**1,03**	n-waarde OK

Buckling length with FEM-software		
n-value	4,44	
N_{Ed} =	6050	kN
$N_{cr;E} = n \times N_{Ed}$ =	26862	kN
$N_{pl,Rd}$ =	6860	kN
$\lambda_{rel} = \sqrt{N_{pl;Rd} / N_{cr;E}}$ =	0,51	-
χ_{buc} = (curve =)	0,88	-
$N_{b,Rd} = \chi A f_y / \gamma_{M1}$ =	**6049**	kN
U.C. =	1,00	Voldoet

Torsieknik

Versie: 1.4

Onderwerp	**Randstijl S+95**	*Toetsing*	
Profiel	**INP425x2 v1**	U.C.	**0,98** Voldoet

Normaalkracht

$N_{c;s;d}$ = **5400,0** kN

Staalsoort	**S235**	
Doorsnedeklasse:	**1**	Geldig
Gewicht	2,08	kN/m

Doorsnedegrootheden

I_y $10^4\,mm^4$	I_z $10^4\,mm^4$	I_v $10^4\,mm^4$	A mm^4
38710	38710	38710	26474

I_t $10^4\,mm^4$	I_{wa} mm^4
429	1,119E+12

Geometrie

$l_{y;buc}$ =	2,50	m
$l_{z;buc}$ =	2,50	m
$l_{v;buc}$ =	2,50	m
l_{tk} =	2,50	m
Steun 1	Gaffel	
Steun 2	Gaffel	
Classificatie	Geschoord	

Doorsnedecapaciteit

$N_{pl;d} = A \times f_{y;d}$ = 6221 kN

Knikstabiliteit y-as

$\lambda_{y;rel} = l_{buc} / (i_y \times \lambda_{euler})$	0,22	-
$\chi_{y;buc}$ = (kromme b)	0,99	-
$N_{b,Rd} = \chi A f_y$ =	6177	kN
U.C.	**0,87**	Voldoet

Knikstabiliteit z-as

$\lambda_{z;rel} = l_{buc} / (i_z \times \lambda_{euler})$	0,22	-
$\chi_{z;buc}$ = (kromme b)	0,99	-
$N_{b,Rd} = \chi A f_y$ =	6177	kN
U.C.	**0,87**	Voldoet

Knikstabiliteit v-as

$\lambda_{z;rel} = l_{buc} / (i_z \times \lambda_{euler})$	0,22	-
$\lambda_{eff} = 0,10+0,80\,\lambda =$	0,28	-
$\chi_{z;buc}$ = (kromme b)	0,97	-
$N_{b,Rd} = \chi A f_y$ =	6052	kN
U.C.	**0,89**	Voldoet

Torsieknikstabiliteit

$i_0^2 = i_y^2 + i_z^2 + y_0^2$ =	29244	mm^2
$\beta = 1 - y_0^2/i_0^2$ =	1,000	-
$F_{y;E} = \pi^2 EI_y / l_y^2$ =	128370	kN
$F_{t;E} = 1/i_0^2(G_d I_t + \pi^2 EI_{wa}/l_{t;buc})$ =	24570	kN
$F_{tk;E} = {}^1/_{2\beta}((F_{y;E}+F_{t;E})+\sqrt{(F_{y;E}+F_{t;E})^2-4\beta^2 F_{y;E}F_{t;E}})$		
$F_{tk;E}$ =	24570	kN
$\lambda_{tk;rel} = \sqrt{N_{Rd} / F_{tk;E}}$ =	0,50	-
$\chi_{z;buc}$ = (kromme b)	0,883	-
$N_{b,Rd} = \chi A f_y$ =	5492	kN
U.C.	**0,98**	Voldoet

Buckling length with FEM-software		
n-value	4,8	
N_{Ed} =	5400	kN
$N_{cr;E} = n \times N_{Ed}$ =	25920	kN
$N_{pl,Rd}$ =	6221	kN
$\lambda_{rel} = \sqrt{N_{pl;Rd} / N_{cr;E}}$ =	0,49	-
χ_{buc} = (curve =)	0,89	-
$N_{b,Rd} = \chi A f_y / \gamma_{M1}$ =	**5529**	kN
U.C. =	0,98	Voldoet

Torsieknik

Versie: 1.4

Onderwerp	**Randstijl S+95 ID12-ID16**	*Toetsing*	
Profiel	**INP425x2 v1**	U.C.	**0,98** Voldoet

Normaalkracht

$N_{c;s;d}$ = **5700,0** kN

Staalsoort **S235**

Doorsnedeklasse: **1** Geldig

Gewicht 2,08 kN/m

Doorsnedegrootheden

I_y	I_z	I_v	A
$10^4\,mm^4$	$10^4\,mm^4$	$10^4\,mm^4$	mm^4
38710	38710	38710	26474

I_t	I_{wa}
$10^4\,mm^4$	mm^4
429	1,119E+12

Geometrie

$l_{y;buc}$ =	2,50	m
$l_{z;buc}$ =	2,50	m
$l_{v;buc}$ =	2,50	m
l_{tk} =	2,50	m
Steun 1	Gaffel	
Steun 2	Gaffel	
Classificatie	Geschoord	

Doorsnedecapaciteit

$N_{pl;d} = A \times f_{y;d}$ = 6221 kN

Knikstabiliteit y-as

$\lambda_{y;rel} = l_{buc} / (i_y \times \lambda_{euler})$	0,22	-
$\chi_{y;buc}$ = (kromme b)	0,99	-
$N_{b,Rd} = \chi A f_y$ =	6177	kN
U.C.	**0,92**	Voldoet

Knikstabiliteit z-as

$\lambda_{z;rel} = l_{buc} / (i_z \times \lambda_{euler})$	0,22	-
$\chi_{z;buc}$ = (kromme b)	0,99	-
$N_{b,Rd} = \chi A f_y$ =	6177	kN
U.C.	**0,92**	Voldoet

Knikstabiliteit v-as

$\lambda_{z;rel} = l_{buc} / (i_z \times \lambda_{euler})$	0,22	-
$\lambda_{eff} = 0{,}10+0{,}80\,\lambda =$	0,28	-
$\chi_{z;buc}$ = (kromme b)	0,97	-
$N_{b,Rd} = \chi A f_y$ =	6052	kN
U.C.	**0,94**	Voldoet

Torsieknikstabiliteit

$i_0^2 = i_y^2 + i_z^2 + y_0^2$ =	29244	mm^2
$\beta = 1 - y_0^2/i_0^2$ =	1,000	-
$F_{y;E} = \pi^2 E I_y / l_y^2$ =	128370	kN
$F_{t;E} = 1/i_0^2(G_d I_t + \pi^2 E I_{wa}/l_{t;buc})$ =	24570	kN
$F_{tk;E} = {}^1/_{2\beta}((F_{y;E}+F_{t;E})+\sqrt{(F_{y;E}+F_{t;E})^2-4\beta^2 F_{y;E}F_{t;E}})$		
$F_{tk;E}$ =	24570	kN
$\lambda_{tk;rel} = \sqrt{N_{Rd} / F_{tk;E}}$ =	0,50	-
$\chi_{z;buc}$ = (kromme b)	0,883	-
$N_{b,Rd} = \chi A f_y$ =	5492	kN
U.C.	**1,04**	n-waarde OK

Buckling length with FEM-software		
n-value	7,8	
N_{Ed} =	5700	kN
$N_{cr;E} = n \times N_{Ed}$ =	44460	kN
$N_{pl,Rd}$ =	6221	kN
$\lambda_{rel} = \sqrt{N_{pl;Rd} / N_{cr;E}}$ =	0,37	-
χ_{buc} = (curve =)	0,94	-
$N_{b,Rd} = \chi A f_y / \gamma_{M1}$ =	**5825**	kN
U.C. =	0,98	Voldoet

Torsieknik

Versie: 1.4

Onderwerp	Randstijl S+95	*Toetsing*		
Profiel	INP425x2+2PL230x25	U.C.	**0,99**	Voldoet

Normaalkracht

$N_{c;s;d}$ = **8310,0** kN

Staalsoort **S235**

Doorsnedeklasse: **1** Geldig

Gewicht 2,98 kN/m

Doorsnedegrootheden

I_y	I_z	I_v	A
$10^4\,mm^4$	$10^4\,mm^4$	$10^4\,mm^4$	mm^4
65980	65980	61570	37974

I_t	I_{wa}
$10^4\,mm^4$	mm^4
1499	3,32E+12

Geometrie

$l_{y;buc}$ =	2,50	m
$l_{z;buc}$ =	2,50	m
$l_{v;buc}$ =	2,50	m
l_{tk} =	2,50	m
Steun 1	Gaffel	
Steun 2	Gaffel	
Classificatie	Geschoord	

Doorsnedecapaciteit

$N_{pl;d} = A \times f_{y;d}$ = 8924 kN

Knikstabiliteit y-as

$\lambda_{y;rel} = l_{buc} / (i_y \times \lambda_{euler})$	0,20	-
$\chi_{y;buc}$ = (kromme b)	1,00	-
$N_{b,Rd} = \chi A f_y$ =	8918	kN
U.C.	**0,93**	Voldoet

Knikstabiliteit z-as

$\lambda_{z;rel} = l_{buc} / (i_z \times \lambda_{euler})$	0,20	-
$\chi_{z;buc}$ = (kromme b)	1,00	-
$N_{b,Rd} = \chi A f_y$ =	8918	kN
U.C.	**0,93**	Voldoet

Knikstabiliteit v-as

$\lambda_{z;rel} = l_{buc} / (i_z \times \lambda_{euler})$	0,21	-
$\lambda_{eff} = 0{,}10 + 0{,}80\,\lambda =$	0,27	-
$\chi_{z;buc}$ = (kromme b)	0,98	-
$N_{b,Rd} = \chi A f_y$ =	8710	kN
U.C.	**0,95**	Voldoet

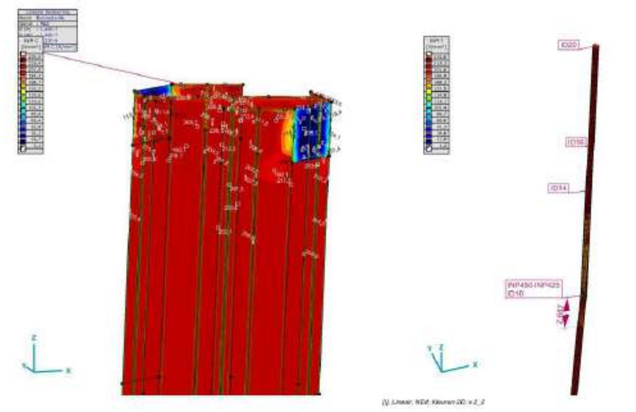
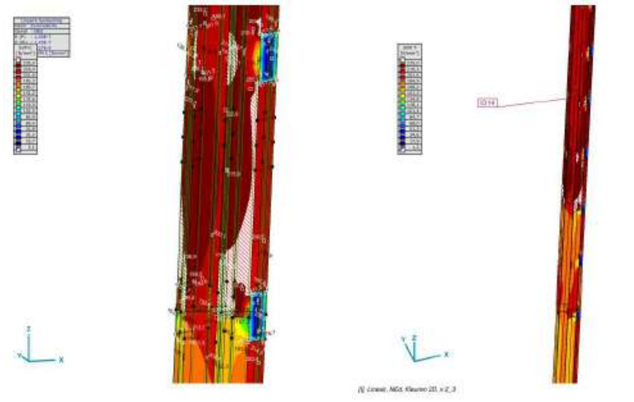
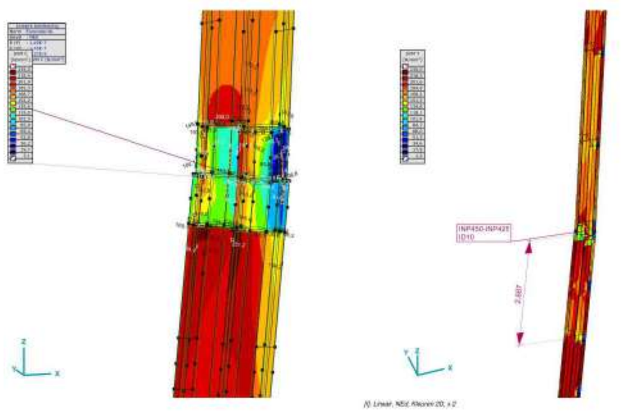
Torsieknikstabiliteit

$i_0^2 = i_y^2 + i_z^2 + y_0^2$ =	34750	mm^2
$\beta = 1 - y_0^2/i_0^2$ =	1,000	-
$F_{y;E} = \pi^2 E I_y / l_y^2$ =	218802	kN
$F_{t;E} = 1/i_0^2(G_d I_t + \pi^2 E I_{wa}/l_{t;buc})$ =	66658	kN
$F_{tk;E} = {}^1/_{2\beta}((F_{y;E}+F_{t;E})+\sqrt{(F_{y;E}+F_{t;E})^2-4\beta^2 F_{y;E}F_{t;E}})$		
$F_{tk;E}$ =	66658	kN
$\lambda_{tk;rel} = \sqrt{N_{Rd} / F_{tk;E}}$ =	0,37	-
$\chi_{z;buc}$ = (kromme b)	0,939	-
$N_{b,Rd} = \chi A f_y$ =	8383	kN
U.C.	**0,99**	Voldoet

Buckling length with FEM-software		
n-value	7,8	
N_{Ed} =	8310	kN
$N_{cr;E} = n \times N_{Ed}$ =	64818	kN
$N_{pl,Rd}$ =	8924	kN
$\lambda_{rel} = \sqrt{N_{pl;Rd} / N_{cr;E}}$ =	0,37	-
χ_{buc} = (curve =)	0,94	-
$N_{b,Rd} = \chi A f_y / \gamma_{M1}$ =	**8365**	kN
U.C. =	0,99	Voldoet

3.2 Stress level

The stress level has been observed as a second topic of the study. At four critical locations the stresses are displayed.

	
At top it is observed that stresses are equally distributed over the section with the exception of the coupling plate. The stress level of 205 N/mm2 corresponds to 5412 kN of force, in accordance with expectation.	*At the start of the reinforcement, some local areas in the web show stresses above 235 N/mm2. This is as expected and the reason the reinforced section was continued one panel above the height it was required. In reality due to bolt losses, the stress will smoothen out, making it acceptable.*
	
At the inclination change with transition of INP450 to INP425 the stresses were initially above 235 N/mm2. With the proposed reinforcements, stress levels stay below yield limit, although margin is less than expected if an equal stress distribution would be assumed.	*At the bottom it is observed that stresses are equally distributed over the section with the exception of the coupling plate. The stress level of 208 N/mm2 corresponds to 6110 kN of force, in accordance with expectation.*

4 CONCLUSION

The main legs of tower type S+95 consisting of cruciform INP-sections which were found inadequate for torsional buckling have been subject of investigation to their stability. The main reason was the insufficient capacity of the cross section, secondly, insufficient support against rotation played another role.

The proposed solution is to couple the flanges with plates in order to increase torsional resistance of the section. The inadequate support against rotation of the section is solved by adding horizontal members to make a stable system consisting of three members.

In this study the effectiveness of the proposed strengthening measures has been investigated using the buckling analysis offered by the software package AxisVM.

A model consisting of one of the four main legs was used in the study, using shell elements and linear line supports against rotation and lateral supports.

The study shows that the strengthening proposal with a combination of plates and added struts is effective. The n-value which is the ratio between load and capacity increases from 2,4 to a minimum of 4,4 which suffices for roughly two-thirds of the length of the INP-column. Two segments of the main leg however had still insufficient capacity. For the most heavily loaded section within this segment, the INP425 needs to be reinforced with plates. This section reaches the capacity based on verbouwlevel loads. The other part of the segment that was insufficient requires a higher number of coupling plates in order to fulfill afkeurlevel loads.

ATTACHMENTS

Output of AxisVM

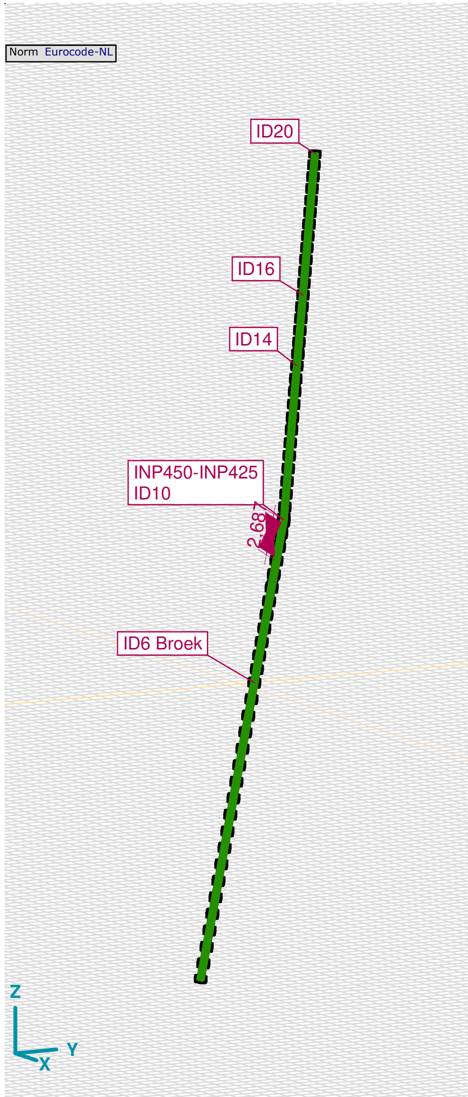
Project: KIJ-GT

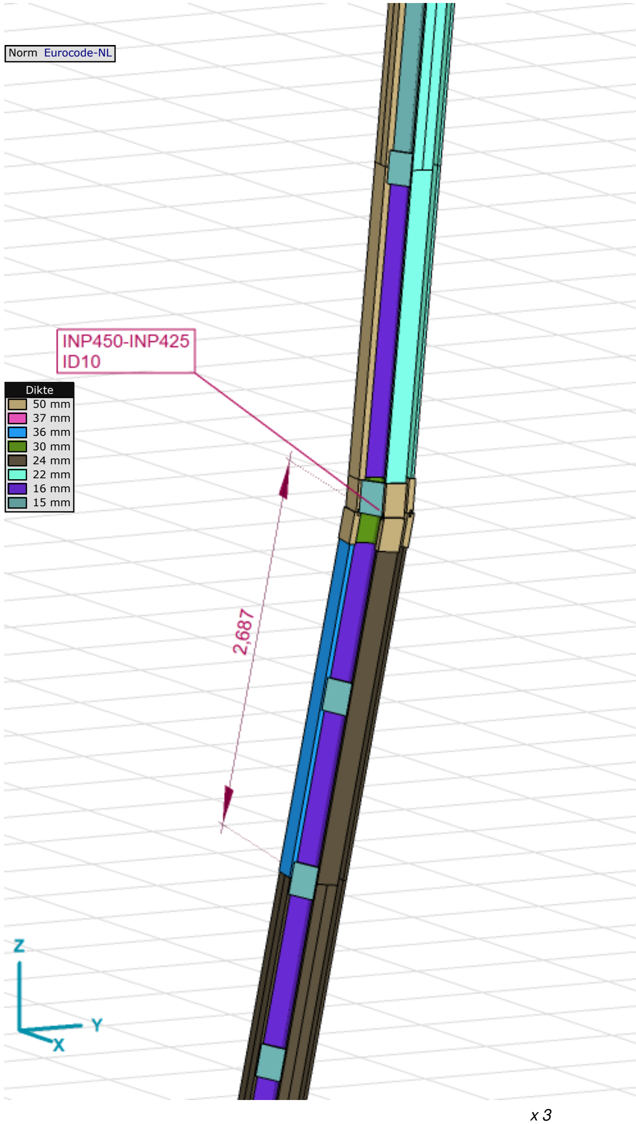
Constructeur: DNV GL - Energy

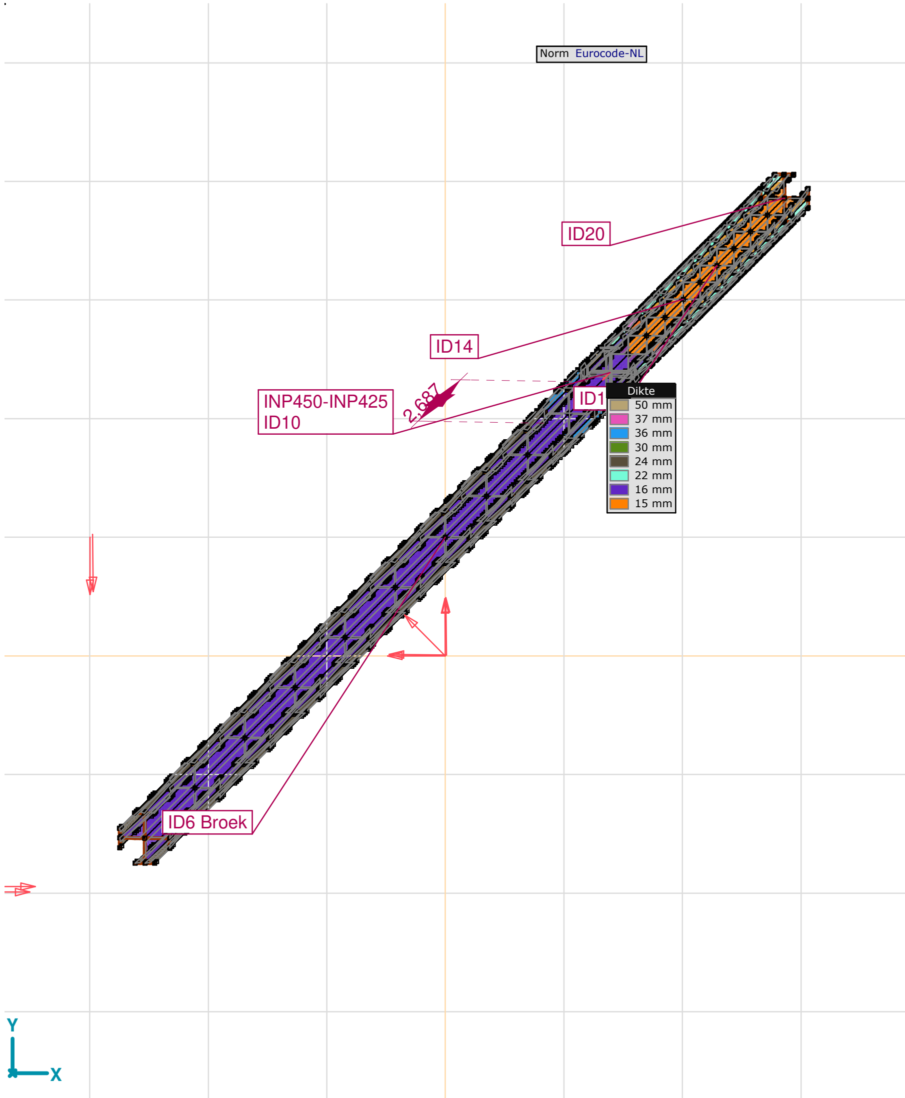
AxisVM X5 R4h · Geregistreerd aan DNV GL - Energy
S+95 Leg study 16.axs

Rapport

Rapport, Inhoudsopgave


Norm Eurocode-NL
ID20
ID16
ID14
INP450-INP425
ID10
2,687
ID6 Broek
Z
Y
X


Norm Eurocode-NL
INP450-INP425
ID10
Dikte
50 mm
37 mm
36 mm
30 mm
24 mm
22 mm
16 mm
15 mm
2,687
Z
Y
X
x 3

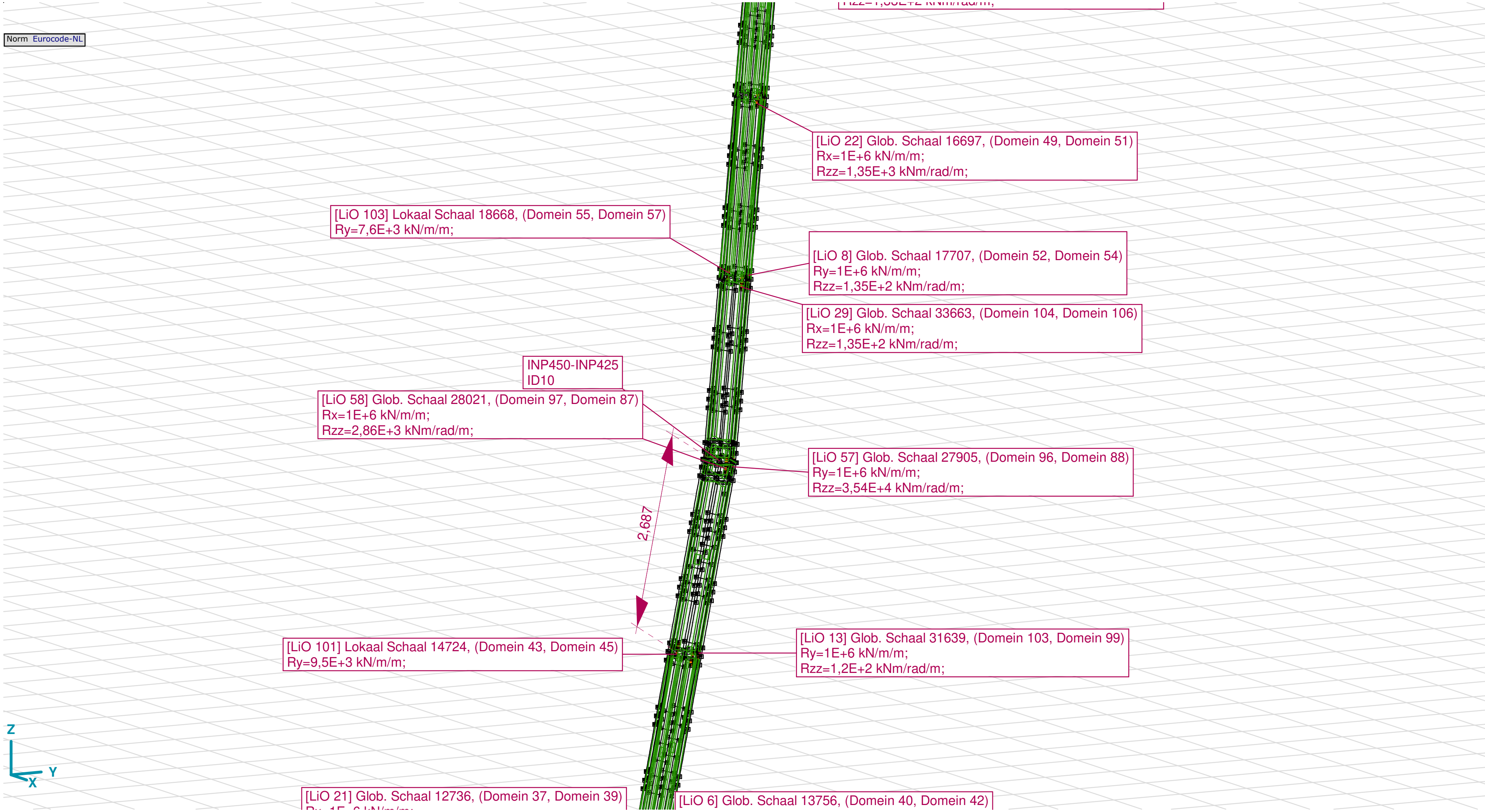

Norm Eurocode-NL
ID20
ID14
INP450-INP425
ID10
2,687
Dikte
50 mm
37 mm
36 mm
30 mm
24 mm
22 mm
16 mm
15 mm
ID6 Broek
Y
X

Materialen

	Naam	*Type*	*Nationale norm*	*Materiaalnorm*	*Model*	*E_x [N/mm^2]*	*E_y [N/mm^2]*	*ν*	*α_T [1/°C]*	*ρ [kg/m^3]*	*Materiaal kleur*	*Contour kleur*	*Structuur*
1	S 235	Staal	Eurocode-NL	10025-2	Plastisch	210000	210000	0,30	1,2E-5	7850			Steel
2	S 355	Staal	Eurocode-NL	10025-2	Plastisch	210000	210000	0,30	1,2E-5	7850			Steel

	Naam	*P_1*	*P_2*	*P_3*	*P_4*	*P_5*	*P_6*	*P_7*	*P_8*	*P_9*	*P_{10}*	*P_{11}*	*P_{12}*	*P_{13}*	*P_{14}*
1	S 235	f_y[N/mm^2] = 235,00	f_u[N/mm^2] = 360,00	f_y^*[N/mm^2] = 215,00	f_u^*[N/mm^2] = 360,00										
2	S 355	f_y[N/mm^2] = 355,00	f_u[N/mm^2] = 510,00	f_y^*[N/mm^2] = 335,00	f_u^*[N/mm^2] = 470,00										

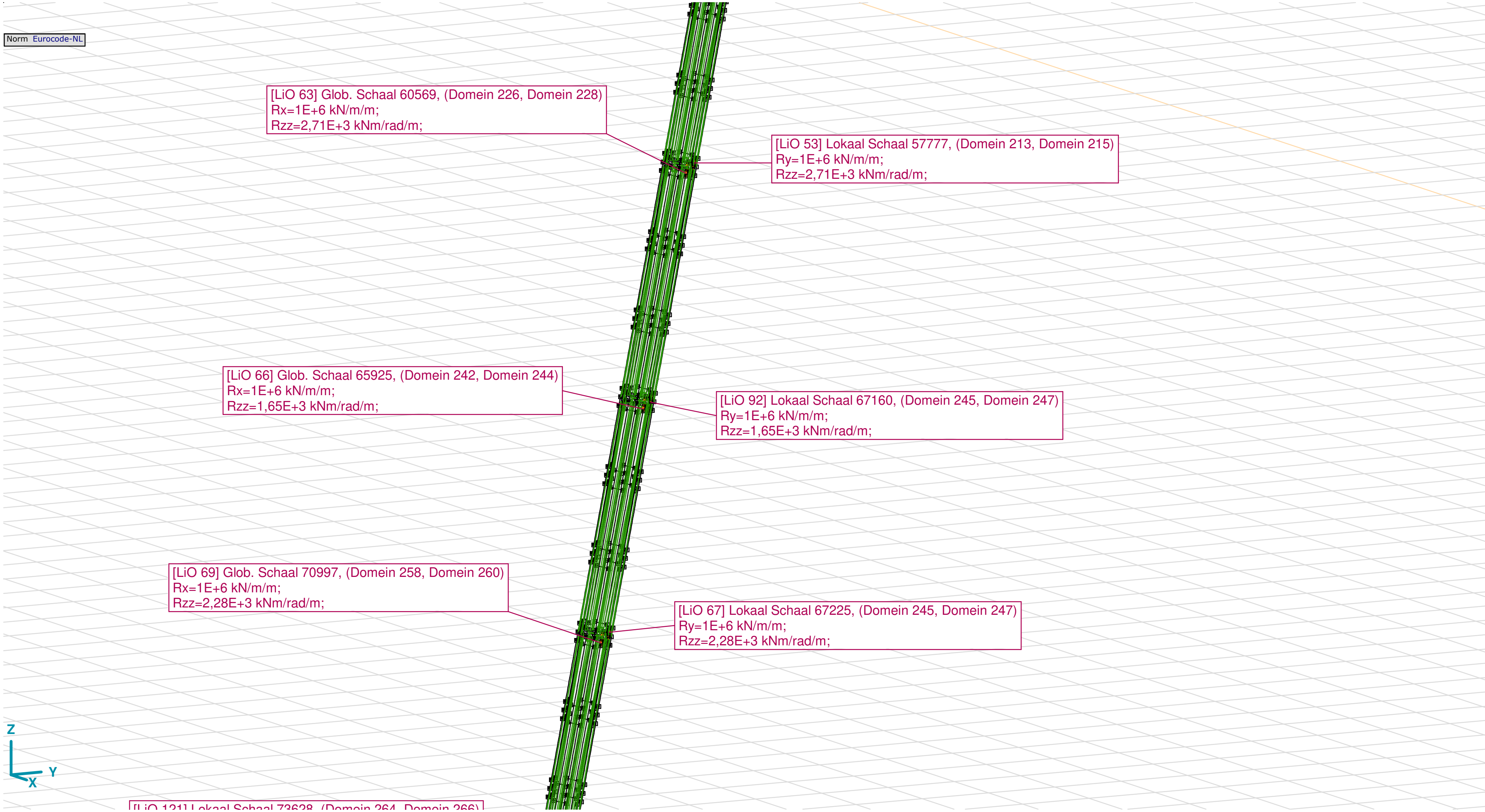
Naam: Materiaalnaam; **Type:** Type materiaal; **Model:** Materiaal model; **E_x:** Elasticiteitsmodulus in lokale x richting; **E_y:** Elasticiteitsmodulus in lokale y richting; **ν:** Poisson's verhouding; **α_T:** Warmteuitzettingscoëfficiënt; **ρ:** Dichtheid; **Materiaal kleur:** Materiaalkleur; **Contour kleur:** Contourkleur; **P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9, P_{10}, P_{11}, P_{12}, P_{13}, P_{14}:** Ontwerpparameter;


Norm Eurocode-NL
[LiO 22] Glob. Schaal 16697, (Domein 49, Domein 51)
Rx=1E+6 kN/m/m;
Rzz=1,35E+3 kNm/rad/m;
[LiO 103] Lokaal Schaal 18668, (Domein 55, Domein 57)
Ry=7,6E+3 kN/m/m;
[LiO 8] Glob. Schaal 17707, (Domein 52, Domein 54)
Ry=1E+6 kN/m/m;
Rzz=1,35E+2 kNm/rad/m;
[LiO 29] Glob. Schaal 33663, (Domein 104, Domein 106)
Rx=1E+6 kN/m/m;
Rzz=1,35E+2 kNm/rad/m;
INP450-INP425
ID10
[LiO 58] Glob. Schaal 28021, (Domein 97, Domein 87)
Rx=1E+6 kN/m/m;
Rzz=2,86E+3 kNm/rad/m;
[LiO 57] Glob. Schaal 27905, (Domein 96, Domein 88)
Ry=1E+6 kN/m/m;
Rzz=3,54E+4 kNm/rad/m;
2,687
[LiO 101] Lokaal Schaal 14724, (Domein 43, Domein 45)
Ry=9,5E+3 kN/m/m;
[LiO 13] Glob. Schaal 31639, (Domein 103, Domein 99)
Ry=1E+6 kN/m/m;
Rzz=1,2E+2 kNm/rad/m;
Z
Y
X
[LiO 21] Glob. Schaal 12736, (Domein 37, Domein 39)
[LiO 6] Glob. Schaal 13756, (Domein 40, Domein 42)

Tekening

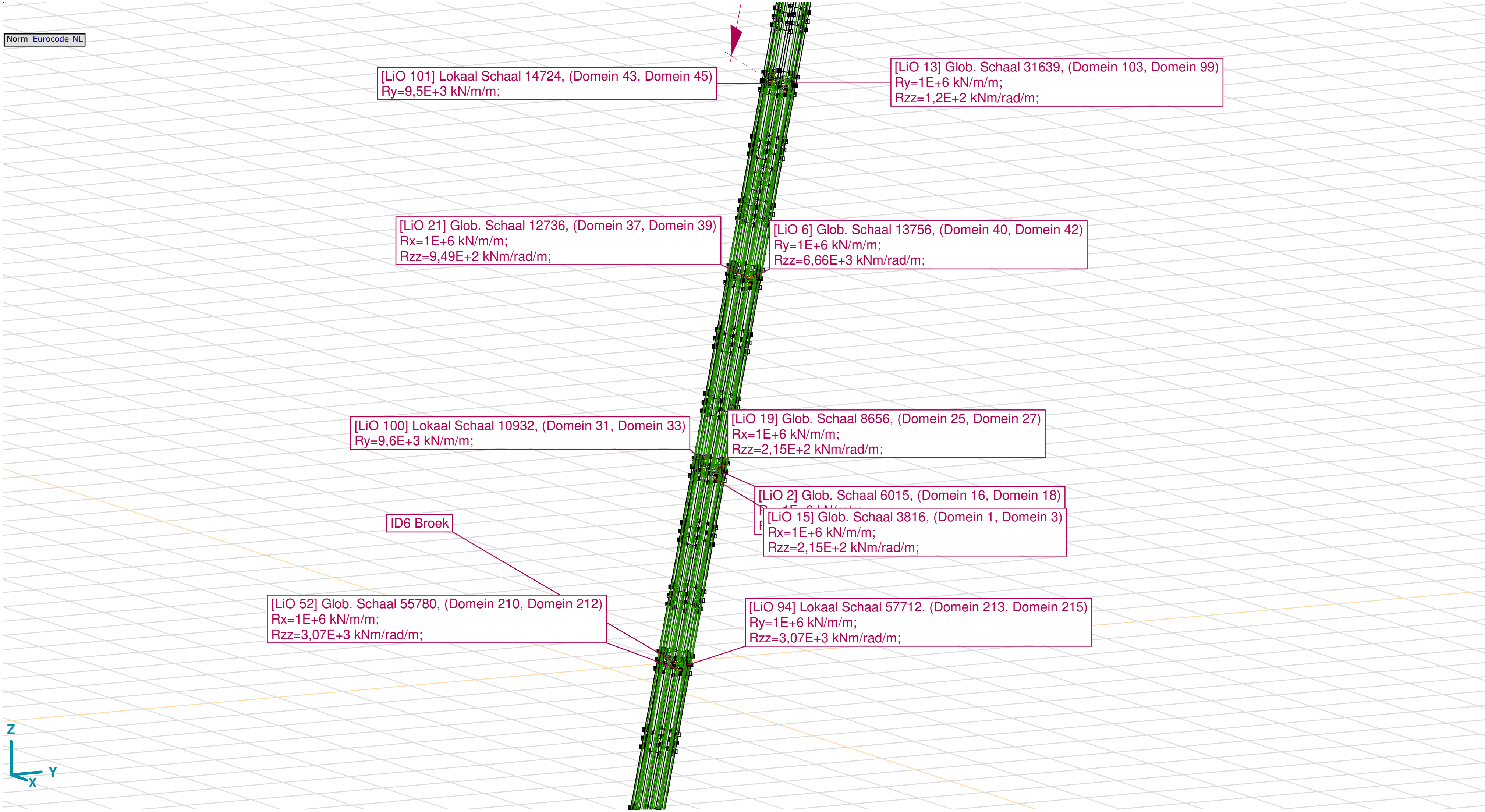

Norm Eurocode-NL
[LiO 121] Lokaal Schaal 73628, (Domein 264, Domein 266)
Ry=3,9E+4 kN/m/m;
[LiO 70] Lokaal Schaal 72013, (Domein 261, Domein 263)
Ry=1E+6 kN/m/m;
Rzz=2,86E+2 kNm/rad/m;
[LiO 72] Glob. Schaal 76069, (Domein 274, Domein 276)
Rx=1E+6 kN/m/m;
Rzz=2,86E+2 kNm/rad/m;
[LiO 73] Lokaal Schaal 77369, (Domein 277, Domein 279)
Ry=1E+6 kN/m/m;
Rzz=1,98E+2 kNm/rad/m;
[LiO 119] Lokaal Schaal 78701, (Domein 280, Domein 282)
Ry=2,1E+4 kN/m/m;
[LiO 83] Glob. Schaal 81140, (Domein 290, Domein 292)
Rx=1E+6 kN/m/m;
Rzz=1,98E+2 kNm/rad/m;
[LiO 76] Lokaal Schaal 80291, Domein 291
Rx=1E+10 kN/m/m;
Ry=1E+10 kN/m/m;
Z
Y
X

Tekening1

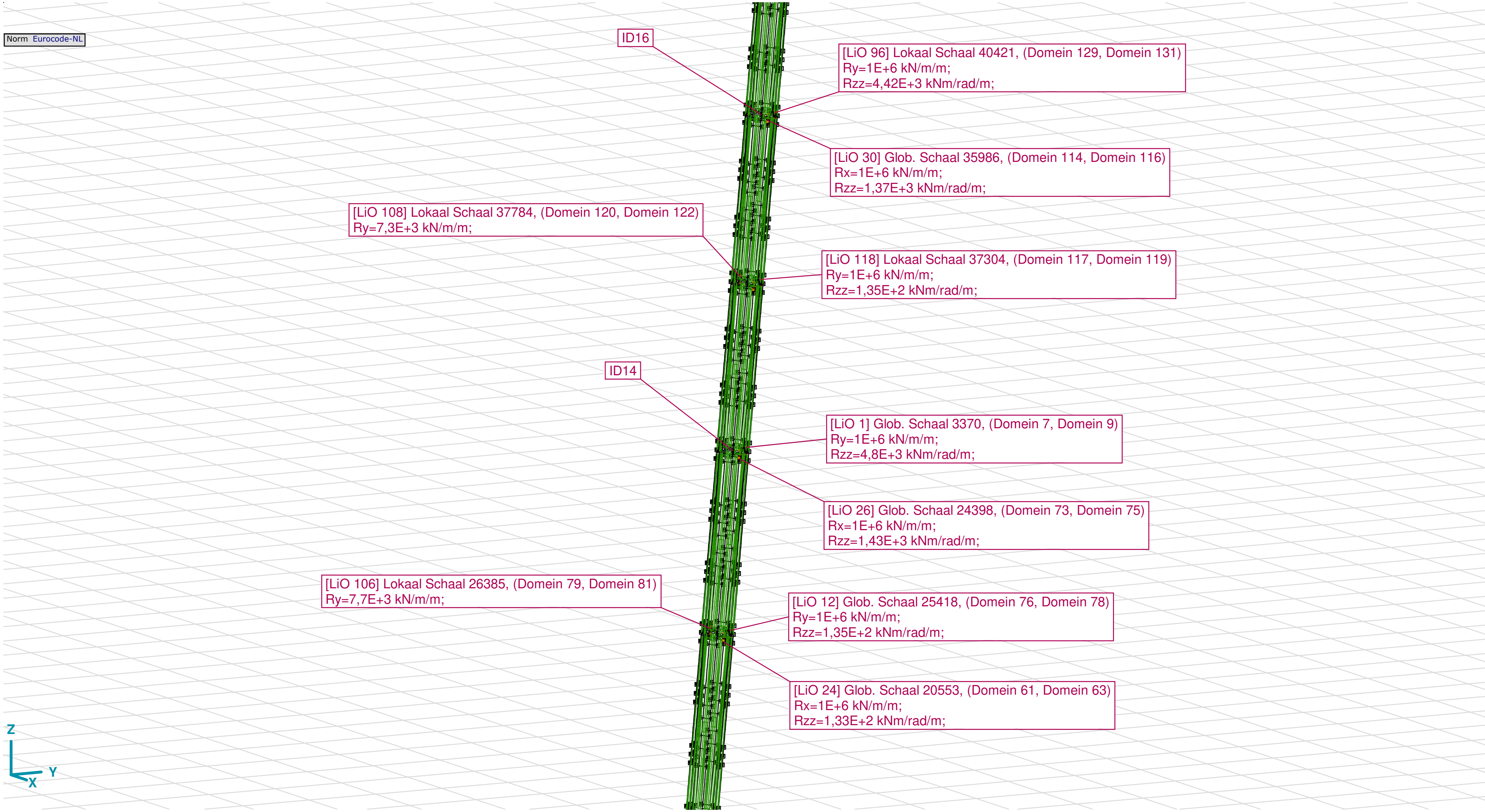

Norm Eurocode-NL
[LiO 63] Glob. Schaal 60569, (Domein 226, Domein 228)
Rx=1E+6 kN/m/m;
Rzz=2,71E+3 kNm/rad/m;
[LiO 53] Lokaal Schaal 57777, (Domein 213, Domein 215)
Ry=1E+6 kN/m/m;
Rzz=2,71E+3 kNm/rad/m;
[LiO 66] Glob. Schaal 65925, (Domein 242, Domein 244)
Rx=1E+6 kN/m/m;
Rzz=1,65E+3 kNm/rad/m;
[LiO 92] Lokaal Schaal 67160, (Domein 245, Domein 247)
Ry=1E+6 kN/m/m;
Rzz=1,65E+3 kNm/rad/m;
[LiO 69] Glob. Schaal 70997, (Domein 258, Domein 260)
Rx=1E+6 kN/m/m;
Rzz=2,28E+3 kNm/rad/m;
[LiO 67] Lokaal Schaal 67225, (Domein 245, Domein 247)
Ry=1E+6 kN/m/m;
Rzz=2,28E+3 kNm/rad/m;
Z
Y
X

Tekening2

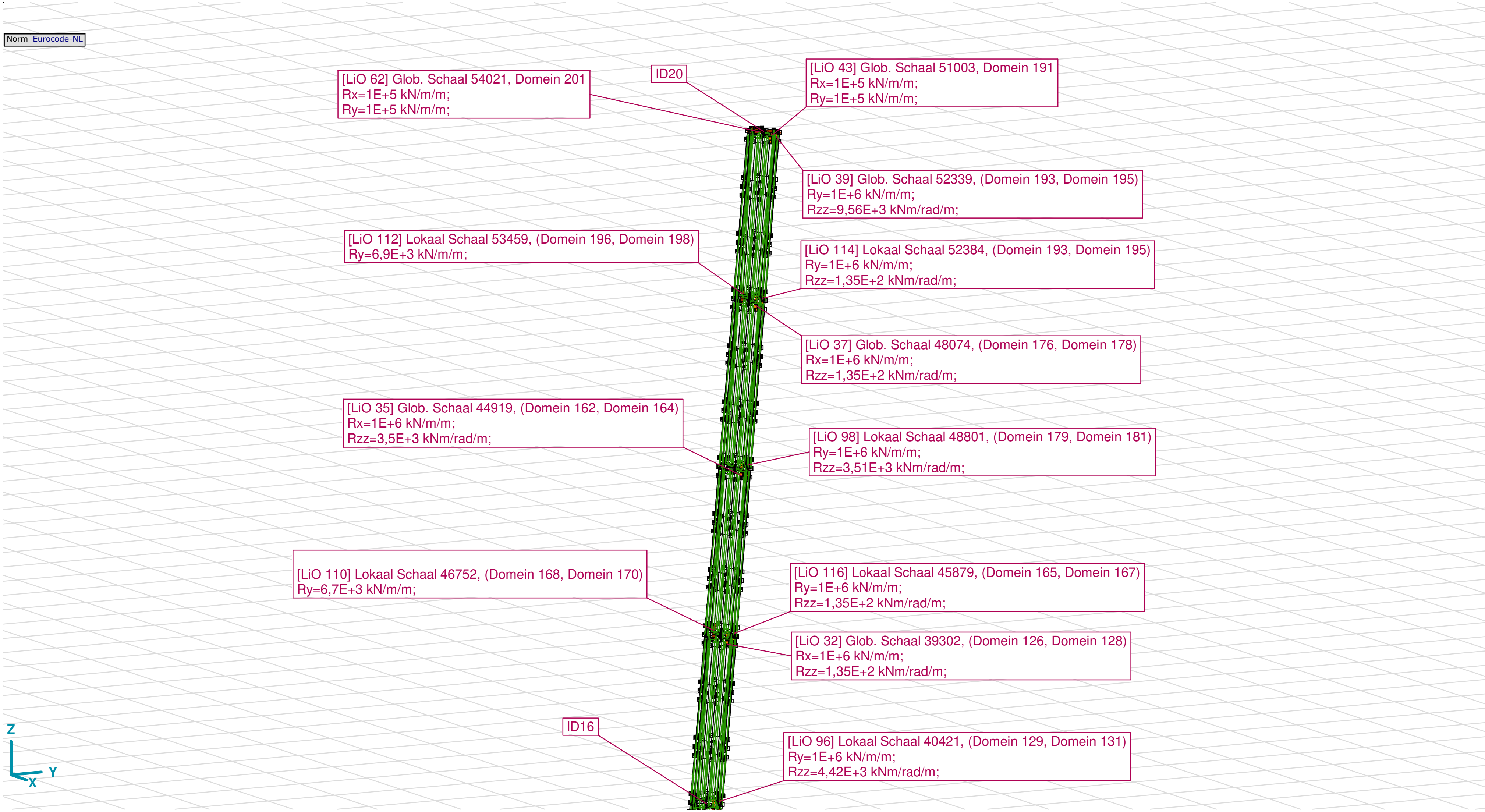
Project: KIJ-GT
Constructeur: DNV GL - Energy
Model: **S+95 Leg study 16.axs**



Tekening3


Norm Eurocode-NL
ID16
[LiO 96] Lokaal Schaal 40421, (Domein 129, Domein 131)
Ry=1E+6 kN/m/m;
Rzz=4,42E+3 kNm/rad/m;
[LiO 30] Glob. Schaal 35986, (Domein 114, Domein 116)
Rx=1E+6 kN/m/m;
Rzz=1,37E+3 kNm/rad/m;
[LiO 108] Lokaal Schaal 37784, (Domein 120, Domein 122)
Ry=7,3E+3 kN/m/m;
[LiO 118] Lokaal Schaal 37304, (Domein 117, Domein 119)
Ry=1E+6 kN/m/m;
Rzz=1,35E+2 kNm/rad/m;
ID14
[LiO 1] Glob. Schaal 3370, (Domein 7, Domein 9)
Ry=1E+6 kN/m/m;
Rzz=4,8E+3 kNm/rad/m;
[LiO 26] Glob. Schaal 24398, (Domein 73, Domein 75)
Rx=1E+6 kN/m/m;
Rzz=1,43E+3 kNm/rad/m;
[LiO 106] Lokaal Schaal 26385, (Domein 79, Domein 81)
Ry=7,7E+3 kN/m/m;
[LiO 12] Glob. Schaal 25418, (Domein 76, Domein 78)
Ry=1E+6 kN/m/m;
Rzz=1,35E+2 kNm/rad/m;
[LiO 24] Glob. Schaal 20553, (Domein 61, Domein 63)
Rx=1E+6 kN/m/m;
Rzz=1,33E+2 kNm/rad/m;
Z
Y
X

Tekening5


Norm Eurocode-NL
[LiO 62] Glob. Schaal 54021, Domein 201
Rx=1E+5 kN/m/m;
Ry=1E+5 kN/m/m;
ID20
[LiO 43] Glob. Schaal 51003, Domein 191
Rx=1E+5 kN/m/m;
Ry=1E+5 kN/m/m;
[LiO 39] Glob. Schaal 52339, (Domein 193, Domein 195)
Ry=1E+6 kN/m/m;
Rzz=9,56E+3 kNm/rad/m;
[LiO 112] Lokaal Schaal 53459, (Domein 196, Domein 198)
Ry=6,9E+3 kN/m/m;
[LiO 114] Lokaal Schaal 52384, (Domein 193, Domein 195)
Ry=1E+6 kN/m/m;
Rzz=1,35E+2 kNm/rad/m;
[LiO 37] Glob. Schaal 48074, (Domein 176, Domein 178)
Rx=1E+6 kN/m/m;
Rzz=1,35E+2 kNm/rad/m;
[LiO 35] Glob. Schaal 44919, (Domein 162, Domein 164)
Rx=1E+6 kN/m/m;
Rzz=3,5E+3 kNm/rad/m;
[LiO 98] Lokaal Schaal 48801, (Domein 179, Domein 181)
Ry=1E+6 kN/m/m;
Rzz=3,51E+3 kNm/rad/m;
[LiO 110] Lokaal Schaal 46752, (Domein 168, Domein 170)
Ry=6,7E+3 kN/m/m;
[LiO 116] Lokaal Schaal 45879, (Domein 165, Domein 167)
Ry=1E+6 kN/m/m;
Rzz=1,35E+2 kNm/rad/m;
[LiO 32] Glob. Schaal 39302, (Domein 126, Domein 128)
Rx=1E+6 kN/m/m;
Rzz=1,35E+2 kNm/rad/m;
ID16
[LiO 96] Lokaal Schaal 40421, (Domein 129, Domein 131)
Ry=1E+6 kN/m/m;
Rzz=4,42E+3 kNm/rad/m;
Z
Y
X

Tekening6

Lijnopleggingen

	Lijn	*Type*	*Ref. elem.*	*Rx [kN/m/m]*	*Ry [kN/m/m]*	*Rz [kN/m/m]*	*Rxx [kNm/rad/m]*	*Ryy [kNm/rad/m]*	*Rzz [kNm/rad/m]*	*NL(x)*	*NL(y)*	*NL(z)*
1	Rand (631)	Glob.	(Domein 7, Domein 9)	0	1E+6	0	0	0	4,8E+3		Symmetrisch	
2	Rand (4337)	Glob.	(Domein 16, Domein 18)	0	1E+6	0	0	0	2,15E+2		Symmetrisch	
3	Rand (12600)	Glob.	(Domein 28, Domein 30)	0	1E+6	0	0	0	6,66E+3		Symmetrisch	
4	Rand (12652)	Glob.	(Domein 28, Domein 30)	0	1E+6	0	0	0	2,15E+2		Symmetrisch	
5	Rand (18798)	Glob.	(Domein 40, Domein 42)	0	1E+6	0	0	0	1,2E+2		Symmetrisch	
6	Rand (18850)	Glob.	(Domein 40, Domein 42)	0	1E+6	0	0	0	6,66E+3		Symmetrisch	
7	Rand (24949)	Glob.	(Domein 52, Domein 54)	0	1E+6	0	0	0	4,69E+3		Symmetrisch	
8	Rand (24998)	Glob.	(Domein 52, Domein 54)	0	1E+6	0	0	0	1,35E+2		Symmetrisch	
9	Rand (30807)	Glob.	(Domein 64, Domein 66)	0	1E+6	0	0	0	1,35E+2		Symmetrisch	
10	Rand (30856)	Glob.	(Domein 64, Domein 66)	0	1E+6	0	0	0	4,69E+3		Symmetrisch	
11	Rand (36636)	Glob.	(Domein 76, Domein 78)	0	1E+6	0	0	0	4,8E+3		Symmetrisch	
12	Rand (36685)	Glob.	(Domein 76, Domein 78)	0	1E+6	0	0	0	1,35E+2		Symmetrisch	
13	Rand (43826)	Glob.	(Domein 103, Domein 99)	0	1E+6	0	0	0	1,2E+2		Symmetrisch	
14	Rand (46557)	Glob.	(Domein 105, Domein 107)	0	1E+6	0	0	0	1,35E+2		Symmetrisch	
15	Rand (1648)	Glob.	(Domein 1, Domein 3)	1E+6	0	0	0	0	2,15E+2	Symmetrisch		
16	Rand (322)	Glob.	(Domein 4, Domein 6)	1E+6	0	0	0	0	1,34E+2	Symmetrisch		
17	Rand (277)	Glob.	(Domein 4, Domein 6)	1E+6	0	0	0	0	1,43E+3	Symmetrisch		
18	Rand (11059)	Glob.	(Domein 25, Domein 27)	1E+6	0	0	0	0	9,49E+2	Symmetrisch		

	Lijn	*NL(xx)*	*NL(yy)*	*NL(zz)*	*F(x) [kN/m]*	*F(y) [kN/m]*	*F(z) [kN/m]*	*M(x) [kNm/m]*	*M(y) [kNm/m]*	*M(z) [kNm/m]*
1	Rand (631)			Symmetrisch						
2	Rand (4337)			Symmetrisch						
3	Rand (12600)			Symmetrisch						
4	Rand (12652)			Symmetrisch						
5	Rand (18798)			Symmetrisch						
6	Rand (18850)			Symmetrisch						
7	Rand (24949)			Symmetrisch						
8	Rand (24998)			Symmetrisch						
9	Rand (30807)			Symmetrisch						
10	Rand (30856)			Symmetrisch						
11	Rand (36636)			Symmetrisch						
12	Rand (36685)			Symmetrisch						
13	Rand (43826)			Symmetrisch						
14	Rand (46557)			Symmetrisch						
15	Rand (1648)			Symmetrisch						
16	Rand (322)			Symmetrisch						
17	Rand (277)			Symmetrisch						
18	Rand (11059)			Symmetrisch						

Lijnopleggingen

	Lijn	*Type*	*Ref. elem.*	*Rx [kN/m/m]*	*Ry [kN/m/m]*	*Rz [kN/m/m]*	*Rxx [kNm/rad/m]*	*Ryy [kNm/rad/m]*	*Rzz [kNm/rad/m]*	*NL(x)*	*NL(y)*	*NL(z)*
19	Rand (11111)	Glob.	(Domein 25, Domein 27)	1E+6	0	0	0	0	2,15E+2	Symmetrisch		
20	Rand (16494)	Glob.	(Domein 37, Domein 39)	1E+6	0	0	0	0	1,2E+2	Symmetrisch		
21	Rand (16546)	Glob.	(Domein 37, Domein 39)	1E+6	0	0	0	0	9,49E+2	Symmetrisch		
22	Rand (23460)	Glob.	(Domein 49, Domein 51)	1E+6	0	0	0	0	1,35E+3	Symmetrisch		
23	Rand (23509)	Glob.	(Domein 49, Domein 51)	1E+6	0	0	0	0	1,35E+2	Symmetrisch		
24	Rand (29342)	Glob.	(Domein 61, Domein 63)	1E+6	0	0	0	0	1,33E+2	Symmetrisch		
25	Rand (29391)	Glob.	(Domein 61, Domein 63)	1E+6	0	0	0	0	1,35E+3	Symmetrisch		
26	Rand (35188)	Glob.	(Domein 73, Domein 75)	1E+6	0	0	0	0	1,43E+3	Symmetrisch		
27	Rand (35237)	Glob.	(Domein 73, Domein 75)	1E+6	0	0	0	0	1,33E+2	Symmetrisch		
28	Rand (43148)	Glob.	(Domein 102, Domein 98)	1E+6	0	0	0	0	1,2E+2	Symmetrisch		
29	Rand (45839)	Glob.	(Domein 104, Domein 106)	1E+6	0	0	0	0	1,35E+2	Symmetrisch		
30	Rand (48340)	Glob.	(Domein 114, Domein 116)	1E+6	0	0	0	0	1,37E+3	Symmetrisch		
31	Rand (48385)	Glob.	(Domein 114, Domein 116)	1E+6	0	0	0	0	1,34E+2	Symmetrisch		
32	Rand (58519)	Glob.	(Domein 126, Domein 128)	1E+6	0	0	0	0	1,35E+2	Symmetrisch		
33	Rand (58564)	Glob.	(Domein 126, Domein 128)	1E+6	0	0	0	0	1,37E+3	Symmetrisch		
34	Rand (1596)	Glob.	Domein 1	1E+6	0	0	0	0	3,07E+3	Symmetrisch		
35	Rand (66393)	Glob.	(Domein 162, Domein 164)	1E+6	0	0	0	0	3,5E+3	Symmetrisch		
36	Rand (66438)	Glob.	(Domein 162, Domein 164)	1E+6	0	0	0	0	1,35E+2	Symmetrisch		

	Lijn	*NL(xx)*	*NL(yy)*	*NL(zz)*	*F(x) [kN/m]*	*F(y) [kN/m]*	*F(z) [kN/m]*	*M(x) [kNm/m]*	*M(y) [kNm/m]*	*M(z) [kNm/m]*
19	Rand (11111)			Symmetrisch						
20	Rand (16494)			Symmetrisch						
21	Rand (16546)			Symmetrisch						
22	Rand (23460)			Symmetrisch						
23	Rand (23509)			Symmetrisch						
24	Rand (29342)			Symmetrisch						
25	Rand (29391)			Symmetrisch						
26	Rand (35188)			Symmetrisch						
27	Rand (35237)			Symmetrisch						
28	Rand (43148)			Symmetrisch						
29	Rand (45839)			Symmetrisch						
30	Rand (48340)			Symmetrisch						
31	Rand (48385)			Symmetrisch						
32	Rand (58519)			Symmetrisch						
33	Rand (58564)			Symmetrisch						
34	Rand (1596)			Symmetrisch						
35	Rand (66393)			Symmetrisch						
36	Rand (66438)			Symmetrisch						

Lijnopleggingen

	Lijn	*Type*	*Ref. elem.*	*Rx [kN/m/m]*	*Ry [kN/m/m]*	*Rz [kN/m/m]*	*Rxx [kNm/rad/m]*	*Ryy [kNm/rad/m]*	*Rzz [kNm/rad/m]*	*NL(x)*	*NL(y)*	*NL(z)*
37	Rand (70477)	Glob.	(Domein 176, Domein 178)	1E+6	0	0	0	0	1,35E+2	Symmetrisch		
38	Rand (70522)	Glob.	(Domein 176, Domein 178)	1E+6	0	0	0	0	3,5E+3	Symmetrisch		
39	Rand (77910)	Glob.	(Domein 193, Domein 195)	0	1E+6	0	0	0	9,56E+3		Symmetrisch	
40	Rand (77259)	Glob.	(Domein 190, Domein 192)	1E+6	0	0	0	0	1,71E+3	Symmetrisch		
41	Rand (77304)	Glob.	(Domein 190, Domein 192)	1E+6	0	0	0	0	1,35E+2	Symmetrisch		
42	Rand (77357)	Glob.	Domein 190	1E+5	1E+5	0	0	0	0	Symmetrisch	Symmetrisch	
43	Rand (77605)	Glob.	Domein 191	1E+5	1E+5	0	0	0	0	Symmetrisch	Symmetrisch	
44	Rand (79385)	Glob.	Domein 196	1E+5	1E+5	0	0	0	0	Symmetrisch	Symmetrisch	
45	Rand (80294)	Glob.	Domein 197	1E+5	1E+5	0	0	0	0	Symmetrisch	Symmetrisch	
46	Rand (80697)	Glob.	Domein 199	1E+5	1E+5	0	0	0	0	Symmetrisch	Symmetrisch	
47	Rand (80945)	Glob.	Domein 200	1E+5	1E+5	0	0	0	0	Symmetrisch	Symmetrisch	
48	Rand (81250)	Glob.	Domein 198	1E+5	1E+5	0	0	0	0	Symmetrisch	Symmetrisch	
49	Rand (78608)	Glob.	Domein 192	1E+5	1E+5	0	0	0	0	Symmetrisch	Symmetrisch	
50	Rand (78008)	Glob.	Domein 193	1E+5	1E+5	0	0	0	0	Symmetrisch	Symmetrisch	
51	Rand (78256)	Glob.	Domein 194	1E+5	1E+5	0	0	0	0	Symmetrisch	Symmetrisch	
52	Rand (82958)	Glob.	(Domein 210, Domein 212)	1E+6	0	0	0	0	3,07E+3	Symmetrisch		
54	Rand (83022)	Glob.	Domein 210	1E+6	0	0	0	0	2,71E+3	Symmetrisch		
55	Rand (42099)	Glob.	(Domein 94, Domein 91)	1E+6	0	0	0	0	2,86E+3	Symmetrisch		

	Lijn	*NL(xx)*	*NL(yy)*	*NL(zz)*	*F(x) [kN/m]*	*F(y) [kN/m]*	*F(z) [kN/m]*	*M(x) [kNm/m]*	*M(y) [kNm/m]*	*M(z) [kNm/m]*
37	Rand (70477)			Symmetrisch						
38	Rand (70522)			Symmetrisch						
39	Rand (77910)			Symmetrisch						
40	Rand (77259)			Symmetrisch						
41	Rand (77304)			Symmetrisch						
42	Rand (77357)									
43	Rand (77605)									
44	Rand (79385)									
45	Rand (80294)									
46	Rand (80697)									
47	Rand (80945)									
48	Rand (81250)									
49	Rand (78608)									
50	Rand (78008)									
51	Rand (78256)									
52	Rand (82958)			Symmetrisch						
54	Rand (83022)			Symmetrisch						
55	Rand (42099)			Symmetrisch						

Lijnopleggingen

	Lijn	Type	Ref. elem.	Rx [kN/m/m]	Ry [kN/m/m]	Rz [kN/m/m]	Rxx [kNm/rad/m]	Ryy [kNm/rad/m]	Rzz [kNm/rad/m]	NL(x)	NL(y)	NL(z)
56	Rand (42495)	Glob.	(Domein 95, Domein 112)	0	1E+6	0	0	0	3,54E+4		Symmetrisch	
57	Rand (41864)	Glob.	(Domein 96, Domein 88)	0	1E+6	0	0	0	3,54E+4		Symmetrisch	
58	Rand (41069)	Glob.	(Domein 97, Domein 87)	1E+6	0	0	0	0	2,86E+3	Symmetrisch		
59	Rand (78610)	Glob.	Domein 192	1E+5	1E+5	0	0	0	0	Symmetrisch	Symmetrisch	
60	Rand (79633)	Glob.	Domein 195	1E+5	1E+5	0	0	0	0	Symmetrisch	Symmetrisch	
61	Rand (81252)	Glob.	Domein 198	1E+5	1E+5	0	0	0	0	Symmetrisch	Symmetrisch	
62	Rand (82117)	Glob.	Domein 201	1E+5	1E+5	0	0	0	0	Symmetrisch	Symmetrisch	
63	Rand (89716)	Glob.	(Domein 226, Domein 228)	1E+6	0	0	0	0	2,71E+3	Symmetrisch		
65	Rand (89780)	Glob.	Domein 226	1E+6	0	0	0	0	1,65E+3	Symmetrisch		
66	Rand (98346)	Glob.	(Domein 242, Domein 244)	1E+6	0	0	0	0	1,65E+3	Symmetrisch		
68	Rand (98410)	Glob.	Domein 242	1E+6	0	0	0	0	2,28E+3	Symmetrisch		
69	Rand (106040)	Glob.	(Domein 258, Domein 260)	1E+6	0	0	0	0	2,28E+3	Symmetrisch		
71	Rand (106104)	Glob.	Domein 258	1E+6	0	0	0	0	2,86E+2	Symmetrisch		
72	Rand (113734)	Glob.	(Domein 274, Domein 276)	1E+6	0	0	0	0	2,86E+2	Symmetrisch		
74	Rand (113798)	Glob.	Domein 274	1E+6	0	0	0	0	1,98E+2	Symmetrisch		
83	Rand (121428)	Glob.	(Domein 290, Domein 292)	1E+6	0	0	0	0	1,98E+2	Symmetrisch		
53	Rand (83946)	Rand r.	(Domein 213, Domein 215)	0	1E+6	0	0	0	2,71E+3		Symmetrisch	
64	Rand (91640)	Rand r.	(Domein 229, Domein 231)	0	1E+6	0	0	0	1,65E+3		Symmetrisch	

	Lijn	NL(xx)	NL(yy)	NL(zz)	F(x) [kN/m]	F(y) [kN/m]	F(z) [kN/m]	M(x) [kNm/m]	M(y) [kNm/m]	M(z) [kNm/m]
56	Rand (42495)			Symmetrisch						
57	Rand (41864)			Symmetrisch						
58	Rand (41069)			Symmetrisch						
59	Rand (78610)									
60	Rand (79633)									
61	Rand (81252)									
62	Rand (82117)									
63	Rand (89716)			Symmetrisch						
65	Rand (89780)			Symmetrisch						
66	Rand (98346)			Symmetrisch						
68	Rand (98410)			Symmetrisch						
69	Rand (106040)			Symmetrisch						
71	Rand (106104)			Symmetrisch						
72	Rand (113734)			Symmetrisch						
74	Rand (113798)			Symmetrisch						
83	Rand (121428)			Symmetrisch						
53	Rand (83946)			Symmetrisch						
64	Rand (91640)			Symmetrisch						

Lijnopleggingen

	Lijn	*Type*	*Ref. elem.*	*Rx [kN/m/m]*	*Ry [kN/m/m]*	*Rz [kN/m/m]*	*Rxx [kNm/rad/m]*	*Ryy [kNm/rad/m]*	*Rzz [kNm/rad/m]*	*NL(x)*	*NL(y)*	*NL(z)*
67	Rand (99334)	Rand r.	(Domein 245, Domein 247)	0	1E+6	0	0	0	2,28E+3		Symmetrisch	
70	Rand (107028)	Rand r.	(Domein 261, Domein 263)	0	1E+6	0	0	0	2,86E+2		Symmetrisch	
73	Rand (114722)	Rand r.	(Domein 277, Domein 279)	0	1E+6	0	0	0	1,98E+2		Symmetrisch	
75	Rand (121494)	Rand r.	Domein 290	1E+10	1E+10	0	0	0	0	Symmetrisch	Symmetrisch	
76	Rand (121995)	Rand r.	Domein 291	1E+10	1E+10	0	0	0	0	Symmetrisch	Symmetrisch	
77	Rand (122418)	Rand r.	Domein 293	1E+10	1E+10	0	0	0	0	Symmetrisch	Symmetrisch	
78	Rand (122919)	Rand r.	Domein 294	1E+10	1E+10	0	0	0	0	Symmetrisch	Symmetrisch	
79	Rand (124344)	Rand r.	Domein 296	1E+10	1E+10	0	0	0	0	Symmetrisch	Symmetrisch	
80	Rand (124845)	Rand r.	Domein 297	1E+10	1E+10	0	0	0	0	Symmetrisch	Symmetrisch	
81	Rand (126256)	Rand r.	Domein 299	1E+10	1E+10	0	0	0	0	Symmetrisch	Symmetrisch	
82	Rand (126754)	Rand r.	Domein 300	1E+10	1E+10	0	0	0	0	Symmetrisch	Symmetrisch	
84	Rand (123342)	Rand r.	Domein 292	1E+10	1E+10	0	0	0	0	Symmetrisch	Symmetrisch	
85	Rand (127160)	Rand r.	Domein 298	1E+10	1E+10	0	0	0	0	Symmetrisch	Symmetrisch	
86	Rand (125202)	Rand r.	Domein 295	1E+10	1E+10	0	0	0	0	Symmetrisch	Symmetrisch	
87	Rand (128141)	Rand r.	Domein 301	1E+10	1E+10	0	0	0	0	Symmetrisch	Symmetrisch	
88	Rand (122352)	Rand r.	(Domein 293, Domein 295)	0	1E+6	0	0	0	1,98E+2		Symmetrisch	
89	Rand (114658)	Rand r.	(Domein 277, Domein 279)	0	1E+6	0	0	0	2,86E+2		Symmetrisch	
90	Rand (106964)	Rand r.	(Domein 261, Domein 263)	0	1E+6	0	0	0	2,28E+3		Symmetrisch	

	Lijn	*NL(xx)*	*NL(yy)*	*NL(zz)*	*F(x) [kN/m]*	*F(y) [kN/m]*	*F(z) [kN/m]*	*M(x) [kNm/m]*	*M(y) [kNm/m]*	*M(z) [kNm/m]*
67	Rand (99334)			Symmetrisch						
70	Rand (107028)			Symmetrisch						
73	Rand (114722)			Symmetrisch						
75	Rand (121494)									
76	Rand (121995)									
77	Rand (122418)									
78	Rand (122919)									
79	Rand (124344)									
80	Rand (124845)									
81	Rand (126256)									
82	Rand (126754)									
84	Rand (123342)									
85	Rand (127160)									
86	Rand (125202)									
87	Rand (128141)									
88	Rand (122352)			Symmetrisch						
89	Rand (114658)			Symmetrisch						
90	Rand (106964)			Symmetrisch						

Lijnopleggingen

	Lijn	Type	Ref. elem.	Rx [kN/m/m]	Ry [kN/m/m]	Rz [kN/m/m]	Rxx [kNm/rad/m]	Ryy [kNm/rad/m]	Rzz [kNm/rad/m]	NL(x)	NL(y)	NL(z)
91	Rand (91576)	Rand r.	(Domein 229, Domein 231)	0	1E+6	0	0	0	2,71E+3		Symmetrisch	
92	Rand (99270)	Rand r.	(Domein 245, Domein 247)	0	1E+6	0	0	0	1,65E+3		Symmetrisch	
93	Rand (4389)	Rand r.	(Domein 16, Domein 18)	0	1E+6	0	0	0	3,07E+3		Symmetrisch	
94	Rand (83882)	Rand r.	(Domein 213, Domein 215)	0	1E+6	0	0	0	3,07E+3		Symmetrisch	
95	Rand (54508)	Rand r.	(Domein 117, Domein 119)	0	1E+6	0	0	0	4,42E+3		Symmetrisch	
96	Rand (60600)	Rand r.	(Domein 129, Domein 131)	0	1E+6	0	0	0	4,42E+3		Symmetrisch	
97	Rand (67044)	Rand r.	(Domein 165, Domein 167)	0	1E+6	0	0	0	3,51E+3		Symmetrisch	
98	Rand (72526)	Rand r.	(Domein 179, Domein 181)	0	1E+6	0	0	0	3,51E+3		Symmetrisch	
99	Rand (7969)	Rand r.	(Domein 19, Domein 21)	0	9,6E+3	0	0	0	0		Symmetrisch	
100	Rand (14242)	Rand r.	(Domein 31, Domein 33)	0	9,6E+3	0	0	0	0		Symmetrisch	
101	Rand (20388)	Rand r.	(Domein 43, Domein 45)	0	9,5E+3	0	0	0	0		Symmetrisch	
102	Rand (44519)	Rand r.	(Domein 102, Domein 100)	0	9,5E+3	0	0	0	0		Symmetrisch	
103	Rand (26485)	Rand r.	(Domein 55, Domein 57)	0	7,6E+3	0	0	0	0		Symmetrisch	
104	Rand (47184)	Rand r.	(Domein 104, Domein 108)	0	7,6E+3	0	0	0	0		Symmetrisch	
105	Rand (32302)	Rand r.	(Domein 67, Domein 69)	0	7,7E+3	0	0	0	0		Symmetrisch	
106	Rand (38181)	Rand r.	(Domein 79, Domein 81)	0	7,7E+3	0	0	0	0		Symmetrisch	
107	Rand (2304)	Rand r.	(Domein 10, Domein 12)	0	7,3E+3	0	0	0	0		Symmetrisch	
108	Rand (55912)	Rand r.	(Domein 120, Domein 122)	0	7,3E+3	0	0	0	0		Symmetrisch	

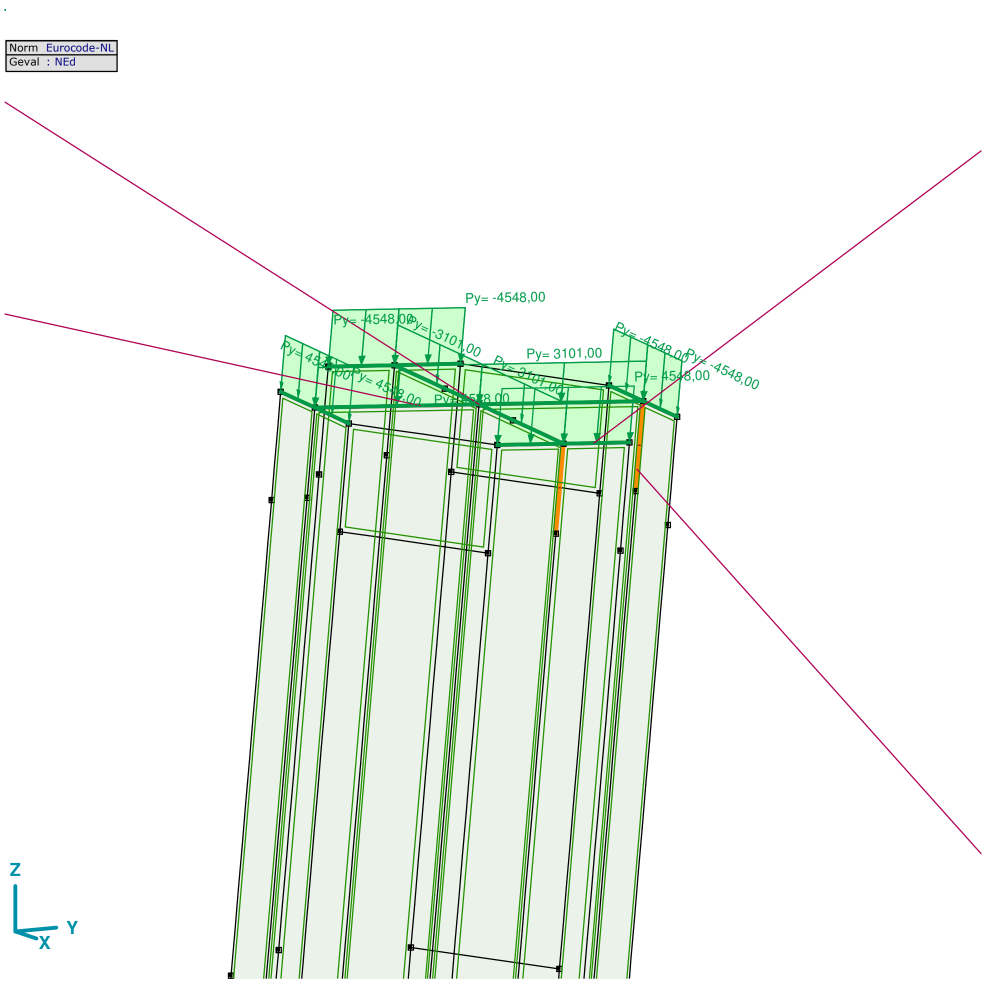
	Lijn	NL(xx)	NL(yy)	NL(zz)	F(x) [kN/m]	F(y) [kN/m]	F(z) [kN/m]	M(x) [kNm/m]	M(y) [kNm/m]	M(z) [kNm/m]
91	Rand (91576)			Symmetrisch						
92	Rand (99270)			Symmetrisch						
93	Rand (4389)			Symmetrisch						
94	Rand (83882)			Symmetrisch						
95	Rand (54508)			Symmetrisch						
96	Rand (60600)			Symmetrisch						
97	Rand (67044)			Symmetrisch						
98	Rand (72526)			Symmetrisch						
99	Rand (7969)									
100	Rand (14242)									
101	Rand (20388)									
102	Rand (44519)									
103	Rand (26485)									
104	Rand (47184)									
105	Rand (32302)									
106	Rand (38181)									
107	Rand (2304)									
108	Rand (55912)									

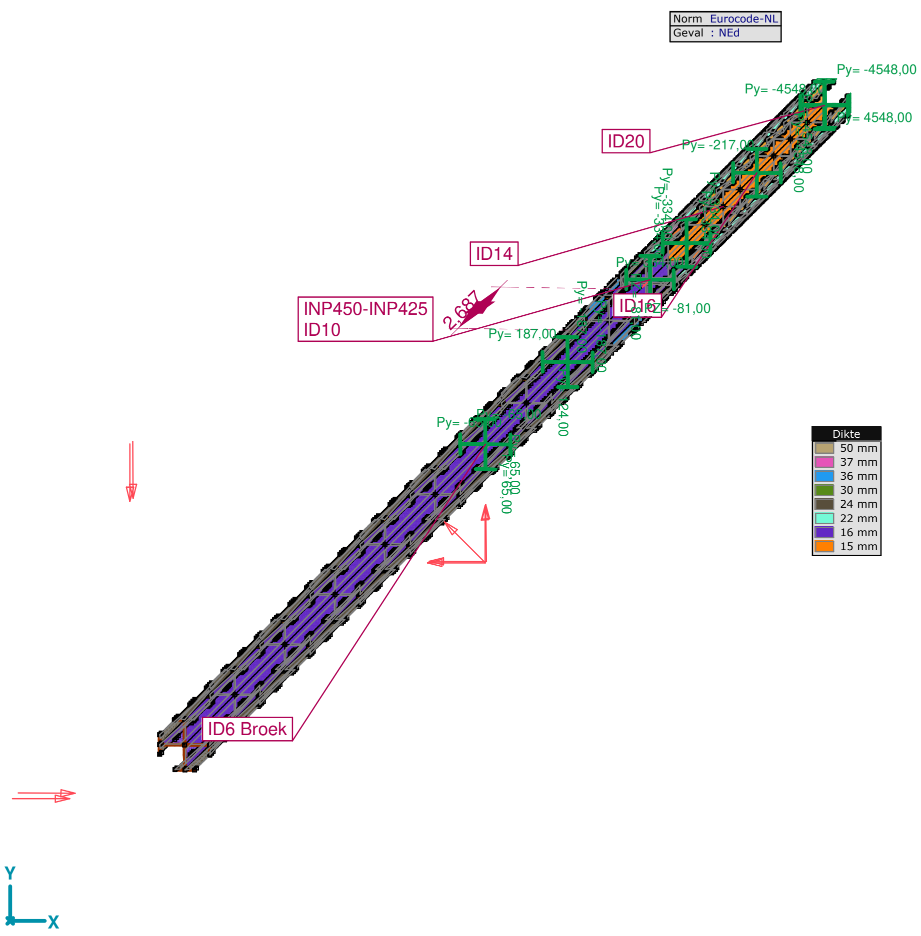
Lijnopleggingen

	Lijn	*Type*	*Ref. elem.*	*Rx [kN/m/m]*	*Ry [kN/m/m]*	*Rz [kN/m/m]*	*Rxx [kNm/rad/m]*	*Ryy [kNm/rad/m]*	*Rzz [kNm/rad/m]*	*NL(x)*	*NL(y)*	*NL(z)*
109	Rand (61206)	Rand r.	(Domein 132, Domein 134)	0	6,7E+3	0	0	0	0		Symmetrisch	
110	Rand (67740)	Rand r.	(Domein 168, Domein 170)	0	6,7E+3	0	0	0	0		Symmetrisch	
111	Rand (73853)	Rand r.	(Domein 182, Domein 184)	0	6,9E+3	0	0	0	0		Symmetrisch	
112	Rand (79332)	Rand r.	(Domein 196, Domein 198)	0	6,9E+3	0	0	0	0		Symmetrisch	
113	Rand (72481)	Rand r.	(Domein 179, Domein 181)	0	1E+6	0	0	0	1,35E+2		Symmetrisch	
114	Rand (77955)	Rand r.	(Domein 193, Domein 195)	0	1E+6	0	0	0	1,35E+2		Symmetrisch	
115	Rand (60555)	Rand r.	(Domein 129, Domein 131)	0	1E+6	0	0	0	1,35E+2		Symmetrisch	
116	Rand (67089)	Rand r.	(Domein 165, Domein 167)	0	1E+6	0	0	0	1,35E+2		Symmetrisch	
117	Rand (676)	Rand r.	(Domein 7, Domein 9)	0	1E+6	0	0	0	1,35E+2		Symmetrisch	
118	Rand (54553)	Rand r.	(Domein 117, Domein 119)	0	1E+6	0	0	0	1,35E+2		Symmetrisch	
119	Rand (116648)	Rand r.	(Domein 280, Domein 282)	0	2,1E+4	0	0	0	0		Symmetrisch	
120	Rand (124278)	Rand r.	(Domein 296, Domein 298)	0	2,1E+4	0	0	0	0		Symmetrisch	
121	Rand (108954)	Rand r.	(Domein 264, Domein 266)	0	3,9E+4	0	0	0	0		Symmetrisch	
122	Rand (116584)	Rand r.	(Domein 280, Domein 282)	0	3,9E+4	0	0	0	0		Symmetrisch	

	Lijn	*NL(xx)*	*NL(yy)*	*NL(zz)*	*F(x) [kN/m]*	*F(y) [kN/m]*	*F(z) [kN/m]*	*M(x) [kNm/m]*	*M(y) [kNm/m]*	*M(z) [kNm/m]*
109	Rand (61206)									
110	Rand (67740)									
111	Rand (73853)									
112	Rand (79332)									
113	Rand (72481)			Symmetrisch						
114	Rand (77955)			Symmetrisch						
115	Rand (60555)			Symmetrisch						
116	Rand (67089)			Symmetrisch						
117	Rand (676)			Symmetrisch						
118	Rand (54553)			Symmetrisch						
119	Rand (116648)									
120	Rand (124278)									
121	Rand (108954)									
122	Rand (116584)									

Lijn: Ondersteund lijnelement; **Type:** Opleggingstype; **Ref. elem.:** Referentie-element; **Rx, Ry, Rz:** Verplaatsingsstijfheid; **Rxx, Ryy, Rzz:** Rotatiestijfheid; **NL(x), NL(y), NL(z), NL(xx), NL(yy), NL(zz):** Niet-lineaire parameters; **F(x):** Weerstand in X-richting; **F(y):** Weerstand in Y-richting; **F(z):** Weerstand in Z-richting; **M(x):** Weerstandsmoment in X-richting; **M(y):** Weerstandsmoment in Y-richting; **M(z):** Weerstandsmoment in Z-richting;





NEd, x 2

NEd: Oppervlak lijnlast

	Richting	px [kN/m]	py [kN/m]	pz [kN/m]	pm [kNm/m]	X [m]	Y [m]	Z [m]	Richting	dL [m]
1	Globaal	0	0	–81,00	0	1,189	2,309	10,634	-	0
		0	0	–81,00	0	1,189	2,471	10,619	-	0,162

NEd: Oppervlak lijnlast

	Richting	*px [kN/m]*	*py [kN/m]*	*pz [kN/m]*	*pm [kNm/m]*	*X [m]*	*Y [m]*	*Z [m]*	*Richting*	*dL [m]*
2	Globaal	0	0	–81,00	0	1,590	2,308	10,596	-	0
		0	0	–81,00	0	1,589	2,469	10,581	-	0,162
3	Globaal	0	0	–81,00	0	1,308	2,590	10,596	-	0
		0	0	–81,00	0	1,469	2,589	10,581	-	0,162
4	Globaal	0	0	–81,00	0	1,309	2,189	10,634	-	0
		0	0	–81,00	0	1,471	2,189	10,619	-	0,162
5	Globaal	0	0	–54,00	0	1,189	2,390	10,627	-	0
		0	0	–54,00	0	1,590	2,388	10,588	-	0,402
6	Globaal	0	0	–54,00	0	1,390	2,189	10,627	-	0
		0	0	–54,00	0	1,389	2,590	10,588	-	0,402
7	Relatief aan rand	0	4548,00	0	0	2,779	3,659	34,384	-	0
		0	4548,00	0	0	2,940	3,658	34,374	-	0,162
8	Relatief aan rand	0	–4548,00	0	0	2,778	4,060	34,359	-	0
		0	–4548,00	0	0	2,940	4,060	34,349	-	0,162
9	Relatief aan rand	0	–4548,00	0	0	2,659	3,779	34,384	-	0
		0	–4548,00	0	0	2,658	3,940	34,374	-	0,162
10	Relatief aan rand	0	4548,00	0	0	3,060	3,778	34,359	-	0
		0	4548,00	0	0	3,060	3,940	34,349	-	0,162
11	Relatief aan rand	0	–3101,00	0	0	2,860	3,659	34,379	-	0
		0	–3101,00	0	0	2,859	3,859	34,367	-	0,201
12	Relatief aan rand	0	3101,00	0	0	2,859	3,859	34,367	-	0
		0	3101,00	0	0	2,859	4,060	34,354	-	0,201
13	Relatief aan rand	0	–3101,00	0	0	2,659	3,860	34,379	-	0
		0	–3101,00	0	0	2,859	3,859	34,367	-	0,201
14	Relatief aan rand	0	3101,00	0	0	2,859	3,859	34,367	-	0
		0	3101,00	0	0	3,060	3,859	34,354	-	0,201
15	Relatief aan rand	0	217,00	0	0	2,211	3,091	25,199	-	0
		0	217,00	0	0	2,372	3,090	25,189	-	0,162
16	Relatief aan rand	0	217,00	0	0	2,492	3,210	25,174	-	0
		0	217,00	0	0	2,491	3,371	25,165	-	0,162
17	Relatief aan rand	0	–217,00	0	0	2,091	3,211	25,199	-	0
		0	–217,00	0	0	2,090	3,372	25,189	-	0,162
18	Relatief aan rand	0	–217,00	0	0	2,210	3,492	25,174	-	0
		0	–217,00	0	0	2,371	3,491	25,165	-	0,162
19	Relatief aan rand	0	–148,00	0	0	2,291	3,090	25,194	-	0
		0	–148,00	0	0	2,291	3,291	25,182	-	0,201
20	Relatief aan rand	0	148,00	0	0	2,291	3,291	25,182	-	0
		0	148,00	0	0	2,291	3,492	25,169	-	0,201
21	Relatief aan rand	0	–148,00	0	0	2,090	3,291	25,194	-	0
		0	–148,00	0	0	2,291	3,291	25,182	-	0,201

NEd: Oppervlak lijnlast

	Richting	px [kN/m]	py [kN/m]	pz [kN/m]	pm [kNm/m]	X [m]	Y [m]	Z [m]	Richting	dL [m]
22	Relatief aan rand	0	148,00	0	0	2,291	3,291	25,182	-	0
		0	148,00	0	0	2,492	3,291	25,169	-	0,201
23	Relatief aan rand	0	−334,00	0	0	1,498	2,618	15,616	-	0
		0	−334,00	0	0	1,497	2,779	15,606	-	0,162
24	Relatief aan rand	0	334,00	0	0	1,899	2,617	15,591	-	0
		0	334,00	0	0	1,899	2,779	15,581	-	0,162
25	Relatief aan rand	0	−334,00	0	0	1,617	2,899	15,591	-	0
		0	−334,00	0	0	1,779	2,899	15,581	-	0,162
26	Relatief aan rand	0	−228,00	0	0	1,699	2,498	15,611	-	0
		0	−228,00	0	0	1,698	2,698	15,598	-	0,201
27	Relatief aan rand	0	−228,00	0	0	1,498	2,699	15,611	-	0
		0	−228,00	0	0	1,698	2,698	15,598	-	0,201
28	Relatief aan rand	0	228,00	0	0	1,698	2,698	15,598	-	0
		0	228,00	0	0	1,899	2,698	15,586	-	0,201
29	Relatief aan rand	0	228,00	0	0	1,698	2,698	15,598	-	0
		0	228,00	0	0	1,698	2,899	15,586	-	0,201
30	Relatief aan rand	0	334,00	0	0	1,618	2,498	15,616	-	0
		0	334,00	0	0	1,779	2,497	15,606	-	0,162
31	Relatief aan rand	0	−187,00	0	0	0,614	1,484	5,342	-	0
		0	−187,00	0	0	0,779	1,483	5,321	-	0,166
32	Relatief aan rand	0	187,00	0	0	0,484	1,614	5,342	-	0
		0	187,00	0	0	0,483	1,779	5,321	-	0,166
33	Relatief aan rand	0	187,00	0	0	0,611	1,907	5,287	-	0
		0	187,00	0	0	0,775	1,905	5,266	-	0,166
34	Relatief aan rand	0	−187,00	0	0	0,907	1,611	5,287	-	0
		0	−187,00	0	0	0,905	1,775	5,266	-	0,166
35	Relatief aan rand	0	124,00	0	0	0,696	1,483	5,331	-	0
		0	124,00	0	0	0,695	1,695	5,304	-	0,213
36	Relatief aan rand	0	124,00	0	0	0,483	1,696	5,331	-	0
		0	124,00	0	0	0,695	1,695	5,304	-	0,213
37	Relatief aan rand	0	−124,00	0	0	0,695	1,695	5,304	-	0
		0	−124,00	0	0	0,693	1,906	5,276	-	0,213
38	Relatief aan rand	0	−124,00	0	0	0,695	1,695	5,304	-	0
		0	−124,00	0	0	0,906	1,693	5,276	-	0,213
39	Relatief aan rand	0	65,00	0	0	−0,081	0,789	0,038	-	0
		0	65,00	0	0	0,084	0,788	0,017	-	0,166
40	Relatief aan rand	0	−65,00	0	0	−0,211	0,919	0,038	-	0
		0	−65,00	0	0	−0,212	1,084	0,017	-	0,166
41	Relatief aan rand	0	−65,00	0	0	−0,084	1,212	−0,017	-	0
		0	−65,00	0	0	0,081	1,211	−0,038	-	0,166

NEd: Oppervlak lijnlast

	Richting	*px [kN/m]*	*py [kN/m]*	*pz [kN/m]*	*pm [kNm/m]*	*X [m]*	*Y [m]*	*Z [m]*	*Richting*	*dL [m]*
42	Relatief aan rand	0	65,00	0	0	0,212	0,916	–0,017	-	0
		0	65,00	0	0	0,211	1,081	–0,038	-	0,166
43	Relatief aan rand	0	–43,00	0	0	0,002	0,789	0,027	-	0
		0	–43,00	0	0	0	1,000	0	-	0,213
44	Relatief aan rand	0	–43,00	0	0	–0,211	1,002	0,027	-	0
		0	–43,00	0	0	0	1,000	0	-	0,213
45	Relatief aan rand	0	43,00	0	0	0	1,000	0	-	0
		0	43,00	0	0	0,211	0,998	–0,027	-	0,213
46	Relatief aan rand	0	43,00	0	0	0	1,000	0	-	0
		0	43,00	0	0	–0,002	1,211	–0,027	-	0,213

px, py, pz: Belastingkracht component; **pm:** Belastingsmoment component; **X:** Belasting in X-richting; **Y:** Belasting in Y-richting; **Z:** Belasting in Z-richting;

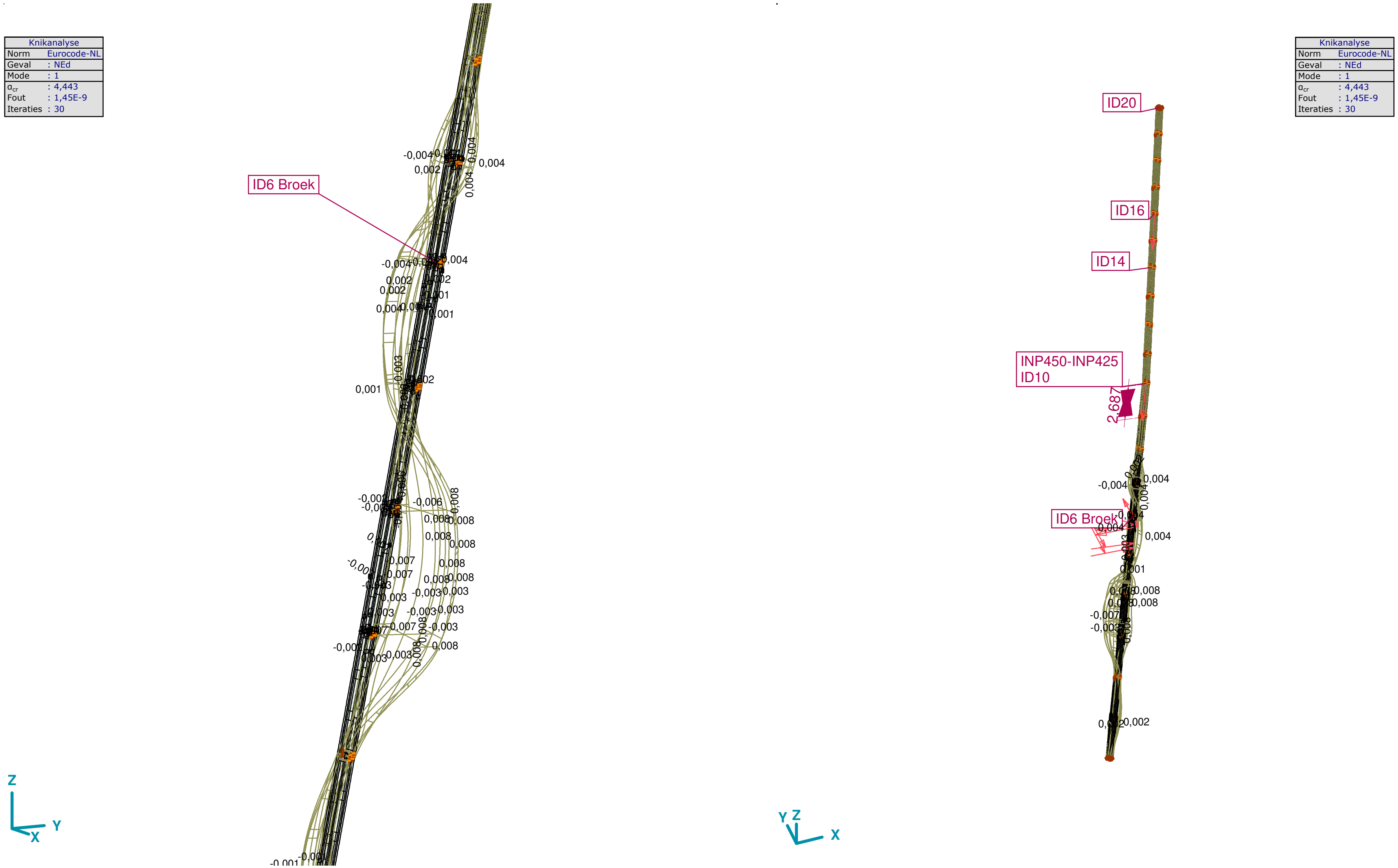
Maatgevende belastingsfactoren [NEd]

	α_{cr}	*Fout*		α_{cr}	*Fout*		α_{cr}	*Fout*
1	4,443	1,45E-9	6	6,428	2,27E-7	11	7,369	8,08E-6
2	4,648	9,28E-10	7	6,879	1,22E-6	12	7,493	8,73E-6
3	4,814	1,43E-9	8	7,027	1,66E-6	13	7,718	5,17E-5
4	4,837	4,46E-10	9	7,121	6,02E-6	14	7,843	4,89E-5
5	6,195	3,29E-8	10	7,246	1,01E-5	15	7,859	7,18E-5

α_{cr}: Maatgevende belasting parameter; **Fout:** Fout in oplossing;

Project: KIJ-GT

Constructeur: DNV GL - Energy
Model: **S+95 Leg study 16.axs**



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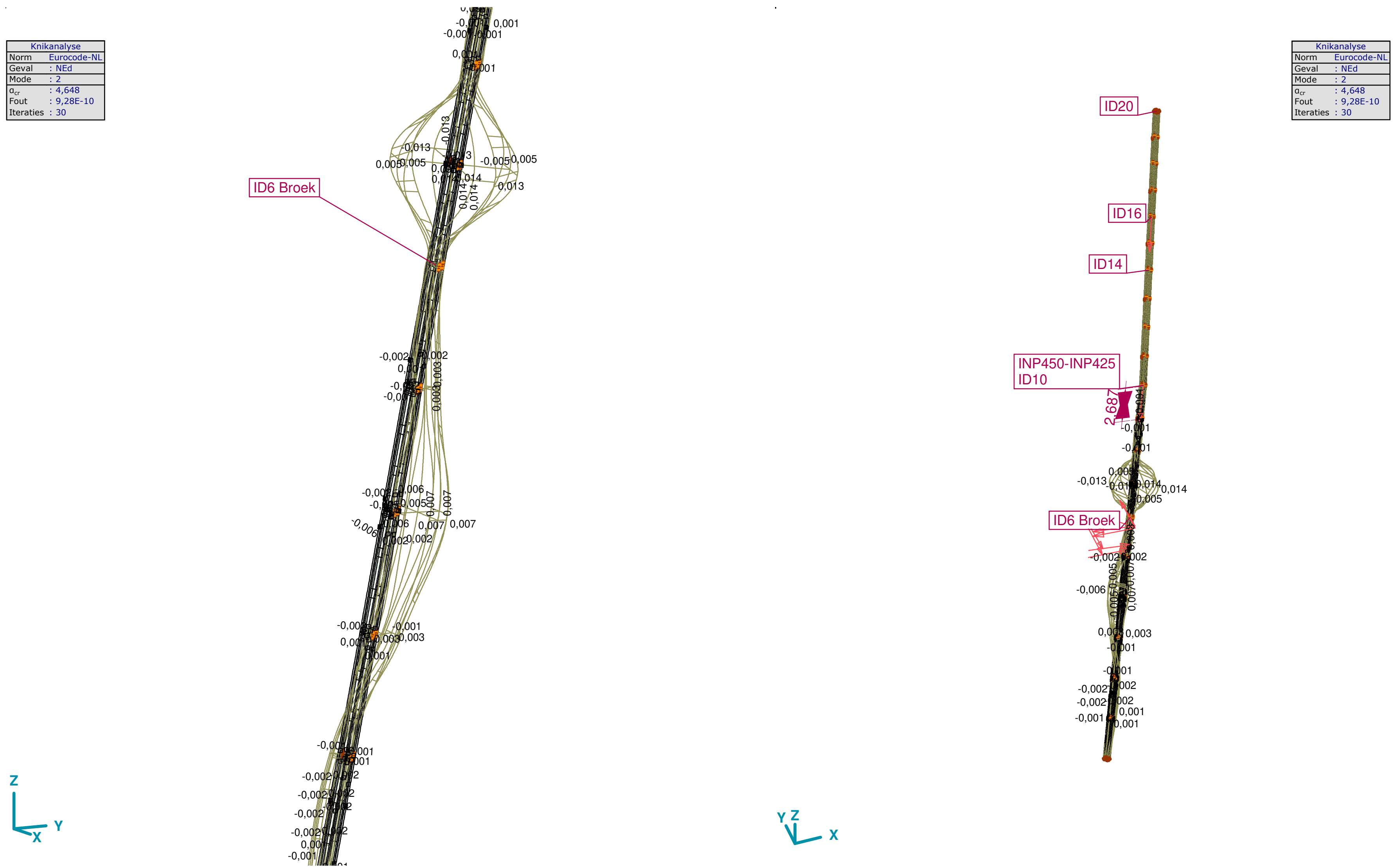

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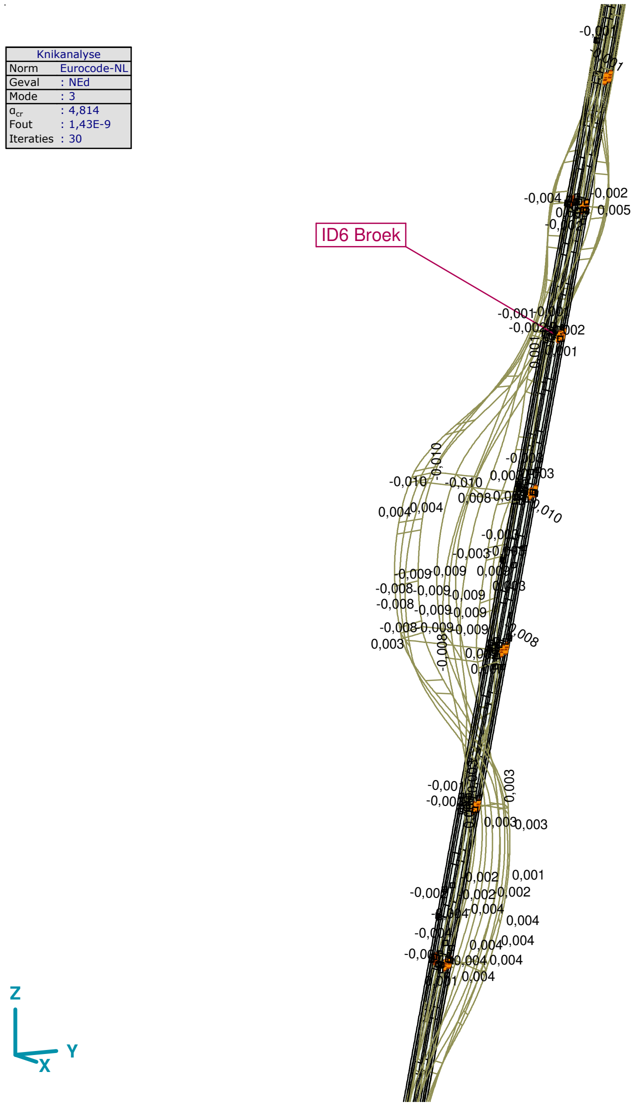

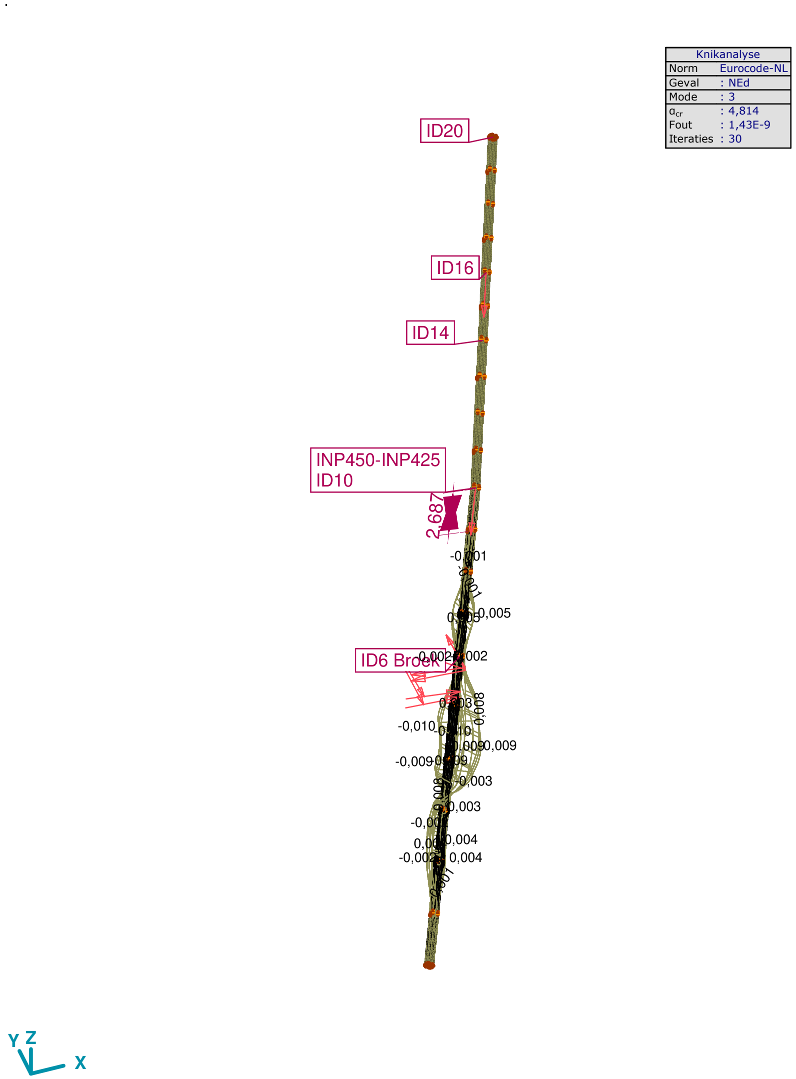

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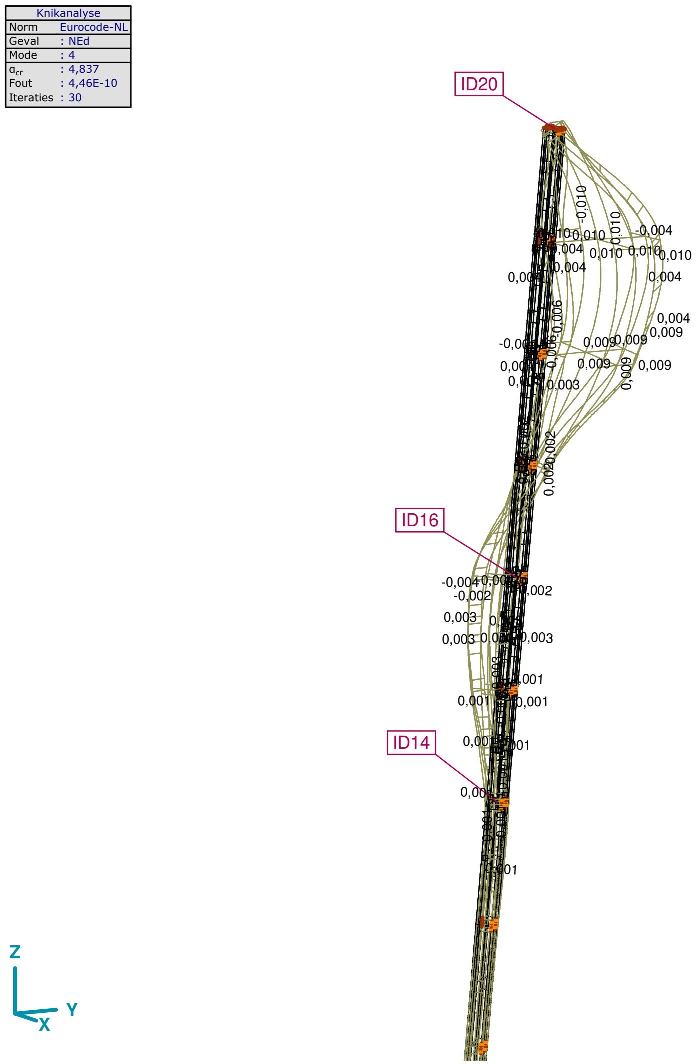

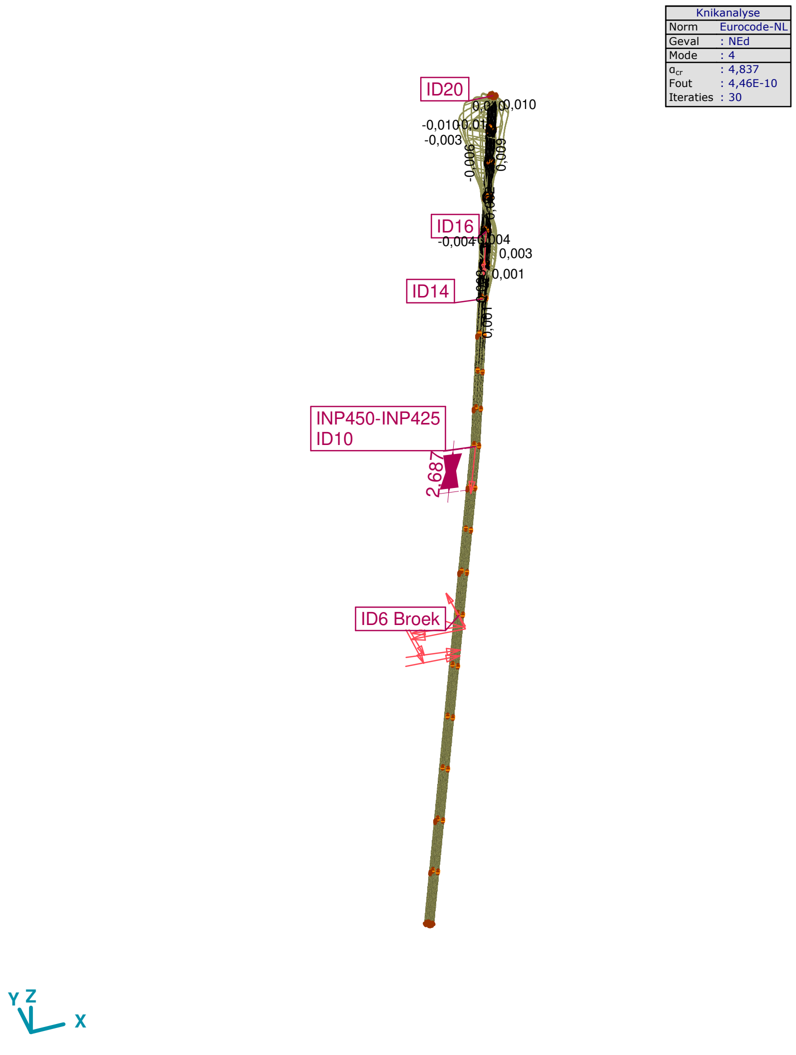

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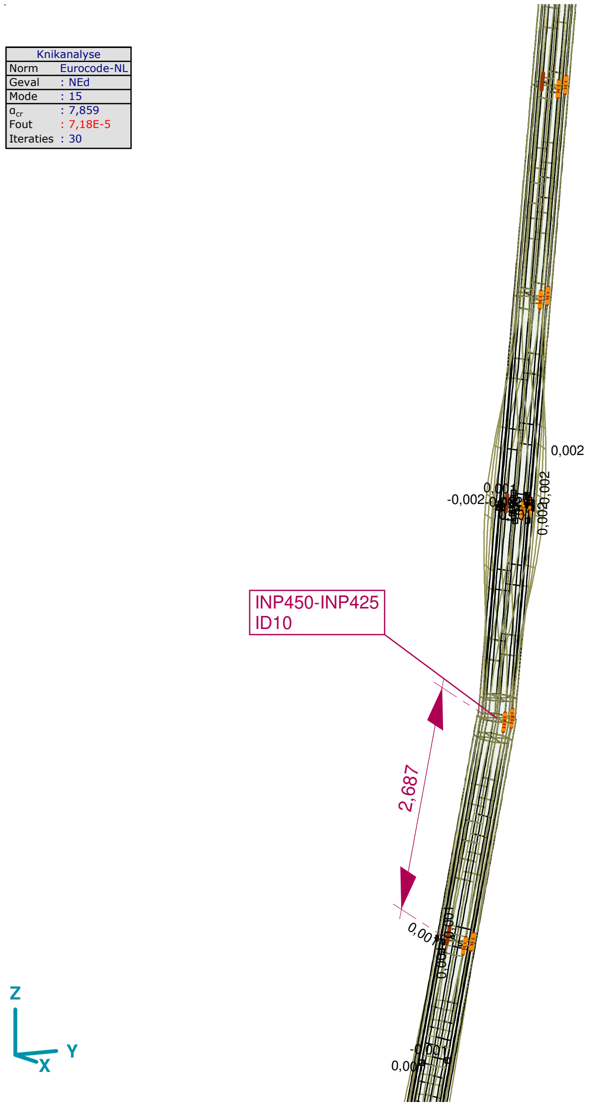

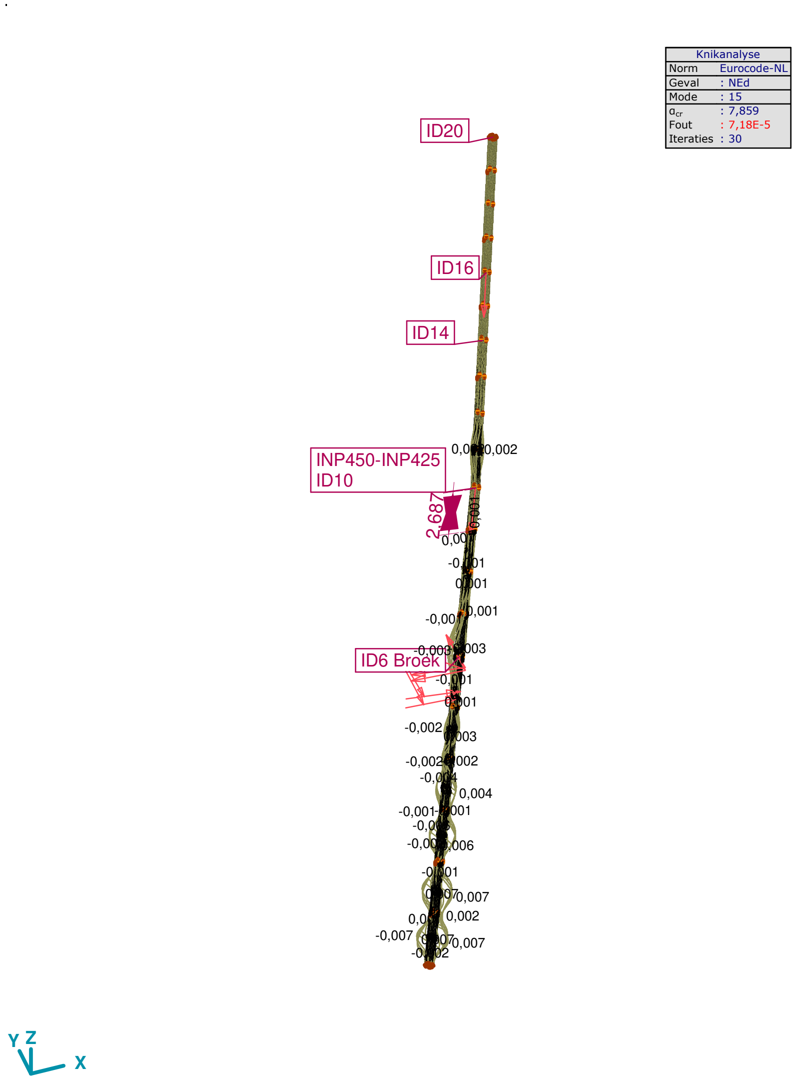

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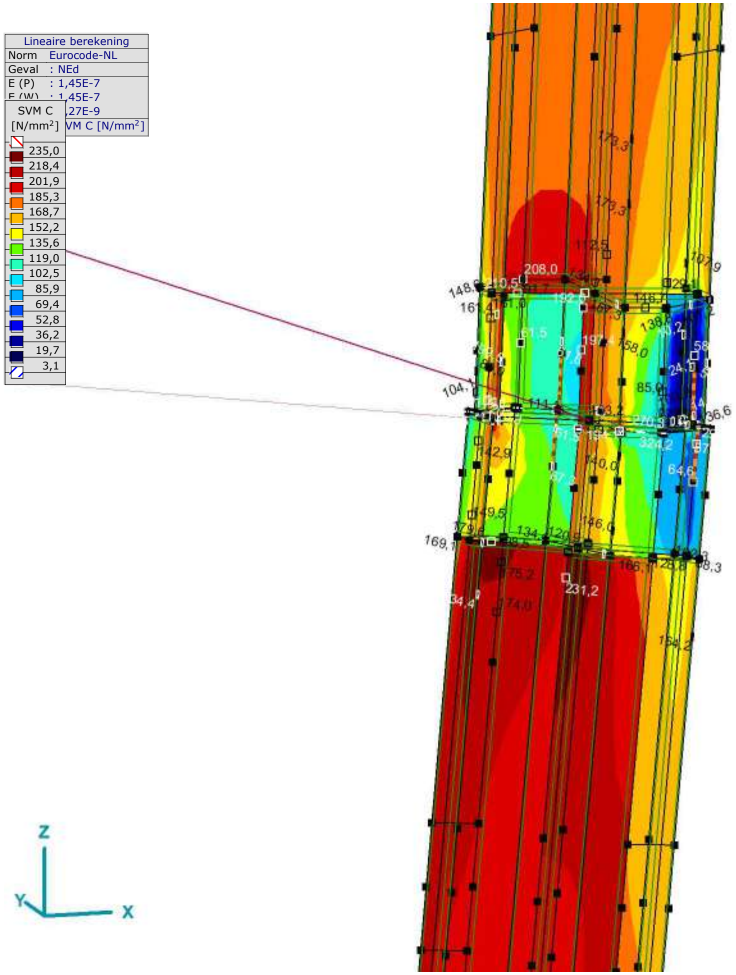

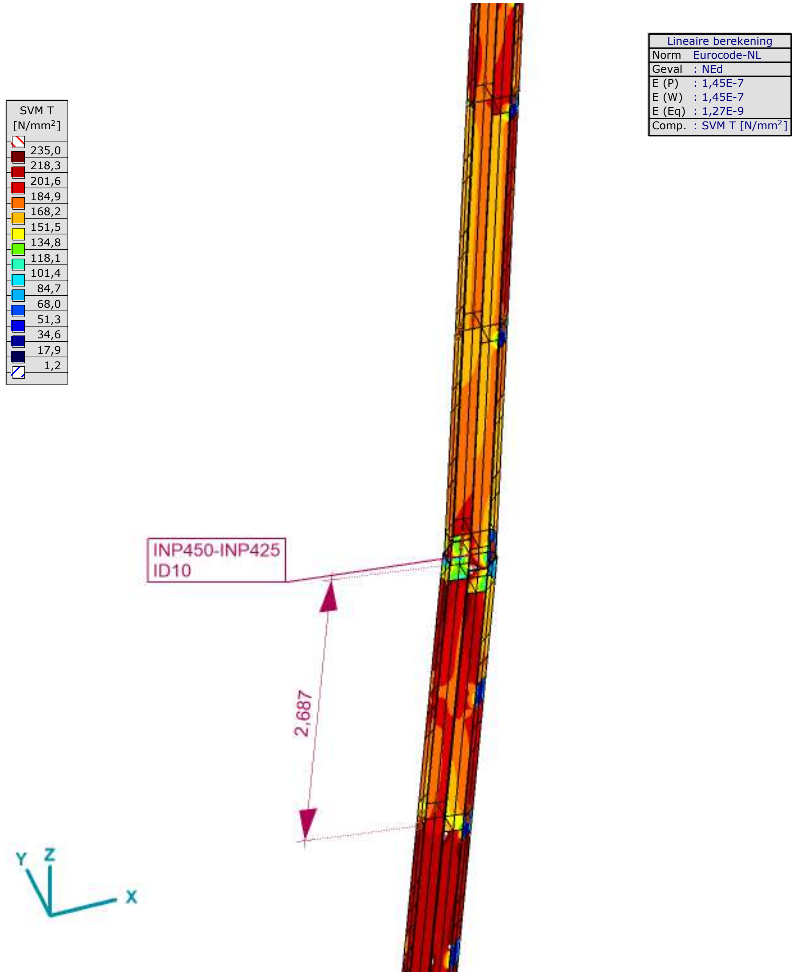

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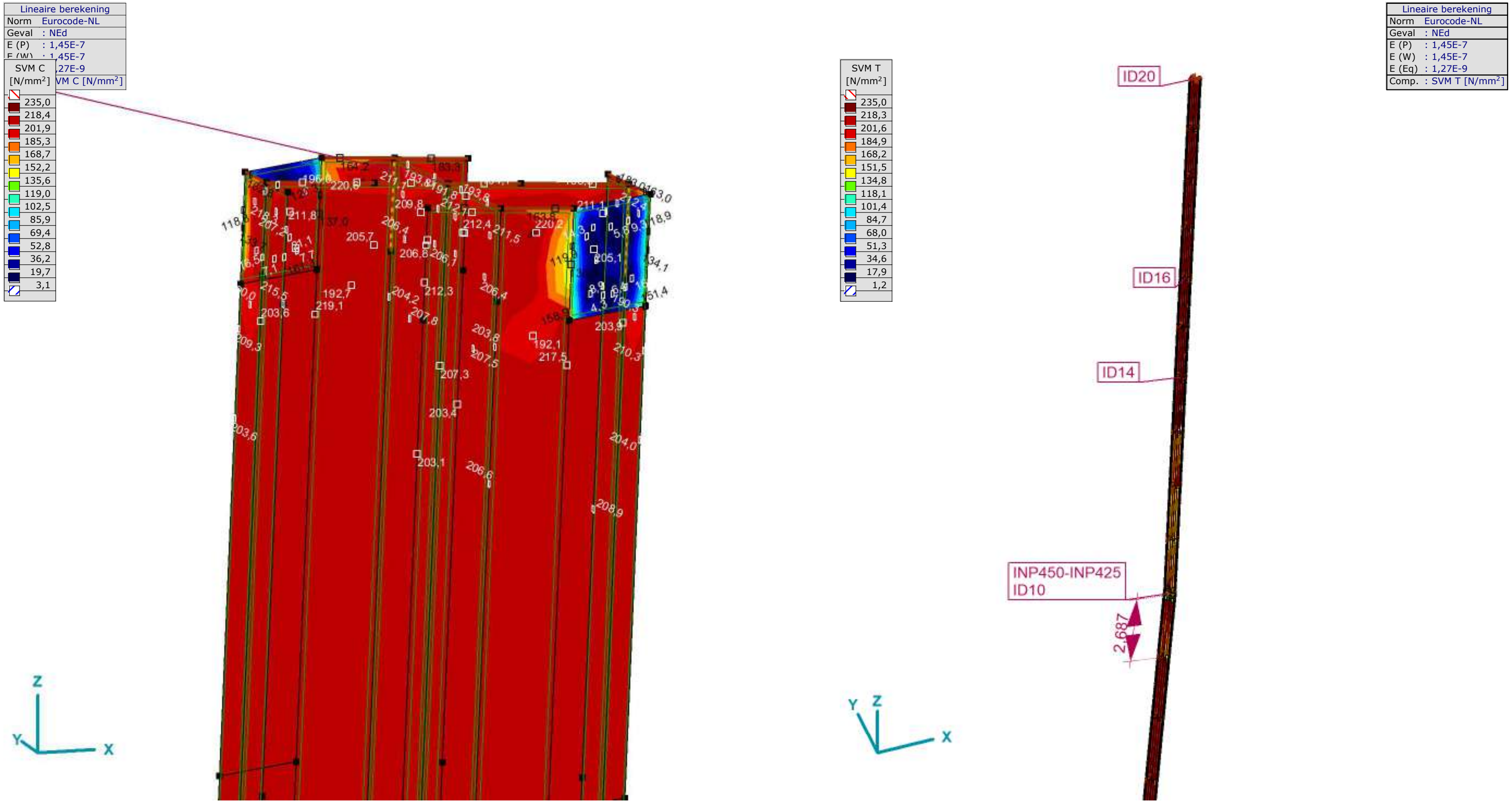

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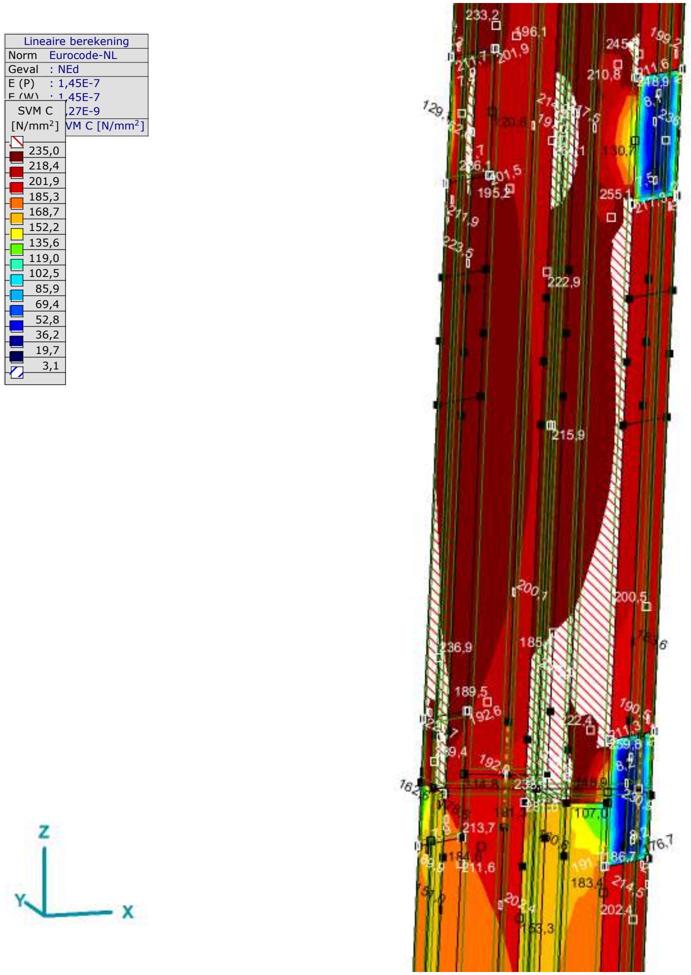

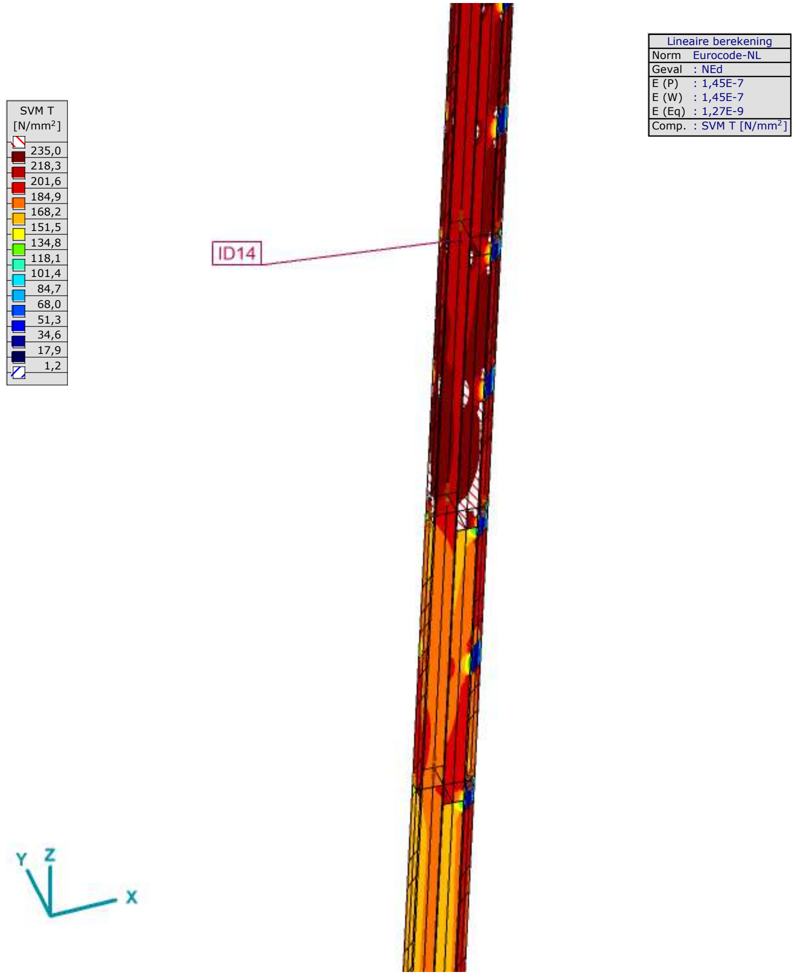

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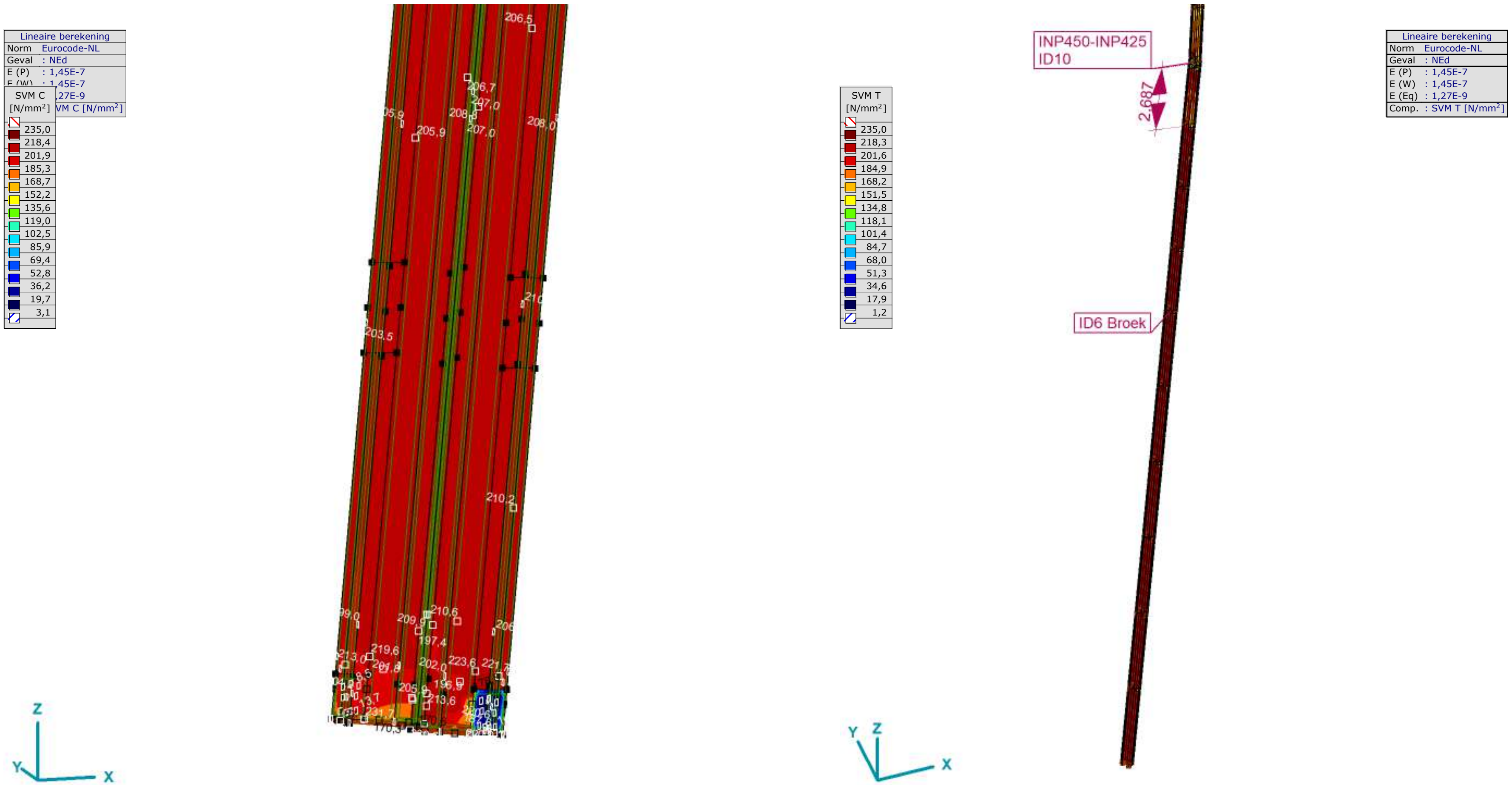

[I], Lineair, NEd, Kleuren 2D, x 2_4

APPENDIX G DOCUMENTEN TNO

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Datum
18 februari 2021

Onze referentie
Rapport TNO 2021 R10305

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Doorkiesnummer
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Projectnummer
060.48035/01.01

Onderwerp
Beoordeling individueel risico draagmasten Lekkruising

Geachte heer Van der Wekken,

Hierbij ontvangt u het briefrapport betreffende ‘Beoordeling individueel risico draagmasten Lekkruising.

Dit document heeft de status van een TNO rapport, en is bij TNO bekend onder het nummer **TNO 2021 R10305**. Dit rapport mag niet worden vermenigvuldigd en/of openbaar gemaakt door middel van druk, fotokopie, microfilm of op welke andere wijze dan ook, zonder voorafgaande toestemming van TNO. Dit rapport is in opdracht opgesteld. Voor de rechten en verplichtingen van opdrachtgever wordt verwezen naar de Algemene Voorwaarden voor onderzoeksopdrachten aan TNO. Het ter inzage geven van het TNO-rapport aan direct belanghebbenden is toegestaan.

Met vriendelijke groet,

ValidSigned door IJsbrand van Straalen op 18-02-2021

Dr. ir. YJ van Straalen
Auteur

ValidSigned door Peter Rasker op 19-02-2021

Dr. P.C. Rasker
Research manager
Structural Reliability

Inleiding

Voor de beoordeling van de constructieve veiligheid van bestaande hoogspanningsmasten gaat TenneT uit van het TNO-rapport [1]. In paragrafen 2.4 en 2.5 van dit rapport zijn de aan te houden betrouwbaarheidsindices voor respectievelijk verbouw en afkeur gegeven. In voetnoot b van tabel 2.3 voor de situatie afkeur, is aangegeven dat het maatschappelijk risico waarop de gegeven waarden voor de betrouwbaarheidsindices voor verbouw en afkeur zijn gebaseerd, in alle gevallen boven het individuele risico liggen met een minimale waarde van de betrouwbaarheid van β_{15} = 1,1 (waarde behorende bij een referentieperiode van 15 jaar). De achtergronden hiervoor zijn nader uiteengezet in hoofdstuk 5 van bijlage B1 van het rapport.

TenneT vraagt zich af of de conclusie dat de waarde van het individuele risico lager ligt dan van het maatschappelijke risico, ook van toepassing is voor drie masten van de verbinding Krimpen – Geertruidenberg. Dit betreft de masten 12 en 13 – type S+95 – van 163m, en de mast 49 – type S+75- van 143m, elders in de verbinding Krimpen – Geertruidenberg. Dit, omdat deze masten veel hoger zijn dan de meest voorkomende masten en omdat nabij deze masten bebouwing aanwezig is.

TNO heeft een nadere analyse uitgevoerd om antwoord te kunnen geven op deze vraag van TenneT. In dit memorandum is deze analyse toegelicht, die gebaseerd is op de aanpak zoals nader omschreven in hoofdstuk 5 van bijlage B1 van het TNO-rapport [1]. In aanvulling daarop is ook ingegaan op het groepsrisico.

Aanpak beoordeling individueel risico

Onder het individuele risico (IR) wordt verstaan de kans op overlijden van een maatgevend individu gedurende een periode van een jaar als gevolg van een bepaalde dreiging. Voor het IR wordt een eis gehanteerd van 10^{-5} per jaar.
Het individuele risico IR is gedefinieerd als:

$$IR = P_f \cdot P_{d|f}$$

waarbij P_f de kans op falen van een hoogspanningsmast is [-/jaar] en $P_{d|f}$ de kans op overlijden is gegeven dat een hoogspanningsmast faalt [-]. Indien de eis voor IR wordt aangehouden (10^{-5} per jaar) en de kans voor $P_{d|f}$ kan worden ingeschat, dan is de aan te houden minimale kans op falen als volgt te bepalen:

$$P_f = IR / P_{d|f}$$

De overeenkomende betrouwbaarheidsindex β volgt uit de definitie $P = \Phi(-\beta)$.
Voor een woning dichtbij een hoogspanningsmast is de kans op overlijden van een bewoner gegeven dat een hoogspanningsmast faalt, gelijk aan het product van de volgende factoren:

- De kans dat de bewoner aanwezig is;
- De kans dat de mast het huis raakt;
- De kans op een zware beschadiging;
- De kans dat een persoon komt te overlijden.

De kans dat de bewoner aanwezig is, is gelijk aan 1. Dit, omdat moet worden verondersteld dat in geval van een maatgevend individu de bewoner permanent aanwezig is. In hoofdstuk 5 van bijlage B1 van het TNO-rapport [1] is aangenomen dat de kans dat de mast het huis raakt orde 0,25 is (huis staat in één van de vier valrichtingen), dat de kans op zware beschadiging orde 0,1 is, en dat de kans op overlijden orde 0,1 is. Hieruit volgt dat de kans op overlijden gegeven een instorting orde 0,002 is. Vervolgens is geredeneerd dat dit past bij een betrouwbaarheidsindex op jaarbasis van $\beta_1 = 2,3$, op basis waarvan een betrouwbaarheidsindex voor een referentieperiode van 15 jaar is aangehouden van $\beta_{15} = 1,1$.

Beoordeling individueel risico draagmasten Lekkruising

In de bijlage zijn op luchtfoto's cirkels aangegeven waarbinnen de masten kunnen neerkomen indien deze falen. Ervan uitgaande dat een mast bij falen vanwege een storm in oostelijke richting zal neerkomen, kan de conclusie getrokken worden dat voor elk van de drie masten woningen of andere gebouwen in de betreffende zone aanwezig zijn.

Aangaande de kans dat de mast een huis zal raken, is de observatie dat de in het TNO-rapport [1] aangenomen orde 0,25 hoog is voor de hier beschouwde drie masten en de locaties van de woningen in de nabijheid van deze masten. De kans is voor een woning in de meest kritische zone is ingeschat op orde 0,1. Deze waarde volgt uit de overweging voor de situatie voor de laagste van de drie masten (mast 49, zie bijlage) waarbij een woning ten oosten van de mast op ca. 70 m afstand in de sector van 90°, een kans van ca. 0,1 heeft dat deze geraakt wordt door de mast na falen.

Aangaande de kans op zware schade, zal de kans voor de hier beschouwde masten hoger zijn dan de kans ingeschat in het TNO-rapport [1] met een orde 0,1. De veel hogere masten zijn opgebouwd uit zwaardere elementen en de valhoogte is ook veel groter. Voor een betonnen woning waarbij de aaneengesloten betonnen wanden en vloeren nog enige weerstand bezitten, is ingeschat dat de kans op zware schade orde 0,4 is. Voor een woning opgebouwd uit baksteen wanden, een houten dak en houten vloeren waarbij de constructie veel minder robuust is vergeleken met een betonnen woning, is de kans op zware schade orde 0,8. De kans dat een persoon komt te overlijden blijft ongewijzigd (orde 0,1).

In onderstaande tabel zijn de berekeningsresultaten voor beide situaties gegeven

Berekening	Betonnen woning	Woning met metselwerk wanden, houten dak en houten vloeren
IR [-/jaar]	10^{-5}	10^{-5}
Kans dat mast woning raakt	0,1	0,1
Kans op zware beschadiging woning	0,4	0,8
Kans dat persoon overlijdt	0,1	0,1
$P_{d\|f}$ [-]	0,004	0,008
P_f [-/jaar]	0,0025	0,00125
β_1	2,8	3,0
β_{15}	1,8	2,1

Uit deze nadere analyse volgt dat de betrouwbaarheidsindex β_{15} (1,8 en 2,1 afhankelijk van de constructie van de woning) aanmerkelijk hoger is dan voor de meest voorkomende hoogspanningsmasten met een ingeschatte waarde β_{15} = 1,1 (TNO-rapport [1]). Weliswaar is de kans dat een mast de woning raakt kleiner vanwege een grotere afstand, maar de kans op zware beschadiging van de woning is aanmerkelijk hoger. Deze waarden van de betrouwbaarheidsindex komen overeen met de waarden die in het TNO-rapport zijn aangehouden voor de constructieve toets van bestaande hoogspanningsmasten. Voor afkeur geldt dat β_{15} = 2,0 voor CC2-0 (van toepassing is voor de beschouwde drie masten) en voor verbouw geldt dat β_{15} = 2,4 voor CC2. Op basis van deze analyse trekt TNO de conclusie dat de waarden van de betrouwbaarheidsindex voor het individuele risico op het zelfde niveau liggen als voor het maatschappelijke risico.

Groepsrisico

Bij de indeling van bouwwerken in een gevolgklasse houdt NEN-EN 1990 o.a. rekening met het aantal personen dat bedreigd wordt bij falen van een constructie. Voor gevolgklasse CC2 betreft dit een beperkt aantal. Ook voor de situatie van de hier beschouwde drie masten is nog altijd sprake van één of enkele woningen die bij falen van een mast kunnen worden geraakt. De conclusie is dan ook dat het niet noodzakelijk is dat er gekozen moet worden voor een hogere gevolgklasse.

Conclusies

Voor de drie masten van de verbinding Krimpen – Geertruidenberg, is het individuele risico hoger dan de waarde die in het TNO-rapport [1] is vastgesteld voor de meest voorkomende hoogspanningsmasten. Omdat de bijbehorende betrouwbaarheidsindex voor het individuele risico voor een referentieperiode van 15 jaar overeenkomt met de betrouwbaarheidsindex voor het maatschappelijke risico die als maatgevend is aangehouden, betekent dit dat voor de drie beschouwde masten van de bepalingsmethodes zoals beschreven in het TNO-rapport kan worden uitgegaan bij toetsing van deze drie masten. Met de huidige aanwezige bebouwing is het groepsrisico niet van belang; uiteraard moet TenneT zich er wel van bewust zijn dat bij wijzigingen in de bebouwing dit anders kan worden.

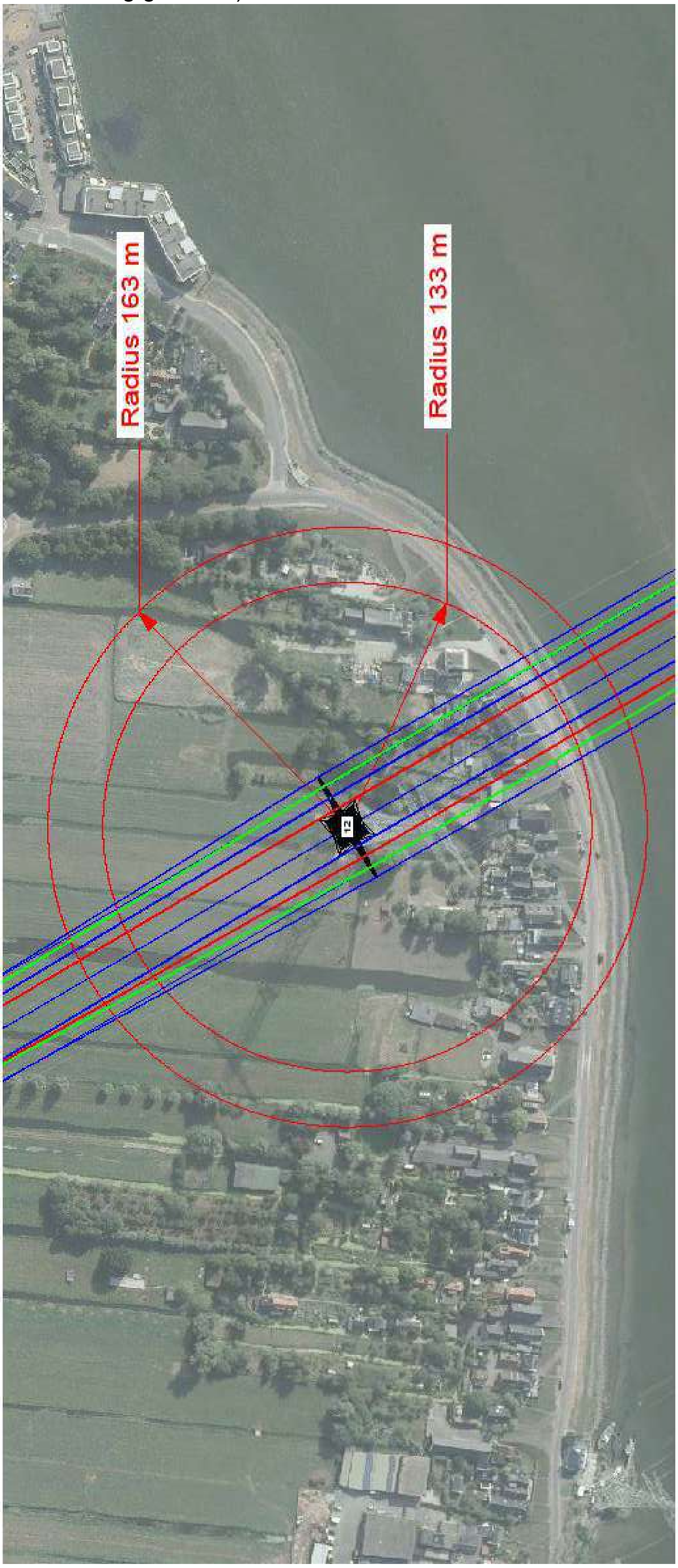
Referenties

[1] Geurts, C.P.W., Steenbergen R.J.D.M., Steenbergen, H.M.G.M., Ploeg, T.J., Scholten, N.P.M., Tol, A.F. van, *Beoordeling van de constructie van bestaande hoogspanningsmaten*, TNO 2018 R11159, 16 oktober 2018

Bijlage – Overzicht van gebieden waar masten kunnen neerkomen
(4 pagina's)

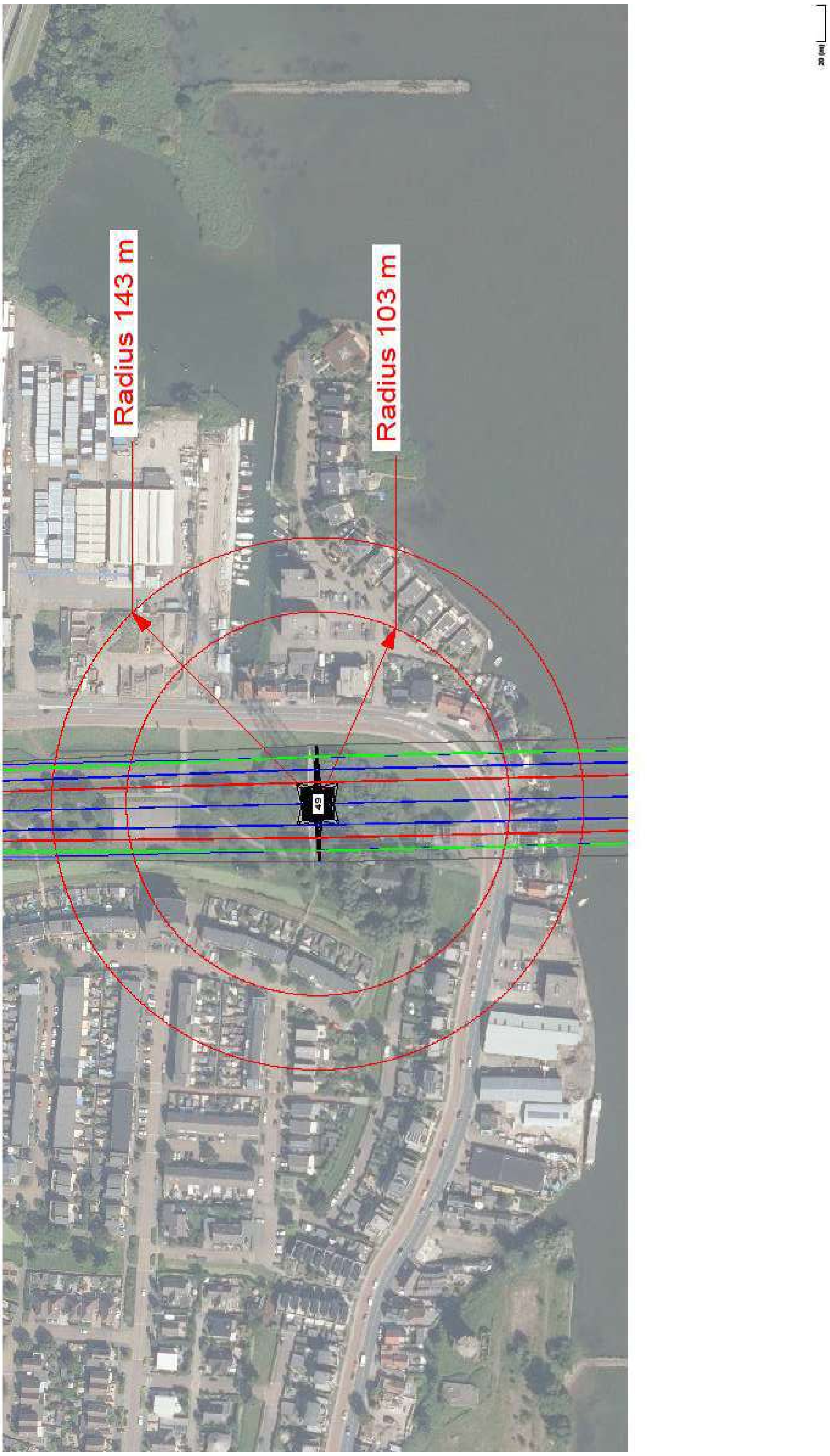
TenneT heeft op luchtfoto's van de omgeving van de drie beschouwde masten de cirkels aangegeven waarbinnen de masten zullen neerkomen. De grootste cirkel heeft een radius gelijk aan de hoogte van de mast en de binnenste cirkel komt overeen de afstand tussen de top van de mast en de locatie met het meest kritische onderdeel van de staalconstructie van de mast.
De verwachte valrichting is loodrecht op de lijnverbinding in oostelijke richting (maar rechts op de schetsen), met een mogelijk afwijking van +45° en -45°.

Mast 12 (afbeelding is kwart slag gedraaid)



Mast 13 (afbeelding is kwart slag gedraaid)

Mast 49 (afbeelding is kwart slag gedraaid)



DNV GL Nederlands BV, Project: "706-50-001 GT-KIJ nieuwe situatie"
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Projectnummer
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Onderwerp
Briefrapport Toepassing van windrichtingsafhankelijke stuwdruk (cdir)

Geachte mevrouw Van der Ploeg,

Voor Nederland schrijft de Nationale Bijlage bij NEN-EN 1991-1-4 voor alle windrichtingen een waarde c_{dir} = 1 voor. In specifieke gevallen kan het zinvol zijn toch met windrichtingsafhankelijkheid te rekenen onder toepassing van het gelijkwaardigheidsbeginsel, waarbij de veiligheid niet lager mag zijn dan die vanuit het Bouwbesluit wordt voorgeschreven. De keuze van c_{dir} alsmede de wijze van toepassen moet daarom zorgvuldig worden vastgelegd. Doel is om een karakteristieke waarde voor de windbelasting te bepalen die ten hoogste eens in de 50 jaar wordt overschreden. Toepassing van de veiligheidsfactoren conform de regelgeving leidt dan tot de rekenwaarde die toegepast dient te worden.

Afleiding van c_{dir} voor Nederland.

De waarde van c_{dir} is afgeleid als de verhouding tussen de windsnelheid met een herhalingstijd van 50 jaar, gegeven een windrichtingsinterval, gedeeld door de windsnelheid met een herhalingstijd ongeacht de windrichting.
Op basis van de statistische gegevens van de meteostations Den Helder, Schiphol en Eindhoven is een waarde voor c_{dir} voor de windgebieden I, II en III in Nederland afgeleid voor intervallen van 15 graden (dit zijn de meteostations die in de basis de stuwdrukken bepalen zoals die in de Nationale Bijlage zijn gegeven). Na toepassing van enkele vereenvoudigingen (samenvoegen van windrichtingen en windgebieden) en het kiezen van een minimaal te hanteren waarde voor c_{dir} = 0,85, levert dit voor Nederland de waarden voor c_{dir} die in Tabel 1 zijn vermeld. Deze waarden zijn van toepassing voor alle windgebieden (dus voor geheel Nederland).

Tabel 1: Waarde voor c_{dir} voor Nederland.

Windrichting ϕ (graden)	c_{dir}
$0 \leq \phi \leq 195$	0,85
$195 < \phi \leq 225$	0,90
$225 < \phi < 315$	1,00
$315 \leq \phi \leq 360$	0,85

De c_{dir} geldt als een factor op de te hanteren basiswindsnelheid. Omdat de windbelasting evenredig is met het kwadraat van de windsnelheid is de belasting evenredig met c_{dir}^2. Bij de laagste waarden van c_{dir} uit de tabel is de reductie in de windbelasting 28%.
Voor Nederland kan het gebruik van c_{dir} interessant zijn wanneer de maatgevende belasting wordt gevonden bij een windrichting uit het noorden of uit het oosten.
Bij toepassing van druk- en krachtcoëfficiënten uit normbladen wordt geadviseerd voor de te hanteren c_{dir} de hoogste waarde binnen het interval rond de maatgevende windrichting ±45° te kiezen. Als voorbeeld: Als de constructie wordt berekend voor een windrichting van 180 graden (zuidenwind) dan wordt voor c_{dir} de maximale waarde uit het interval 135 – 225 graden aanstroming gekozen. Dit betekent dat c_{dir} = 0,90 voor deze aanstroomrichting.

Wanneer er richtingsafhankelijke waarden beschikbaar zijn van de druk- of krachtcoëfficiënten c_p of c_f (bepaald uit windtunnelonderzoek) kunnen deze coëfficiënten worden gebruikt in combinatie met de betreffende waarden voor c_{dir}. Er wordt dan per beschouwde windrichting een belasting berekend met een herhalingstijd van 50 jaar.

Tenslotte kan er bij constructies waarbij in de omgeving sprake is van duidelijk verschillende ruwheid in verschillende richtingen ook gebruik gemaakt worden van c_{dir}.
Het kan voorkomen dat bij de overheersende windrichting een hogere terreinruwheid (en daarmee lagere belasting) hoort dan bij een minder relevante windrichting (bijvoorbeeld noordoostenwind). Het is dan te overwegen de waarde voor c_{dir} te berekenen, en per windrichtingsinterval de stuwdruk met de specifieke stuwdruk te bepalen. Voor de ruwheidsbepaling per 90 graden interval is de procedure uit de Nationale Bijlage van toepassing.

Hoogachtend,

ValidSigned by Chris Geurts
on 08-02-2021

C.P.W. Geurts
Auteur

ValidSigned by Adri Vervuurt
on 09-02-2021

A.H.J.M. Vervuurt
Project manager

ValidSigned by Tom Basten
on 09-02-2021

T.G.H. Basten
Research Manager Structural Dynamics

OVER DNV GL

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Bijlage 19 Rapportage Mastconstructie WB+0

“TOETSING EN HERONTWERP MASTEN EN FUNDATIES BBB380”

KIJ-GT380 – Rapportage mast WB+0

TenneT TSO B.V.

Meridian doc. nr.: 002.589.40 0916516
Rapport nr.: 21-1106 Rev.0
Datum: 2021-07-06

Projectnaam:	"Toetsing en herontwerp masten en fundaties BBB380"	DNV GL - Energy Energy Advisory Postbus 9035 6800 ET ARNHEM
Rapport titel:	KIJ-GT380 – Rapportage mast WB+0	
Klant:	TenneT TSO B.V.	
Contactpersoon:	[redacted]	
Datum:	2021-07-06	
Project nr.:	10166260	Tel: +31 26 356 9111
Organisatie unit:	TDT	KvK 09006404
Meridian doc.nr.:	002.589.40 0916516	
Rapport nr.:	21-1106 Rev.0	

[redacted]

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Trefwoorden:

Versie	Datum	Reden voor uitgave	Auteur	Beoordeeld	Goedgekeurd
0	2021-07-06	Eerste uitgave	[redacted]	[redacted]	[redacted]

DNV GL Netherlands B.V.

Inhoud

1 INLEIDING

1.1 Inleiding

Om in de toekomst meer elektriciteit te kunnen transporteren is het noodzakelijk om naast de nieuwbouw van verbindingen bestaande hoogspanningsverbindingen aan te passen zodat er een grotere transportcapaciteit mogelijk wordt gemaakt.

Om die reden is de opdrachtgever (OG) voornemens de bestaande 380 kV-koppelnetring op te waarderen. Het opwaarderen van de bestaande verbindingen valt onder het programma "Beter benutten bestaande 380 kV-ring" en omvat de volgende deelprojecten:

- Opwaardering 380 kV-verbinding Lelystad – Ens (LLS-ENS380)
- Opwaardering 380 kV-verbinding Diemen – Lelystad (DIM-LLS380)
- Opwaardering 380 kV-verbinding Rilland – Zandvliet (RLL-ZVL380)
- Opwaardering 380 kV-verbinding Krimpen aan den IJssel - Geertruidenberg (KIJ-GT380)
- Opwaardering 380 kV-verbinding Ens - Zwolle (ENS-ZL380)
- Opwaardering 380 kV-verbinding Maasbracht - Eindhoven (MBT-EHV380)

Om te komen tot een DO waarmee de werkzaamheden kunnen worden gestart is door TenneT aan DNV GL opdracht verstrekt voor de volgende onderdelen:

1. In eerste fase het opstellen en creëren van:

1.1 E-studie deel 1

1.2 Uitgangspuntenrapporten ten behoeve van de constructieve analyse van masten en fundaties

1.3 Sonderingmodellen

1.4 Fundatiemodellen

1.5 Mastmodellen

2. In tweede fase de uitvoering van de DO-fase bevattende:

2.1 Toetsing conform het uitgangspuntenrapport van de bestaande fundaties

2.2 Globale specificatie van benodigde fundatieversterkingen ten behoeve van aanbesteding

2.3 Toetsing conform het uitgangspuntenrapport van de bestaande masten

2.4 Globale specificatie van benodigde mastversterkingen ten behoeve van aanbesteding

2.5 E-studie deel 2

In deze studie wordt voor de lijn Krimpen aan den IJssel - Geertruidenberg de controle van de mastconstructie van masttypen WB+0 gerapporteerd.

Inhoudelijk is de Nederlandse versie van de rapportage ongewijzigd ten opzichte van de Engelse versie. Om deze reden zijn de bijlagen in dit rapport één op één overgenomen uit de Engelse versie. Hierdoor wijkt het revisienummer van de bijlagen af van het revisienummer van de rapportage.

1.2 Doelstelling en scope van dit rapport

Het doel van deze studie is om te bepalen of de in dit rapport beschreven bestaande mast geschikt is om te worden uitgerust met de ACCCZ-Warsaw geleider.

Nadat de wijzigingen zijn toegepast dient aantoonbaar geverifieerd te worden dat het systeem voldoet aan de vigerende eisen.

1.3 Relatie overige documenten

1.3.1 Verificatie & validatie plan

De door TenneT aangeleverde set met eisen is beoordeeld op relevantie en voor de relevante eisen is aangegeven in welk document wordt aangetoond dat er aan de eis wordt voldaan. De resultaten hiervan zijn opgenomen in het rapport "Verificatie & Validatieplan 380 kV verbinding Krimpen aan den IJssel - Geertruidenberg" [1].

1.3.2 E-studie deel 1

In de rapportage "KIJ-GT380 - E-studie deel 1" [2] is bepaald welke aanpassingen benodigd zijn om de ACCCZ Warsaw geleider toe te passen binnen de verbinding Krimpen aan den IJssel - Geertruidenberg. Voor het masttype WB+0 blijft de transpositie van de fasedraden behouden, maar zullen de bestaande, porseleinen isolatoren en geleiders van de transpositie worden vervangen voor isolatoren en geleiders van composiet. Uit de E-studie volgen verder geen zaken die relevant zijn voor de constructie van masttype WB+0.

1.3.3 Uitgangspunten rapport

De uitgangspunten op basis waarvan de berekeningen in deze rapportage zijn uitgevoerd zijn opgenomen in het rapport "Uitgangspuntenrapport 380kV verbinding Krimpen aan den IJssel - Geertruidenberg" [3].

2 EISEN

In onderstaande Tabel 1 zijn de eisen opgenomen die binnen deze rapportage worden getoetst.

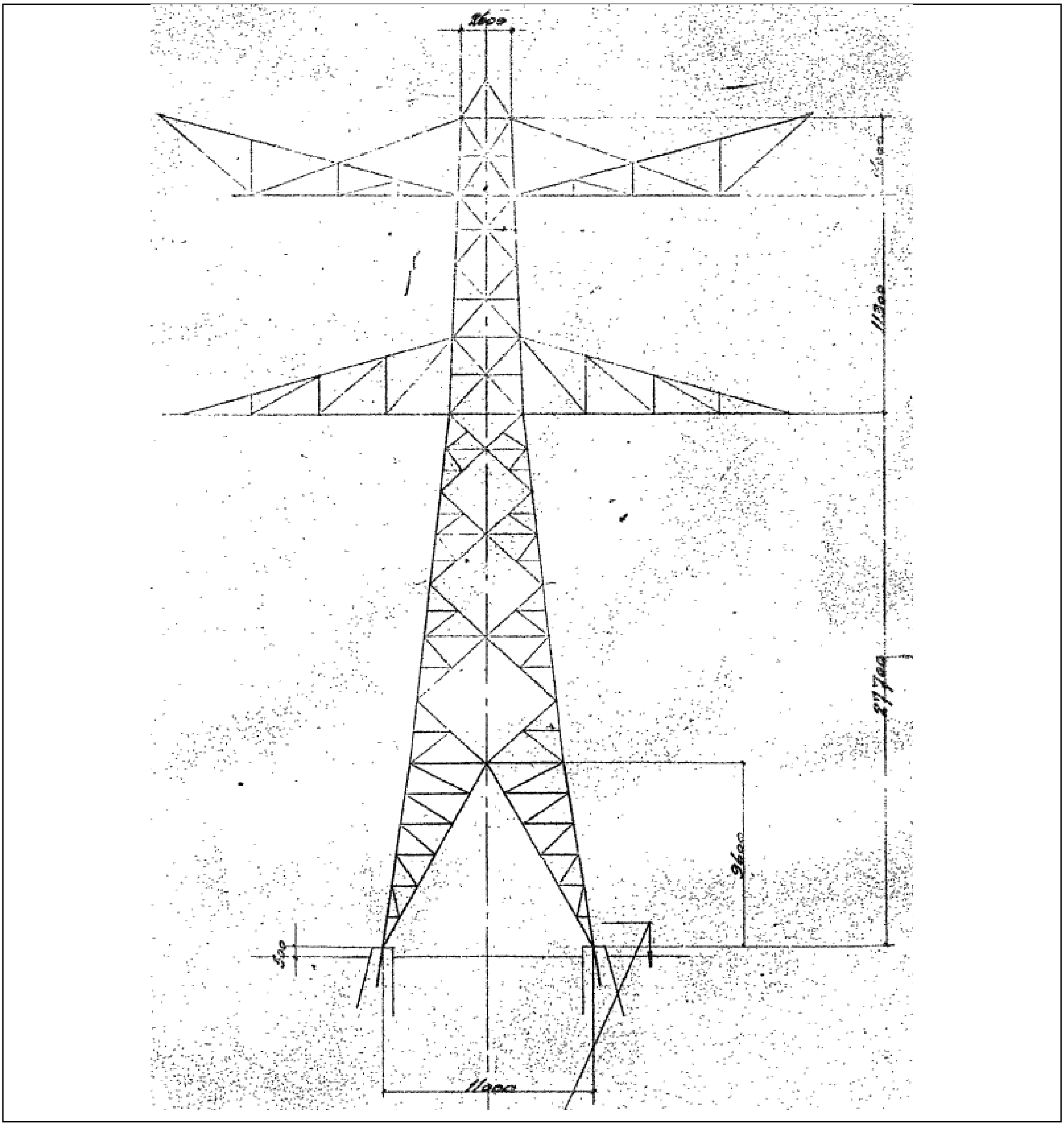
Tabel 1 Relevante eisen

Eis Id	Titel	Eis Tekst	Bewijsvoering
BO Eis: H2.7-6	Omgeving, beperkings factoren	Het ontwerp dient geverifieerd te worden op de uitvoerbaarheid.	Tabel 6
PVE.05.001 5.14	Masten	Aanwijzingen t.a.v. klimvoorziening en valbeveiliging: Huidige klimweg blijft gehandhaafd en zal voldoen aan de eisen zoals opgenomen in de NEN 1060:1977. Valbeveiliging is/zal worden uitgevoerd in het type "latch way". Indien staaldelen in de nabijheid (aangrenzend profiel) van de klimweg gewijzigd worden, dient geverifieerd te worden dat de klimvoorziening in overeenstemming is met de NEN 1060:1977.	Tabel 6

3 BEREKENINGEN

3.1 Mastbeeld

Het mastbeeld op basis van de Asset-data is weergegeven in Figuur 1.



Figuur 1 Mastbeeld WB+0 (transpositie niet weergegeven)

Figuur 2   Mast 37 met transpositie (bron: hoogspanningsnet.com)

3.2 Mastenlijst

In deze rapportage wordt masttype WB+0 getoetst. Er komt één masten van het type WB+0 voor in de verbinding, dit is mast 37 en staat in windgebied II. Bij de mast is rekening gehouden met verhoogde windbelasting als gevolg van een hogere aangrenzende mast (hoger is een negatieve waarde). De wind en weight span van de verschillende masten zijn in Tabel 2 weergegeven.

Tabel 2 Mastnummers

Mastnummer	Masttype	Maatgevend mastnummer	Wind span (m)	Weight span (m)	Hoogteverschil
37	WB+0	37	358	359	0.3

Bovenstaande waarden voor de wind en weight span zijn gebruikt om de geleiderbelastingen te bepalen.

3.3 Uitgangspunten berekening

De berekening is uitgevoerd op basis van de uitgangspunten zoals opgenomen in het uitgangspuntenrapport [3]. Hierin is een volledig overzicht opgenomen van de belastingcombinaties en toegepaste belastingfactoren

Tabel 3 Uitgangspunten berekening

Algemeen	Norm	NEN-EN50341-2-15:2019
	Windgebied	II
	Terreincategorie	II (onbebouwde omgeving)
	Reductiefactor cdir	1,00
Situatie initieel	Gevolgklasse	CC2-0
	Betrouwbaarheidsniveau	Afkeur CC2-0
	Referentieperiode	30 jaar
Situatie na aanpassingen	Gevolgklasse	CC2
	Betrouwbaarheidsniveau	Verbouw
	Referentieperiode	50 jaar

3.4 Proces stappen

Het proces van het bepalen van eventueel benodigde verstevigingen bestaat uit de volgende stappen:

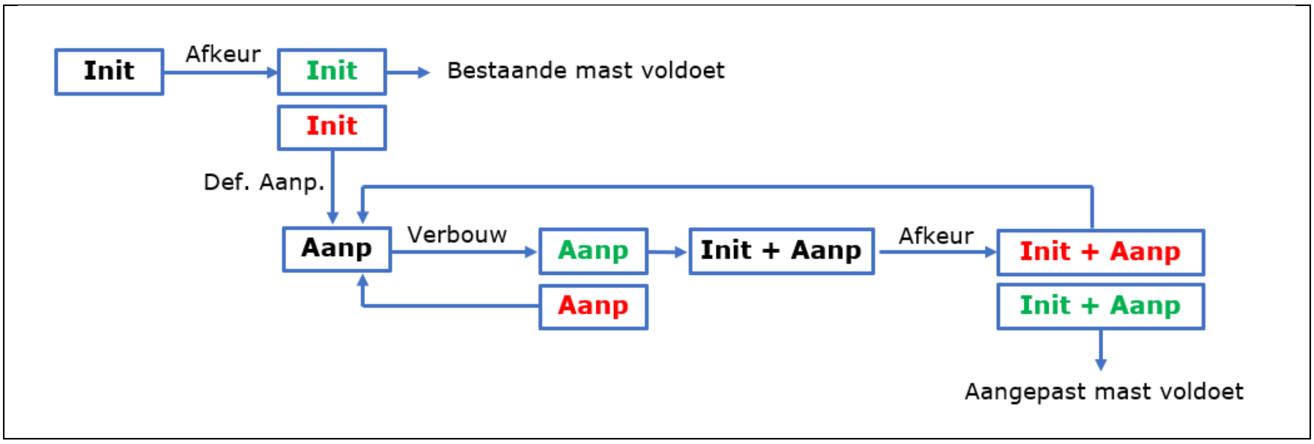
Stap 1: Toets bestaande (Init) mast op Afkeur

Stap 2: Definiëren benodigde aanpassingen indien initiële mast niet voldoet aan toets op Afkeur (Def. Aanp.)

Stap 3: Het toetsen van (alleen) de uitgewerkte aanpassingen (Aanp) op Verbouw

Stap 4: Het opnieuw toetsen van de complete mast inclusief aanpassingen (Initi + Aanp) op Afkeur

Het hierboven omschreven proces is in Figuur 3 weergegeven.



Figuur 3 Proces diagram

3.5 Geleiderbelastingen

De berekening is uitgevoerd met het geleiderbelastingenprogramma van DNV GL. In Appendix A zijn de resultaten van de geleiderbelastingen samengevat.

3.6 Reacties op de fundering

De oplegreacties op de fundering worden ontleend aan de uitvoer van het geleiderbelastingenprogramma, zie ook Appendix A.

3.7 Modellering

Op basis van de as-built tekeningen is de mast in PLS-TOWER ingevoerd. De hoofdelementen zijn gemodelleerd. Niet-dragende profielen als knikverkorters zijn weggelaten en worden separaat getoetst. De profielen inclusief de boutverbindingen zijn in PLS-TOWER ingevoerd en getoetst. Controle van de schetsplaten en andere detailverbindingen valt buiten de scope.

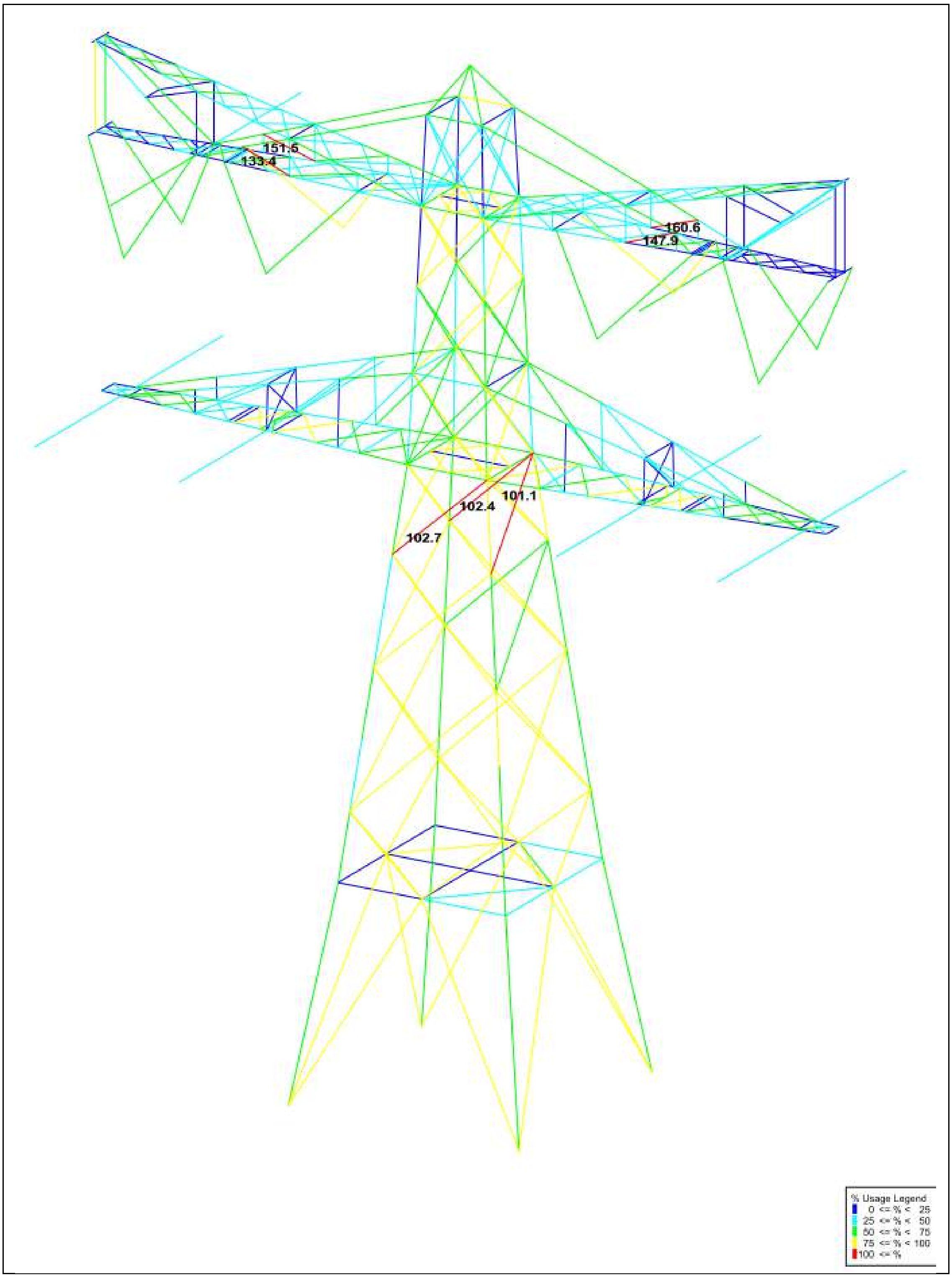
De geleiderbelastingen vanuit het geleiderbelastingenprogramma zijn als invoer voor de belastingen gebruikt.

Aanvullend zijn de belastingen uit de transpositie berekend en meegenomen in de PLS-TOWER berekeningen. Voor berekening belastingen, zie Appendix D.

Diagonalen in voor- en achtervlak respectievelijk de twee zijvlakken zijn samengenomen in een groep en de toetsing wordt per staafgroep uitgevoerd. Ingeval dat een element uit een groep is overbelast, geldt dit voor alle elementen uit de betreffende groep.

4 TOETSING MAST

Het resultaat van de controle van de mastconstructie type WB+0 met belastingen op afkeurniveau is weergegeven in Figuur 4.



Figuur 4 Resultaat PLS-TOWER WB+0 (37)

De resultaten van de controles van profielen, knikverkorters en ankers randstijl zijn opgenomen in Tabel 4.

Tabel 4 Samenvatting controle

Controle van	Beoordeling		Referentie
Profielen		Voldoen niet	Figuur 4
Knikverkorters	Voldoen		Appendix C
Ankers en voetplaat	Voldoen		Appendix D

5 AANPASSINGEN

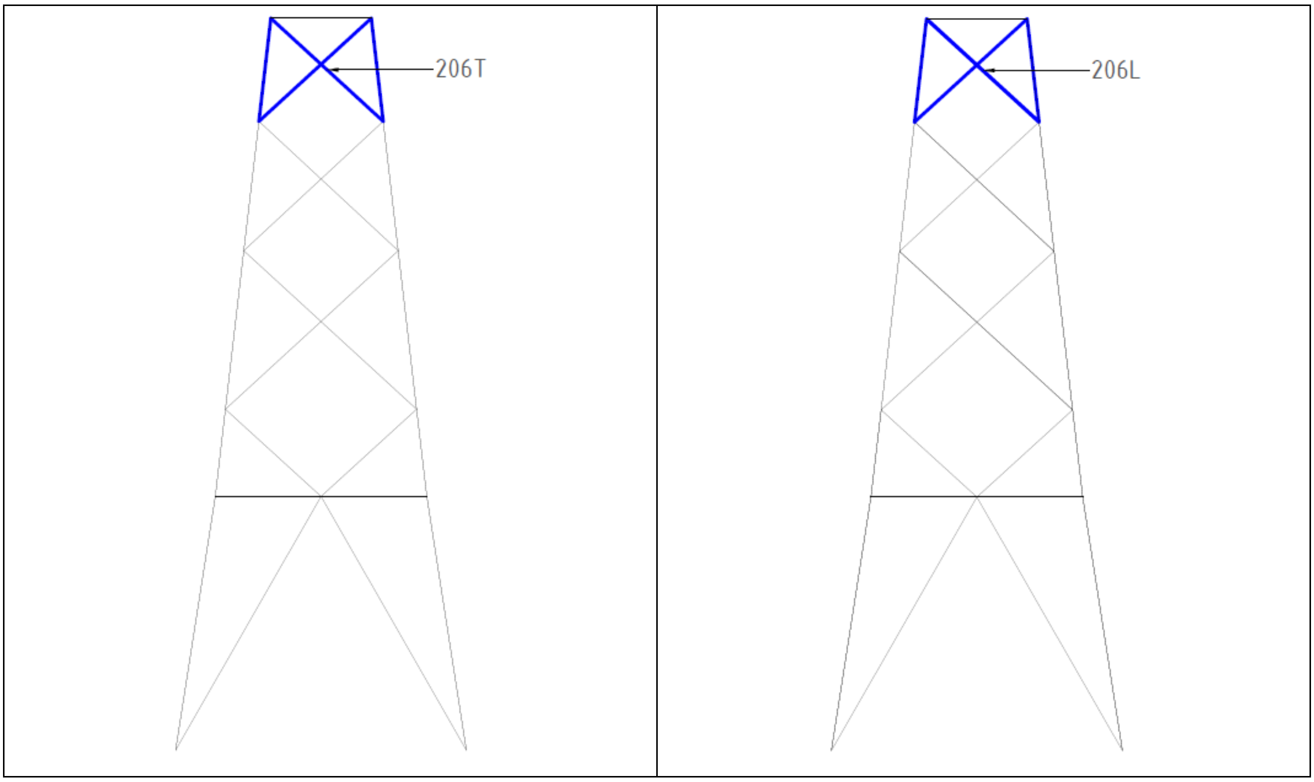
5.1 Inleiding

Een versterkingsvoorstel om de mast aan afkeurniveau te laten voldoen en nieuwe onderdelen aan verbouwniveau is uitgewerkt. Dit voorstel bevat de volgende maatregelen:

- Vervangen van kruisdiagonalen in het tussenstuk;
- Vervanging diagonalen zijvlak boventraverse.

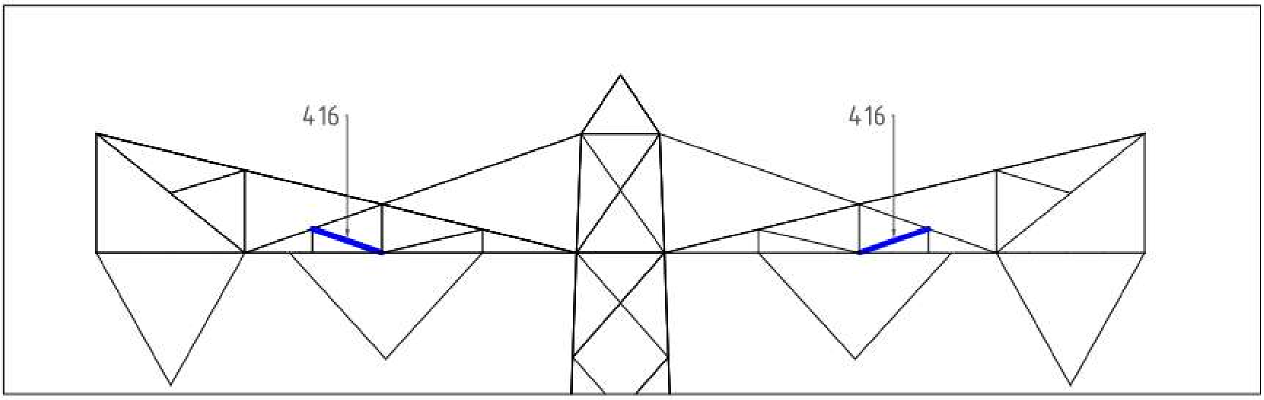
5.2 Aanpassingen

Conform berekening, zie Appendix B, moeten de kruisdiagonalen in het tussenstuk van beide zijvlakken worden vervangen. In Figuur 5 zijn de betreffende kruisdiagonaal weergegeven. Voor afmetingen profielen en bouten, zie Appendix E.



Figuur 5 Zijaanzicht (links) en vooraanzicht (rechts) tussenstuk met te vervangen kruisdiagonalen

In Figuur 6 worden de te vervangen diagonalen in de boventraverse weergegeven.



Figuur 6 Vooraanzicht boventraverse

Een overzicht van het nettogewicht van de profielen die nodig zijn voor de aanpassingen van mast 11-1 zijn weergegeven in Tabel 5. Het gewicht van eventueel benodigde schetsplaten is niet meegenomen.

Tabel 5 Gewichten profielen voor aanpassingen mast 37

Staafgroep	Profiel	Materiaal	Bouten	Profiel nw.	Materiaal nw.	Bouten nw.	Maatregel	Aantal	Lengte (m)	Gewicht (kg)
206L	L150.10	S235	6M24-5.6t	L150.10	S355	6M24-8.8t	Profiel uitgewisseld	4	5.79	534.73
206T	L150.10	S235	6M24-5.6t	L150.10	S355	6M24-8.8t	Profiel uitgewisseld	4	5.79	534.73
416	L50.5	S235	1M16-5.6t	L70.7	S355	1M16-8.8t	Profiel uitgewisseld	4	2.48	73.21
								12	**56.24**	**1148.67**

5.3 Eisen verificatie

De verificatie van de van toepassing zijnde eisen is uitgevoerd in onderstaande Tabel 6.

Tabel 6 Verificatie eisen

Eis Id	Eis Tekst	Ja	Nee	N.v.t.	toelichting
BO Eis: H2.7-6	Aanpassingen uitvoerbaar?	X			De toe te voegen staalonderdelen zijn met geboute verbindingen te bevestigen. Dit is een bewezen methode.
PVE.05.001 5.14	Staaldelen in nabijheid van klimweg gewijzigd?	X			De wijzigingen in de nabijheid van de klimweg (diagonalen) zijn in te passen zonder negatieve invloed op de begaanbaarheid.
	klimvoorziening nog in overeenstemming is met de NEN 1060:1964?			X	Geen wijzigingen

6 REFERENTIES

[1] „002.589.40 0817486 - 20-0473 - Verificatie & validatieplan 380kV verbinding Krimpen aan de IJssel - Geertruidenberg".

[2] „002.589.40 0808624 - 20-0472 - E-studie deel 1 380kV verbinding Krimpen aan de IJssel - Geertruidenberg".

[3] „002.589.40 0808629 - 20-0345 - Uitgangspuntenrapport 380kV verbinding Krimpen aan de IJssel - Geertruidenberg".

APPENDIX A CONDUCTOR LOADS

Content

ISSUE	DATE	REVISION	CHK'D	APP'D
0.0	2021-04-21			

Data

Norm	NEN-EN50341-2-15:2019
Initial	
Consequence class	CC2-0
Reliability level	Afkeur
Reference period	30 jaar
After adjustment	
Consequence class	CC2
Reliability level	Verbouw
Reference period	50 jaar
Wind zone	II
Wind speed	27 m/s
Terrain categorie	II
Reduction factor Cdir	1.00
Ice region	B
Tower type	Hoekmast
Tower height	45 m
Max. Span	393 m
Line angle	159°
Catenary	1400 m
Wind span	359 m
EDS Weight span	358 m
Min. Weight span	356 m
Max. Weight span	358 m

Client: TenneT Taking power further

DNV·GL

Title:

Berekening masttype WB+0 II

JOB No.	-	DATE	-
DRAWN	-	CHKD	-
DESIGN	-	APPD	-

Document name:

KIJ-GT_WB+0 II_37_Report.pdf

Project number:

Project client number:

0.0

Project: KIJ-GT
Tower: WB+0 II
Number: 37

Auteur: TBR
Versie: v11.7

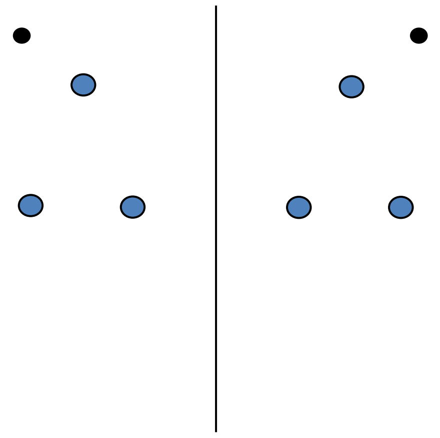
Conductor loads

General

Description	WB+0 II
Tower type	Hoekmast
Number of circuits	2
Configuration	2-circuit-donau
Number of earth wires	2

Starting points

Norm	NEN-EN50341-2-15:2019
Consequence class	CC2-0
Reliability level initial	Afkeur CC2-0
Reference period intial	30 jaar
Consequence class modified	CC2
Reliability level modified	Verbouw
Reference period modified	50 jaar
Wind zone	II
Wind speed (m/s)	27.0 m/s
Terrain category	II
Reduction factor c_{dir}	1.00
Ice region phase conductor	B
Ice region earth conductor	B



Configuratie geleiders

Conductors back

Description	Voltage	Conductor Back	Bundle Ba	Ice region	Additional weight	Additional diameter	Catenary P_{back}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Conductors ahead

Description	Voltage	Conductor Ahead	Bundle Ah	Ice region	Additional weight	Additional diameter	Catenary P_{ahead}
Circuit 1	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Circuit 2	380 kV	ACCCZ-Warsaw	3	B	2 %	2 %	1400
Bliksemdraad 1		ACSR-26/7-242/39-HAWK	1	B	2 %	2 %	1500
Bliksemdraad 2		OPGW 226	1	B	2 %	2 %	1500

Insulators *(1)*

Description	Suspension	Weight [kN]	Length [m]	Wind area [m^2]
Circuit 1	Afspanketting	2.00	4.83	1.00
Circuit 2	Afspanketting	2.00	4.83	1.00
Bliksemdraad 1	Vast (Bliksemdraad)	0.10	0.30	0.05
Bliksemdraad 2	Vast (Bliksemdraad)	0.10	0.30	0.05

1. *Properties apply to the entire isolator set*

Suspension height and position in mast

Circuits	Designation	Number	Suspension height	Attach point	Position in tower Horizontal distance
Circuit 1	10	380ct1f1	27.7 m	27.7 m	16.3 m
Circuit 1	11	380ct1f2	27.7 m	27.7 m	9.0 m
Circuit 1	12	380ct1f3	39.0 m	39.0 m	12.7 m
Circuit 2	21	380ct2f1	27.7 m	27.7 m	-16.3 m
Circuit 2	20	380ct2f2	27.7 m	27.7 m	-9.0 m
Circuit 2	22	380ct2f3	39.0 m	39.0 m	-12.7 m
Bliksemdraad 1	1	bl1	42.7 m	43.0 m	17.5 m
Bliksemdraad 2	3	bl2	42.7 m	43.0 m	-17.5 m

Project: KIJ-GT
Tower: WB+0 II
Number: 37

Height adjustment adjacent masts	(wind and weight span adjustment)		
	Back	Ahead	
Height increase for wind pressure	0.0 m	0.0 m	(positive: higher)
Height decrease for vertical load	0.0 m	0.0 m	(negative: decrease, more weight span)

Decrease: Niet in 0,9EG-combinaties

Height difference adjacent tower and change of direction with respect to Line direction

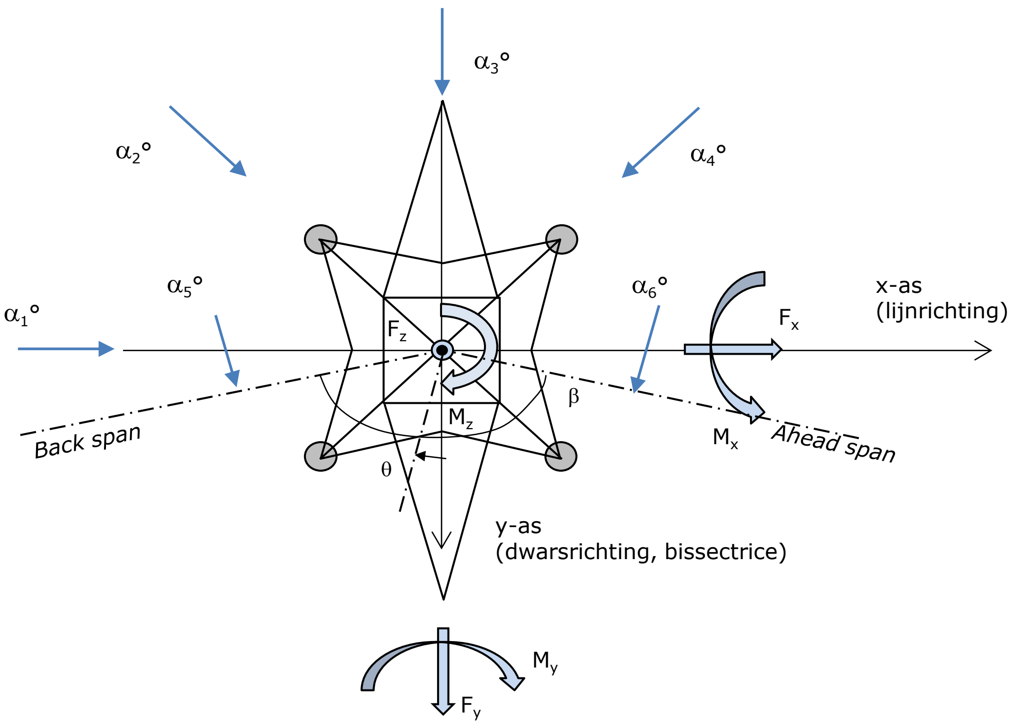
			Hoogteverschil		Richtingsverandering	
Circuits	Aanduiding	Nummer	Δh_back	Δh_ahead	Δy_back	Δy_ahead
Circuit 1	10	380ct1f1	0.4	-0.1 m	0.0	0.0 m
Circuit 1	11	380ct1f2	0.4	-0.1 m	0.0	0.0 m
Circuit 1	12	380ct1f3	0.3	-0.1 m	0.0	0.0 m
Circuit 2	21	380ct2f1	0.4	-0.1 m	0.0	0.0 m
Circuit 2	20	380ct2f2	0.4	-0.1 m	0.0	0.0 m
Circuit 2	22	380ct2f3	0.3	-0.1 m	0.0	0.0 m
Bliksemdraad 1	1	bl1	0.2	0.1 m	0.0	0.0 m
Bliksemdraad 2	3	bl2	0.2	0.1 m	0.0	0.0 m

Line and tower data

		Back	Ahead
		393.0	324.0 m
Ruling span $\sqrt{(\Sigma L^3/\Sigma L)}$		376.2	324.0 m
Line angle	β	159 °	
Tower orientation with respect to bi:	θ	0 °	
Section length		4495	324 m
Height bottom of tower to ground level		0.5 m	
Wind directions considered	α_1	0 °	
Wind directions according to:	α_2	45 °	
Geleiderbelastingen	α_3	90 °	
	α_4	135 °	
	α_5	79.5 °	
	α_6	100.5 °	

Wind directions apply to the main direction of mast construction, not to the bisector.

Windrichtingen en positieve richtingen belastingen



Considered number of wind directions	
1a	6
3	6
4	1
6	1
Overig	1

Project: KIJ-GT
Tower: WB+0 II
Number: 37

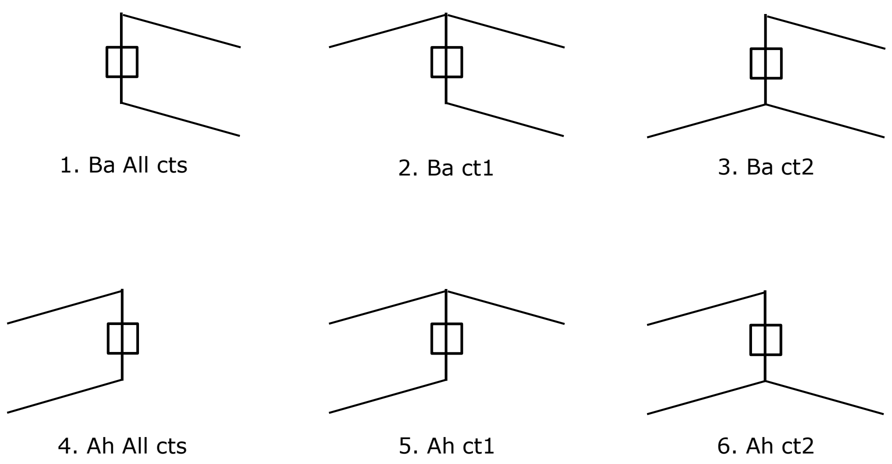
Absence of conductors

		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	380ct1f1	1	0	1	0	1	0
Circuit 1	380ct1f2	1	0	1	0	1	0
Circuit 1	380ct1f3	1	0	1	0	1	0
Circuit 2	380ct2f1	0	1	1	0	1	0
Circuit 2	380ct2f2	0	1	1	0	1	0
Circuit 2	380ct2f3	0	1	1	0	1	0
Bliksemdraad 1	bl1	1	0	1	0	1	0
Bliksemdraad 2	bl2	0	1	1	0	1	0

Load situations SPLS

Considered situations SPLS: 1 up to 6, All possible situations

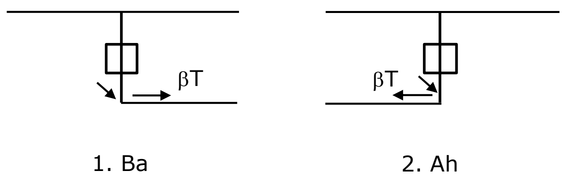
Principle of load situations:



Load situation 5a. Conductor failure

Considered situations conductor failure 5a: 1 and 2, all possible situations

Principle of load situations:



Project: KIJ-GT
Tower: WB+0 II
Number: 37

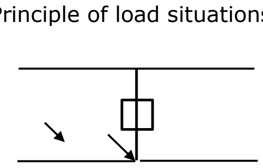
Load situations LC6. Construction and maintenance
Under 6a, the load due to the presence of a line verhicle or line bicycle in combination with point load on the traverse is assesed.
Combination 6b does not contain any loads in conductor or on traverse. This combination has been added to be able to combine with separate control platforms, etc. The situations are applied in ULS and in every SPLS situation (in case of angle tower).

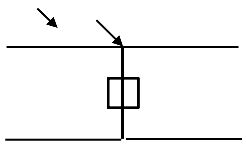
	Phase	Earth
Line vehicle	3.0 kN	2.0 kN
Concentrated load cross arm	1.0 kN	1.0 kN

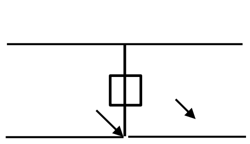
Beschouwde situaties bouw- en onderhoud 6a: 1 t/m 4, alle mogelijke situaties.

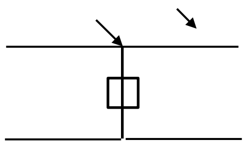
Presence line vehicle: Circuit, belasting tegelijk aanwezig in alle geleiders per circuit.

Principle of load situations:


1. Ba Ct1


2. Ba Ct2


3. Ah Ct1


4. Ah Ct2

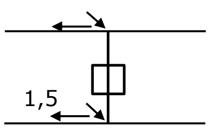
Load situations 8. Galloping as a static load

Conductor		
Suspension tower phase	0.866 W	1.5 W
Suspension tower earth	1.5 EDS	1.5 W
Strain tower phase and earth	1.5 EDS	1.5 W

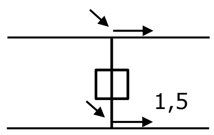
Considered situations galloping 8: None (existing structure)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principle of load situations:



1. Ba



2. Ah

Load combination 8. Galloping as a dynamic load
Only applies to tension towers
Load consists of EDS tensile load in one of the conductors on one side of the tower
Can be converted by user to fatigue spectrum via the load spectrum of table 4.11 / NL.1

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Project: KIJ-GT
Tower: WB+0 II
Number: 37

Tower structure

Properties

Tower type	Hoekmast		
Tower designation	WB+0 II		
Base plate w.r.t. ground level	0.5 m		
Tower height w.r.t. base plate	45.0 m		
Tower self weight	393.0 kN		
Width and slope at foundation	x-ri.	y-ri.	
Leg spread	11.00	11.00	m
Inclination of main leg	0.156	0.156	-
Horizontal force factor	1.1	1.1	-

Calculation Wind load

Dynamic factor G_T	1.00 *(Masthoogte < 60 m)*
Wind load diagonally to tower body proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Wind load diagonally on traverse proportional to:	(A1C1sin^2(phi)+A2C2cos^2(phi))
Magnification factor diagonal wind to tower body	(1+0,2sin^2(2phi))
Magnification factor diagonal wind to cross arm	(1+0,2sin^2(2phi))
Magnification factor wind parallel to perpendicular to cross a	0.4

Properties mast sections longitudinal direction (front view, yz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	9.60	11.00	8.00	9.60	0.156	91.20	11.44	0.13	3.28
Middenstuk 1	18.90	8.00	5.84	9.30	0.116	64.37	10.66	0.17	3.08
Middenstuk 2	27.70	5.84	3.80	8.80	0.116	42.42	9.75	0.23	2.80
Bovenstuk 1	35.50	3.80	3.19	7.80	0.039	27.26	6.62	0.24	2.75
Bovenstuk 2	43.00	3.19	2.65	7.50	0.036	21.90	5.25	0.24	2.76
Topstuk	45.00	2.65		2.00		2.65	0.28	0.11	3.38
Ondertraverse	27.70	14.40		4.00		28.80	4.95	0.17	3.06
Boventraverse	39.00	16.00		4.00		32.00	8.06	0.25	2.72

Properties tower sections transversal direction (side view, xz plane)

Description	h [m]	b_1 [m]	b_2 [m]	Δh [m]	Δ_x [m]	A_0 [m^2]	A_1 [m^2]	$\chi = A_1/A_0$ [-]	C_t
Broekstuk 1	9.60	11.00	8.00	9.60	0.156	91.20	11.44	0.13	3.28
Middenstuk 1	18.90	8.00	5.84	9.30	0.116	64.37	10.66	0.17	3.08
Middenstuk 2	27.70	5.84	3.80	8.80	0.116	42.42	9.75	0.23	2.80
Bovenstuk 1	35.50	3.80	3.19	7.80	0.039	27.26	6.62	0.24	2.75
Bovenstuk 2	43.00	3.19	2.65	7.50	0.036	21.90	5.25	0.24	2.76
Topstuk	45.00	2.65		2.00		2.65	0.28	0.11	3.38
Ondertraverse	27.70	14.40		4.00		28.80	4.95	0.17	3.06
Boventraverse	39.00	16.00		4.00		32.00	8.06	0.25	2.72

Note: Surface transverse direction is reduced in calculation.

Project: KIJ-GT
Tower: WB+0 II
Number: 37

Wind surface feeders telecom installations

Part	A (m^2/m)	Factor	Δh	A_1
Broekstuk 1				
Middenstuk 1				
Middenstuk 2				
Bovenstuk 1				
Bovenstuk 2				

Input antennas

Description	A (m^2)	h (m)	C_f (m)
Antenne 1			
Schotel			
Schotel			

Tower section loads longitudinal (x-direction) per wind direction

Description	p_w [kN/m^2]	F_{x1} [kN]	F_{x2} [kN]	F_{x3} [kN]	F_{x4} [kN]	h_{ef} [m]	M_{y1} [kNm]	M_{y2} [kNm]	M_{y3} [kNm]	M_{y4} [kNm]
Broekstuk 1	0.85	31.9	27.1	0.0	-27.1	4.8	153.2	130.0	0.0	-130.0
Middenstuk 1	0.96	31.5	26.8	0.0	-26.8	14.3	449.4	381.3	0.0	-381.3
Middenstuk 2	1.12	30.5	25.9	0.0	-25.9	23.3	710.9	603.2	0.0	-603.2
Bovenstuk 1	1.22	22.3	18.9	0.0	-18.9	31.6	704.2	597.5	0.0	-597.5
Bovenstuk 2	1.29	18.8	15.9	0.0	-15.9	39.3	736.5	624.9	0.0	-624.9
Topstuk	1.33	1.3	1.1	0.0	-1.1	44.0	55.5	47.1	0.0	-47.1
Ondertraverse	1.19	36.0	21.4	0.0	-21.4	29.0	1045.3	620.8	0.0	-620.8
Boventraverse	1.30	57.0	33.9	0.0	-33.9	40.3	2299.7	1366.0	0.0	-1366.0
Totaal		229.3	170.9	0.0	-170.9		6154.6	4370.9	0.0	-4370.9

Tower section loads transversal (y-direction) per wind direction

Description	p_w [kN/m^2]	F_{y1} [kN]	F_{y2} [kN]	F_{y3} [kN]	F_{x4} [kN]	h_{ef} [m]	M_{x1} [kNm]	M_{x2} [kNm]	M_{x3} [kNm]	M_{x4} [kNm]
Broekstuk 1	0.85	0.0	27.1	31.9	27.1	4.8	0.0	130.0	153.2	130.0
Middenstuk 1	0.96	0.0	26.8	31.5	26.8	14.3	0.0	381.3	449.4	381.3
Middenstuk 2	1.12	0.0	25.9	30.5	25.9	23.3	0.0	603.2	710.9	603.2
Bovenstuk 1	1.22	0.0	18.9	22.3	18.9	31.6	0.0	597.5	704.2	597.5
Bovenstuk 2	1.29	0.0	15.9	18.8	15.9	39.3	0.0	624.9	736.5	624.9
Topstuk	1.33	0.0	1.1	1.3	1.1	44.0	0.0	47.1	55.5	47.1
Ondertraverse	1.19	0.0	21.4	14.4	21.4	29.0	0.0	620.8	418.1	620.8
Boventraverse	1.30	0.0	33.9	22.8	33.9	40.3	0.0	1366.0	919.9	1366.0
Total		0.0	170.9	173.5	170.9		0.0	4370.9	4147.6	4370.9

Resulting loads from mast construction incl. Antenna without conductors level foundation (char. Value)

Load / wind direction	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
Permanente belasting	0	0	393	0	0	0
Windrichting 0°	229	0	0	0	6155	0
Windrichting 45°	171	171	0	4371	4371	0
Windrichting 90°	0	173	0	4148	0	0
Windrichting 135°	-171	171	0	4371	-4371	0

Project: KIJ-GT
Tower: WB+0 II
Number: 37

Intermediate results for conductor loads

Conductors back

Circuit	Geleider	Diameter [mm]	A [mm²]	G [N/m]	E [N/mm²]	αT [-]
Circuit 1	ACCCZ-Warsaw	27.7	571.0	14.98	62700	1.88E-05
Circuit 2	ACCCZ-Warsaw	27.7	571.0	14.98	62700	1.88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21.8	281.1	9.81	75000	1.89E-05
Bliksemdraad 2	OPGW 226	21.7	264.0	9.80	81000	2.30E-05

Conductors ahead

Circuit	Geleider	Diameter [mm]	A [mm²]	G [N/m]	E [N/mm²]	αT [-]
Circuit 1	ACCCZ-Warsaw	27.7	571.0	14.98	62700	1.88E-05
Circuit 2	ACCCZ-Warsaw	27.7	571.0	14.98	62700	1.88E-05
Bliksemdraad 1	ACSR-26/7-242/39-HAWK	21.8	281.1	9.81	75000	1.89E-05
Bliksemdraad 2	OPGW 226	21.7	264.0	9.80	81000	2.30E-05

Vertical load back

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	3	2	45.8	B	4+0,2d	9.5	28.6
Circuit 2	3	2	45.8	B	4+0,2d	9.5	28.6
Bliksemdraad 1	1	2	10.0	B	4+0,2d	8.4	8.4
Bliksemdraad 2	1	2	10.0	B	4+0,2d	8.3	8.3

Vertical load ahead

Circuit	Bundle [-]	Additional [%]	$w_{z,G}$ [N/m]	Ice region	Formula	[N/m]	[N/m]
Circuit 1	3	2	45.8	B	4+0,2d	9.5	28.6
Circuit 2	3	2	45.8	B	4+0,2d	9.5	28.6
Bliksemdraad 1	1	2	10.0	B	4+0,2d	8.4	8.4
Bliksemdraad 2	1	2	10.0	B	4+0,2d	8.3	8.3

Insulators

Conductor	$G_{isolator}$ [kN]	Number -	$F_{v,iso}$ [kN]	Length [m]	Wind surf. [m²]	Wind heigth [m]	Pressure [kN/m²]	Drag factor [-]	$F_{h,iso}$ [kN]
380ct1f1	2.00	1	2	4.8	1.0	28.20	1.18	1.2	1.42
380ct1f2	2.00	1	2	4.8	1.0	28.20	1.18	1.2	1.42
380ct1f3	2.00	1	2	4.8	1.0	39.50	1.30	1.2	1.55
380ct2f1	2.00	1	2	4.8	1.0	28.20	1.18	1.2	1.42
380ct2f2	2.00	1	2	4.8	1.0	28.20	1.18	1.2	1.42
380ct2f3	2.00	1	2	4.8	1.0	39.50	1.30	1.2	1.55
bl1	0.10	0.5	0.05	0.3	0.1	43.21	1.33	1.2	0.08
bl2	0.10	0.5	0.05	0.3	0.1	43.21	1.33	1.2	0.08

Project: KIJ-GT
Tower: WB+0 II
Number: 37

Wind load back

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	19.2	1.05	0.55	0.46	1.08	28.25	53.0	44.2	46.9	97.7	81.5
380ct1f2	19.2	1.05	0.55	0.46	1.08	28.25	53.0	44.2	46.9	97.7	81.5
380ct1f3	30.5	1.21	0.59	0.49	1.04	28.25	62.5	51.9	46.9	119.5	99.4
380ct2f1	19.2	1.05	0.55	0.46	1.08	28.25	53.0	44.2	46.9	97.7	81.5
380ct2f2	19.2	1.05	0.55	0.46	1.08	28.25	53.0	44.2	46.9	97.7	81.5
380ct2f3	30.5	1.21	0.59	0.49	1.04	28.25	62.5	51.9	46.9	119.5	99.4
bl1	34.7	1.25	0.60	0.50	1.16	22.24	19.3	16.0	41.5	37.2	30.9
bl2	34.7	1.25	0.60	0.50	1.16	22.13	19.3	16.0	41.4	37.1	30.8

Wind load ahead

Conductor	Height wind [m]	Pressure [kN/m^2]	G_{c_dwars} [-]	G_{c_trek} [-]	C_c [-]	$d_{additional}$ [mm]	w_y [N/m]	$w_{y,section}$ [N/m]	$D_{ijs,additional}$ [mm]	$w_{y,ijs}$ [N/m]	$w_{y,ijs,section}$ [N/m]
380ct1f1	21.9	1.10	0.56	0.63	1.07	28.25	55.7	62.5	46.9	103.8	116.3
380ct1f2	21.9	1.10	0.56	0.63	1.07	28.25	55.7	62.5	46.9	103.8	116.3
380ct1f3	33.2	1.24	0.59	0.66	1.03	28.25	64.3	72.0	46.9	123.9	138.7
380ct2f1	21.9	1.10	0.56	0.63	1.07	28.25	55.7	62.5	46.9	103.8	116.3
380ct2f2	21.9	1.10	0.56	0.63	1.07	28.25	55.7	62.5	46.9	103.8	116.3
380ct2f3	33.2	1.24	0.59	0.66	1.03	28.25	64.3	72.0	46.9	123.9	138.7
bl1	37.4	1.28	0.60	0.68	1.16	22.24	19.8	22.2	41.5	38.4	42.9
bl2	37.4	1.28	0.60	0.68	1.16	22.13	19.8	22.1	41.4	38.3	42.9

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Project: KIJ-GT
Tower: WB+0 II
Number: 37

Conductor loads	Auteur: TBR Versie: v11.7

Starting points

Consequence class	Afkeur CC2-0
Reference period	30 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1.05	1.05	0.00	1.12	0.00	0.0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0.90	1.05	0.00	1.12	0.00	0.0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0.90	0.90	0.00	1.12	0.00	0.0
ULS 3	Wind+ice	-5°	1.05	1.05	0.00	0.34	0.97	0.0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0.90	1.05	0.00	0.34	0.97	0.0
ULS 4	Cold+wind	-20°	1.05	1.05	0.00	0.22	0.00	0.0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0.90	1.05	0.00	0.22	0.00	0.0
ULS 5a	Torsional loads	10°	1.00	1.00	1.00	0.00	0.00	1.0
ULS 5b	Longitudinal loads	10°	1.00	1.00	0.00	0.00	0.00	1.0
ULS 6	Construction + maintenance	5°	1.05	1.05	1.20	0.22	0.00	0.0
ULS 6_0,9	Construction + maintenance	5°	1.05	1.05	0.00	0.22	0.00	0.0
ULS 7	Permanent	10°	1.15	1.15	0.00	0.00	0.00	0.0
ULS 8	Special	10°	1.00	1.00	0.00	0.00	0.00	1.0
SPLS (strength, for angle towers: absence of conductors)				γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1.05	1.05	0.0	0.78	0.00	0.0
SPLS 1a_0,9	Wind 0,9	10°	0.90	1.05	0.0	0.78	0.00	0.0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0.90	1.05	0.0	0.78	0.00	0.0
SPLS 3	Wind+ice	-5°	1.05	1.05	0.0	0.36	0.34	0.0
SPLS 3_0,9	Wind+ice 0,9	-5°	0.90	1.05	0.0	0.36	0.34	0.0
SPLS 4	Cold+wind	-20°	1.05	1.05	0.0	0.24	0.00	0.0
SPLS 4_0,9	Cold+wind 0,9	-20°	0.90	1.05	0.0	0.24	0.00	0.0
SPLS 6	Maintenance	5°	1.05	1.05	1.2	0.24	0.0	0.0
SPLS 6_0,9	Maintenance	5°	1.05	1.05	0.0	0.24	0.0	0.0
SLS (deformations, fatigue, EDS)								
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1.00	1.00	0.0	0.94	0.0	0.0
SLS 3	Wind+ice	-5°	1.00	1.00	0.0	0.28	0.88	0.0
SLS 4	Wind	-20°	1.00	1.00	0.0	0.19	0.0	0.0
SLS 6	Maintenance	5°	1.00	1.00	0.0	0.19	0.0	0.0
SLS 7	EDS, no wind	10°	1.00	1.00	0.0	0.00	0.0	0.0

Number of wind directions	6
Number of load combinations for ULS	54
Number of load combinations for SPLS	222
Number of load combinations for SLS	15
Number of concentrated loads	5820

Project: KIJ-GT
Tower: WB+0 II
Number: 37

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-30.8	32.4	9.4	9.7	5.8	5.3
380ct1f1	-107.1	111.7	30.0	31.5	16.9	14.7
380ct1f2	-107.1	111.7	30.0	31.5	16.9	14.7
380ct1f3	-109.4	115.5	33.4	34.7	16.9	14.7
380ct2f1	-107.1	111.7	30.0	31.5	16.9	14.7
380ct2f2	-107.1	111.7	30.0	31.5	16.9	14.7
380ct2f3	-109.4	115.5	33.4	34.7	16.9	14.7
bl2	-30.9	32.4	9.3	9.7	5.8	5.3
Post 40	0.0	0.0	0.0	0.0	0.0	
Post 41	0.0	0.0	0.0	0.0	0.0	
Post 42	0.0	0.0	0.0	0.0	0.0	
Post 43	0.0	0.0	0.0	0.0	0.0	

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	356.8	357.4	357.6
380ct1f1	357.1	357.3	357.4
380ct1f2	357.1	357.3	357.4
380ct1f3	357.6	357.8	357.8
380ct2f1	357.1	357.3	357.4
380ct2f2	357.1	357.3	357.4
380ct2f3	357.6	357.8	357.8
bl2	356.8	357.4	357.6
Post 40			
Post 41			
Post 42			
Post 43			

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	357.6	357.6
380ct1f1	357.5	357.5
380ct1f2	357.5	357.5
380ct1f3	357.9	357.9
380ct2f1	357.5	357.5
380ct2f2	357.5	357.5
380ct2f3	357.9	357.9
bl2	357.6	357.6
Post 40		
Post 41		
Post 42		
Post 43		

Envelop of weight span over all combinations (incl. 0,9 combinations)		
For all conductors		Wind / Weight span ratio
Max. weight span	358.0 m	0.999 -
Min. weight span	356.5 m	0.994 -

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Project: KIJ-GT
Tower: WB+0 II
Number: 37

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	32.2	18.6	5.8	-31.5	33.6
380ct1f1	96.6	60.0	16.9	-110.2	114.7
380ct1f2	96.6	60.0	16.9	-110.2	114.7
380ct1f3	102.1	66.5	16.9	-112.9	118.9
380ct2f1	96.6	60.0	16.9	-110.2	114.7
380ct2f2	96.6	60.0	16.9	-110.2	114.7
380ct2f3	102.1	66.5	16.9	-112.9	118.9
bl2	32.3	18.6	5.8	-31.6	33.6
Post 40	2.3	2.3	5.8	0.0	
Post 41	2.3	2.3	5.8	0.0	
Post 42	2.3	2.3	5.8	0.0	
Post 43	2.3	2.3	5.8	0.0	

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	14.8	2.7	2.0	-15.0	15.0
380ct1f1	63.1	11.7	10.9	-64.2	64.2
380ct1f2	63.1	11.7	10.9	-64.2	64.2
380ct1f3	63.1	11.7	11.0	-64.2	64.2
380ct2f1	63.1	11.7	10.9	-64.2	64.2
380ct2f2	63.1	11.7	10.9	-64.2	64.2
380ct2f3	63.1	11.7	11.0	-64.2	64.2
bl2	14.7	2.7	2.0	-15.0	15.0
Post 40	0.0	0.0	5.0	0.0	
Post 41	0.0	0.0	5.0	0.0	
Post 42	0.0	0.0	5.0	0.0	
Post 43	0.0	0.0	5.0	0.0	

1 **Control uplift SLS-wind**

Combinatie	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	0.0	0.0
	380ct1f1	0.0	0.0
	380ct1f2	0.0	0.0
	380ct1f3	0.0	0.0
	380ct2f1	0.0	0.0
	380ct2f2	0.0	0.0
	380ct2f3	0.0	0.0
	bl2	0.0	0.0
	Post 40	0.0	
	Post 41	0.0	
	Post 42	0.0	
	Post 43	0.0	

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Project: KIJ-GT
Tower: WB+0 II
Number: 37

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		110	419	157	13544	3609	0
ULS 1a_0,9_0		10	159	154	4914	377	-104
ULS 1a_0,9_0,9_90		119	408	135	13238	3901	0
ULS 3_0		0	248	222	7773	18	-32
SLS 7		0	151	150	4656	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

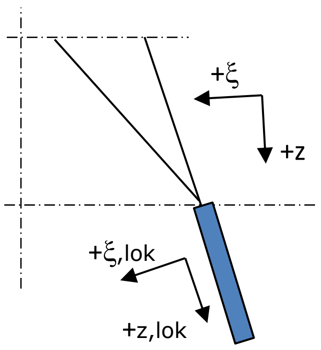
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	110	614	570	18206	3609	0
ULS 1a_0,9_0,9_90	119	603	488	17900	3901	0
SLS 7	0	151	543	4656	0	0

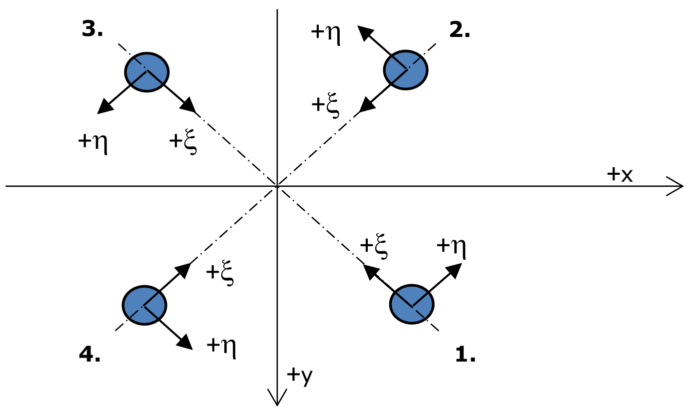
Foundation loads, selection of load combinations based on greatest value

Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_90	110	614	508	**18241**	3609	0
SPLS 3_90 Ba All Cts	639	212	520	6152	**20828**	-5
SPLS 3_100.5 Ah Ct2	-264	274	562	8547	-8457	**4227**
SPLS 1a_0,9_90 Ba All Cts	582	311	447	**8801**	**18986**	0

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg





Axis systems

Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 1a_90 Ba All Cts	236	248	**1389**	-9	-342	-35	1422
2	SPLS 3_0 Ba All Cts	154	-149	**882**	-4	-214	-20	903
3	SPLS 3_135 Ah All Cts	-133	-126	**764**	5	-184	-15	782
4	SPLS 1a_90 Ah All Cts	-218	229	**1281**	8	-316	-33	1312

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-89	-84	**-512**	-3	122	9	-524
2	SPLS 1a_0,9_90 Ah All Cts	-176	188	**-1039**	-8	257	28	-1064
3	SPLS 1a_0,9_90 Ba All Cts	195	207	**-1151**	8	284	30	-1179
4	SPLS 1a_0,9_0 Ba All Cts	114	-110	**-640**	3	159	17	-655

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_100.5 Ah Ct2	119	-72	131	**135**	-33	-4	134
2	SPLS 3_0,9_100.5 Ah Ct2	-208	17	-649	**135**	159	15	-665
3	SPLS 3_100.5 Ah Ct2	-119	74	136	**137**	-32	-2	140
4	SPLS 3_100.5 Ah Ct2	-61	255	913	**137**	-223	-21	935

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	SPLS 3_100.5 Ah Ct1	-77	122	110	**-141**	-32	-8	112
2	SPLS 3_100.5 Ah Ct1	-7	206	-596	**-141**	150	19	-611
3	SPLS 3_0,9_100.5 Ah Ct1	69	-115	154	**-130**	-32	2	158
4	SPLS 6a_90 Ba Ct2 Ah Ct2	-88	-97	-37	**-131**	6	-2	-38

Project: KIJ-GT
Tower: WB+0 II
Number: 37

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 6a_90 Ah All Cts Ba Ct2	-46	-94	**-431**	**34**	99	4	-441
2	SPLS 1a_0,9_90 Ah Ct1	-33	218	**-703**	**-131**	178	23	-720
3	SPLS 1a_0,9_90 Ba Ct1	70	235	**-859**	**117**	216	26	-880
4	SPLS 1a_0,9_0 Ba All Cts	114	-110	**-640**	**3**	159	17	-655

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	60	61	347	-1	-85	-9	356
2	SLS 7	-13	14	-76	-1	19	3	-78
3	SLS 7	13	14	-76	1	19	3	-78
4	SLS 7	-60	61	347	1	-85	-9	356

Envelope of load combinations for all of the legs

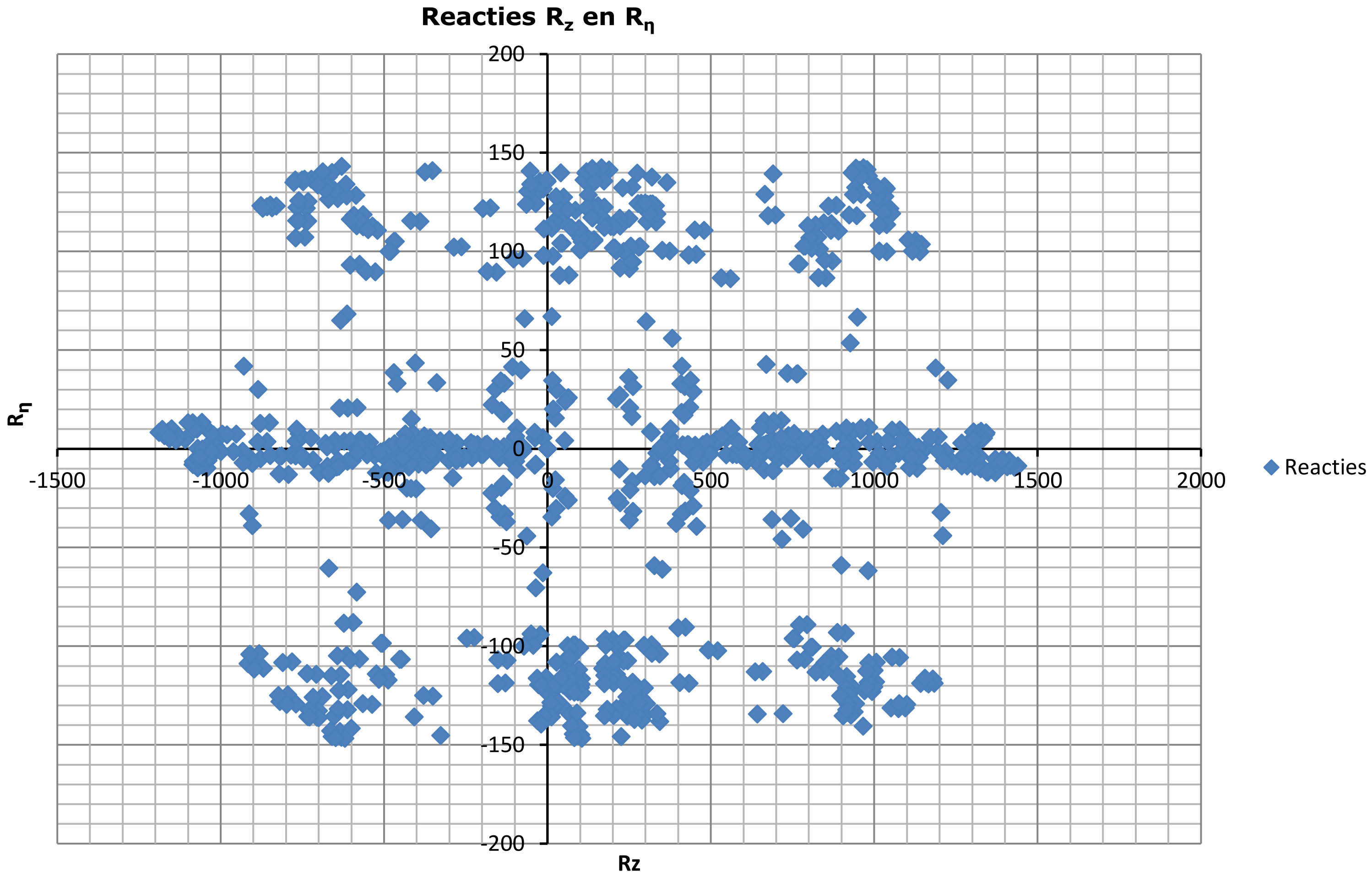
Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	SPLS 1a_90 Ba All Cts	236	248	**1389**	-9	-342	-35	1422
Max. tension	SPLS 1a_0,9_90 Ba All Cts	195	207	**-1151**	8	284	30	-1179
Max. pos. torsie	SPLS 3_100.5 Ah Ct2	-61	255	913	**137**	-223	-21	935
Max. neg. torsie	SPLS 3_100.5 Ah Ct1	-77	122	110	**-141**	-32	-8	112
Comb. tension+torsie	SPLS 1a_0,9_90 Ba Ct1	70	235	**-859**	**117**	216	26	-880

Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	60	61	**347**	-1	-85	-9	356
2	SLS 1a_135	-88	84	**-450**	2	122	22	-461
3	SLS 1a_90	122	133	**-716**	7	180	22	-733
4	SLS 1a_0	-6	11	**69**	4	-12	3	71

Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_90	169	179	**987**	-7	-246	-28	1011
2	SLS 1a_0	45	-31	**202**	-10	-54	-9	207
3	SLS 7	13	14	**-76**	1	19	3	-78
4	SLS 1a_135	-132	134	**721**	2	-188	-28	739


Reacties R_z en R_η
200
150
100
50
0
-50
-100
-150
-200
-1500
-1000
-500
0
500
1000
1500
2000
R_η
Rz
Reacties

Project: KIJ-GT
Tower: WB+0 II
Number: 37

Conductor loads

Auteur: TBR
Versie: v11.7

Starting points

Consequence class	Verbouw CC2
Reference period	50 jaar

ULS (strength)		**NEN-EN50341-2-15:2019**						
Load case	description	Temp	γ_G	γ_G		γ_Q		γ_a
		°C	$G_{k,mast}$	$G_{k,geleider}$	Q_{pk}	Q_{wk}	Q_{ik}	A_k
ULS 1a	Wind	10°	1.15	1.15	0.00	1.40	0.00	0.0
ULS 1a_0,9	Wind 0,9Gk only tower	10°	0.90	1.15	0.00	1.40	0.00	0.0
ULS 1a_0,9_0,9	Wind 0,9Gk conductors too	10°	0.90	0.90	0.00	1.40	0.00	0.0
ULS 3	Wind+ice	-5°	1.15	1.15	0.00	0.42	1.30	0.0
ULS 3_0,9	Wind+ice 0,9Gk	-5°	0.90	1.15	0.00	0.42	1.30	0.0
ULS 4	Cold+wind	-20°	1.15	1.15	0.00	0.28	0.00	0.0
ULS 4_0,9	Cold+wind 0,9Gk	-20°	0.90	1.15	0.00	0.28	0.00	0.0
ULS 5a	Torsional loads	10°	1.00	1.00	1.00	0.00	0.00	1.0
ULS 5b	Longitudinal loads	10°	1.00	1.00	0.00	0.00	0.00	1.0
ULS 6	Construction + maintenance	5°	1.15	1.15	1.30	0.28	0.00	0.0
ULS 6_0,9	Construction + maintenance	5°	1.15	1.15	0.00	0.28	0.00	0.0
ULS 7	Permanent	10°	1.30	1.30	0.00	0.00	0.00	0.0
ULS 8	Special	10°	1.00	1.00	0.00	0.00	0.00	1.0
SPLS	(strength, for angle towers: absence of conductors)			γ_G	γ_Q			
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SPLS 1a	Wind	10°	1.15	1.15	0.0	0.78	0.00	0.0
SPLS 1a_0,9	Wind 0,9	10°	0.90	1.15	0.0	0.78	0.00	0.0
SPLS 1a_0,9_0,9	Wind 0,9	10°	0.90	1.15	0.0	0.78	0.00	0.0
SPLS 3	Wind+ice	-5°	1.15	1.15	0.0	0.36	0.34	0.0
SPLS 3_0,9	Wind+ice 0,9	-5°	0.90	1.15	0.0	0.36	0.34	0.0
SPLS 4	Cold+wind	-20°	1.15	1.15	0.0	0.24	0.00	0.0
SPLS 4_0,9	Cold+wind 0,9	-20°	0.90	1.15	0.0	0.24	0.00	0.0
SPLS 6	Maintenance	5°	1.15	1.15	1.2	0.24	0.0	0.0
SPLS 6_0,9	Maintenance	5°	1.15	1.15	0.0	0.24	0.0	0.0
SLS	(deformations, fatigue, EDS)							
				G_k	Q_{pk}	Q_{wk}	Q_{ik}	A_k
SLS 1a	Wind	10°	1.00	1.00	0.0	1.00	0.0	0.0
SLS 3	Wind+ice	-5°	1.00	1.00	0.0	0.30	1.00	0.0
SLS 4	Wind	-20°	1.00	1.00	0.0	0.20	0.0	0.0
SLS 6	Maintenance	5°	1.00	1.00	0.0	0.20	0.0	0.0
SLS 7	EDS, no wind	10°	1.00	1.00	0.0	0.00	0.0	0.0

Number of wind directions	6
Number of load combinations for ULS	54
Number of load combinations for SPLS	222
Number of load combinations for SLS	15
Number of concentrated loads	5820

Project: KIJ-GT
Tower: WB+0 II
Number: 37

Summary table - Conductor loads

The four tables below show:
- The maximum conductor load in the global axis system, split into proportion of back and ahead span
- The combined conductor load (Ba+Ah) in the global axis system with the maximum tensile force in the local axes. Components Fx and Fy as absolute values
- The everyday (EDS) values of the combined conductor loads (Ba+Ah) with corresponding tensile forces
- Check for uplift, where a negative value indicates uplift

Note: Maximum values for Fx, Fy and Fz do not necessarily belong to the same load combination.

Maximum values for back and ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-33.6	37.9	11.3	11.6	6.3	5.8
380ct1f1	-124.5	129.4	35.8	37.5	19.9	16.9
380ct1f2	-124.5	129.4	35.8	37.5	19.9	16.9
380ct1f3	-127.4	134.0	40.1	41.6	19.9	16.9
380ct2f1	-124.5	129.4	35.8	37.5	19.9	16.9
380ct2f2	-124.5	129.4	35.8	37.5	19.9	16.9
380ct2f3	-127.4	134.0	40.1	41.6	19.9	16.9
bl2	-33.8	37.9	11.3	11.6	6.3	5.8
Post 40	0.0	0.0	0.0	0.0	0.0	
Post 41	0.0	0.0	0.0	0.0	0.0	
Post 42	0.0	0.0	0.0	0.0	0.0	
Post 43	0.0	0.0	0.0	0.0	0.0	

Min. Weight span (m)

Weight spar	Combinatie1		
Geleider	SLS 1a	SLS 4	SLS 7
bl1	356.8	357.4	357.6
380ct1f1	357.1	357.3	357.4
380ct1f2	357.1	357.3	357.4
380ct1f3	357.6	357.8	357.8
380ct2f1	357.1	357.3	357.4
380ct2f2	357.1	357.3	357.4
380ct2f3	357.6	357.8	357.8
bl2	356.8	357.4	357.6
Post 40			
Post 41			
Post 42			
Post 43			

Max. Weight span (m)

Weight spar	Combinatie1	
Geleider	ULS 1a	ULS 3
bl1	357.6	357.6
380ct1f1	357.5	357.5
380ct1f2	357.5	357.5
380ct1f3	358.0	357.9
380ct2f1	357.5	357.5
380ct2f2	357.5	357.5
380ct2f3	358.0	357.9
bl2	357.6	357.6
Post 40		
Post 41		
Post 42		
Post 43		

Envelop of weight span over all combinations (incl. 0,9 combinations)		
For all conductors		Wind / Weight span ratio
Max. weight span	358.0 m	0.999 -
Min. weight span	356.1 m	0.993 -

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Project: KIJ-GT
Tower: WB+0 II
Number: 37

Maximum values back + ahead span **Maximum tension in conductor**

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	33.2	22.3	6.3	-34.7	39.3
380ct1f1	100.8	71.5	19.9	-128.2	133.0
380ct1f2	100.8	71.5	19.9	-128.2	133.0
380ct1f3	106.1	79.6	19.9	-131.5	139.0
380ct2f1	100.8	71.5	19.9	-128.2	133.0
380ct2f2	100.8	71.5	19.9	-128.2	133.0
380ct2f3	106.1	79.6	19.9	-131.5	139.0
bl2	33.3	22.3	6.3	-35.0	39.3
Post 40	2.8	2.8	6.5	0.0	
Post 41	2.8	2.8	6.5	0.0	
Post 42	2.8	2.8	6.5	0.0	
Post 43	2.8	2.8	6.5	0.0	

EDS-loads conductor

Geleider	Fx [kN]	Fy [kN]	Fz [kN]	Ft_ba [kN]	Ft_ah [kN]
bl1	14.8	2.7	2.0	-15.0	15.0
380ct1f1	63.1	11.7	10.9	-64.2	64.2
380ct1f2	63.1	11.7	10.9	-64.2	64.2
380ct1f3	63.1	11.7	11.0	-64.2	64.2
380ct2f1	63.1	11.7	10.9	-64.2	64.2
380ct2f2	63.1	11.7	10.9	-64.2	64.2
380ct2f3	63.1	11.7	11.0	-64.2	64.2
bl2	14.7	2.7	2.0	-15.0	15.0
Post 40	0.0	0.0	5.0	0.0	
Post 41	0.0	0.0	5.0	0.0	
Post 42	0.0	0.0	5.0	0.0	
Post 43	0.0	0.0	5.0	0.0	

1 **Control uplift SLS-wind**

Combinatie	Geleider	Fz_ba [kN]	Fz_ah [kN]
SLS 4	bl1	0.0	0.0
	380ct1f1	0.0	0.0
	380ct1f2	0.0	0.0
	380ct1f3	0.0	0.0
	380ct2f1	0.0	0.0
	380ct2f2	0.0	0.0
	380ct2f3	0.0	0.0
	bl2	0.0	0.0
	Post 40	0.0	
	Post 41	0.0	
	Post 42	0.0	
	Post 43	0.0	

Project: KIJ-GT
Tower: WB+0 II
Number: 37

ULS foundation loads for LC 1 and 3, wind purpendicular to the line or bisector and EDS, from conductors

Combination	Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90		134	501	172	16227	4393	0
ULS 1a_0,9_0		11	172	167	5348	434	-130
ULS 1a_0,9_0,9_90		149	486	135	15797	4858	0
ULS 3_0		-5	286	260	8992	-129	-40
SLS 7		0	151	150	4656	0	0

ULS foundation loads, LC 1 and 3, wind purpendicular to the line or bisector and EDS, total conductors and tower

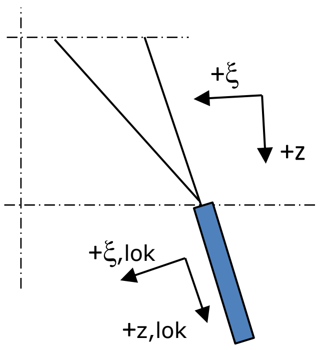
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_90	134	744	624	22034	4393	0
ULS 1a_0,9_0,9_90	149	729	488	21604	4858	0
SLS 7	0	151	543	4656	0	0

Foundation loads, selection of load combinations based on greatest value

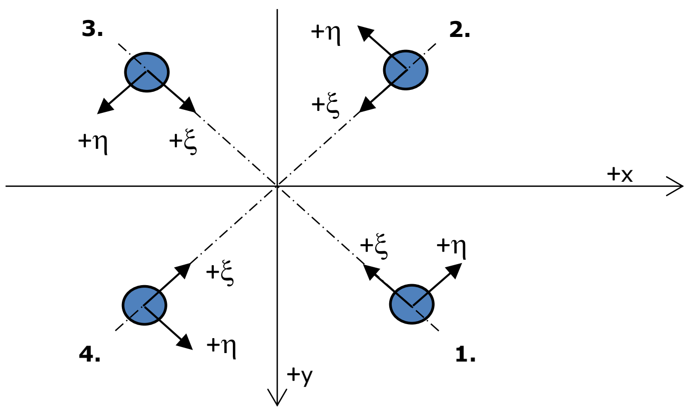
Combination	F_x [kN]	F_y [kN]	F_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
ULS 1a_0,9_90	134	744	521	**22091**	4393	0
SPLS 3_90 Ba All Cts	666	217	568	6286	**21675**	-5
SPLS 3_100.5 Ah Ct2	-283	282	614	8823	-9069	**4395**
SPLS 1a_0,9_90 Ba All Cts	605	315	455	**8936**	**19715**	0

Note: Largest values can appear in multiple combinations, one combination is displayed.

Support reactions per leg



Axis systems



Maximum compression load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 1a_90 Ba All Cts	245	257	**1439**	-9	-355	-37	1474
2	SPLS 3_0 Ba All Cts	164	-158	**936**	-4	-228	-21	959
3	SPLS 3_135 Ah All Cts	-143	-136	**820**	5	-197	-16	840
4	SPLS 1a_90 Ah All Cts	-228	240	**1342**	8	-331	-35	1374

Maximum tension load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-96	-91	**-552**	-3	132	10	-566
2	SPLS 1a_0,9_90 Ah All Cts	-184	196	**-1086**	-8	269	29	-1112
3	SPLS 1a_0,9_90 Ba All Cts	202	213	**-1189**	8	293	31	-1217
4	SPLS 1a_0,9_0 Ba All Cts	121	-117	**-680**	3	168	18	-696

Maximum torsional load (positive)

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_100.5 Ah Ct2	120	-78	119	**140**	-30	-3	122
2	SPLS 3_0,9_100.5 Ah Ct2	-218	20	-688	**140**	168	16	-705
3	SPLS 6a_90 Ba Ct1 Ah Ct1	9	212	-630	**143**	156	17	-646
4	SPLS 3_100.5 Ah Ct2	-66	268	967	**142**	-236	-22	990

Maximum torsional load (negative)

Index	Combination	R_x	R_y	R_z	R_η	R_ξ	$R_{\xi,lok}$	$R_{z,lok}$
Index	Combination	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
1	SPLS 3_100.5 Ah Ct1	-82	126	104	**-147**	-31	-8	107
2	SPLS 3_100.5 Ah Ct1	-7	215	-621	**-147**	157	20	-636
3	SPLS 6a_90 Ba Ct2 Ba Ct1	166	-26	-408	**-136**	99	9	-418
4	SPLS 6a_90 Ba Ct2 Ah Ct2	-94	-101	-31	**-138**	5	-2	-32

Project: KIJ-GT
Tower: WB+0 II
Number: 37

Combination Ftensile+Fhor

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-96	-91	**-552**	**-3**	132	10	-566
2	SPLS 1a_0,9_90 Ah Ct1	-36	227	**-734**	**-136**	186	24	-752
3	SPLS 1a_0,9_90 Ba Ct1	69	243	**-877**	**123**	220	27	-898
4	SPLS 1a_0,9_0 Ba All Cts	121	-117	**-680**	**3**	168	18	-696

Permanent load

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	60	61	347	-1	-85	-9	356
2	SLS 7	-13	14	-76	-1	19	3	-78
3	SLS 7	13	14	-76	1	19	3	-78
4	SLS 7	-60	61	347	1	-85	-9	356

Envelope of load combinations for all of the legs

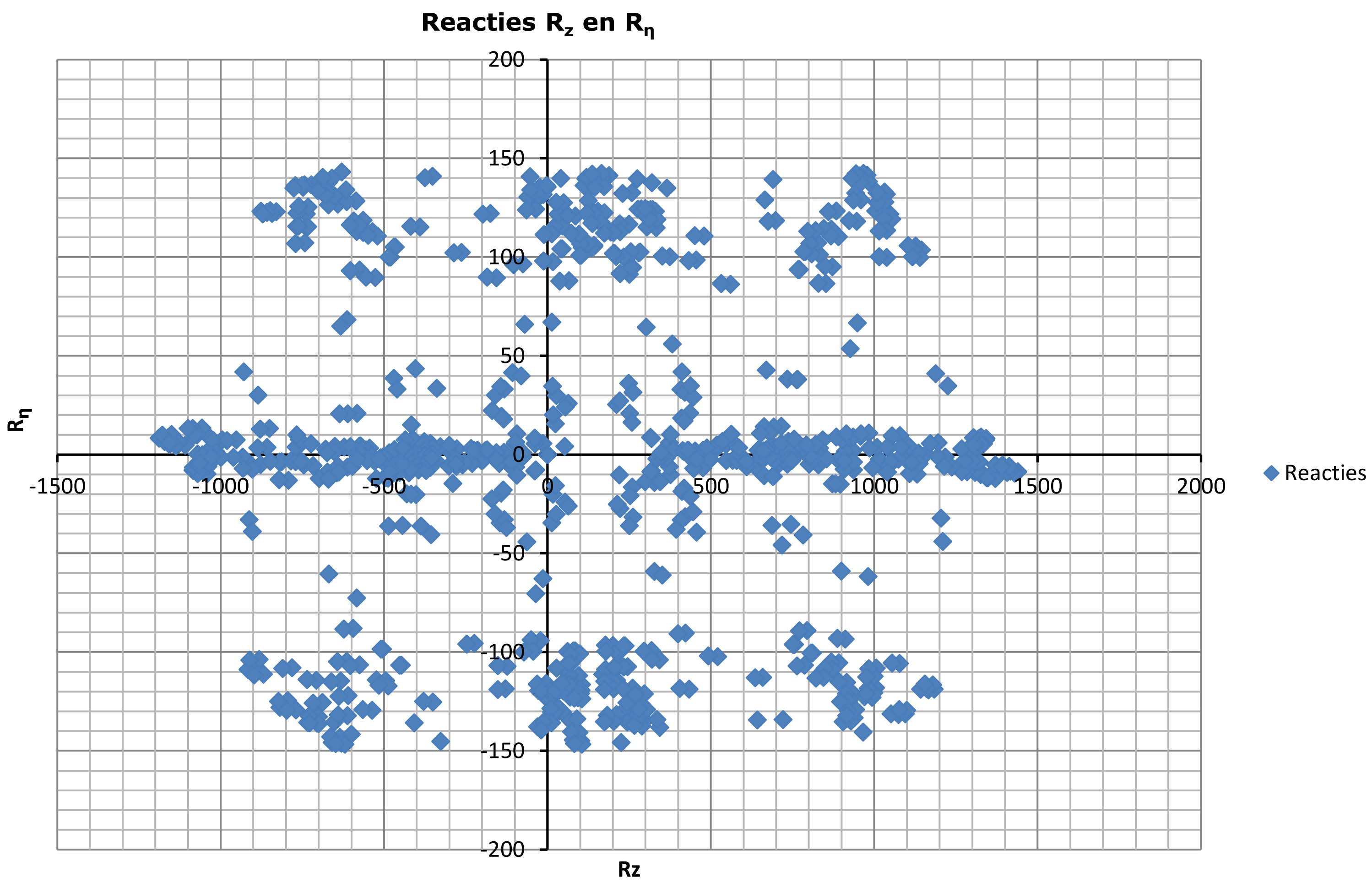
Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	SPLS 1a_90 Ba All Cts	245	257	**1439**	-9	-355	-37	1474
Max. tension	SPLS 1a_0,9_90 Ba All Cts	202	213	**-1189**	8	293	31	-1217
Max. pos. torsie	SPLS 6a_90 Ba Ct1 Ah Ct1	9	212	-630	**143**	156	17	-646
Max. neg. torsie	SPLS 3_100.5 Ah Ct1	-7	215	-621	**-147**	157	20	-636
Comb. tension+torsie	SPLS 1a_0,9_90 Ba Ct1	69	243	**-877**	**123**	220	27	-898

Maximum tension load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 7	60	61	**347**	-1	-85	-9	356
2	SLS 1a_135	-91	88	**-468**	3	127	23	-479
3	SLS 1a_90	130	141	**-760**	8	191	23	-778
4	SLS 1a_0	-2	8	**52**	4	-8	4	54

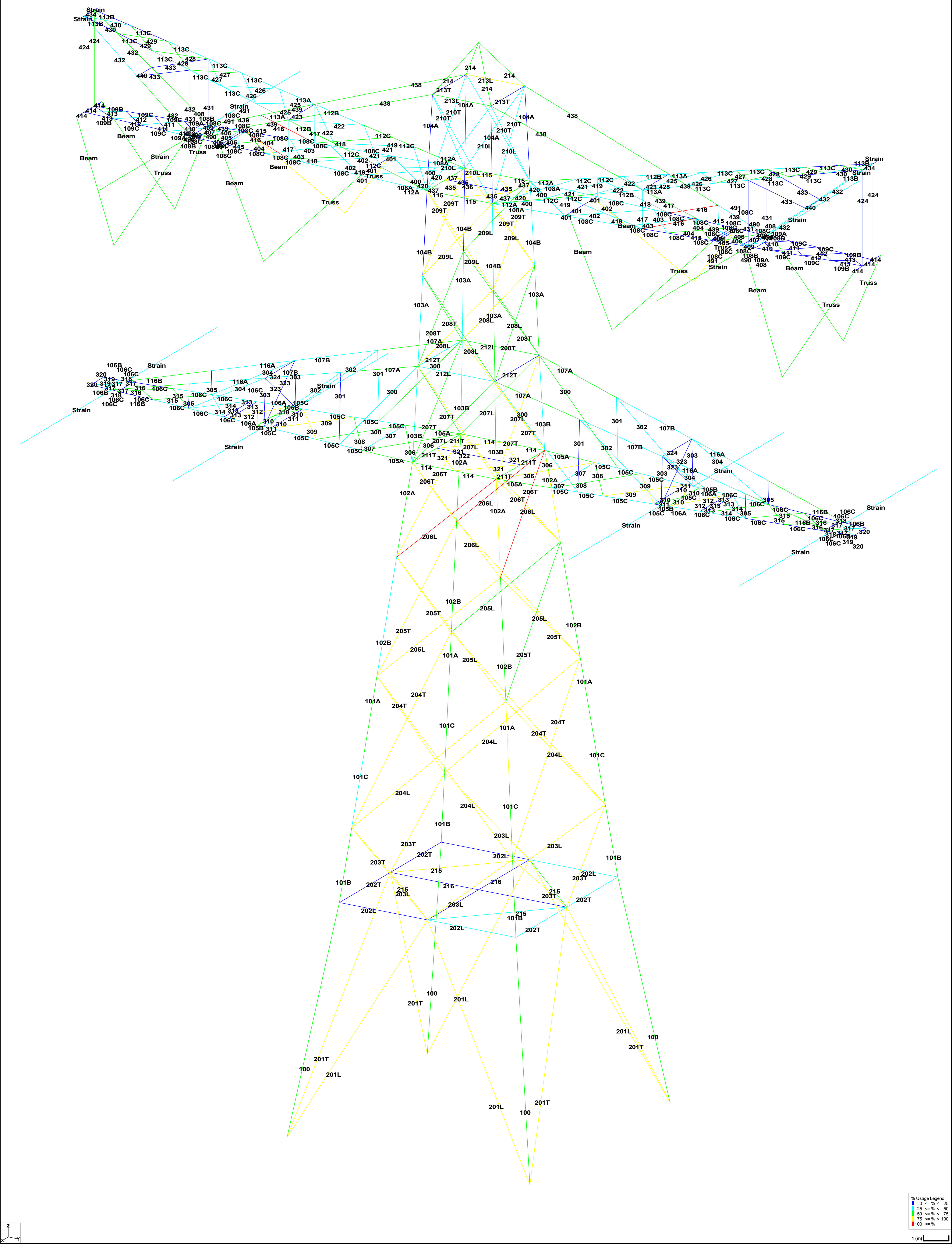
Maximum compression load - SLS

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SLS 1a_90	177	187	**1031**	-8	-257	-29	1056
2	SLS 1a_0	49	-34	**219**	-10	-58	-10	224
3	SLS 7	13	14	**-76**	1	19	3	-78
4	SLS 1a_135	-135	137	**739**	2	-193	-29	757


Reacties R_z en R_η
200
150
100
50
0
-50
-100
-150
-200
-1500
-1000
-500
0
500
1000
1500
2000
R_η
Rz
Reacties

APPENDIX B PLS-TOWER OUTPUT

DNV GL Nederlands BV, Project: "WB+0 (da) ini"
Tower Version 16.63, 17:33:25 Wednesday, 21 April, 2021
Undeformed geometry displayed



Assessment of groups for initial mast (afkeur level)

Date 22-04-21
Author KCh
Version 1.0

KIJ-GT 380
WB+0
37

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
100		250x250x18#	S235	12M24-5.6t	0.17	0.17	0.17	33	**-1387.8**	SPLS 1a_90 Ba All Cts	1975.3	1859.6	2799.4	0.75		**1155.9**	PLS 1a_0,9_90 Ba All Cts	2030.6	1859.6	2392.6	0.62	
101A		250x250x18#	S235	10M24-5.6t	0.55	0.55	0.55	35	**-1238.3**	SPLS 1a_90 Ba All Cts	1960.2	1599.1	2332.8	0.77		**1058.7**	PLS 1a_0,9_90 Ba All Cts	2030.6	1599.1	1993.8	0.66	
101B		250x250x18#	S235	12M24-5.6t	0.55	0.55	0.55	35	**-1363.6**	SPLS 1a_90 Ba All Cts	1963.3	1859.6	2799.4	0.73		**1154.6**	PLS 1a_0,9_90 Ba All Cts	2030.6	1859.6	2392.6	0.62	
101C		250x250x18#	S235		0.55	0.55	0.55	35	**-1242.1**	SPLS 1a_90 Ba All Cts	1958.6	0.0	0.0	0.63		**1055.7**	PLS 1a_0,9_90 Ba All Cts	2061.0	0.0	0.0	0.51	
102A		200x200x18	S235	12M24-5.6t	0.27	0.27	0.27	27	**-799.3**	SPLS 1a_90 Ba All Cts	1588.2	941.5	2799.4	0.85		**649.0**	PLS 1a_0,9_90 Ba All Cts	1548.5	941.5	2392.6	0.69	
102B		200x200x18	S235	12M24-5.6t	0.27	0.27	0.27	34	**-1015.3**	SPLS 1a_90 Ba All Cts	1548.1	1987.7	2799.4	0.66		**830.3**	PLS 1a_0,9_90 Ba All Cts	1548.5	1987.7	2392.6	0.54	
103A		180x180x16#	S235	8M24-5.6t	0.50	0.50	0.50	54	**-410.3**	SPLS 1a_90 Ba All Cts	1143.6	674.7	1658.9	0.61		**290.0**	PLS 1a_0,9_90 Ba All Cts	1220.3	674.7	1417.8	0.43	
103B		180x180x16#	S235	10M24-5.6t	0.50	0.50	0.50	57	**-439.9**	SPLS 1a_90 Ba All Cts	1125.2	847.2	2073.6	0.52		**356.9**	PLS 1a_0,9_90 Ba All Cts	1220.3	847.2	1612.8	0.42	
104A		120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	85	**-69.7**	SPLS 6a_90 Ba Ct1 Ba Ct2	390.5	508.3	777.6	0.18		**6.0**	SPLS 1a_0,9_0 Ah Ct1	466.6	508.3	664.6	0.01	
104B		120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	75	**-139.7**	SPLS 6a_90 Ba All Cts Ah Ct2	422.1	506.7	777.6	0.33		**112.9**	SPLS 1a_0,9_90 Ba Ct1	466.6	506.7	664.6	0.24	
105A		180x180x18#	S235	10M24-5.6t	1.57	1.00	1.00	69	**-622.1**	SPLS 6a_90 Ba Ct1 Ah Ct1	1171.8	831.3	2332.8	0.75		**496.3**	SPLS 3_0,9_100.5 Ba Ct2	1361.8	831.3	1993.8	0.60	
105B		180x180x18#	S235	8M24-5.6t	1.00	1.00	1.00	9	**-352.5**	SPLS 6a_90 Ba Ct1 Ah Ct1	1454.7	677.8	1866.2	0.52		**257.3**	SPLS 3_0,9_100.5 Ba Ct2	1361.8	677.8	1595.1	0.38	
105C		180x180x18#	S235		3.35	1.00	1.00	67	**-554.6**	SPLS 6a_90 Ba Ct1 Ah Ct1	1189.3	0.0	0.0	0.47		**415.9**	SPLS 3_0,9_100.5 Ba Ct2	1454.7	0.0	0.0	0.29	
106A		160x160x17#	S235	8M24-5.6t	2.78	1.00	1.00	79	**-329.7**	SPLS 6a_90 Ba Ct1 Ah Ct1	917.9	677.8	1762.6	0.49		**247.8**	SPLS 3_0,9_100.5 Ba Ct2	1116.1	677.8	1506.5	0.37	
106B		160x160x17#	S235	2M20-5.6t	1.50	1.00	1.00	22	**0.0**		1213.5	117.6	367.2	0.00		**12.9**	ULS 1a_79.5	668.3	117.6	296.7	0.11	
106C		160x160x17#	S235		1.97	1.00	1.00	69	**-292.3**	SPLS 6a_90 Ba Ct1 Ah Ct1	984.5	0.0	0.0	0.30		**225.4**	SPLS 3_0,9_100.5 Ba Ct2	1219.7	0.0	0.0	0.18	
107A		80x80x8	S235	3M24-5.6t	2.00	1.00	1.00	314	**0.0**		34.0	254.2	311.0	0.00		**111.7**	PLS 6a_90 Ba Ct1 Ba Ct2	160.8	254.2	259.0	0.70	
107B		80x80x8	S235	4M24-5.6t	2.00	1.00	1.00	307	**0.0**		35.3	338.9	414.7	0.00		**83.8**	PLS 6a_90 Ba Ct1 Ba Ct2	211.0	338.9	347.4	0.40	
108A		180x180x16#	S235	12M24-5.6t	1.00	0.50	0.50	58	**-421.2**	SPLS 3_100.5 Ba All Cts	1119.8	999.7	2488.3	0.42		**273.4**	SPLS 3_0,9_90 Ba All Cts	1220.3	999.7	2126.8	0.27	
108B		180x180x16#	S235	4M20-5.6t	16.65	1.00	1.00	91	**-20.6**	ULS 1a_0	884.3	235.2	691.2	0.09		**19.0**	ULS 1a_0,9_0	1253.5	235.2	691.2	0.08	
108C		180x180x16#	S235		1.26	0.50	1.00	76	**-371.4**	SPLS 6a_90 Ba All Cts Ah Ct1	999.5	0.0	0.0	0.37		**196.2**	S 3_0,9_100.5 Ba All Cts	1301.9	0.0	0.0	0.15	
109A		100x100x6	S235	4M20-5.6t	6.29	1.00	1.00	163	**-21.2**	ULS 1a_0	77.7	235.2	259.2	0.27		**18.1**	ULS 1a_0,9_0,9_0	237.4	235.2	259.2	0.08	
109B		100x100x6	S235	2M20-5.6t	3.62	1.00	1.00	163	**-12.5**	ULS 1a_0	77.8	117.6	129.6	0.16		**10.5**	ULS 1a_0,9_0	145.4	117.6	102.1	0.10	
109C		100x100x6	S235		3.96	1.00	1.00	163	**-12.4**	ULS 1a_45	77.7	0.0	0.0	0.16		**8.4**	ULS 1a_0,9_0	277.3	0.0	0.0	0.03	
438		120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	299	**0.0**		58.3	254.2	311.0	0.00		**190.1**	ULS 1a_0	263.0	254.2	265.8	0.75	
439		120x120x8	S235	3M24-5.6t	2.00	1.00	1.00	131	**0.0**		173.4	254.2	311.0	0.00		**168.1**	ULS 1a_0	263.0	254.2	265.8	0.66	
112A		120x120x11	S235	4M24-5.6t	1.42	1.00	1.00	98	**-199.2**	SPLS 6a_90 Ba Ct1 Ah Ct1	328.5	338.9	570.2	0.61		**187.3**	S 6a_90 Ba All Cts Ah Ct2	356.4	338.9	475.6	0.55	
112B		120x120x11	S235	5M24-5.6t	1.57	1.00	1.00	96	**-163.9**	SPLS 6a_90 Ba Ct1 Ah Ct1	316.2	423.6	712.8	0.52		**170.5**	PLS 6a_90 Ba Ct2 Ah Ct2	513.2	423.6	609.2	0.40	
112C		120x120x11	S235		3.36	2.29	1.00	89	**-192.4**	SPLS 6a_90 Ba Ct1 Ah Ct1	333.0	0.0	0.0	0.58		**180.3**	S 6a_90 Ba All Cts Ah Ct2	599.7	0.0	0.0	0.30	
113A		150x100x10	S235	5M24-5.6t	3.00	1.00	1.00	101	**-140.9**	SPLS 6a_90 Ba Ct1 Ah Ct1	289.1	423.6	648.0	0.49		**168.8**	S 6a_90 Ba All Cts Ah Ct2	495.3	423.6	553.8	0.40	
113B		150x100x10	S235	4M24-5.6t	3.11	1.00	1.00	109	**-30.2**	SPLS 1a_0,9_0 Ba All Cts	269.7	338.9	518.4	0.11		**48.4**	SPLS 1a_0 Ba Ct1	495.3	338.9	443.1	0.14	
113C		150x100x10	S235		2.83	1.00	1.00	101	**-128.4**	SPLS 6a_90 Ba Ct1 Ah Ct1	288.6	0.0	0.0	0.45		**155.8**	S 6a_90 Ba All Cts Ah Ct2	571.3	0.0	0.0	0.27	
114		180x180x18#	S235	10M24-5.6t	2.00	1.00	1.00	69	**-603.2**	SPLS 3_100.5 Ba All Cts	1169.6	831.3	2332.8	0.73		**455.4**	S 3_0,9_100.5 Ba All Cts	1361.8	831.3	1993.8	0.55	
115		180x180x16#	S235	12M24-5.6t	2.00	1.00	1.00	54	**-579.2**	SPLS 3_100.5 Ba All Cts	1142.5	999.7	2488.3	0.58		**421.5**	S 3_0,9_100.5 Ba All Cts	1220.3	999.7	2126.8	0.42	
116A		70x70x7	S235	4M20-5.6t	2.00	1.00	1.00	355	**0.0**		21.3	235.2	302.4	0.00		**75.8**	PLS 6a_90 Ba Ct2 Ba Ct1	163.8	235.2	181.2	0.46	
116B		70x70x7	S235	3M20-5.6t	2.00	1.00	1.00	361	**0.0**		20.7	176.4	226.8	0.00		**76.0**	PLS 6a_90 Ba Ct2 Ba Ct1	125.5	176.4	155.3	0.61	
201T		120x120x11	S235	4M24-5.6t	0.27	0.17	0.17	82	**-292.1**	SPLS 3_100.5 Ah Ct2	352.8	338.9	570.2	0.86		**288.8**	SPLS 3_0,9_100.5 Ah Ct1	356.4	338.9	475.6	0.85	
201L		120x120x11	S235	4M24-5.6t	0.27	0.17	0.17	82	**-299.2**	SPLS 3_100.5 Ah Ct1	352.8	338.9	570.2	0.88		**294.3**	SPLS 3_0,9_100.5 Ah Ct2	356.4	338.9	475.6	0.87	
202L		120x120x12	S235	2M24-5.6t	1.00	1.00	1.00	170	**-47.8**	SPLS 1a_90 Ba All Cts	195.2	169.4	311.0	0.28		**32.3**	PLS 1a_0,9_90 Ba All Cts	329.5	169.4	265.8	0.19	
202T		120x120x12	S235	2M24-5.6t	1.00	1.00	1.00	170	**-52.6**	SPLS 1a_90 Ba All Cts	195.2	169.4	311.0	0.31		**37.8**	PLS 1a_0,9_90 Ba All Cts	329.5	169.4	265.8	0.22	
203L		150x150x10	S235	3M24-5.6t	1.00	0.50	0.50	103	**-216.8**	SPLS 3_100.5 Ah Ct1	340.1	254.2	388.8	0.85		**217.0**	SPLS 3_0,9_100.5 Ah Ct2	384.5	254.2	269.2	0.85	
203T		150x150x10	S235	3M24-5.6t	1.00	0.50	0.50	103	**-210.1**	SPLS 3_0,9_100.5 Ah Ct2	340.1	254.2	388.8	0.83		**219.2**	SPLS 3_100.5 Ah Ct1	384.5	254.2	269.2	0.86	
204L		150x150x12	S235	4M24-5.6t	0.56	0.28	0.28	111	**-276.0**	SPLS 3_0,9_100.5 Ah Ct2	380.2	338.9	622.1	0.81		**269.4**	SPLS 3_100.5 Ah Ct1	456.2	338.9	421.1	0.79	
204T		150x150x12	S235	4M24-5.6t	0.56	0.28	0.28	111	**-281.3**	SPLS 3_100.5 Ah Ct1	380.2	338.9	622.1	0.83		**262.8**	SPLS 3_0,9_100.5 Ah Ct2	456.2	338.9	421.1	0.78	
205L		150x150x12	S235	5M24-5.6t	0.56	0.28	0.28	88	**-327.9**	SPLS 3_100.5 Ah Ct1	460.1	423.6	777.6	0.77		**332.8**	SPLS 3_0,9_100.5 Ah Ct2	456.2	423.6	518.8	0.79	
205T		150x150x12	S235	5M24-5.6t	0.56	0.28	0.28	88	**-321.3**	SPLS 3_0,9_100.5 Ah Ct2	460.1	423.6	777.6	0.76		**342.0**	SPLS 3_100.5 Ah Ct1	456.2	423.6	518.8	0.81	
206L		150x150x10	S235	6M24-5.6t	0.56	0.28	0.28	70	**-405.7**	SPLS 3_0,9_100.5 Ah Ct2	445.4	508.3	777.6	0.91		**395.0**	SPLS 3_100.5 Ah Ct2	384.5	508.3	513.8	1.03	nettodsn.
206T		150x150x10	S235	6M24-5.6t	0.56	0.28	0.28	70	**-420.2**	SPLS 3_100.5 Ah Ct1	445.4	508.3	777.6	0.94		**388.6**	SPLS 3_0,9_100.5 Ah Ct2	384.5	508.3	513.8	1.01	nettodsn.
207L		150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	97	**-256.5**	SPLS 3_100.5 Ah Ct1	381.0	338.9	518.4	0.76		**228.4**	PLS 6a_90 Ba Ct2 Ah Ct2	384.5	338.9	350.9	0.67	
207T		150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	97	**-272.9**	SPLS 3_100.5 Ah Ct2	381.0	338.9	518.4	0.81		**202.0**	SPLS 3_0,9_100.5 Ah Ct1	384.5	338.9	350.9	0.60	
208L		150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	90	**-239.7**	SPLS 3_0,9_100.5 Ah Ct2	401.7	338.9	518.4	0.71		**271.7**	SPLS 3_100.5 Ah Ct1	384.5	338.9	350.9	0.80	
208T		150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	90	**-225.2**	SPLS 3_0,9_100.5 Ah Ct1	401.7	338.9	518.4	0.66		**237.7**	PLS 6a_90 Ba Ct1 Ah Ct1	384.5	338.9	350.9	0.70	
209L		150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	84	**-296.4**	SPLS 3_100.5 Ah Ct1	422.7	338.9	518.4	0.87		**260.1**	SPLS 3_0,9_100.5 Ah Ct2	384.5	338.9	350.9	0.77	
209T		150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	84	**-260.7**	SPLS 6a_90 Ba Ct1 Ah Ct1	422.7	338.9	518.4	0.77		**245.2**	SPLS 3_0,9_100.5 Ah Ct1	384.5	338.9	350.9	0.72	
210L		100x100x6	S235	1M24-5.6t	0.53	0.53	0.53	132	**-36.2**	SPLS 6a_90 Ba Ct1 Ah Ct2	90.8	84.7	77.8	0.47		**32.8**	PLS 6a_90 Ba Ct1 Ba Ct2	127.9	84.7	66.5	0.49	
210T		100x100x6	S235	1M24-5.6t	0.53	0.53	0.53	132	**-30.1**	ULS 1a_0	90.8	84.7	77.8	0.39		**5.5**	SPLS 1a_0,9_0 Ba Ct1	127.9	84.7	66.5	0.08	
211T		100x100x8	S235	4M24-5.6t	2.00	1.00	1.00	124	**-60.2**	SPLS 3_0,9_100.5 Ah Ct1	151.1	338.9	414.7	0.40		**175.9**	SPLS 3_100.5 Ah Ct2	293.9	338.9	319.0	0.60	
212L		100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	178	**-18.4**	SPLS 3_0,9_90 Ba All Cts	103.8	254.2	311.0	0.18		**130.7**	SPLS 3_135 Ah All Cts	270.5	254.2	265.8	0.51	
212T		100x100x8	S235	4M24-5.6t	2.00	1.00	1.00	228	**-30.6**	ULS 1a_0,9_90	70.0	338.9	414.7	0.44		**63.5**	ULS 1a_90	293.9	338.9	319.0	0.22	
213L		100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	135	**0.0**		145.7	254.2	311.0	0.00		**162.6**	ULS 1a_0	211.1	254.2	265.8	0.77	
213T		70x70x5#	S235	2M24-5.6t	1.00	1.00	1.00	191	**0.0**		42.0	169.4	129.6	0.00		**4.7**	SPLS 1a_100.5 Ba Ct1	112.9	169.4	91.7	0.05	
214		50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	283	**-12.1**	SPLS 1a_0 Ba Ct1	16.3	75.4	86.4	0.74		**11.1**	SPLS 1a_0,9_0 Ba Ct1	52.4	75.4	44.1	0.25	
215		60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	483	**-5.8**	ULS 1a_0,9_0,9_135	6.4	37.7	43.2	0.90		**4.8**	ULS 1a_0,9_0,9_45	60.5	37.7	32.0	0.15	
216		70x70x5#	S235	1M16-5.6t	1.00	0.50	0.50	370	**-1.2**	SPLS 3_100.5 Ah Ct1	11.8	37.7	43.2	0.11		**0.0**		74.9	37.7	32.0	0.00	
300		50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	560	**0.0**		5.1	75.4	86.4	0.00		**24.0**	ULS 3_100.5	57.7	75.4	44.1	0.54	
301		80x80x8	S235	1M20-5.6t	1.00	1.00	1.00	192	**-16.0**	ULS 3_135	59.4	58.8	86.4	0.27		**0.0**		133.6	58.8	69.8	0.00	
302		60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	400	**0.0**		13.3	117.6	129.6	0.00		**35.5**	ULS 3_135	84.4	117.6	88.7	0.42	
303		75x50x5	S235	1M20-5.6t	1.00	1.00	1.00	186	**-5.9**	ULS 3_135	30.3	58.8	54.0	0.19		**0.0**		31.7	58.8	14.4	0.00	
304		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	427	**0.0**		6.6	37.7	43.2	0.00		**9.2**	ULS 3_100.5	37.4	37.7	22.0	0.42	
305		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	104	**-1.0**	ULS 3_100.5	46.8	37.7	43.2	0.03		**0.0**		37.4	37.7	18.4	0.00	
306		100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	120	**-89.2**	SPLS 3_100.5 Ba All Cts	124.7	117.6	129.6	0.76		**31.6**	S 3_0,9_100.5 Ba All Cts	138.8	117.6	91.6	0.34	
307		HEA160	S235	2M20-5.6t	1.00	1.00	1.00	42	**0.0**		735.6	117.6	216.0	0.00		**32.5**	ULS 1a_100.5	766.1	117.6	0.0	0.28	
308		100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	107	**-72.0**	SPLS 3_0,9_100.5 Ba Ct2	138.8	117.6	129.6	0.61		**67.6**	SPLS 3_100.5 Ba Ct2	137.2	117.6	91.6	0.74	
309		100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	98	**-83.6**	SPLS 3_100.5 Ba All Cts	149.6	117.6	129.6	0.71		**85.9**	S 3_0,9_100.5 Ba All Cts	145.4	117.6	91.6	0.94	
310		100x65x11	S235	2M20-5.6t	2.00	1.00	1.00	89	**-9.6**	SPLS 3_0,9_90 Ba Ct2	235.5	117.6	237.6	0.08		**74.0**	SPLS 3_100.5 Ba All Cts	191.5	117.6	232.8	0.63	
311		80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	89	**-45.2**	SPLS 3_0,9_100.5 Ba Ct2	104.2	84.7	77.8	0.58		**45.6**	SPLS 3_0,9_100.5 Ba Ct2	93.3	84.7	59.8	0.76	
312		70x70x6	S235	1M20-5.6t	0.55	0.55	0.55	108	**-51.2**	SPLS 3_90 Ba All Cts	76.5	58.8	64.8	0.87		**17.6**	S 3_0,9_100.5 Ba All Cts	82.9	58.8	52.4	0.34	
313		HEA160	S235	2M20-5.6t	1.00	1.00	1.00	27	**0.0**		788.4	117.6	216.0	0.00		**14.8**	SPLS 1a_100.5 Ah All Cts	766.1	117.6	0.0	0.13	
314		70x70x6	S235	2M20-5.6t	0.55	0.55	0.55	105	**-49.3**	SPLS 3_100.5 Ba All Cts	98.3	117.6	129.6	0.50		**32.3**	S 3_0,9_100.5 Ba All Cts	84.5	117.6	91.6	0.38	
315		80x80x6#	S235	2M20-5.6t	0.56	0.56	0.56	84	**-43.4**	SPLS 3_0,9_100.5 Ba Ct2	135.3	117.6	129.6	0.37		**53.3**	SPLS 3_100.5 Ba All Cts	105.8	117.6	91.6	0.58	
316		80x80x6#	S235	2M20-5.6t	0.57	0.57	0.57	78	**-71.0**	SPLS 3_100.5 Ba All Cts	141.6	117.6	129.6	0.60		**64.4**	S 3_0,9_100.5 Ba All Cts	117.2	117.6	91.6	0.70	
317		100x65x11	S235	2M20-5.6t	2.00	2.00	2.00	81	**0.0**		250.7	117.6	237.6	0.00		**56.8**	ULS 3_0,9_100.5	191.5	117.6	232.8	0.48	
318		70x70x7	S235	1M24-5.6t	1.00	1.00	1.00	63	**-42.6**	SPLS 3_100.5 Ba Ct2	119.1	84.7	90.7	0.50		**21.9**	SPLS 3_0,9_100.5 Ba Ct2	88.7	84.7	57.8	0.38	
319		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	89	**-14.9**	ULS 1a_79.5	53.2	37.7	43.2	0.40		**0.0**		37.4	37.7	22.0	0.00	

DNV·GL

Assessment of groups for initial mast (afkeur level)

Date 22-04-21
Author KCh
Version 1.0

KIJ-GT 380
WB+0
37

Group Label	Description	Profile	Steel Quality	Bolts	RLX	RLY	RLZ	Slenderness	Compression	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Exceedance (Comp)	Tension	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Exceedance (Tens)
320		HEA160	S235		1.00	1.00	1.00	13	**0.0**		825.9	0.0	0.0	0.00		**8.9**	ULS 1a_100.5	916.5	0.0	0.0	0.01	
321		120x120x11	S235	2M24-5.6t	1.00	1.00	1.00	114	**-159.8**	SPLS 3_0,9_100.5 Ah Ct1	286.0	169.4	285.1	0.94		**162.6**	SPLS 3_100.5 Ah Ct1	306.2	169.4	243.7	0.96	
322		60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	325	**-1.6**	SPLS 6a_90 Ah Ct2 Ah Ct1	12.6	58.8	54.0	0.13		**0.0**		54.7	58.8	37.0	0.00	
323		50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	168	**-1.5**	SPLS 1a_0 Ah All Cts	27.7	37.7	43.2	0.05		**5.0**	ULS 3_0,9_135	37.4	37.7	22.0	0.23	
324		65x50x5	S235	1M20-5.6t	1.00	1.00	1.00	217	**-3.9**	ULS 3_0,9_90	22.2	58.8	54.0	0.18		**0.3**	SPLS 1a_135 Ah All Cts	54.7	58.8	27.7	0.01	
400		100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	117	**-57.8**	SPLS 3_90 Ba Ct1	128.0	117.6	129.6	0.49		**27.7**	SPLS 3_0,9_90 Ba All Cts	143.8	117.6	104.7	0.26	
401		HEA160	S235	2M20-5.6t	9.46	9.46	9.46	64	**0.0**		649.2	117.6	216.0	0.00		**19.3**	ULS 1a_0	766.1	117.6	0.0	0.16	
402		100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	100	**-54.3**	SPLS 3_90 Ba All Cts	148.2	117.6	129.6	0.46		**43.7**	SPLS 3_0,9_90 Ba Ct1	168.5	117.6	104.7	0.42	
403		80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	94	**-45.5**	SPLS 3_0,9_90 Ba All Cts	124.7	117.6	129.6	0.39		**50.9**	SPLS 3_90 Ba All Cts	121.0	117.6	104.7	0.49	
404		80x80x8	S235	2M20-5.6t	0.55	0.55	0.55	93	**-69.1**	SPLS 3_90 Ba Ct1	164.6	117.6	172.8	0.59		**59.7**	S 3_0,9_100.5 Ba All Cts	166.1	117.6	139.6	0.51	
405		HEA160	S235	2M20-5.6t	1.00	1.00	1.00	42	**-29.6**	ULS 7	735.1	117.6	216.0	0.25		**31.5**	ULS 7	766.1	117.6	0.0	0.27	
406		65x65x7	S235	2M20-5.6t	0.55	0.55	0.55	83	**-59.1**	SPLS 3_100.5 Ba All Cts	125.7	117.6	151.2	0.50		**57.2**	SPLS 3_0,9_100.5 Ba Ct1	94.9	117.6	119.1	0.60	
407		100x100x12	S235	2M20-5.6t	1.00	1.00	1.00	78	**0.0**		342.6	117.6	259.2	0.00		**28.3**	ULS 3_90	278.4	117.6	259.2	0.24	
408		100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	47	**-19.3**	SPLS 1a_0 Ba Ct2	401.9	117.6	259.2	0.16		**23.2**	SPLS 3_0,9_100.5 Ba Ct1	278.4	117.6	259.2	0.20	
409		60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	82	**-22.5**	SPLS 3_0,9_90 Ba Ct1	79.5	58.8	64.8	0.38		**21.9**	SPLS 1a_0,9_0 Ba Ct2	65.7	58.8	44.4	0.49	
410		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	107	**-6.8**	ULS 1a_0	46.0	37.7	43.2	0.18		**6.3**	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.28	
411		50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	100	**-6.1**	ULS 1a_0,9_0	48.5	37.7	43.2	0.16		**6.2**	ULS 1a_0	37.4	37.7	22.0	0.28	
412		50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	94	**-6.6**	ULS 1a_0,9_0,9_0	51.1	37.7	43.2	0.18		**6.6**	ULS 1a_0,9_0	37.4	37.7	22.0	0.30	
413		50x50x5	S235	1M16-5.6t	0.56	0.56	0.56	95	**-9.1**	ULS 1a_0	50.6	37.7	43.2	0.24		**7.7**	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.35	
414		HEA160	S235	2M20-5.6t	2.00	2.00	2.00	30	**-4.1**	ULS 1a_0	777.9	117.6	216.0	0.04		**2.1**	ULS 1a_0,9_0	766.1	117.6	0.0	0.02	
415		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	83	**-8.6**	SPLS 1a_0,9_0 Ah Ct1	55.1	37.7	43.2	0.23		**15.0**	SPLS 1a_0 Ah All Cts	37.4	37.7	22.0	0.48	
416		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	256	**-24.4**	SPLS 1a_0 Ah All Cts	15.2	37.7	43.2	1.61	knik	**12.0**	SPLS 1a_0,9_0 Ah Ct1	37.4	37.7	22.0	0.54	
417		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	168	**-1.9**	ULS 1a_0,9_0,9_0	27.8	37.7	43.2	0.07		**10.9**	ULS 1a_0	37.4	37.7	22.0	0.50	
418		75x75x7#	S235	1M16-5.6t	1.00	1.00	1.00	236	**-20.0**	SPLS 1a_0 Ah Ct1	36.4	37.7	60.5	0.55		**4.8**	SPLS 1a_0,9_0 Ah All Cts	114.9	37.7	44.8	0.13	
419		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	81	**-3.3**	SPLS 1a_0,9_0 Ah All Cts	55.7	37.7	43.2	0.09		**8.2**	SPLS 1a_0 Ah Ct1	37.4	37.7	22.0	0.37	
420		50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	206	**-9.6**	SPLS 1a_0 Ba Ct1	21.0	37.7	43.2	0.45		**6.3**	SPLS 1a_0,9_0 Ba All Cts	37.4	37.7	22.0	0.29	
421		50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	191	**-6.6**	SPLS 6a_90 Ba All Cts Ah Ct2	23.4	37.7	43.2	0.28		**10.0**	SPLS 1a_0 Ba Ct1	37.4	37.7	22.0	0.45	
422		50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	179	**-10.5**	SPLS 1a_0 Ba Ct1	25.6	37.7	43.2	0.41		**7.8**	S 6a_90 Ba All Cts Ah Ct2	37.4	37.7	22.0	0.35	
423		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	215	**-2.9**	SPLS 6a_90 Ba Ct1 Ba Ct2	19.7	37.7	43.2	0.15		**0.0**		37.4	37.7	22.0	0.00	
424		60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	343	**-13.6**	ULS 1a_0,9_0	13.7	58.8	64.8	0.99		**22.2**	ULS 1a_0	65.7	58.8	44.4	0.50	
425		50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	144	**-8.9**	SPLS 6a_90 Ba All Cts Ah Ct2	33.6	37.7	43.2	0.27		**8.6**	PLS 6a_90 Ba Ct2 Ah Ct2	37.4	37.7	22.0	0.39	
426		50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	139	**-10.4**	SPLS 6a_90 Ba All Cts Ah Ct2	35.1	37.7	43.2	0.30		**10.8**	S 6a_90 Ba All Cts Ah Ct2	37.4	37.7	22.0	0.49	
427		50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	123	**-12.4**	SPLS 6a_90 Ba All Cts Ah Ct2	40.2	37.7	43.2	0.33		**11.6**	S 6a_90 Ba All Cts Ah Ct2	37.4	37.7	22.0	0.53	
428		60x60x5	S235	1M16-5.6t	0.55	0.55	0.55	107	**-16.4**	SPLS 6a_90 Ba All Cts Ah Ct2	55.4	37.7	43.2	0.44		**17.5**	S 6a_90 Ba All Cts Ah Ct2	60.5	37.7	32.0	0.55	
429		60x60x5	S235	1M16-5.6t	0.55	0.55	0.55	94	**-22.9**	SPLS 6a_90 Ba Ct2 Ah Ct2	61.4	37.7	43.2	0.61		**21.1**	S 6a_90 Ba All Cts Ah Ct2	60.5	37.7	32.0	0.66	
430		60x60x5	S235	2M16-5.6t	0.56	0.56	0.56	90	**-28.1**	SPLS 6a_90 Ba All Cts Ah Ct2	79.4	75.4	86.4	0.37		**31.3**	S 6a_90 Ba All Cts Ah Ct2	61.2	75.4	64.0	0.51	
431		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	286	**-2.6**	SPLS 1a_100.5 Ba All Cts	12.8	37.7	43.2	0.20		**0.0**		37.4	37.7	22.0	0.00	
432		120x120x8	S235	1M24-5.6t	2.00	1.00	1.00	173	**-56.2**	ULS 1a_0	111.7	84.7	103.7	0.66		**25.8**	ULS 1a_0,9_0,9_0	216.6	84.7	88.6	0.30	
433		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	270	**0.0**		14.0	37.7	43.2	0.00		**1.3**	ULS 1a_135	37.4	37.7	22.0	0.06	
434		UNP160	S235		1.00	1.00	1.00	42	**0.0**		378.8	0.0	0.0	0.00		**29.0**	ULS 3_0,9_90	564.0	0.0	0.0	0.05	
435		120x120x8	S235	2M24-5.6t	1.00	1.00	1.00	88	**-153.9**	SPLS 3_0,9_100.5 Ah Ct1	262.2	169.4	207.4	0.91		**155.2**	SPLS 3_100.5 Ah Ct1	226.0	169.4	177.2	0.92	
436		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	305	**-0.9**	ULS 3_0	11.5	37.7	43.2	0.08		**0.0**		37.4	37.7	22.0	0.00	
437		100x100x6	S235	4M24-5.6t	2.00	1.00	1.00	96	**-80.4**	SPLS 3_0,9_100.5 Ah Ct1	142.4	338.9	311.0	0.56		**146.1**	PLS 6a_90 Ah Ct1 Ah Ct2	225.0	338.9	265.8	0.65	
490		HEA160	S235	2M20-5.6t	2.00	2.00	2.00	13	**-4.2**	ULS 1a_0	825.3	117.6	216.0	0.04		**79.0**	ULS 3_0,9_90	916.5	0.0	0.0	0.09	
491		HEA160	S235	2M20-5.6t	2.00	2.00	2.00	8	**-5.4**	ULS 1a_0	834.0	117.6	216.0	0.05		**2.4**	ULS 7	766.1	117.6	0.0	0.02	
440		50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	117	**0.0**		42.1	37.7	43.2	0.00		**0.3**	ULS 1a_0	37.4	37.7	22.0	0.01	

DNV·GL

Assessment of groups for strenghtened mast (afkeur level)

Date 22-04-21
Author KCh
Version 1.0

KIJ-GT 380
WB+0
37

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
100	0	250x250x18#	S235	12M24-5.6t	0.17	0.17	0.17	33	-1388.1	SPLS 1a_90 Ba All Cts	1975.3	1859.6	2799.4	0.75		1156.1	SPLS 1a_0,9_90 Ba All	2030.6	1859.6	2392.6	0.62
101A	0	250x250x18#	S235	10M24-5.6t	0.55	0.55	0.55	35	-1238.7	SPLS 1a_90 Ba All Cts	1960.2	1599.1	2332.8	0.77		1058.9	SPLS 1a_0,9_90 Ba All	2030.6	1599.1	1993.8	0.66
101B	0	250x250x18#	S235	12M24-5.6t	0.55	0.55	0.55	35	-1364.0	SPLS 1a_90 Ba All Cts	1963.3	1859.6	2799.4	0.73		1154.7	SPLS 1a_0,9_90 Ba All	2030.6	1859.6	2392.6	0.62
101C	0	250x250x18#	S235		0.55	0.55	0.55	35	-1242.5	SPLS 1a_90 Ba All Cts	1958.6	0.0	0.0	0.63		1055.9	SPLS 1a_0,9_90 Ba All	2061.0	0.0	0.0	0.51
102A	0	200x200x18	S235	12M24-5.6t	0.27	0.27	0.27	27	-799.6	SPLS 1a_90 Ba All Cts	1588.2	941.5	2799.4	0.85		649.1	SPLS 1a_0,9_90 Ba All	1548.5	941.5	2392.6	0.69
102B	0	200x200x18	S235	12M24-5.6t	0.27	0.27	0.27	34	-1015.6	SPLS 1a_90 Ba All Cts	1548.1	1987.7	2799.4	0.66		830.5	SPLS 1a_0,9_90 Ba All	1548.5	1987.7	2392.6	0.54
103A	0	180x180x16#	S235	8M24-5.6t	0.50	0.50	0.50	54	-410.6	SPLS 1a_90 Ba All Cts	1143.6	674.7	1658.9	0.61		290.0	SPLS 1a_0,9_90 Ba All	1220.3	674.7	1417.8	0.43
103B	0	180x180x16#	S235	10M24-5.6t	0.50	0.50	0.50	57	-440.1	SPLS 1a_90 Ba All Cts	1125.2	847.2	2073.6	0.52		357.0	SPLS 1a_0,9_90 Ba All	1220.3	847.2	1612.8	0.42
104A	0	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	85	-69.7	SPLS 6a_90 Ba Ct1 Ba	390.5	508.3	777.6	0.18		5.9	SPLS 1a_0,9_0 Ah Ct1	466.6	508.3	664.6	0.01
104B	0	120x120x10	S235	6M24-5.6t	0.50	0.50	0.50	75	-139.8	SPLS 6a_90 Ba All Cts	422.1	506.7	777.6	0.33		112.9	SPLS 1a_0,9_90 Ba Ct	466.6	506.7	664.6	0.24
105A	0	180x180x18#	S235	10M24-5.6t	1.57	1.00	1.00	69	-622.1	SPLS 6a_90 Ba Ct1 Ah	1171.8	831.3	2332.8	0.75		496.3	SPLS 3_0,9_100.5 Ba (	1361.8	831.3	1993.8	0.60
105B	0	180x180x18#	S235	8M24-5.6t	1.00	1.00	1.00	9	-352.5	SPLS 6a_90 Ba Ct1 Ah	1454.7	677.8	1866.2	0.52		257.3	SPLS 3_0,9_100.5 Ba (	1361.8	677.8	1595.1	0.38
105C	0	180x180x18#	S235		3.35	1.00	1.00	67	-554.6	SPLS 6a_90 Ba Ct1 Ah	1189.3	0.0	0.0	0.47		415.9	SPLS 3_0,9_100.5 Ba (	1454.7	0.0	0.0	0.29
106A	0	160x160x17#	S235	8M24-5.6t	2.78	1.00	1.00	79	-329.7	SPLS 6a_90 Ba Ct1 Ah	917.9	677.8	1762.6	0.49		247.8	SPLS 3_0,9_100.5 Ba (	1116.1	677.8	1506.5	0.37
106B	0	160x160x17#	S235	2M20-5.6t	1.50	1.00	1.00	22	0.0		1213.5	117.6	367.2	0.00		12.9	ULS 1a_79.5	668.3	117.6	296.7	0.11
106C	0	160x160x17#	S235		1.97	1.00	1.00	69	-292.3	SPLS 6a_90 Ba Ct1 Ah	984.5	0.0	0.0	0.30		225.4	SPLS 3_0,9_100.5 Ba (	1219.7	0.0	0.0	0.18
107A	0	80x80x8	S235	3M24-5.6t	2.00	1.00	1.00	314	0.0		34.0	254.2	311.0	0.00		111.7	SPLS 6a_90 Ba Ct1 Ba	160.8	254.2	259.0	0.70
107B	0	80x80x8	S235	4M24-5.6t	2.00	1.00	1.00	307	0.0		35.3	338.9	414.7	0.00		83.8	SPLS 6a_90 Ba Ct1 Ba	211.0	338.9	347.4	0.40
108A	0	180x180x16#	S235	12M24-5.6t	1.00	0.50	0.50	58	-421.2	SPLS 3_100.5 Ba All Ct	1119.8	999.7	2488.3	0.42		273.2	SPLS 3_0,9_90 Ba All (	1220.3	999.7	2126.8	0.27
108B	0	180x180x16#	S235	4M20-5.6t	16.65	1.00	1.00	91	-20.6	ULS 1a_0	884.3	235.2	691.2	0.09		19.1	ULS 1a_0,9_0	1253.5	235.2	691.2	0.08
108C	0	180x180x16#	S235		1.26	0.50	1.00	76	-371.5	SPLS 6a_90 Ba All Cts	999.5	0.0	0.0	0.37		196.0	SPLS 3_0,9_100.5 Ba /	1301.9	0.0	0.0	0.15
109A	0	100x100x6	S235	4M20-5.6t	6.29	1.00	1.00	163	-21.2	ULS 1a_0	77.7	235.2	259.2	0.27		18.2	ULS 1a_0,9_0,9_0	237.4	235.2	259.2	0.08
109B	0	100x100x6	S235	2M20-5.6t	3.62	1.00	1.00	163	-12.5	ULS 1a_0	77.8	117.6	129.6	0.16		10.5	ULS 1a_0,9_0	145.4	117.6	102.1	0.10
109C	0	100x100x6	S235		3.96	1.00	1.00	163	-12.5	ULS 1a_45	77.7	0.0	0.0	0.16		8.5	ULS 1a_0,9_0	277.3	0.0	0.0	0.03
438	0	120x120x8	S235	3M24-5.6t	1.00	1.00	1.00	299	0.0		58.3	254.2	311.0	0.00		190.4	ULS 1a_0	263.0	254.2	265.8	0.75
439	0	120x120x8	S235	3M24-5.6t	2.00	1.00	1.00	131	0.0		173.4	254.2	311.0	0.00		168.3	ULS 1a_0	263.0	254.2	265.8	0.66
112A	0	120x120x11	S235	4M24-5.6t	1.42	1.00	1.00	98	-199.4	SPLS 6a_90 Ba Ct1 Ah	328.5	338.9	570.2	0.61		187.2	SPLS 6a_90 Ba All Cts	356.4	338.9	475.6	0.55
112B	0	120x120x11	S235	5M24-5.6t	1.57	1.00	1.00	96	-163.8	SPLS 6a_90 Ba Ct1 Ah	316.2	423.6	712.8	0.52		170.7	SPLS 6a_90 Ba Ct2 Ah	513.2	423.6	609.2	0.40
112C	0	120x120x11	S235		3.36	2.29	1.00	89	-192.6	SPLS 6a_90 Ba Ct1 Ah	333.0	0.0	0.0	0.58		180.4	SPLS 6a_90 Ba All Cts	599.7	0.0	0.0	0.30
113A	0	150x100x10	S235	5M24-5.6t	3.00	1.00	1.00	101	-140.8	SPLS 6a_90 Ba Ct1 Ah	289.1	423.6	648.0	0.49		168.8	SPLS 6a_90 Ba All Cts	495.3	423.6	553.8	0.40
113B	0	150x100x10	S235	4M24-5.6t	3.11	1.00	1.00	109	-30.3	SPLS 1a_0,9_0 Ba All (	269.7	338.9	518.4	0.11		48.4	SPLS 1a_0 Ba Ct1	495.3	338.9	443.1	0.14
113C	0	150x100x10	S235		2.83	1.00	1.00	101	-128.3	SPLS 6a_90 Ba Ct1 Ah	288.6	0.0	0.0	0.44		155.8	SPLS 6a_90 Ba All Cts	571.3	0.0	0.0	0.27
114	0	180x180x18#	S235	10M24-5.6t	2.00	1.00	1.00	69	-603.2	SPLS 3_100.5 Ba All Ct	1169.6	831.3	2332.8	0.73		455.4	SPLS 3_0,9_100.5 Ba /	1361.8	831.3	1993.8	0.55
115	0	180x180x16#	S235	12M24-5.6t	2.00	1.00	1.00	54	-579.3	SPLS 3_100.5 Ba All Ct	1142.5	999.7	2488.3	0.58		421.3	SPLS 3_0,9_100.5 Ba /	1220.3	999.7	2126.8	0.42
116A	0	70x70x7	S235	4M20-5.6t	2.00	1.00	1.00	355	0.0		21.3	235.2	302.4	0.00		75.8	SPLS 6a_90 Ba Ct2 Ba	163.8	235.2	181.2	0.46
116B	0	70x70x7	S235	3M20-5.6t	2.00	1.00	1.00	361	0.0		20.7	176.4	226.8	0.00		76.0	SPLS 6a_90 Ba Ct2 Ba	125.5	176.4	155.3	0.61
201T	0	120x120x11	S235	4M24-5.6t	0.27	0.17	0.17	82	-292.1	SPLS 3_100.5 Ah Ct2	352.8	338.9	570.2	0.86		288.8	SPLS 3_0,9_100.5 Ah (	356.4	338.9	475.6	0.85
201L	0	120x120x11	S235	4M24-5.6t	0.27	0.17	0.17	82	-299.2	SPLS 3_100.5 Ah Ct1	352.8	338.9	570.2	0.88		294.3	SPLS 3_0,9_100.5 Ah (	356.4	338.9	475.6	0.87
202L	0	120x120x12	S235	2M24-5.6t	1.00	1.00	1.00	170	-47.8	SPLS 1a_90 Ba All Cts	195.2	169.4	311.0	0.28		32.3	SPLS 1a_0,9_90 Ba All	329.5	169.4	265.8	0.19
202T	0	120x120x12	S235	2M24-5.6t	1.00	1.00	1.00	170	-52.6	SPLS 1a_90 Ba All Cts	195.2	169.4	311.0	0.31		37.8	SPLS 1a_0,9_90 Ba All	329.5	169.4	265.8	0.22
203L	0	150x150x10	S235	3M24-5.6t	1.00	0.50	0.50	103	-216.8	SPLS 3_100.5 Ah Ct1	340.1	254.2	388.8	0.85		217.0	SPLS 3_0,9_100.5 Ah (	384.5	254.2	269.2	0.85
203T	0	150x150x10	S235	3M24-5.6t	1.00	0.50	0.50	103	-210.1	SPLS 3_0,9_100.5 Ah (	340.1	254.2	388.8	0.83		219.2	SPLS 3_100.5 Ah Ct1	384.5	254.2	269.2	0.86
204L	0	150x150x12	S235	4M24-5.6t	0.56	0.28	0.28	111	-276.0	SPLS 3_0,9_100.5 Ah (	380.2	338.9	622.1	0.81		269.4	SPLS 3_100.5 Ah Ct1	456.2	338.9	421.1	0.79
204T	0	150x150x12	S235	4M24-5.6t	0.56	0.28	0.28	111	-281.3	SPLS 3_100.5 Ah Ct1	380.2	338.9	622.1	0.83		262.8	SPLS 3_0,9_100.5 Ah (	456.2	338.9	421.1	0.78
205L	0	150x150x12	S235	5M24-5.6t	0.56	0.28	0.28	88	-327.9	SPLS 3_100.5 Ah Ct1	460.1	423.6	777.6	0.77		332.8	SPLS 3_0,9_100.5 Ah (	456.2	423.6	518.8	0.79
205T	0	150x150x12	S235	5M24-5.6t	0.56	0.28	0.28	88	-321.3	SPLS 3_0,9_100.5 Ah (	460.1	423.6	777.6	0.76		342.0	SPLS 3_100.5 Ah Ct1	456.2	423.6	518.8	0.81
206L	0	150x150x10	**S355**	**6M24-8.8t**	0.56	0.28	0.28	70	-405.7	SPLS 3_0,9_100.5 Ah (	575.5	813.3	1058.4	0.70		395.0	SPLS 3_100.5 Ah Ct2	523.3	813.3	732.7	0.75
206T	0	150x150x10	**S355**	**6M24-8.8t**	0.56	0.28	0.28	70	-420.2	SPLS 3_100.5 Ah Ct1	575.5	813.3	1058.4	0.73		388.6	SPLS 3_0,9_100.5 Ah (	523.3	813.3	732.7	0.74
207L	0	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	97	-256.5	SPLS 3_100.5 Ah Ct1	381.0	338.9	518.4	0.76		228.4	SPLS 6a_90 Ba Ct2 Ah	384.5	338.9	350.9	0.67
207T	0	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	97	-273.0	SPLS 3_100.5 Ah Ct2	381.0	338.9	518.4	0.81		202.0	SPLS 3_0,9_100.5 Ah (	384.5	338.9	350.9	0.60
208L	0	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	90	-239.7	SPLS 3_0,9_100.5 Ah (	401.7	338.9	518.4	0.71		271.7	SPLS 3_100.5 Ah Ct1	384.5	338.9	350.9	0.80
208T	0	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	90	-225.2	SPLS 3_0,9_100.5 Ah (	401.7	338.9	518.4	0.66		237.7	SPLS 6a_90 Ba Ct1 Ah	384.5	338.9	350.9	0.70
209L	0	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	84	-296.4	SPLS 3_100.5 Ah Ct1	422.7	338.9	518.4	0.87		260.1	SPLS 3_0,9_100.5 Ah (	384.5	338.9	350.9	0.77
209T	0	150x150x10	S235	4M24-5.6t	0.53	0.53	0.53	84	-260.7	SPLS 6a_90 Ba Ct1 Ah	422.7	338.9	518.4	0.77		245.2	SPLS 3_0,9_100.5 Ah (	384.5	338.9	350.9	0.72
210L	0	100x100x6	S235	1M24-5.6t	0.53	0.53	0.53	132	-36.2	SPLS 6a_90 Ba Ct1 Ah	90.8	84.7	77.8	0.47		32.8	SPLS 6a_90 Ba Ct1 Ba	127.9	84.7	66.5	0.49
210T	0	100x100x6	S235	1M24-5.6t	0.53	0.53	0.53	132	-30.1	ULS 1a_0	90.8	84.7	77.8	0.39		5.5	SPLS 1a_0,9_0 Ba Ct1	127.9	84.7	66.5	0.08
211T	0	100x100x8	S235	4M24-5.6t	2.00	1.00	1.00	124	-60.2	SPLS 3_0,9_100.5 Ah (	151.1	338.9	414.7	0.40		175.9	SPLS 3_100.5 Ah Ct2	293.9	338.9	319.0	0.60
212L	0	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	178	-18.4	SPLS 3_0,9_90 Ba All (	103.8	254.2	311.0	0.18		130.7	SPLS 3_135 Ah All Cts	270.5	254.2	265.8	0.51
212T	0	100x100x8	S235	4M24-5.6t	2.00	1.00	1.00	228	-30.6	ULS 1a_0,9_90	70.0	338.9	414.7	0.44		63.5	ULS 1a_90	293.9	338.9	319.0	0.22
213L	0	100x100x8	S235	3M24-5.6t	1.00	1.00	1.00	135	0.0		145.7	254.2	311.0	0.00		162.9	ULS 1a_0	211.1	254.2	265.8	0.77
213T	0	70x70x5#	S235	2M24-5.6t	1.00	1.00	1.00	191	0.0		42.0	169.4	129.6	0.00		4.7	SPLS 1a_100.5 Ba Ct1	112.9	169.4	91.7	0.05
214	0	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	283	-12.1	SPLS 1a_0 Ba Ct1	16.3	75.4	86.4	0.74		11.1	SPLS 1a_0,9_0 Ba Ct1	52.4	75.4	44.1	0.25
215	0	60x60x5	S235	1M16-5.6t	1.00	1.00	1.00	483	-5.8	ULS 1a_0,9_0,9_135	6.4	37.7	43.2	0.90		4.8	ULS 1a_0,9_0,9_45	60.5	37.7	32.0	0.15
216	0	70x70x5#	S235	1M16-5.6t	1.00	0.50	0.50	370	-1.2	SPLS 3_100.5 Ah Ct1	11.8	37.7	43.2	0.11		0.0		74.9	37.7	32.0	0.00
300	0	50x50x5	S235	2M16-5.6t	1.00	1.00	1.00	560	0.0		5.1	75.4	86.4	0.00		24.0	ULS 3_100.5	57.7	75.4	44.1	0.54
301	0	80x80x8	S235	1M20-5.6t	1.00	1.00	1.00	192	-16.0	ULS 3_135	59.4	58.8	86.4	0.27		0.0		133.6	58.8	69.8	0.00
302	0	60x60x6	S235	2M20-5.6t	1.00	1.00	1.00	400	0.0		13.3	117.6	129.6	0.00		35.5	ULS 3_135	84.4	117.6	88.7	0.42
303	0	75x50x5	S235	1M20-5.6t	1.00	1.00	1.00	186	-5.9	ULS 3_135	30.3	58.8	54.0	0.19		0.0		31.7	58.8	14.4	0.00
304	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	427	0.0		6.6	37.7	43.2	0.00		9.2	ULS 3_100.5	37.4	37.7	22.0	0.42
305	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	104	-1.0	ULS 3_100.5	46.8	37.7	43.2	0.03		0.0		37.4	37.7	18.4	0.00
306	0	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	120	-89.2	SPLS 3_100.5 Ba All Ct	124.7	117.6	129.6	0.76		31.6	SPLS 3_0,9_100.5 Ba /	138.8	117.6	91.6	0.34
307	0	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	42	0.0		735.6	117.6	216.0	0.00		32.5	ULS 1a_100.5	766.1	117.6	0.0	0.28
308	0	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	107	-72.0	SPLS 3_0,9_100.5 Ba (	138.8	117.6	129.6	0.61		67.6	SPLS 3_100.5 Ba Ct2	137.2	117.6	91.6	0.74
309	0	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	98	-83.6	SPLS 3_100.5 Ba All Ct	149.6	117.6	129.6	0.71		85.9	SPLS 3_0,9_100.5 Ba /	145.4	117.6	91.6	0.94
310	0	100x65x11	S235	2M20-5.6t	2.00	1.00	1.00	89	-9.6	SPLS 3_0,9_90 Ba Ct2	235.5	117.6	237.6	0.08		74.0	SPLS 3_100.5 Ba All Ct	191.5	117.6	232.8	0.63
311	0	80x80x6#	S235	1M24-5.6t	1.00	1.00	1.00	89	-45.2	SPLS 3_0,9_100.5 Ba (	104.2	84.7	77.8	0.58		45.6	SPLS 3_0,9_100.5 Ba (	93.3	84.7	59.8	0.76
312	0	70x70x6	S235	1M20-5.6t	0.55	0.55	0.55	108	-51.2	SPLS 3_90 Ba All Cts	76.5	58.8	64.8	0.87		17.6	SPLS 3_0,9_100.5 Ba /	82.9	58.8	52.4	0.34
313	0	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	27	0.0		788.4	117.6	216.0	0.00		14.8	SPLS 1a_100.5 Ah All (	766.1	117.6	0.0	0.13
314	0	70x70x6	S235	2M20-5.6t	0.55	0.55	0.55	105	-49.3	SPLS 3_100.5 Ba All Ct	98.3	117.6	129.6	0.50		32.3	SPLS 3_0,9_100.5 Ba /	84.5	117.6	91.6	0.38
315	0	80x80x6#	S235	2M20-5.6t	0.56	0.56	0.56	84	-43.4	SPLS 3_0,9_100.5 Ba (	135.3	117.6	129.6	0.37		53.3	SPLS 3_100.5 Ba All Ct	105.8	117.6	91.6	0.58
316	0	80x80x6#	S235	2M20-5.6t	0.57	0.57	0.57	78	-71.0	SPLS 3_100.5 Ba All Ct	141.6	117.6	129.6	0.60		64.4	SPLS 3_0,9_100.5 Ba /	117.2	117.6	91.6	0.70

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Assessment of groups for strengthened mast (afkeur level)

Date 22-04-21
Author KCh
Version 1.0

KIJ-GT 380
WB+0
37

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
317	0	100x65x11	S235	2M20-5.6t	2.00	2.00	2.00	81	0.0		250.7	117.6	237.6	0.00		56.8	ULS 3_0,9_100.5	191.5	117.6	232.8	0.48
318	0	70x70x7	S235	1M24-5.6t	1.00	1.00	1.00	63	-42.6	SPLS 3_100.5 Ba Ct2	119.1	84.7	90.7	0.50		21.9	SPLS 3_0,9_100.5 Ba (	88.7	84.7	57.8	0.38
319	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	89	-14.9	ULS 1a_79.5	53.2	37.7	43.2	0.40		0.0		37.4	37.7	22.0	0.00
320	0	HEA160	S235		1.00	1.00	1.00	13	0.0		825.9	0.0	0.0	0.00		8.9	ULS 1a_100.5	916.5	0.0	0.0	0.01
321	0	120x120x11	S235	2M24-5.6t	1.00	1.00	1.00	114	-159.8	SPLS 3_0,9_100.5 Ah (	286.0	169.4	285.1	0.94		162.6	SPLS 3_100.5 Ah Ct1	306.2	169.4	243.7	0.96
322	0	60x60x5	S235	1M20-5.6t	1.00	1.00	1.00	325	-1.6	SPLS 6a_90 Ah Ct2 Ah	12.6	58.8	54.0	0.13		0.0		54.7	58.8	37.0	0.00
323	0	50x50x5	S235	1M16-5.6t	0.52	0.52	0.52	168	-1.5	SPLS 1a_0 Ah All Cts	27.7	37.7	43.2	0.05		5.0	ULS 3_0,9_135	37.4	37.7	22.0	0.23
324	0	65x50x5	S235	1M20-5.6t	1.00	1.00	1.00	217	-3.9	ULS 3_0,9_90	22.2	58.8	54.0	0.18		0.3	SPLS 1a_135 Ah All Cts	54.7	58.8	27.7	0.01
400	0	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	117	-57.8	SPLS 3_90 Ba Ct1	128.0	117.6	129.6	0.49		27.7	SPLS 3_0,9_90 Ba All (	143.8	117.6	104.7	0.26
401	0	HEA160	S235	2M20-5.6t	9.46	9.46	9.46	64	0.0		649.2	117.6	216.0	0.00		19.3	ULS 1a_0	766.1	117.6	0.0	0.16
402	0	100x100x6	S235	2M20-5.6t	0.55	0.55	0.55	100	-54.3	SPLS 3_90 Ba All Cts	148.2	117.6	129.6	0.46		43.7	SPLS 3_0,9_90 Ba Ct1	168.5	117.6	104.7	0.42
403	0	80x80x6#	S235	2M20-5.6t	0.55	0.55	0.55	94	-45.5	SPLS 3_0,9_90 Ba All (	124.7	117.6	129.6	0.39		50.9	SPLS 3_90 Ba All Cts	121.0	117.6	104.7	0.49
404	0	80x80x8	S235	2M20-5.6t	0.55	0.55	0.55	93	-69.1	SPLS 3_90 Ba Ct1	164.6	117.6	172.8	0.59		59.7	SPLS 3_0,9_100.5 Ba /	166.1	117.6	139.6	0.51
405	0	HEA160	S235	2M20-5.6t	1.00	1.00	1.00	42	-29.6	ULS 7	735.1	117.6	216.0	0.25		31.5	ULS 7	766.1	117.6	0.0	0.27
406	0	65x65x7	S235	2M20-5.6t	0.55	0.55	0.55	83	-59.0	SPLS 3_100.5 Ba All Ct	125.7	117.6	151.2	0.50		57.2	SPLS 3_0,9_100.5 Ba (	94.9	117.6	119.1	0.60
407	0	100x100x12	S235	2M20-5.6t	1.00	1.00	1.00	78	0.0		342.6	117.6	259.2	0.00		28.3	ULS 3_90	278.4	117.6	259.2	0.24
408	0	100x100x12	S235	2M20-5.6t	2.00	1.00	1.00	47	-19.3	SPLS 1a_0 Ba Ct2	401.9	117.6	259.2	0.16		23.2	SPLS 3_0,9_100.5 Ba (	278.4	117.6	259.2	0.20
409	0	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	82	-22.5	SPLS 3_0,9_90 Ba Ct1	79.5	58.8	64.8	0.38		21.9	SPLS 1a_0,9_0 Ba Ct2	65.7	58.8	44.4	0.49
410	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	107	-6.8	ULS 1a_0	46.0	37.7	43.2	0.18		6.3	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.29
411	0	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	100	-6.1	ULS 1a_0,9_0	48.5	37.7	43.2	0.16		6.3	ULS 1a_0	37.4	37.7	22.0	0.28
412	0	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	94	-6.7	ULS 1a_0,9_0,9_0	51.1	37.7	43.2	0.18		6.7	ULS 1a_0,9_0	37.4	37.7	22.0	0.30
413	0	50x50x5	S235	1M16-5.6t	0.56	0.56	0.56	95	-9.1	ULS 1a_0	50.6	37.7	43.2	0.24		7.7	ULS 1a_0,9_0,9_0	37.4	37.7	22.0	0.35
414	0	HEA160	S235	2M20-5.6t	2.00	2.00	2.00	30	-4.1	ULS 1a_0	777.9	117.6	216.0	0.04		2.1	ULS 1a_0,9_0	766.1	117.6	0.0	0.02
415	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	83	-9.6	SPLS 1a_0,9_0 Ah Ct1	55.1	37.7	43.2	0.26		16.4	SPLS 1a_0 Ah All Cts	37.4	37.7	22.0	0.53
416	0	**70x70x7**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	182	-26.6	SPLS 1a_0 Ah All Cts	54.9	60.3	82.3	0.48		13.6	SPLS 1a_0,9_0 Ah Ct1	71.3	60.3	42.0	0.32
417	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	168	-2.0	ULS 1a_0,9_0,9_0	27.8	37.7	43.2	0.07		11.0	ULS 1a_0	37.4	37.7	22.0	0.50
418	0	75x75x7#	S235	1M16-5.6t	1.00	1.00	1.00	236	-20.3	SPLS 1a_0 Ah Ct1	36.4	37.7	60.5	0.56		4.7	SPLS 1a_0,9_0 Ah All (	114.9	37.7	44.8	0.12
419	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	81	-3.2	SPLS 1a_0,9_0 Ah All (	55.7	37.7	43.2	0.09		8.4	SPLS 1a_0 Ah Ct1	37.4	37.7	22.0	0.38
420	0	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	206	-9.6	SPLS 1a_0 Ba Ct1	21.0	37.7	43.2	0.46		6.3	SPLS 1a_0,9_0 Ba All (	37.4	37.7	22.0	0.29
421	0	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	191	-6.6	SPLS 6a_90 Ba All Cts	23.4	37.7	43.2	0.28		10.0	SPLS 1a_0 Ba Ct1	37.4	37.7	22.0	0.45
422	0	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	179	-10.5	SPLS 1a_0 Ba Ct1	25.6	37.7	43.2	0.41		7.8	SPLS 6a_90 Ba All Cts	37.4	37.7	22.0	0.35
423	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	215	-2.9	SPLS 6a_90 Ba Ct1 Ba	19.7	37.7	43.2	0.15		0.0		37.4	37.7	22.0	0.00
424	0	60x60x6	S235	1M20-5.6t	1.00	1.00	1.00	343	-13.6	ULS 1a_0,9_0	13.7	58.8	64.8	0.99		22.3	ULS 1a_0	65.7	58.8	44.4	0.50
425	0	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	144	-8.9	SPLS 6a_90 Ba All Cts	33.6	37.7	43.2	0.27		8.6	SPLS 6a_90 Ba Ct2 Ah	37.4	37.7	22.0	0.39
426	0	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	139	-10.4	SPLS 6a_90 Ba All Cts	35.1	37.7	43.2	0.30		10.8	SPLS 6a_90 Ba All Cts	37.4	37.7	22.0	0.49
427	0	50x50x5	S235	1M16-5.6t	0.55	0.55	0.55	123	-12.3	SPLS 6a_90 Ba All Cts	40.2	37.7	43.2	0.33		11.6	SPLS 6a_90 Ba All Cts	37.4	37.7	22.0	0.53
428	0	60x60x5	S235	1M16-5.6t	0.55	0.55	0.55	107	-16.4	SPLS 6a_90 Ba All Cts	55.4	37.7	43.2	0.44		17.5	SPLS 6a_90 Ba All Cts	60.5	37.7	32.0	0.55
429	0	60x60x5	S235	1M16-5.6t	0.55	0.55	0.55	94	-22.9	SPLS 6a_90 Ba Ct2 Ah	61.4	37.7	43.2	0.61		21.1	SPLS 6a_90 Ba All Cts	60.5	37.7	32.0	0.66
430	0	60x60x5	S235	2M16-5.6t	0.56	0.56	0.56	90	-28.1	SPLS 6a_90 Ba All Cts	79.4	75.4	86.4	0.37		31.4	SPLS 6a_90 Ba All Cts	61.2	75.4	64.0	0.51
431	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	286	-2.6	SPLS 1a_100.5 Ba All (	12.8	37.7	43.2	0.21		0.0		37.4	37.7	22.0	0.00
432	0	120x120x8	S235	1M24-5.6t	2.00	1.00	1.00	173	-56.3	ULS 1a_0	111.7	84.7	103.7	0.67		25.9	ULS 1a_0,9_0,9_0	216.6	84.7	88.6	0.31
433	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	270	0.0		14.0	37.7	43.2	0.00		1.3	ULS 1a_135	37.4	37.7	22.0	0.06
434	0	UNP160	S235		1.00	1.00	1.00	42	0.0		378.8	0.0	0.0	0.00		29.0	ULS 3_0,9_90	564.0	0.0	0.0	0.05
435	0	120x120x8	S235	2M24-5.6t	1.00	1.00	1.00	88	-153.9	SPLS 3_0,9_100.5 Ah (	262.2	169.4	207.4	0.91		155.2	SPLS 3_100.5 Ah Ct1	226.0	169.4	177.2	0.92
436	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	305	-0.9	ULS 3_0	11.5	37.7	43.2	0.08		0.0		37.4	37.7	22.0	0.00
437	0	100x100x6	S235	4M24-5.6t	2.00	1.00	1.00	96	-80.4	SPLS 3_0,9_100.5 Ah (	142.4	338.9	311.0	0.56		146.1	SPLS 6a_90 Ah Ct1 Ah	225.0	338.9	265.8	0.65
490	0	HEA160	S235	2M20-5.6t	2.00	2.00	2.00	13	-4.2	ULS 1a_0	825.3	117.6	216.0	0.04		79.0	ULS 3_0,9_90	916.5	0.0	0.0	0.09
491	0	HEA160	S235	2M20-5.6t	2.00	2.00	2.00	8	-5.4	ULS 1a_0	834.0	117.6	216.0	0.05		2.4	ULS 7	766.1	117.6	0.0	0.02
440	0	50x50x5	S235	1M16-5.6t	1.00	1.00	1.00	117	0.0		42.1	37.7	43.2	0.00		0.3	ULS 1a_0	37.4	37.7	22.0	0.01

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Assessment of groups for strengthened mast (verbouw level)

Date 22-04-21
Author KCh
Version 1.0

KIJ-GT 380
WB+0
37

Staafgroep	Omschrijving	Profiel	Staalsoort	Bouten	RLX	RLY	RLZ	Slankheid	Druk	Combinatie druk	Knik	Afschuiving	Stuik (druk)	U.C. (druk)	Opm.	Trek	Combinatie trek	Nettodsn.	Afschuif	Stuik (trek)	U.C. (trek)
206L		150x150x10	**S355**	**6M24-8.8t**	0.56	0.28	0.28	70	**-422.1**	SPLS 3_0,9_100.5 Ah (	575.5	813.3	1058.4	0.73		**410.6**	SPLS 3_100.5 Ah Ct2	523.3	813.3	732.7	0.78
206T		150x150x10	**S355**	**6M24-8.8t**	0.56	0.28	0.28	70	**-439.9**	SPLS 6a_90 Ba Ct1 Ah	575.5	813.3	1058.4	0.76		**406.4**	SPLS 3_0,9_100.5 Ah (	523.3	813.3	732.7	0.78
416		**70x70x7**	**S355**	**1M16-8.8t**	1.00	1.00	1.00	182	**-29.8**	ULS 1a_0	54.9	60.3	82.3	0.54		**16.1**	ULS 1a_0,9_0,9_0	71.3	60.3	42.0	0.38

APPENDIX C   REDUNDANT MEMBERS CHECK

Knikverkorters initial construction (afkeur)

Date: 2020-08-04
Author: Muhammed Khan
Version: 1.8

KIJ-GT
WB+0
37

Posnr.	Section	Schematization	Profile	Steel Quality	Bolt	Quality	Length (m)	Angle (°)	Slenderness (-)	Normal Force (kN)	Moment (kNm)	Buckling Cap. (kN)	Shear Cap. Bolt (kN)	Bearing Cap. (kN)	Net Section Cap. (kN)	Moment Cap. (kNm)	Highest U.C.	Exceedance Type
13	Broekstuk	Enkele staaf	L50.5	S235	M16	5.6	0.58	0	59	**19.8**	**0.14**	61.8	37.7	30.3	31.7	0.72	0.65	
18	Broekstuk	Enkele staaf	L60.5	S235	M16	5.6	1.69	79	143	**19.8**	**0.00**	40.9	37.7	32.0	60.5	1.05	0.62	
11	Broekstuk	Enkele staaf	L50.5	S235	M16	5.6	1.24	0	127	**19.8**	**0.31**	38.7	37.7	30.3	31.7	0.72	0.65	
17	Broekstuk	Enkele staaf	L60.5	S235	M16	5.6	1.91	57	163	**19.8**	**0.00**	35.1	37.7	32.0	60.5	1.05	0.62	
10	Broekstuk	Enkele staaf	L60.6	S235	M16	5.6	1.89	0	162	**19.8**	**0.47**	41.8	37.7	38.4	72.6	1.24	0.52	
16	Broekstuk	Enkele staaf	L70.6	S235	M16	5.6	2.31	44	169	**19.8**	**0.00**	46.7	37.7	38.4	89.9	1.71	0.52	
9	Broekstuk	Enkele staaf	L70.6	S235	M16	5.6	2.55	0	186	**19.8**	**0.64**	41.0	37.7	38.4	89.9	1.71	0.52	
15	Broekstuk	Enkele staaf	L70.6	S235	M16	5.6	2.82	34	205	**19.8**	**0.00**	35.7	37.7	38.4	89.9	1.71	0.55	
8	Broekstuk	Enkele staaf	L80.6	S235	M16	5.6	3.21	0	204	**19.8**	**0.80**	41.4	37.7	38.4	107.1	2.25	0.52	
14	Broekstuk	Enkele staaf	L80.6	S235	M16	5.6	3.22	27	204	**19.8**	**0.72**	41.3	37.7	38.4	107.1	2.25	0.52	
23	Pootverband	Enkele staaf	L50.5	S235	M16	5.6	1.31	0	135	**3.5**	**0.33**	36.2	37.7	30.3	31.7	0.72	0.46	
26	Pootverband	Enkele staaf	L50.5	S235	M16	5.6	2.83	77	291	**3.5**	**0.00**	12.5	37.7	30.3	31.7	0.72	0.28	
22	Pootverband	Kniksteun en verticale steun	L50.5	S235	M16	5.6	2.73	0	180	**3.5**	**0.34**	20.3	37.7	30.3	31.7	0.54	0.66	
25	Pootverband	Enkele staaf	L50.5	S235	M16	5.6	3.05	64	314	**3.5**	**0.00**	11.0	37.7	30.3	31.7	0.72	0.32	
21	Pootverband	Kniksteun en verticale steun	L50.5	S235	M16	5.6	4.14	0	274	**3.5**	**0.52**	11.6	37.7	30.3	31.7	0.54	1.00	
24	Pootverband	Enkele staaf	L60.5	S235	M16	5.6	3.39	51	288	**3.5**	**0.00**	15.3	37.7	32.0	60.5	1.05	0.23	
69	Eerste TSNSTUK	Enkele staaf	L70.5	S235	M16	5.6	2.48	38	180	**19.7**	**0.00**	36.0	37.7	32.0	74.9	1.78	0.62	
59	Eerste TSNSTUK	Enkele staaf	L60.5	S235	M16	5.6	1.92	0	164	**19.7**	**0.48**	34.7	37.7	32.0	60.5	1.05	0.62	
60	Eerste TSNSTUK	Enkele staaf	L50.5	S235	M16	5.6	1.51	0	155	**19.7**	**0.38**	30.7	37.7	30.3	31.7	0.72	0.65	
70	Eerste TSNSTUK	Enkele staaf	L60.5	S235	M16	5.6	2.17	52	184	**19.7**	**0.00**	29.7	37.7	32.0	60.5	1.05	0.66	
61	Eerste TSNSTUK	Enkele staaf	L80.6	S235	M16	5.6	2.97	0	189	**19.7**	**0.74**	46.3	37.7	38.4	107.1	2.25	0.52	
71	Eerste TSNSTUK	Enkele staaf	L60.5	S235	M16	5.6	2.12	40	180	**19.7**	**0.00**	30.6	37.7	32.0	60.5	1.05	0.65	
62	Eerste TSNSTUK	Enkele staaf	L50.5	S235	M16	5.6	1.54	0	158	**19.7**	**0.39**	29.9	37.7	30.3	31.7	0.72	0.66	
63	Tweede TSNSTUK	Enkele staaf	L50.5	S235	M16	5.6	1.25	0	128	**15.9**	**0.31**	38.2	37.7	30.3	31.7	0.72	0.52	
72	Tweede TSNSTUK	Enkele staaf	L50.5	S235	M16	5.6	1.79	52	183	**15.9**	**0.00**	24.7	37.7	30.3	31.7	0.72	0.64	
64	Tweede TSNSTUK	Enkele staaf	L60.6	S235	M16	5.6	2.39	0	204	**15.9**	**0.60**	30.5	37.7	38.4	72.6	1.24	0.52	
73	Tweede TSNSTUK	Enkele staaf	L50.5	S235	M16	5.6	1.74	40	178	**15.9**	**0.00**	25.6	37.7	30.3	31.7	0.72	0.62	
65	Tweede TSNSTUK	Enkele staaf	L50.5	S235	M16	5.6	1.28	0	131	**15.9**	**0.32**	37.3	37.7	30.3	31.7	0.72	0.52	
66	Tweede TSNSTUK	Enkele staaf	L50.5	S235	M16	5.6	1.00	0	102	**15.9**	**0.25**	47.6	37.7	30.3	31.7	0.72	0.52	
74	Tweede TSNSTUK	Enkele staaf	L60.5	S235	M16	5.6	1.42	52	121	**15.9**	**0.00**	49.4	37.7	32.0	60.5	1.05	0.50	
67	Tweede TSNSTUK	Enkele staaf	L50.5	S235	M16	5.6	1.89	0	194	**15.9**	**0.47**	22.9	37.7	30.3	31.7	0.72	0.69	
75	Tweede TSNSTUK	Enkele staaf	L50.5	S235	M16	5.6	1.38	40	142	**15.9**	**0.00**	34.2	37.7	30.3	31.7	0.72	0.52	
68	Tweede TSNSTUK	Enkele staaf	L50.5	S235	M16	5.6	1.03	0	105	**15.9**	**0.26**	46.4	37.7	30.3	31.7	0.72	0.52	
20	Tussenschot	Kniksteun en verticale steun	L60.5	S235	M16	5.6	5.39	0	294	**2.0**	**0.67**	12.6	37.7	32.0	60.5	0.81	0.87	
27	Tussenschot	Kruisende staaf halverwege	L70.5	S235	M16	5.6	7.86	0	368	**2.0**	**0.98**	10.5	37.7	32.0	74.9	1.78	0.55	

APPENDIX D ANCHOR CHECKS AND OTHER CALCULATIONS

ANCHORS WB+0

Drawings provided for tower structure WB+0 don't include anchors. However, from other data it can be deduced that 6 anchor bolts are present. The figures below are based on the EA+0 structure. The position of anchor bolts and plate thickness have been verified by a field study[1]. The tower legs are connected to the foundation with a 550x800x75 mm foot plate and six anchors with diameter 65 mm.

The anchor rods are connected to a horizontal rod "schieter" which allows for distribution of the tensile force to the concrete.

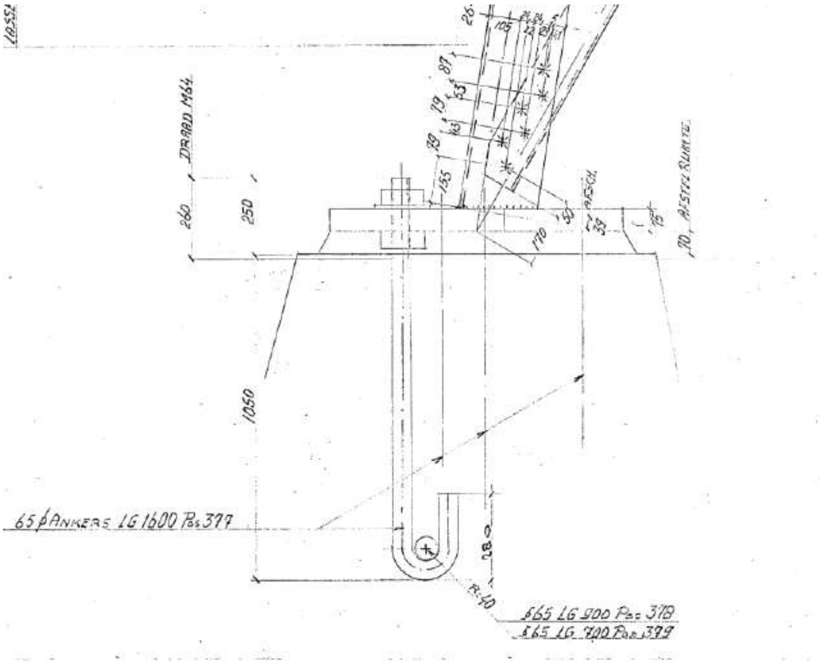

Figure 1 Anchor detail

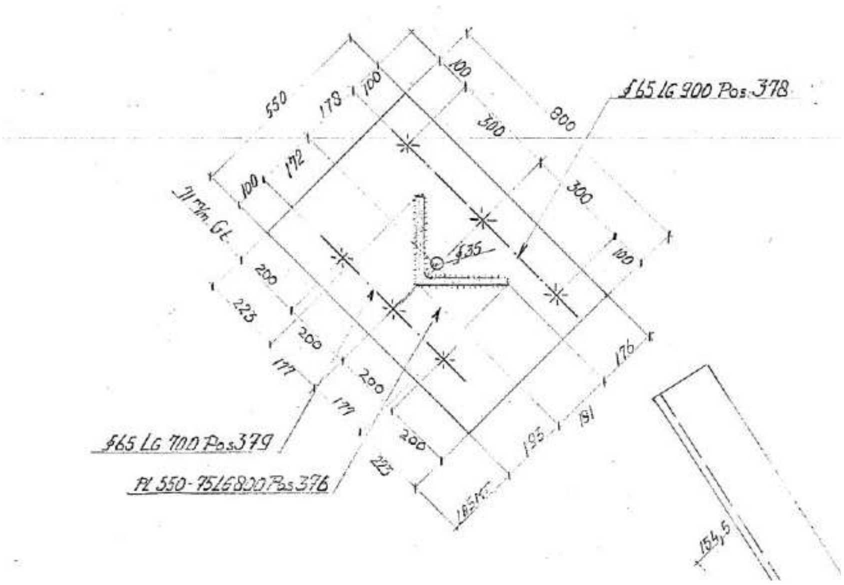

Figure 2 Anchor footplate

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[1] Rapport Bejan Bouw en Betontechniek d.d. 4-11-2020; 200152A-003 Krimpen aan den IJssel - Geertruidenberg v1.0.pdf

Loads

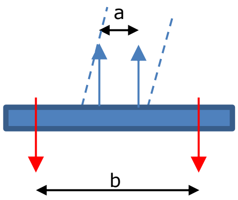
The loads generated on the tower are based on WB+0 structure number 37 in wind zone II:

Envelope of load combinations for all of the legs

Index	Combination	R_x [kN]	R_y [kN]	R_z [kN]	R_η [kN]	R_ξ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. pressure	SPLS 1a_90 Ba All Cts	245	257	**1439**	-9	-355	-37	1474
Max. tension	SPLS 1a_0,9_90 Ba All Cts	202	213	**-1189**	8	293	31	-1217
Max. pos. torsie	SPLS 6a_90 Ba Ct1 Ah Ct1	9	212	-630	**143**	156	17	-646
Max. neg. torsie	SPLS 3_100.5 Ah Ct1	-7	215	-621	**-147**	157	20	-636
Comb. tension+torsie	SPLS 1a_0,9_90 Ba Ct1	69	243	**-877**	**123**	220	27	-898

Footplate and anchors

The strength of the foot plate will be determined assuming a horizontal yield line across the length of the plate. The tensile force is distributed to two point loads each separated by half of the diagonal width of the tower leg.



Figuur 1 Scheme for check of foot plate

a: $1/2 \cdot 250 / \sqrt{2} = 88$ mm

b: 350 mm

The eccentricity becomes $1/2 \cdot (350-88) = 131$ mm

In the spreadsheet the anchor bolts and foot plate have been checked. The concrete strength is assumed to be equal or more than C20/25. This assumption is higher than what would be derived for old designation K225 but has been verified with concrete cylinder tests. Refer to aforementioned investigation report. The foot plate is embedded in concrete. The anchor bolts will not be loaded by bending.

The tower fulfills the required strength. See the output:

Tower 37: U.C. = 194 / 655 = 0,30 ≤ 1,00 OK

Conclusion: The foot plates of tower structure WB+0 have sufficient strength.

DNV·GL

Project: Krimpen - Geertruidenberg 380

Date: 30-11-2020
Version: 2.6

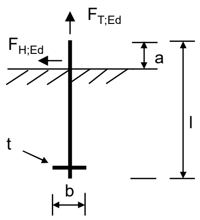
Anchors

NEN-EN 1992-1-1 and 1993-1-8 with NA
CUR-BmS 10

Subject:	**WB II**	**Checks:**		
		Anchor bolt to tension	0,30	***OK***
		Anchor bolt to shear	0,21	***OK***
		Dowel ("schieter")	0,42	***OK***

Inputs

Anchor diameter		**M64**	
Achor quality		**4.6**	
Thread		Cut	
Anchor length	l =	1300	mm
Anchor length above concrete	a =	250	mm



Load on anchor group

T: the external tension force on the anchor group

Tension force	T =	**1161**	kN
Shear force	$F_{H,Ed}$ =	**336**	kN
Number of anchors for tension		6	
Number of anchors for shear		6	
$F_{T;Ed} = T / n$ =		193,5	kN
$F_{v;Ed} = F_{H,Ed} / n$ =		56,0	kN

Anchor properties

d_b =	64,00	mm
$A_{b;s}$ =	2676	mm^2
f_{yb} =	240	N/mm^2
f_{ub} =	400	
γ_{Mb}	1,25	-
$\alpha_{red;2}$	0,85	-
$\alpha_b = 0{,}44 - 0{,}0003 f_{yb}$ =	0,37	-

Capacity per anchor

$F_{T;Rd} = 0{,}9\alpha_{red;2} f_{ub} A_s / g_{M2}$ =	**655,1**	kN
$F_{v;Rd} = \alpha_b f_{ub} A_s / g_{Mb}$ =	**267,9**	kN

Foot plate

$F_{t,Rd}$: the tensile force in the anchors when yielding of foot plate is reached.

Steel material		**S235**	
Thickness	t =	75	mm
Width	b_{ef} =	267	mm
Leverage arm	m =	131	mm
$M_{pl,Rd} = 1/4 b_{ef} t_p^2 f_{yd}$ =		88,2	kNm
$F_{t,Rd} = M_{pl,Rd} / m$ =		673,6	kN

Check of dowel ("schieter")

$$\frac{\sigma_b'}{f_{cd}} = \frac{12{,}8}{40{,}0} = 0{,}32 \quad \textit{OK}$$

$$\frac{F_{T,Ed}}{F_{v;Rd}} = \frac{194}{460} = 0{,}42 \quad \textit{OK}$$

Capacity of concrete

Concrete strength		**C20/25**	
f_{ck} =		20	N/mm^2
k_b =		3	-
γ_{Mc} =		1,5	-
$f_{cd} = f_{ck} k_b / \gamma_{Mc}$ =		40	MPa

Dowel

Diameter	d_S =	**65**	mm
Length	b =	**233**	mm
Spread	$c = t\sqrt{(f_{yd} / 3f_{jd})}$ =	92	mm
Effective length	b_{eff} = min(b; d+2c)	233	mm
Cross section	$A_S = \pi/4\ d_S^2$ =	3318	mm^2
Distributed load	$q = F_{T,Ed} / b_{eff}$ =	830	kN/m
Concrete pressure	$\sigma_b' = q / d_S$ =	12,8	MPa

Shear stress in dowel

Load	$F_{T,Ed}$ =	194	kN
Allowable	$F_{v,Rd} = f_{yd} / \sqrt{3} \times A_s$ =	460	kN

Capacity of foot plate

$$\frac{F_{T,Ed}}{F_{t;Rd}} = \frac{193{,}5}{673{,}6} = 0{,}29 \quad \textit{OK}$$

Capacity of anchor for tension

$$\frac{F_{T,Ed}}{F_{T;Rd}} = \frac{193{,}5}{655{,}1} = 0{,}30 \quad \textit{OK}$$

Check foot plate for tension

$$\frac{T}{n \times F_{t;Rd}} = \frac{1161{,}0}{4041{,}3} = 0{,}29 \quad \textit{OK}$$

Check anchor for shear

$$\frac{F_{v,Ed}}{F_{v;Rd}} = \frac{56{,}0}{267{,}9} = 0{,}21 \quad \textit{OK}$$

CALCULATION OF POST INSULATOR LOADS

The following parameters are calculated:

- The forces on the insulator attachment due to wind loading and weight
- The required measurements of the components

The diagram below is a representation of the loads on the insulator:

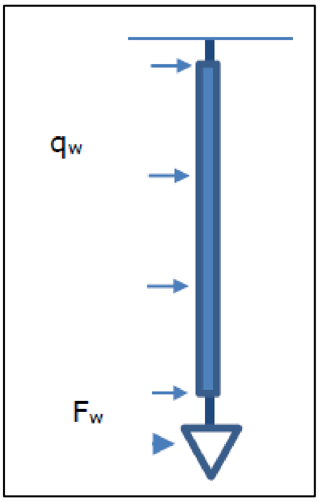


Figure 1: Diagrammatic representation of the loads on the post insulator

Forces on the insulator attachment

Wind pressure based on non-urban terrain in wind zone II at a height of 39 m: q_h = 1,29 kN/m^2

Wind load per meter based on an insulator diameter of 0,2 m and a drag factor of 1,2:

<u>q_w</u> = 1,2 x 0,2 x 1,29 = 0,31 kN/m

F_w = 2 x 4 m x 0,31 kN/m = 2,48 kN

Conductor with C_c = 0,9:

F_w based on a supported length of 9 m and a structural factor of 1:
F_w = 9 x 1 x 0,9 x 3 x 0,036 x 1,29 = 1,128 kN

<u>Invoer geleiderbelastingen:</u>

Wind area = 2 x 4 m x 0,2 m = 1,6 m^2

Conductor wind area: 9 m x 3 x 0,036 = 1,0 m^2

Total wind area for geleiderbelasting sheet: 2,6 m^2

Calculation of vertical weight

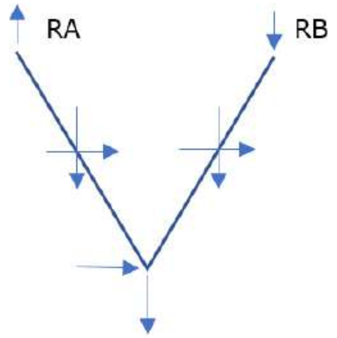
$F_{insulator}$ = 2 x 2,0 kN = 4 kN

$F_{conductor}$ = 9 m x 3 x 0,024 = 0,7 kN

Reaction Force

ΣM_B=0: -RA x 5 + 4 x 2,5 + 0,7 x 2,5 + 2,48 x 2 + 1,128 x 4 = 0

RA = 21,22 / 5 = 4,24 kN



Relatively small forces, pin connections based short circuit requirement suffices.

Check for bending of beams HEA160

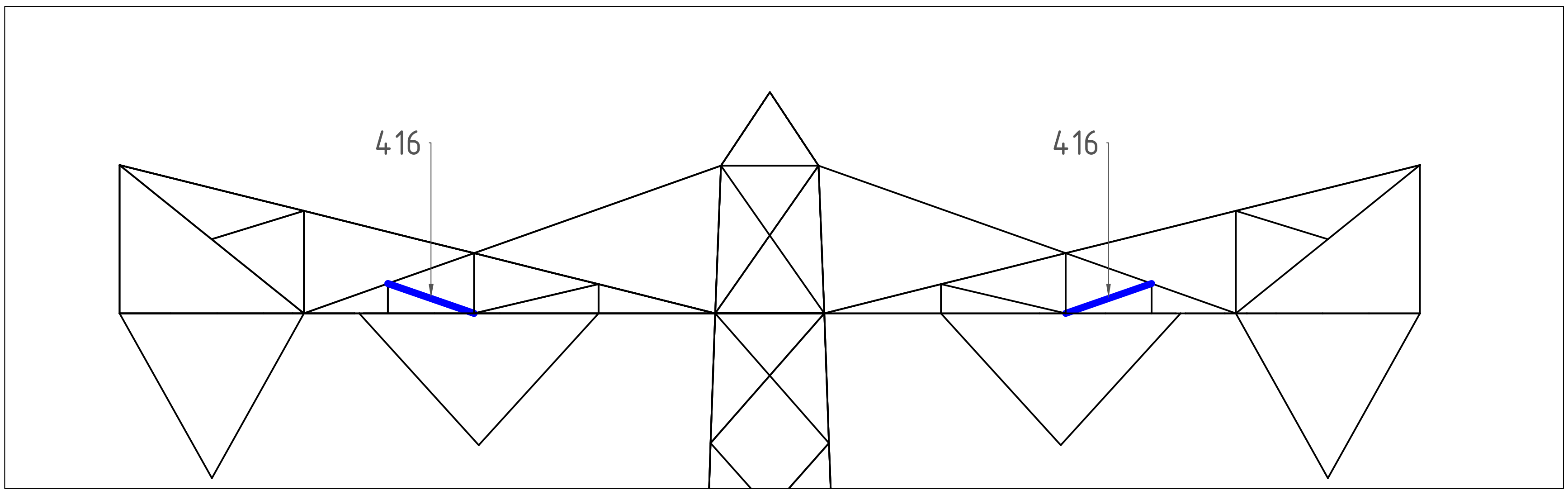
M = 0,6 x 4,24 = 2,6 kNm

M_{Rd} = 51,7 kNm

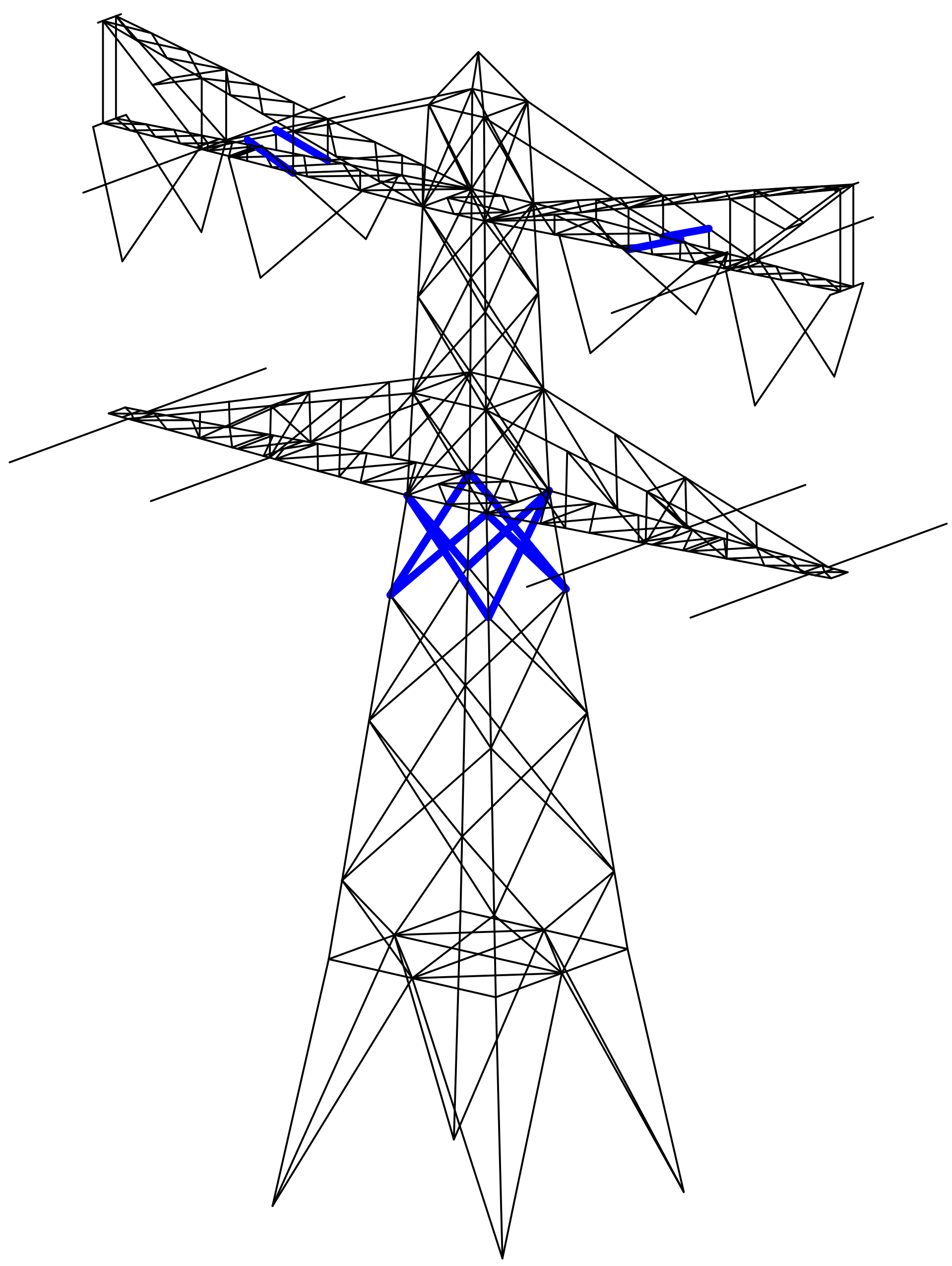
U.C = 2,6 / 51,7 = 0,1 < 1,0 OK.

APPENDIX E DRAWINGS

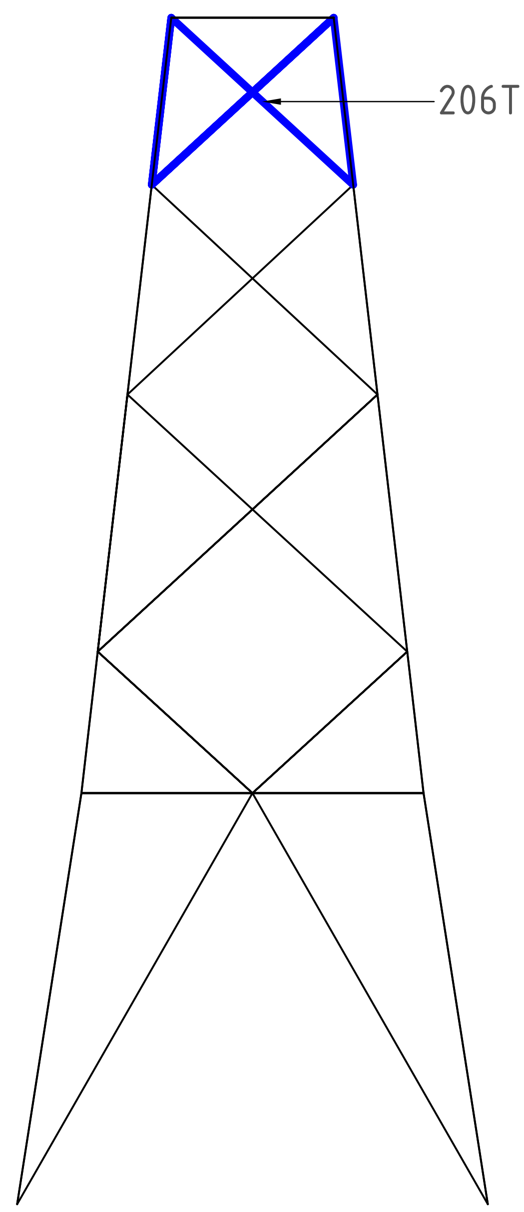
	Initial Profiles and Bolts				Final Profiles and Bolts			
Group label	Profile type (ini)	Profile size (ini)	Steel quality (ini)	Bolt size and quality (ini)	Profile type (new)	Profile size (new)	Steel quality (new)	Bolt size and quality (new)
206T	EA	L150x10	S235 t<=40	M24-5.6t-NEN2012	EA	L150x10	S355 t<=40	M24-8.8t-NEN2012
206L	EA	L150x10	S235 t<=40	M24-5.6t-NEN2012	EA	L150x10	S355 t<=40	M24-8.8t-NEN2012
416	EA	L50x5	S235 t<=40	M16-5.6t-NEN2012	EA	L70x7	S355 t<=40	M16-8.8t-NEN2012



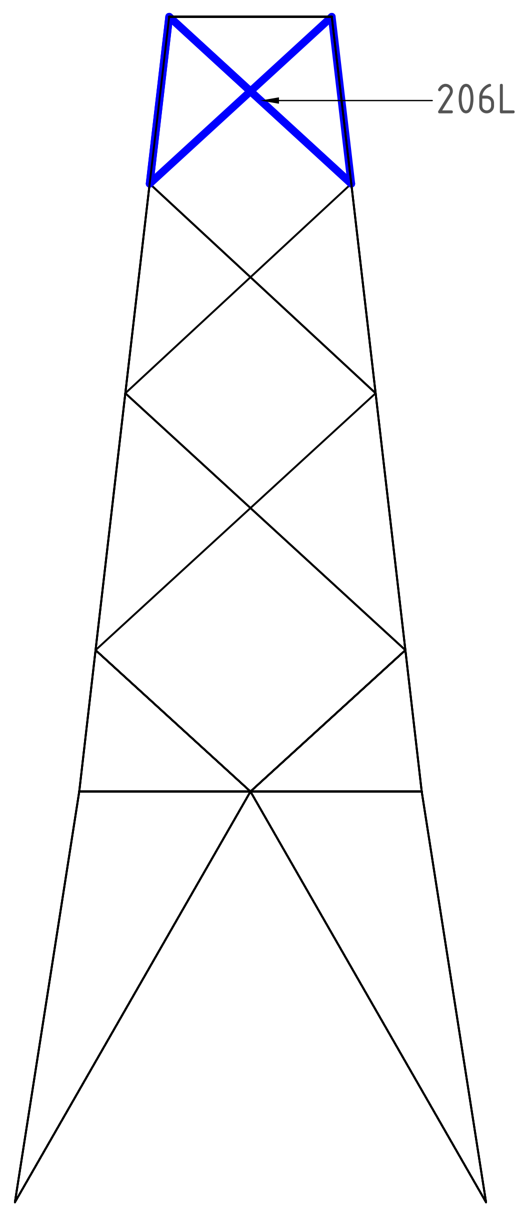
Front View - Upper Crossarm



Overview



Side View



Front View

Notes and legend:

- New redundants according to drawing
- Size for new redundants is 50x50x5
- Other changes according to the table
- All changes are symmetrical unless otherwise indicated
- Material quality t ≤ 16mm S355J0
- Material quality t > 16mm S355J2
- Bolt quality 8.8 rolled

Profile exchanged
New redundant
Bolt exchanged

01	22-04-2021	Dimension added
00	04-08-2020	Version 1.0

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Projectname: Mast constructions KIJ - GT 380 kV

Third angle projection:

Drawing no.: 10166260-022

Design state: FINAL		Scale: -	Description: Modifications overview for mast type WB+0 (mast 37) page 1 of 2	Revision: 01
Drawn by: KCh	22-04-2021	Units: m		
Checked by: TBR	22-04-2021	Project no: 10166260		Format: A2
Approved by: JHu	22-04-2021	Company: TenneT		

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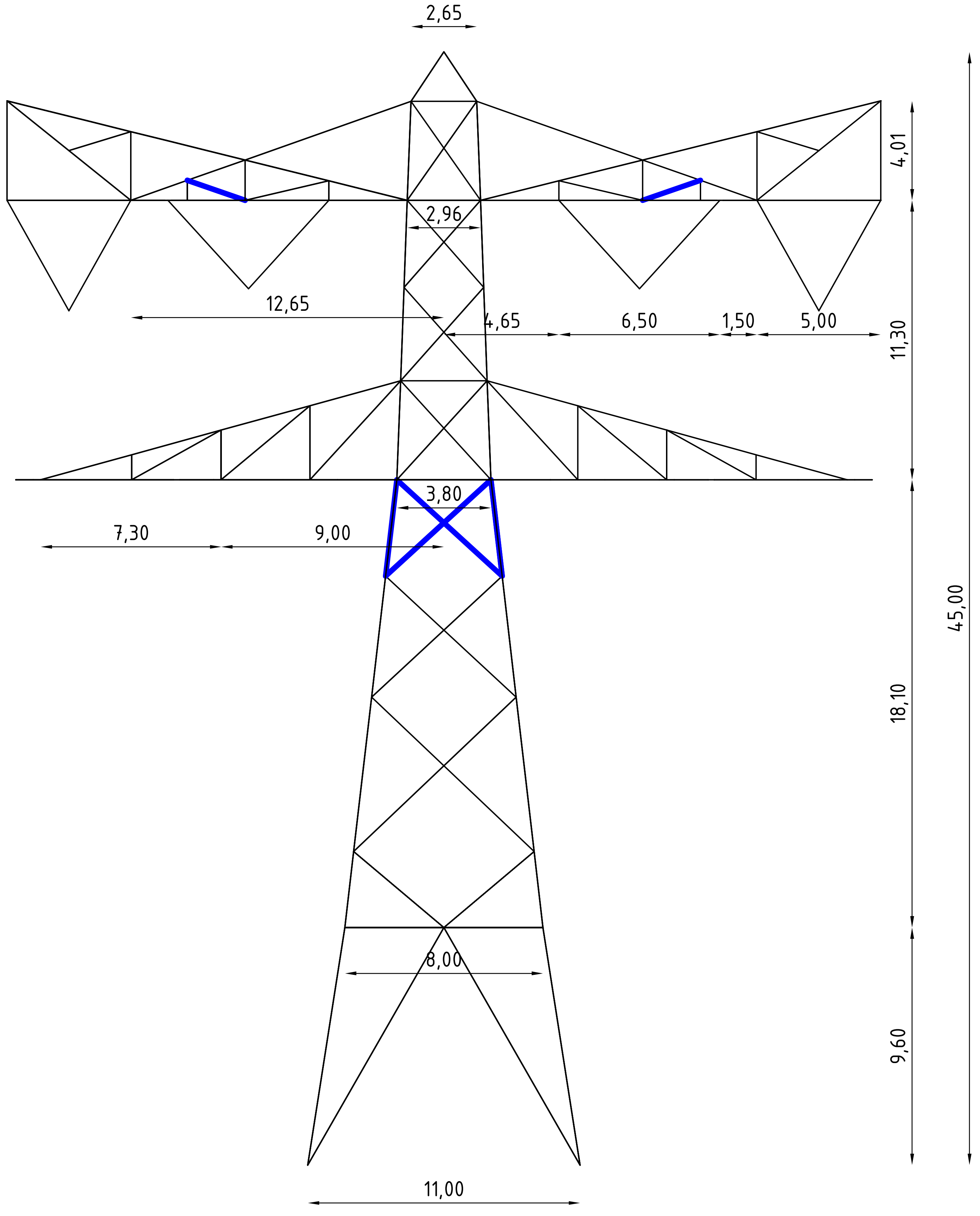
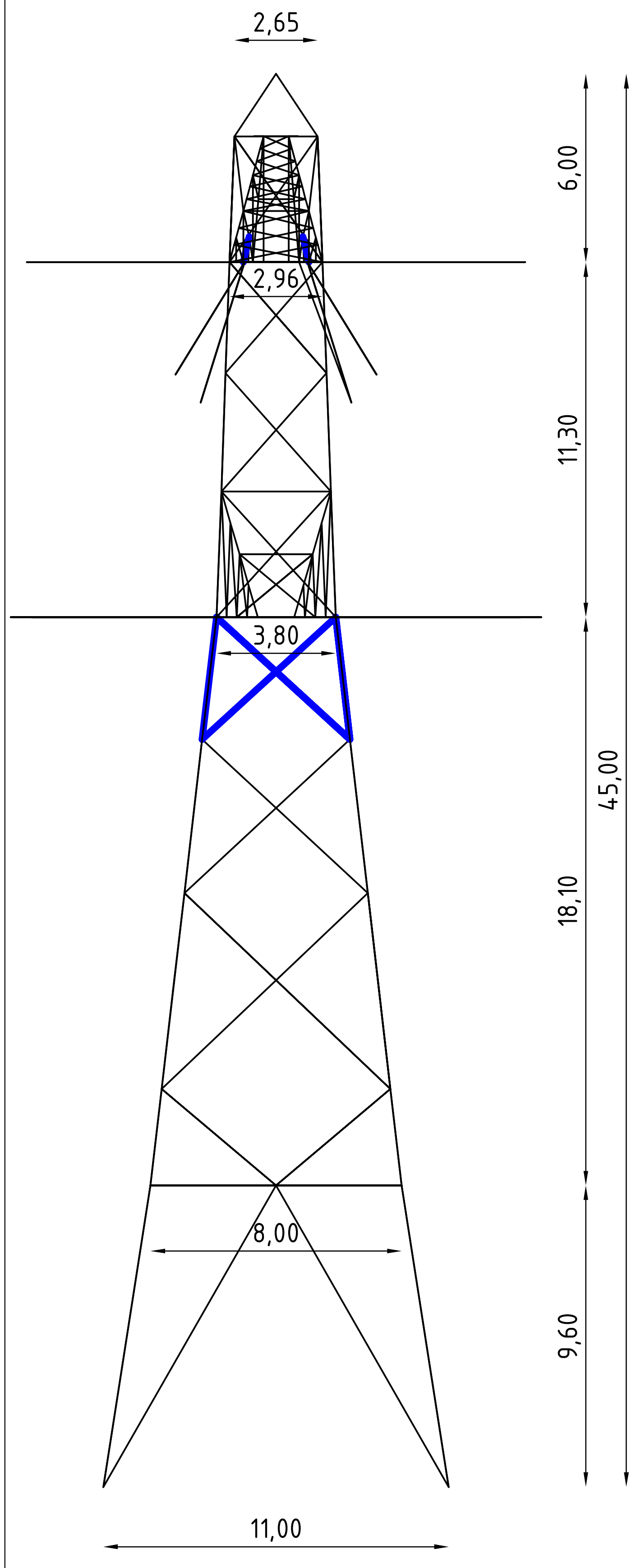


Front View



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