[redacted]

Van: [redacted]@shell.com
Verzonden: maandag 7 april 2014 12:47
Aan: evenementen
CC: [redacted]@shell.com; [redacted]@shell.com; [redacted]@shell.com
Onderwerp: RE: Z14-60058 Grasweg aanvulling evenemenent 'Viering 100 jaar Shell Technology Centre Amsterdam' 5 en 7-6-2014
Bijlagen: Brandveiligheidscertificaat - Flextent.pdf; Bouwboek Flextenten.pdf

Geachte heer [redacted], Beste [redacted],

In bijlage vindt u de aanvullende informatie over de flextenten.

Indien u nog vragen hebt over deze informatie kunt u contact met mij opnemen. De heer [redacted] is tot maandag 14 april 2014 afwezig.

Real Estate

Kind regards/Met vriendelijke groet,

[redacted]

Project & Services Coordinator
Eurest Services B.V.

Shell International B.V., The Hague, The Netherlands, Trade Register no. 27155369

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From: [redacted]@noord.amsterdam.nl] **On Behalf Of** evenementen
Sent: Friday, April 04, 2014 3:01 PM
To: [redacted]
Cc: evenementen
Subject: Z14-60058 Grasweg aanvulling evenemenent 'Viering 100 jaar Shell Technology Centre Amsterdam' 5 en 7-6-2014

Geachte heer [redacted],

Bij het stadsdeel Noord, gemeente Amsterdam hebben wij uw aanvraag ontvangen voor de viering 100 jaar Shell Technology Centre Amsterdam op 5 en 7 juni 2014. Uw aanvraag is niet volledig. Wij ontvangen de volgende gegevens van u:

- Constructiegegevens van de overkappingen.

Deze aanvullende ontvangen wij voor 11 april 2014.

In de bijlage vindt u de aanvullingsbrief en deze brief zal eveneens per post worden toegezonden.

Met vriendelijke groet,

[redacted]
Senior medewerker openbare orde
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Buikslotermeerplein 2000, 1025 XL Amsterdam
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E3 Fire Certificate of RHI ALLWEATHER MK4

Material should comply with the standards mentioned below (NTA 8020-40:206):

NTA 8020-40:2006

Tabel 1 — Klassen brandvoortplanting

Norm	Klasse	Herkomst	Druppelvorming
NEN 6065	2	Nederland	geen eisen
NEN-EN 13501-1	B	Europa	3 klassen: d0, d1, d2
DIN 4102-1	B1	Duitsland	moet worden vermeld in rapport (Brennendes Abtropfen)
NF P92-503	M2	Frankrijk	moet worden vermeld in rapport (Apparition de gouttes enflammées)

In NEN 6065, *Bepaling van de bijdrage tot brandvoortplanting van bouwmateriaal(combinaties)* worden geen eisen gesteld over de druppelvorming van het materiaal.

Indien geen druppelvorming optreedt tijdens de beproeving volgens DIN 4102-1 of NF P92-503, mag worden aangenomen dat het materiaal geen druppelvorming vertoont.

As the analysed structures are larger than 25 m^2.

RHI Stretch Tents and Marquees
Suite 8
Private Bag X16
Constantia, 7848
SOUTH AFRICA

your delivery of	your reference	our reference	date
2011-05-19		[redacted]	Zwijnaarde, 2011-06-16

Analysis Report 80245/B

Modification of analysis report 80245, made on 2011-06-09

Required tests :

NF P 92-503 (1995) - "Electric burner "
NF P 92-505 (1995) - "Test for melting materials"
NF P 92-507 (2004) – "Interior materials – Classification according to their reaction to fire"
French decree from 21 November 2002 - Reaction to fire tests on interior materials

Identification number	Information given by the client	Date of receipt
T105641	RHI ALLWEATHER MK4	2011-05-19

62

[redacted]

order responsible

For further information, please contact our sectorial adviser [redacted]

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The results of the analysis cover the received samples. Centexbel is not responsible for the representativeness of the samples.

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Reference : T105641 - RHI ALLWEATHER MK4

NF P 92-503 (1995) - "Electric burner "
French decree from 21 November 2002 - Reaction to fire tests on interior materials

End of tests: 7 June 2011

- The test specimens have not been cleaned nor submitted to an accelerated ageing procedure.

Conditioning
minimum 7 days at (23 ± 2) °C and (50 ± 5) % RH
or
until constant mass is achieved

	length		width	
	face A	face B	face A	face B
Hole formation due to melting	yes	yes	yes	yes
Max. afterflame time (s)	163	140	107	110
Afterglow	no	no	no	no
Afterglow with propagation in area > 25 cm	no	no	no	no
Damaged length (cm)	23	29	32,5	30
Damaged width in area >45 cm (cm)	/	/	/	/
Flaming molten droplets	no	no	no	no
Non-flaming molten droplets	yes	no	no	no
Flaming debris	no	no	no	no
Non-flaming debris	yes	no	yes	no

Average damaged length (cm)	28,5
Average damaged width in area >45 cm (cm)	0

63

Performed under accreditation as the fire lab under the responsibility of Pros Van Hoeyland.

Reference : T105641 - RHI ALLWEATHER MK4

NF P 92-505 (1995) - "Test for melting materials"
French decree from 21 November 2002 - Reaction to fire tests on interior materials

End of tests: 9 June 2011

- The test specimens have not been cleaned nor submitted to an accelerated ageing procedure.

Conditioning
minimum 7 days at (23 ± 2) °C and (50 ± 5) % RH
or
until constant mass is achieved

face A / face B	first ignition (s)	non-flaming debris	flaming debris	ignition cotton wool
1	82	no	no	no
2	*	no	no	no
3	66	no	no	no
4	58	no	no	no

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* no ignition

Conclusion: **M2**

Performed under accreditation in the fire lab under the responsibility of Pros Van Hoeyland.

Certificate of Test

NF6424

REPORT No.: FNF10135

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TEST FOR FLAMMABILITY OF MATERIALS IN ACCORDANCE WITH AS 1530.2-1993

TRADE NAME: RHI Allweather MK3

SPONSOR: RHI Tents
29 Boulevard Way
Capricorn Park, Mulzenberg
CAPE TOWN WC
SOUTH AFRICA

DESCRIPTION OF SAMPLE: The sponsor described the tested specimen as polyester knit fabric with PVC coating on the unexposed side. The PVC contained flame retardant additives.

Nominal total thickness: 1.5 mm
Nominal total mass: 750 g/m²
Colours: white

TEST PROCEDURE: Samples were tested in accordance with Australian Standard 1530 Part 2 - Test for Flammability of Materials - 1993. Nine (9) samples were tested in accordance with AS 1530.2-1993. The test results were based upon the samples with the uncoated polyester side out.

RESULTS: The following were obtained for the specimen:

	Maximum Flame Height	Time for Flame to Reach Top (t)	Area Under Curve (cm²)
Mean	5.2	N/A	3.04
Coefficient of Variance (%)	12.77	N/A	29.75

From which the following indices were obtained:

SPREAD Factor	SPEED Factor	HEAT Factor	FLAMMABILITY INDEX
5	N/A	1	6

The results of this fire test may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all fire conditions.

DATE OF TEST: 30 May 2011

Issued on the 31st day of May 2011 without alterations or additions.

[redacted]
Testing Officer

[redacted]
Manager, Fire Testing and Assessments

NATA

This document is issued in accordance with NATA's accreditation requirements.
Accreditation No. 165 – Corporate Site No. 3625

CSIRO

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14 Julius Avenue, Riverside Corporate Park, North Ryde NSW 2113 AUSTRALIA
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E4 Requirements for Textile connections [EN-13782 Annex C3.3]

EN 13782:2005 (E)

C.3.3 Textile connection

Common textile connections are:

— mechanic type (seam, elastic ropes, hooks, plates, zips, stichings);

— chemical - physical type (welding, gluing);

— or mixed.

It is possible to realise connections in other way clearly characterised and defined as after specified.

The connection's classes are three:

— 1st class: connections performed from qualified manufacturer using methodologies defined (that characterise all the parameters and work conditions) from the coated fabric manufacturer or from the membrane assembler and continuously tested, to calculate f_k according to EN 1991-1-1;

— 2nd class: connections performed from qualified personnel using methodologies defined (that characterise all the parameters and work conditions) from the coated fabric manufacturer or from the membrane assembler and initially tested and repeatability checked by visual peeling test;

— 3th class: connections anyway performed, permitted exclusively for the realisation of secondary elements whose failure will not create unfavourable load cases or effects reducing the safety of the tent or of plugging.

In the design the connection class should be chosen in accordance with the structure type.

For tents with primary load bearing structure textile connection can be of 1st or 2nd class.

For membrane tents, the connection should be of 1st class.

The test results and the related test specimen should be filed together with all information allowing reproduction. The files should be retained for 5 years.

The national standards dealing with burning behaviour applied for tents are mentioned in Annex A.

It is assumed that RHI manufactures the membrane according to EN10204:2004-3.1 to be able to use 1st class weldings in the calculation.

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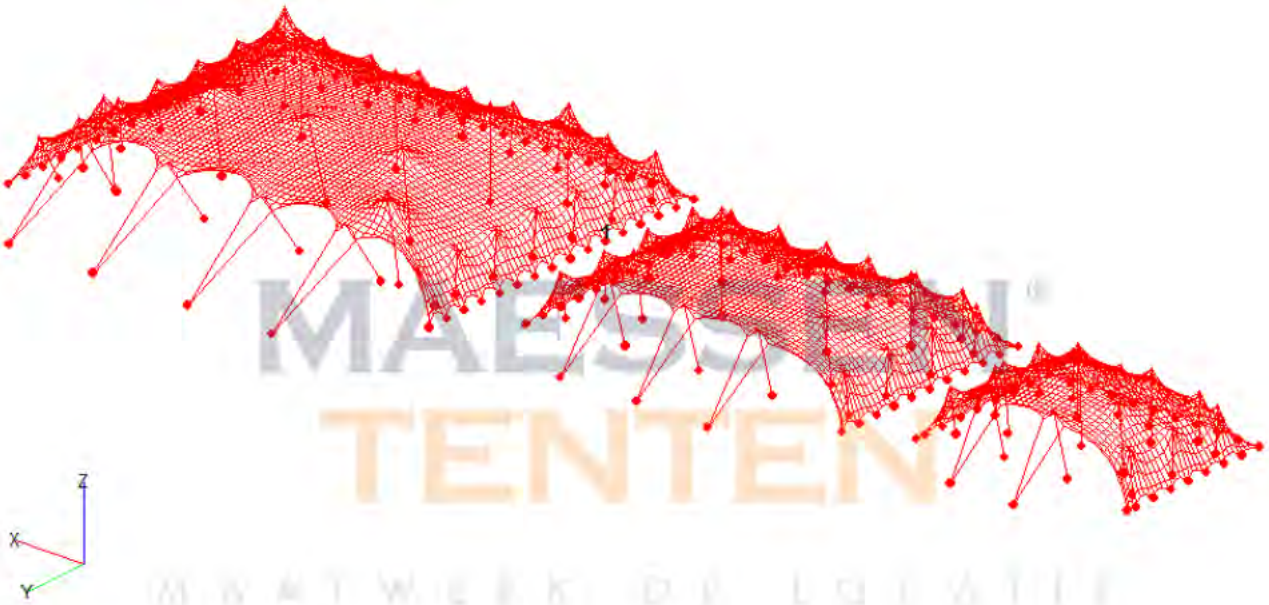

project	**Stretch Tent Range Analysis 7.5 x 10m / 10 x 15m / 15 x 20m**
subject	**Statical Analysis**
client	**Maessen Tenten**
reportnumber	**1303204_001_RA01_V01**
version	**V01**
author	[redacted]
date	**22.04.2013**

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projectnumber	1303204_001
project	Stretch Tent Range Analysis
client	Maessen Tenten Postbus 16 2240 AA Wassenaar [redacted] www.maessententen.nl
advice	Tentech bv Postbus 85190 3508 AD Utrecht [redacted] www.tentech.nl
subject	Statical Analysis of Stretch tent range
reportnumber	1303204_001_RA01
version	V01
date	22.04.2013
author	[redacted]
signature	[redacted]
authorized by	[redacted]
signature	
validity	Valid through 22.04.2018

MAESSEN® TENTEN

Introduction

Maessen Tenten commissioned Tentech to perform a Statical Analyis and produce a so-called Tent book of a range of Stretch tents.
Maessen Tenten is a Dutch company based in Wassenaar that rents and sells tent structures made out of a stretchable membrane. This enables a freedom of form as there is not a predescibed shape necessary. Depending on the location, the number of poles, length of the poles, placement of the poles, number and type of tie-downs can be varied. Resulting in a custome made cover at each new location.

This freedom of form is enabled by the stretch fabric, as the desired form is stretched in shape.
The drawback of this flexibility in shape is the difficulty to investigate all the different possibilities and to put them into a kind of order in a statical analysis.

Therefore the following approach is taken: 3 different sizes of Stretch tents are calculated and investigated, all with a certain pole / covered surface ratio. The objective is to determine a minimal set of poles and tie-downs that ensures a stable structure.

With the found restrictions, it is possible to build different sizes / shapes in three steps.

First step:	different shapes / sizes up to max 7.5 x 10m (taking into account the requirements on spacing of poles)
Second step:	different shapes / sizes up to max 10 x 15m (taking into account the requirements on spacing of poles)
Thrid step:	different shapes / sizes up to max 15 x 20m (taking into account the requirements on spacing of poles)

Utrecht, April 22th 2013,

[redacted]

MAESSEN®
TENTEN
MAATWERK OP LOCATIE

Overzicht

Owner of the Tent	Maessen Tenten Postbus 16 2240 AA Wassenaar [redacted] www.maessententen.nl
The fabric is manufactured by:	RHI Stretch Tents and Marquees Suite 8 Private bag X16 Constantia, 7848 South Africa [redacted] E info@rhitents.com www.rhitents.com
Tentsize	7.5 x 10m / 10 x 15m / 15 x 20m
Height masts	2 / 3 / 4 m
Highest point of fabric	4m
Highest point of masts	4m
Basic dimensions mast	
2m mast up till 7.5 x 10 / 10 x 15m	EN AW 6061 T6 tube Ø50 x 1.8mm
2m mast up till 15 x20m	EN AW 6061 T6 tube Ø50 x 3mm
3m mast up till 7.5 x 10 / 10 x 15m	EN AW 6061 T6 tube Ø50 x 1.8mm
3m mast up till 15 x 20m	EN AW 6061 T6 tube Ø50 x 3mm
4m mast up till 7.5 x 10 / 10 x 15m	EN AW 6061 T6 tube Ø70 x 3.18mm
4m mast up till 7.5 x 10 / 10 x 15m	EN AW 6061 T6 tube Ø70 x 4mm
Lashing Capacity (LC) storm belts (from 10x 15 up till 15 x 20m)	➢ 2400 daN
Breaking load of storm belts (from 10x 15 up till 15 x 20m)	7500 daN
Nr. of anchors for dense cohesionless soil	
Ties front up till 7.5 x 10m	1 per tie (1200 x 30mm)
Tie-down points up till 7.5 x 10m	1 per tie-down point (1200 x 30mm)
Tie front up till 10 x 15m	2 per tie (1200 x 30mm)
Tie-down points up till 10 x 15m	1 per tie-down point (1200 x 30mm)
Ties front up till 15 x 20m	1 per tie (1200 x 30mm)
Tie-down points up till 15 x 20m	1 per tie-down point (1200 x 30mm)
Storm belts up till 15 x 20m	3 per belt (1500 x 45mm)
User defined load	No user defined load is possible
At strong wind, the lee-side should be lifted	
At Wind force 8 Beaufort the structure should be cleared from people	
Storm belts are not to be removed (from 10 x 15 up till 15 x 20m).	
Fire retardancy class	See annex E3

MAESSEN® TENTEN OVERLOCATIE

First inspection date:	[first year][EN 13782-Annex D]

MAESSEN®
TENTEN
MAATWERK OP LOCATIE

First inspection date:	[third year][EN 13782-Annex D]

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MAESSEN® TENTEN MAATWERK OP LOCATIE

1. Project description

1.1. Geometry

The principle of a stretch tent is based on a rectangular piece of stretchable fabric with a fixing possibility every 750mm along the boundary. There are no predefined spots in the fabric where the poles should be placed. There is a freedom in positioning the poles and therewith a freedom of shape is obtained.

However, to be able to verify the capacity of the different sizes, some order has to be prescribed:

- There is made use of 3 types of poles: 2m, 3m and 4m length.
- The structure has one governing opening, made with 3m poles.
- Along the other 3 boundaries the fabric is tied down to the ground every meter, directly or with a rope. Moreover these boundaries are supported by 2m poles, spaced 2 -2.5m
- The governing opening is supported with 3m poles and tied down to the ground with two ropes per pole, at both sides of the pole
  - Up till 7.5 x 10m: 2 poles
  - up till 10 x 15m: 3 poles
  - Up till 15 x 20m: 4 poles

Covers with more governing openings are not regarded in this calculation.

To characterize the structure further, the concept of valleys is introduced. In between the field poles (the poles that are not placed along the boundary), a valley occurs in the fabric. The valleys are regarded as linear lines along the length or width of the cover. The amount of valleys (unless they are devided equally) compared to the length or width of the structure, gives a ratio that should be taken into account when preparing a layout for a cover.

7.5 x 10 m

Up till a size of 7.5 x 10, 2 valleys in both length and width are needed.

Length ratio: 2 / 10 = 0.2
Width ratio: 2 / 7.5 = 0.26
Nr. of poles along governing opening: 2

Due to the relatively small width, the ratio is high in this case. But the minimal amount of valleys is 2.

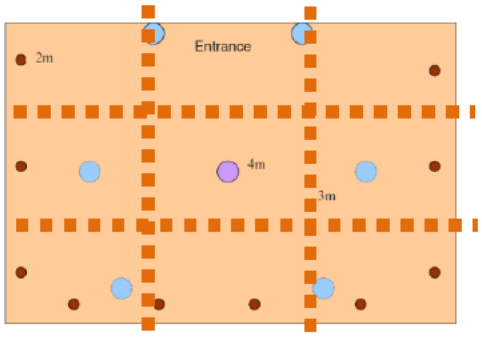

FIGURE 1 , SIZE 7.5 X 10M. BROWN = 2M, BLUE = 3M, PURPLE = 4M, YELLOW = VALLEY

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TENTEN
MAATWERK OP LOCATIE

10 x 15m

From the size 7.5 x 10m until the size of 10 x 15m, 3 valleys in the lenght and 2 valleys in the width are needed
10 x 15 m

Length ratio:	3 / 15 = 0.2
Width ratio:	2 / 10 = 0.2
Nr. of poles along governing opening:	3

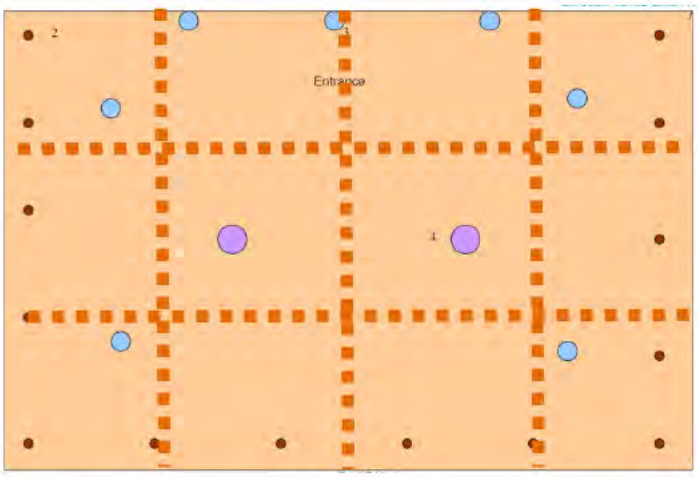

FIGURE 2 , SIZE 10 X 15M. BROWN = 2M, BLUE = 3M, PURPLE = 4M, YELLOW = VALLEY

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MAATWERK OP LOCATIE

15 x 20m

From the size of 10 x 15m until the size of 15 x 20m, 4 valleys in the length and 3 valleys in the width are needed.
Moreover, additional belts are to be placed in the valleys along the length and are to be tied down to the ground.

Length ratio:	4 / 20 = 0.2
Width ratio:	3 / 15 = 0.2
Nr. Of poles along governing opening:	4

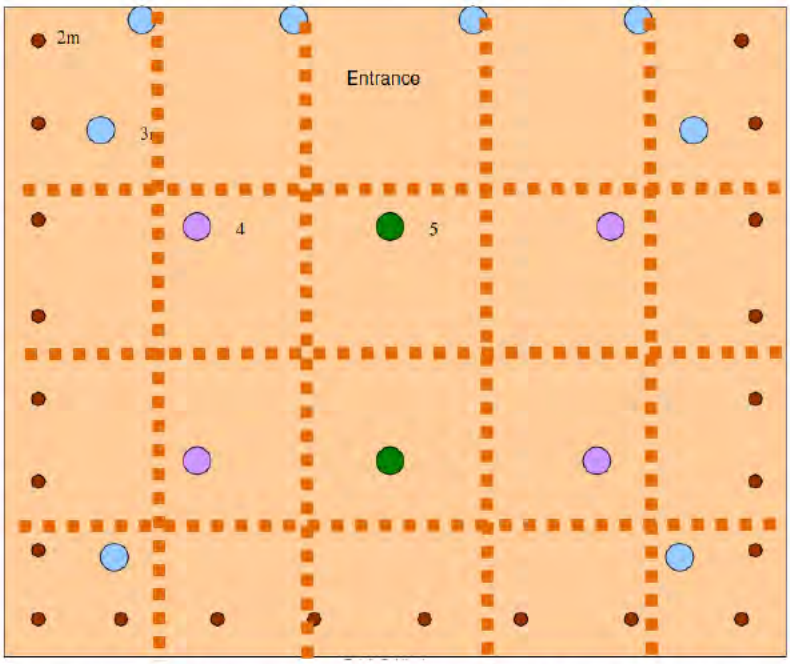

FIGURE 3 , SIZE 15 X 20M. BROWN = 2M, BLUE = 3M, PURPLE = 4M, GREEN = 5M YELLOW = VALLEY

1.2. Membrane Curvature

The stretch tent is a form active structure based on the curvature principle. When the membrane is loaded, the curvature in the structure is increasing or decreasing, depending on the direction of the curvature. This change in curvature takes care of the regulation of the stresses in the fabric. As the change in curvature is considerable due to the flexible character of the fabric, the deformations are considerable, too. Especially at sizes above 10 x 15m, additional measures have to be taken to limit these deformations. This is done by additional belts in the transverse valleys.

The poles are supporting the fabric. The top of the poles are enlarged with a plastic disk wit rubber rounded heads, reducing the peak load in the fabric. Vice versa the fabric supports the poles in transverse direction, enabling the assumption of a 2-sided hinged pole.

1.3. Used materials

The following materials are used in the structure:

metals

material	type	weight	E-module	F_y	F_u
6061 T6	aluminium	7850 kg/m^3	70000 N/mm^2	235 N/mm^2	360 N/mm^2
synthetics					
material	type	weight	LC	breakload	
PES	50mm			7500 daN 75 kN	
			Tensile strength [roll-length]	Tensile strength [roll-width]	
PES/PVC RHI Allweather M4	type 1	700 gr/m^2	1400 N/5cm 28 kN/m	1300 N/5cm 26kN/m	

TABLE 1 USED MATERIALS

MAESSEN® TENTEN
MAATWERK OPLOSSING

The fabric is a polyester Knit fabric with a PVC coating, referred to as RHI ALL Weather MK4, see Annex E.

The admissible strenght of the fabric according to article 7.6.1 of NEN-EN 13782:

$f_d = f_{tk} / \gamma_m$

f_d = admissible fabric load

f_{tk} = Characteristic tensile strength

γ_m = material factor according totable 4 NEN-EN 13782

f_d = 60 / 2.5 = 24.0 kN/m in roll-length direction

f_d = 60 / 2.5 = 24.0 kN/m in roll-width direction

Hereby is assumed that the manufacturer is working according to NEN-EN-10204 3.1.

Fabric is an orthotrophe material which has two main directions, the roll-width and the roll-length. Material properties in these directions differ. Look for Annex E for the material properties of the material used.

2. Codes and assumptions

2.1. Codes

The load assumptions and capacity checks are based upon the following codes:

European codes:		
NEN-EN 1990	Eurocode	*Basis of stuctural Design*
NEN-EN 1993	Eurocode 3	*Design of steel structures*
NEN-EN 1999	Eurocode 9	*Design of aluminium structures*
NEN-EN 13782		*Temporary Structures – Tents 7- Safety*
NEN-EN 10204		Productis of steel –inspections documents
NEN-EN 12195-2		Belts
NEN 6770		Steel structures
EN-ISO 1141		*Synthetic fibre ropes Polyester*
EN-ISO 1346		*Synthetic fibre ropes Polypropylene*
EN-ISO 1969		*Synthetic fibre ropes Polyethylene*
NTA-8020-40		Dutch Technical Agreement on Fire Retardancy and Smoke behaviour

2.2. Fundamental combinations

Conform NEN-EN 13782, 6.6.2

The design values of the actions shall be combined in the following way:

$\gamma_G \cdot G_k + \gamma_F \cdot Q_{k,1}$

$\gamma_G \cdot G_k + \Sigma\gamma_F \cdot Q_{k,i}$

Where:

$\gamma_G = 1.35$	Partial safety factor for unfavourable permanent actions
$\gamma_G = 1.00$	Partial safety factor for favourable permanent actions
$\gamma_F = 1.50$	Partial safety factor for only one variable action
$\gamma_F = 1.35$	Partial safety factor for more variable actions

G_k	Characteristic value of permanent action
$Q_{k,i}$	Characteristic vaule of one of the variable actions

Safety factor against overturning, sliding and lifting (NEN-EN 13782 table 2):

$\gamma_G = 1.00$	Partial safety factor for favourable permanent actions
$\gamma_F = 1.20$	Partial safety factor for unfavourable wind loads

2.3. Design Actions

- Dead load of structure (permanent action) of the structure is taken into account.
- Wind load (variable action) is taken into account according to NEN EN 13782.
- Snow load (variable action) is not taken into account according to NEN EN 13782.
- No user load (variable action) is taken into account.

MAESSEN® TENTEN MAATWERK OP LOCATIE

2.4. Load cases

LG 1 Dead load (SW):

Dead load of aluminium structure and dead load of fabric are determined by the software package.

LG2 Pretension (P)

A pretension is assumed of 0.2 kN/m'.

LG 3 Wind load (W_S):

Wind load conform NEN-EN 13782, 6.4.2.2.

For any other location where v_{ref} > 28 m/s, calculations shall be provided for the tent verifying the stability and resistance with the local conditions.

For v_{ref} < 28 m/s, the wind load per unit may be evaluated applying the following minimum values given in EN 1991-1-4 with:

C_{TEM} = 0.8
T_r = 10 years
c_d = 1
c_{alt} = 1

height h < 5m
q_{ref} = 0.5 kN/m^2 NEN-EN 13782, Table 1

Cp values are taken from NEN-EN 13782, 6.4.2.3:

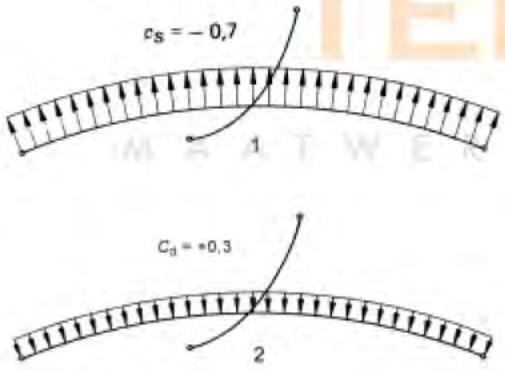

FIGURE 4 , C_p VALUES FOR MEMBRANE STRUCTURES NEN-EN 13782

c_s = -0.7 (suction)

LG 4 Wind load (W_P):

c_d = +0.3 (pressure)

LG 5 Wind load (W_B):

Values above are for freestanding canopies or closed structures. As therer is one governing opening, also the load case

c_s = -1.3 (suction) (NEN-EN-1991-1-4)

is taken into account to allow for a blocked canopy.

MAESSEN® TENTEN MEETWERK DE LOCATIE

BG 6 Conventional load

The stability of the structure should be checked with an overall downward load of 0.1 kN/m2, only to be combined with dead load. As the downward windload is larger than the conventional load, this load case is not taken into account.

BG 7 User defined load

No user defined load is taken into account.

2.5. Load Combinations

The following loadcombinations are taken into account:

	LG 1 (SW)	LG 2 (P)	LG 3 (W_S)	LGC 4(W_S)	LG 5 (W_B)
LC 1	x	x	x		
LC 2	x	x		x	
LC 3	x	x			x

TABLE 2. LOAD COMBINATIONS (LC)

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3. Approach

3.1. Modelling

The analysis of the structure is performed with the software package EASY FCS supplied by TECHNET GmbH, Berlin. This software is specially developed for membrane structures because of the large deformability of the structure. Therefore the performed analysis is a full non-linear second order analysis.

The membrane is modelled as a cable net structure and supported by hinged poles. The formfinding of the shape is performed using the Force Density approach.
Windload is applied on the fabric as a pressuer, thus acting perpendicular to the surface.

Since the fabric is a highly deformative material, it is only possible to calculate stresses and deformations with a non-linear method. FEM-software EASY is being used for the calculations. The non-linearity of the calculations doesn´t make it possible to use partial safety factors beforehand, since the deformations will be greater due to these safety factors, resulting in lower stresses in the fabric. See figure below. It is unsafe to add the factors in advance, they will be added afterwards.

As a membrane structure is a form-active structure, article 6.3 (4) b) of the EN-1990:2002 applies:

When the action effect increases less than the action, the partial factor γ_F should be applied to the action effect of the representative value of the action.

This means that no load factors are applied on the load beforehand, but afterwards.

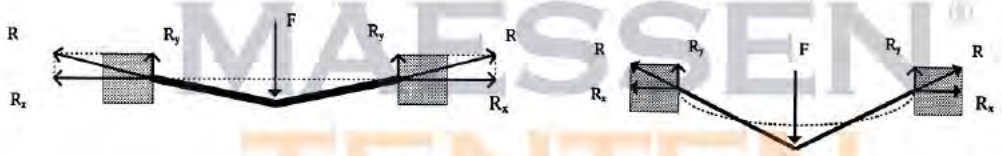

FIGURE 5 , MEMBRANE PRINCIPLE

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3.2. Structural system of the cover

The modelled membrane structure is build up out of a so-called humpback shape. This is the case when many poins are carrying the fabric, therewith creating a smooth curved surface.
The boundaries of the structure are only slightly reinforced. The fabric is doubled into an open pocket and an elastic rope is put into the pocket to create a smooth boundary. Each tab along the boundary is reinforced with at least 3 layers of fabric. So point loads are introduced gradually into the fabric.

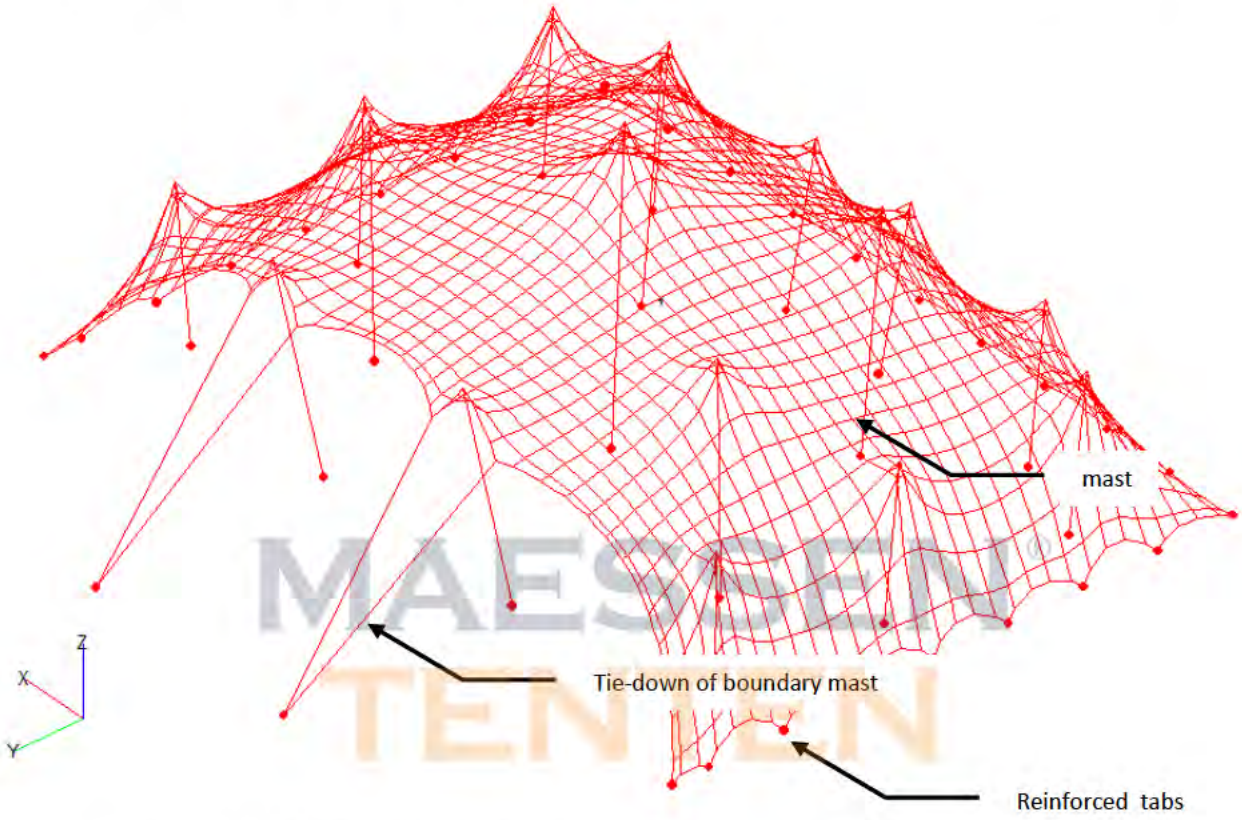

FIGURE 6 , SYSTEM OF THE TENTSTRUCTURE

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3.3. Approach

The load out of the fabric is determined by 3 loadcases. Upward wind with a shape factof (Cp) of 0.7 and downward wind with a shape factor of 0.3. Additionally a shape factor of 1.3 is used to take into account a blocked situation of the cover with respect to the wind.

The capacity of the masts is determined with the force out of the fabric. Moreover the anchor forces are determined and the anchoring system is determined.

4. Results of the Statical Analysis

4.1. LC01 Pretension + Dead Weight

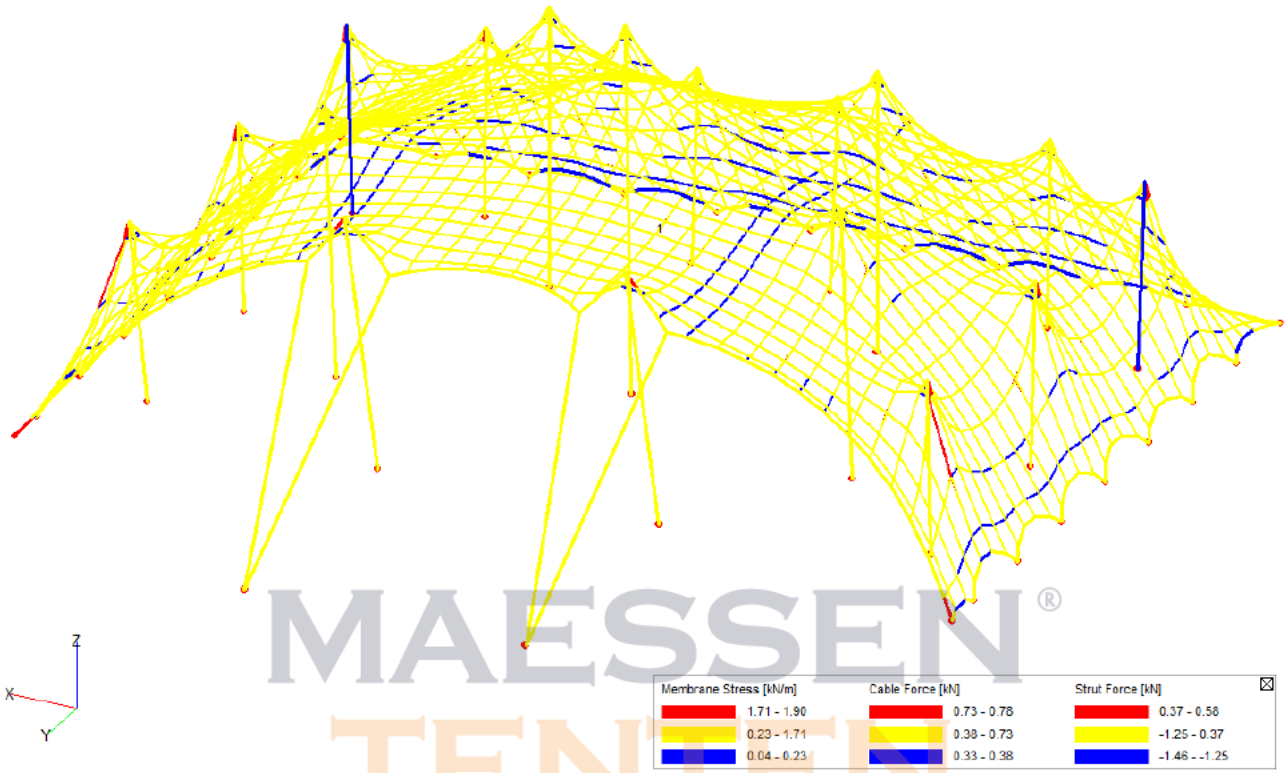

FIGURE 7, LC01 7.5 X 10M FORCES IN KN AND KN/M (F_{REP})

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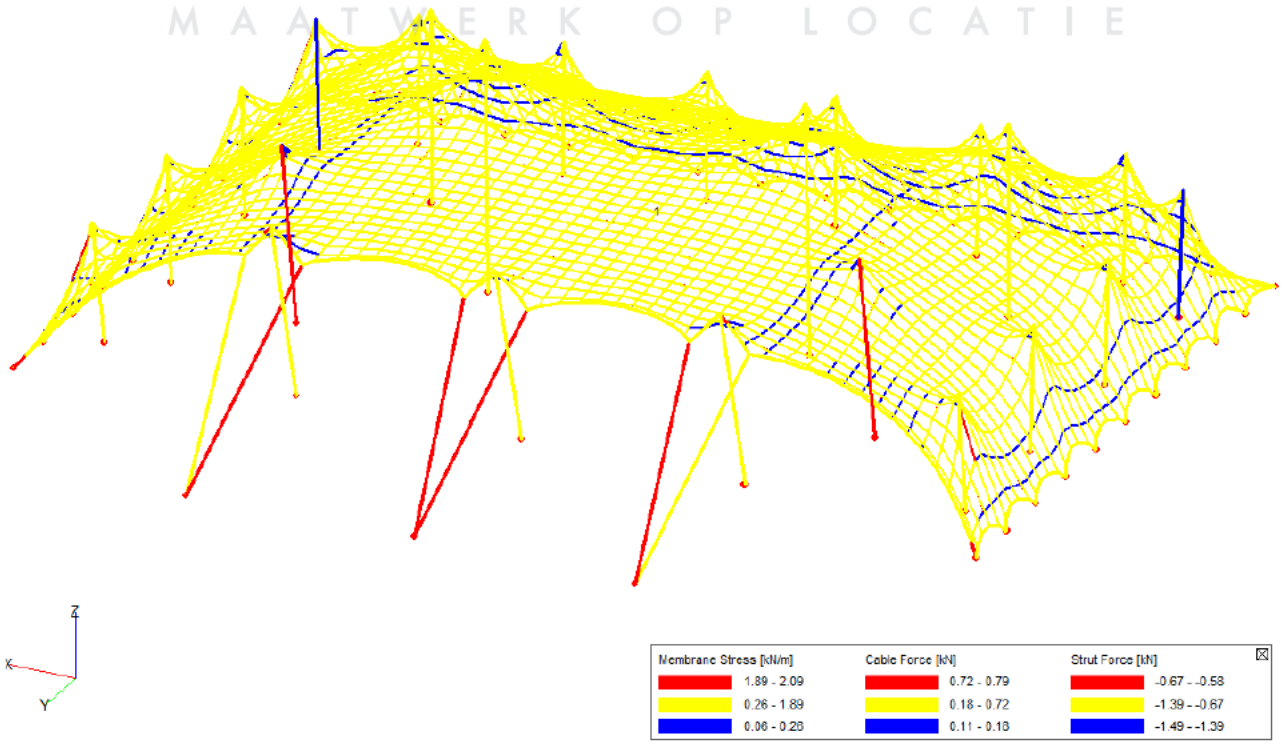

FIGURE 8,LC01 10 X 15M FORCES IN KN AND KN/M (FREP)

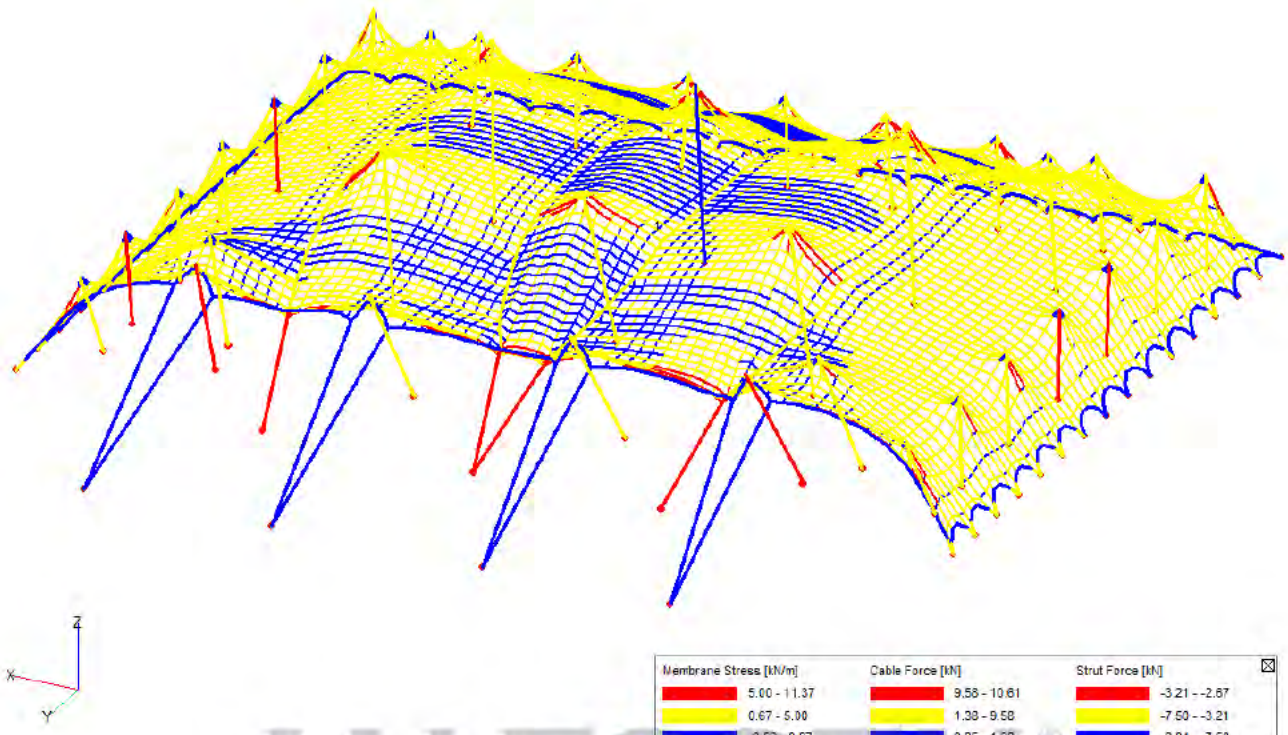

FIGURE 9, LC01 15 X 20M FORCES IN KN AND KN/M (F_{REP})

As can be seen in the pictures, the stress level in the structures 7.5 x 10m and 10 x 15m is low. The forces that occur in this load case are not taken into account further. The stress level in the 15 x 20m structure is considerably higher, caused by the additional added storm belts who are tied down to the ground with a pretension of 10 kN.

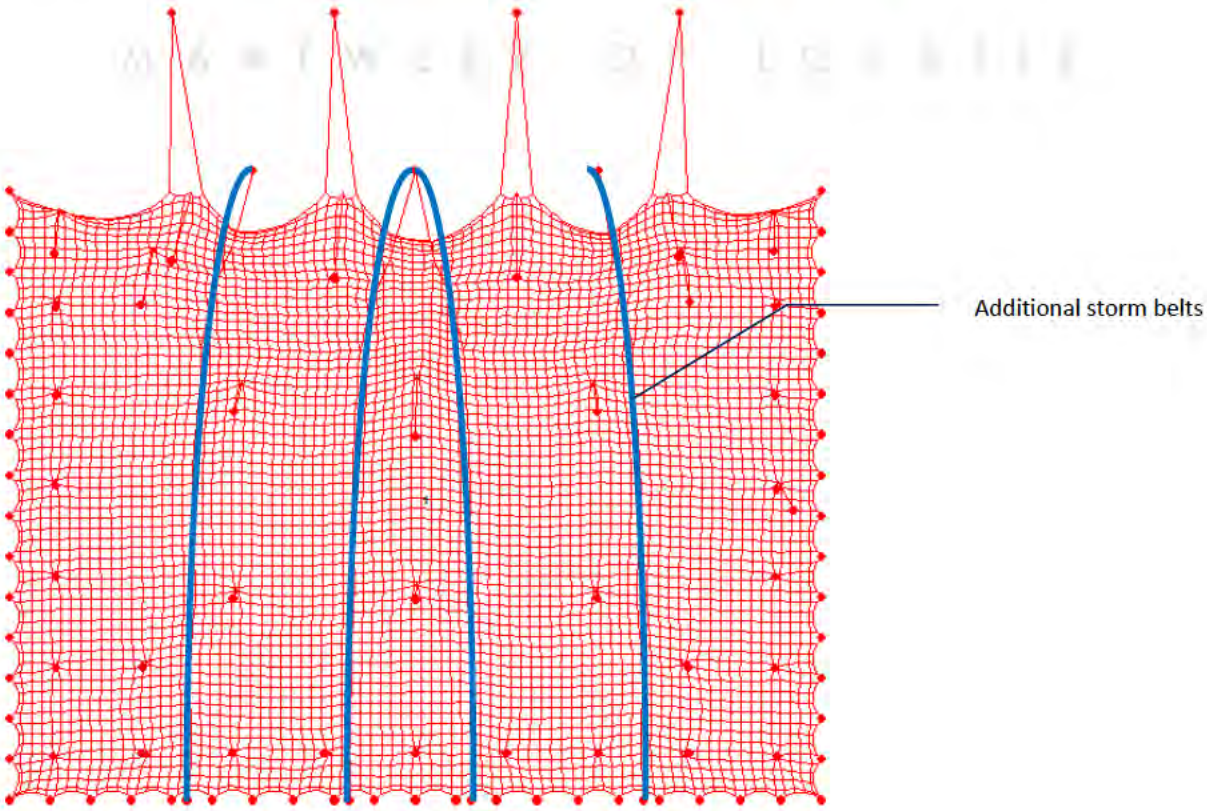

FIGURE 10, ADDITIONAL STORM BELTS FOR 15 X 20M, PLACED IN THE VALLEYS (IN EACH VALLEY ONE BELT)

4.2. LC02, Wind suction

4.2.1 size 7.5 x 10m

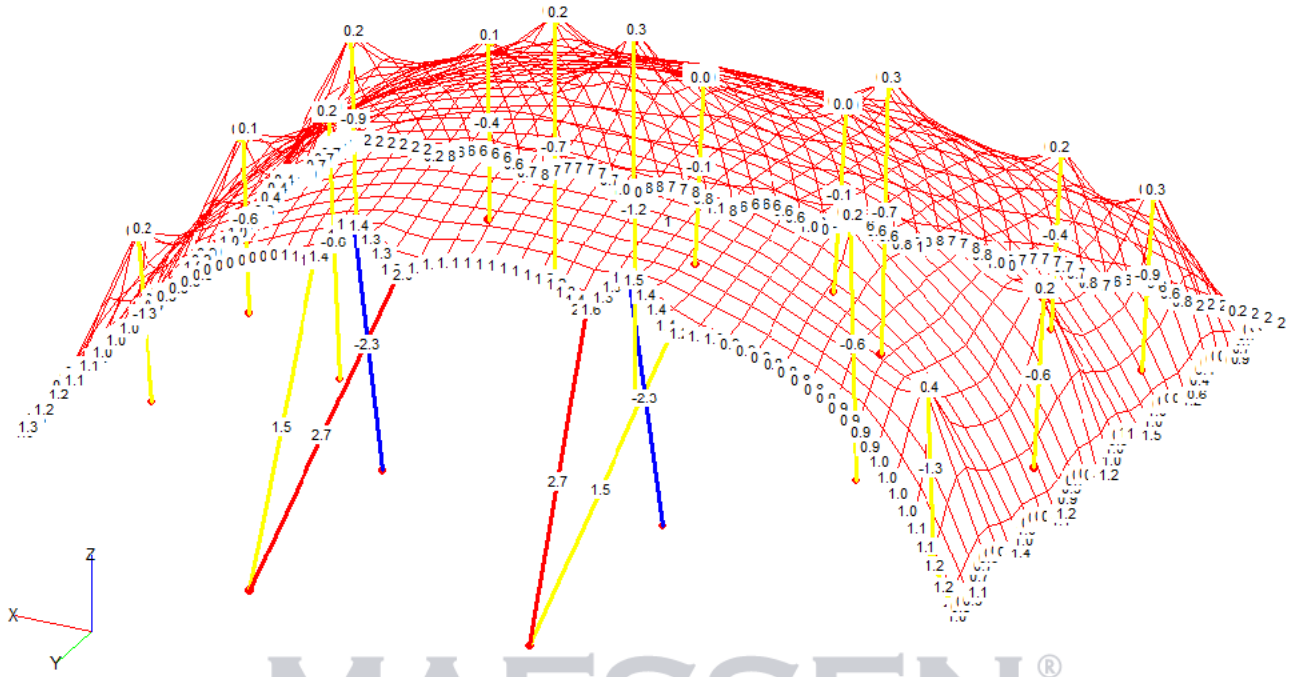

FIGURE 11, LC02 FORCES IN THE BELTS AND STRUTS IN KN (F_{REP})

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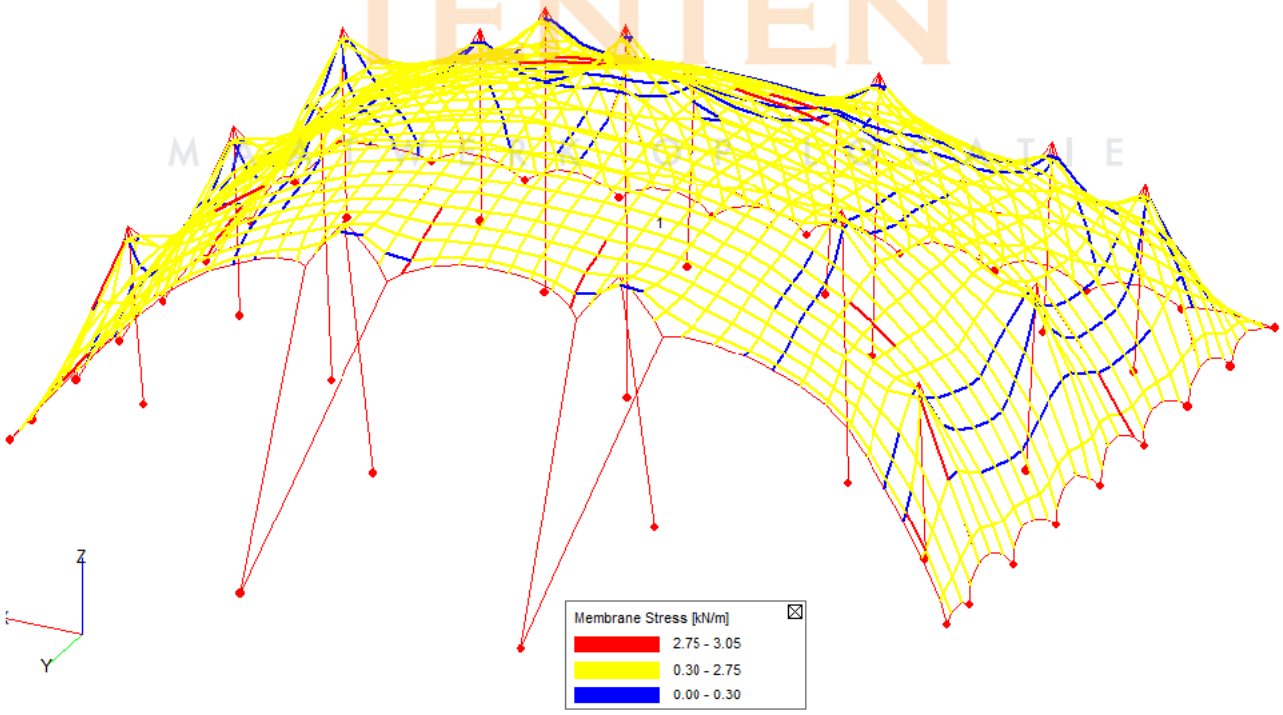

FIGURE 12, LC02 STRESSES IN THE MEMBRANE IN KN/M (F_{REP})

4.2.2 Size 10 x 15m

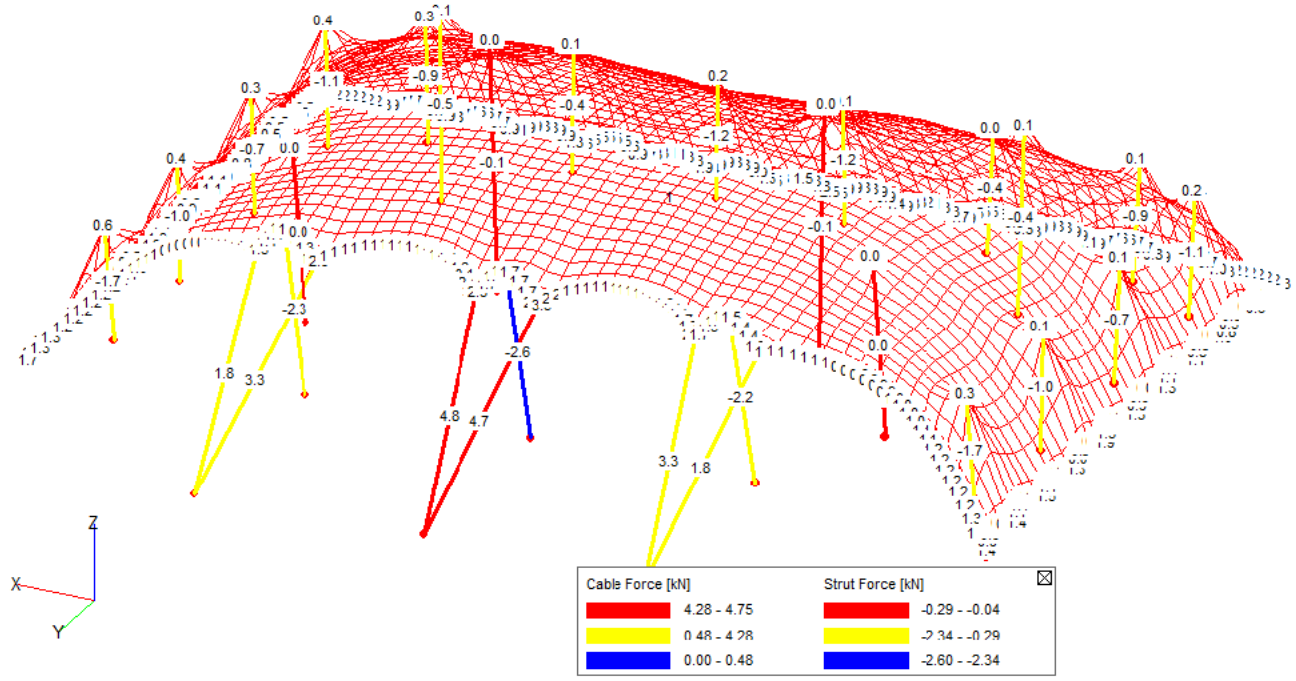

FIGURE 13, LC02 FORCES IN THE BELTS AND STRUTS IN KN (F_{REP})

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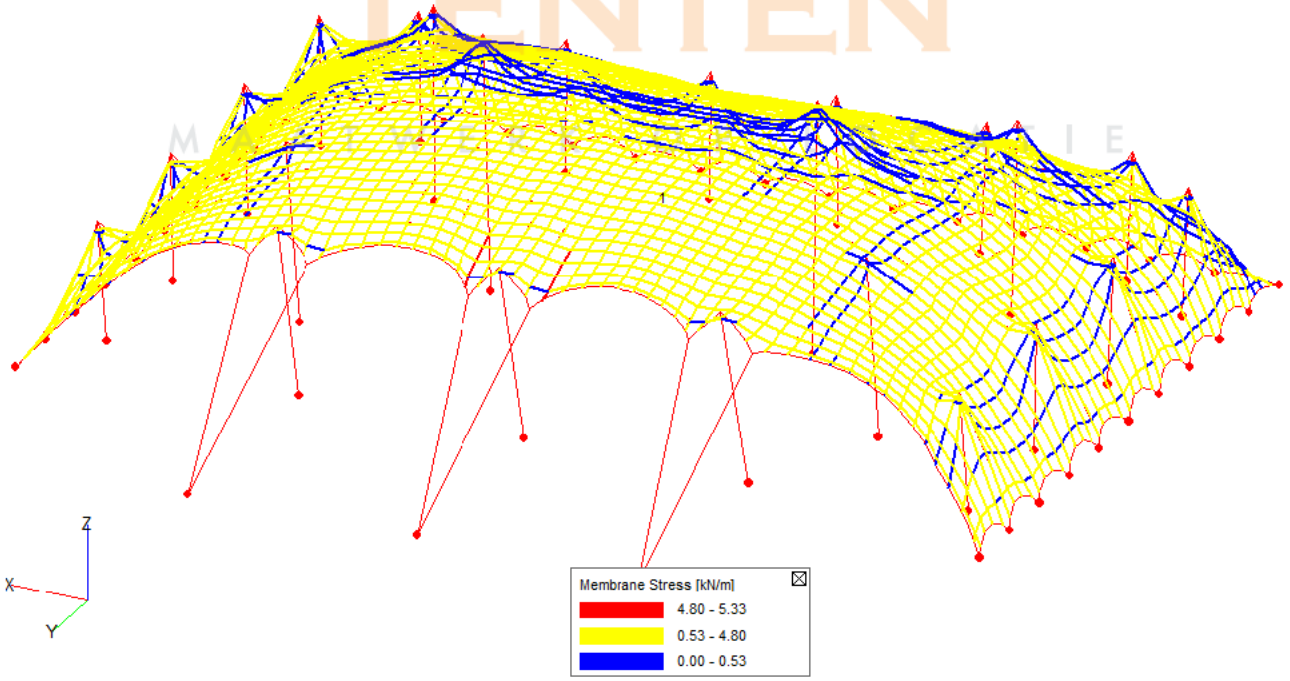

FIGURE 14, LC02 STRESSES IN THE MEMBRANE IN KN/M (F_{REP})

4.2.3 Size 15 x 20m

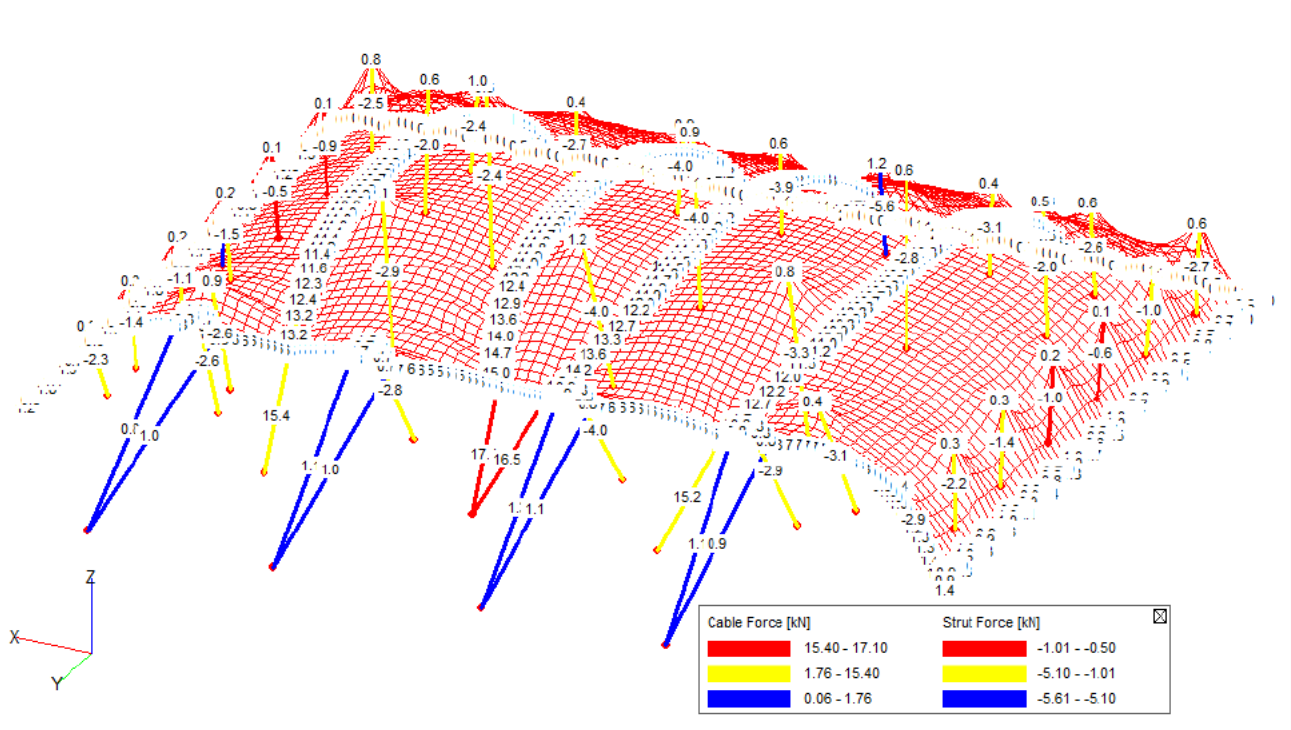

FIGURE 15, LC02 FORCES IN THE BELTS AND STRUTS IN KN (F_{REP})

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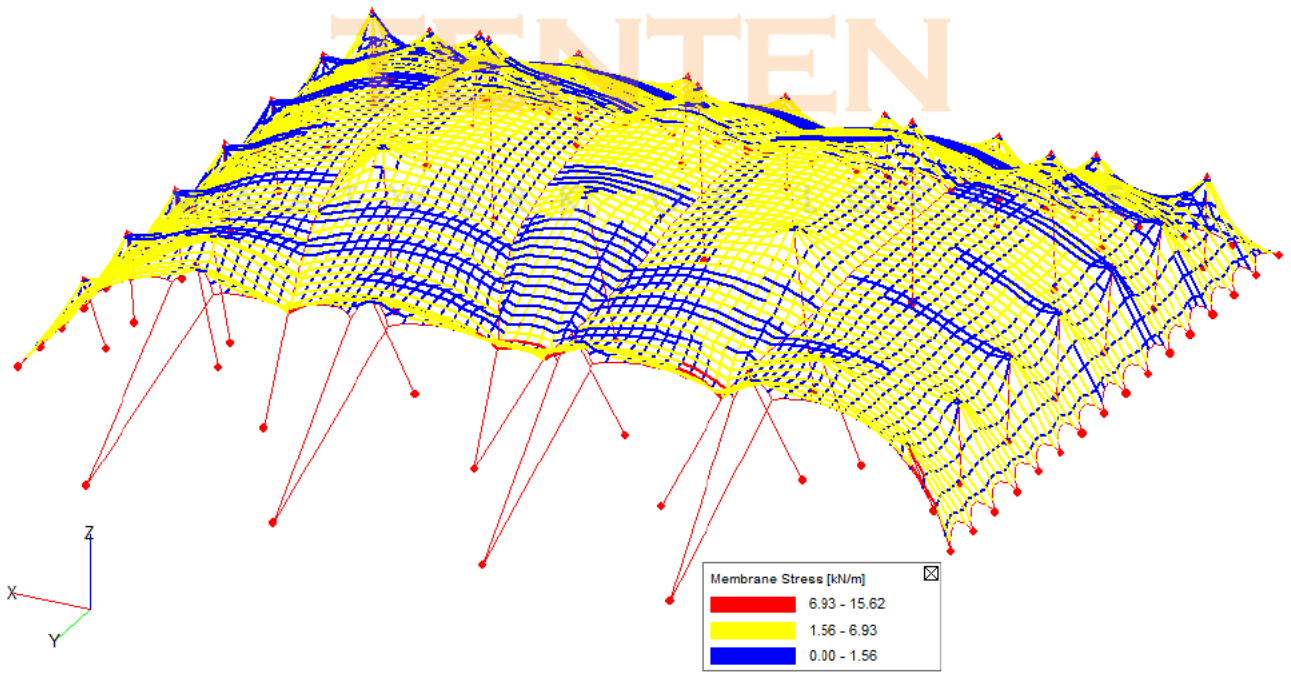

FIGURE 16, LC02 STRESSES IN THE MEMBRANE IN KN/M (F_{REP})

4.3. LC03, Windpressure

4.3.1 size 7.5 x 10m

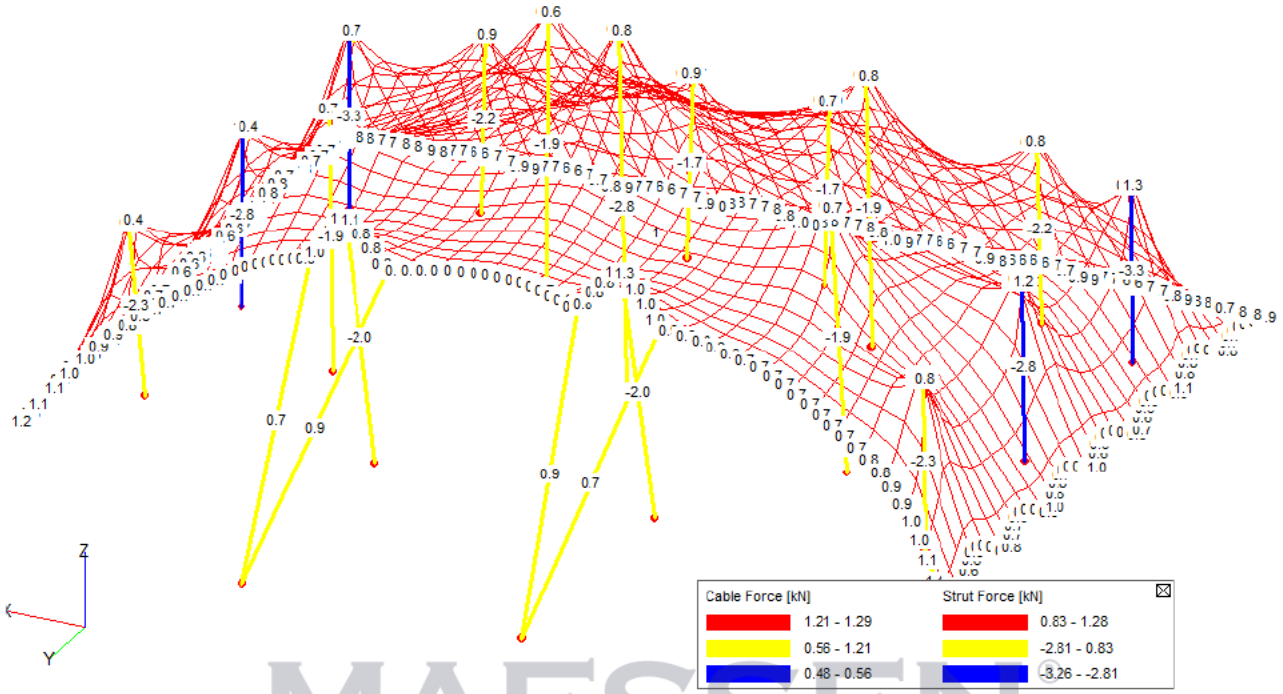

FIGURE 17, LC03 FORCES IN THE BELTS AND STRUTS IN KN (F_{REP})

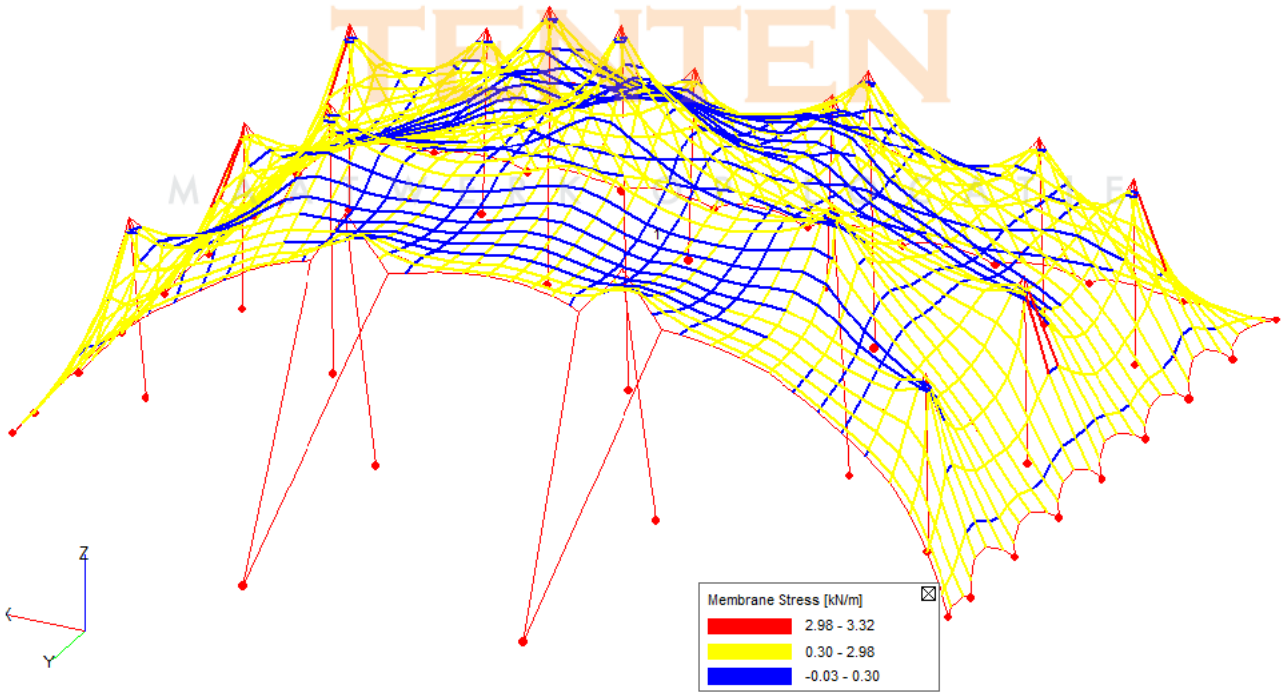

FIGURE 18, LC03 STRESSES IN THE MEMBRANE IN KN/M (F_{REP})

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4.3.2 Size 10 x 15m

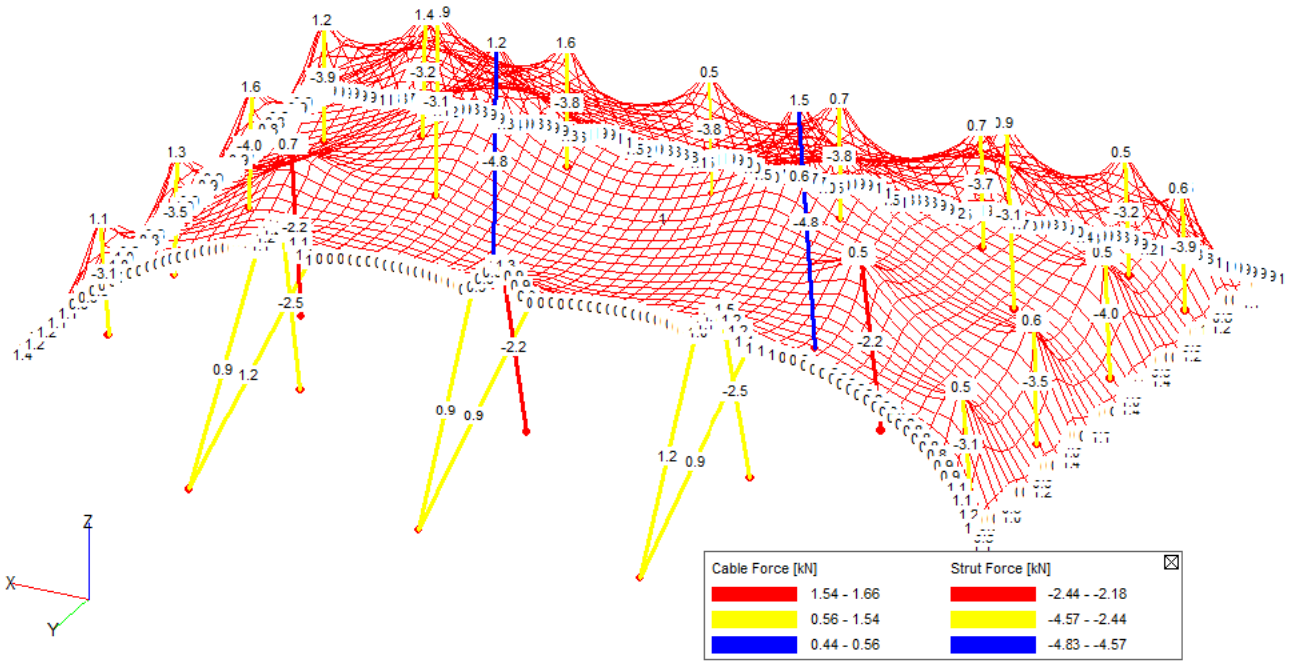

FIGURE 19, LC03 FORCES IN THE BELTS AND STRUTS IN KN (F_{REP})

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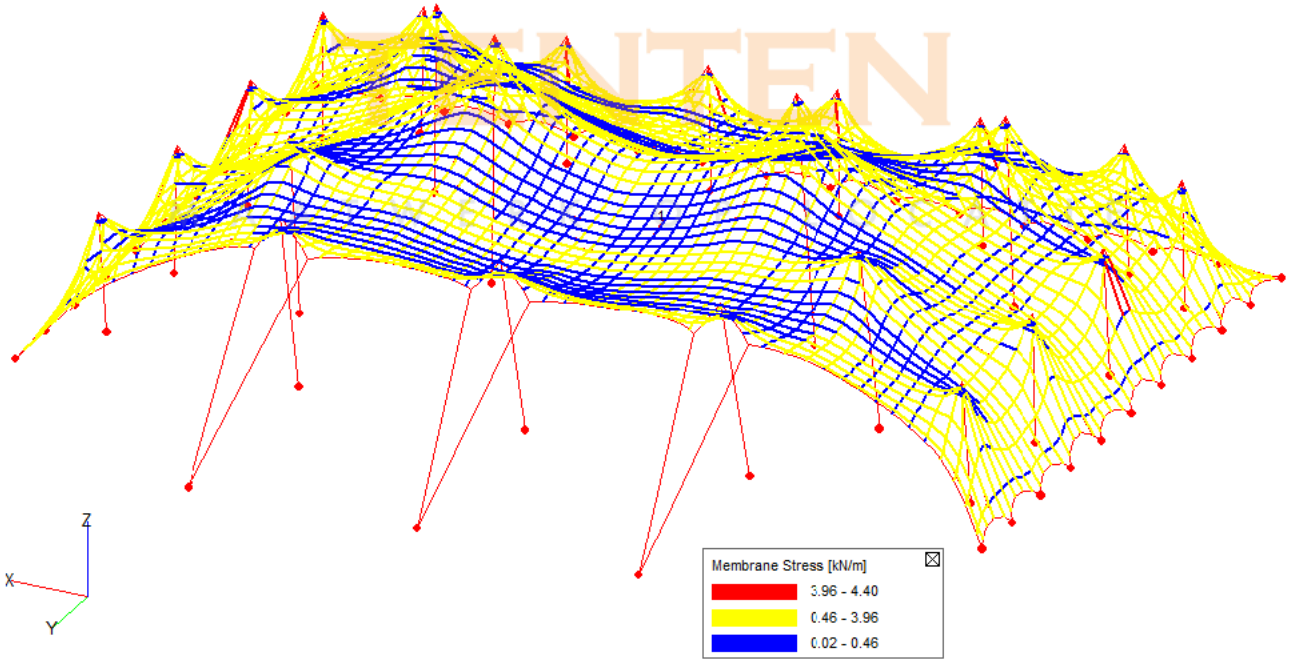

FIGURE 20, LC03 STRESSES IN THE MEMBRANE IN KN/M (F_{REP})

4.3.3 Size 15 x 20m

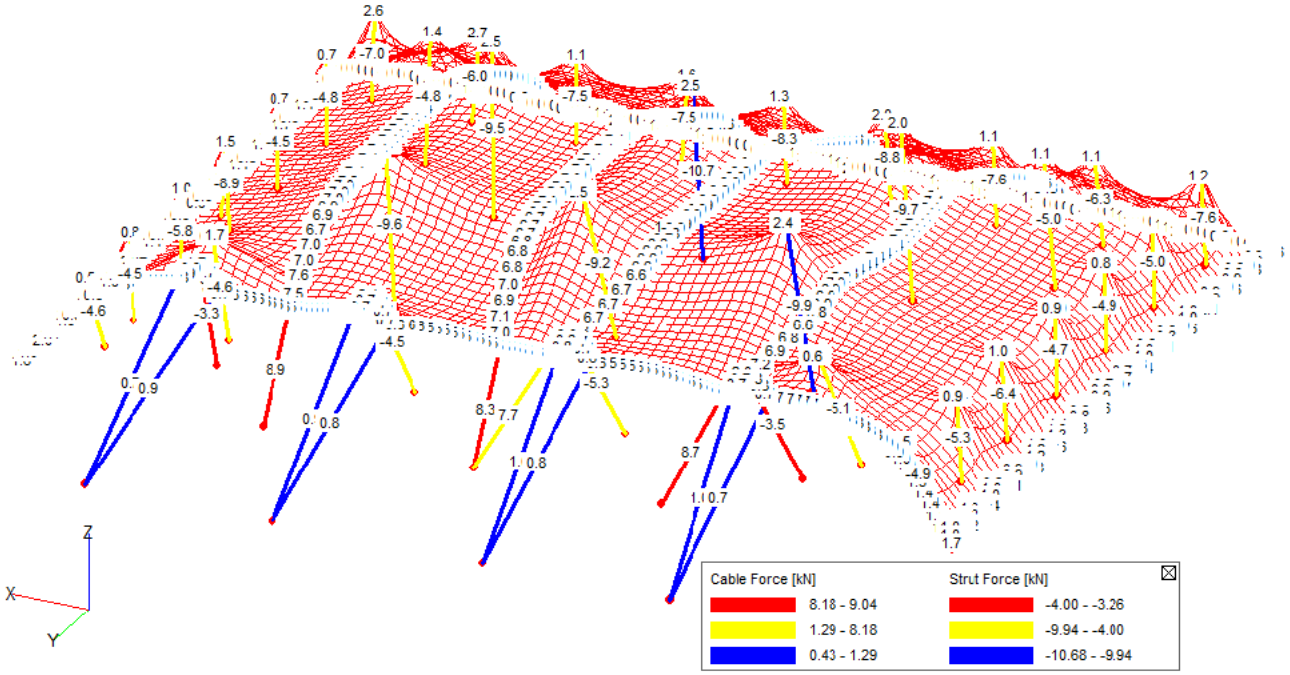

FIGURE 21, LC03 FORCES IN THE BELTS AND STRUTS IN KN (F_{REP})

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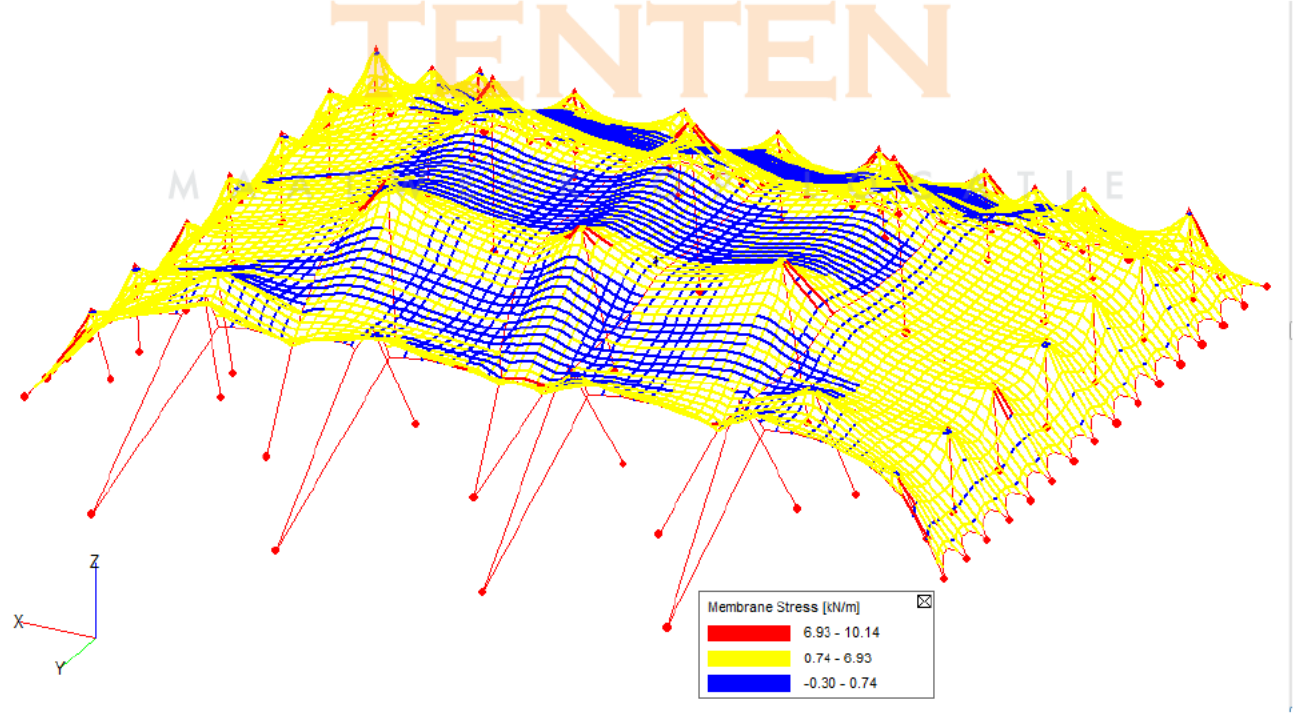

FIGURE 22, LC03 STRESSES IN THE MEMBRANE IN KN/M (F_{REP})

4.4. LC04 Wind suction blocked

4.4.1 size 7.5 x 10m

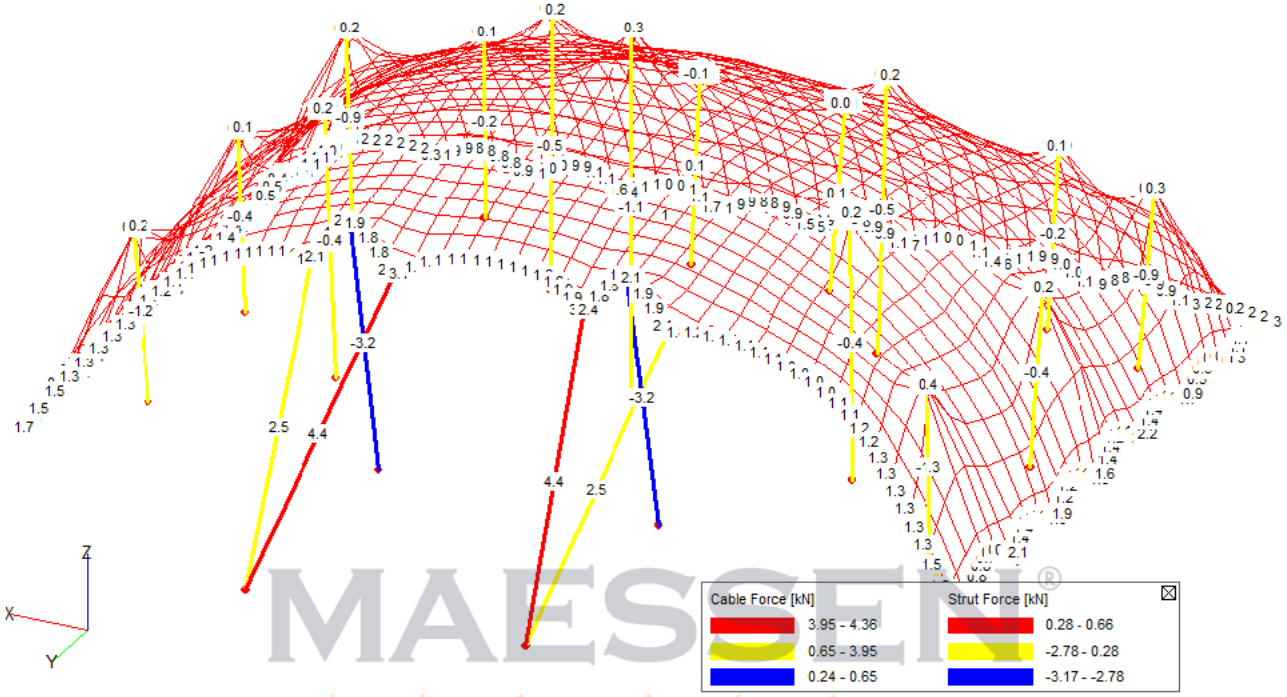

FIGURE 23, LC04 FORCES IN THE BELTS AND STRUTS IN KN (F_{REP})

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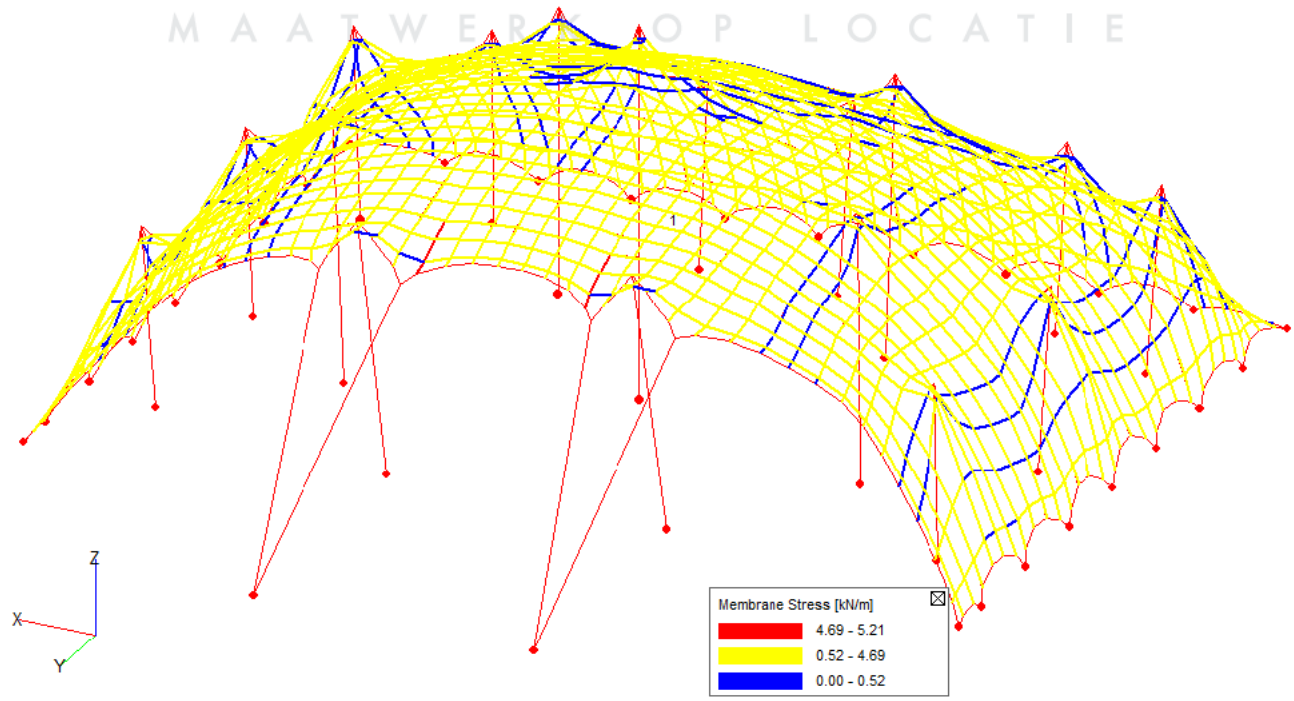

FIGURE 24, LC04 STRESSES IN THE MEMBRANE IN KN/M (F_{REP})

4.4.2 Size 10 x 15m

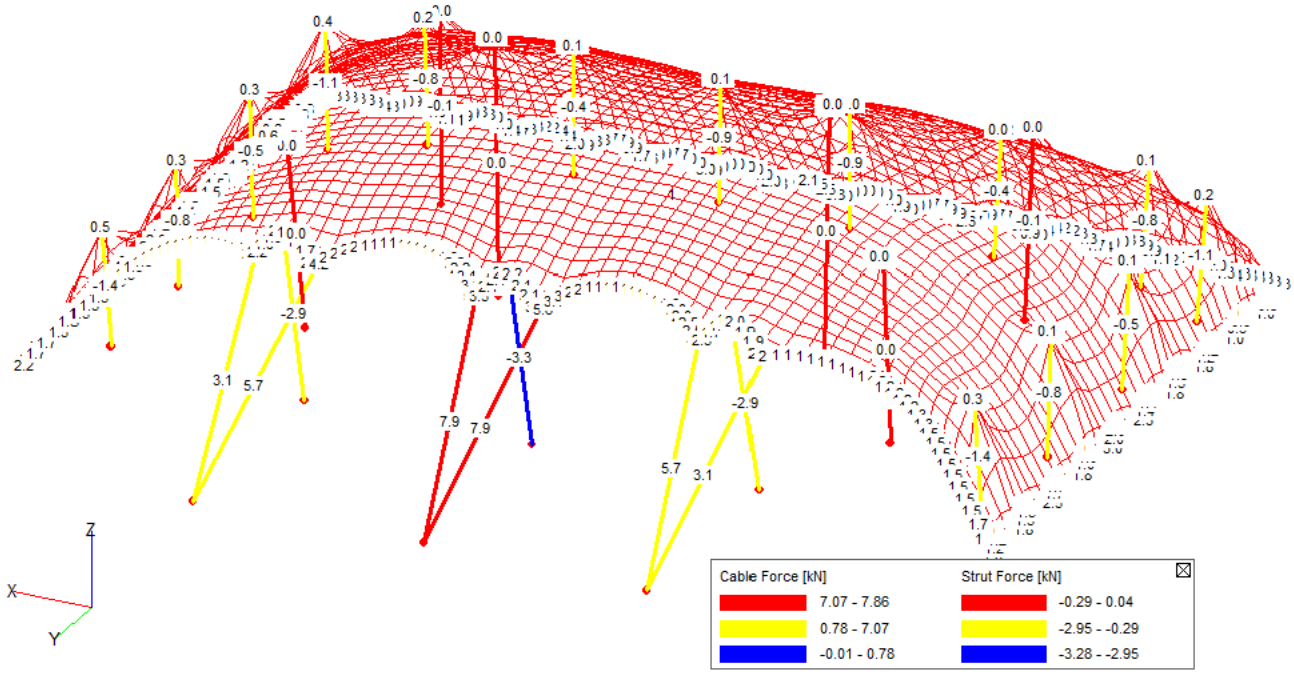

FIGURE 25, LC04 FORCES IN THE BELTS AND STRUTS IN KN (F_{REP})

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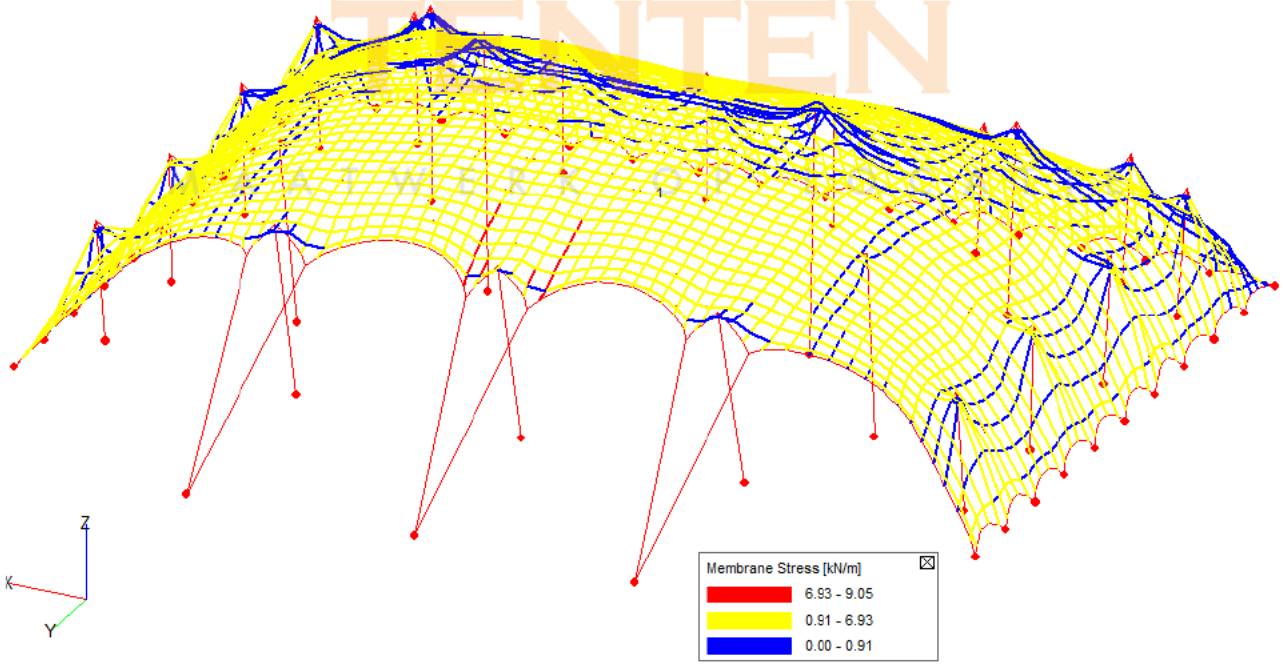

FIGURE 26, LC04 STRESSES IN THE MEMBRANE IN KN/M (F_{REP})

4.4.3 Size 15 x 20m

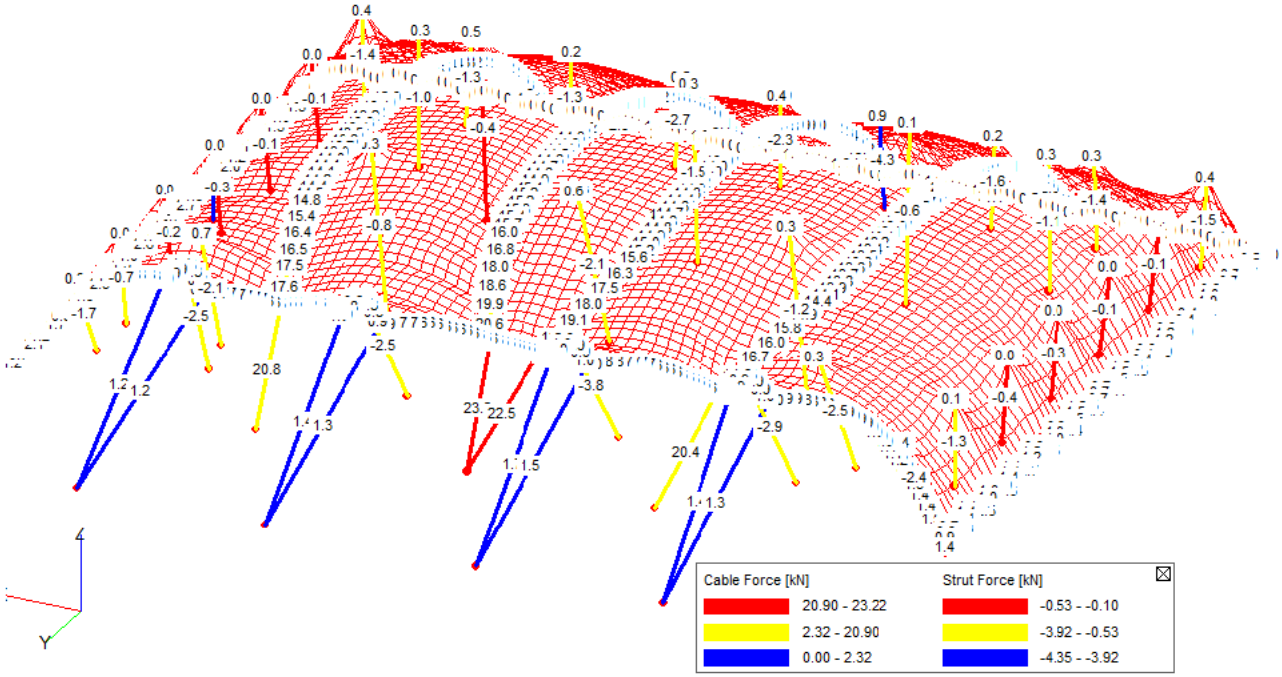

FIGURE 27, LC04 FORCES IN THE BELTS AND STRUTS IN KN (F_{REP})

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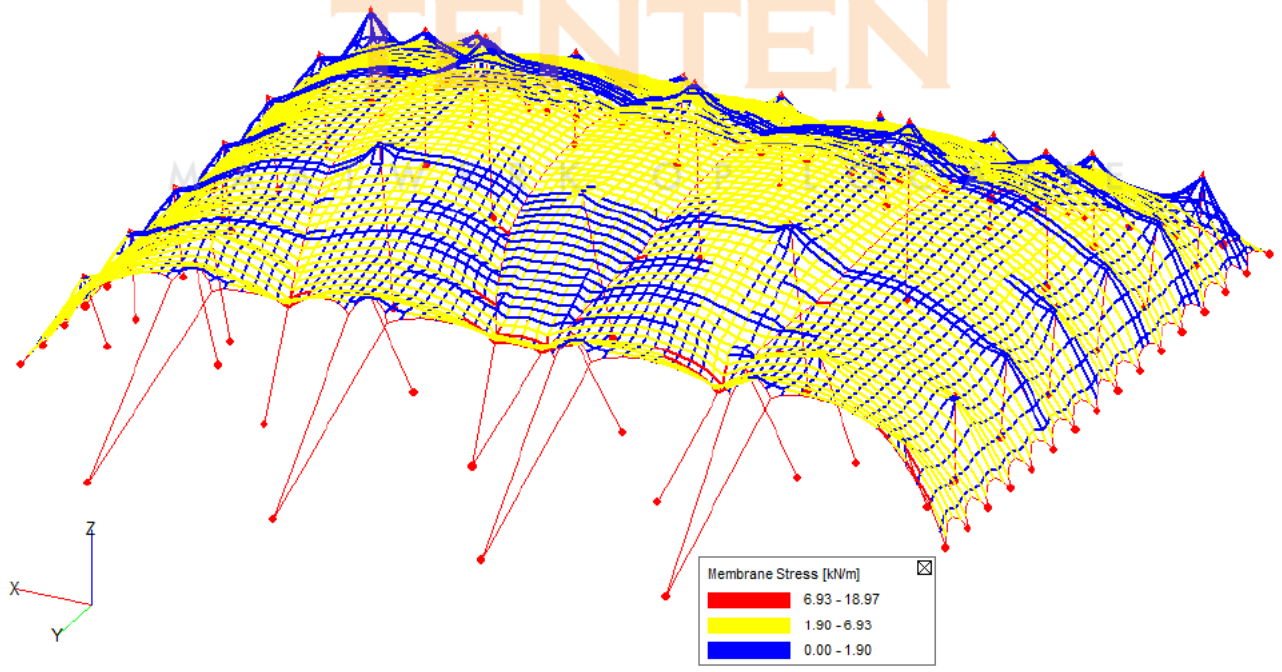

FIGURE 28, LC04 STRESSES IN THE MEMBRANE IN KN/M (F_{REP})

5. Capacity check

The forces in the different load combinations are shown below:

Frep	(without load factor 1.5)					
		kN	kN	kN	kN	kN
wind up	(LC02)	2m mast	3m mast	4mast	ties	storm belt
7.5 x 10		1.3	2.3	1.2	2.7	
10 x 15		1.7	2.6	0.1	4.3	
15 x 20		5.6	4	4	1.3	17.1
		kN	kN	kN	kN	kN
wind down (LC03)		2m mast	3m mast	4mast	ties	storm belt
7.5 x 10		3.3	2	2.8	0.9	
10 x 15		4	3.1	4.8	1.2	
15 x 20		8.3	5.1	10.7	0.9	8.3
		kN	kN	kN	kN	kN
wind up blocked (LC		2m mast	3m mast	4mast	ties	storm belt
7.5 x 10		1.3	0.5	1.1	4.4	
10 x 15		0.1	3.3	0	7.9	
15 x 20		4.3	3.8	2.1	1.7	23.2
max		8.3	5.1	10.7	7.9	23.2

TABLE 1, MAX FORCES (F_{REP})

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As no load factor is applied on the load beforehand, these values are multiplied with the load factor 1.5:

Fd	(with load factor 1.5)					
		kN	kN	kN	kN	kN
wind up	(LC02)	2m mast	3m mast	4mast	ties	storm belt
7.5 x 10		1.95	3.45	1.8	4.05	
10 x 15		2.55	3.9	0.15	6.45	
15 x 20		8.4	6	6	1.95	25.65
		kN	kN	kN	kN	kN
wind down (LC03)		2m mast	3m mast	4mast	ties	storm belt
7.5 x 10		4.95	3	4.2	1.35	
10 x 15		6	4.65	7.2	1.8	
15 x 20		12.45	7.65	16.05	1.35	12.45
					0	
		kN	kN	kN	kN	kN
wind up blocked (LC		2m mast	3m mast	4mast	ties	storm belt
7.5 x 10		1.95	0.75	1.65	6.6	
10 x 15		0.15	4.95	0	11.85	
15 x 20		6.45	5.7	3.15	2.55	34.8
max		12.45	7.65	16.05	11.85	34.8

TABLE 2, MAX FORCES (F_D)

		kN	kN	kN	kN	kN
		2m mast	3m mast	4mast	ties	storm belt
7.5 x 10	max	4.95	3.45	4.2	6.6	0
10 x 15	max	6	4.95	7.2	11.85	0
15 x 20	max	12.45	7.65	16.05	2.55	34.8

TABLE 3, MAX FORCES PER TENT SIZE (F_D)

5.1. 2m mast

Masts are made out of Aluminium, Grade EN AW-6061 T6 (EP)

For the **7.5 x 10m** and the **10 x 15m**, a pole diameter is used of 50mm, thickness 1.8mm

Profile = tube Ø50 x 1.8mm
Length = 2.0 m
Quality = EN AW-6061 T6 (EP)

Fd,max = 6 kN.

Buckling capacity 2m mast: 11.24 kN, see Annex B1.

UC **F_d / F_{ud} < 1** **6 / 11.24 = 0.53 < 1** **OK**

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For the **15 x 20m**, a pole diameter is used of 50mm, thickness 3mm

Profile = tube Ø50 x 3mm
Length = 2.0 m
Quality = EN AW-6061 T6 (EP)

Fd,max = 12.45 kN.

Buckling capacity 2m mast: 17.46 kN, see Annex B1.

UC **F_d / F_{ud} < 1** **12.45 / 17.46 = 0.71 < 1** **OK**

5.2. 3m mast

Masts are made out of Aluminium, Grade EN AW-6061 T6 (EP)

For the **7.5 x 10m** and the **10 x 15m**, a pole diameter is used of 50mm, thickness 1.8mm

Profile = tube Ø50 x 1.8mm
Length = 3.0 m
Quality = EN AW-6061 T6 (EP)

Fd,max = 4.95 kN.

Buckling capacity 3m mast: 5.19 kN, see Annex B2.

UC **$F_d / F_{ud} < 1$** **4.95 / 5.19 = 0.95 < 1** **OK**

For the **15 x 20m**, a pole diameter is used of 50mm, thickness 3mm

Profile = tube Ø50 x 3 mm
Length = 3.0 m
Quality = EN AW-6061 T6 (EP)

Fd,max = 7.65 kN.

Buckling capacity 3m mast: 8.06 kN, see Annex B2.

UC **$F_d / F_{ud} < 1$** **7.65 / 8.06 = 0.95 < 1** **OK**

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5.3. 4m mast

Masts are made out of Aluminium, Grade EN AW-6061 T6 (EP)

For the **7.5 x 10m** and the **10 x 15m**, a pole diameter is used of 70mm, thickness 3.18mm

Profile = tube Ø70 x 3.18mm
Length = 4.0 m
Quality = EN AW-6061 T6 (EP)

Fd,max = 7.2 kN.

Buckling capacity 4m mast: 13.73 kN, see Annex B3.

UC **$F_d / F_{ud} < 1$** **7.2 / 13.73 = 0.52 < 1** **OK**

For the **15 x 20m**, a pole diameter is used of 70mm, thickness 4mm

Profile = tube Ø70 x 4 mm
Length = 4.0 m
Quality = EN AW-6061 T6 (EP)

Fd,max = 16.05 kN.

Buckling capacity 4m mast: 16.68 kN, see Annex B3.

UC $F_d / F_{ud} < 1$ 16.05 / 16.68 = 0.96 < 1 OK

5.4. Ties

Ties are made out of synthetic fibre ropes. Safety factors out of the NEN-EN 13782 are used to indicate the capacity of the ropes:

rope diameter mm	Safety factor
12	4
14	3,3
16	3,3
18	2,7
20	2,7
>20	2,7
NOTE Values to apply to ultimate limit state.	

TABLE 4, TABLE 6 OUT OF NEN-EN 13782, FACTORS FOR SYNTHETIC FIBRE ROPES (ACCORDING TO EN ISO 1141, EN ISO 1346 AND EN ISO 1969)

gamma M voor 12 mm mag 4 zijn ipv 4,4. Laat je de keuze nu aan de gebruiker? Of isvoorgeschreven wat er gebruikt moet worden, ik zie namelijk nergens welke touwen gebruikt worden met welke breaking load.

Minimal Breaking load synthetic ropes (kN)				
	kN	12mm	14mm	16mm
	ties	ym = 4.4	ym = 3.3	ym = 3.3
7.5 x 10	6.6	29.04	21.78	21.78
10 x 15	11.85	52.14	39.11	39.11
15 x 20	2.55	11.22	8.42	8.42

TABLE 5, MINIMAL BREAKING LOAD SYNTHETIC FIBRES

When the points of the fabric are not directly fixed to the ground, but by means of a tie, thereby taking into account the prescribed spacing, the forces in the anchor points and therewith in the ropes, do not exceed the forces in the ties specified here (see chapter on anchorage). Therefore the same rope can be used as specified for the 7.5 x 10m tent. Welke zijn gespecificeerd?

Storm belts

For the tent size 15 x 20, 4 additional storm belts are placed over the structure. They take over a large part of the uplift load and therefore get a relatively large load.

On the design load of the storm belts, an additional material factor of 2 is required on the breaking capacity of the belts. When not a breaking strength is specified but a Lashing capacity (LC), the LC can be compared with the representative values of the force in the storm belts, as they are produced conform NEN-EN-12195-2 where a safety factor of 3 is incorporated into the LC value.

Chosen type of belt: 50mm wide belt, breaking capacity 7500 daN (see Annex E)

UC Fd / Fsd = 34.8 / (75 / 2) = 0.92

5.5. Anchorage

5.5.1 7.5 x 10m tent

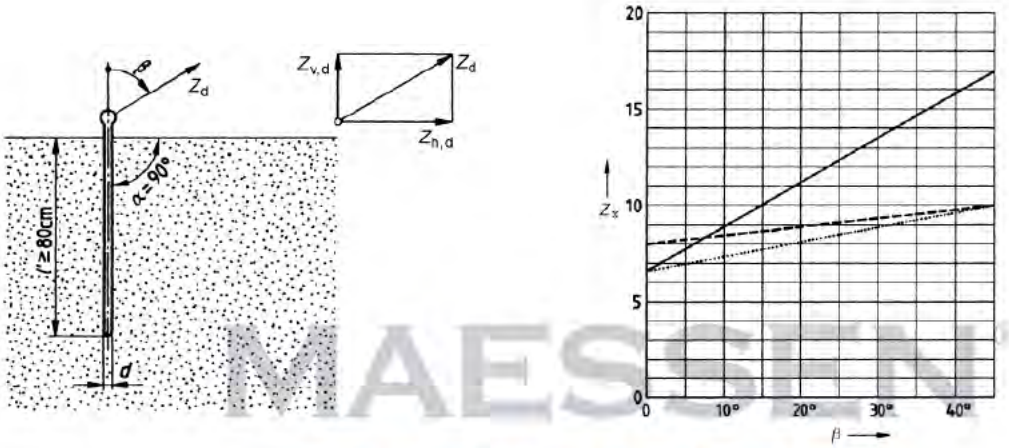
A distinction is made between the anchorage of the ties at the front of the structure, the tie-down points of the fabric directly to the ground and the storm belts.

Anchorage of the ties at the front of the structure

Max force (Frep) in one tie: 4.4 kN.

Partial safety factor on anchorage: $\gamma_f = 1{,}2$ (see 2.2)

$Zd = Frep_{tie} \times \gamma_f = 1.2 \times 4.4 = 5.28$ kN



Angle of pull	Load bearing capacity N
$\beta = 0$	$Z_d = 6{,}5$ dl' for stiff cohesive and for dense cohesion less soils
$\beta = 0$	$Z_d = 8$ dl' for very stiff cohesive soils
$\beta \geq 45$	$Z_d = 10$ dl' for cohesive soils of at least medium to stiff consistency
$\beta \geq 45$	$Z_d = 17$ dl' for dense cohesion less soils
$0 < \beta < 45$	The load bearing capacity for the soil types shall be determined by interpolation

Z_d is the anchor service load (service load), in N;
$Z_{h,d}$ is the horizontal anchor service load, in N;
$Z_{v,d}$ is the vertical anchor service load, in N;
d is the anchor diameter, in cm;
l' is the depth of penetration in cm;
α is the angle of penetration;
β is the angle of acting tensile force to the vertical

Figure 4 & 5, table 5 from NEN-EN 13782

Needed capacity of anchor:		Zd	=	5.28 kN
β = Arctan			>	45^0
Length of anchor in the ground		l'	=	100 cm
Diameter of anchor		d	=	3 cm
Zu,d = 17 d l' for *dense soils*	= 17 x 3 x 100		=	5.1 kN

⇨ 1 anchor applied:

UC Zd / Zu,d ≤ 1 5.28 / (5.1 x 1) = 1.03 ≈ 1 **Ok**

These values are for dense cohesionless soil.

For stiff cohesive soils, this capacity is reduced to 59%. Admissible is 5.1 x 0.59= 3.0 kN. Then 2 anchors need to be placed. When more than one anchor is used, the distance between two anchors shall be at least 5 x d to be able to use the full capacity of the anchors.

Anchoring of Tie-down points of fabric

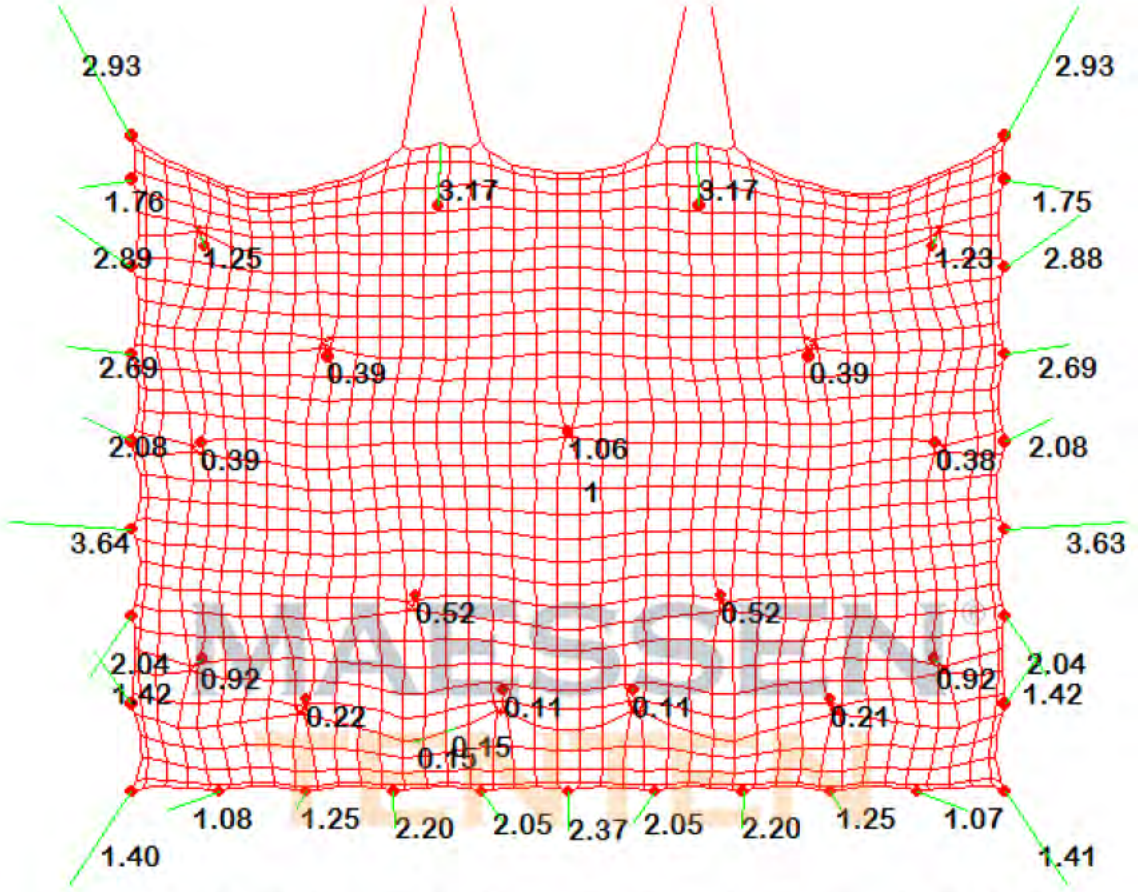


FIGURE 29, MAX FORCES IN TIE-DOWN POINTS (FREP) 7.5 X 10M

Max force (Frep) in one tie: 3.64 kN.
Partial safety factor on anchorage: γ_f = 1,2 (see 2.2)

Zd = $Frep_{tie}$ x γ_f = 1.2 x 3.64 = 4.37 kN

Needed capacity of anchor:		Zd	=	4.37 kN
β = Arctan			>	45 ^{0}
Length of anchor in the ground		l'	=	100 cm
Diameter of anchor		d	=	3 cm
Zu,d = 17 d l' for *dense soils*	= 17 x 3 x 100		=	5.1 kN

⇨ 1 anchor applied:

UC Zd / Zu,d ≤ 1 4.37 / (5.1 x 1) = 0.86 < 1 **Ok**

These values are for dense cohesionless soil.

For stiff cohesive soils, this capacity is reduced to 59%. Admissible is 5.1 x 0.59= 3.0 kN. Then 2 anchors need to be placed.

When more than one anchor is used, the distance between two anchors shall be at least 5 x d to be able to use the full capacity of the anchors.

Anchoring of storm belts

No storm belts are applied at the 7.5 x 10m tent.

5.5.2 10 x 15m tent

A distinction is made between the anchorage of the ties at the front of the structure, the tie-down points of the fabric directly to the ground and the storm belts.

Anchorage of the ties at the front of the structure

Max force (Frep) in one tie: 7.9 kN.

Partial safety factor on anchorage: $\gamma_f = 1{,}2$ (see 2.2)

$Zd = Frep_{tie} \times \gamma_f = 1.2 \times 7.9 = 9.48$ kN

Needed capacity of anchor:		Zd	=	9.48 kN
β = Arctan			>	45^0
Length of anchor in the ground		l'	=	100 cm
Diameter of anchor		d	=	3 cm
Zu,d = 17 d l' for *dense soils*	=	17 x 3 x 100	=	5.1 kN

⇨ 2 anchors applied:

UC Zd / Zu,d ≤ 1 9.48 / (5.1 x 2) = 0.92 < 1 **Ok**

These values are for dense cohesionless soil.

For stiff cohesive soils, this capacity is reduced to 59%. Admissible is 5.1 x 0.59= 3.0 kN. Then 3 anchors need to be placed.
When more than one anchor is used, the distance between two anchors shall be at least 5 x d to be able to use the full capacity of the anchors.

Anchoring of Tie-down points of fabric

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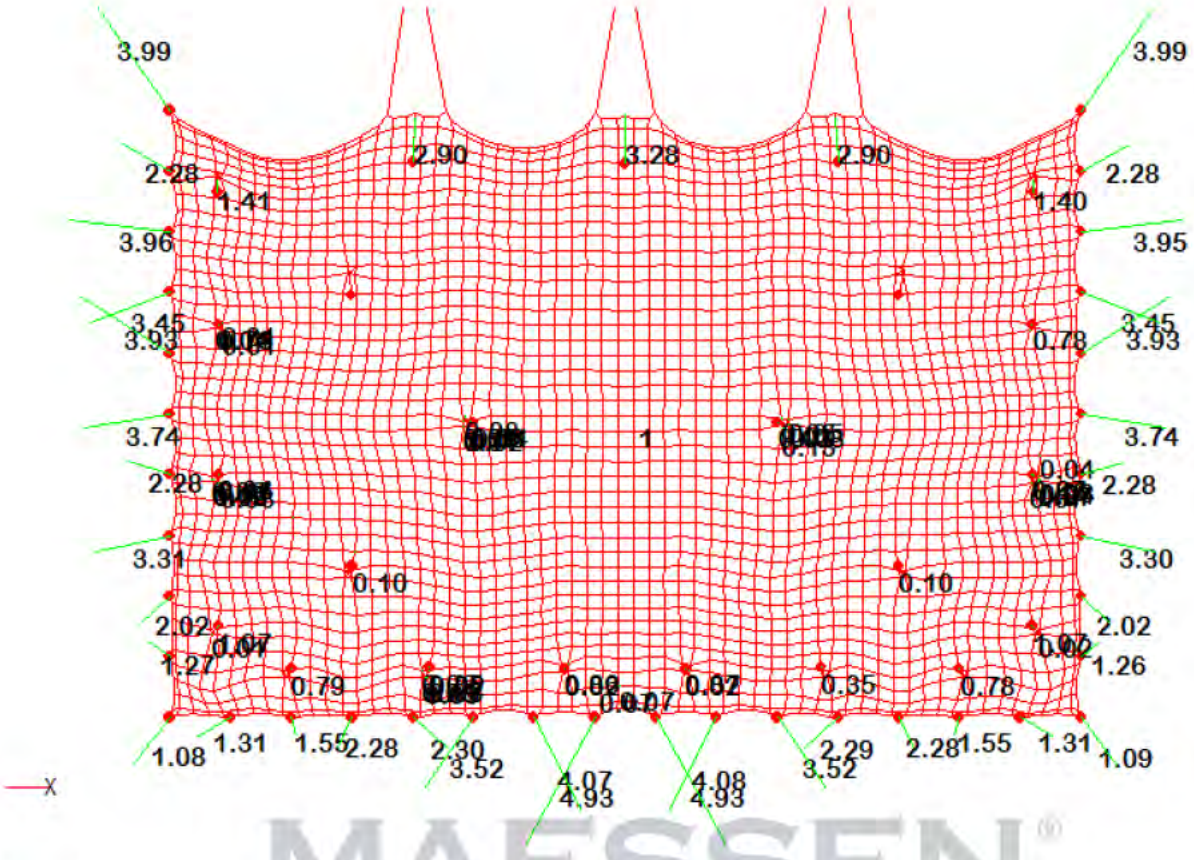

FIGURE 30, MAX FORCES IN TIE-DOWN POINTS (FREP) 10 X 15M

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Max force (Frep) in one tie: (4.07 + 4.93) / 2 = 4.5kN.
(an average value is chosen because it is assumed that these values are distributed equally)

Partial safety factor on anchorage: $\gamma_f = 1{,}2$ (see 2.2)

$Zd = Frep_{tie} \times \gamma_f = 1.2 \times 4.5 = 5.4$ kN

Needed capacity of anchor:	Zd	=	5.4 kN
β = Arctan		>	45 ^{0}
Length of anchor in the ground	l'	=	100 cm
Diameter of anchor	d	=	3 cm
Zu,d = 17 d l' for *dense soils* = 17 x 3 x 100		=	5.1 kN

⇨ 1 anchor applied:

UC Zd / Zu,d ≤ 1 5.4 / (5.1 x 1) = 1.05 ≈ 1 **Ok**

These values are for dense cohesionless soil.

For stiff cohesive soils, this capacity is reduced to 59%. Admissible is 5.1 x 0.59= 3.0 kN. Then 2 anchors need to be placed. When more than one anchor is used, the distance between two anchors shall be at least 5 x d to be able to use the full capacity of the anchors.

Anchoring of storm belts

No storm belts are applied at the 10 x 15m tent.

5.5.3 15 x 20m tent

A distinction is made between the anchorage of the ties at the front of the structure, the tie-down points of the fabric directly to the ground and the storm belts.

Anchorage of the ties at the front of the structure

Max force (Frep) in one tie: 1.7 kN.

This force is considerably lower than the forces at the 7x10m and 10 x 15m. This is caused by the storm belts that are applied at the 15 x 20m. They take the load

Partial safety factor on anchorage: γ_f = 1,2 (see 2.2)

$Zd = Frep_{tie} \times \gamma_f = 1.2 \times 1.7 = 2.04$ kN

Needed capacity of anchor:		Zd	=	2.04 kN
β = Arctan			>	45^0
Length of anchor in the ground		l'	=	100 cm
Diameter of anchor		d	=	3 cm
Zu,d = 17 d l' for *dense soils*	= 17 x 3 x 100		=	5.1 kN

⇨ 1 anchor applied:

UC Zd / Zu,d ≤ 1 2.04 / (5.1 x 1) = 0.4 < 1 **Ok**

These values are for dense cohesionless soil.

For stiff cohesive soils, this capacity is reduced to 59%. Admissible is 5.1 x 0.59= 3.0 kN. Then 1 anchor need to be placed. When more than one anchor is used, the distance between two anchors shall be at least 5 x d to be able to use the full capacity of the anchors.

Anchoring of Tie-down points of fabric

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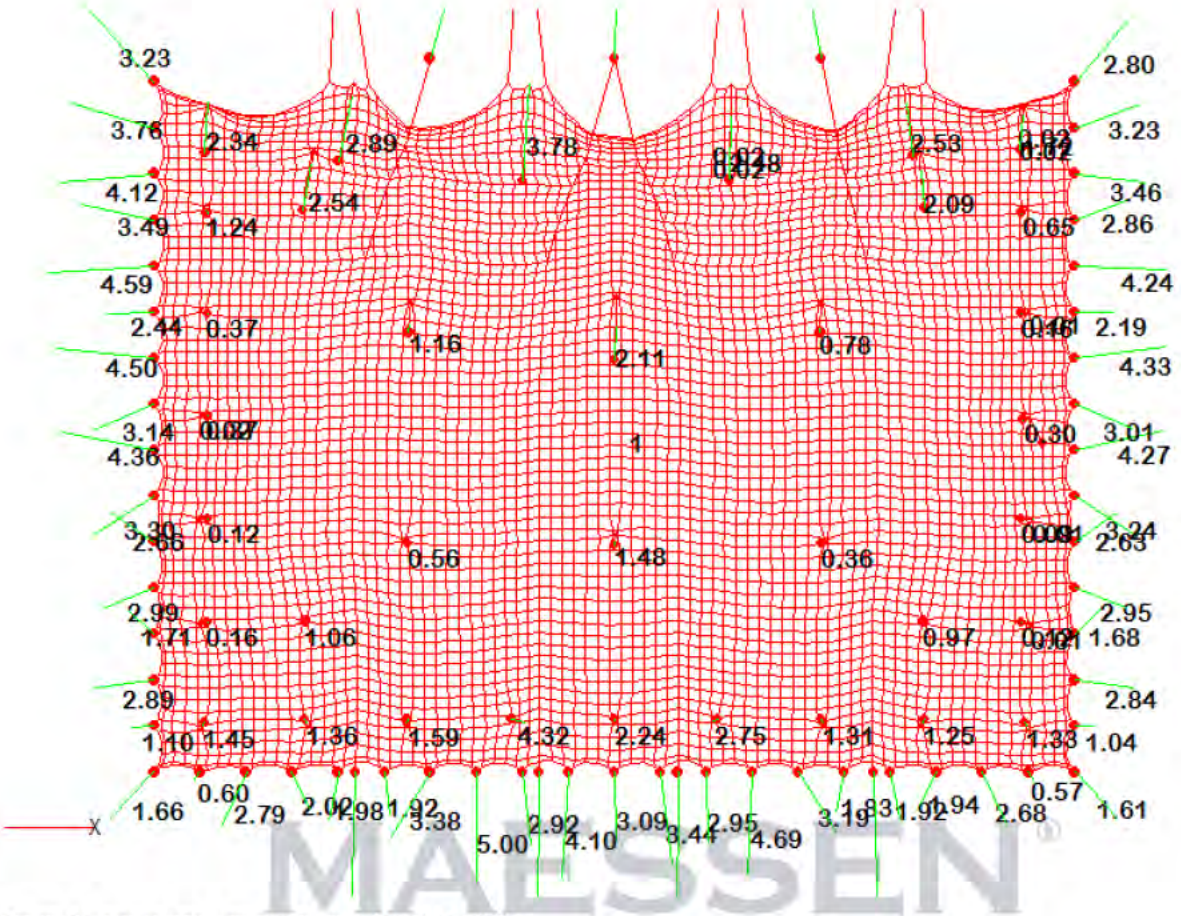

FIGURE 31, MAX FORCES IN TIE-DOWN POINTS (FREP) 15 X 20M

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Max force (Frep) in one tie: 4.5kN.
(an average value is chosen because it is assumed that these values are distributed equally)

Partial safety factor on anchorage: $\gamma_f = 1{,}2$ (see 2.2)

$Zd = Frep_{tie} \times \gamma_f = 1.2 \times 4.5 = 5.4$ kN

Needed capacity of anchor:	Zd	=	5.4 kN
β = Arctan		>	45 °
Length of anchor in the ground	l'	=	100 cm
Diameter of anchor	d	=	3 cm
Zu,d = 17 d l' for *dense soils* = 17 x 3 x 100		=	5.1 kN

⇨ 1 anchor applied:

UC Zd / Zu,d ≤ 1 5.4 / (5.1 x 1) = 1.05 ≈ 1 **Ok**

These values are for dense cohesionless soil.

For stiff cohesive soils, this capacity is reduced to 59%. Admissible is 5.1 x 0.59= 3.0 kN. Then 2 anchors need to be placed. When more than one anchor is used, the distance between two anchors shall be at least 5 x d to be able to use the full capacity of the anchors.

Anchoring of storm belts

Max force (Frep) in one tie: 23.2 kN.

Partial safety factor on anchorage: γ_f = 1,2 (see 2.2)

Zd = $Frep_{tie}$ x γ_f = 1.2 x 23.2 = 27.84 kN

Needed capacity of anchor:	Zd	=	27.84 kN
β = Arctan		>	45 ^{0}
Length of anchor in the ground	l'	=	130 cm
Diameter of anchor	d	=	4.5 cm
Zu,d = 17 d l' for *dense soils* = 17 x 4.5 x 130		=	9.95 kN

⇨ 3 anchor applied:

UC Zd / Zu,d ≤ 1 27.84 / (9.95 x 3) = 0.93 < 1 **Ok**

These values are for dense cohesionless soil.

For stiff cohesive soils, this capacity is reduced to 59%. Admissible is 9.95 x 0.59= 5.9 kN. Then 5 anchors need to be placed. When more than one anchor is used, the distance between two anchors shall be at least 5 x d to be able to use the full capacity of the anchors.

<u>Anchor tests according to NEN-EN 13782</u>

A safety factor of v = 1,6 regarding ultimate limit load is to apply for the lowest test value in order to determine the load bearing capacity in subsequent calculation. The load bearing capacity determined in this manner shall not result in anchor movement which would result in stresses, deformations or instability inadmissible for the structure. If the foundation conditions are comparable, test loadings carried out in another location may be adduced for substantiation purposes.

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MAATWERK OP LOCATIE

For example:

Force in belts: Frep = 16.2 kN
Fsd_{belt} = 1.2 x Frep = 1.2 x 16.2 = 19.4 kN

The partial safety factor γ = 1.6 is applied on the ultimate limit load:.

$Z_{u,dtest}$ > 1.6 x Fsd = 1.6 x 19.4 = 31.1 kN

If for example the anchor test point out there is a minimal anchor capacity of 16 kN (1600 kg), then 2 anchors are needed: 2x 16 = 32 kN > $Z_{u,dtest}$.

5.6. Fabric

It is assumed that the fabric is manufactured according to NEN-EN 10204 3.1. (see Annex E4))

Check of the fabric stresses:

In all cases the fabric stresses stay below 6.93 kN/m'.

f_{ud} = 28 / 2.5 = 11.2 kN/m in kettingrichting

f_{ud} = 26 / 2.5 = 10.4 kN/m in inslagrichting

$f_{d,ketting}$ = f_{rep} x 1.5 = 6.93 x 1.5 = 10.4 kN/m'

$f_{d,inslag}$ = f_{rep} x 1.5 = 6.93 x 1.5 = 10.4 kN/m'

UC $f_{d,ketting}$ / f_{ud} = 10.4 / 11.2	**=**	**0.93**	**< 1**	**ok**
UC $f_{d,inslag}$ / f_{ud} = 10.4 / 10.4	**=**	**1**	**< 1**	**ok**

5.7. Boundary detail

At each meter along the perimeter, a connection detail is foreseen on the boundary of the fabric, the loads out of the ties and the tie-down points, are directly introduced into the fabric. There is no boundary reinforcement that spreads out the forces.

RHI has developed a special connection detail, that consists out of 3 different layers of fabric. As the strength per width of one layer of fabric is known, an indication of the strength of one connection can be given by multiplying the number of layers with an average width:



FIGURE 32,DETAIL OF BOUNDARY

Capacity: 4 x 10.4 = 41.6 kN/m (3 layers in total)

Average width of reinforcement: 0.3m. Capacity of connection: 41.6 x 0.3 = 12.48 kN

Max Fd in ties: 11.85 kN (10 x 15m)

UC	**11.85 / 12.48**	**=**	**0.95**	**< 1**	**OK**

When only the connection points are used for anchoring the fabric, a large sag occurs between those points. It is possible to put an additional rope throught all the connection points to reduce the sag.

Annex

A Drawings

B Buckling analysis 2m mast
Buckling analysis 3m mast
Buckling analysis 4m mast

C Load cases

D support reactions

E material specifications

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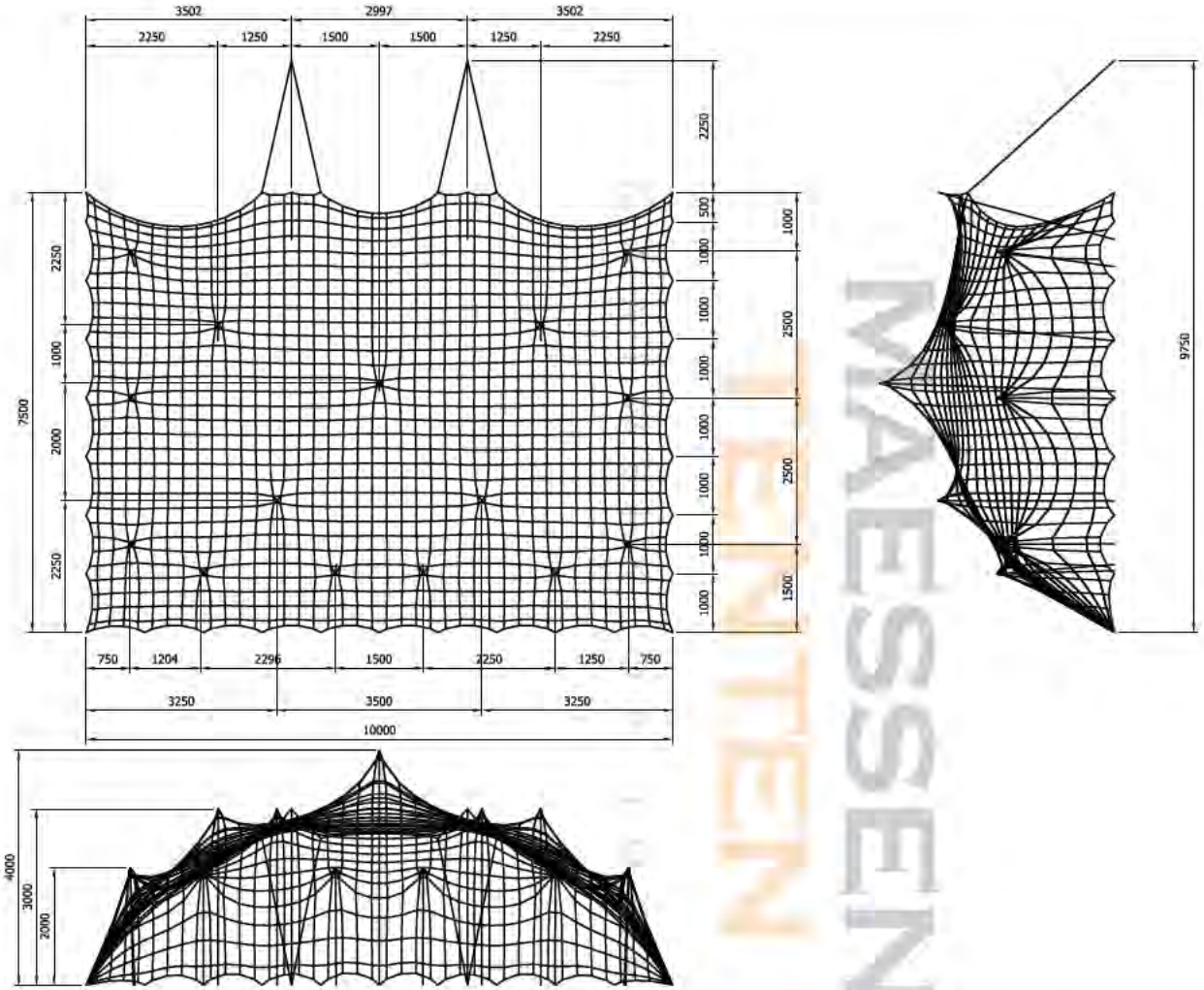

Each fabric foundation point: 1 anchor l=1200 ø30mm (Leff = 1000mm)
Each Tie: 1 anchor l=1200 ø30mm (Leff = 1000mm), Where two ties meet: 2 anchors
anchor size: length 1200mm, ø30mm.
Depth of anchor: 1000mm
For dense cohesionless soil

Maessen Tenten Stretch tent max 7.5 x 10m

tentech
Rotsoord 13 E . 3523 CL Utrecht
P.O. box 85190 . 3508 AD Utrecht
T [redacted]
F
ontwerp en advies voor lichtgewicht bouwen

Maessen Tenten Stretch Tents

E: info@maessententen .nl
www.maessententen.nl

editor:	date:	status:	check:	date:
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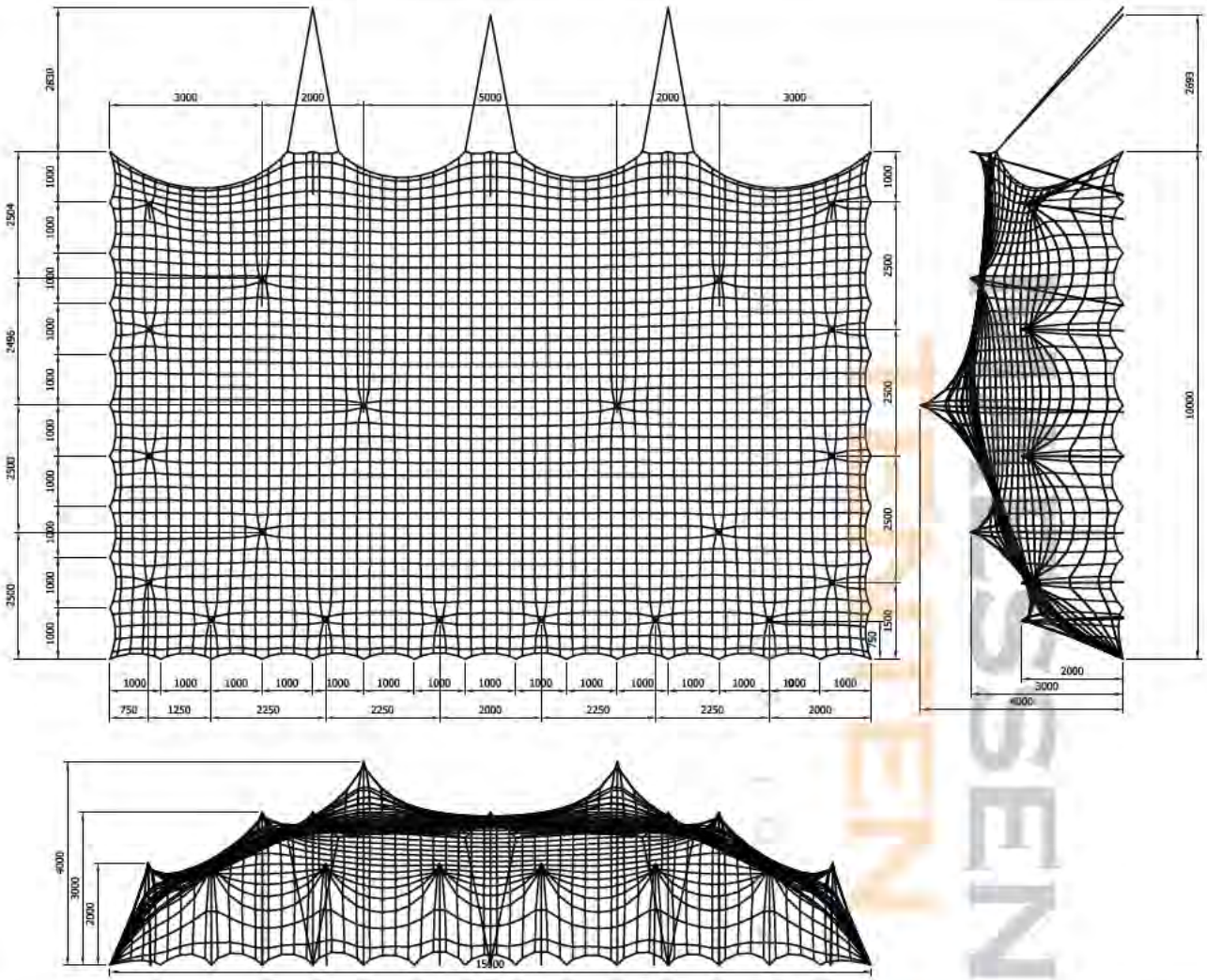
MAESSEN TENTEN



Each fabric foundation point: 1 anchor l=1200 ø30mm (Leff = 1000mm)
Each Tie: 2 anchors l=1200 ø30mm (Leff = 1000mm), Where two ties meet: 4 anchors
anchor size: length 1200mm, ø30mm.
Depth of anchor: 1000mm
For dense cohesionless soil

Maessen Tenten Stretch tent max 10 x 15m

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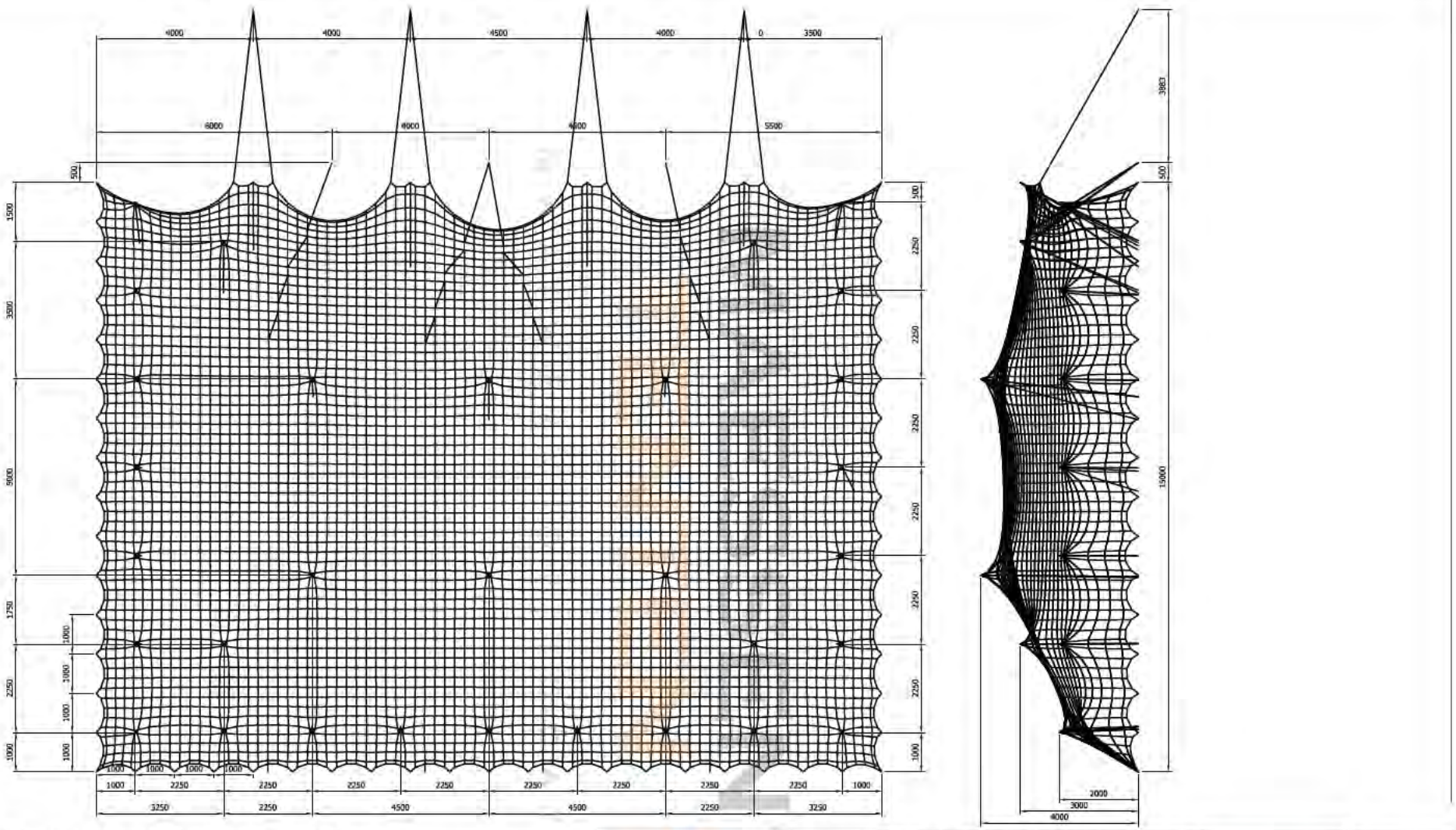

Each fabric foundation point: 1 anchor l=1200 ⌀30mm (Leff = 1000mm)
Each Tie: 1 anchors l=1200 ⌀30mm (Leff = 1000mm), Where two ties meet: 2 anchors
anchor size: length 1200mm, ⌀30mm.
Depth of anchor: 1000mm
For dense cohesionless soil
Storm belts: each belt 3 anchors L= 1500 ⌀45mm (Leff = 1300mm)

Maessen Tenten Stretch tent max 15 x 20m

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Rotsoord 13 E . 3523 CL Utrecht
P.O. box 85190 . 3508 AD Utrecht
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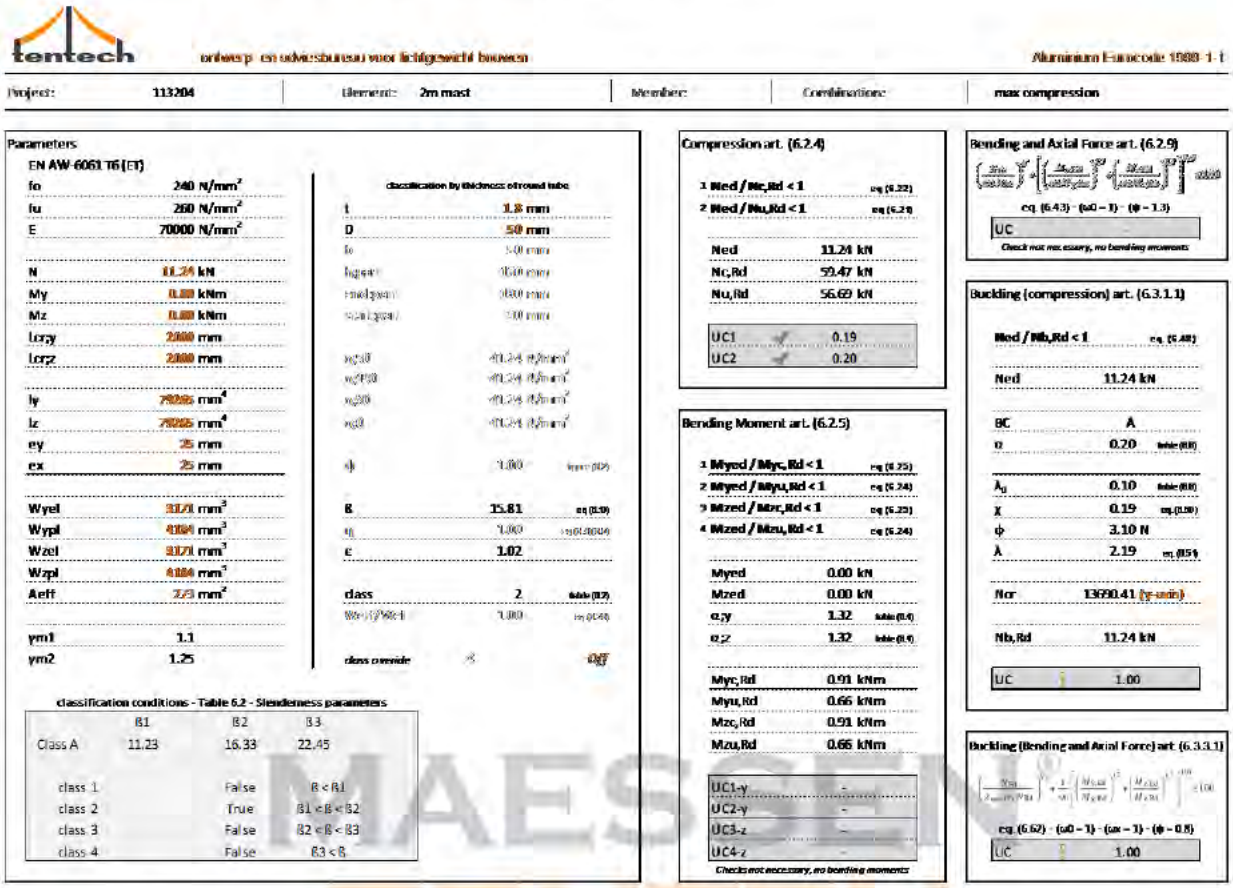
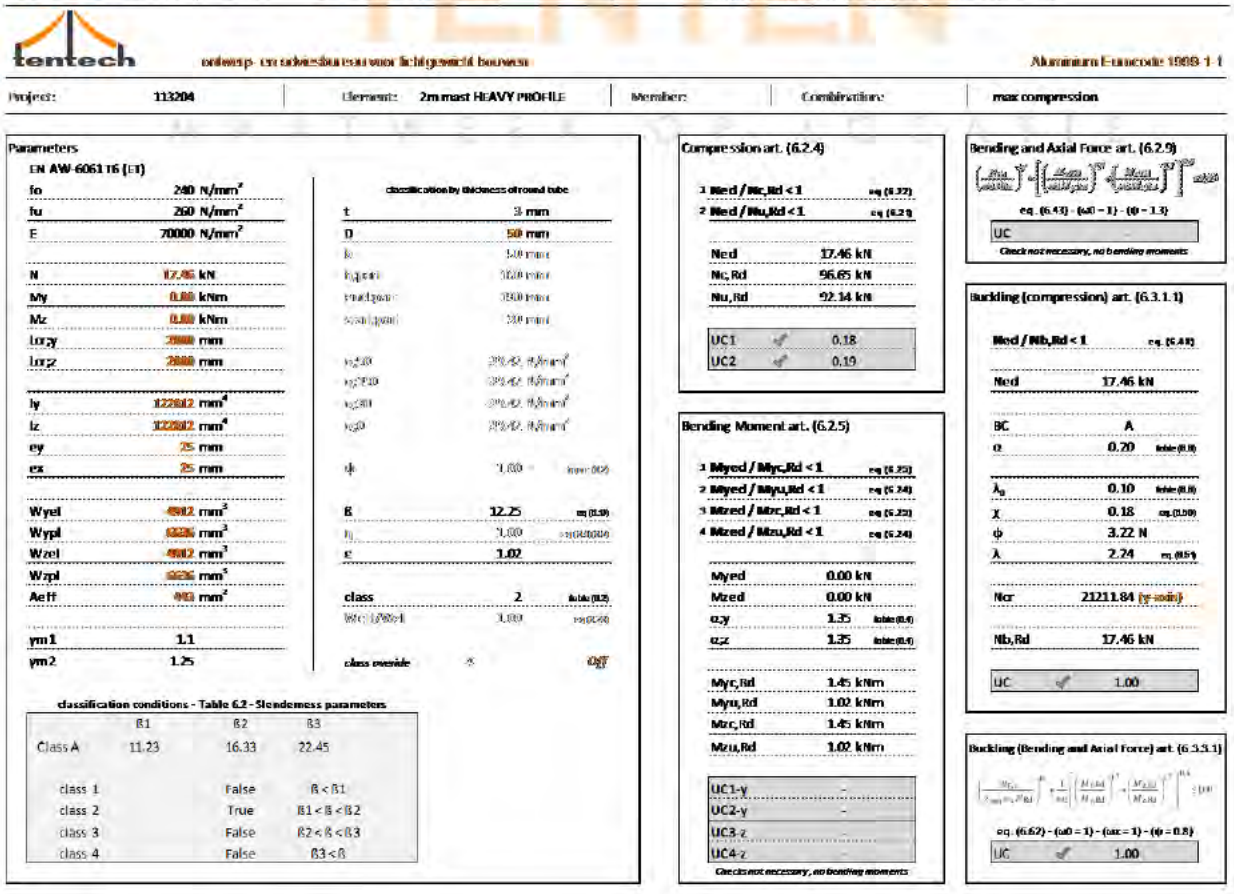
Annex B1: Buckling capacity 2m mast 50 x 1.8 / 50 x 3 EN AW-6061 T6





MAESCH TENTEN

Annex B2: Buckling capacity 3m mast 50 x 1.8 / 50 x 3 EN AW-6061 T6

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Project: 113204 | Element: 3m mast | Member: | Combination: | max compression

Parameters

EN AW-6061 T6 (ET)

fo	240 N/mm²		
fu	260 N/mm²		
E	70000 N/mm²		
N	5.19 kN		
My	0.00 kNm		
Mz	0.00 kNm		
Lcry	3000 mm		
Lcrz	3000 mm		
Iy	78965 mm⁴		
Iz	78965 mm⁴		
ey	25 mm		
ex	25 mm		
Wyel	3171 mm³		
Wypl	4284 mm³		
Wzel	3171 mm³		
Wzpl	4284 mm³		
Aeff	273 mm²		
γm1	1.1		
γm2	1.25		

classification by thickness of round tube

t	1.8 mm	
D	50 mm	
b	140 mm	
hpeak	1000 mm	
midpoint	1000 mm	
start point	200 mm	
σ@0	70.94 N/mm²	
σ@100	70.94 N/mm²	
σ@200	70.94 N/mm²	
σ@0	70.94 N/mm²	
ϕ	1.00	eq.(6.50)
ß	15.81	eq.(6.49)
η	1.00	eq.(6.48)(6.49)
ε	1.02	
class	2	table (5.2)
Wel,f/Wel	1.00	eq.(6.44)
class overide	-	Off

classification conditions - Table 6.2 - Slenderness parameters

	ß1	ß2	ß3	
Class A	11.23	16.33	22.45	
class 1		False		ß < ß1
class 2		True		ß1 < ß < ß2
class 3		False		ß2 < ß < ß3
class 4		False		ß3 < ß

Compression art. (6.2.4)

1 Ned / Nc,Rd < 1		eq.(6.23)
2 Ned / Nu,Rd < 1		eq.(6.23)
Ned	5.19 kN	
Nc,Rd	59.47 kN	
Nu,Rd	56.69 kN	
UC1	0.09	
UC2	0.09	

Bending Moment art. (6.2.5)

1 Myed / Myc,Rd < 1		eq.(6.31)
2 Myed / Myu,Rd < 1		eq.(6.34)
3 Mzed / Mzc,Rd < 1		eq.(6.35)
4 Mzed / Mzu,Rd < 1		eq.(6.34)
Myed	0.00 kN	
Mzed	0.00 kN	
α;y	1.32	table (6.6)
α;z	1.32	table (6.6)
Myc,Rd	0.91 kNm	
Myu,Rd	0.66 kNm	
Mzc,Rd	0.91 kNm	
Mzu,Rd	0.66 kNm	
UC1-y	-	
UC2-y	-	
UC3-z	-	
UC4-z	-	

Checks not necessary, no bending moments

Bending and Axial Force art. (6.2.9)

$$\left[\left(\frac{M_{y,Ed}}{M_{N,y,Rd}}\right)^{\alpha} + \left(\frac{M_{z,Ed}}{M_{N,z,Rd}}\right)^{\beta}\right]^{\gamma} \le 1.0$$

eq. (6.43) - (ωO = 1) - (ϕ = 1.3)

UC

Check not necessary, no bending moments

Buckling (compression) art. (6.3.1.1)

Ned / Nb,Rd < 1		eq. (6.48)
Ned	5.19 kN	
BC	A	
α	0.20	table (6.6)
λ_0	0.10	table (6.6)
χ	0.09	eq.(6.50)
ϕ	6.19 N	
λ	3.28	eq. (6.49)
Ncr	6084.63 (y-axis)	
Nb,Rd	5.19 kN	
UC	1.00	

Buckling (Bending and Axial Force) art. (6.3.3.1)

$$\left(\frac{N_{Ed}}{\chi_{min} N_{Rk}/\gamma_{M1}}\right)^{\alpha} + k_{yy}\left(\frac{M_{y,Ed}+\Delta M_{y,Ed}}{M_{y,Rk}/\gamma_{M1}}\right)^{\beta} + k_{yz}\left(\frac{M_{z,Ed}+\Delta M_{z,Ed}}{M_{z,Rk}/\gamma_{M1}}\right)^{\gamma} \le 1.0$$

eq. (6.62) - (ωO = 1) - (ωx = 1) - (ϕ = 0.5)

UC	1.00

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tentech — ontwerp- en adviesbureau voor lichtgewicht bouwen — Aluminium Eurocode 1999-1-1

Project: 113204 | Element: 3m mast HEAVY PROFILE | Member: | Combination: | max compression

Parameters

EN AW-6061 T6 (ET)

fo	240 N/mm²		
fu	260 N/mm²		
E	70000 N/mm²		
N	8.06 kN		
My	0.00 kNm		
Mz	0.00 kNm		
Lcry	3000 mm		
Lcrz	3000 mm		
Iy	122812 mm⁴		
Iz	122812 mm⁴		
ey	25 mm		
ex	25 mm		
Wyel	4912 mm³		
Wypl	6636 mm³		
Wzel	4912 mm³		
Wzpl	6636 mm³		
Aeff	443 mm²		
γm1	1.1		
γm2	1.25		

classification by thickness of round tube

t	3 mm	
D	50 mm	
b	140 mm	
hpeak	1000 mm	
midpoint	1000 mm	
start point	200 mm	
σ@0	108.30 N/mm²	
σ@100	108.30 N/mm²	
σ@200	108.30 N/mm²	
σ@0	108.30 N/mm²	
ϕ	1.00	eq.(6.50)
ß	12.25	eq.(6.49)
η	1.00	eq.(6.48)(6.49)
ε	1.02	
class	2	table (5.2)
Wel,f/Wel	1.00	eq.(6.44)
class overide	-	Off

classification conditions - Table 6.2 - Slenderness parameters

	ß1	ß2	ß3	
Class A	11.23	16.33	22.45	
class 1		False		ß < ß1
class 2		True		ß1 < ß < ß2
class 3		False		ß2 < ß < ß3
class 4		False		ß3 < ß

Compression art. (6.2.4)

1 Ned / Nc,Rd < 1		eq.(6.23)
2 Ned / Nu,Rd < 1		eq.(6.23)
Ned	8.06 kN	
Nc,Rd	96.65 kN	
Nu,Rd	92.14 kN	
UC1	0.08	
UC2	0.09	

Bending Moment art. (6.2.5)

1 Myed / Myc,Rd < 1		eq.(6.31)
2 Myed / Myu,Rd < 1		eq.(6.34)
3 Mzed / Mzc,Rd < 1		eq.(6.35)
4 Mzed / Mzu,Rd < 1		eq.(6.34)
Myed	0.00 kN	
Mzed	0.00 kN	
α;y	1.35	table (6.6)
α;z	1.35	table (6.6)
Myc,Rd	1.45 kNm	
Myu,Rd	1.02 kNm	
Mzc,Rd	1.45 kNm	
Mzu,Rd	1.02 kNm	
UC1-y	-	
UC2-y	-	
UC3-z	-	
UC4-z	-	

Checks not necessary, no bending moments

Bending and Axial Force art. (6.2.9)

$$\left[\left(\frac{M_{y,Ed}}{M_{N,y,Rd}}\right)^{\alpha} + \left(\frac{M_{z,Ed}}{M_{N,z,Rd}}\right)^{\beta}\right]^{\gamma} \le 1.0$$

eq. (6.43) - (ωO = 1) - (ϕ = 1.3)

UC

Check not necessary, no bending moments

Buckling (compression) art. (6.3.1.1)

Ned / Nb,Rd < 1		eq. (6.48)
Ned	8.06 kN	
BC	A	
α	0.20	table (6.6)
λ_0	0.10	table (6.6)
χ	0.03	eq.(6.50)
ϕ	6.46 N	
λ	3.36	eq. (6.49)
Ncr	9427.48 (y-axis)	
Nb,Rd	8.06 kN	
UC	1.00	

Buckling (Bending and Axial Force) art. (6.3.3.1)

$$\left(\frac{N_{Ed}}{\chi_{min} N_{Rk}/\gamma_{M1}}\right)^{\alpha} + k_{yy}\left(\frac{M_{y,Ed}+\Delta M_{y,Ed}}{M_{y,Rk}/\gamma_{M1}}\right)^{\beta} + k_{yz}\left(\frac{M_{z,Ed}+\Delta M_{z,Ed}}{M_{z,Rk}/\gamma_{M1}}\right)^{\gamma} \le 1.0$$

eq. (6.62) - (ωO = 1) - (ωx = 1) - (ϕ = 0.5)

UC	1.00

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Annex B3: Buckling capacity 4m mast 70 x 3.18 / 70 x 4 EN AW-6061 T6

tentech — ontwerp- en adviesbureau voor lichtgewicht bouwen — Aluminium Eurocode 1999-1-1

Project: 113204 | Element: 4m mast | Member: | Combination: | max compression

Parameters

EN AW-6061 T6 (ET)

fo	240 N/mm²	classification by thickness of round tube	
fu	260 N/mm²	t	3.18 mm
E	70000 N/mm²	D	70 mm
N	13.73 kN	h	63.64 mm
My	0.00 kNm	hpart	31.82 mm
Mz	0.00 kNm	midpart	31.82 mm
Lcry	4000 mm	subpart	20 mm
Lcrz	4000 mm	σy,t	240.00 N/mm²
		σy,mid	240.00 N/mm²
Iy	573403 mm⁴	σy,sub	240.00 N/mm²
Iz	573403 mm⁴	σy,h	240.00 N/mm²
ey	35 mm		
ez	35 mm	ψ	1.000
		β	14.08
Wyel	16369 mm³	η	1.000
Wypl	18299 mm³	ε	1.02
Wzel	16369 mm³		
Wzpl	18299 mm³	class	2
Aeff	668 mm²	Wel/Wpl	1.000
γm1	1.1		
γm2	1.25	class overide	0 Off

classification conditions - Table 6.2 - Slenderness parameters

	β1	β2	β3	
Class A	11.23	16.33	22.45	
class 1		False		β < β1
class 2		True		β1 < β < β2
class 3		False		β2 < β < β3
class 4		False		β3 < β

Compression art. (6.2.4)

1 Ned / Nc,Rd < 1	eq (6.22)	
2 Ned / Nu,Rd < 1	eq (6.23)	
Ned	13.73 kN	
Nc,Rd	145.65 kN	
Nu,Rd	138.85 kN	
UC1	0.09	
UC2	0.10	

Bending Moment art. (6.2.5)

1 Myed / Myc,Rd < 1	eq (6.25)	
2 Myed / Myu,Rd < 1	eq (6.24)	
3 Mzed / Mzc,Rd < 1	eq (6.25)	
4 Mzed / Mzu,Rd < 1	eq (6.24)	
Myed	0.00 kN	
Mzed	0.00 kN	
αy	1.33	table (6.6)
αz	1.33	table (6.6)
Myc,Rd	3.10 kNm	
Myu,Rd	2.22 kNm	
Mzc,Rd	3.10 kNm	
Mzu,Rd	2.22 kNm	
UC1-y	-	
UC2-y	-	
UC3-z	-	
UC4-z	-	

Check not necessary, no bending moments

Bending and Axial Force art. (6.2.9)

$$\left(\frac{M_{y,Ed}}{M_{N,y,Rd}}\right)^{\beta} + \left(\frac{M_{z,Ed}}{M_{N,z,Rd}}\right)^{\beta} \le 1.00$$

eq. (6.43) - (αO = 1) - (β = 1.9)

UC -

Check not necessary, no bending moments

Buckling (compression) art. (6.3.1.1)

Ned / Nb,Rd < 1 eq. (6.48)

Ned	13.73 kN	
BC	A	
α	0.20	table (6.5)
λ_0	0.10	table (6.5)
χ	0.09	eq. (6.50)
ϕ	5.77 N	
λ	3.15	eq. (6.49)
Ncr	16123.77 (yr axis)	
Nb,Rd	13.73 kN	
UC	1.00	

Buckling (Bending and Axial Force) art. (6.3.1.1)

$$\left(\frac{N_{Ed}}{\chi_{min}\gamma_{M1}\frac{N_{Rk}}{\gamma_{M1}}}\right)^{\beta} + \frac{1}{\omega_{LT}}\left(\frac{M_{y,Ed}}{M_{y,Rd}}\right)^{\beta} + \left(\frac{M_{z,Ed}}{M_{z,Rd}}\right)^{\beta} \le 1.00$$

eq. (6.62) - (αO = 1) - (αx = 1) - (β = 0.8)

UC 1.00

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tentech — ontwerp- en adviesbureau voor lichtgewicht bouwen — Aluminium Eurocode 1999-1-1

Project: 113204 | Element: 4m mast HEAVY PROFILE | Member: | Combination: | max compression

Parameters

EN AW-6061 T6 (ET)

fo	240 N/mm²	classification by thickness of round tube	
fu	260 N/mm²	t	4 mm
E	70000 N/mm²	D	70 mm
N	16.68 kN	h	62 mm
My	0.00 kNm	hpart	31 mm
Mz	0.00 kNm	midpart	31 mm
Lcry	4000 mm	subpart	20 mm
Lcrz	4000 mm	σy,t	240.00 N/mm²
		σy,mid	240.00 N/mm²
Iy	453256 mm⁴	σy,sub	240.00 N/mm²
Iz	453256 mm⁴	σy,h	240.00 N/mm²
ey	35 mm		
ez	35 mm	ψ	1.000
		β	12.55
Wyel	12960 mm³	η	1.000
Wypl	14496 mm³	ε	1.02
Wzel	12960 mm³		
Wzpl	14496 mm³	class	2
Aeff	829 mm²	Wel/Wpl	1.000
γm1	1.1		
γm2	1.25	class overide	0 Off

classification conditions - Table 6.2 - Slenderness parameters

	β1	β2	β3	
Class A	11.23	16.33	22.45	
class 1		False		β < β1
class 2		True		β1 < β < β2
class 3		False		β2 < β < β3
class 4		False		β3 < β

Compression art. (6.2.4)

1 Ned / Nc,Rd < 1	eq (6.22)	
2 Ned / Nu,Rd < 1	eq (6.23)	
Ned	16.68 kN	
Nc,Rd	180.96 kN	
Nu,Rd	172.51 kN	
UC1	0.09	
UC2	0.10	

Bending Moment art. (6.2.5)

1 Myed / Myc,Rd < 1	eq (6.25)	
2 Myed / Myu,Rd < 1	eq (6.24)	
3 Mzed / Mzc,Rd < 1	eq (6.25)	
4 Mzed / Mzu,Rd < 1	eq (6.24)	
Myed	0.00 kN	
Mzed	0.00 kN	
αy	1.35	table (6.6)
αz	1.35	table (6.6)
Myc,Rd	3.81 kNm	
Myu,Rd	2.69 kNm	
Mzc,Rd	3.81 kNm	
Mzu,Rd	2.69 kNm	
UC1-y	-	
UC2-y	-	
UC3-z	-	
UC4-z	-	

Check not necessary, no bending moments

Bending and Axial Force art. (6.2.9)

$$\left(\frac{M_{y,Ed}}{M_{N,y,Rd}}\right)^{\beta} + \left(\frac{M_{z,Ed}}{M_{N,z,Rd}}\right)^{\beta} \le 1.00$$

eq. (6.43) - (αO = 1) - (β = 1.9)

UC -

Check not necessary, no bending moments

Buckling (compression) art. (6.3.1.1)

Ned / Nb,Rd < 1 eq. (6.48)

Ned	16.68 kN	
BC	A	
α	0.20	table (6.5)
λ_0	0.10	table (6.5)
χ	0.09	eq. (6.50)
ϕ	5.89 N	
λ	3.19	eq. (6.49)
Ncr	19571.39 (yr axis)	
Nb,Rd	16.68 kN	
UC	1.00	

Buckling (Bending and Axial Force) art. (6.3.1.1)

$$\left(\frac{N_{Ed}}{\chi_{min}\gamma_{M1}\frac{N_{Rk}}{\gamma_{M1}}}\right)^{\beta} + \frac{1}{\omega_{LT}}\left(\frac{M_{y,Ed}}{M_{y,Rd}}\right)^{\beta} + \left(\frac{M_{z,Ed}}{M_{z,Rd}}\right)^{\beta} \le 1.00$$

eq. (6.62) - (αO = 1) - (αx = 1) - (β = 0.8)

UC 1.00

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MAESTRO TENTEN

Bijlage C: Loadcases

7.5 x 10m

LC02

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	NORMAL	0.3500	0.0000	-6.2847	24.4326	96.61
SUM			0.0000	-6.2847	24.4326	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	NORMAL	0.0000	-6.2847	24.4326
SUM	AREA-LOADS	0.0000	-6.2847	24.4326

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

SUM_X	SUM_Y	SUM_Z
0.0000	-6.2847	24.4737

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LC03

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	NORMAL	-0.1500	0.0000	2.6934	-10.4711	96.61
SUM			0.0000	2.6934	-10.4711	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	NORMAL	0.0000	2.6934	-10.4711
SUM	AREA-LOADS	0.0000	2.6934	-10.4711

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

SUM_X	SUM_Y	SUM_Z
0.0000	2.6934	-10.4887

LC04

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	NORMAL	0.6500	0.0000	-11.6716	45.3749	96.61
SUM			0.0000	-11.6716	45.3749	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	NORMAL	0.0000	-11.6716	45.3749
SUM	AREA-LOADS	0.0000	-11.6716	45.3749

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

SUM_X	SUM_Y	SUM_Z
0.0000	-11.6716	45.4512

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10 x 15m

LC02

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	NORMAL	0.3500	0.0001	-10.1879	49.5110	180.55
SUM			0.0001	-10.1879	49.5110	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	NORMAL	0.0001	-10.1879	49.5110
SUM	AREA-LOADS	0.0001	-10.1879	49.5110

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

SUM_X	SUM_Y	SUM_Z
0.0001	-10.1879	49.6034

LC03

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	NORMAL	-0.1500	0.0000	4.3651	-21.2148	180.53
SUM			0.0000	4.3651	-21.2148	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	NORMAL	0.0000	4.3651	-21.2148
SUM	AREA-LOADS	0.0000	4.3651	-21.2148

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

SUM_X	SUM_Y	SUM_Z
0.0000	4.3651	-21.2547

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LC04

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	NORMAL	0.6500	0.0001	-18.9154	91.9309	180.53
SUM			0.0001	-18.9154	91.9309	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	NORMAL	0.0001	-18.9154	91.9309
SUM	AREA-LOADS	0.0001	-18.9154	91.9309

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

	SUM_X	SUM_Y	SUM_Z
	0.0001	-18.9154	92.1038

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15 x 20m

LC02

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	NORMAL	0.3500	0.0726	-12.6265	97.9368	338.45
SUM			0.0726	-12.6265	97.9368	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	NORMAL	0.0726	-12.6265	97.9368
SUM	AREA-LOADS	0.0726	-12.6265	97.9368

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

	SUM_X	SUM_Y	SUM_Z
	0.0726	-12.6265	98.3937

LC03

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	NORMAL	-0.1500	-0.0300	6.6050	-42.1422	342.30
SUM			-0.0300	6.6050	-42.1422	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	NORMAL	-0.0300	6.6050	-42.1422
SUM	AREA-LOADS	-0.0300	6.6050	-42.1422

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

	SUM_X	SUM_Y	SUM_Z
	-0.0300	6.6050	-42.3202

MAESSEN® TENTEN MAATWERK OPLOSSING

LC04

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	NORMAL	0.6500	0.1348	-23.4492	181.8827	338.45
SUM			0.1348	-23.4492	181.8827	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	NORMAL	0.1348	-23.4492	181.8827
SUM	AREA-LOADS	0.1348	-23.4492	181.8827

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

	SUM_X	SUM_Y	SUM_Z
	0.1348	-23.4492	182.7311

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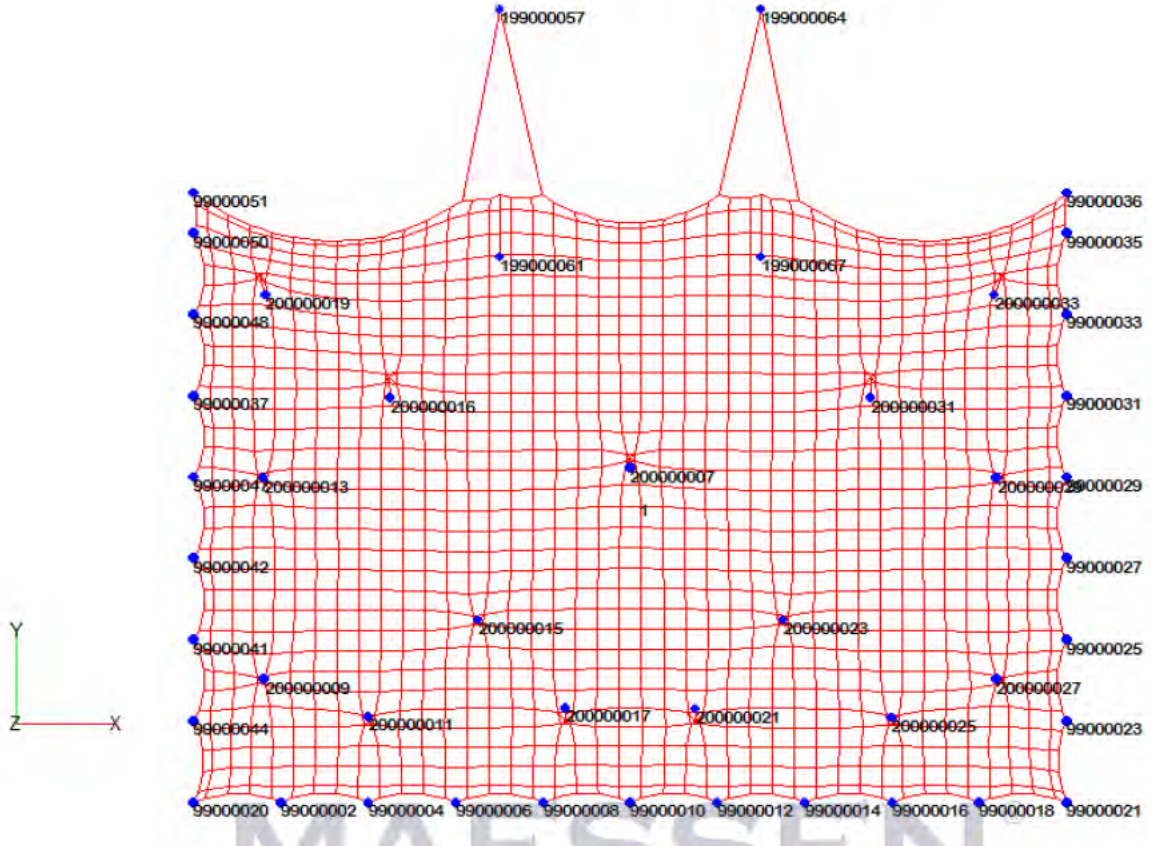
Bijlage D: Support reactions

D1 7.5 X 10M

	7 5 X 10M	REPRESENTATIVE VALUES (NO LOAD FACTOR INCLUDED)											
	nr				LC02			LC03			LC04		
		X	Y	Z	Fx	Fy	Fz	Fx	Fy	Fz	Fx	Fy	Fz
		[m]	[m]	[m]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Tie-down	99000020	-5.00	-3.75	0.00	-0 53	-0.81	-0.34	-1.11	-1.09	-0.32	-0.72	-1.08	-0.52
Tie-down	99000044	-5.00	-2.75	0.00	-0 34	0.37	-0.78	-0.87	-0.13	-1.13	-0.44	0.63	-1.20
Tie-down	99000041	-5.00	-1.75	0.00	-0.40	-0.47	-1.19	-0.81	0.11	-1.22	-0.49	-0.69	-1.85
Tie-down	99000042	-5.00	-0.75	0.00	-1 03	0.00	-2.12	-0.58	0.00	-0.77	-1.41	0.08	-3.35
Tie-down	99000047	-5.00	0.25	0.00	-0.47	0.18	-1.40	-0.88	-0.08	-1.51	-0.55	0.28	-1.98
Tie-down	99000037	-5.00	1.25	0.00	-0 59	-0.01	-1.64	-0.84	0.08	-1.13	-0.75	0.10	-2.58
Tie-down	99000048	-5.00	2.25	0.00	-0.72	0.28	-1.88	-0.60	0.17	-0.91	-0.87	0.59	-2.69
Tie-down	99000050	-5.00	3.25	0.00	-0 51	-0.03	-1.19	-0.43	0.08	-0.71	-0.62	-0.11	-1.64
Tie-down	99000051	-5.00	3.75	0.00	-0 90	1.52	-1.30	-0.81	1.23	-1.03	-1.14	2.03	-1.78
Tie-down	99000002	-4.00	-3.75	0.00	-0.42	-0.21	-0.56	0.06	-0.82	-0.72	-0.59	-0.22	-0.87
Tie-down	99000004	-3.00	-3.75	0.00	-0.10	-0.23	-0.83	0.01	-0.82	-1.06	-0.14	-0.22	-1.23
Tie-down	99000006	-2.00	-3.75	0.00	-0 01	-0.40	-1.36	-0.07	-0.79	-0.93	0.01	-0.43	-2.16
Tie-down	99000008	-1.00	-3.75	0.00	0.20	-0.36	-1.29	-0.07	-0.82	-1.09	0.27	-0.38	-2.00
TIE	199000057	-1.50	6.00	0.00	-0 21	2.84	-2.99	-0.05	1.05	-1.10	-0.32	4.69	-4.88
Tie-down	99000010	0.00	-3.75	0.00	0.00	-0.41	-1.43	0.00	-0.86	-1.15	0.00	-0.47	-2.33
Tie-down	99000012	1.00	-3.75	0.00	-0 20	-0.36	-1.29	0.07	-0.82	-1.09	-0.27	-0.38	-2.00
Tie-down	99000014	2.00	-3.75	0.00	0.01	-0.39	-1.36	0.07	-0.79	-0.93	-0.01	-0.43	-2.15
Tie-down	99000016	3.00	-3.75	0.00	0.10	-0.23	-0.82	-0.01	-0.83	-1.07	0.14	-0.21	-1.22
Tie-down	99000018	4.00	-3.75	0.00	0.41	-0.20	-0.55	-0.07	-0.82	-0.73	0.58	-0.22	-0.87
TIE	199000064	1.50	6.00	0.00	0.21	2.84	-2.99	0.05	1.05	-1.10	0.32	4.69	-4.88
Tie-down	99000021	5.00	-3.75	0.00	0.53	-0.82	-0.34	1.11	-1.08	-0.32	0.73	-1.08	-0.52
Tie-down	99000023	5.00	-2.75	0.00	0.33	0.37	-0.78	0.86	-0.13	-1.12	0.43	0.63	-1.20
Tie-down	99000025	5.00	-1.75	0.00	0.40	-0.47	-1.19	0.81	0.11	-1.22	0.49	-0.68	-1.86
Tie-down	99000027	5.00	-0.75	0.00	1.03	0.00	-2.12	0.58	-0.01	-0.77	1.40	0.08	-3.35
Tie-down	99000029	5.00	0.25	0.00	0.47	0.18	-1.40	0.88	-0.08	-1.51	0.55	0.28	-1.98
Tie-down	99000031	5.00	1.25	0.00	0.59	-0.01	-1.64	0.84	0.08	-1.13	0.75	0.10	-2.58
Tie-down	99000033	5.00	2.25	0.00	0.72	0.28	-1.87	0.60	0.18	-0.91	0.87	0.59	-2.68
Tie-down	99000035	5.00	3.25	0.00	0.51	-0.03	-1.19	0.43	0.08	-0.71	0.63	-0.11	-1.63
Tie-down	99000036	5.00	3.75	0.00	0.90	1.52	-1.30	0.81	1.23	-1.03	1.14	2.02	-1.78
STRUTS	200000017	-0.74	-2.59	0.00	0.00	-0.01	0.08	0.00	-0.11	1.74	0.00	0.02	-0.11
STRUTS	200000021	0.74	-2.59	0.00	0.00	-0.01	0.08	0.00	-0.11	1.74	0.00	0.02	-0.11
STRUTS	200000025	2.99	-2.70	0.00	0.01	-0.02	0.35	-0.04	-0.01	2.22	0.01	-0.02	0.21
STRUTS	200000011	-3.00	-2.70	0.00	-0 01	-0.02	0.36	0.06	-0.01	2.21	-0.01	-0.02	0.22
STRUTS	200000031	2.75	1.22	0.00	0.01	0.04	0.56	-0.04	0.15	1.90	0.01	0.02	0.39
STRUTS	200000016	-2.75	1.22	0.00	-0 01	0.04	0.56	0.04	0.15	1.90	-0.01	0.02	0.39
STRUTS	200000029	4.20	0.24	0.00	0.03	-0.01	0.60	-0.04	0.02	2.82	0.02	-0.01	0.38
STRUTS	200000013	-4.20	0.24	0.00	-0 03	-0.01	0.60	0.04	0.02	2.82	-0.02	-0.01	0.39
STRUTS	200000015	-1.75	-1.51	0.00	-0 01	-0.02	0.72	0.03	0.03	1.90	-0.01	-0.02	0.52
STRUTS	200000023	1.75	-1.51	0.00	0.01	-0.02	0.72	-0.03	0.03	1.90	0.01	-0.02	0.52
STRUTS	200000027	4.19	-2.24	0.00	0.04	-0.03	0.87	0.00	0.04	3.26	0.06	-0.06	0.92
STRUTS	200000009	-4.19	-2.24	0.00	-0 04	-0.03	0.87	0.00	0.04	3.26	-0.06	-0.05	0.92
STRUTS	200000007	0.00	0.36	0.00	0.00	0.01	1.21	0.00	0.14	2.79	0.00	0.00	1.06
STRUTS	200000033	4.17	2.49	0.00	0.04	0.16	1.30	0.09	0.24	2.27	0.05	0.13	1.23
STRUTS	200000019	-4.17	2.49	0.00	-0 04	0.16	1.31	-0.09	0.24	2.28	-0.04	0.13	1.24
STRUTS	199000061	-1.50	2.95	0.00	0.02	0.55	2.25	0.01	0.48	1.94	0.03	0.73	3.08
STRUTS	199000067	1.50	2.95	0.00	-0 02	0.55	2.25	-0.01	0.48	1.94	-0.03	0.74	3.09
				Sum of loads	0.00	6.29	-24.47		-2.69	10.49		11.67	-45.45

MAESSEN® TENTEN DAKVERKOPLOSSING

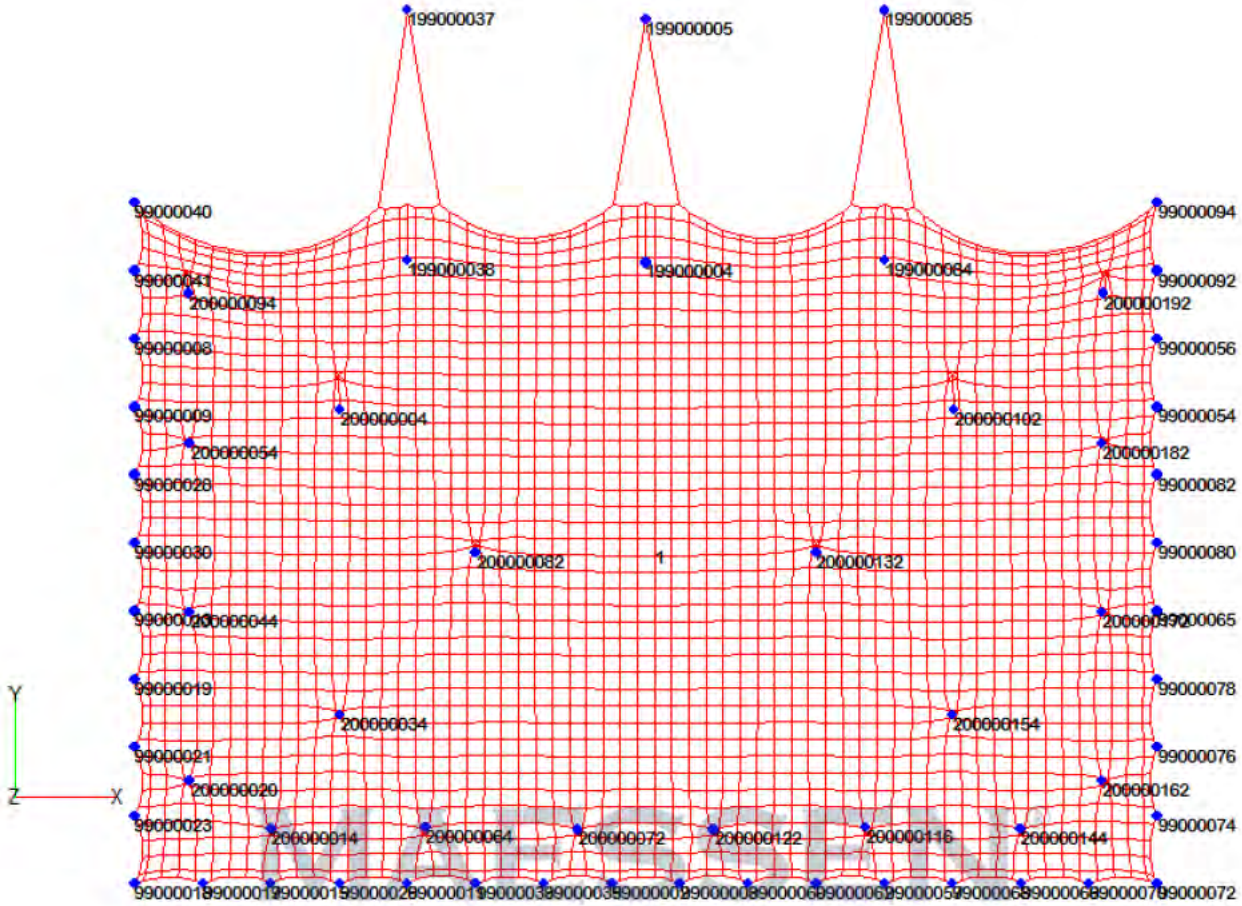


MAESSEN
TENTEN
MAATWERK OP LOCATIE

D2 10 X 15M

	10 X 15M	REPRESENTATIVE VALUES (NO LOAD FACTOR INCLUDED)											
	nr				LC02			LC03			LC04		
		X	Y	Z	Fx	Fy	Fz	Fx	Fy	Fz	Fx	Fy	Fz
		[m]	[m]	[m]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
TIE-DOWN	99000023	-7.50	-4.00	0.00	-0.30	0.06	-0.84	-1.06	-0.01	-1.35	-0.34	0.25	-1.20
TIE-DOWN	99000021	-7.50	-3.00	0.00	-0.42	-0.23	-1.28	-1.03	-0.17	-1.51	-0.49	-0.47	-1.90
TIE-DOWN	99000019	-7.50	-2.00	0.00	-0.88	-0.24	-1.89	-1.01	0.01	-1.34	-1.23	-0.26	-3.06
TIE-DOWN	99000013	-7.50	-1.00	0.00	-0.54	0.20	-1.48	-1.20	-0.13	-2.00	-0.70	0.22	-2.16
TIE-DOWN	99000030	-7.50	0.00	0.00	-0.86	-0.25	-1.93	-1.18	0.15	-1.48	-1.42	-0.23	-3.45
TIE-DOWN	99000028	-7.50	1.00	0.00	-1.01	0.48	-2.22	-0.97	-0.08	-1.46	-1.48	0.97	-3.51
TIE-DOWN	99000009	-7.50	2.00	0.00	-0.89	-0.23	-2.01	-1.04	0.06	-1.60	-1.30	-0.49	-3.16
TIE-DOWN	99000008	-7.50	3.00	0.00	-1.16	-0.03	-2.23	-0.81	0.32	-1.09	-1.69	0.20	-3.57
TIE-DOWN	99000041	-7.50	4.00	0.00	-0.72	0.30	-1.67	-0.75	0.05	-1.29	-0.81	0.47	-2.08
TIE-DOWN	99000040	-7.50	5.00	0.00	-1.34	1.88	-1.89	-1.12	1.56	-1.42	-1.73	2.49	-2.60
TIE	199000037	-3.50	7.83	0.00	-0.26	3.84	-3.30	-0.08	1.62	-1.35	-0.46	6.60	-5.66
TIE	199000005	0.00	7.69	0.00	0.00	7.00	-6.31	0.00	1.32	-1.18	0.00	11.56	-10.44
TIE	199000085	3.50	7.83	0.00	0.26	3.84	-3.31	0.08	1.62	-1.35	0.46	6.60	-5.67
TIE-DOWN	99000018	-7.50	-5.00	0.00	-0.44	-0.59	-0.27	-1.44	-1.46	-0.49	-0.60	-0.80	-0.42
TIE-DOWN	99000017	-6.50	-5.00	0.00	-0.44	-0.29	-0.76	0.06	-1.00	-1.05	-0.56	-0.33	-1.14
TIE-DOWN	99000015	-5.50	-5.00	0.00	0.08	-0.33	-1.16	-0.13	-0.92	-1.54	0.10	-0.29	-1.52
TIE-DOWN	99000026	-4.50	-5.00	0.00	-0.15	-0.40	-1.37	-0.11	-1.16	-1.63	-0.24	-0.50	-2.21
TIE-DOWN	99000011	-3.50	-5.00	0.00	0.40	-0.40	-1.35	-0.19	-1.18	-1.98	0.60	-0.54	-2.16
TIE-DOWN	99000033	-2.50	-5.00	0.00	-0.61	-0.72	-1.81	0.13	-1.17	-1.67	-0.82	-1.17	-3.21
TIE-DOWN	99000035	-1.50	-5.00	0.00	0.37	-1.06	-2.37	-0.19	-1.06	-1.66	0.78	-1.54	-3.69
TIE-DOWN	99000002	-0.50	-5.00	0.00	-0.74	-1.46	-2.79	0.28	-0.96	-1.62	-1.16	-2.11	-4.30
TIE-DOWN	99000003	0.50	-5.00	0.00	0.74	-1.47	-2.79	-0.28	-0.96	-1.62	1.16	-2.11	-4.30
TIE-DOWN	99000060	1.50	-5.00	0.00	-0.37	-1.06	-2.37	0.19	-1.06	-1.66	-0.78	-1.54	-3.69
TIE-DOWN	99000062	2.50	-5.00	0.00	0.61	-0.72	-1.81	-0.13	-1.16	-1.68	0.81	-1.18	-3.22
TIE-DOWN	99000057	3.50	-5.00	0.00	-0.40	-0.40	-1.34	0.19	-1.17	-1.97	-0.59	-0.53	-2.15
TIE-DOWN	99000068	4.50	-5.00	0.00	0.15	-0.40	-1.37	0.11	-1.15	-1.63	0.24	-0.50	-2.21
TIE-DOWN	99000066	5.50	-5.00	0.00	-0.08	-0.32	-1.16	0.13	-0.93	-1.54	-0.09	-0.29	-1.52
TIE-DOWN	99000070	6.50	-5.00	0.00	0.44	-0.29	-0.76	-0.06	-1.00	-1.05	0.56	-0.32	-1.13
TIE-DOWN	99000072	7.50	-5.00	0.00	0.45	-0.60	-0.27	1.44	-1.45	-0.49	0.60	-0.80	-0.42
TIE-DOWN	99000074	7.50	-4.00	0.00	0.30	0.06	-0.84	1.06	-0.01	-1.34	0.33	0.25	-1.19
TIE-DOWN	99000076	7.50	-3.00	0.00	0.42	-0.23	-1.28	1.03	-0.17	-1.51	0.49	-0.47	-1.90
TIE-DOWN	99000078	7.50	-2.00	0.00	0.88	-0.24	-1.89	1.01	0.00	-1.34	1.23	-0.26	-3.05
TIE-DOWN	99000065	7.50	-1.00	0.00	0.54	0.19	-1.48	1.20	-0.13	-2.00	0.70	0.21	-2.16
TIE-DOWN	99000080	7.50	0.00	0.00	0.86	-0.25	-1.93	1.18	0.15	-1.48	1.42	-0.23	-3.45
TIE-DOWN	99000082	7.50	1.00	0.00	1.01	0.48	-2.22	0.97	-0.08	-1.47	1.48	0.97	-3.51
TIE-DOWN	99000054	7.50	2.00	0.00	0.89	-0.23	-2.01	1.04	0.06	-1.61	1.30	-0.49	-3.16
TIE-DOWN	99000056	7.50	3.00	0.00	1.16	-0.02	-2.23	0.82	0.32	-1.10	1.69	0.21	-3.57
TIE-DOWN	99000092	7.50	4.00	0.00	0.72	0.30	-1.67	0.75	0.06	-1.29	0.81	0.46	-2.08
TIE-DOWN	99000094	7.50	5.00	0.00	1.34	1.88	-1.89	1.12	1.57	-1.42	1.73	2.48	-2.60
MAST	199000004	0.00	4.12	0.00	0.00	0.69	2.51	0.00	0.57	2.11	0.00	0.84	3.17
MAST	200000004	-4.50	1.96	0.00	0.00	0.01	0.05	0.06	0.38	2.18	0.00	0.00	0.00
MAST	200000102	4.51	1.96	0.00	0.00	0.01	0.05	-0.07	0.39	2.18	0.00	0.00	0.00
MAST	199000038	-3.50	4.15	0.00	0.03	0.59	2.16	0.06	0.64	2.42	0.04	0.75	2.80
MAST	199000084	3.50	4.15	0.00	-0.03	0.59	2.16	-0.06	0.64	2.43	-0.04	0.75	2.80
MAST	200000094	-6.71	3.67	0.00	0.00	0.26	1.65	0.01	0.45	3.06	-0.01	0.21	1.40
MAST	200000192	6.71	3.67	0.00	0.00	0.26	1.64	-0.01	0.45	3.07	0.01	0.20	1.39
MAST	200000154	4.49	-2.51	0.00	0.01	-0.01	0.46	-0.09	0.12	3.11	0.00	0.00	0.10
MAST	200000034	-4.49	-2.51	0.00	-0.01	-0.01	0.46	0.09	0.12	3.11	0.00	0.00	0.10
MAST	200000144	5.50	-4.20	0.00	0.03	-0.03	0.90	-0.09	0.02	3.22	0.04	-0.04	0.78
MAST	200000014	-5.50	-4.20	0.00	-0.03	-0.03	0.91	0.10	0.02	3.23	-0.04	-0.04	0.78
MAST	200000054	-6.69	1.47	0.00	-0.02	0.01	1.02	0.08	0.02	3.53	-0.02	0.00	0.78
MAST	200000182	6.69	1.47	0.00	0.02	0.01	1.02	-0.08	0.03	3.53	0.02	0.00	0.78
MAST	200000116	3.22	-4.17	0.00	0.01	-0.03	0.45	-0.02	0.05	3.75	0.01	-0.03	0.35
MAST	200000064	-3.23	-4.17	0.00	-0.01	-0.03	0.46	0.04	0.07	3.76	-0.01	-0.03	0.35
MAST	200000122	1.00	-4.21	0.00	-0.01	-0.01	1.17	0.02	0.16	3.77	0.00	-0.01	0.87
MAST	200000072	-1.00	-4.21	0.00	0.01	-0.01	1.17	-0.02	0.16	3.78	0.00	-0.01	0.86
MAST	200000162	6.69	-3.49	0.00	0.04	-0.04	1.07	-0.04	0.11	3.84	0.05	-0.05	1.06
MAST	200000020	-6.69	-3.49	0.00	-0.04	-0.04	1.08	0.04	0.10	3.84	-0.05	-0.05	1.07
MAST	200000172	6.70	-1.01	0.00	0.03	-0.02	0.70	-0.14	0.11	3.98	0.02	-0.02	0.46
MAST	200000044	-6.70	-1.01	0.00	-0.03	-0.02	0.70	0.14	0.11	3.98	-0.02	-0.02	0.47
MAST	200000082	-2.50	-0.14	0.00	0.00	0.00	0.07	0.19	0.29	4.81	0.00	0.00	-0.04
MAST	200000132	2.50	-0.14	0.00	0.00	0.00	0.07	-0.19	0.29	4.81	0.00	0.00	-0.03
				SUM	0.00	10.19	-49.60	0.00	-4.36	21.25	0.00	18.92	-92.11

VAESSEN® TENTEN A A WERK TOE ATE



TENTEN
MAATWERK OP LOCATIE

D3 15 X 20M

15 X 20M	REPRESENTATIVE VALUES (NO LOAD FACTOR INCLUDED)												
nr					LC02			LC03			LC04		
	X	Y	Z		Fx	Fy	Fz	Fx	Fy	Fz	F	Fy	Fz
	[m]	[m]	[m]		[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[	[kN]	[kN]
TIE DOWN	99000002	-10.00	7.50	0.00	-1.52	1.57	-2.17	-1.87	1.77	-2.30	-1.50	1.66	-2.34
TIE DOWN	99000003	-10.00	6.50	0.00	-1.92	0.37	-2.86	-2.56	0.23	-2.98	-1.86	0.55	-3.22
TIE DOWN	99000005	-10.00	5.50	0.00	-2.00	-0.27	-2.95	-2.41	-0.31	-2.78	-2.09	-0.18	-3.55
TIE DOWN	99000007	-10.00	4.50	0.00	-1.53	0.09	-2.56	-2.06	-0.23	-2.70	-1.63	0.35	-3.07
TIE DOWN	99000009	-10.00	3.50	0.00	-1.96	-0.18	-2.92	-2.15	0.06	-2.52	-2.33	-0.16	-3.96
TIE DOWN	99000031	-10.00	2.50	0.00	-1.17	-0.09	-2.06	-2.86	-0.18	-3.74	-1.04	-0.04	-2.21
TIE DOWN	99000011	-10.00	1.50	0.00	-1.71	-0.03	-2.73	-1.98	-0.59	-2.39	-2.14	0.19	-3.96
TIE DOWN	99000014	-10.00	0.50	0.00	-1.09	-0.40	-1.95	-1.66	-0.09	-2.20	-1.35	-0.58	-2.77
TIE DOWN	99000016	-10.00	-0.50	0.00	-1.49	0.18	-2.51	-1.52	-0.31	-1.96	-2.01	0.38	-3.85
TIE DOWN	99000018	-10.00	-1.50	0.00	-1.04	-0.59	-1.89	-1.69	0.08	-2.22	-1.33	-0.85	-2.90
TIE DOWN	99000030	-10.00	-2.50	0.00	-0.84	0.40	-1.65	-1.99	-0.33	-2.59	-0.95	0.64	-2.40
TIE DOWN	99000020	-10.00	-3.50	0.00	-1.09	-0.24	-2.01	-1.76	-0.04	-2.18	-1.14	-0.45	-2.73
TIE DOWN	99000023	-10.00	-4.50	0.00	-0.78	0.28	-1.47	-2.11	-0.25	-2.77	-0.60	0.55	-1.51
TIE DOWN	99000025	-10.00	-5.50	0.00	-1.28	-0.05	-1.97	-1.73	-0.16	-2.00	-1.35	-0.16	-2.55
TIE DOWN	99000027	-10.00	-6.50	0.00	-0.84	-0.02	-1.29	-1.96	-0.13	-2.26	-0.50	-0.01	-0.98
TIE DOWN	99000029	-10.00	-7.50	0.00	-0.98	-1.07	-0.75	-1.93	-1.96	-1.16	-0.97	-1.04	-0.85
TIE DOWN	99000039	-9.00	-7.50	0.00	-0.17	-0.39	-0.67	-0.22	-1.66	-1.91	-0.14	-0.21	-0.54
TIE DOWN	99000041	-8.00	-7.50	0.00	-0.49	-1.20	-2.02	-0.45	-1.89	-2.21	-0.54	-1.19	-2.46
TIE DOWN	99000043	-7.00	-7.50	0.00	0.15	-1.09	-1.95	-0.28	-2.45	-3.17	0.36	-0.80	-1.82
TIE DOWN	99000045	-6.00	-7.50	0.00	-0.10	-1.00	-1.38	0.16	-1.49	-1.63	-0.22	-1.07	-1.65
TIE DOWN	99000047	-5.00	-7.50	0.00	-0.17	-1.07	-1.66	-0.89	-2.40	-2.89	0.12	-0.93	-1.67
TIE DOWN	99000049	-4.00	-7.50	0.00	-0.63	-1.56	-2.71	0.00	-2.82	-3.63	-0.89	-1.44	-2.92
TIE DOWN	99000051	-3.00	-7.50	0.00	-0.10	-2.18	-3.57	-0.22	-2.37	-3.06	0.02	-2.44	-4.37
TIE DOWN	99000053	-2.00	-7.50	0.00	0.29	-1.48	-2.16	0.49	-1.83	-2.30	0.20	-1.59	-2.45
TIE DOWN	99000055	-1.00	-7.50	0.00	-0.37	-2.07	-2.77	-0.85	-2.25	-2.49	-0.15	-2.31	-3.38
TIE DOWN	99000033	0.00	-7.50	0.00	0.04	-1.96	-3.09	0.02	-3.78	-4.72	0.04	-1.48	-2.71
TIE DOWN	99000080	1.00	-7.50	0.00	0.43	-1.78	-2.25	0.85	-1.94	-2.07	0.25	-2.02	-2.78
TIE DOWN	99000082	2.00	-7.50	0.00	-0.12	-1.42	-2.14	-0.39	-1.90	-2.38	0.02	-1.56	-2.51
TIE DOWN	99000084	3.00	-7.50	0.00	0.01	-1.96	-3.27	0.18	-2.25	-2.88	-0.12	-2.24	-4.11
TIE DOWN	99000086	4.00	-7.50	0.00	0.57	-1.43	-2.52	-0.06	-2.77	-3.56	0.83	-1.34	-2.77
TIE DOWN	99000078	5.00	-7.50	0.00	0.13	-0.98	-1.55	0.91	-2.38	-2.86	-0.17	-0.89	-1.59
TIE DOWN	99000090	6.00	-7.50	0.00	0.09	-0.94	-1.30	-0.13	-1.40	-1.53	0.20	-1.04	-1.61
TIE DOWN	99000092	7.00	-7.50	0.00	-0.15	-1.00	-1.84	0.31	-2.28	-2.98	-0.36	-0.75	-1.75
TIE DOWN	99000094	8.00	-7.50	0.00	0.47	-1.08	-1.89	0.45	-1.62	-1.94	0.52	-1.12	-2.38
TIE DOWN	99000096	9.00	-7.50	0.00	0.15	-0.32	-0.58	0.19	-1.41	-1.63	0.13	-0.19	-0.52
TIE DOWN	99000098	10.00	-7.50	0.00	0.91	-1.02	-0.71	1.74	-1.78	-1.05	0.94	-1.01	-0.83
TIE DOWN	99000100	10.00	-6.50	0.00	0.78	-0.01	-1.22	1.93	-0.09	-2.23	0.47	-0.01	-0.93
TIE DOWN	99000102	10.00	-5.50	0.00	1.24	-0.05	-1.92	1.64	-0.06	-1.86	1.32	-0.16	-2.51
TIE DOWN	99000104	10.00	-4.50	0.00	0.76	0.29	-1.43	2.10	-0.22	-2.74	0.58	0.56	-1.48
TIE DOWN	99000106	10.00	-3.50	0.00	1.05	-0.20	-1.96	1.68	0.16	-2.05	1.11	-0.43	-2.70
TIE DOWN	99000088	10.00	-2.50	0.00	0.79	0.42	-1.58	1.85	-0.27	-2.35	0.92	0.66	-2.37
TIE DOWN	99000107	10.00	-1.50	0.00	0.99	-0.55	-1.83	1.58	0.38	-2.06	1.29	-0.82	-2.86
TIE DOWN	99000109	10.00	-0.50	0.00	1.38	0.28	-2.35	0.99	0.02	-1.23	1.93	0.42	-3.79
TIE DOWN	99000111	10.00	0.50	0.00	1.00	-0.42	-1.84	1.33	-0.28	-1.78	1.26	-0.55	-2.68
TIE DOWN	99000113	10.00	1.50	0.00	1.56	0.08	-2.57	1.82	-0.32	-2.30	1.98	0.25	-3.84
TIE DOWN	99000075	10.00	2.50	0.00	0.95	-0.04	-1.76	2.48	-0.05	-3.33	0.87	0.01	-2.01
TIE DOWN	99000124	10.00	3.50	0.00	1.67	-0.09	-2.63	1.87	0.24	-2.29	2.02	-0.07	-3.73
TIE DOWN	99000126	10.00	4.50	0.00	1.10	0.20	-1.98	1.62	-0.09	-2.16	1.20	0.46	-2.55
TIE DOWN	99000128	10.00	5.50	0.00	1.49	-0.29	-2.43	1.96	-0.25	-2.38	1.57	-0.20	-3.08
TIE DOWN	99000130	10.00	6.50	0.00	1.53	0.32	-2.48	2.17	0.24	-2.71	1.46	0.51	-2.84
TIE DOWN	99000132	10.00	7.50	0.00	1.29	1.38	-1.95	1.76	1.75	-2.33	1.23	1.43	-2.07
TIE	140004591	9.30	-0.36	0.00	0.12	-0.23	-0.75	0.91	-1.53	-5.22	0.00	0.00	0.00
TIE	199000057	-2.00	11.88	0.00	-0.07	2.12	-1.16	-0.07	1.58	-0.84	-0.07	2.74	-1.51
TIE	199000065	-6.00	11.88	0.00	-0.13	1.82	-0.99	-0.14	1.48	-0.78	-0.14	2.35	-1.28
TIE	199000119	2.50	11.88	0.00	-0.01	1.83	-1.01	0.00	1.53	-0.83	-0.03	2.39	-1.33
TIE	199000138	6.50	11.88	0.00	0.09	1.63	-0.89	0.10	1.43	-0.77	0.08	2.10	-1.16
MAST	199000120	2.50	5.37	0.00	0.01	1.58	2.31	-0.02	2.56	3.70	0.03	1.40	2.05
MAST	199000066	-6.00	5.78	0.00	0.32	1.40	2.48	0.49	1.71	2.97	0.29	1.41	2.50
MAST	199000058	-2.00	5.35	0.00	0.19	2.28	3.31	0.32	3.06	4.37	0.16	2.14	3.11
MAST	199000139	6.49	5.89	0.00	-0.20	1.18	2.26	-0.33	1.52	2.87	-0.16	1.17	2.24
MAST	200000004	-8.92	-6.42	0.00	-0.04	-0.12	2.70	0.27	0.14	7.54	-0.06	-0.10	1.44
MAST	200000014	-6.74	-6.35	0.00	0.17	-0.12	2.57	0.54	0.08	6.29	0.07	-0.09	1.36
MAST	200000024	-8.85	-4.24	0.00	-0.07	-0.02	1.01	0.01	0.23	5.03	-0.02	0.00	0.16
MAST	200000034	-8.84	-2.01	0.00	-0.05	0.01	0.59	-0.02	0.25	4.92	-0.01	0.00	0.12
MAST	200000044	-8.84	0.24	0.00	-0.06	0.03	0.98	-0.08	0.32	4.68	-0.03	0.00	0.37
MAST	200000054	-6.72	-4.23	0.00	0.04	0.03	2.04	0.26	0.27	4.99	0.00	0.00	1.06
MAST	200000064	-4.50	-6.34	0.00	0.00	-0.15	3.05	0.15	0.29	7.62	-0.02	-0.11	1.59
MAST	200000074	-2.25	-6.34	0.00	0.44	-0.06	5.58	0.66	0.10	8.81	0.31	-0.06	4.31
MAST	200000084	-4.48	-2.53	0.00	-0.03	0.08	2.77	0.30	0.74	9.71	-0.01	0.01	0.56
MAST	200000094	-8.84	2.46	0.00	-0.07	0.08	1.45	0.22	0.50	6.36	-0.03	0.01	0.37
MAST	200000104	-8.85	4.63	0.00	-0.05	0.19	2.17	0.02	0.58	5.26	-0.04	0.09	1.24
MAST	200000114	-8.89	5.96	0.00	0.12	1.43	2.56	0.36	2.45	4.23	0.07	1.12	2.06
MAST	200000124	-6.76	4.69	0.00	0.25	1.30	2.81	0.53	2.23	4.56	0.18	1.04	2.31
MAST	200000134	-4.47	2.05	0.00	0.08	0.61	3.28	0.55	1.91	9.74	0.01	0.21	1.14
MAST	200000144	0.00	-6.34	0.00	0.04	-0.02	3.93	0.08	0.57	8.26	0.02	-0.07	2.24
MAST	200000154	2.25	-6.34	0.00	-0.24	-0.09	3.97	-0.47	0.05	7.51	-0.14	-0.07	2.74
MAST	200000164	4.50	-6.34	0.00	0.02	-0.14	2.73	-0.14	0.29	7.48	0.03	-0.10	1.30
MAST	200000174	0.00	-2.56	0.00	0.02	0.32	4.02	0.03	1.24	10.60	0.01	0.09	1.48
MAST	200000184	4.48	-2.53	0.00	0.04	0.06	2.43	-0.27	0.71	9.46	0.01	0.00	0.36
MAST	200000192	8.92	-6.42	0.00	0.04	-0.12	2.46	-0.24	0.04	7.00	0.06	-0.09	1.33
MAST	200000198	6.74	-6.35	0.00	-0.16	-0.12	2.38	-0.54	0.05	5.96	-0.06	-0.09	1.25
MAST	200000214	8.85	-4.24	0.00	0.06	-0.02	0.92	-0.02	0.11	4.82	0.01	0.00	0.12
MAST	200000224	8.84	-2.01	0.00	0.04	0.00	0.49	0.01	0.04	4.50	0.01	0.00	0.09
MAST	200000234	8.88	0.16	0.00	0.08	0.07	1.51	0.34	0.28	8.93	0.02	0.01	0.30
MAST	200000242	6.72	-4.23	0.00	-0.04	0.02	1.94	-0.27	0.23	4.79	0.00	0.00	0.97
MAST	200000254	4.47	2.04	0.00	-0.02	0.52	2.86	-0.38	1.85	9.46	0.00	0.13	0.77
MAST	200000264	0.00	1.46	0.00	0.04	1.43	3.76	0.09	3.41	8.52	0.02	0.73	1.98
MAST	200000274	8.84	2.47	0.00	0.06	0.04	1.06	-0.11	0.21	5.84	0.02	0.00	0.16
MAST	200000284	8.85	4.65	0.00	0.07	0.09	1.39	0.09	0.33	4.50	0.04	0.03	0.65
MAST	200000294	8.82	6.02	0.00	0.04	1.08	2.05	-0.02	2.10	4.07	0.06	0.78	1.53
MAST	200000302	6.75	4.76	0.00	-0.15	1.05	2.37	-0.37	1.92	4.18	-0.09	0.83	1.92
STORM BELT	68000001	5.62	-7.50	0.00	0.31	-7.11	-7.28	0.43	-6.21	-5.81	0.23	-8.24	-8.92
STORM BELT	68000002	1.38	-7.50	0.00	0.00	-8.50	-8.63	0.03	-6.22	-5.99	-0.07	-10.32	-10.91
STORM BELT	68000003	-1.63	-7.50	0.00	-0.13	-8.31	-9.02	-0.10	-6.02	-6.35	-0.14	-10.10	-11.24
STORM BELT	68000004	-5.62	-7.50	0.00	-0.35	-7.14	-7.38	-0.43	-6.31	-5.95	-0.28	-8.18	-8.93
STORM BELT	68000005	4.50	8.00	0.00	-1.95	11.09	-10.49	-1.06	6.52	-5.90	-2.77	14.81	-14.36
STORM BELT	68000006	0.00	8.00	0.00	0.71	25.55	-20.82	0.35	12.53	-9.52	0.76	34.12	-29.03
STORM BELT	68000007	-4.00	8.00	0.00	3.04	10.65	-10.45	1.64	6.21	-5.81	4.11	14.07	-14.12

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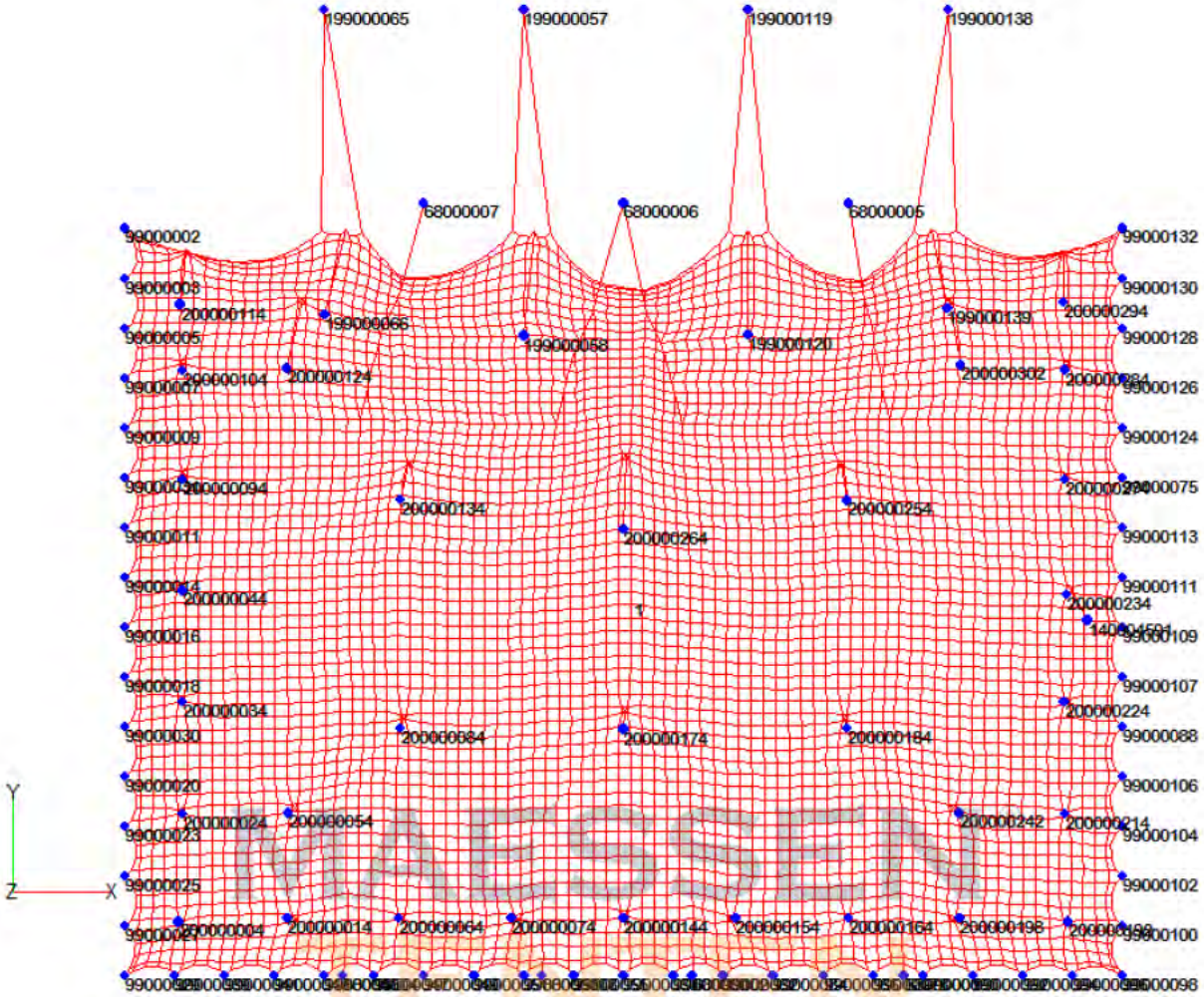
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Annex E: Material specifications

E1 Fabric tensile test
E2 Fabric biaxial test
E3 Fabric fire certificate
E4 Storm belt specification
E5 Aluminium certificate

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Intertek

RHI TRADING **REPORT NUMBER: SAFT00048898**

Report Date: 29-NOV-2010

For the attention of [redacted]
E-mail:

DESCRIPTION:	1 SAMPLE WHITE POLYESTER/ COAT KNIT FABRIC
CONDITION:	SAMPLE RECEIVED IN GOOD CONDITION
STATED FIBRE COMPOSITION:	NOT STATED
QUALITY REFERENCE:	RHI ALLWEATHER M4
FABRIC SUPPLIER:	NOT STATED
ORDER NUMBER:	NOT STATED
SAMPLE RECEIVED:	17-NOV-2010
REQUEST:	TENSILE STRENGTH ISO 13934-1 BURSTING STRENGTH
RESULTS:	See attachment
COMMENTS:	No requirements supplied.

MAPSSEN TENTEN

sanas Testing Laboratory

T0186

[redacted]

Prepared by : [redacted]

Laboratory Manager
For and on behalf of
INTERTEK LABTEST

Labtest (South Africa) (Pty) Ltd.
9th Floor, 2 Long Street, Cape Town 8001, SOUTH AFRICA
P.O. Box 8379, Roggebaai 8012, SOUTH AFRICA
Telephone: +27 21 415 7000 Fax: +27 21 418 5127
Director: [redacted] France)
Reg. Number 2002/019/33/07

RHI TRADING **REPORT NUMBER: SAFT00048898**

TEST RESULTS

226 TENSILE STRENGTH – STRIP METHOD
ISO 13934-1 : 1999

Dry

Length	1400N
Width	1300N

265 BURSTING STRENGTH
BSEN 13938-1

Diaphragm Diameter	30 mm
	>500 kPa

Due to fabric distention, the sample exceeded the maximum capacity of the test apparatus without rupture or bursting.

END OF TEST REPORT

IMPORTANT TERMS AND CONDITIONS

1. UNLESS STATED OTHERWISE, ALL RESULTS AND OPINIONS GIVEN IN ANY TEST REPORT RELATE ONLY TO THOSE PROPERTIES OF THE ACTUAL SAMPLES FOR WHICH SPECIFIC TESTS HAVE BEEN CONDUCTED. THE REPORT SHALL NOT BE DEEMED TO IMPLY THAT ANY BULK FROM WHICH THE TESTED SAMPLE MAY HAVE BEEN DRAWN IS THE SAME IN EVERY RESPECT AS THE TESTED SAMPLE.
2. THE RESULTS RELATE TO THE MOST RECENT METHODS AVAILABLE WITH A 95% CONFIDENCE LEVEL.
3. NO PART OF THIS DOCUMENT MAY BE REPRODUCED IN ANY WAY WITHOUT THE WRITTEN APPROVAL OF INTERTEK SA. OUR STANDARD TERMS AND CONDITIONS OF BUSINESS SHALL APPLY.

PLEASE BE ADVISED THAT
REMAINING SAMPLES NOT COLLECTED WITHIN A MONTH WILL BE DISPOSED OF.

As a professional organization, Intertek Labtest (South Africa) (Pty) Ltd always strives to provide a professional service of high quality and to meet our customer's expectations. In order to continually improve on the quality of our service we welcome customer feedback, both positive and negative. From time to time Intertek SA will actively seek feedback from customers in order to monitor customer perception of Intertek as a testing laboratory. Please do not hesitate to contact us should you have any comments or questions.

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Director: [redacted] (France)
Reg. Number 2002/019733/07

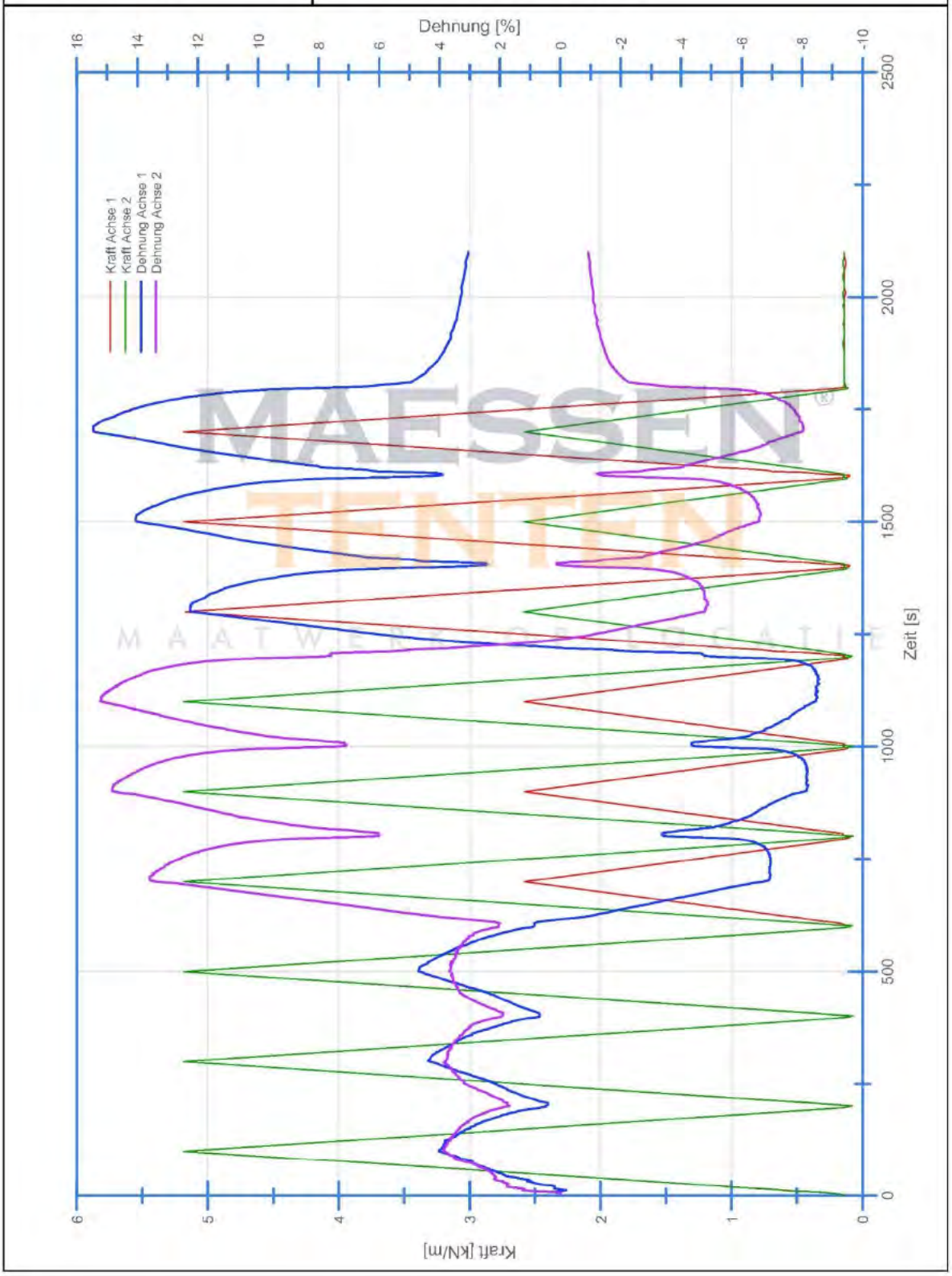
E2 Fabric biaxial test

UNIVERSITÄT DUISBURG ESSEN

Fakultät für Ingenieurwissenschaften - Abteilung Bauwissenschaften
Essener Labor für Leichte Flächentragwerke ELLF
45141 Essen, Universitätsstr. 15, Tel.: 0201/183-4223, Fax: -4276

Kraft-Dehnungs-Zeit-Diagramm zur biaxialen Zugprüfung

Versuch: TEN1511	Material: Flexmembran "Chino MK3"



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E3 Fire Certificate of RHI ALLWEATHER MK4

Material should comply with the standards mentioned below [NTA 8020-40:206]:

Tabel 1 — Klassen brandvoortplanting

Norm	Klasse	Herkomst	Druppelvorming
NEN 6065	2	Nederland	geen eisen
NEN-EN 13501-1	B	Europa	3 klassen: d0, d1, d2
DIN 4102-1	B1	Duitsland	moet worden vermeld in rapport (Brennendes Abtropfen)
NF P92-503	M2	Frankrijk	moet worden vermeld in rapport (Apparition de gouttes enflammées)

In NEN 6065, *Bepaling van de bijdrage tot brandvoortplanting van bouwmateriaal(combinaties)* worden geen eisen gesteld over de druppelvorming van het materiaal.

Indien geen druppelvorming optreedt tijdens de beproeving volgens DIN 4102-1 of NF P92-503, mag worden aangenomen dat het materiaal geen druppelvorming vertoont.

As the analysed structures are larger than 25 m^2.

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RHI Stretch Tents and Marquees
Suite 8
Private Bag X16
Constantia, 7848
SOUTH AFRICA

your delivery of	your reference	our reference	date
2011-05-19		[redacted]	Zwijnaarde, 2011-06-16

Analysis Report 80245/B

Modification of analysis report 80245, made on 2011-06-09

Required tests :

NF P 92-503 (1995) - "Electric burner "
NF P 92-505 (1995) - "Test for melting materials"
NF P 92-507 (2004) – "Interior materials – Classification according to their reaction to fire"
French decree from 21 November 2002 - Reaction to fire tests on interior materials

Identification number	Information given by the client	Date of receipt
T105641	RHI ALLWEATHER MK4	2011-05-19

[redacted]
order responsible

For further information, please contact our sectorial adviser [redacted]

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The results of the analysis cover the received samples. Centexbel is not responsible for the representativeness of the samples.

ISO 17025
BELAC
056-TEST

VAT BE 0459.218.289 Fin. Acc. 210-0472965-45 IBAN BE44 2100 4729 6545

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Reference : T105641 - RHI ALLWEATHER MK4

NF P 92-503 (1995) - "Electric burner "
French decree from 21 November 2002 - Reaction to fire tests on interior materials

End of tests: 7 June 2011

- The test specimens have not been cleaned nor submitted to an accelerated ageing procedure.

Conditioning
minimum 7 days at (23 ± 2) °C and (50 ± 5) % RH
or
until constant mass is achieved

	length		width	
	face A	face B	face A	face B
Hole formation due to melting	yes	yes	yes	yes
Max. afterflame time (s)	163	140	107	110
Afterglow	no	no	no	no
Afterglow with propagation in area > 25 cm	no	no	no	no
Damaged length (cm)	23	29	32,5	30
Damaged width in area >45 cm (cm)	/	/	/	/
Flaming molten droplets	no	no	no	no
Non-flaming molten droplets	yes	no	no	no
Flaming debris	no	no	no	no
Non-flaming debris	yes	no	yes	no

Average damaged length (cm)	28,5
Average damaged width in area >45 cm (cm)	0

Performed under accreditation in the fire lab under the responsibility of [redacted]

MAESSEN® TENTEN

Reference : **T105641 - RHI ALLWEATHER MK4**

NF P 92-505 (1995) - "Test for melting materials"
French decree from 21 November 2002 - Reaction to fire tests on interior materials

End of tests: 9 June 2011

- The test specimens have not been cleaned nor submitted to an accelerated ageing procedure.

Conditioning
minimum 7 days at (23 ± 2) °C and (50 ± 5) % RH
or
until constant mass is achieved

face A / face B	first ignition (s)	non-flaming debris	flaming debris	ignition cotton wool
1	82	no	no	no
2	*	no	no	no
3	66	no	no	no
4	58	no	no	no

* no ignition

Conclusion: **M2**

Performed under accreditation in the fire lab under the responsibility of [redacted]

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Certificate of Test

NF6424

REPORT No.: FNF10135

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TEST FOR FLAMMABILITY OF MATERIALS IN ACCORDANCE WITH AS 1530.2-1993

TRADE NAME: RHI Allweather MK3

SPONSOR: RHI Tents
29 Boulevard Way
Capricom Park, Muizenberg
CAPE TOWN WC
SOUTH AFRICA

DESCRIPTION OF SAMPLE: The sponsor described the tested specimen as polyester knit fabric with PVC coating on the unexposed side. The PVC contained flame retardant additives.

Nominal total thickness:	1.5 mm
Nominal total mass:	750 g/m²
Colours:	white

TEST PROCEDURE: Samples were tested in accordance with Australian Standard 1530 Part 2 - Test for Flammability of Materials - 1993. Nine (9) samples were tested in accordance with AS 1530.2-1993. The test results were based upon the samples with the uncoated polyester side out.

RESULTS: The following were obtained for the specimen:

	Maximum Flame Height	Time for Flame to Reach Top (t)	Area Under Curve (cm²)
Mean	5.2	N/A	3.04
Coefficient of Variance (%)	12.77	N/A	29.75

From which the following indices were obtained:

SPREAD Factor	SPEED Factor	HEAT Factor	FLAMMABILITY INDEX
5	N/A	1	6

The results of this fire test may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all fire conditions.

DATE OF TEST: 30 May 2011

Issued on the 31st day of May 2011 without alterations or additions.

[redacted]
Testing Officer

[redacted]
Manager, Fire Testing and Assessments

This document is issued in accordance with NATA's accreditation requirements.
Accreditation No. 165 – Corporate Site No. 3625

CSIRO Materials Science and Engineering
14 Julius Avenue, Riverside Corporate Park, North Ryde NSW 2113 AUSTRALIA
Telephone: 61 2 9490 5444 Facsimile:61 2 9490 5555

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E4 Requirements for Textile connections [EN-13782 Annex C3.3]

EN 13782:2005 (E)

C.3.3 Textile connection

Common textile connections are:

— mechanic type (seam, elastic ropes, hooks, plates, zips, stichings);

— chemical - physical type (welding, gluing);

— or mixed.

It is possible to realise connections in other way clearly characterised and defined as after specified.

The connection's classes are three:

— 1st class: connections performed from qualified manufacturer using methodologies defined (that characterise all the parameters and work conditions) from the coated fabric manufacturer or from the membrane assembler and continuously tested, to calculate f_{tk} according to EN 1991-1-1;

— 2nd class: connections performed from qualified personnel using methodologies defined (that characterise all the parameters and work conditions) from the coated fabric manufacturer or from the membrane assembler and initially tested and repeatability checked by visual peeling test;

— 3th class: connections anyway performed, permitted exclusively for the realisation of secondary elements whose failure will not create unfavourable load cases or effects reducing the safety of the tent or of plugging.

In the design the connection class should be chosen in accordance with the structure type.

For tents with primary load bearing structure textile connection can be of 1st or 2nd class.

For membrane tents, the connection should be of 1st class.

The test results and the related test specimen should be filed together with all information allowing reproduction. The files should be retained for 5 years.

The national standards dealing with burning behaviour applied for tents are mentioned in Annex A.

It is assumed that RHI manufactures the membrane according to EN10204:2004-3.1 to be able to use 1st class weldings in the calculation.

Package Control (Nederland) B.V.

Postbus 35, 4286 ZG Almkerk
Industrieweg 28, 4283 GZ Giessen
http://www.package-control.nl

T: 0183 - 443700
F: 0183 - 443833
E: info@package.nl

BANDWEEFSEL

Type	omschrijving	breedte	breeksterkte
1503	oranje polyester	25 mm	1200 kg
1503	groen polyester	25 mm	1200 kg
1503	rood polyester	25 mm	1200 kg
1503	blauw polyester	25 mm	1200 kg
1503	geel polyester	25 mm	1200 kg
1503	wit polyester	25 mm	1200 kg
1503	zwart polyester	25 mm	1200 kg
1502	groen polyester	25 mm	2.000 kg
1502	rood polyester	25 mm	2.000 kg
1502	blauw polyester	25 mm	2.000 kg
1502	geel polyester	25 mm	2.000 kg
1502	grijs polyester	25 mm	2.000 kg
1501	groen polyester	35 mm	3.000 kg
1501	rood polyester	35 mm	3.000 kg
1501	blauw polyester	35 mm	3.000 kg
1501	geel polyester	35 mm	3.000 kg
1501	oranje polyester	35 mm	3.000 kg
1504	grijs polyester	45 mm	3.000 kg
1504	blauw polyester	45 mm	3.000 kg
1514	groen polyester	48 mm	6.000 kg
1514	rood polyester	48 mm	6.000 kg
1514	blauw polyester	48 mm	6.000 kg
1514	geel polyester	48 mm	6.000 kg
1514	oranje polyester	48 mm	6.000 kg
1514	zwart polyester	48 mm	6.000 kg
1514	wit polyester	48 mm	6.000 kg
1505	blauw polyester	50 mm	6.800 kg
1506	geel polyester	50 mm	7.500 kg
1515	groen polyester	75 mm	15.000 kg
1508	zwart polypropileen	48 mm	n.v.t.
1509	autogordelband	48 mm	n.v.t.
1510-30	1510-30mm elastisch bandweefsel	30 mm	n.v.t.
1510-40	1510-40mm elastisch bandweefsel	40 mm	

E6 Certificate of used material for masts

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