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Structural Report F54S

17341

for the system by

Global Truss
Furong Industrial Area
Shajing Town

Baoan District Shenzen China

compiled by: A. Rumpel

Aachen, 30.06.2017

INGENIEURKAMMER-BAU NORDRHEIN-WESTFALEN
BERATENDER INGENIEUR
101448

This Structural Report includes pages 1 - 32

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1 PRELIMINARY NOTES

1.1 Basics

The currently applicable regulations and standards, in particular:

DIN EN 1991-1	Actions on structures (Eurocode 1)
DIN EN 13814	Fairground and amusement park machinery and structures
DIN EN 13782	Temporary Structures – Tents
DIN EN 1993-1	Design of steel structures (Eurocode 3)
DIN EN 1999-1	Design of aluminium structures (Eurocode 1)

1.2 Materials

Tubes	Aluminium EN AW-6082 T6
Bolts	42CrMo4 8.8

1.3 General Remarks

This structural report is an structural calculation concerning a trusssystem produced by the company GLOBAL TRUSS. The truss type goes by the name F54S.

The structural report is the basis for the certification by TÜV based on EN 1999-1.

The truss system is part of a "modular construction system" with the different truss lengths

500mm, 1000mm, 1500mm, 2000mm, 2500mm, 3000mm, 3500mm, 4000mm,
4500mm and 5000mm.

The Trusses consist of two upper and two lower main chords (round tube 50 x 4mm), which are arranged in a quadratic shape.
The trusses also consist of welded diagonal bracings (round tube 30 x 3mm) at the sides and welded vertical struts (round tube 50 x 4mm) between the nodes of the diagonal bracings in the upper and lower level.

The distance between the system lines of the mainchords is 47 cm in vertical- and 47 cm in horizontal direction.

The trusses are connected with couplers consisting of female fittings, connectors and bolts.

The allowable loads are listed in tables (see chapter 6).

The verification of the single parts is done according the safety concept of EN 1990 with a partial safety factor of the loading side of 1.50 for payloads.

For applications which can be calculated on the basis of other codes, the partial safety factors can be adjusted (for example temporary structures acc. EN 13814, yF = 1.35 for payloads).

To use the resulting allowable loads with British Standard (BS) and ANSI, the allowable loads listed in tables have to be multiplied by 0.85.

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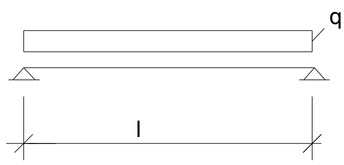
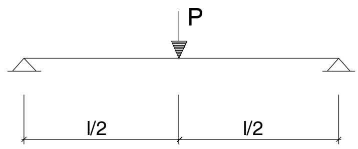
1.4 Geometry and Loadings

The following loadcases are taken into account

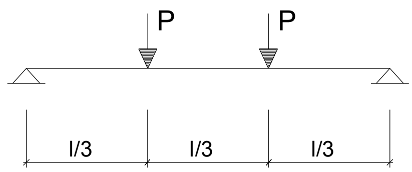
uniformly distributed load (UDL)



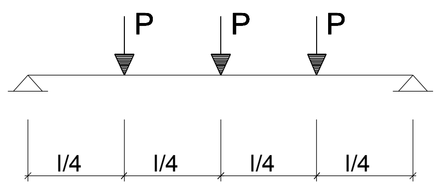
Single-load in 1/2 point



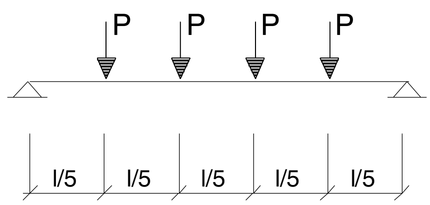
Single-load in 1/3 point



Single-load in 1/4 point



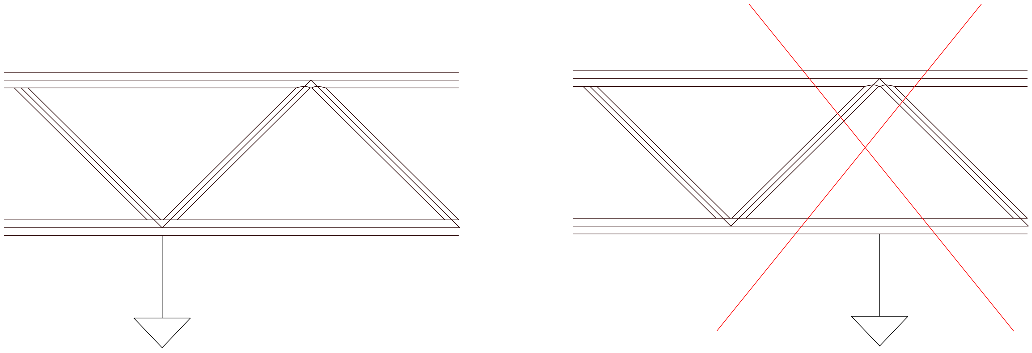
Single-load in 1/5 point



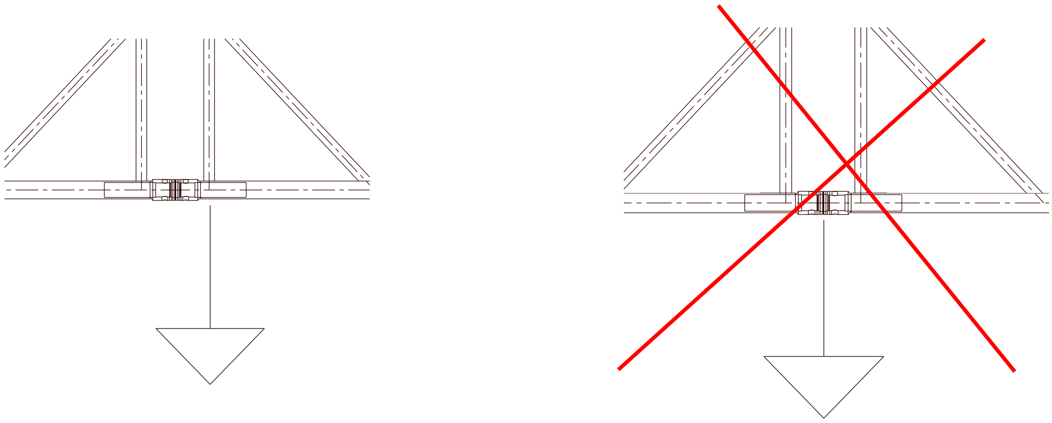
The selfweight of the truss is approx. 16 kg/m

For the application of the calculated allowable loadings the following rules have to be regarded:

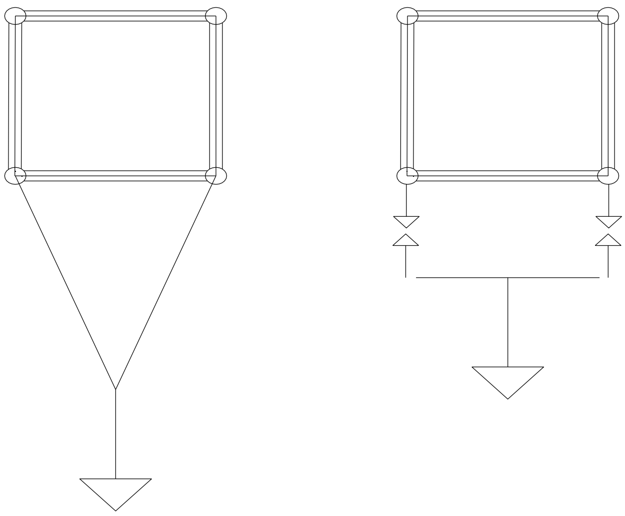
Large loads have to be applied at the nodes or have to be distributed by appropriate constructions.



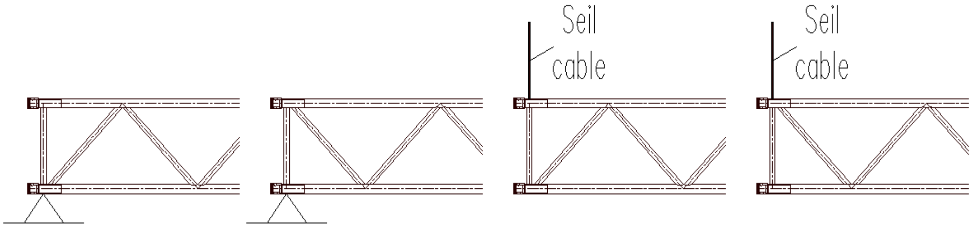
Loads at the middle of the couplers are not allowed.



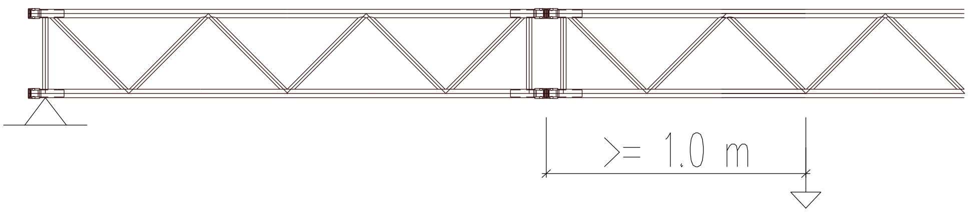
All loads have to be distributed equally to both chords.



For the support or suspension there are the following possibilities:



When restricting the position of the coupler (see chapter 4, case 2), the coupler has to be located > 1, 0 m from the loading point into the direction of the support.



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2 SYSTEM

Drawings F54S. . . . .

F54S050-Model, F54S100-Model, F54S150-Model, F54S200-Model, F54S250-Model, F54S300-Model, F54S350-Model, F54S400-Model, F54S450-Model, F54S500-Model

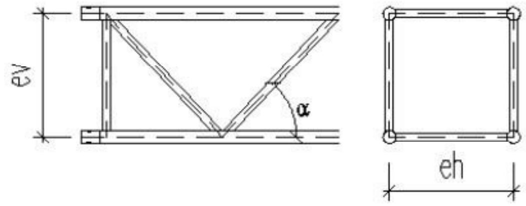
see annex

3 SECTION- AND MATERIAL PROPERTIES

Properties Tubes

	D	t	A	I	Wel	i
	[mm]	[mm]	[cm²]	[cm⁴]	[cm³]	[cm]
main chords	50,0	4	5,78	15,41	6,16	1,63
vertical Bracing	30	3	2,54	2,35	1,56	0,96
horizontal Struts	50	4	5,78	15,41	6,16	1,63

Truss geometry



distance axes main chords	vertical	ev	47	[cm]
	horizontal	eh	47	[cm]
min. gradient bracing	vertical	α	44,6	[°]
	horizontal	α	-	[°]

Properties truss-Section

A	$= 4 \times A_G$	=	23,12	[cm²]
Iyy	$= 4 \times I_G + 4 \times A_G \times (ev/2)^2$	=	12830,81	[cm⁴]
Izz	$= 4 \times I_G + 4 \times A_G \times (eh/2)^2$	=	12830,81	[cm⁴]
It		=	876,00	[cm⁴]
iy	$= (Iyy/A)^{1/2}$	=	23,56	[cm]
iz	$= (Izz/A)^{1/2}$	=	23,56	[cm]

Index G : section properties main chord

Calculation of torsion moment of inertia:

A torsion moment of 1,0 kNm is applied. The torsion moment of inertia is calculated with the resulting deformations.

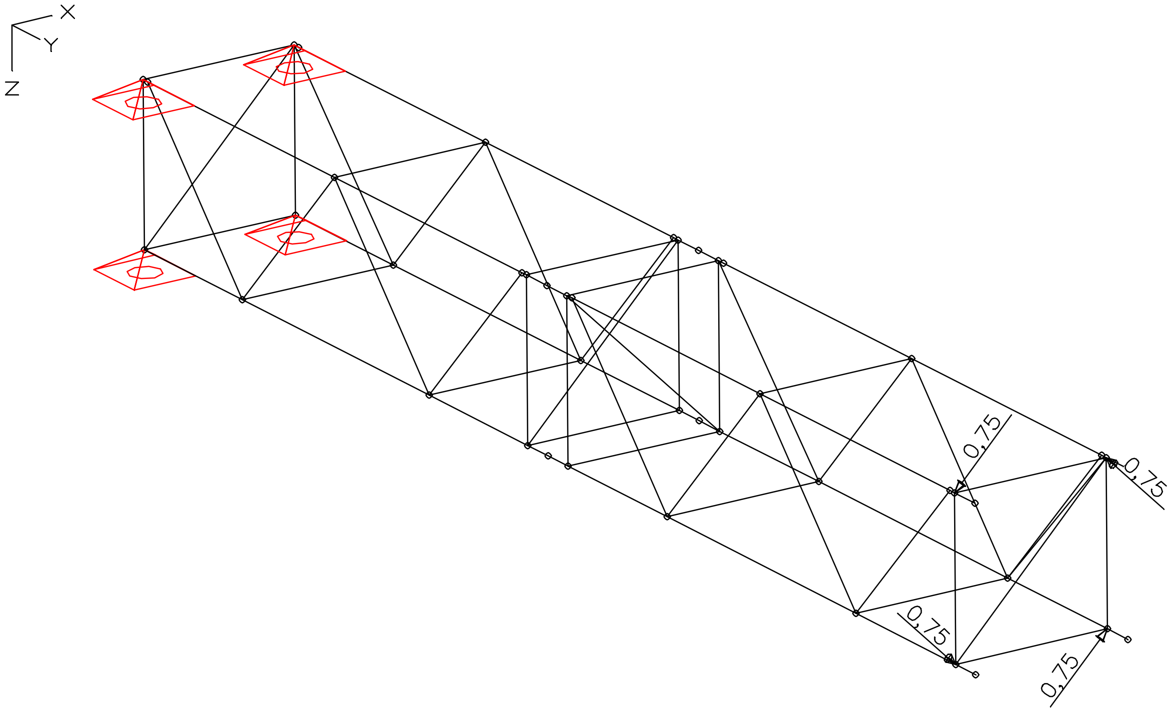
Average deformation u= (6,3 + 6,2 + 4,5 + 4,4) / 4 = 5,35 mm
=> $\vartheta = 5{,}35 / (470 \cdot \sqrt{2} / 2) = 0{,}0161$

M_T = 1,0 kNm = 100 kNcm
G = 27000 N/mm² = 2700 kN/cm²
l = 3,81 m = 381 cm

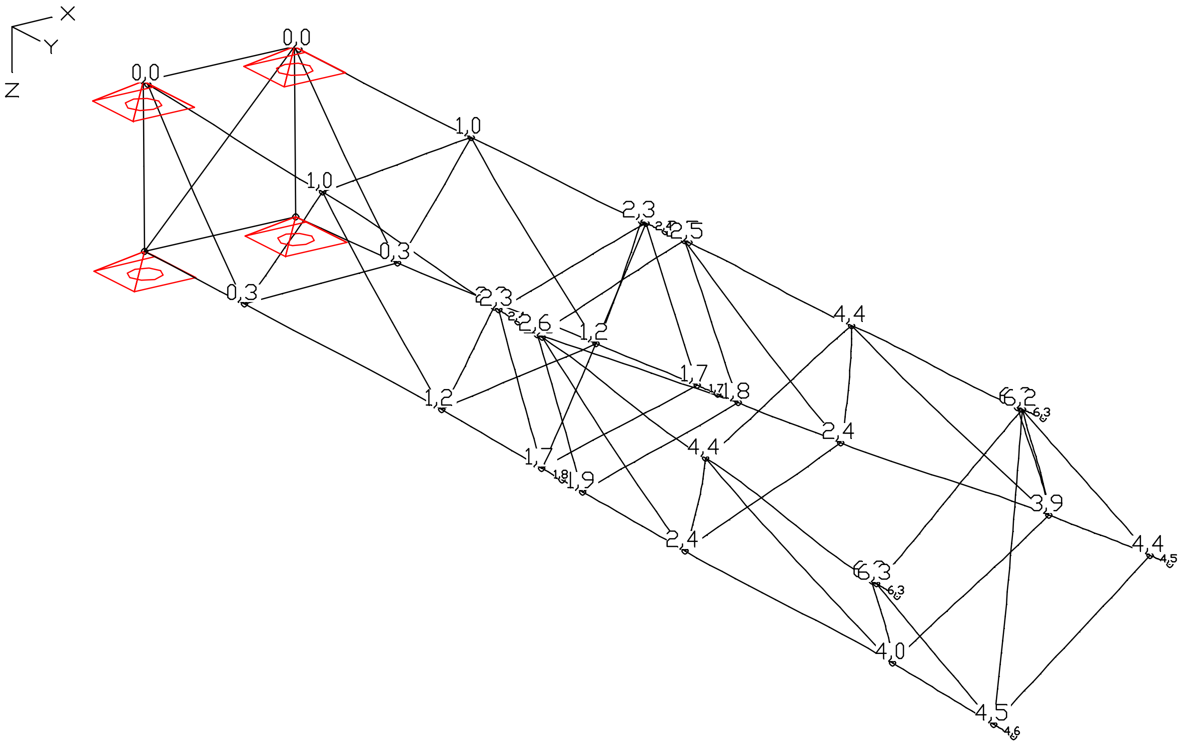
$I_T = M_T \cdot l / (G \cdot \vartheta) = 100 \cdot 381 / (2700 \cdot 0{,}0161) = 876{,}6\ cm^4$

17341 – F54S
Torsion Moment of Inertia

30.06.2017
M 1 :



LC 1: Load



Deformations u; LF 1

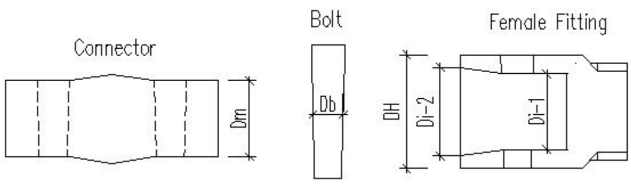
Material properties

Chords and bracing	EN AW 6082 T6 (AlMgSi1)			
allowable stress acc. to EN-1999-1-1				
Partial safety factors material				
γ_{M1}=	1,10		Buckling class / BC=	A
γ_{M2}=	1,25			
0,2%-Proof Strength			ultimate tensile strength	
fo t≤5mm=	250	[N/mm²]	fu t≤5mm=	290 [N/mm²]
fo t>5mm=	260	[N/mm²]	fu t>5mm=	310 [N/mm²]
fo,haz=	125	[N/mm²]	fu,haz=	185 [N/mm²]
Strength of welding seams			fw=	190 [N/mm²]
Factor for HAZ-values for TIG-welding:				0,8

Bolt	42 CrMo (8.8)

Connector	EN AW 2011 T6 (AlCuBiPb)			
0,2%-Proof Strength			ultimate tensile strength	
fo>	230	[N/mm²]	fu>	310 [N/mm²]

Female fitting	EN AW 6082 T6			
allowable stress acc. to EN-1999-1-1				
partial safety factors material				
γ_{M1}=	1,10			
γ_{M2}=	1,25			
0,2%-Proof Strength			ultimate tensile strength	
fo=	250	[N/mm²]	fu=	290 [N/mm²]



Section- and material properties of the chord tubes

Material	E=	70000	[N/mm²]	
	fo=	250,00	[N/mm²]	
	fo/YM1=	227,27	[N/mm²]	
	fo,haz=	125,00	[N/mm²]	
	fu=	290,00	[N/mm²]	
	fu/YM2=	232,00	[N/mm²]	
	fu,haz=	185,00	[N/mm²]	
	fu,haz/YM2=	148,00	[N/mm²]	
cross section	D0=	50,00	[mm]	
	A=	5,78	[cm²]	
	I=	15,41	[cm⁴]	
	i=	1,63	[cm]	
Determination of section-clas	β=	10,61	[-]	$3 \cdot (D0 / t)^{0,5}$ nach 6.10
	ε=	1,00	[-]	$(250 / fo)^{0,5}$
	Section class=	2		acc. chapter 6.1.4.4
Coefficients for buckling	BC=	A	[-]	
	α=	0,20	[-]	
	λo=	0,10	[-]	
teff in heat affected zone	red-Factor=	0,8	[-]	(WIG $_{TIG}$)
	node with 2 bracing			
	D1=	30,00	[mm]	
	D2=	50,00	[mm]	
	U_{WEZ}=	153,54	[mm]	π / **2** · D0 + D1 / 2 + 2 · 30
	U_{Total}=	157,08	[mm]	
	teff,o / t=	0,41	[-]	[1 - (1 - red-Faktor · fo,haz / fo) · U_{WEZ} / U_{Total}]
	teff,u / t=	0,52	[-]	[1 - (1 - red-Faktor · fu,haz / fu) · U_{WEZ} / U_{Total}]

Section- and material properties of the bracing

Material	E=	70000	[N/mm²]
	fo=	250,00	[N/mm²]
	fo/YM1=	227,27	[N/mm²]
	BC=	A	[-]
	α=	0,20	[-]
	λo=	0,1	[-]
cross section	D0=	30	[mm]
	A=	2,54	[cm²]
	I=	2,35	[cm⁴]
	i=	0,96	[cm]

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4 ALLOWABLE LOADING SINGLE COMPONENTS

Main chord in heat affected zone at coupler				
	N_{Rd} =A x 0,8* x $f_{u,haz}$ / γ_{M2}=	**68,44**	[kN]	*(WIG TIG) local welding seam acc. chapter 6.2.9.3 (1)
Main chord in heat affected zone node with 2 bracing				
	N_{Rd} = A_{eff} x f_o / γ_{M1}= (mit A_{eff}= $t_{eff,o}$ / t x A)	**54,33**	[kN]	local welding seam acc. Chapter 6.2.9.3 (2)
Buckling main chord bewteer nodes without bracing in the middle	sk=	94,00	[cm]	
	Ncr=	120,45	[kN]	
	λ*=	1,10	[-]	
	ϕ=	1,20	[-]	
	X=	0,59	[-]	
	N_{Rd} = X x A x f_o / γ_{M1}=	**77,82**	[kN]	acc. equation 6.49
Welding seam between chord and female conical coupler				
	fw=	190,00	[N/mm²]	
	γ_{mw}=	1,25	[-]	
	N_{Rd} = A x fw / γ_{M1}=	**87,86**	[kN]	acc. equation 8.29

relevant for main chord tubes: **NRd_G = 54,33 kN**

Section- and material properties of the bracing

Material	E=	70000	[N/mm²]	
	fo=	250,00	[N/mm²]	
	fo/YM1=	227,27	[N/mm²]	
	BC=	A	[-]	
	α=	0,20	[-]	
	λo=	0,1	[-]	
cross section	D0=	30	[mm]	
	A=	2,54	[cm²]	
	I=	2,35	[cm⁴]	
	i=	0,96	[cm]	
Bracing in heat affected zone				
	NRd = A x 0,8* x fu,haz / YM2=	**30,13**	[kN]	*(WIG TIG) local welding seam acc. chapter 6.2.9.3 (1)
Buckling bracing	sk=	50,00	[cm]	
		(buckling length = 0,75 x l)		
	Ncr=	64,87	[kN]	
	λ*=	0,99	[-]	
	ϕ=	1,08	[-]	
	X=	0,66	[-]	
	NRd = X x AG x fo / YM1=	**38,33**	[kN]	acc. equation 6.49
Welding seam between chord and female conical coupler				
	fw=	190,00	[N/mm²]	
	Ymw=	1,25	[-]	
	NRd = A x fw / YM1=	**38,68**	[kN]	acc. equation 8.29

relevant for bracing tubes: **NRd_D = 30,13 kN**

Allowable normal force at coupler:

Bolt

Material 42CrMo (10.9)	$f_{y,bk}$=	64,00 [kN/cm²]
	$f_{u,bk}$=	80,00 [kN/cm²]
Geometry	D_b=	1,53 [cm]
	A_b=	1,84 [cm²]

Allowable loading due to shearing acc. to EN 1999-1-1

	$N_{Rd} = 2 \times 0{,}60 \times A_b \times f_{ub,k} / 1{,}25$=	**141,20** [kN]

Connector

Material	EN AW 2011 (AlCuBiPb F37)	
Geometry	D_m=	37,8 [mm]
Bearing stress in connector	f_u / γ_{M2}=	248,00 [N/mm²]
	d_o=	16 [mm]
	t=	37,8 [mm]
	e_1=	23,5 [mm]
	α_b=	0,49 [-]
	e_2=	16 [mm]
	k_1=	1,1 [-]
	$N_{Rd} = k_1 \times \alpha_b \times f_u \times d \times t / \gamma_{M2}$=	**80,78** [kN]

Remaining section under tension

	$N_{Rd} = 0{,}9 \times A_{,net} \times f_u / \gamma_{M2}$=	**115,49** [kN]

Female Fitting

Geometry	D_H=	59 [mm]
	D_{i-1}=	39,4 [mm]
	D_{i-2}=	45,2 [mm]
	D_{i-m}=	42,3 [mm]
Bearing stress in female fitting	f_u / γ_{M2}=	232 [N/mm²]
	d_o=	17,1 [mm]
	$t = D_H - D_{i-m}$=	16,7 [mm]
	e_1>	29,4 [mm]
	α_b=	0,57
	e_2>	30 [mm]
	k_1=	2,5
	$N_{Rd} = k_1 \times \alpha_b \times f_u \times d \times t / \gamma_{M2}$=	**94,92** [kN]

The allowable normal force of the coupler is not relevant compared to the allowable normal force of the tube. (N_{RdG} = 54,33 kN < 80,78 kN).

Interaction bending and normal force at coupler

Normal force and bending moments are transferred by the welding seam between coupler and chord.

Verification of interaction bending and normal force at coupler

=> $\mathbf{(Nsd_G / NRd_G)^{1,3} + (Msd_G / MRd_G) < 1{,}0}$

mit $Nsd_G = Nsd / 4 + Msd / (2 \cdot 0{,}47\ m)$
und $Msd_G = 0{,}25 \cdot Qsd \cdot 8{,}0\ cm = 2{,}0\ cm \cdot Qsd$
=> a = factor for cantilever at the coupler = 2,0 cm

Nsd, Msd und Qsd: global internal forces in the truss (in kN resp. kNm)

The global internal forces include the following safety factors acc. Eurocode:

Selfweight of the truss: yF = 1,35

Net load on the truss: yF = 1,50

NRd_G = = allowable loading of the chord in the heat affected zone (see following table):

Main chord in heat affected zone at coupler			
N_{Rd} =A x 0,8* x fu,haz / Y_{M2}=	**68,44**	[kN]	*(WIG $_{TIG}$) local welding seam acc. chapter 6.2.9.3 (1)

MRd_G = MuRd (see following table):

Local bending of chord			
local welding seam acc. Chapter 6.2.9.3 (1)			
D=	50	[mm]	
red-Faktor=	0,8	[-]	(WIG $_{TIG}$)
ρo,haz=	0,64	[-]	fu,haz / fu
tu,eff=	2,04	[mm]	red-Faktor · ρu,haz · t
W_{net}= π x R² x tu,eff=	3,39	[cm³]	with R = D / 2 - t / 2
MuRd = Wnet · fu / yM2=	**78,71**	[kNcm]	acc. equation 6.24

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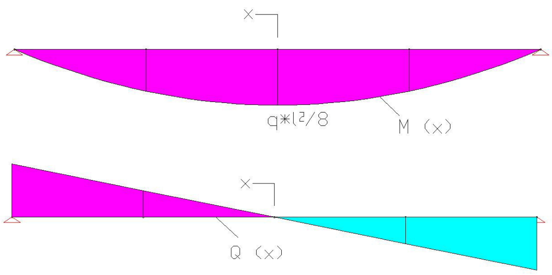
The following 3 cases are taken into account.

1. Loading with **uniformly distributed load (UDL)**

The coupler is always located at the theoretically worst point. This results from the following extremum-calculation:

Note: For the determination of the worst position of the coupler, the exponent 1,3, for the relation of actual load to the allowable load is not taken into account with sufficient accuracy.



Msd (x) = qsd · L² / 8 - qsd · x² / 2
Qsd (x) = qsd · x

NRd_G = 68,44 kN
MRd_G = 78,71 kNcm

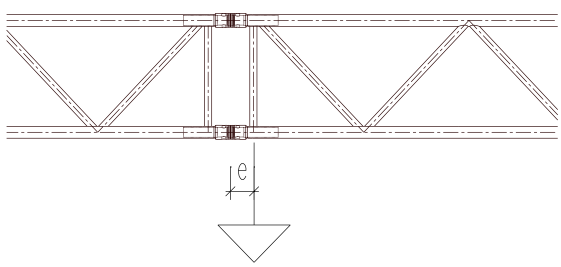
M-Q Interaction Msd(x) / (2 · 0,47 · 68,44) + Qsd(x) · 2,0 / 78,71

Extremum: d/dx σ (x) = 0

=> x = 2 · 0,47 · 68,44 · 2 / 78,71 = 1,63 m
(from middle of span)

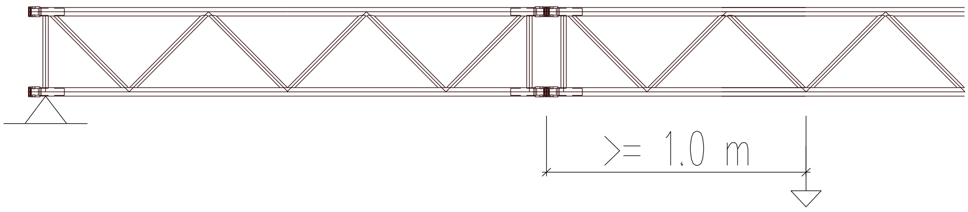
2. Loading with **single-point loads** without requirements for position of couplers

No requirements for position of coupler (Distance between load and coupler is e, see below). The allowable loads of this case have to be regarded, if the distance between coupler and load is <1,0 m.



3. Alternative to (2): Loading with **single-point loads with requirements for position of couplers**

In this case it is assumed, that the coupler is located >1,0m from the loading-point. The coupler has to be located in that manner, so that the distance is >1,0m into the direction of the support-point.



Summary

Following points are relevant for the determination of the allowable loads:

1. Allowable normal force in main chord (NRd_G)

   Main chord in heat affected zone at coupler is relevant => NRd_G = 54,33 kN

2. Global shear force in truss (Q)

   Allowable normal force in diagonals at nodes is relevant => NRd_D = 30,13 kN

   allowable shear force: $QRd / (2 \cdot \sin 44{,}6°) < 0{,}9 \cdot NRd_D$
   (10% reduction because of minor stresses)

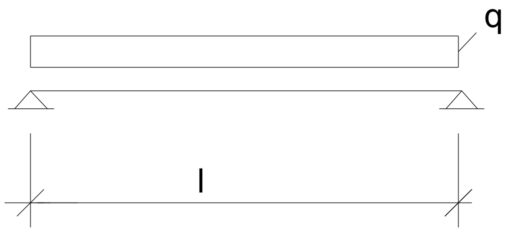
   => zul QRd = $0{,}9 \cdot 30{,}13 \cdot 2 \cdot \sin 44{,}6°$ => QRd = 38,08 kN

3. Interaction bending and normal force at coupler see pg. 14

5 ALLOWABLE LOADING SINGLE SPAN GIRDER

5.1 Uniformly distributed load (UDL)

System:



$qsd = psd + gsd$ (payload + selfweight, including safety)

Normal force in chord:

$NRd \geq qsd \cdot L^2 / 8 / (n \cdot b)$

$\Rightarrow qsd \leq NRd \cdot (n \cdot b) \cdot 8 / L^2$

$\Rightarrow zul\ p = (NRd \cdot (n \cdot b) \cdot 8 / L^2 - gsd) / yF$

Normal force in diagonals:

$QRd \geq qsd \cdot L / 2$

$\Rightarrow qsd \leq QRd \cdot 2 / L$

$\Rightarrow zul\ p = (QRd \cdot 2 / L - gsd) / yF$

Interaction at coupler:

Verification of interaction bending and normal force at coupler by an iterative method.

$\Rightarrow (Nsd_G / NRd_G)^{1,3} + (Msd_G / MRd_G) < 1,0$

applied: The coupler is located at e = 1,63 m from the middle of the span (theoretically worst point, see extremum-calculation in chapter 4))

Loading-table: see next page

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Loading table:

The coupler is located at e = 1,63 m from the middle of the span (theoretically worst point, see extremum-calculation in chapter 4)

Uniformly distributed load UDL

	allowable load as a function of			
	Nrd	Qrd	Interaction at coupler	
L [m]	**zul q [kN/m]**	**zul q [kN/m]**	**zul q [kN/m]**	**min zul q [kN/m]**
4,00	16,88	12,55	13,73	12,55
5,00	10,75	10,01	10,39	10,01
6,00	7,42	8,32	7,83	7,42
7,00	5,41	7,11	6,01	5,41
8,00	4,11	6,20	4,72	4,11
9,00	3,22	5,50	3,78	3,22
10,00	2,58	4,93	3,08	2,58
11,00	2,11	4,47	2,55	2,11
12,00	1,75	4,09	2,14	1,75
13,00	1,47	3,76	1,82	1,47
14,00	1,25	3,48	1,55	1,25
15,00	1,07	3,24	1,34	1,07
16,00	0,92	3,03	1,17	0,92
17,00	0,80	2,84	1,02	0,80
18,00	0,70	2,68	0,90	0,70
19,00	0,61	2,53	0,79	0,61
20,00	0,54	2,39	0,70	0,54
21,00	0,47	2,27	0,62	0,47
22,00	0,42	2,16	0,56	0,42
23,00	0,37	2,06	0,50	0,37
24,00	0,33	1,97	0,45	0,33

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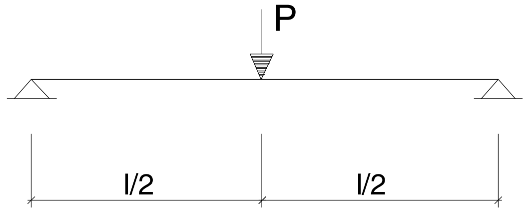
5.2 Single-load in 1/2 point

System



Normal force in chord:

$NRd \geq (Psd \cdot L / 4 + gsd \cdot L^2 / 8) / (n \cdot b)$

$\Rightarrow Psd \leq [NRd \cdot (n \cdot b) - gsd \cdot L^2 / 8] \cdot 4 / L$

$\Rightarrow \text{zul } P = [NRd \cdot (n \cdot b) - gsd \cdot L^2 / 8] \cdot 4 / L / yF$

Normal force in diagonals:

$QRd \geq Psd / 2 + gsd \cdot L / 2$ $\Rightarrow Psd \leq (QRd - gsd \cdot L / 2) \cdot 2$

$\Rightarrow \text{zul } P = (QRd - gsd \cdot L / 2) \cdot 2 / yF$

Interaction at coupler:

Verification of interaction bending and normal force at coupler by an iterative method.

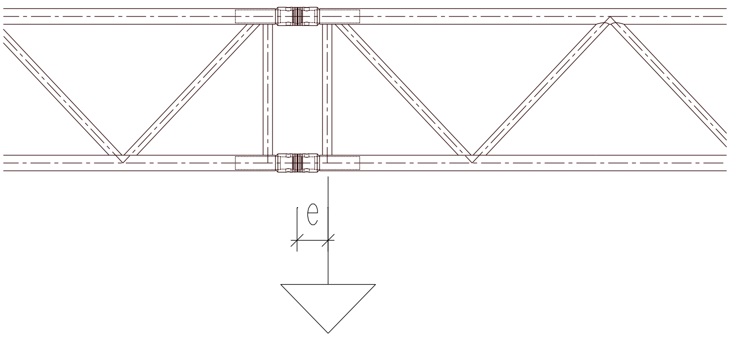
$\Rightarrow (Nsd_G / NRd_G)^{1,3} + (Msd_G / MRd_G) < 1,0$

applied: Loading point at coupler e = 0,095 m

Alternatively: Location of coupler from loading point >= 1,0 m

Loading-tables: see next pages

Loading point at coupler e = 0,095 m



Single-load in 1/2point

	allowable load as a function of			
	Nrd	Qrd	Interaction at coupler	
			0,095	= e [m]
L [m]	**zul P [kN]**	**zul P [kN]**	**zul P [kN]**	**min zul P [kN]**
4,00	33,76	50,20	26,30	26,30
5,00	26,88	50,05	22,78	22,78
6,00	22,27	49,91	20,03	20,03
7,00	18,95	49,77	17,83	17,83
8,00	16,45	49,62	16,02	16,02
9,00	14,48	49,48	14,51	14,48
10,00	12,90	49,33	13,23	12,90
11,00	11,59	49,19	12,13	11,59
12,00	10,48	49,05	11,18	10,48
13,00	9,54	48,90	10,33	9,54
14,00	8,72	48,76	9,59	8,72
15,00	8,00	48,61	8,92	8,00
16,00	7,36	48,47	8,32	7,36
17,00	6,79	48,33	7,77	6,79
18,00	6,27	48,18	7,27	6,27
19,00	5,80	48,04	6,81	5,80
20,00	5,37	47,89	6,38	5,37
21,00	4,97	47,75	5,98	4,97
22,00	4,61	47,61	5,61	4,61
23,00	4,27	47,46	5,26	4,27
24,00	3,95	47,32	4,93	3,95

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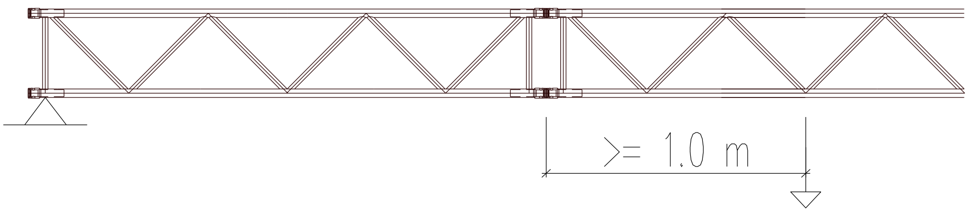
Location of coupler from loading point e >= 1,0 m



Single-load in 1/2point

	allowable load as a function of			
	Nrd	Qrd	Interaction at coupler	
			1	= e [m]
L [m]	**zul P [kN]**	**zul P [kN]**	**zul P [kN]**	**min zul P [kN]**
4,00	33,76	50,20	35,34	33,76
5,00	26,88	50,05	29,46	26,88
6,00	22,27	49,91	25,11	22,27
7,00	18,95	49,77	21,79	18,95
8,00	16,45	49,62	19,19	16,45
9,00	14,48	49,48	17,10	14,48
10,00	12,90	49,33	15,37	12,90
11,00	11,59	49,19	13,93	11,59
12,00	10,48	49,05	12,71	10,48
13,00	9,54	48,90	11,65	9,54
14,00	8,72	48,76	10,73	8,72
15,00	8,00	48,61	9,92	8,00
16,00	7,36	48,47	9,19	7,36
17,00	6,79	48,33	8,54	6,79
18,00	6,27	48,18	7,95	6,27
19,00	5,80	48,04	7,41	5,80
20,00	5,37	47,89	6,92	5,37
21,00	4,97	47,75	6,47	4,97
22,00	4,61	47,61	6,04	4,61
23,00	4,27	47,46	5,65	4,27
24,00	3,95	47,32	5,28	3,95

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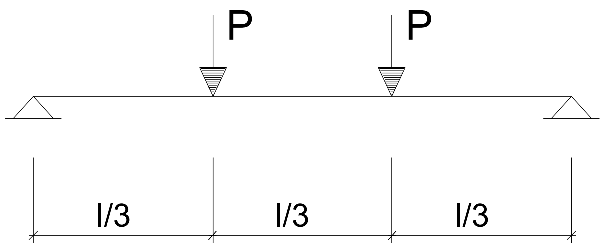
5.3 Single-loads in 1/3 points

System



Normal force in chord:

NRd ≥ (Psd · L / 3 + gsd · L² / 8) / (n · b)

=> Psd ≤ [NRd · (n · b) - gsd · L² / 8] · 3 / L

=> zul P = [NRd · (n · b) - gsd · L² / 8] · 3 / L / γF

Normal force in diagonals:

QRd ≥ Psd / 2 gsd · L / 2 => Psd ≤ (QRd – gsd · L / 2)

=> zul P = (QRd – gsd · L / 2) / γF

Interaction at coupler:

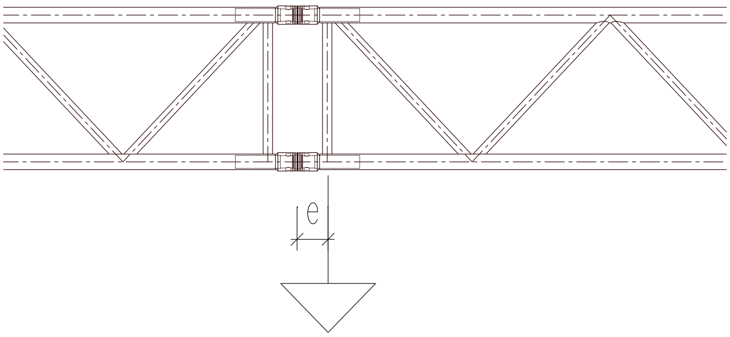
Verification of interaction bending and normal force at coupler by an iterative method.

=> $(Nsd_G / NRd_G)^{1,3} + (Msd_G / MRd_G) < 1,0$

applied:	Loading point at coupler	e = 0,095 m
	Alternatively: Location of coupler from loading point	>= 1,0 m

Loading-tables: see next pages

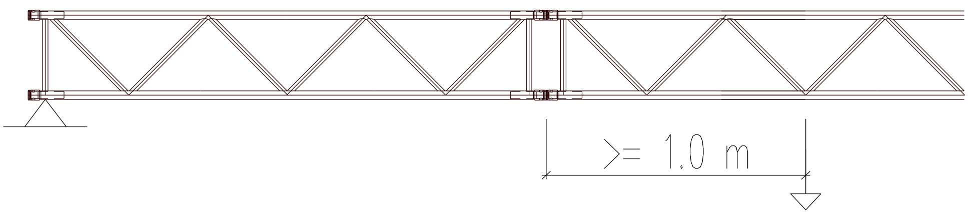
Loading point at coupler e = 0,095 m



Single-load in 1/3points

	allowable load as a function of			
	Nrd	Qrd	Interaction at coupler	
			0,095	= e [m]
L [m]	**zul P [kN]**	**zul P [kN]**	**zul P [kN]**	**min zul P [kN]**
4,00	25,32	25,10	16,20	16,20
5,00	20,16	25,03	14,35	14,35
6,00	16,70	24,95	12,88	12,88
7,00	14,21	24,88	11,65	11,65
8,00	12,34	24,81	10,62	10,62
9,00	10,86	24,74	9,74	9,74
10,00	9,67	24,67	8,98	8,98
11,00	8,69	24,59	8,30	8,30
12,00	7,86	24,52	7,71	7,71
13,00	7,15	24,45	7,18	7,15
14,00	6,54	24,38	6,70	6,54
15,00	6,00	24,31	6,26	6,00
16,00	5,52	24,23	5,87	5,52
17,00	5,09	24,16	5,50	5,09
18,00	4,70	24,09	5,17	4,70
19,00	4,35	24,02	4,86	4,35
20,00	4,03	23,95	4,57	4,03
21,00	3,73	23,87	4,30	3,73
22,00	3,45	23,80	4,05	3,45
23,00	3,20	23,73	3,81	3,20
24,00	2,96	23,66	3,59	2,96

Location of coupler from loading point e >= 1,0 m



Single-load in 1/3points

	allowable load as a function of			
	Nrd	Qrd	Interaction at coupler	
			1	= e [m]
L [m]	**zul P [kN]**	**zul P [kN]**	**zul P [kN]**	**min zul P [kN]**
4,00	25,32	25,10	23,14	23,14
5,00	20,16	25,03	20,08	20,08
6,00	16,70	24,95	17,52	16,70
7,00	14,21	24,88	15,45	14,21
8,00	12,34	24,81	13,75	12,34
9,00	10,86	24,74	12,35	10,86
10,00	9,67	24,67	11,17	9,67
11,00	8,69	24,59	10,18	8,69
12,00	7,86	24,52	9,32	7,86
13,00	7,15	24,45	8,58	7,15
14,00	6,54	24,38	7,92	6,54
15,00	6,00	24,31	7,35	6,00
16,00	5,52	24,23	6,83	5,52
17,00	5,09	24,16	6,36	5,09
18,00	4,70	24,09	5,94	4,70
19,00	4,35	24,02	5,56	4,35
20,00	4,03	23,95	5,21	4,03
21,00	3,73	23,87	4,88	3,73
22,00	3,45	23,80	4,58	3,45
23,00	3,20	23,73	4,29	3,20
24,00	2,96	23,66	4,03	2,96

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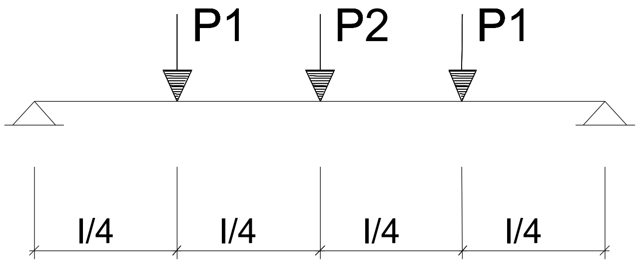
5.4 Single-loads in 1/4 points

System



Normal force in chord:

NRd ≥ (Psd · L / 4 + gsd · L² / 8) / (n · b)

=> Psd ≤ [NRd · (n · b) - gsd · L² / 8] · 2 / L

=> zul P = [NRd · (n · b) - gsd · L² / 8] · 2 / L / yF

Normal force in diagonals:

QRd ≥ 3 / 2 · Psd + gsd · L / 2 => Psd ≤ (QRd – gsd · L / 2) · 2 / 3

=> zul P = (QRd – gsd · L / 2) · 2 / 3 / yF

Interaction at coupler:

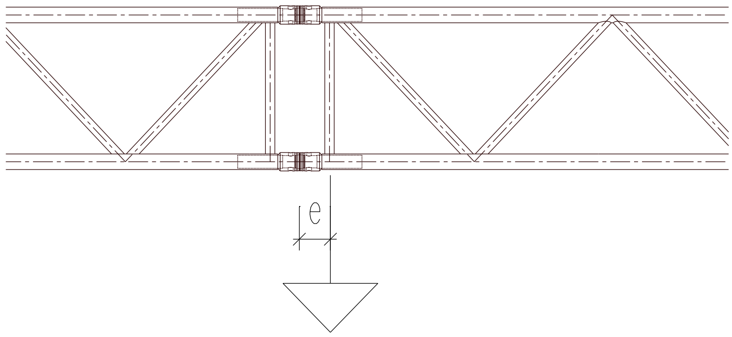
Verification of interaction bending and normal force at coupler by an iterative method.

=> $(Nsd_G / NRd_G)^{1,3} + (Msd_G / MRd_G) < 1,0$

applied:	Loading point at coupler	e = 0,095 m
	Alternatively: Location of coupler from loading point	>= 1,0 m

Loading-tables: see next pages

Loading point at coupler e = 0,095 m



Single-load in 1/4points

	allowable load as a function of				
	Nrd	Qrd	Interaction at coupler 1	Interaction at coupler 2	
			0,095	0,095	= e [m]
L [m]	**zul P [kN]**	**zul P [kN]**	**zul P [kN]**	**zul P [kN]**	**min zul P [kN]**
4,00	16,88	16,73	11,91	16,33	11,91
5,00	13,44	16,68	10,88	13,68	10,88
6,00	11,13	16,64	10,00	11,74	10,00
7,00	9,48	16,59	9,23	10,26	9,23
8,00	8,22	16,54	8,56	9,09	8,22
9,00	7,24	16,49	7,97	8,14	7,24
10,00	6,45	16,44	7,43	7,35	6,45
11,00	5,79	16,40	6,95	6,69	5,79
12,00	5,24	16,35	6,50	6,12	5,24
13,00	4,77	16,30	6,10	5,62	4,77
14,00	4,36	16,25	5,73	5,19	4,36
15,00	4,00	16,20	5,38	4,80	4,00
16,00	3,68	16,16	5,06	4,46	3,68
17,00	3,39	16,11	4,76	4,15	3,39
18,00	3,13	16,06	4,47	3,86	3,13
19,00	2,90	16,01	4,21	3,61	2,90
20,00	2,68	15,96	3,95	3,37	2,68
21,00	2,49	15,92	3,71	3,15	2,49
22,00	2,30	15,87	3,48	2,95	2,30
23,00	2,13	15,82	3,26	2,76	2,13
24,00	1,97	15,77	3,05	2,58	1,97

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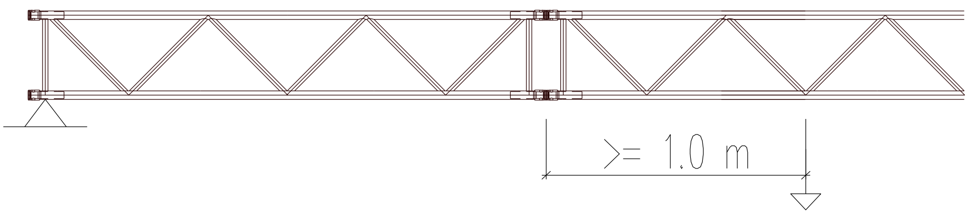
Location of coupler from loading point e >= 1,0 m

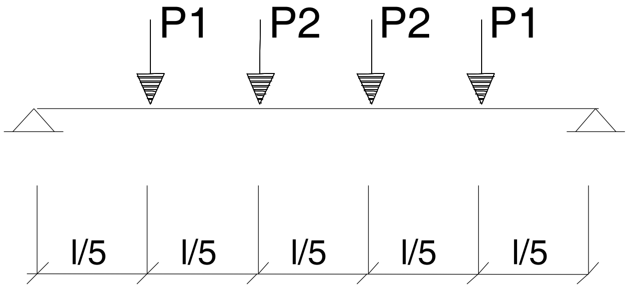


Single-load in 1/4points

	allowable load as a function of				
	Nrd	Qrd	Interaction at coupler 1	Interaction at coupler 2	
			1	1	= e [m]
L [m]	**zul P [kN]**	**zul P [kN]**	**zul P [kN]**	**zul P [kN]**	**min zul P [kN]**
4,00	16,88	16,73	17,29	19,67	16,73
5,00	13,44	16,68	15,93	15,96	13,44
6,00	11,13	16,64	14,40	13,39	11,13
7,00	9,48	16,59	13,03	11,51	9,48
8,00	8,22	16,54	11,83	10,06	8,22
9,00	7,24	16,49	10,79	8,91	7,24
10,00	6,45	16,44	9,88	7,98	6,45
11,00	5,79	16,40	9,08	7,21	5,79
12,00	5,24	16,35	8,38	6,55	5,24
13,00	4,77	16,30	7,75	5,99	4,77
14,00	4,36	16,25	7,18	5,50	4,36
15,00	4,00	16,20	6,67	5,07	4,00
16,00	3,68	16,16	6,20	4,69	3,68
17,00	3,39	16,11	5,77	4,35	3,39
18,00	3,13	16,06	5,38	4,05	3,13
19,00	2,90	16,01	5,01	3,77	2,90
20,00	2,68	15,96	4,67	3,51	2,68
21,00	2,49	15,92	4,35	3,28	2,49
22,00	2,30	15,87	4,06	3,06	2,30
23,00	2,13	15,82	3,78	2,86	2,13
24,00	1,97	15,77	3,51	2,67	1,97

5.5 Single-loads in 1/5 points

System



Normal force in chord:

NRd ≥ (Psd · 3 / 5 · L + gsd · L² / 8) / (n · b)

=> Psd ≤ [NRd · (n · b) - gsd · L² / 8] · 5 / 3

=> zul P = [NRd · (n · b) - gsd · L² / 8] · 5 / 3 / L / yF

Normal force in diagonals:

QRd ≥ 2 · Psd + gsd · L / 2 => Psd ≤ (QRd – gsd · L / 2) / 2

=> zul P = (QRd – gsd · L / 2) / 2 / yF

Interaction at coupler:

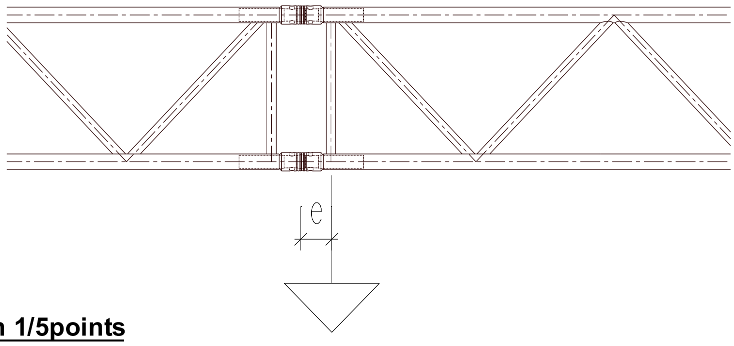
Verification of interaction bending and normal force at coupler by an iterative method.

$$=> (Nsd_G / NRd_G)^{1,3} + (Msd_G / MRd_G) < 1,0$$

applied:	Loading point at coupler	e = 0,095 m
	Alternatively: Location of coupler from loading pointe	>= 1,0 m

Loading-tables: see next pages

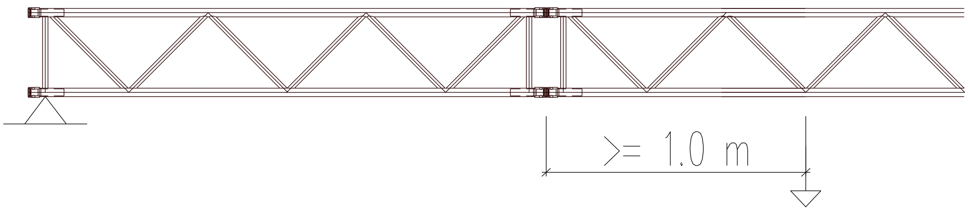
Loading point at coupler e = 0,095 m



Single-load in 1/5points

	allowable load as a function of				
	Nrd	Qrd	Interaction at coupler 1	Interaction at coupler 2	
			0,095	0,095	= e [m]
L [m]	**zul P [kN]**	**zul P [kN]**	**zul P [kN]**	**zul P [kN]**	**min zul P [kN]**
4,00	14,07	12,55	9,77	11,67	9,77
5,00	11,20	12,51	8,99	10,01	8,99
6,00	9,28	12,48	8,36	8,74	8,36
7,00	7,90	12,44	7,80	7,74	7,74
8,00	6,85	12,41	7,29	6,93	6,85
9,00	6,03	12,37	6,84	6,26	6,03
10,00	5,37	12,33	6,43	5,69	5,37
11,00	4,83	12,30	6,05	5,21	4,83
12,00	4,37	12,26	5,70	4,79	4,37
13,00	3,97	12,23	5,37	4,42	3,97
14,00	3,63	12,19	5,07	4,09	3,63
15,00	3,33	12,15	4,79	3,80	3,33
16,00	3,07	12,12	4,52	3,54	3,07
17,00	2,83	12,08	4,27	3,30	2,83
18,00	2,61	12,05	4,03	3,09	2,61
19,00	2,42	12,01	3,80	2,89	2,42
20,00	2,24	11,97	3,59	2,70	2,24
21,00	2,07	11,94	3,38	2,53	2,07
22,00	1,92	11,90	3,18	2,37	1,92
23,00	1,78	11,87	2,99	2,23	1,78
24,00	1,64	11,83	2,81	2,09	1,64

Location of coupler from loading point e >= 1,0 m



Single-load in 1/5points

	allowable load as a function of				
	Nrd	Qrd	Interaction at coupler 1	Interaction at coupler 2	
			1	1	= e [m]
L [m]	**zul P [kN]**	**zul P [kN]**	**zul P [kN]**	**zul P [kN]**	**min zul P [kN]**
4,00	14,07	12,55	not relevant	not relevant	12,55
5,00	11,20	12,51	12,91	12,64	11,20
6,00	9,28	12,48	12,12	10,72	9,28
7,00	7,90	12,44	11,20	9,27	7,90
8,00	6,85	12,41	10,32	8,15	6,85
9,00	6,03	12,37	9,53	7,25	6,03
10,00	5,37	12,33	8,81	6,51	5,37
11,00	4,83	12,30	8,16	5,90	4,83
12,00	4,37	12,26	7,58	5,37	4,37
13,00	3,97	12,23	7,05	4,92	3,97
14,00	3,63	12,19	6,57	4,53	3,63
15,00	3,33	12,15	6,13	4,18	3,33
16,00	3,07	12,12	5,72	3,88	3,07
17,00	2,83	12,08	5,35	3,60	2,83
18,00	2,61	12,05	5,00	3,35	2,61
19,00	2,42	12,01	4,68	3,12	2,42
20,00	2,24	11,97	4,37	2,91	2,24
21,00	2,07	11,94	4,09	2,72	2,07
22,00	1,92	11,90	3,82	2,55	1,92
23,00	1,78	11,87	3,57	2,38	1,78
24,00	1,64	11,83	3,33	2,23	1,64

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6 SUMMARY OF THE RESULTS

6.1 Allowable loadings

Allowable load F54S

single-span beam

		Single point loads			
Span	UDL	in 1/2 Point	in 1/3 Points	in 1/4 Points	in 1/5 Points
[m]	[kN/m]	[kN]	[kN]	[kN]	[kN]
4	12,55	26,30	16,20	11,91	9,77
5	10,01	22,78	14,35	10,88	8,99
6	7,42	20,03	12,88	10,00	8,36
7	5,41	17,83	11,65	9,23	7,74
8	4,11	16,02	10,62	8,22	6,85
9	3,22	14,48	9,74	7,24	6,03
10	2,58	12,90	8,98	6,45	5,37
11	2,11	11,59	8,30	5,79	4,83
12	1,75	10,48	7,71	5,24	4,37
13	1,47	9,54	7,15	4,77	3,97
14	1,25	8,72	6,54	4,36	3,63
15	1,07	8,00	6,00	4,00	3,33
16	0,92	7,36	5,52	3,68	3,07
17	0,80	6,79	5,09	3,39	2,83
18	0,70	6,27	4,70	3,13	2,61
19	0,61	5,80	4,35	2,90	2,42
20	0,54	5,37	4,03	2,68	2,24
21	0,47	4,97	3,73	2,49	2,07
22	0,42	4,61	3,45	2,30	1,92
23	0,37	4,27	3,20	2,13	1,78
24	0,33	3,95	2,96	1,97	1,64

The values of the table are only valid for single-span girder.

The truss-elements have to be braced with diagonals.

Large loads have to be applied at the nodes or have to be distributed by appropriate constructions.

Loads at the middle of the couplers are not allowed.

All loads have to be distributed equally to both chords.

The specified values include partial safety coefficients on the loadings side acc. EN 1990 of yF = 1.50 for payloads and yG = 1.35 for selfweight of the truss.

For applictaions which can be calculated on the basis of other codes, the partial safety factors can be adjusted (for example temporary structures acc. EN 13814, yF = 1.35 for payloads).

To use the resulting allowable loads with British Standard (BS) and ANSI, allowable loads listed in tables have to be multiplied by 0.85.

The values are calculated with no requirements for the location o the couplers. In case that the distance from the couplers to the loadingpoints of the single-point loads is ≥ 1,0 m into the direction of the support, the values of the calculations for the different loadcases can be used (see chapter 5).

6.2 Deflections at max. allowable loadings:

Deflections [cm] for F54 at max. allowable loads

[cm]

		Single point loads			
Span	UDL	in 1/2 Point	in 1/3 Points	in 1/4 Points	in 1/5 Points
[m]	[cm]	[cm]	[cm]	[cm]	[cm]
4	0,47	0,40	0,42	0,43	0,44
5	0,92	0,68	0,72	0,76	0,80
6	1,42	1,03	1,13	1,22	1,30
7	1,94	1,47	1,64	1,80	1,92
8	2,54	2,00	2,24	2,41	2,56
9	3,21	2,60	2,96	3,06	3,24
10	3,97	3,22	3,78	3,78	4,00
11	4,81	3,92	4,71	4,59	4,85
12	5,73	4,68	5,75	5,47	5,78
13	6,74	5,52	6,87	6,44	6,79
14	7,83	6,44	7,98	7,48	7,89
15	9,00	7,44	9,18	8,61	9,07
16	10,26	8,51	10,45	9,82	10,33
17	11,61	9,67	11,82	11,12	11,68
18	13,04	10,92	13,27	12,51	13,12
19	14,56	12,25	14,81	13,98	14,65
20	16,17	13,67	16,44	15,54	16,27
21	17,86	15,19	18,16	17,20	17,97
22	19,66	16,81	19,97	18,94	19,77
23	21,54	18,53	21,87	20,79	21,66
24	23,51	20,35	23,87	22,72	23,64

= deflection > L/100

ANNEXE A: COMPARATIVE CALCULATION INFLUENCE OF HORIZONTAL LEVELS

The horizontal levels of the truss F54S are not stiffened by diagonal bracings. There are only vertical struts. By the following calculation it is examined to what extend this has an influence on the load bearing capacity of the truss.

For the calculation a system with a total length of 24m is chosen. The permissible loads for the F54S-Truss with l= 24 m are applied in the system.

Load cases:

LC1) Permissible uniformly distributed load for l= 24m + self weight of the truss

p_v = (0,33 + 0,16) / 4 = 0,1225 kN/m per chord

LC2) as LC1 + horizontal load of p/100

p_h = 0,135 / 100 = 0,001225 kN/m

LC3) Calculation acc. second order theory with safety 1,5 acc. EN 1990

Results

(see software print)

acc. first order theory: LF2/LC2: N_{Chord} = -37,12 kN

acc. second order theory: LF3/LC3: N_{Chord} = -55,81 kN (including safety 1,5)

=> N_{II} / N_I = 55,81 / 1,5 / 37,12 = 1,002 < 1,1

Increase of the internal forces resulting from calculation acc. second order theory resp. the influence of the deformation is negligible.

The remaining load reserve is determined by a iterative calculation: the factor of the load in the calculation according second order theory is increased until failure.

Load reserve UDL LC1: 2,92

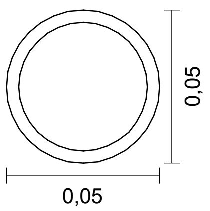
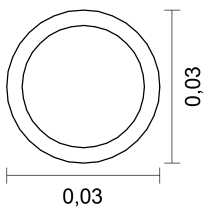
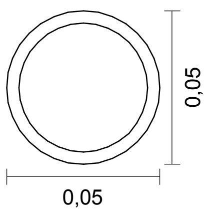
System characteristics

261	Nodes		
510	Elements	510	Beams
4	Supports	0	Slabs
0	Link elements	0	Plains
3	Material properties	0	Shells
3	Section properties	0	Cables
4	Load cases	0	Solids
0	LC Combinations	0	Spring elements
0	Tendon groups		

Result location in area elements: Node
5 Result locations in beam elements

Rotated element systems
0 Element systems
0 Internal force systems
0 Reinforcement systems

Section properties

1	Polygon  	Gurt Centroid [m] ys = -0,000 zs = -0,000 Area [m²] A = 5,7435e-04 Moments of inertia [m4] Ix = 3,0395e-07 Iy = 1,5208e-07 I1 = 1,5208e-07 Iz = 1,5208e-07 I2 = 1,5208e-07 Main axis angle [Grad] Phi = 0,000 Iyz = 0,0000e+00 Averaging of the lateral force shear stress over section width
2	Polygon  	Diagonale Centroid [m] ys = -0,000 zs = -0,000 Area [m²] A = 2,5284e-04 Moments of inertia [m4] Ix = 4,6324e-08 Iy = 2,3175e-08 I1 = 2,3175e-08 Iz = 2,3175e-08 I2 = 2,3175e-08 Main axis angle [Grad] Phi = 0,000 Iyz = 0,0000e+00 Averaging of the lateral force shear stress over section width
3	Polygon  	Querrohr Centroid [m] ys = -0,000 zs = -0,000 Area [m²] A = 5,7435e-04 Moments of inertia [m4] Ix = 3,0395e-07 Iy = 1,5208e-07 I1 = 1,5208e-07 Iz = 1,5208e-07 I2 = 1,5208e-07 Main axis angle [Grad] Phi = 0,000 Iyz = 0,0000e+00 Averaging of the lateral force shear stress over section width

Material properties

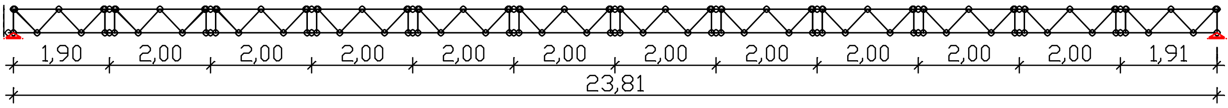
	No.	Type	E-Modu. [MN/m²]	G-Modu. [MN/m²]	Poiss. ratio	alpha.t [1/K]	gamma [kN/m³]	Miscellaneous
1	1	Frei	70000	29167	0,20	1,00e-05	27,000	fc = 145 [MN/m²] ft = 145
2	2	Frei	70000	29167	0,20	1,00e-05	27,000	fc = 145 [MN/m²] ft = 145
3	3	Frei	70000	29167	0,20	1,00e-05	27,000	fc = 145 [MN/m²] ft = 145

List of load cases

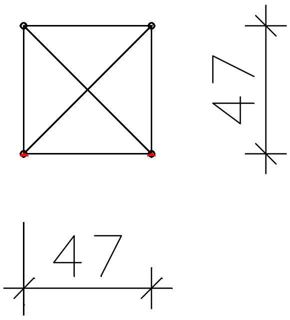
LC.	Label
1	[Unnamed]
2	[Unnamed]
3	[Unnamed]

Sum of installed loads and support reactions

LC.	Label	Fx [kN]	Fy [kN]	Fz [kN]
1	[Unnamed]	-0,000	-0,000	11,679
	Support reactions	-0,000	-0,000	11,679
2		0,117	-0,000	11,679
	Support reactions	0,117	-0,000	11,679
3		0,175	-0,000	17,518
	Support reactions	0,175	0,000	17,518



Dimensions



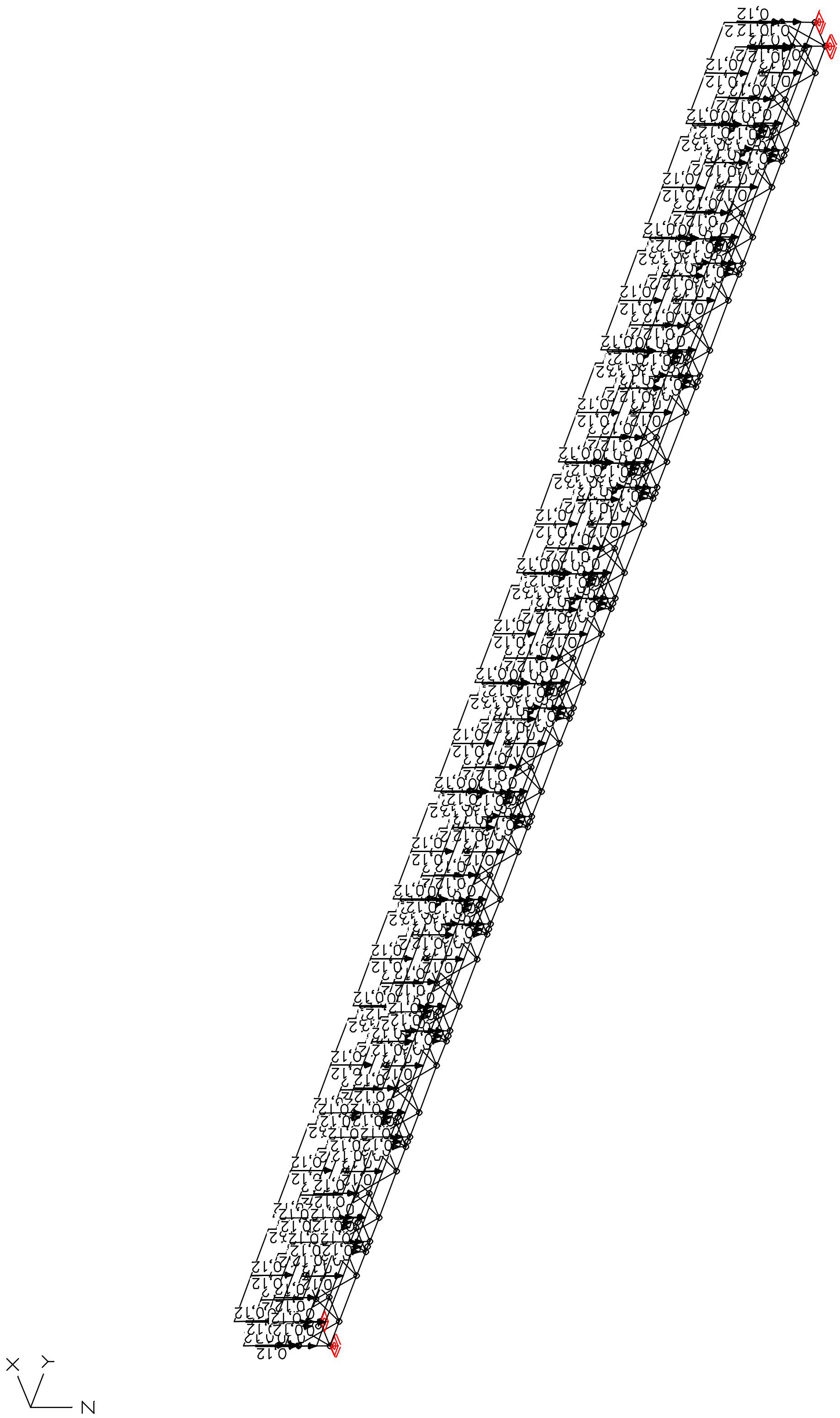
Dimensions

BÜRO FÜR TRAGWERKSPLANUNG UND INGENIEURBAU
vom Felde + Keppler GmbH & Co. KG
LÜTTICHER STR. 10–12
52064 AACHEN
Telefon: 0241/709696
Telefax: 0241/709646
buero @ vom–felde.de

17341 – F54S
Annexe A

30.06.2017
M 1 : 90

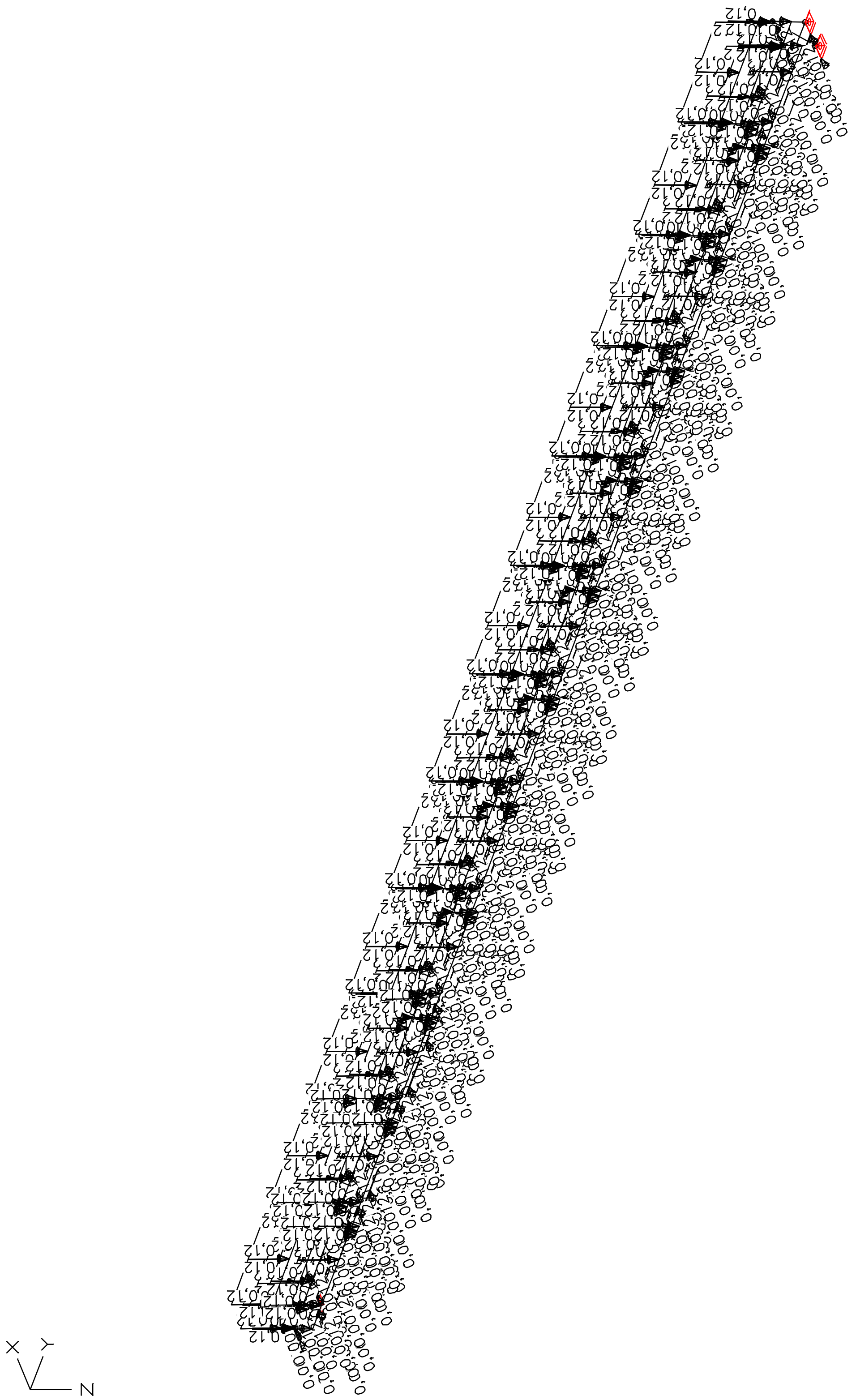
BUCKLING EIGENVALUES: n=4



LC 1: Load

17341 – F54S
Annexe A

30.06.2017
M 1 : 90



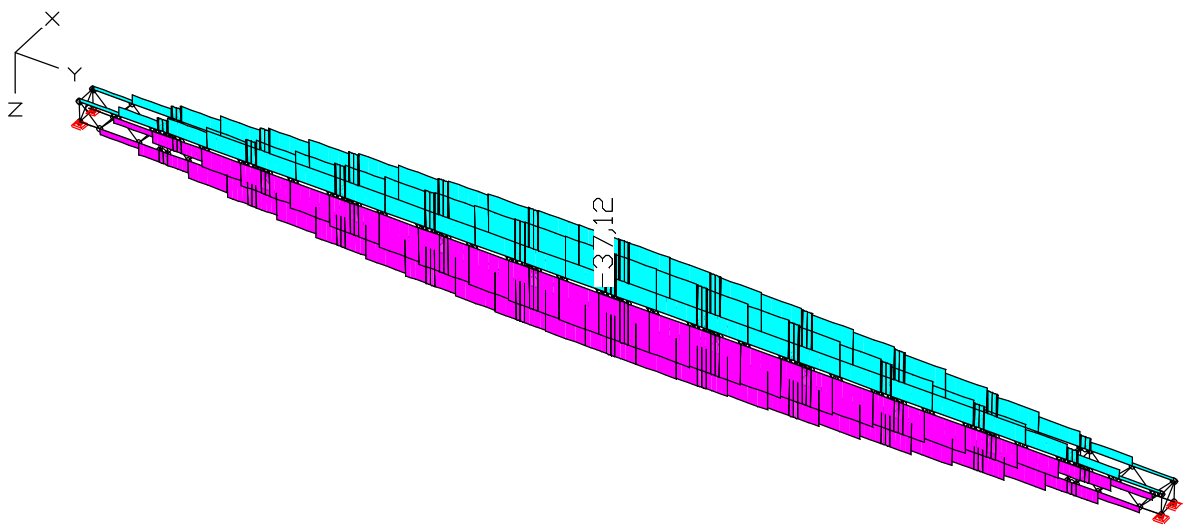
LC 2: Load,

Load data load case 3:

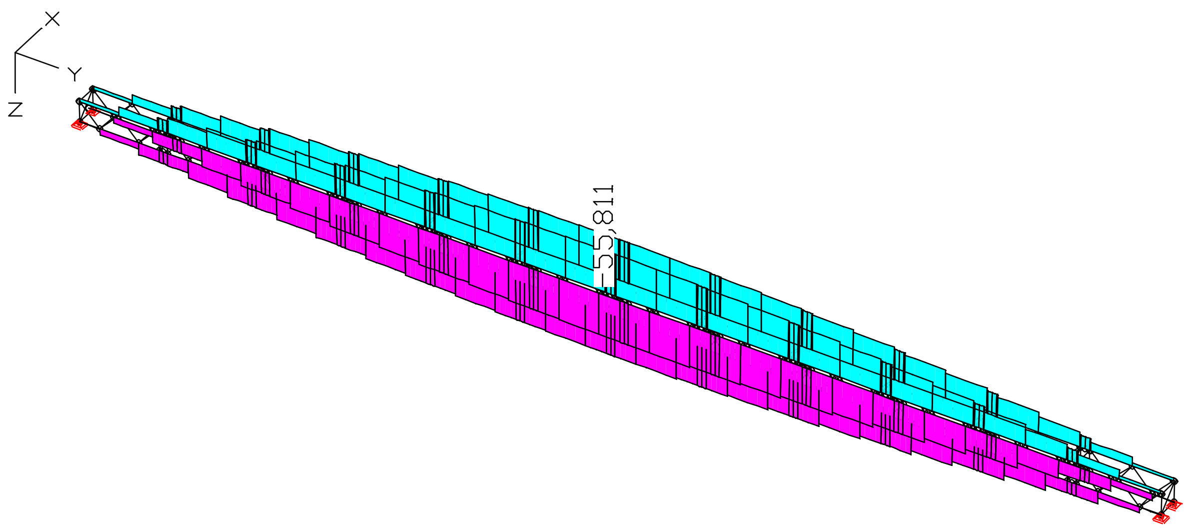
Load group (GRL)
Theory: 2. order theory
No soil pressure > 0: No; No support reac. < 0: No; Error threshold [%]: 1,00
Additional global load factor: 1,00; Predeformation: 0
Consider concrete creeping in the nonlinear analysis: No

Selected load cases

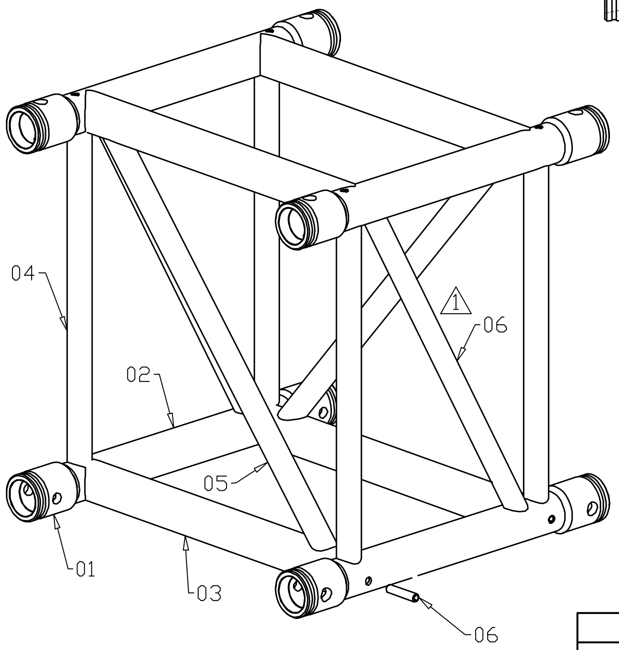
No.	Label	Factor
2		1,5

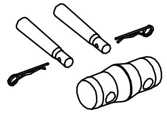


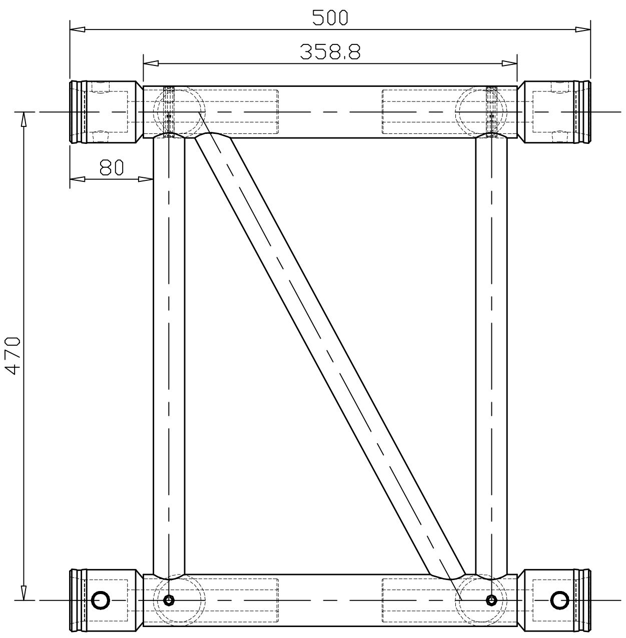
Internal forces Nx; LF 2

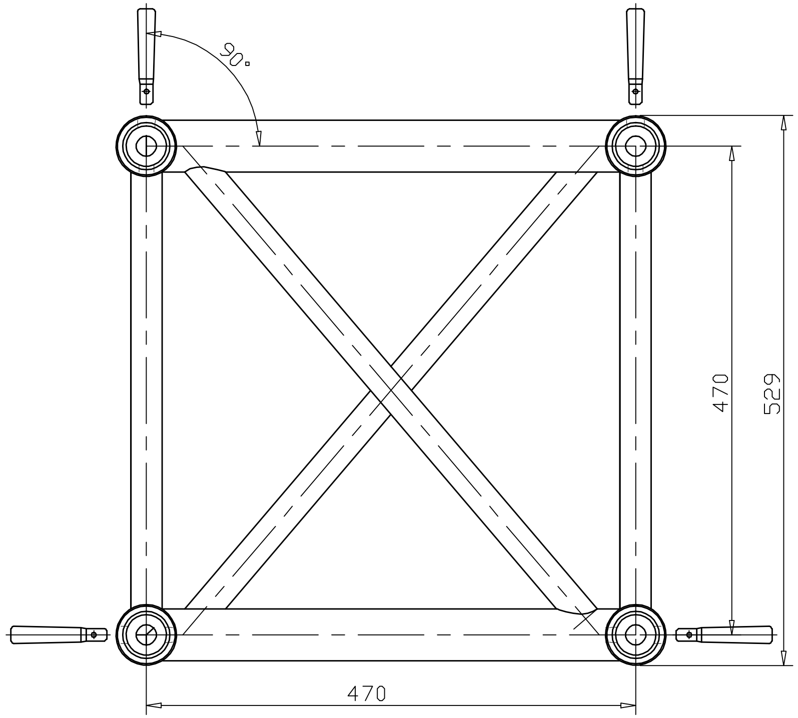


Internal forces Nx; LF 3







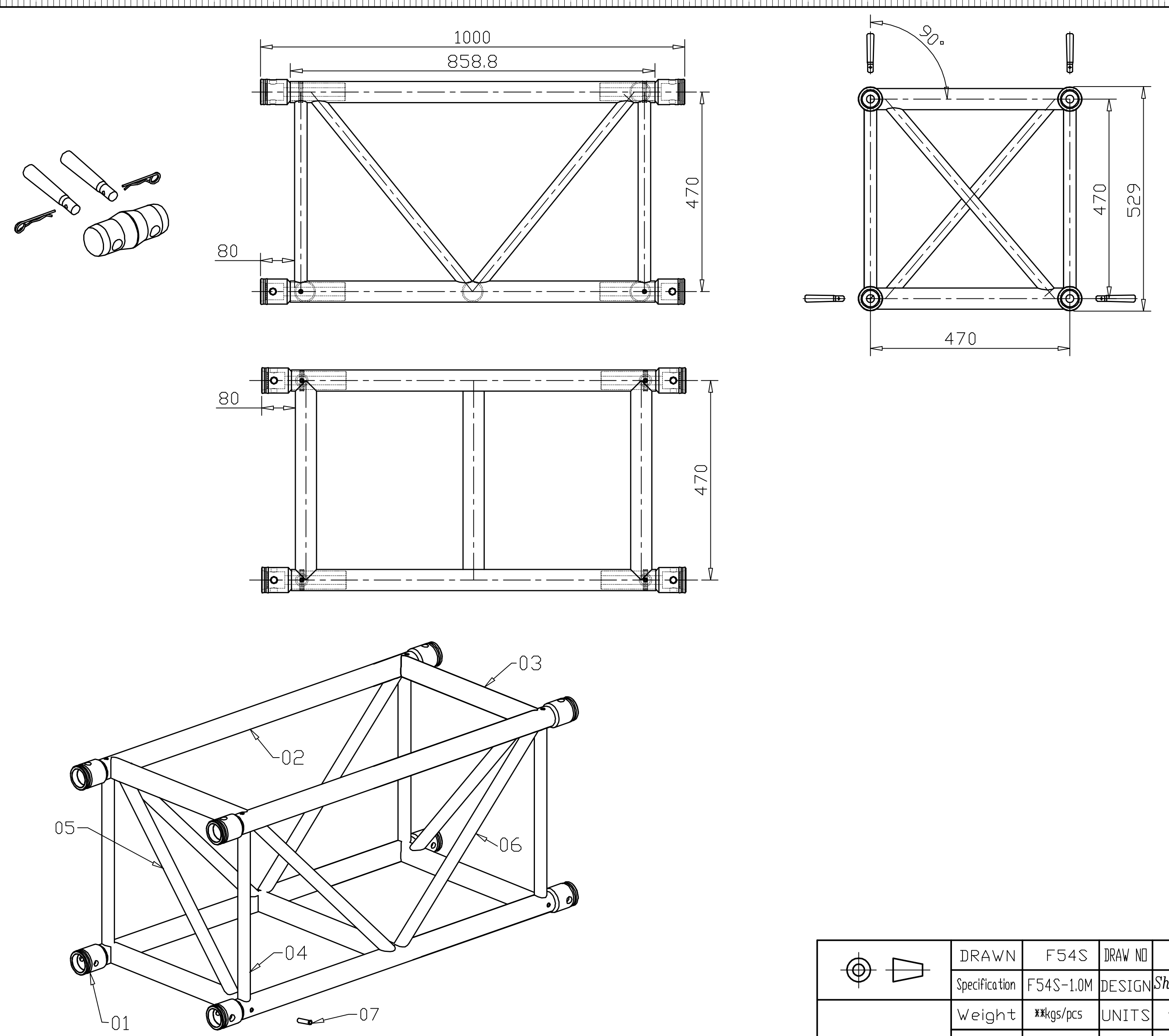


fitting	DMS-01-1	steel	CP	8
	ST-F64-PJ-A-3	S45C	CP	8
	ST-F64-PJ-A-2	#2011	T6	4
07	ø10*50mm	Steel	Black	8
06	ø30*3.0t*493mm	#6082	T6	2
05	ø30*3.0t*577mm	#6082	T6	2
04	ø30*3.0t*419.5mm	#6082	T6	4
03	ø50*4.0t*454mm	#6082	T6	4
02	ø50*4.0t*358.8mm	#6082	T6	4
01	ST-F64-PJ-A-1T	#6082	T6	8
NO.	SPEC.	MATERIAL	FIS-	QTY.

DRAWN	F54S	DRAW NO	F54S050		2D/3D	edition	1
Specification	F54S-0.5M	DESIGN	Shendantao	DATE 09.06.26	CHECKED	APPROVED	
Weight	**kgs/pcs	UNITS	mm	Proofread			
SURFACE	RAW	SCALE	1:7				

MARK	NAME	RETRIEVE CONTENTS	DATE

Global Truss

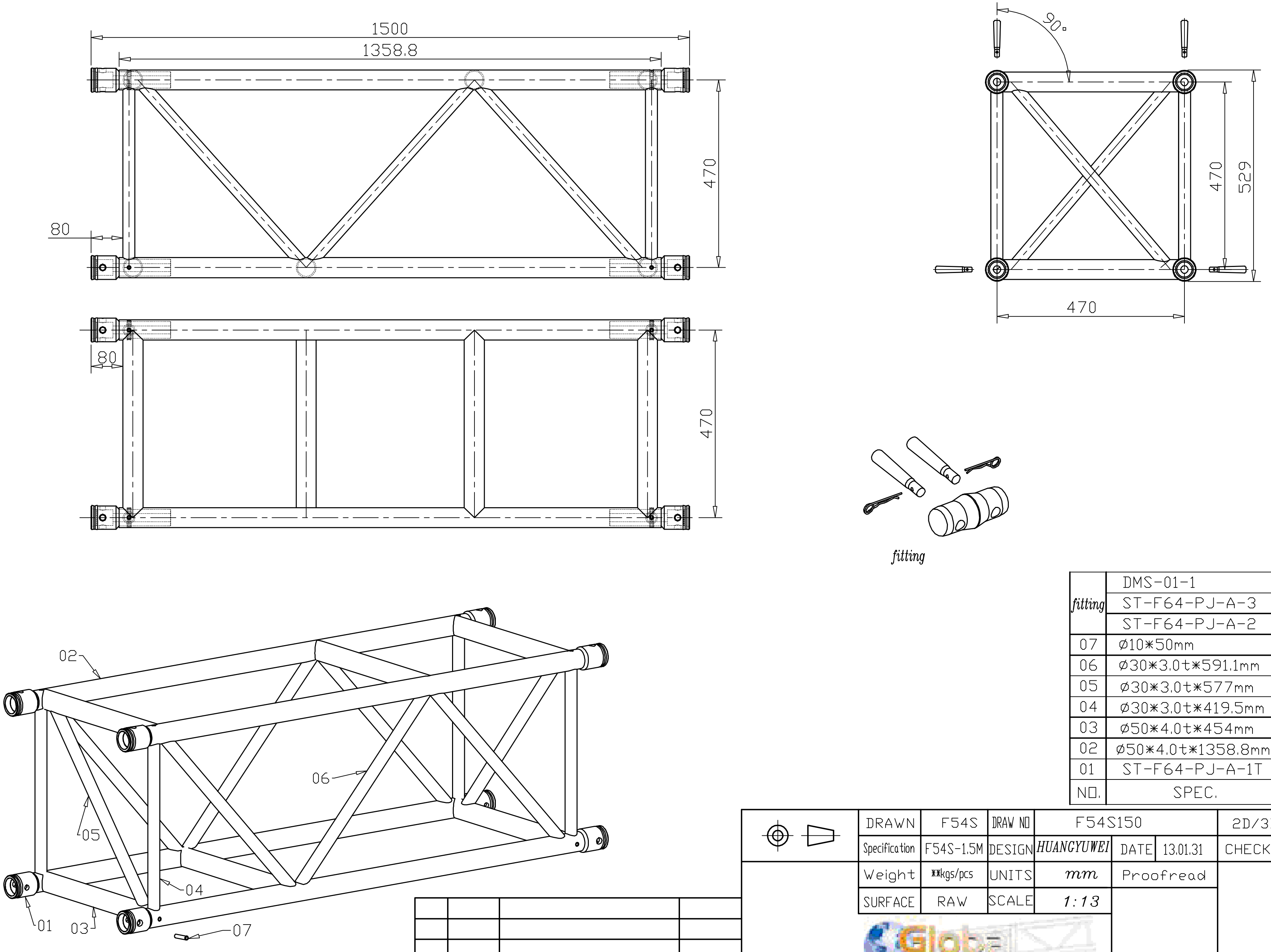


fitting	DMS-01-1	Steel	CP	8
	ST-F64-PJ-A-3	S45C	CP	8
	ST-F64-PJ-A-2	#2011	T6	4
07	Ø10*50mm	Steel	Black	8
06	Ø30*3.0t*565mm	#6082	T6	4
05	Ø30*3.0t*577mm	#6082	T6	2
04	Ø30*3.0t*419.5mm	#6082	T6	4
03	Ø50*4.0t*454mm	#6082	T6	5
02	Ø50*4.0t*858.8mm	#6082	T6	4
01	ST-F64-PJ-A-1T	#6082	T6	8
NO.	SPEC.	MATERIAL	FIS-	QTY.

DRAWN	F54S	DRAW NO	F54S100		2D/3D	edition	1
Specification	F54S-1.0M	DESIGN	Shendantao	DATE 09.06.26	CHECKED	APPROVED	
Weight	**kgs/pcs	UNITS	mm	Proofread			
SURFACE	RAW	SCALE	1:14				

Global Truss

MARK	NAME	RETRIEVE CONTENTS	DATE

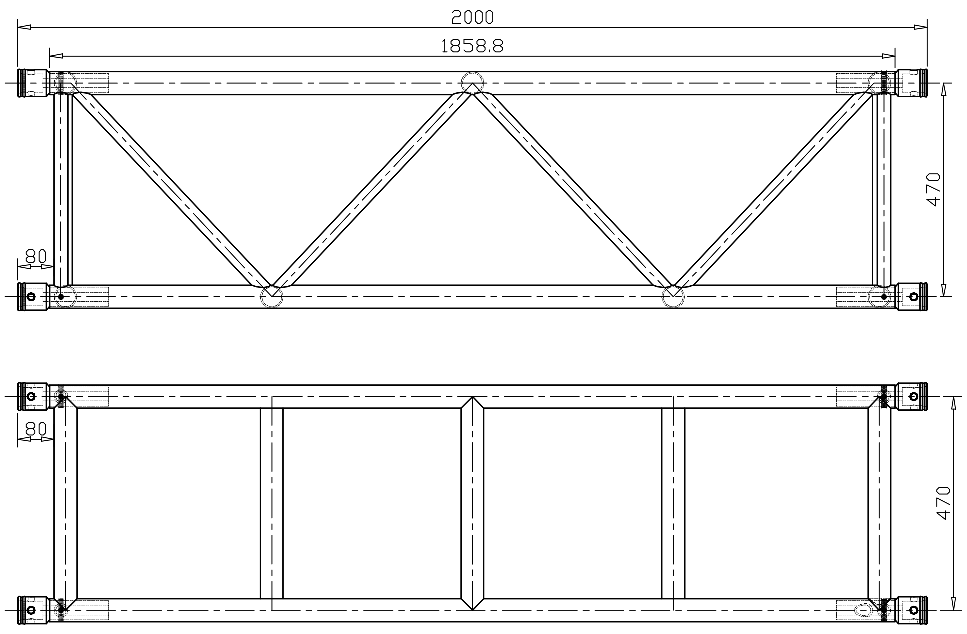


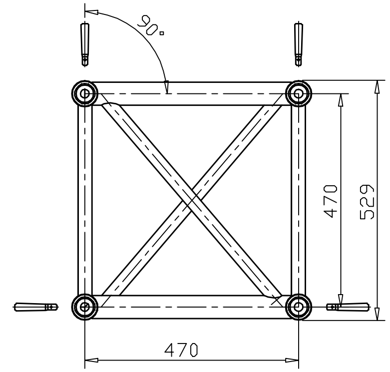
fitting	DMS-01-1	Steel	CP	8
	ST-F64-PJ-A-3	S45C	CP	8
	ST-F64-PJ-A-2	#2011	T6	4
07	ø10*50mm	Steel	Black	8
06	ø30*3.0t*591.1mm	#6082	T6	6
05	ø30*3.0t*577mm	#6082	T6	2
04	ø30*3.0t*419.5mm	#6082	T6	4
03	ø50*4.0t*454mm	#6082	T6	6
02	ø50*4.0t*1358.8mm	#6082	T6	4
01	ST-F64-PJ-A-1T	#6082	T6	8
NO.	SPEC.	MATERIAL	FIS-	QTY.

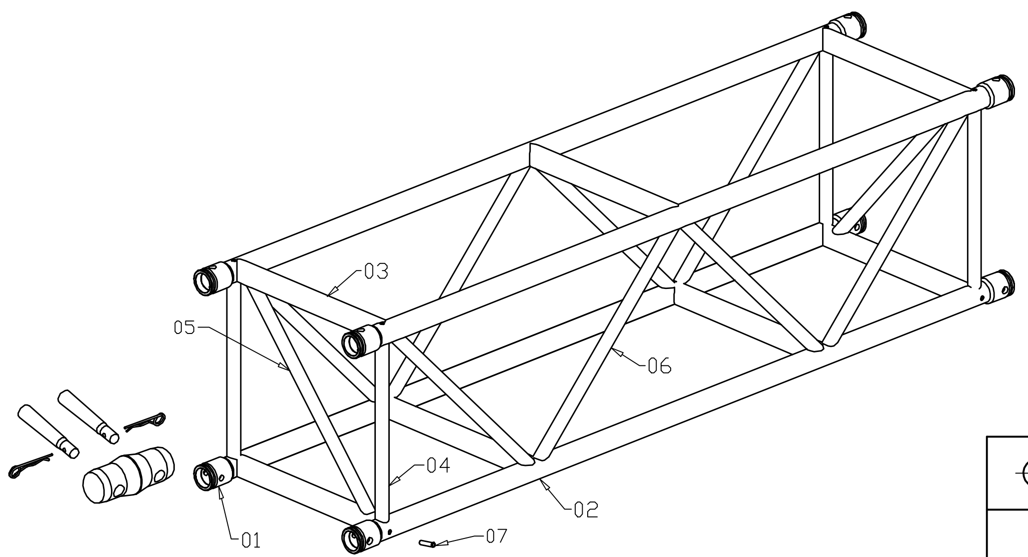
DRAWN	F54S	DRAW NO	F54S150		2D/3D	edition	1
Specification	F54S-1.5M	DESIGN	HUANGYUWEI	DATE 13.01.31	CHECKED	APPROVED	
Weight	**kgs/pcs	UNITS	mm	Proofread			
SURFACE	RAW	SCALE	1:13				

MARK	NAME	RETRIEVE CONTENTS	DATE

Global Truss





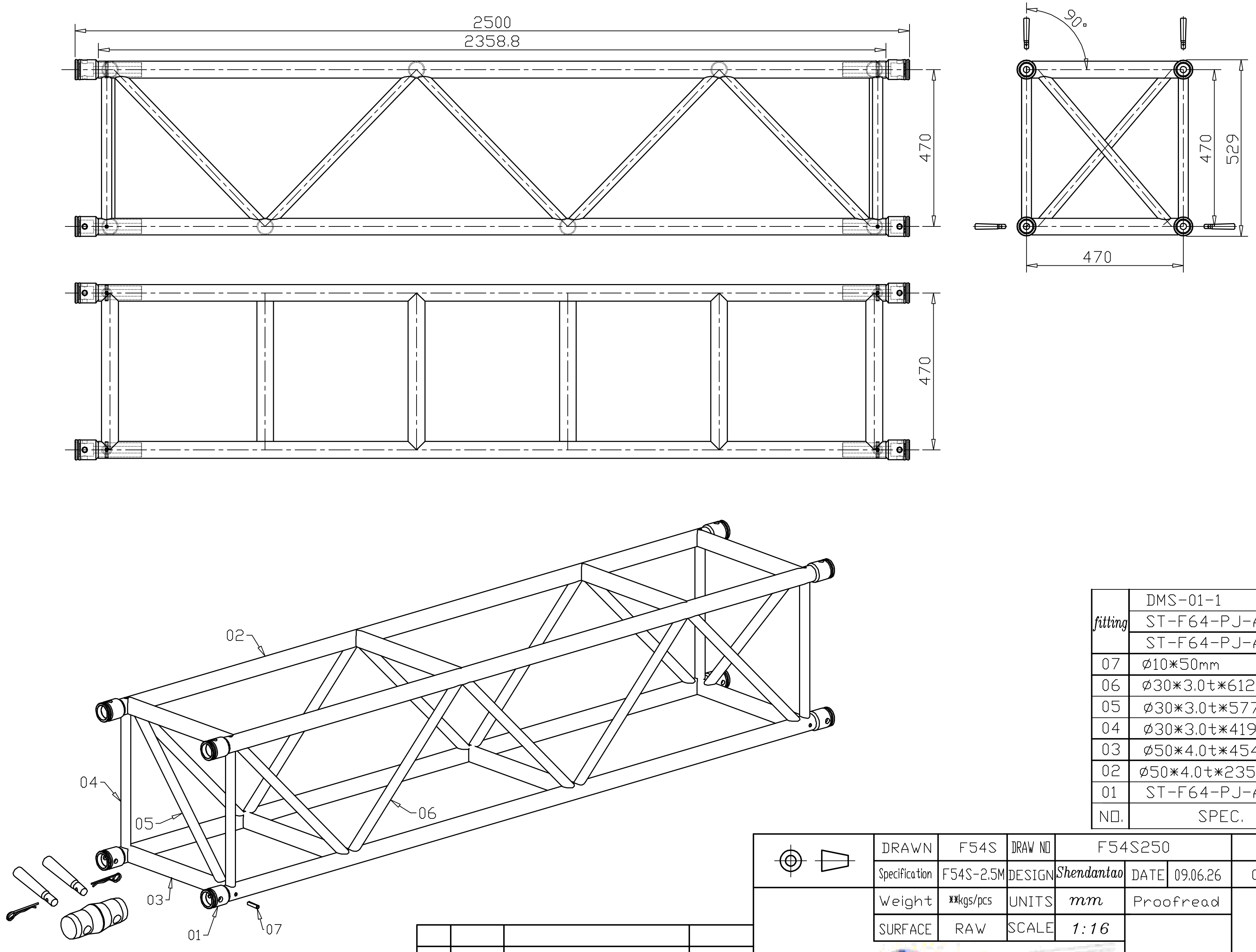


fitting	DMS-01-1	Steel	CP	8
	ST-F64-PJ-A-3	S45C	CP	8
	ST-F64-PJ-A-2	#2011	T6	4
07	Ø10*50mm	Steel	Black	8
06	Ø30*3.0t*604.4mm	#6082	T6	8
05	Ø30*3.0t*577mm	#6082	T6	2
04	Ø30*3.0t*419.5mm	#6082	T6	4
03	Ø50*4.0t*454mm	#6082	T6	7
02	Ø50*4.0t*1858.8mm	#6082	T6	4
01	ST-F64-PJ-A-1T	#6082	T6	8
NO.	SPEC.	MATERIAL	FIS-	QTY.

DRAWN	F54S	DRAW NO	F54S200		2D/3D	edition	1
Specification	F54S-2.0M	DESIGN	Shendantao	DATE 09.06.26	CHECKED	APPROVED	
Weight	**kgs/pcs	UNITS	mm	Proofread			
SURFACE	RAW	SCALE	1:16				

Global Truss

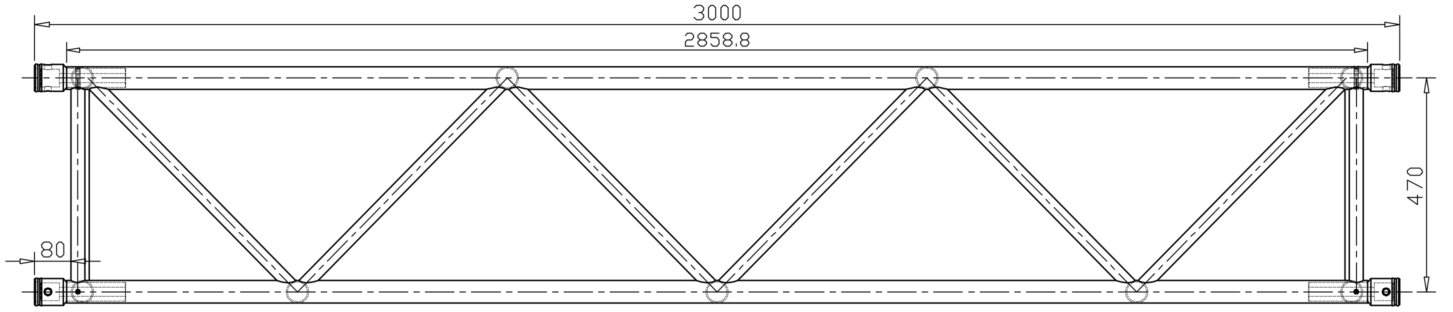
MARK	NAME	RETRIEVE CONTENTS	DATE

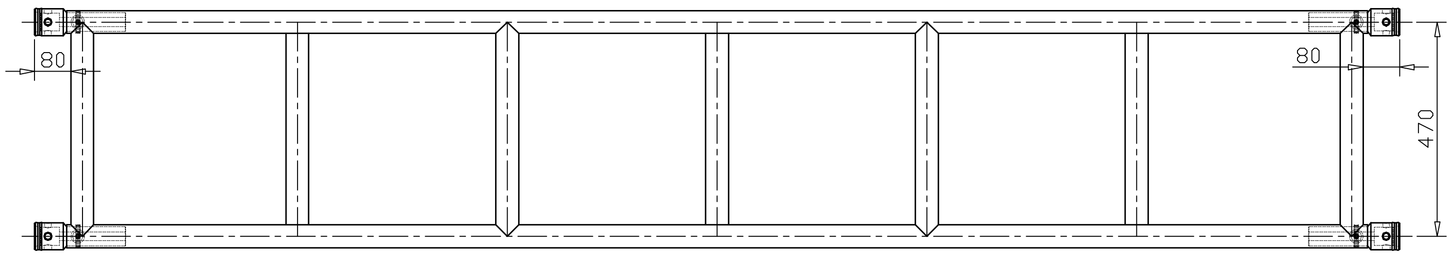


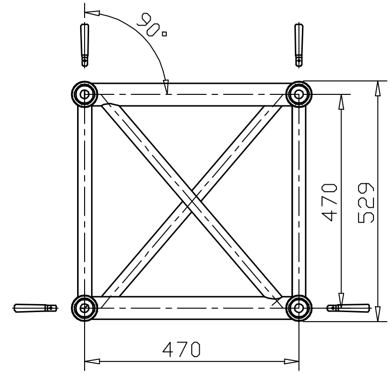
fitting	DMS-01-1	Steel	CP	8
	ST-F64-PJ-A-3	S45C	CP	8
	ST-F64-PJ-A-2	#2011	T6	4
07	ø10*50mm	Steel	Black	8
06	ø30*3.0t*612.5mm	#6082	T6	10
05	ø30*3.0t*577mm	#6082	T6	2
04	ø30*3.0t*419.5mm	#6082	T6	4
03	ø50*4.0t*454mm	#6082	T6	8
02	ø50*4.0t*2358.8mm	#6082	T6	4
01	ST-F64-PJ-A-1T	#6082	T6	8
NO.	SPEC.	MATERIAL	FIS-	QTY.

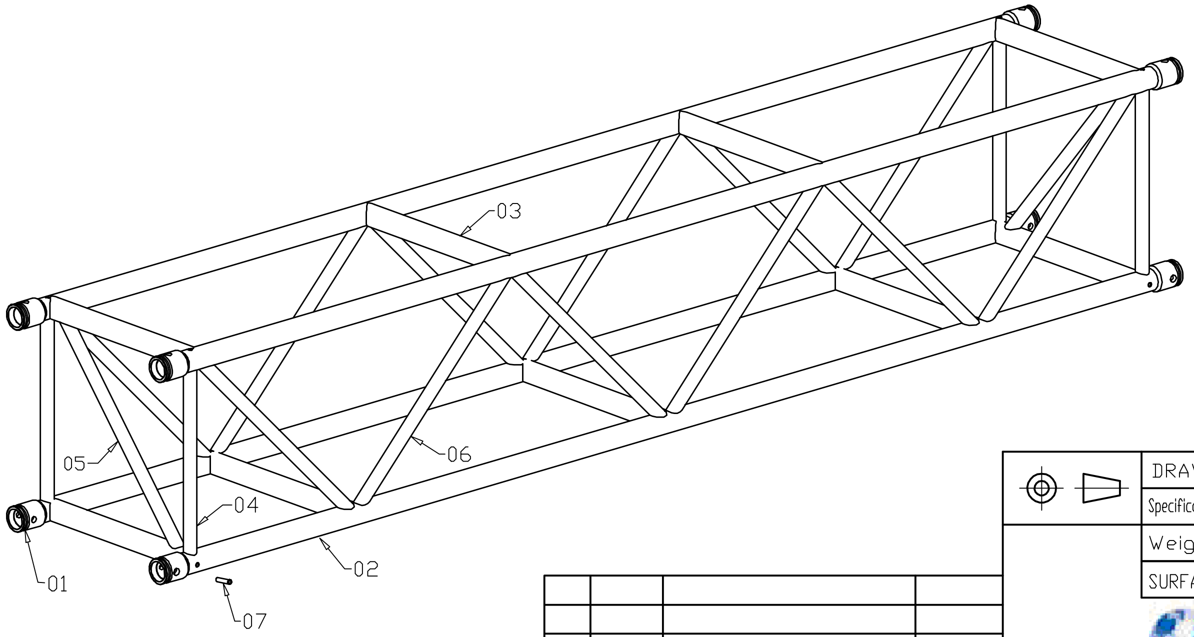
DRAWN	F54S	DRAW NO	F54S250		2D/3D	edition	1
Specification	F54S-2.5M	DESIGN	Shendantao	DATE 09.06.26	CHECKED	APPROVED	
Weight	**kgs/pcs	UNITS	mm	Proofread			
SURFACE	RAW	SCALE	1:16				

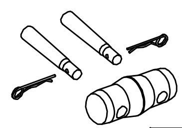
MARK	NAME	RETRIEVE CONTENTS	DATE









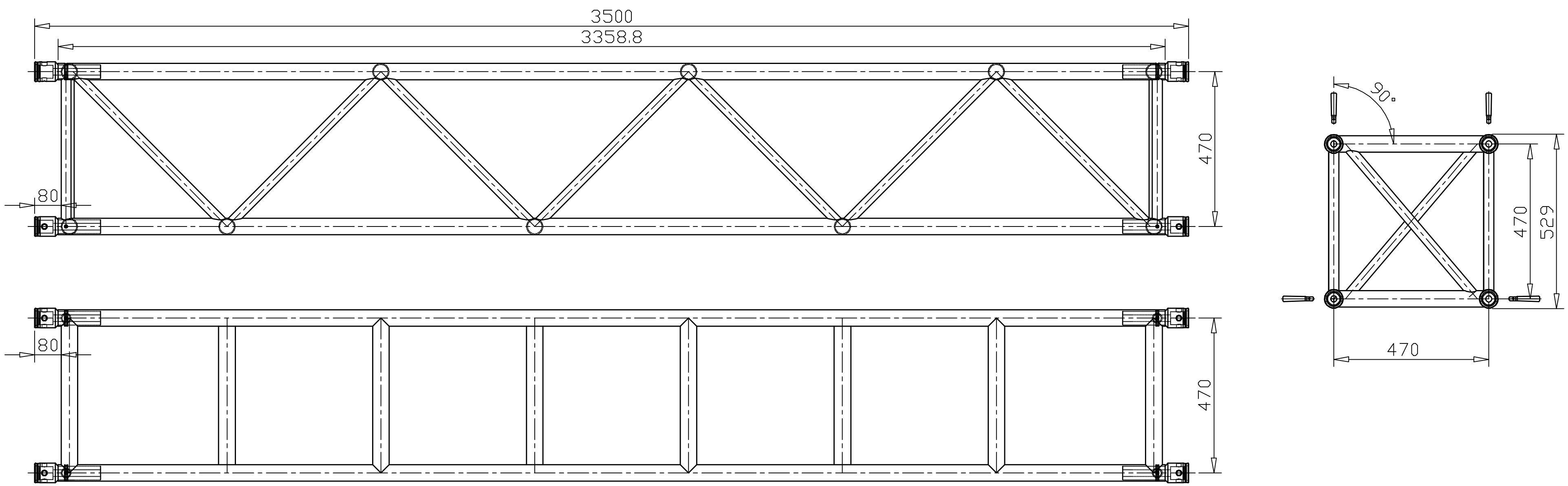


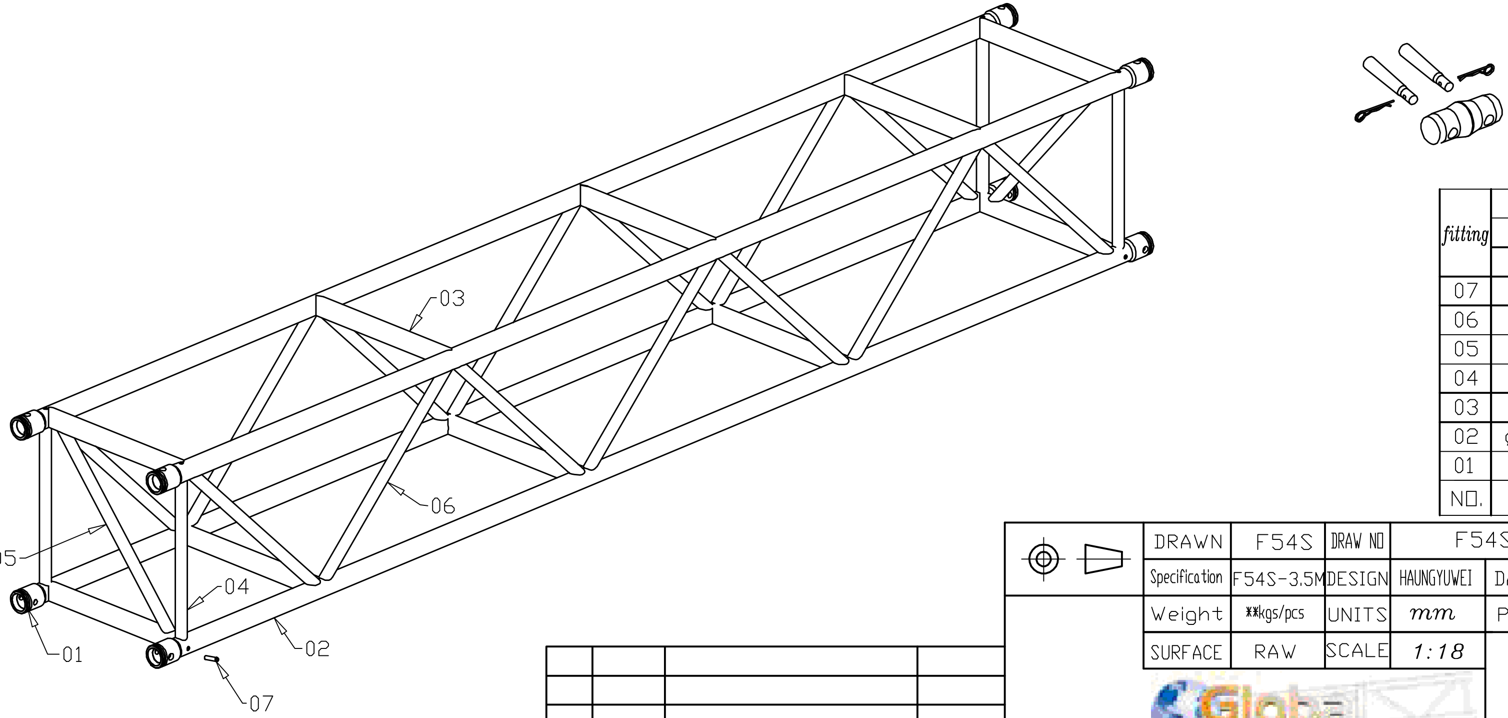
fitting	DMS-01-1	Steel	CP	8
	ST-F64-PJ-A-3	S45C	CP	8
	ST-F64-PJ-A-2	#2011	T6	4
07	ø10*50mm	Steel	Black	8
06	ø30*3.0t*617.8mm	#6082	T6	12
05	ø30*3.0t*577mm	#6082	T6	2
04	ø30*3.0t*419.5mm	#6082	T6	4
03	ø50*4.0t*470mm	#6082	T6	9
02	ø50*4.0t*2858.8mm	#6082	T6	4
01	ST-F64-PJ-A-1T	#6082	T6	8
NO.	SPEC.	MATERIAL	FIS-	QTY.

DRAWN	F54S	DRAW NO	F54S300		2D/3D	edition	2
Specification	F54S-3.0M	DESIGN	dingkui	DATE 09.06.29	CHECKED	APPROVED	
Weight	**kgs/pcs	UNITS	mm	Proofread			
SURFACE	RAW	SCALE	1:10				

Global Truss

MARK	NAME	RETRIEVE CONTENTS	DATE

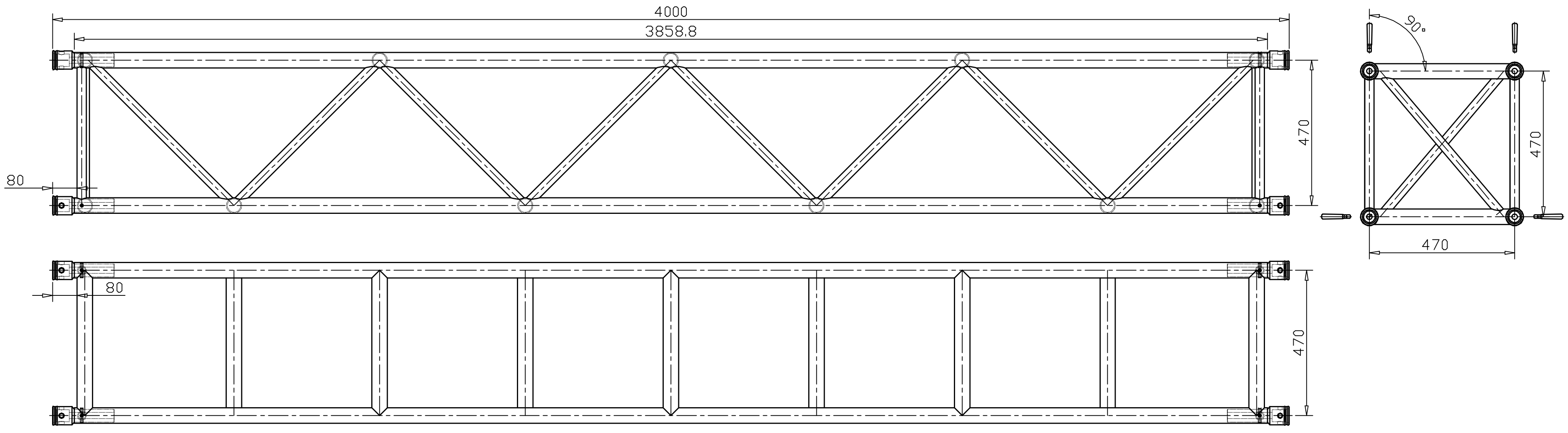


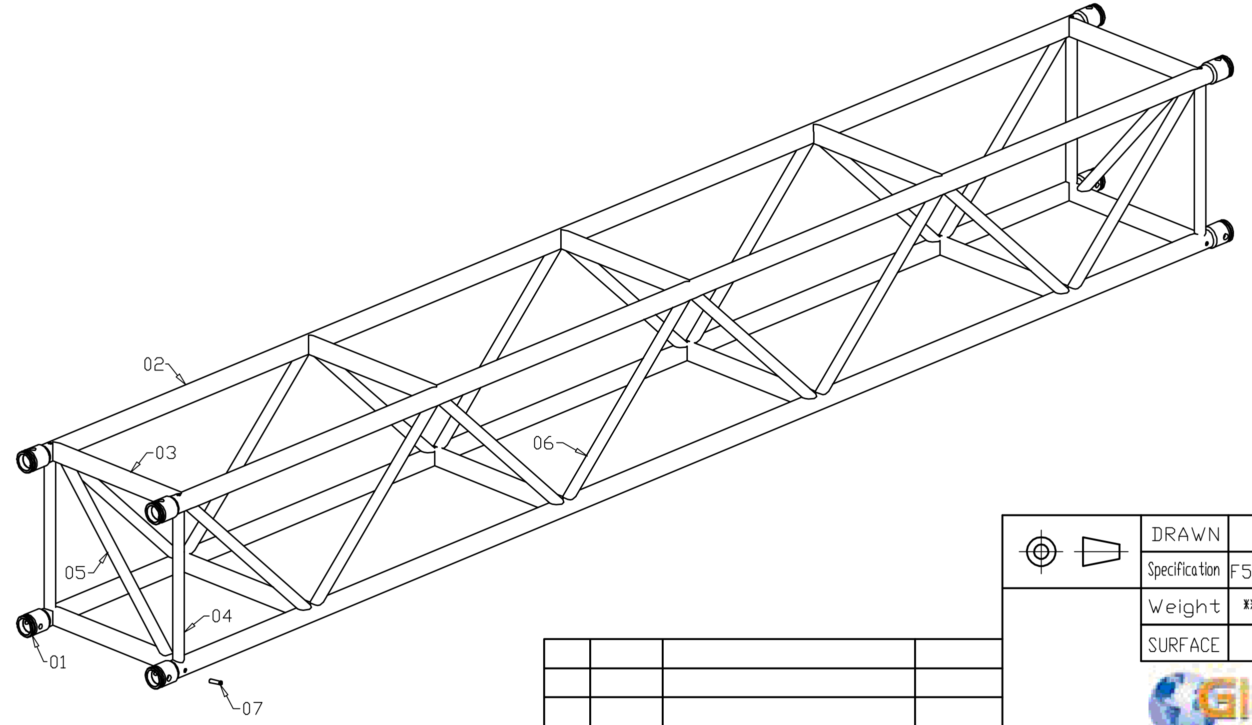


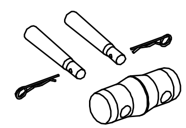
fitting	DMS-01-1	Steel	CP	8
	ST-F64-PJ-A-3	S45C	CP	8
	ST-F64-PJ-A-2	#2011	T6	4
07	ø10*50mm	Steel	Black	8
06	ø30*3.0t*621.7mm	#6082	T6	14
05	ø30*3.0t*577mm	#6082	T6	2
04	ø30*3.0t*419.5mm	#6082	T6	4
03	ø50*4.0t*470mm	#6082	T6	10
02	ø50*4.0t*3358.8mm	#6082	T6	4
01	ST-F64-PJ-A-1T	#6082	T6	8
NO.	SPEC.	MATERIAL	FIS-	QTY.

DRAWN	F54S	DRAW NO	F54S350		2D/3D	edition	2
Specification	F54S-3.5M	DESIGN	HAUNGYUWEI	DATE 13.01.31	CHECKED	APPROVED	
Weight	**kgs/pcs	UNITS	mm	Proofread			
SURFACE	RAW	SCALE	1:18				

MARK	NAME	RETRIEVE CONTENTS	DATE





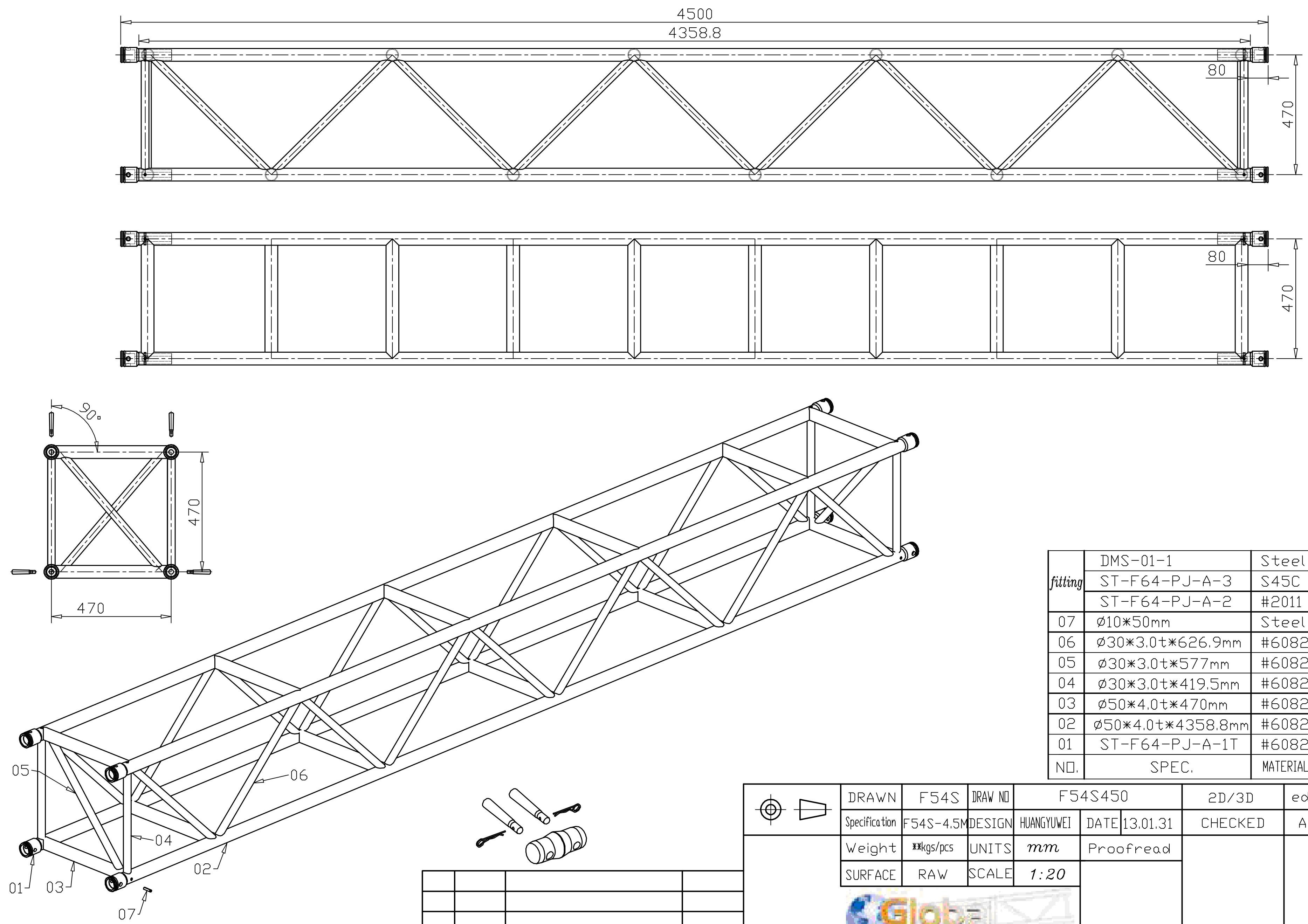


fitting	DMS-01-1	Steel	CP	8
	ST-F64-PJ-A-3	S45C	CP	8
	ST-F64-PJ-A-2	#2011	T6	4
07	Ø10*50mm	Steel	Black	8
06	Ø30*3.0t*624.6mm	#6082	T6	16
05	Ø30*3.0t*577mm	#6082	T6	2
04	Ø30*3.0t*419.5mm	#6082	T6	4
03	Ø50*4.0t*470mm	#6082	T6	11
02	Ø50*4.0t*3858.8mm	#6082	T6	4
01	ST-F64-PJ-A-1T	#6082	T6	8
NO.	SPEC.	MATERIAL	FIS-	QTY.

DRAWN	F54S	DRAW NO	F54S400		2D/3D	edition 1
Specification	F54S-4.0M	DESIGN	HUANGYUWEI	DATE 13.01.31	CHECKED	APPROVED
Weight	**kgs/pcs	UNITS	mm	Proofread		
SURFACE	RAW	SCALE	1:19			

Global Truss

MARK	NAME	RETRIEVE CONTENTS	DATE

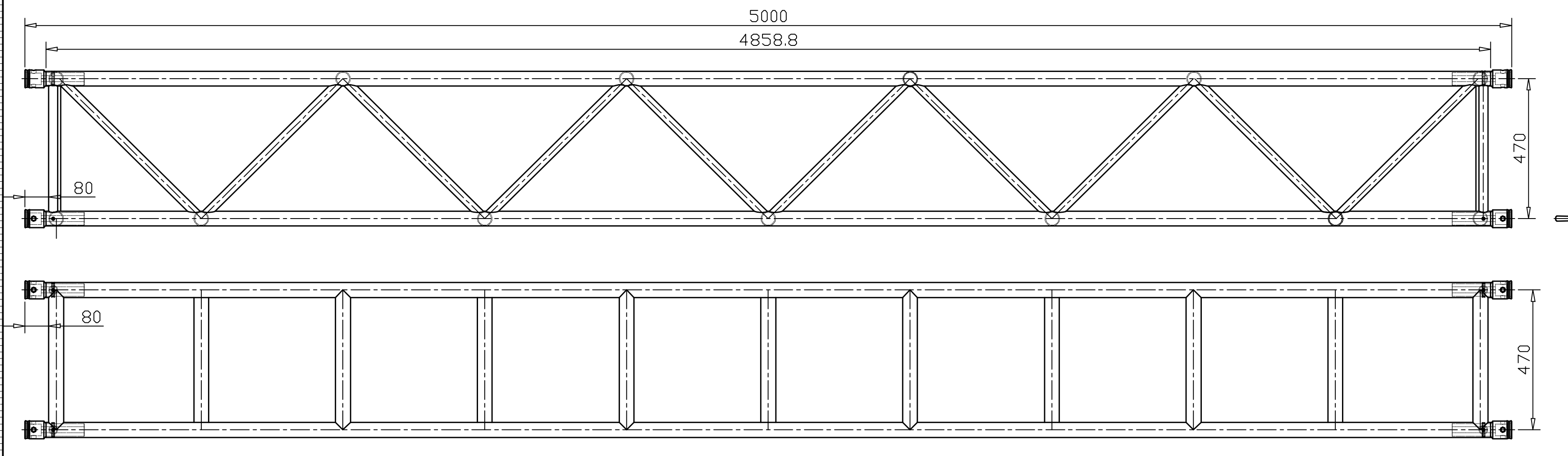


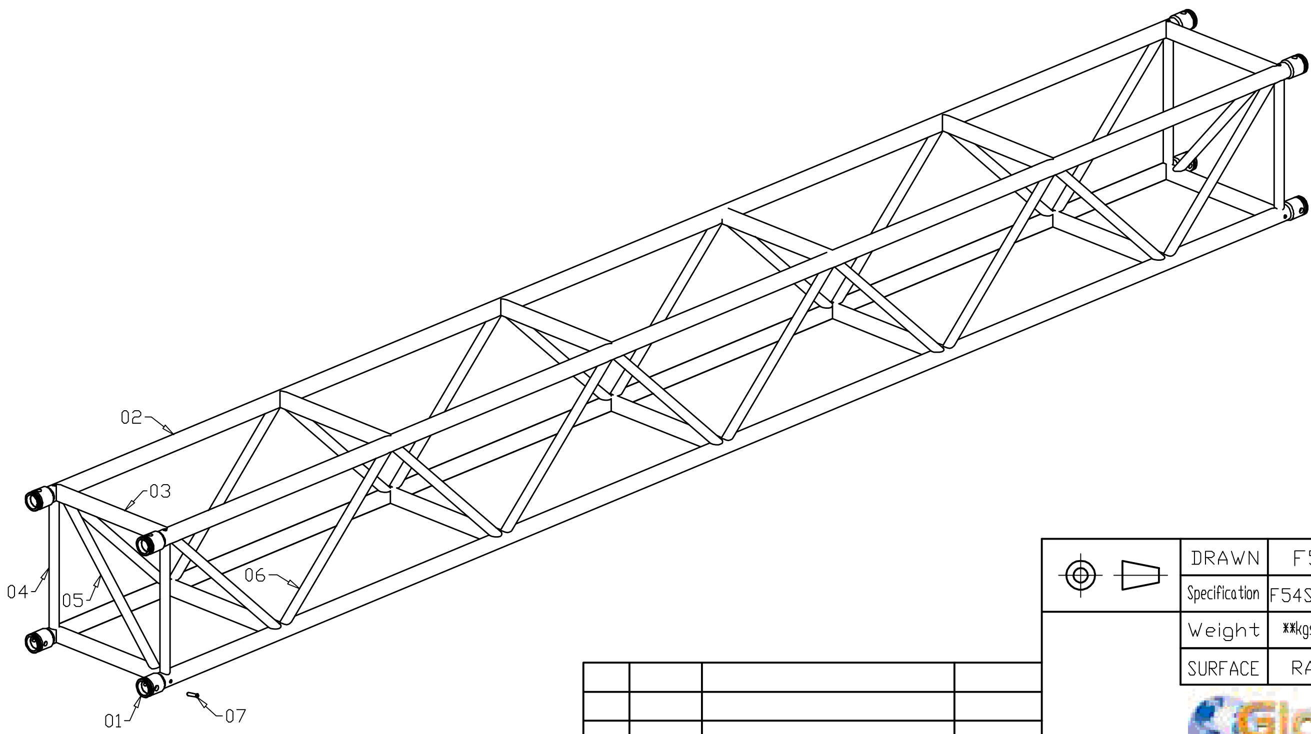
fitting	DMS-01-1	Steel	CP	8
	ST-F64-PJ-A-3	S45C	CP	8
	ST-F64-PJ-A-2	#2011	T6	4
07	Ø10*50mm	Steel	Black	8
06	Ø30*3.0t*626.9mm	#6082	T6	18
05	Ø30*3.0t*577mm	#6082	T6	2
04	Ø30*3.0t*419.5mm	#6082	T6	4
03	Ø50*4.0t*470mm	#6082	T6	12
02	Ø50*4.0t*4358.8mm	#6082	T6	4
01	ST-F64-PJ-A-1T	#6082	T6	8
NO.	SPEC.	MATERIAL	FIS-	QTY.

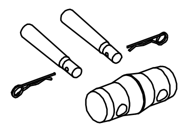
DRAWN	F54S	DRAW NO	F54S450		2D/3D	edition	1
Specification	F54S-4.5M	DESIGN	HUANGYUWEI	DATE 13.01.31	CHECKED	APPROVED	
Weight	**kgs/pcs	UNITS	mm	Proofread			
SURFACE	RAW	SCALE	1:20				

MARK	NAME	RETRIEVE CONTENTS	DATE

Global Truss







fitting	DMS-01-1	Steel	CP	8
fitting	ST-F64-PJ-A-3	S45C	CP	8
fitting	ST-F64-PJ-A-2	#2011	T6	4
07	ø10*50mm	Steel	Black	8
06	ø30*3.0t*628.7mm	#6082	T6	20
05	ø30*3.0t*577mm	#6082	T6	2
04	ø30*3.0t*419.5mm	#6082	T6	4
03	ø50*4.0t*470mm	#6082	T6	13
02	ø50*4.0t*4858.8mm	#6082	T6	4
01	ST-F64-PJ-A-1T	#6082	T6	8
NO.	SPEC.	MATERIAL	FIS-	QTY.

DRAWN	F54S	DRAW NO	F54S500	2D/3D	edition	1
Specification	F54S-5.0M	DESIGN	HUANGYUWEI	DATE 13.01.31	CHECKED	APPROVED
Weight	**kgs/pcs	UNITS	mm	Proofread		
SURFACE	RAW	SCALE	22			

Global Truss

MARK	NAME	RETRIEVE CONTENTS	DATE