

PROJECT:

Logli Massimo DEFENDER glass railings analysis for applications in the Netherlands

Content:

01 System resistance definition by static calculation

REV.: 00

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1 Introduction

1.1 General description and scope of application

This document shows the static calculation of the glass parapets type Defender, which are produced by Logli Massimo SpA to be used in the Netherlands. The parapets can be fixed to the ground from both, the top or the bottom side, by using an aluminium profile, which is designed to host the laminated glass sheet and its fixings.

The parapets can be executed without or with constructive handrail which leads to different resistances and allowable glass compositions. The constructive continuous handrail at top of glass panel must cover the top border and have just sufficient resistance to connect locally the single glass panels together to allow a load distribution to adjacent glass panels at ULS and specially in case of a damaged glass panel.

The static calculations have been carried out considering a variable glass bending length L_1 from 900 mm up to 1200 mm which corresponds to different total heights L_{tot} of the parapet based on the typology of the profile from 1000 mm to 1300 mm. The heights L_{tot} are considered starting either from the load-bearing floor to which the profile is fixed respectively from the bottom border of profile - see figure below, for the two profiles example, whether all the profiles can be found in chapter 1.4

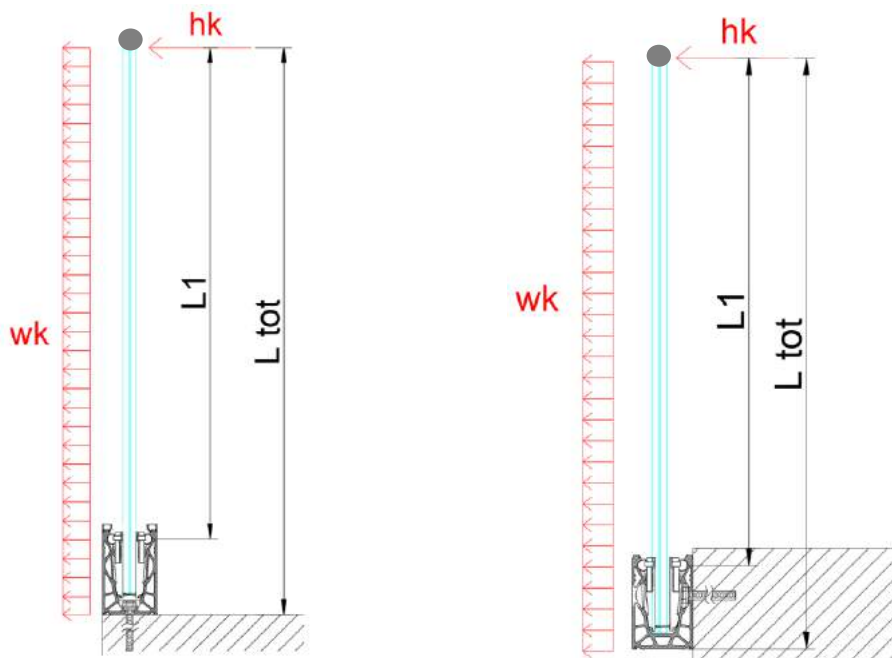


Fig: Reference height L_{tot} for DF88LM and DF88FR exemplarily

All the extruded profiles are produced with EN AW6063-T6 alloy and are fixed to the base by means of anchors or bolts placed generally at a distance of 200 mm or 400 mm centre to centre (designated as E200 or E400 in the following calculations). For the DF88PICO profile the distance is reduced to 125 mm or 250 mm. All the information are provided in detail in chapter 1.4.

The fastenings must be verified for each project individually according to the specific site conditions, acting loads and load combinations, fixing distances, edge distances and any other influencing factors.

The system of the parapet (glass+ profile) has been verified in accordance with the most recent regulations as per the date of issue of this document, valid both in Europe and the Netherlands, and based on the state of the art design. For more detailed information to the basic of design and the considered codes refer to the chapters 1.3 and 1.5

The loads applied to the parapet for the different categories of use are in accordance with the NEN-EN 1991-1-1 and described in chapter 3.

The minimum allowed glass compositions based on the different load categories and for an usage with or without handrail are the following - see chapter 4 and 5 for the different applications:

Glass composition Logli Defender glass parapets					
Interlayer	8+8 FTG	10+10 FTG	12+12 FTG	8+8+4 FTG	10+10+4 FTG
PVB 0.76mm/1.52mm	YES	YES	YES	NO	NO
SGP 0.76mm/1.52mm	YES	YES	YES	YES	YES

FTG...fully tempered glass

PVB interlayer for $T_{gmax}=30^{\circ}C$

SGP interlayer for $T_{gmax}=50^{\circ}C$

At static calculation of the glass panel, for the PVB and SGP- interlayer the material properties (especially the interlayer stiffness) based on NEN 2608 and shown in chapter 2.3 are

considered. Thereby for the PVB interlayer, a maximum temperature at loading of 30°C is allowed whether for the SGP-interlayer a maximum temperature at loading of 50°C is allowed.

The assessment, determination, and combination of the horizontal life loads, wind loads, or any other loads must be made on the basis of the actual design situation by a qualified technician according to the most recent European and Dutch regulations.

The evaluation of the installation of the parapet indoors or outdoors (maximum allowed temperature for interlayers, loads and load combinations, etc.), the dimensioning of the fixations and the determination of the correct parapet height based on minimum required height by building codes and maximum allowable height based on this static calculation must be carried out by a qualified technician.

The static verification of the parapet system (glass and profile) is done for the consequence class CC2 of NEN-EN 1990 and for a risk of damage of $RS < 70$ acc. to NEN-2608 - see chapter 1.3 for more detailed information. For the more restrictive consequence class CC3 and for a risk of damage $RS > 70$, the calculations and therefore the glass compositions and profile resistances given in this document are not anymore valid.

The determination of the corresponding existing consequence class and the risk of damage for the real installation situation must be carried out by a competent technician according to NEN-EN 1990 and EN 2608 and the compatibility with the existing static calculations must be checked.

1.2 Country of installation

Netherlands (NE)

1.3 Basics of the design

1.3.1 Introduction

The design and calculation of the glass parapet is done in accordance with the general rules of NEN-EN 1990 and additional requirements of NEN-2608 for the glass panel and NEN-EN 1999-1-1 for the aluminium profile.

Thereby the limit states, load combinations and partially safety factors shown in this chapter are considered using a lifetime of the glass parapet of 50 years acc. to NEN-EN 1990.

1.3.2 Consequence class

The calculation of the glass parapet Defender Logli shown in this document is done for the consequence class CC2 acc. to NEN-EN 1990.

The determination of the corresponding existing consequence class for the real installation situation must be carried out by a competent technician according to NEN-EN 1990 and EN 2608 and the compatibility with the existing static calculations must be checked.

CC2 → Multiplication factor for consequence class $KF=1.0$

1.3.3 Ultimate limit state (ULS)

The verification of the glass panel at ultimate limit state is done considering the entire unbroken glass composition with material properties acc. to NEN 2608 par. 5.3 and the glass thicknesses t_{calc} considering the tolerances listed in the NEN 2608 chapter 7 and annex E. The stiffness properties of the interlayers type PVB and SGP for a given maximum glass temperature at loading respectively the stiffness of the entire laminated glass panel is calculated according to NEN 2608 annex C.

The maximum tensile stresses in the glass panel at ultimate limit state are calculated analytically based on the fundamental (basic) load combination according to NEN EN 1990 using the equivalent thickness method provided in annex F of NEN 2608 and compared to the ultimate strength provided in chapter 8 of NEN 2608.

Partial safety factors and load combinations factors for fundamental (basic) load combination according to NEN-EN 1990:

Favorable: $\gamma_G=0.90$; $\gamma_Q=0.00$

Unfavorable: $\gamma_G=1.35$; $\gamma_Q=1.50$

$\psi_{0,\text{lifeload}}=0.60$, $\psi_{0,\text{wind}}=0.00$

Note: The calculations shown in chapter 4 and summarized in chapter 5 are made for an horizontal, linear life-load condition, not combined with wind pressure ($\psi_{0,\text{wind}}=0.00$). The same calculations can be used to quantify the maximum allowed wind pressure without linear load by bending moment equivalence at the base. An eventual combination of the life load and wind loads must be done by the executing company respectively the responsible technician based on this technical report and the corresponding national Dutch and European standards.

1.3.4 Serviceability limit state (SLS)

The check of the maximum deformations at serviceability limit state is done in accordance to the prescriptions in chapter 9 of NEN 2608 and NEN-EN-1990+A1+A1/C2/NB:2019, chapter A1.4.3 (7).

Thereby the entire unbroken glass composition with material properties acc. to NEN 2608 par. 5.3 and glass thicknesses acc. to NEN 2608 chapter 7 and annex E are considered.

The stiffness properties of the interlayers type PVB and SGP for a given maximum glass temperature at loading respectively the stiffness of the entire laminated glass panel are calculated according to NEN 2608 annex C, the equivalent glass thickness for calculation of deformations is determined according to chapter F.

Maximum deformation in accordance to NEN-EN-1990+A1+A1/C2/NB:2019, chapter A1.4.3 (7):

For parapets with a difference in height, the horizontal deflection at the upper edge of the parapet considering the contribution of the glass and the aluminium profile acting together shall not exceed **20 mm** at the characteristic load combination.

def.max=20 mm

1.3.5 Degree of damage, residual capacity, and risk analysis

According to NEN 2608-5.4.3 the resistance of a damaged glass panel must be calculated (a glass panel is considered broken and therefore not collaborating to the residual resistance). It must be able to withstand the basic load combination according to NEN-EN 1990 in such a way to avoid further damage to the residual intact glass panel (or panels), whereby the value 1.00 may be used for all load safety factors γ_Q and γ_G .

The degree of damage must be determined in accordance with NEN 2608 - chapter 5.5 and the method set out in Annex D of EN 2608.

NOTE: The calculation of the residual capacity of the laminated glass panels listed in this technical report is considering the situation where the damage is caused by an attack on the structural element by one accessible side and results to the breakage of only one glass sheet at attack side.

This corresponds to a risk of damage of $RS < 70$ according to chapter D.

The risk of damage for each different real installation situation must be determined accordingly by the executing company respectively by the collaborating responsible technician and it must be ensured that the value of RS is below the value of 70 in order to be compliant with the results and calculations provided in this technical document, for use of DEFENDER systems by Logli Massimo.

All the damaged structural elements must be repaired or replaced immediately after damage to restore the required safety level. In the meantime, the damaged zone must be immediately cordoned off and adequately secured and the responsible person must be notified of the damage immediately.

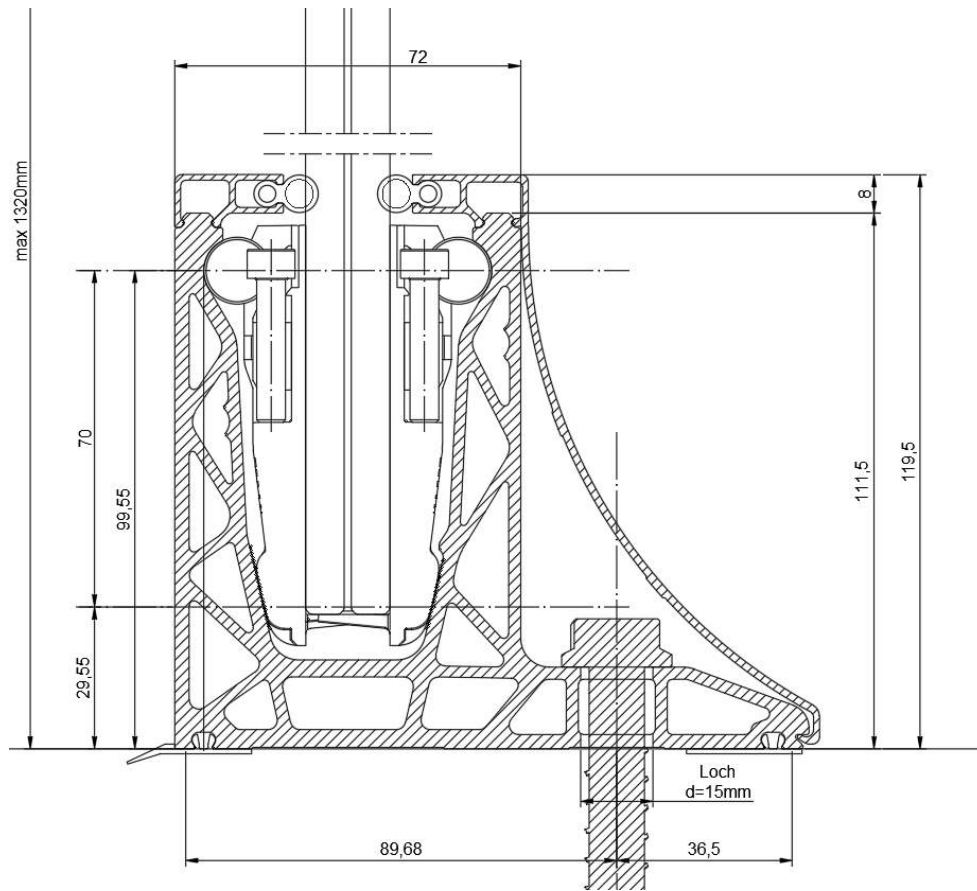
For the analytical and numerical calculations of the residual capacity of the glass panel in chapter 4 only the unbroken glass plates will be considered in the static calculation without any contribution of the broken glass plate.

1.3.6 Ultimate limit state for Impact load

The verification of the impact load based on NEN-EN 1991-1-1 is not part of this document.

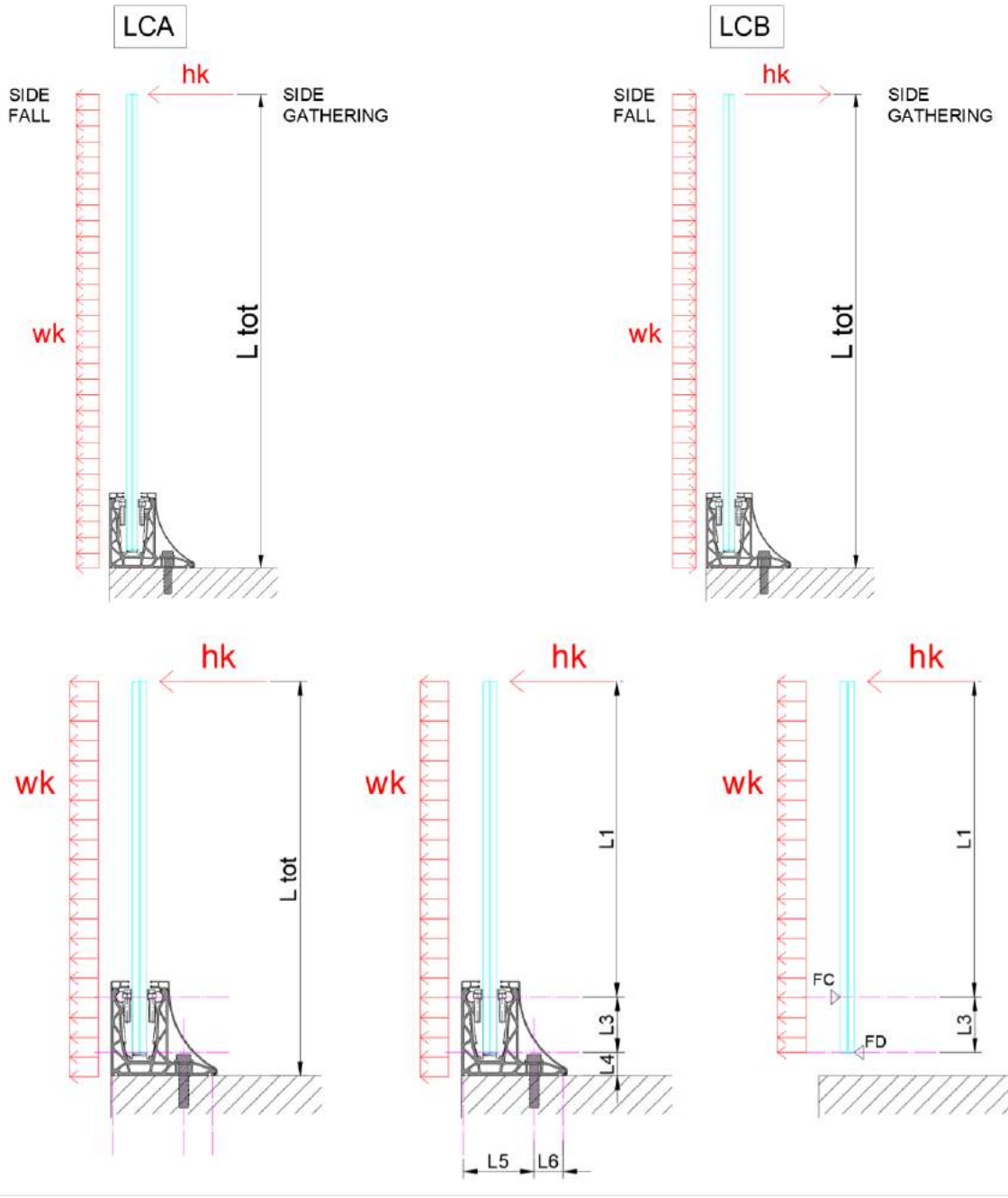
1.4 Geometry

1.4.1 Defender DF88DK

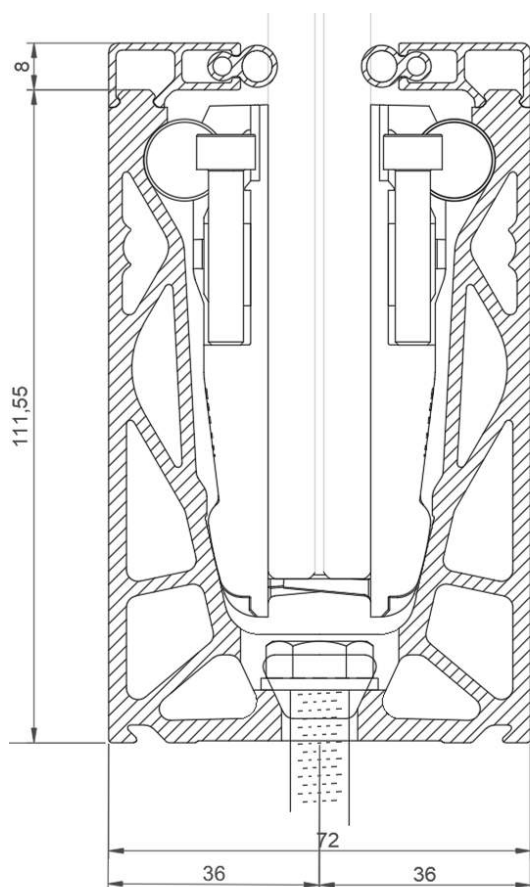


Geometrical distances [mm]							
Profile	L2	L3	L4	L5	L6	e fix 1	e fix 2
DF88DK	12	70	29,55	89,68	36,5	200	400

Free bending length L1 of the glass panel fixed into the basis aluminium profile used as reference height for the glass checks: $L1=L_{tot}-(L3+L4)$.

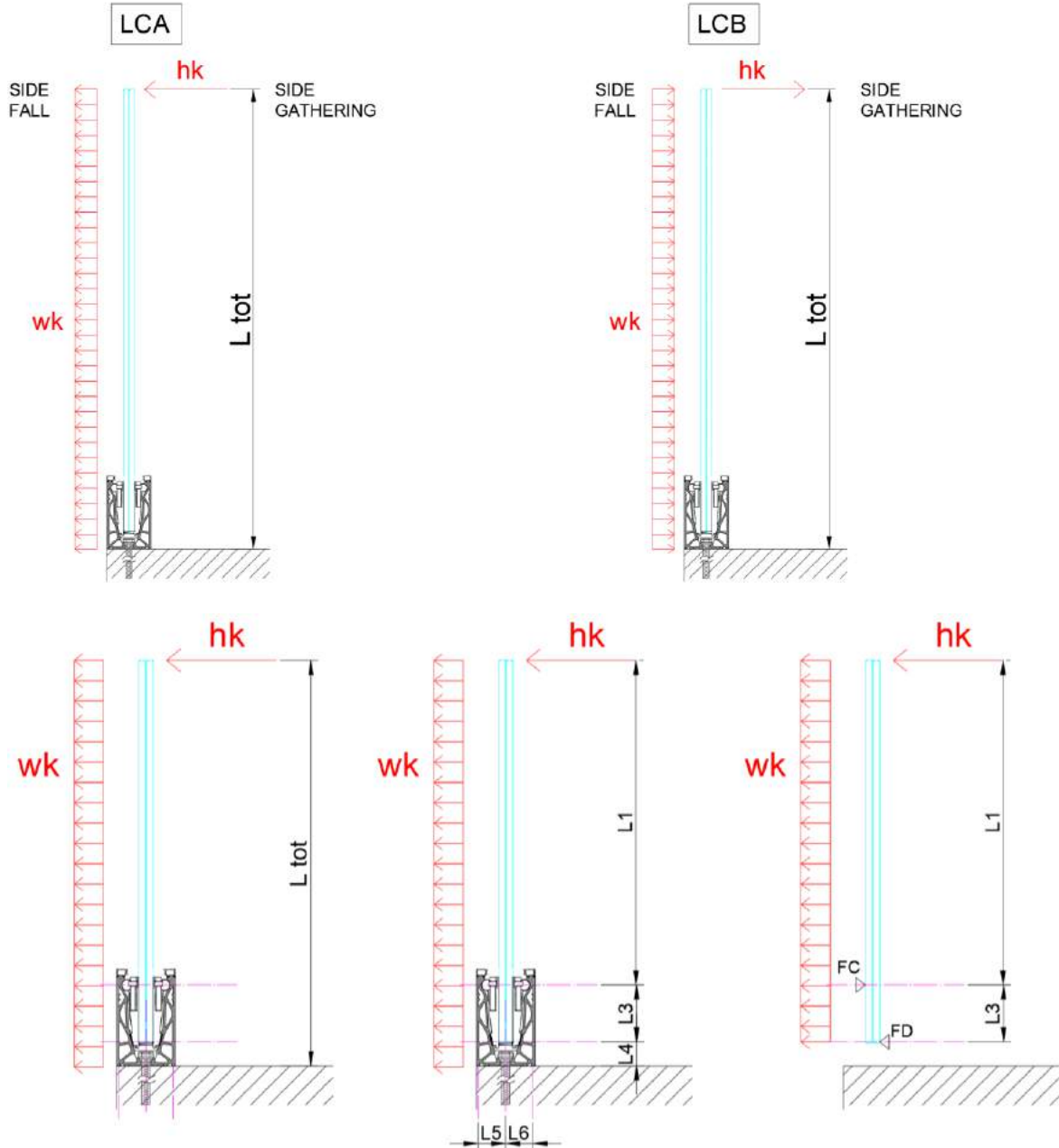


1.4.2 Defender DF88LM

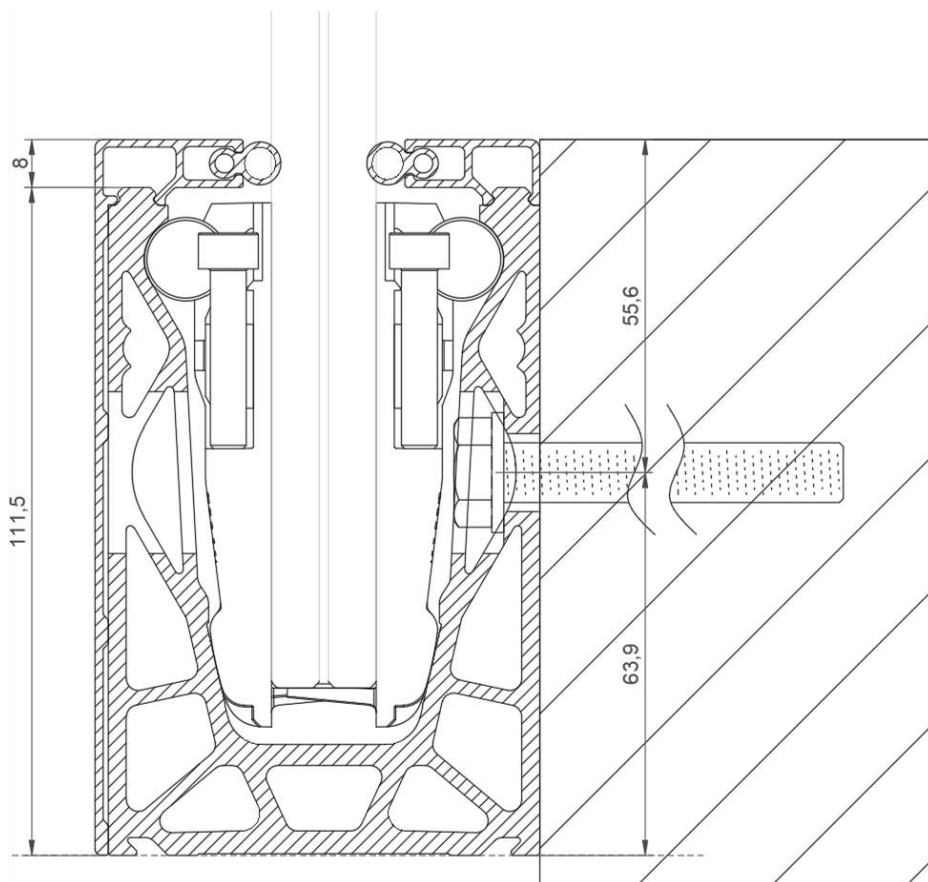


Geometrical distances [mm]							
Profile	L2	L3	L4	L5	L6	e fix 1	e fix 2
DF88LM	12	70	29,55	33,6	33,6	200	400

Free bending length L1 of the glass panel fixed into the basis aluminium profile used as reference height for the glass checks: $L1=L_{tot}-(L3+L4)$.

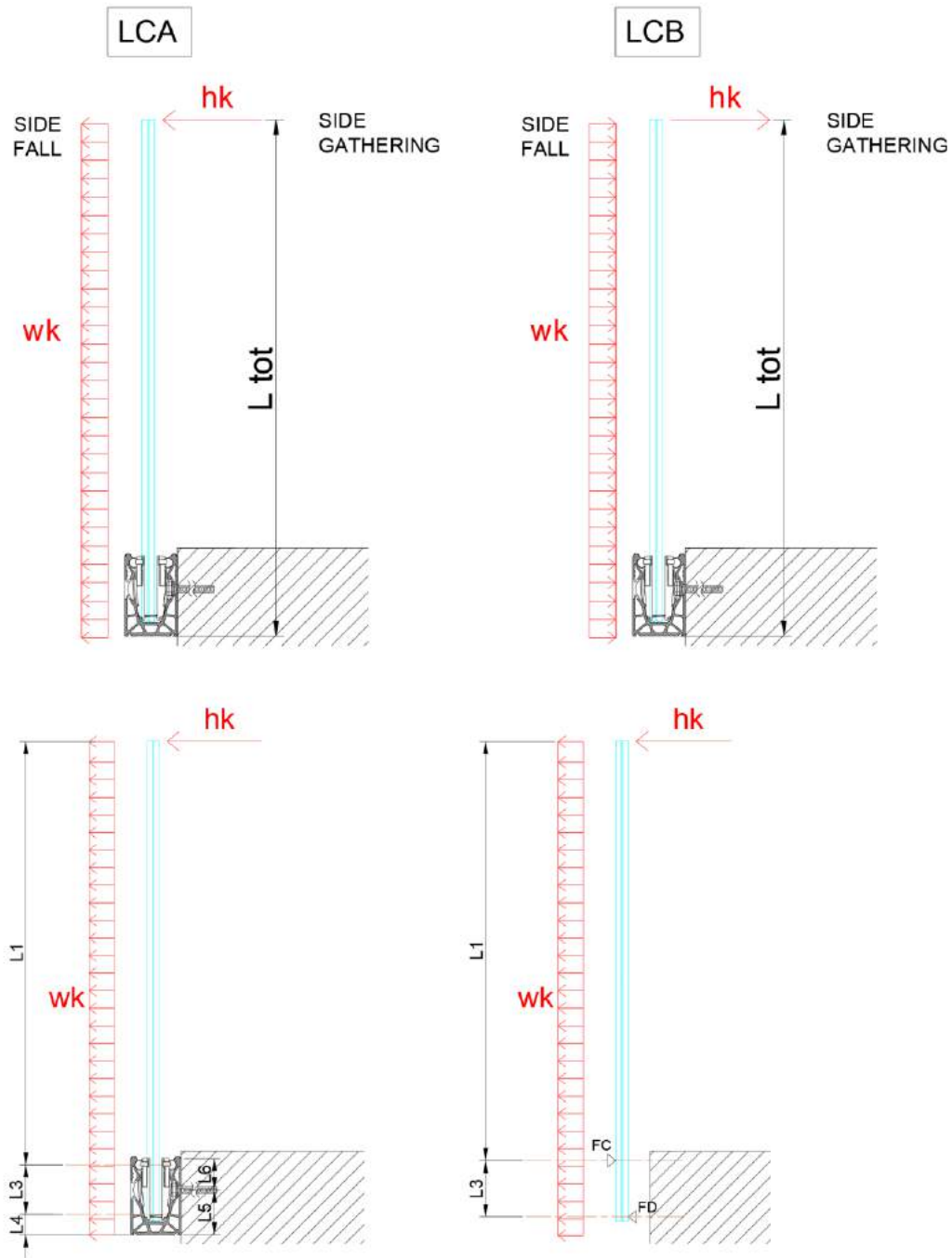


1.4.3 Defender DF88FR

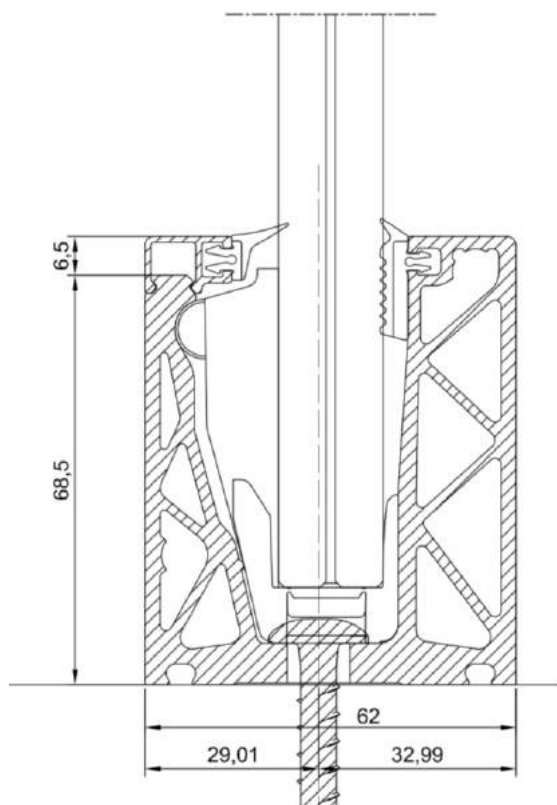


Geometrical distances [mm]							
Profile	L2	L3	L4	L5	L6	e fix 1	e fix 2
DF88FR	12	70	29,5	59,4	40,6	200	400

Free bending length L1 of the glass panel fixed into the aluminium profile used as reference height for the glass checks: $L1=L_{tot}-(L3+L4)$.

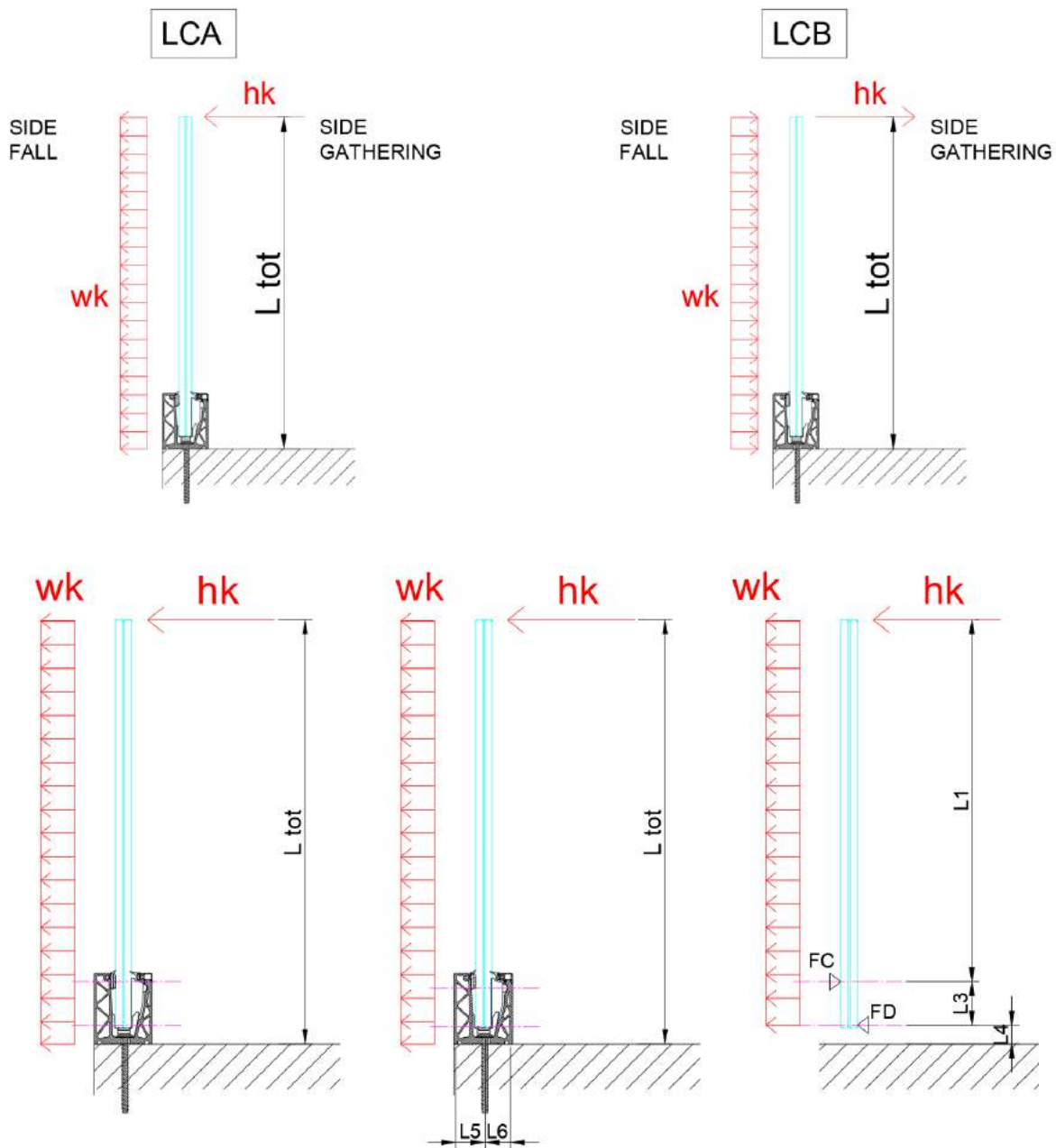


1.4.4 Defender DF88PICO

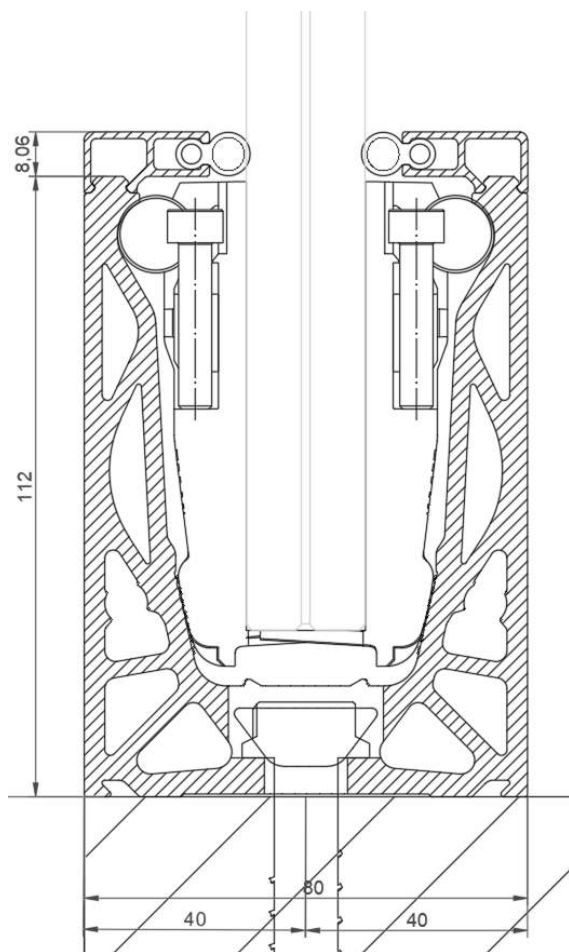


Profile	Geometrical distances [mm]						
	L2	L3	L4	L5	L6	e fix 1	e fix 2
DF88PICO LCA	9	46	20	30,94	26,96	125	250
DF88PICO LCB	15,5	41	18,5	30,94	26,96	125	250

Free bending length L1 of the glass panel fixed into the basis aluminium profile used as reference height for the glass checks: $L1=L_{tot}-(L3+L4)$.

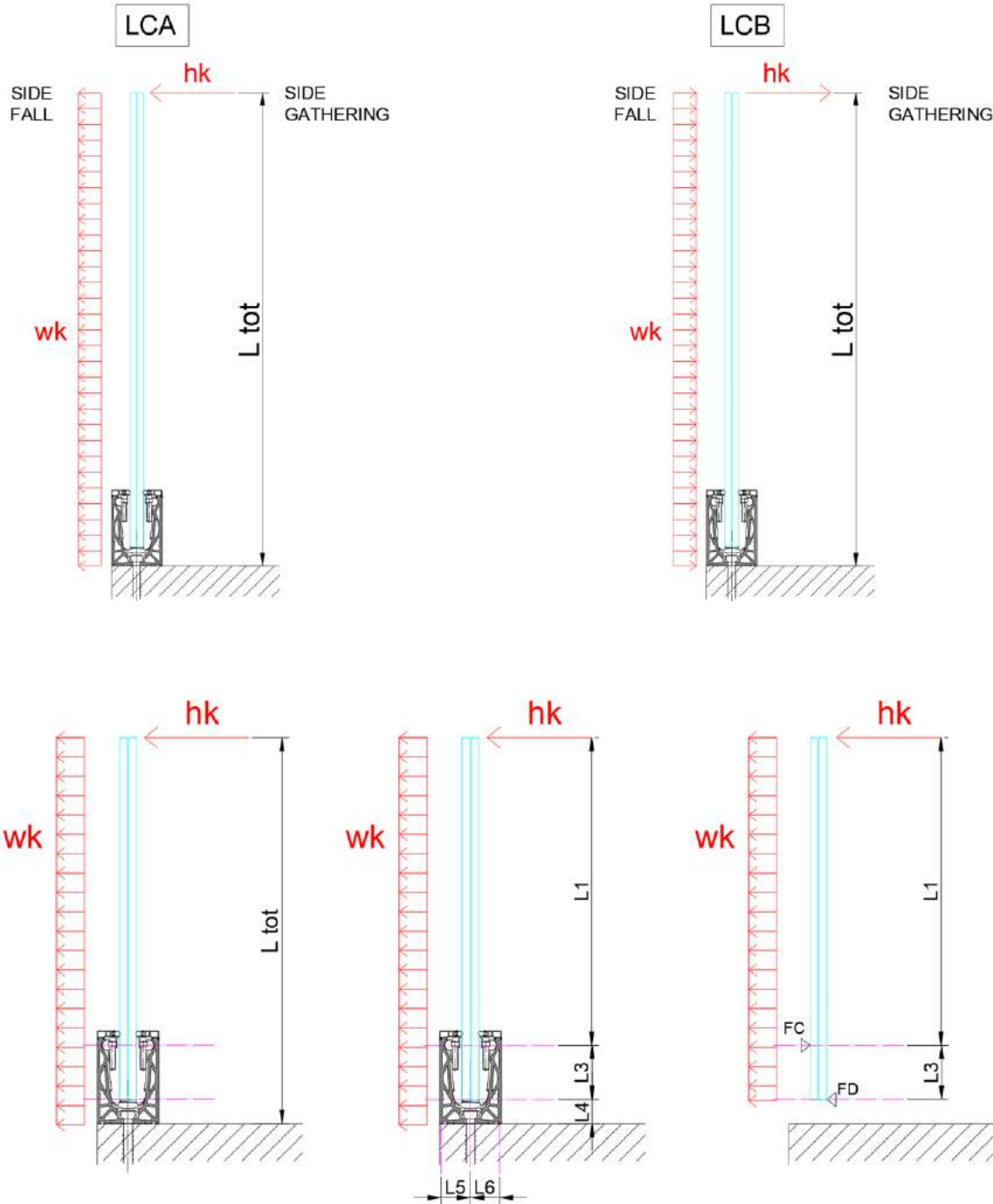


1.4.5 Defender DF1010LM / DF1212LM

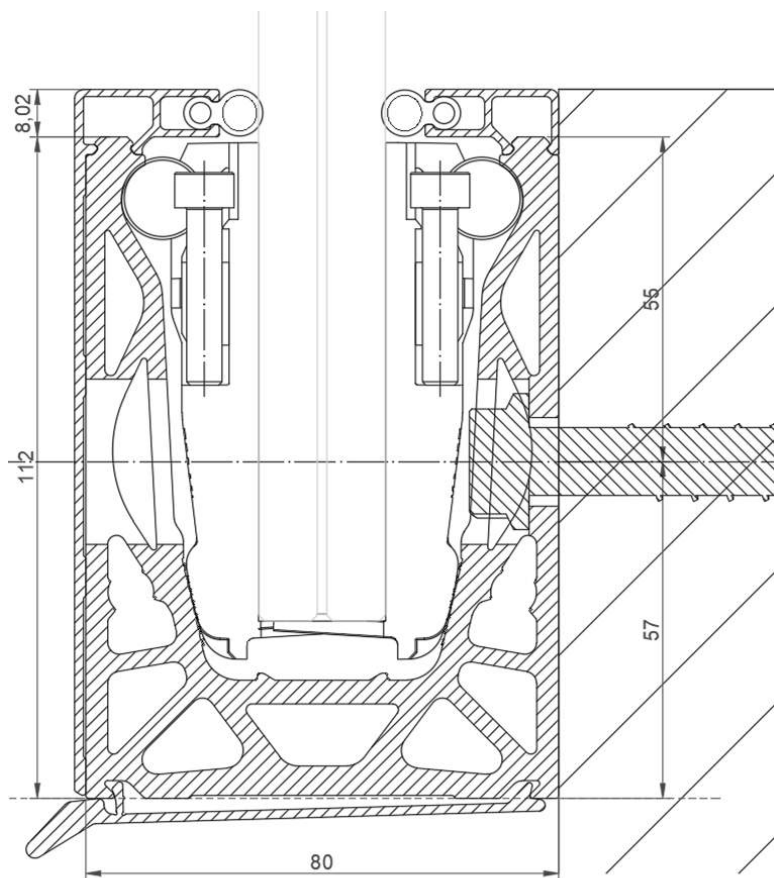


Profile	Geometrical distances [mm]					
	L2	L3	L4	L5	L6	e fix 1
DF1010LM DF1212LM	11	70	31	37,6	37,6	200

Free bending length L1 of the glass panel fixed into the basis aluminium profile used as reference height for the glass checks: $L1=L_{tot}-(L3+L4)$.

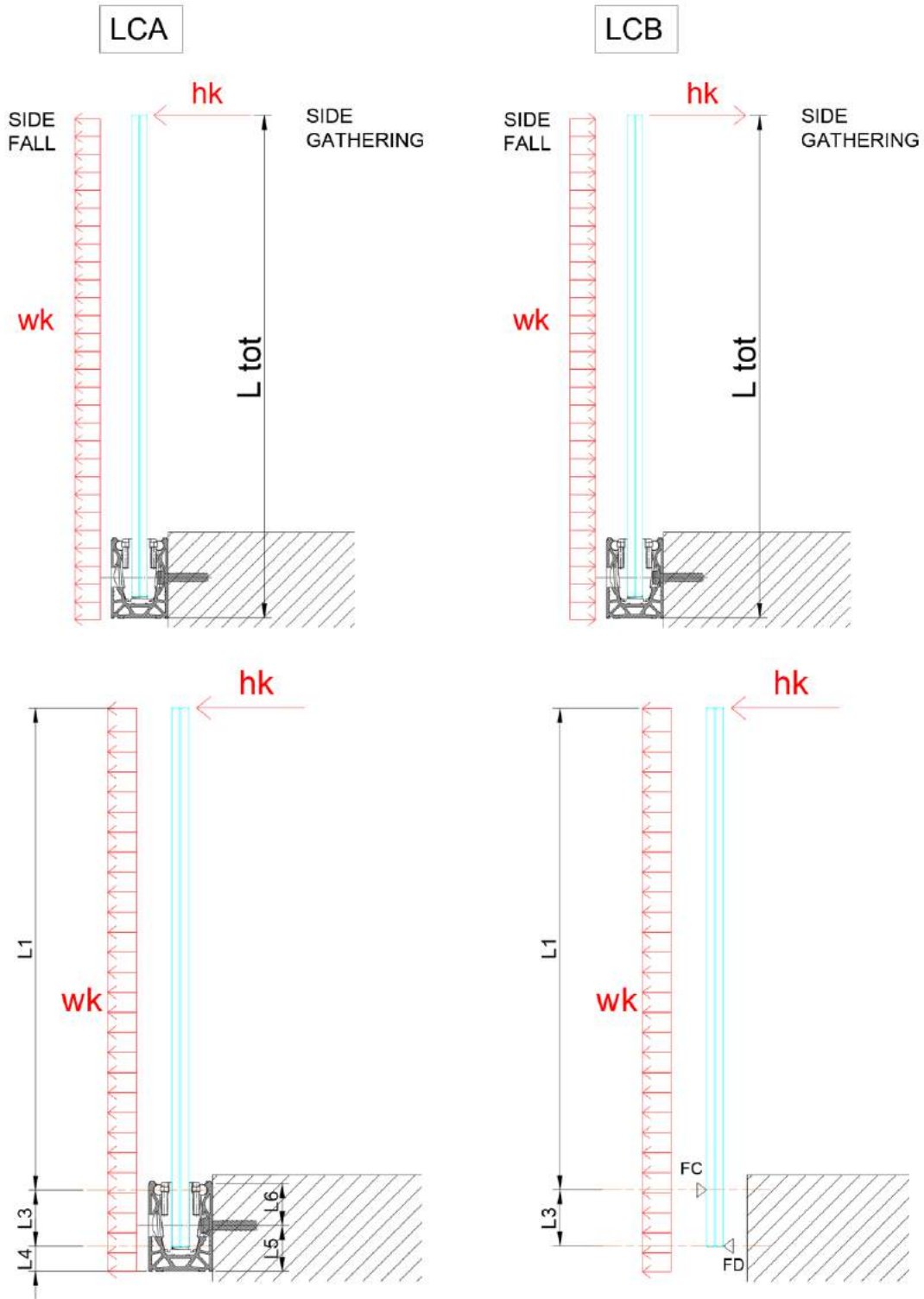


1.4.6 Defender DF1010FR / DF1212FR



Geometrical distances [mm]						
Profile	L2	L3	L4	L5	L6	e fix 1
DF1010FR DF1212FR	11	70	31	52,5	47,5	200

Free bending length L1 of the glass panel fixed into the basis aluminium profile used as reference height for the glass checks: $L1=L_{tot}-(L3+L4)$.



1.5 Standards

1.5.1 General

Eurocode 0: Basis of structural design

NEN-EN 1990+A1:2006+A1:2006 /C2:2019	Eurocode: Basis of structural design	2006/2019
NEN-EN-1990+A1+A1/C2/NB	National Annex to NEN-EN-1990+A1+A1/C2/NB:2019 Eurocode : Basis of structural design	11.2019

1.5.2 Loads

Eurocode 1: Actions on structures

NEN-EN 1991-1-1+C1+C11	Eurocode 1 - Actions on structures - Part 1-1: General actions - Densities, self-weight, imposed loads of buildings	11.2019
NEN-EN 19 91-1-1+C1+C11/NB	National Annex to NEN-EN 1991-1-1+C1+C11: Eurocode 1 - Actions on structures - Part 1-1: General actions - Densities, self-weight, imposed loads of buildings	11.2019

1.5.3 Aluminium

NEN-EN 1999-1-1+A1/A2	Eurocode 9: Design of aluminium structures - Part 1-1: General structural rules	01.2014
NEN-EN 1999-1-1+A1/NB	National Annex to NEN-EN 1999-1-1+A1 Eurocode 9: Design of aluminium structures - Part 1-1: General structural rules	12.2011

1.5.4 Glass

NEN 2608	Glass in building - Requirements and determination method	10.2014
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1.6 Software

Sofistik 2020

SJ Mepla 5.0.7

Microsoft Excel

2 Materials

2.1 Aluminium acc. to NEN - EN 1999-1-1

For EN AW 6063-T6 - EP (extruded profiles) with $t \leq 25\text{mm}$

Young modulus:	$E=70000 \text{ N/mm}^2$
Poisson ratio	$\nu=0.30$
Density	$\rho=2700 \text{ kg/m}^3$
Yield strength:	$f_{ok}=160 \text{ N/mm}^2$
Tensile strength:	$f_{uk}=195 \text{ N/mm}^2$
Maximum elongation:	$A=8\%$
Material safety coefficient	$\gamma_m=1.10$

For the numerical simulation, an ideal elastic-plastic material property curve is used with horizontal yield plateau after reaching the yield stress in accordance to EN 1999-1-1 E.2.1.1. e figure E.1b.

$$f_p = f_{\max} = f_{ok} / \gamma_m = 160 / 1.10 = 145.45 \text{ N/mm}^2$$

$$\varepsilon_p = f_p / E = 145.45 / 70000 = 0.2 \%$$

$E_1 = 0 \text{ N/mm}^2 \rightarrow$ no stiffening after reaching yield stress

$$\varepsilon_u = 0.30 - 0.22 * 160 / 400 = 0.212$$

$$\varepsilon_{\max} = \min(0.5 * \varepsilon_u, A) = \min(10\%, 8\%) = 8\%$$

The maximum allowed plastic elongations are $8\% = 80\%$

2.2 Glass according to NEN-2608

Only laminated fully tempered safety glass (FTG) in accordance with NEN-EN 12150-1 based on soda lime silica glass acc. to NEN-EN 572-1 is used with the following material properties according to NEN-2608 chapter 5.3:

Young-Modulus:	$E=70000 \text{ N/mm}^2$
Poisson ratio	$\nu=0.23$
Density	$\rho=2500 \text{ kg/m}^3$
Characteristic glass resistance float glass	$f_{gk.float}=45 \text{ N/mm}^2$
Characteristic glass resistance fully tempered glass	$f_{gk.FTG}=120 \text{ N/mm}^2$

Note: For the ultimate design resistances of FTG based on the different installation situations, load types and durations see chapter 4.1.

2.3 Interlayer

2.3.1 PVB

Polyvinyl-Butyral-Interlayer (PVB)

Mechanical properties at 23 °C:

breaking load	$> 20 \text{ N/mm}^2$
elongation at failure	$> 250 \%$

These properties must be confirmed by the manufacturer of the interlayer with the certificate of conformity 2.1 according to EN 10204:1995-08.

The stiffness of the interlayer respectively the coupling factors for a certain load duration and temperature are determined according to NEN 2608-Annex C.

Factors		PVB										
Gtl	0,53	N/mm ²										
Etl	1,60	N/mm ²										
t	300	sec										
v	0,5	-										
C1	20,7	-										
C2	91,1	-										
G∞	0,05	N/mm ²										
G0	471	N/mm ²										
T0	20	°C										
Tg	30	°C										
i	1	2	3	4	5	6	7	8	9	10	11	
Gi/G0	0,1606	0,078777	0,2912	0,071155	0,2688	0,089586	0,030183	0,0076056	0,0009634	0,0004059	0,0006143	
τref.i	3,2557E-11	4,941E-09	7,2427E-08	9,8635E-06	0,0028059	0,16441	2,2648	35,364	9367,5	641410	41347000	
τT.i	2,91855E-13	4,4293E-11	6,4927E-10	8,84206E-08	2,5153E-05	0,00147384	0,02030262	0,31701779	83,9742158	5749,86942	370651,924	
(Gi/G0)*e [^] (-t/τT.i)	0	0	0	0	0	0	0	0	2,7057E-05	0,00038527	0,0006138	
Σ(Gi/G0)*e [^] (-t/τT.i)	0,001026125											

Factors		PVB										
Gtl	0,11	N/mm ²										
Etl	0,32	N/mm ²										
t	604800	sec										
v	0,5	-										
C1	20,7	-										
C2	91,1	-										
G∞	0,05	N/mm ²										
G0	471	N/mm ²										
T0	20	°C										
Tg	30	°C										
i	1	2	3	4	5	6	7	8	9	10	11	
Gi/G0	0,1606	0,078777	0,2912	0,071155	0,2688	0,089586	0,030183	0,0076056	0,0009634	0,0004059	0,0006143	
τref.i	3,2557E-11	4,941E-09	7,2427E-08	9,8635E-06	0,0028059	0,16441	2,2648	35,364	9367,5	641410	41347000	
τT.i	2,91855E-13	4,4293E-11	6,4927E-10	8,84206E-08	2,5153E-05	0,00147384	0,02030262	0,31701779	83,9742158	5749,86942	370651,924	
(Gi/G0)*e [^] (-t/τT.i)	0	0	0	0	0	0	0	0	0	8,4558E-50	0,000120153	
Σ(Gi/G0)*e [^] (-t/τT.i)	0,000120153											

Factors		PVB										
Gtl	0,96	N/mm ²										
Etl	2,87	N/mm ²										
t	5	sec										
v	0,5	-										
C1	20,7	-										
C2	91,1	-										
G∞	0,05	N/mm ²										
G0	471	N/mm ²										
T0	20	°C										
Tg	30	°C										
i	1	2	3	4	5	6	7	8	9	10	11	
Gi/G0	0,1606	0,078777	0,2912	0,071155	0,2688	0,089586	0,030183	0,0076056	0,0009634	0,0004059	0,0006143	
τref.i	3,2557E-11	4,941E-09	7,2427E-08	9,8635E-06	0,0028059	0,16441	2,2648	35,364	9367,5	641410	41347000	
τT.i	2,91855E-13	4,4293E-11	6,4927E-10	8,84206E-08	2,5153E-05	0,00147384	0,02030262	0,31701779	83,9742158	5749,86942	370651,924	
(Gi/G0)*e [^] (-t/τT.i)	0	0	0	0	0	0	3,346E-109	1,0751E-09	0,00090771	0,00040555	0,00061429	
Σ(Gi/G0)*e [^] (-t/τT.i)	0,001927551											

2.3.2 SGP (SentryGlas SG5000)

The stiffness of the interlayer respectively the coupling factors for a certain load duration and temperature are determined according to NEN 2608-Annex C.

These properties must be confirmed by the manufacturer of the interlayer.

Factors		SGP											
GtI	4,65	N/mm ²											
Etl	13,87	N/mm ²											
t	300	sec											
v	0,49	-											
C1	135	-											
C2	600	-											
G∞	0,5	N/mm ²											
G0	375	N/mm ²											
T0	25	°C											
Tg	50	°C											
i	1	2	3	4	5	6	7	8	9	10	11	12	
Gi/G0	0,1271	0,1081	0,08897	0,094317	0,115	0,1344	0,1321	0,095388	0,057071	0,027682	0,012042	0,007743	
τref.i	5,991E-12	6,2398E-10	7,1355E-08	0,000021998	0,0029346	0,462	34,44	833,6	24678	807130	58971000	94433000000	
τT.i	2,38506E-17	2,4841E-15	2,8407E-13	8,75756E-11	1,1683E-08	1,8393E-06	0,00013711	0,00331862	0,09824489	3,21324241	234,76778	375944,5444	
(Gi/G0)*e ^{^(-t/τT.i)}	0	0	0	0	0	0	0	0	0	7,8503E-43	0,0033553	0,007736824	
Σ(Gi/G0)*e ^{^(-t/τT.i)}	0,011092127												

Factors		SGP											
GtI	1,08	N/mm ²											
Etl	3,22	N/mm ²											
t	604800	sec											
v	0,49	-											
C1	135	-											
C2	600	-											
G∞	0,5	N/mm ²											
G0	375	N/mm ²											
T0	25	°C											
Tg	50	°C											
i	1	2	3	4	5	6	7	8	9	10	11	12	
Gi/G0	0,1271	0,1081	0,08897	0,094317	0,115	0,1344	0,1321	0,095388	0,057071	0,027682	0,012042	0,007743	
τref.i	5,991E-12	6,2398E-10	7,1355E-08	0,000021998	0,0029346	0,462	34,44	833,6	24678	807130	58971000	94433000000	
τT.i	2,38506E-17	2,4841E-15	2,8407E-13	8,75756E-11	1,1683E-08	1,8393E-06	0,00013711	0,00331862	0,09824489	3,21324241	234,76778	375944,5444	
(Gi/G0)*e ^{^(-t/τT.i)}	0	0	0	0	0	0	0	0	0	0	0	0,001549669	
Σ(Gi/G0)*e ^{^(-t/τT.i)}	0,001549669												

Factors		SGP											
GtI	10,00	N/mm ²											
Etl	29,80	N/mm ²											
t	5	sec											
v	0,49	-											
C1	135	-											
C2	600	-											
G∞	0,5	N/mm ²											
G0	375	N/mm ²											
T0	25	°C											
Tg	50	°C											
i	1	2	3	4	5	6	7	8	9	10	11	12	
Gi/G0	0,1271	0,1081	0,08897	0,094317	0,115	0,1344	0,1321	0,095388	0,057071	0,027682	0,012042	0,007743	
τref.i	5,991E-12	6,2398E-10	7,1355E-08	0,000021998	0,0029346	0,462	34,44	833,6	24678	807130	58971000	94433000000	
τT.i	2,38506E-17	2,4841E-15	2,8407E-13	8,75756E-11	1,1683E-08	1,8393E-06	0,00013711	0,00331862	0,09824489	3,21324241	234,76778	375944,5444	
(Gi/G0)*e ^{^(-t/τT.i)}	0	0	0	0	0	0	0	0	4,5057E-24	0,00583995	0,01178825	0,007742897	
Σ(Gi/G0)*e ^{^(-t/τT.i)}	0,02537109												

3 Loads

3.1 Life load on parapet

The horizontal life load to apply on a parapet is determined according to Dutch national annex NEN-EN 1991-1-1, chapter 6.4 e annex NB.A and is composed of a uniformly distributed horizontal line load q_k and single point loads F_k .

A distinction is made between two zones for load application on the parapet.

Zone a at the height required by building regulations and zone b between zone a and the ground, see figure NB.A.1 of NEN-EN 1991-1-1.

If the parapet is provided with an appropriate handrail at the prescribed height, the handrail forms zone a and the parts of the parapet under the railing are considered to be zone b. If the parapet does not have a handrail at the prescribed height, the load may, as far as physically possible, be distributed over a strip (zone (a)) not higher than 0,1 m immediately below the prescribed height.

The magnitude of the line load q_k is described in Table NB.A.1 of NEN-EN 1991-1-1 and summarized in the table below for the current application. The line load q_k acts in a horizontal direction, over the entire length of the structure, perpendicular to the plane of the parapet and in principle in zone a. The line load must be applied to the parapet at least for the duration given in the table below.

The concentrated load F_k is a free load. F_k can occur in the horizontal direction, depending on the requirements as listed in table NB.A.1 of NEN-EN 1991-1-1, at any point of separation in zone a, zone b and zone (a+b). The size of the concentrated load F_k for the current application is described in the table below. F_k works on an area of 0.2 m x 0.2 m. The concentrated load must be applied to the parapet at least for the time period specified in this table.

F_k and q_k can be directed in both directions, perpendicular to the parapet. On the side of the parapet where there is no floor, half the value given in Table NB.A.1 is considered.

In this document, the main direction of the loads in direction of fall (in direction of height difference) is called LCA, whether the direction contrary to the direction of fall is called LCB and is only considered where decisive.

In this table the loads are listed with respect to the categories of use, for which the Logli Defender parapet is designed and are summarized as follows:

Loaded areas according to tables NB.1-6.2 to N.B.4-6.10	Loading at prescribed height in prescribed zones with minimum load duration			
	q _k	F _k		
	Prescribed height Zone a	Prescribed height Zone a	Zone b	Zone a+b
Class A				
<ul style="list-style-type: none"> A1 Non-common rooms with residential function and associated auxiliary functions 	0,3 kN/m 1 min	0,5 kN 1 min	0,35 kN 10 s	0,2 kN 24 h
<ul style="list-style-type: none"> A2 Common rooms with living function 	0,5 kN/m 1 min	1,0 kN 1 min	0,35 kN 10 s	0,2 kN 24 h
<ul style="list-style-type: none"> A2 Non-communal rooms of a cell function which are not in a cell building, as well as a residential function and associated secondary functions 	0,5 kN/m 1 min	1,0 kN 1 min	0,50 kN 10 s	0,3 kN 24 h
<ul style="list-style-type: none"> C5 class C5 	3,0 kN/m 5 min	1,0 kN 5 min	0,7 kN 5 min	0,5 kN 7 x 24 h
<ul style="list-style-type: none"> Other: class F and G 	0,8 kN/m 5 min	1,0 kN 5 min	1,0 kN 5 min	0,5 kN 7 x 24 h
<ul style="list-style-type: none"> Other: other classes 	0,8 kN/m 5 min	1,0 kN 5 min	0,7 kN 5 min	0,5 kN 7 x 24 h

Note: For this type of uniform parapet, zone b is not decisive since has the same or less amount of force as zone a with the same or shorter load duration and lower bending lever arm for the glass panel. Therefore, zone b will be not considered in the calculation tables of chapter 4.

In the calculation sheets in chapter 4 and the overview tables in chapter 5 the shortcuts “A1”, “A2”, “C52 and “other” related to the different load situations shown in the table above are used to designate the different categories of use.

In addition to the single horizontal loads a single load F_k shall be considered as a free load in vertical direction of 1 kN, as far as this load can be generated in practice due to the design.

To avoid misunderstandings due to the translation, the original table of NEN EN 1991-1-1 is shown below and the corresponding load categories are marked:

Belaste oppervlakken volgens tabellen NB.1-6.2 t.m. NB.4-6.10	Belasting bij voorgeschreven zone en met bijbehorende tijdsduur				Load category used in chapters 4 and 5
	q_k	F_k			
	Voorgeschreven hoogte of zone a ^a	Voorgeschreven hoogte of zone a ^a	Zone b ^a	Zone a + b ^a	
Klasse A					
<ul style="list-style-type: none"> Niet-gemeenschappelijke ruimten met een woonfunctie en bijbehorende nevenfuncties 	0,3 kN/m 1 min	0,5 kN 1 min	0,35 kN ^c 10 s	0,2 kN ^{b,c} 24 h	A1
<ul style="list-style-type: none"> Gemeenschappelijke ruimten met een woonfunctie 	0,5 kN/m 1 min	1 kN 1 min	0,35 kN ^c 10 s	0,2 kN ^{b,c} 24 h	A2
<ul style="list-style-type: none"> Niet-gemeenschappelijke ruimten van een cellfunctie, niet gelegen in een cellingebouw, en van een logiesfunctie en bijbehorende nevenfuncties^d 	0,5 kN/m 1 min	1 kN 1 min	0,5 kN ^d 10 s	0,3 kN ^{b,c} 24 h	
<ul style="list-style-type: none"> Overige ruimte behorende tot klasse A 	0,5 kN/m 1 min	1 kN 1 min	0,5 kN ^c 10 s	0,3 kN ^b 24 h	
Klasse C5	3 kN/m 5 min	1 kN 5 min	0,7 kN 5 min	0,5 kN ^b 7 × 24 h	C5
Klasse F en G	0,8 kN/m 5 min ^e	1 kN 5 min	1 kN 5 min	0,5 kN ^b 7 × 24 h	other
Overige klassen	0,8 kN/m 5 min	1 kN 5 min	0,7 kN 5 min	0,5 kN ^b 7 × 24 h	
^a Voor zones zie figuur NB.A.1. ^b Deze belasting is niet van toepassing op afscheidingen langs trappen. ^c In zone b mag bij plaatconstructies een afstand van 250 mm tussen de rand van de plaat en het zwaartepunt van de last worden aangehouden, op voorwaarde dat zich op een afstand van maximaal 100 mm van de rand van de plaat een balustrade of ander draagkrachtig element bevindt. Bij plaatconstructies met een of meer afmetingen kleiner dan 500 mm moet worden aangenomen dat het zwaartepunt van de last in het midden van deze kleine afmeting ligt. ^d Waarbij de groep van niet-gemeenschappelijke ruimten, gelegen binnen de omhullende ruimte van een andere gebruikruimte die bijdraagt aan het functioneren van de beschouwde gebruiksfunctie, buiten beschouwing blijft. ^e Zie voorts bijlage B van NEN-EN 1991-1-1+C1+C11:2019 voor de horizontale karakteristieke kracht F (in kN), loodrecht op en gelijkmatig verdeeld over elke lengte van 1,5 m van een kering in een parkeergarage, wanneer tussen partijen is vastgelegd dat die kering volgens deze bijlage tegen de botsing van een voertuig bestand moet zijn					
OPMERKING Voor afscheidingen van bruggen zie NEN-EN 1991-2+C1.					

3.2 Combination life load and wind

The calculations shown in chapter 4 and summarized in chapter 5 are for life load only without wind respectively for an equivalent wind load without life-load.

An eventual combination of the life load and wind loads must be done by the executing company respectively the responsible technician based on this technical report and the corresponding national Dutch and European standards.

4 Static calculation

4.1 General description

In the following chapters in compact tabular form for each parapet system the following results are shown:

- ultimate resistance check glass ULS for line load q_k and single loads F_k
- residual resistance check glass considering one broken glass sheet for line load q_k and single loads F_k
- ultimate resistance check ULS profile for line load q_k and single loads F_k
- serviceability SLS deformation check considering contribution of glass and profile
- maximum equivalent wind load based on glass and profile resistance

The resistance values are given for the main direction of loads in direction of fall LCA (see figures 1.4). For LCB refer to chapter 5.5.

Thereby the height of the glass L_1 defined as free bending length out of the profile is varied between 900 mm and 1200 mm.

Furthermore, as interlayers, either PVB or SGP can be chosen.

For the PVB interlayer the maximum allowed glass temperature at loading is 30°C, for the SGP interlayer the maximum allowed glass temperature at loading is 50°C.

As interlayer thickness either 0.76 mm or 1.52 mm can be considered showing the worse results of both in the tables.

Finally, the results are shown for application without and with constructive handrail.

The continuous handrail at top of glass panel must cover the top border and have sufficient resistance to connect the single glass panels together to allow a load distribution to adjacent glass panels at ULS and specially in case of a damaged glass panel.

Therefore, no minimum plate width is required with the usage of a handrail.

4.2 Results ULS and SLS - no handrail

Note:

To keep the document readable and in an acceptable size, following only the results for the decisive highest load category are given for each parapet system and only for the decisive or allowed interlayer (most likely PVB, for triple glasses SGP). Only for DF88DK_E200 exemplarily also the results for SGP-interlayer are shown.

The resistance values are given for the main direction of loads in direction of fall LCA (see figures 1.4). For LCB refer to chapter 5.5.

For the load category C5, the deformation based on the load category “other” is reported.

All the results are given in the summary tables in chapter 5.

If additional results or information is required, please contact Logli company.

4.2.1 DF88DK_E200

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88DK_E200			
Parapet System		Ltot	mm	1000		
Total height of the parapet		L1	mm	900		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	12		
Vertical distance between top of profile and top support of glass into profile		L3	mm	70		
Vertical distance between top and bottom support of glass into profile		L4	mm	29,55		
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200		
Distance between fixations		tnom	mm	8		
Nominal glass thickness		tp1	mm	7,7		
Glass thickness for calculation tp1 for inner plate at loading side		tp2	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	PVB		
Type of interlayer		tv.1	mm	1,52		
Thickness of interlayer		ng	-	2		
Number of sheets of glass of laminated plate		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50		
Maximum temperature of glass panel at loading for SGP		Cat	-	A1		
Load category		CC	-	CC2		
Consequence class		KF1	-	1		
Multiplication factor for consequence class		γQ0	-	1,5		
Load safety factor variable loads as basis value		γQ	-	1,5		
Load safety factor variable loads considering CC		ψ0 LL	-	0,4		
Load combination factor for variable life load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	86400	1
		Load area A	mm ²	-	40000	900000
		km0d	-	0,856	0,856	1,000
		ka	-	1,0	1,076	0,950
		fmTud	N/mm ²	77,65	79,28	80,00
		Gint	N/mm ²	0,75	0,75	0,28
		Eint	N/mm ²	2,25	2,25	2,87
		ω	-	0,239	0,152	0,428
		ωw	-	0,451	0,335	0,411
		teq.ult	mm	12,82	12,24	11,51
		teq.serv	mm	12,91	12,23	11,04
		bcalc	mm	1000	800	1000
		Wel	mm ³	27384	19987	17673
		Med	kNm	0,405	0,600	0,240
		σEd.ULS*	N/mm ²	14,790	34,52	15,62
		utilization	-	0,19	0,44	0,22
		bmin.ULS	mm	-	348	176
		wk,max.glass	kN/m ²	-	-	3,62
		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	For residual capacity check of Fk see Mepla calcs and related tables for bmin
		Med.res	kNm	0,270	0,400	0,160
		Wel.res	mm ³	9882	(Ma/Mab)*(fmTud.ab/fmTud.a)=	
		σEd.res**	N/mm ²	30,056	2,23	
		utilization	-	0,39	zone a decisive	
		σglass.top	mm	5,81	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
		teq.serv	mm ⁴	179147	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
		kprof	(kN/m)/mm	26,5		
		Fp.k	kN/m	4,16		
		Fp.k,max	kN/m	70,0		
		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
		σprof	mm	0,16		
		σtot.top	mm	1,4		
		σtot.top	mm	7,2		
		σmax	mm	20		
		utilization	-	0,36		
		bcalc	mm	1000	800	800
		Fp.Ed	kN/m	6,24	11,65	4,66
		Fp.Rd	kN/m	88,5	-	10,08
		utilization	-	0,07	0,13	0,05
		bmin.prof	mm	-	105	42
		wk,max.profile	kN/m ²	-	-	8,77
		DF88DK_E200				
Parapet System		Ltot	mm	1000		
Total height of the parapet		900	mm			
Glass height		8	mm			
Glass thickness nominal		PVB	-			
Interlayer		1,52	mm			
Thickness interlayer		A1	-			
Load category				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Load				0,3	0,5	0,2
Maximum utilization glass at ULS		ut.glass.ULS	-	0,19		
Maximum utilization profile at ULS		ut.profile.ULS	-	0,07	0,13	0,05
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,39		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	5,8		
Maximum deformation glass + profile at SLS for linear load qk		def.glass-prof.SLS	mm	7,2		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass-prof.SLS	-	0,36		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²			3,62
Minimum plate width ULS glass		bmin.glass.ULS	mm		348	176
Minimum plate width ULS profile		bmin.profile.ULS	mm		105	42
Minimum plate width residual check		bmin.glass.residual	mm	670		
Minimum plate width overall		bmin	mm	670		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF88DK_E200			
Total height of the parapet	Ltot	mm	1000			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	900			
Vertical distance between top of profile and top support of glass into profile	L2	mm	12			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	29,55			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	7,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	7,7			
Type of interlayer	Interlayer	-	SGP			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	A1			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,4			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load		-	Life load			
Material safety factor float glass for predominant	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm²	45			
Characteristic resistance of FTG	fb.k	N/mm²	120			
Type of load			qk [kN/m]	Fk [kN]		wk [kN/m²]
Zone of load		a	0,3	a	a+b	a+b
Value of load			60	60	86400	5
Time of loading	s		-	40000	40000	900000
Load area A	mm²					
Modification factor for the load time	kmod	-	0,856	0,856	0,543	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,950
Design resistance of FTG	f _{mt,ud}	N/mm²	77,65	79,28	70,87	80,00
Shear modulus interlayer	Gint	N/mm²	6,89	6,89	2,80	10,00
Young modulus interlayer	Eint	N/mm²	20,54	20,54	8,36	29,80
Coupling factor of the interlayer(s) at stress	ωσ	-	0,742	0,622	0,401	0,887
Coupling factor of the interlayer(s) at deformatio	ωw	-	0,883	0,822	0,653	0,880
Equivalent glass thickness ULS	teq,ult	mm	14,82	14,48	13,66	15,17
Equivalent glass thickness SLS	teq,serv	mm	14,94	14,68	13,93	14,92
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	800	800	1000
Section moduls with equivalent thickness W=b*teq²/6	Wel	mm³	36604	27941	24868	38339
Bending moment at fixation	Med	kNm	0,405	0,600	0,240	0,608
Bending tensile stress at ULS	σEd.ULS*	N/mm²	11,064	24,69	11,10	18,22
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	-	0,14	0,31	0,16	0,23
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin.ULS	mm	-	249	125	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m²	-	-	-	4,39
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a+b) decisive		For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending moment at fixation	Med.res	kNm	0,400	0,270	0,160	-
Section moduls with residual check	Wel.res	mm³	9882	(Ma/Mab)*((f _{mt,ud} .ab/f _{mt,ud} .a)+		-
Bending tensile stress analytic based on bcalc	σEd.res**	N/mm²	30,056	2,23		-
Maximum utilization residual capacity based on bcalc	utilization	-	0,39	zone a decisive		-
Deformation glass panel at top	δglass.top	mm	3,75	* x 1,15 for wind and Fk to account for difference between constant		
Moment of inertia with equivalent thickness teq,serv	Ieq,serv	mm⁴	277684	tension and real tension distribution acc. to comparative Mepla-calculation		
Linear profile stiffness	kprof	(kN/m)/mm	26,5	** x1,1 to account for difference between constant tension and real tensor		
Characteristic force at top support glass into profile	Fp.k	kN/m	4,16	distribution acc. to comparative Mepla-calculation		
Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k,max	kN/m	70,0			
Validation of linear iteration	valid	-	OK	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary		
Deformation top of profile based on numerical simulation of profile	δprof	mm	0,16			
Deformation top of parapet due to profile deformation/rotation - extrapolation	δprof.top	mm	1,4			
Total deformation at top of parapet = δglass + δprofile	δtot.top	mm	5,2			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δmax	mm	20			
Maximum utilization SLS	utilization	-	0,26			
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	800	800	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	6,24	11,65	4,66	10,08
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	88,5	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,07	0,13	0,05	0,11
Minimum plate width based on profile resistance	bmin.prof	mm	-	105	42	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m²	-	-	-	8,77
Parapet System	DF88DK_E200					
Total height of the parapet	1000	mm				
Glass height	900	mm				
Glass thickness nominal	8	mm				
Interlayer	SGP	-				
Thickness interlayer	1,52	mm				
Load category	A1	-				
Load			qk [kN/m]	Fk [kN]		wk [kN/m²]
Maximum utilization glass at ULS	ut.glass.ULS	-	0,14	0,5	0,2	
Maximum utilization profile at ULS	ut.profile.ULS	-	0,07	0,13	0,05	
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,39			
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	mm	3,8			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	5,2			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,26			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m²				4,39
Minimum plate width ULS glass	bmin.glass.ULS	mm		249	125	
Minimum plate width ULS profile	bmin.profile.ULS	mm		105	42	
Minimum plate width residual check	bmin.glass.residual	mm	670			
Minimum plate width overall	bmin	mm	670			

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88DK_E200			
Parapet System						
Total height of the parapet		Ltot	mm	1100		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1000		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,55		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1000000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{td,ud}	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		ωσ	-	0,266	0,172	0,072
Coupling factor of the interlayer(s) at deformation		ωω	-	0,503	0,382	0,187
Equivalent glass thickness ULS		teq,ult	mm	12,98	12,39	11,60
Equivalent glass thickness SLS		teq,serv	mm	13,18	12,51	11,25
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	900	1000
Section moduls with equivalent thickness W=b ² teq ² /6		Wel	mm ³	28080	23009	20168
Bending moment at fixation		Med	kNm	0,450	0,675	0,270
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	16,026	33,74	15,40
Maximum utilization ULS = σEd/f _{td,ud}		utilization	-	0,21	0,43	0,22
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	383	196
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	3,01
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending moment at fixation		Med.res	kNm	0,300	0,450	0,180
Section moduls with residual check		Wel.res	mm ³	9882	(Ma/Mab)*(f _{td,ud} .ab/f _{td,ud} .a)=	
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm ²	33,395	2,23	zone a decisive
Maximum utilization residual capacity based on bcalc		utilization	-	0,43		
Deformation glass panel at top		δ _{glass,top}	mm	7,48	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq.serv		Ieq.serv	mm ⁴	190875	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	26,5		
Characteristic force at top support glass into profile		Fp.k	kN/m	4,59		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k,max	kN/m	70,0		
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Defomation top of parapet based on numerical simulation of profile		δ _{prof}	mm	0,17		
Defomation top of parapet due to profile deformation/rotation - extrapolation		δ _{prof,top}	mm	1,7		
Total deformation at top of parapet = δ _{glass} + δ _{prof}		δ _{tot,top}	mm	9,2		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δ _{max}	mm	20		
Maximum utilization SLS		utilization	-	0,46		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	900	1000
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	6,88	11,55	4,62
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	88,5	-	12,27
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,08	0,13	0,05
Minimum plate width based on profile resistance		bmin.prof	mm	-	117	47
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	7,21
Parapet System		DF88DK_E200				
Total height of the parapet		1100	mm			
Glass height		1000	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
				0,3	0,5	0,2
Maximum utilization glass at ULS		ut.glass.ULS	-	0,21		
Maximum utilization profile at ULS		ut.profile.ULS	-	0,08	0,13	0,05
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,43		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS		7,5		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	9,2		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,46		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²			3,01
Minimum plate width ULS glass		bmin.glass.ULS	mm		383	196
Minimum plate width ULS profile		bmin.profile.ULS	mm		117	47
Minimum plate width residual check		bmin.glass.residual	mm	800		
Minimum plate width overall		bmin	mm	800		
NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation						

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88DK_E200			
Parapet System						
Total height of the parapet		Ltot	mm	1100		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1000		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,55		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	SGP		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1000000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		fmt.ud	N/mm ²	77,65	79,28	79,87
Shear modulus interlayer		Gint	N/mm ²	6,89	6,89	2,80
Young modulus interlayer		Eint	N/mm ²	20,54	20,54	8,36
Coupling factor of the interlayer(s) at stress		ασ	-	0,769	0,656	0,437
Coupling factor of the interlayer(s) at deformation		αw	-	0,903	0,850	0,698
Equivalent glass thickness ULS		teq.ult	mm	14,89	14,58	13,81
Equivalent glass thickness SLS		teq.serv	mm	15,02	14,80	14,14
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	900	900
Section moduls with equivalent thickness W=b ² teq ³ /6		WeI	mm ³	36951	31881	28607
Bending moment at fixation		Med	kNm	0,450	0,675	0,270
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	12,178	24,35	10,85
Maximum utilization ULS = σEd/σEd.ULS		utilization	-	0,16	0,31	0,15
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	276	138
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	3,57
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending moment at fixation		Med.res	kNm	0,300	0,450	0,180
Section moduls with residual check		WeI.res	mm ³	9882	(Ma/Mab)*(fmt.ud.ab/fmt.ud.a)=	
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm ²	33,395	2,23	zone a decisive
Maximum utilization residual capacity based on bcalc		utilization	-	0,43		
Deformation glass panel at top		σglass.top	mm	5,06	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq.serv		Ieq.serv	mm ⁴	282170	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	26,5		
Characteristic force at top support glass into profile		Fp.k	kN/m	4,59		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k.max	kN/m	70,0		
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Defomation top of profile based on numerical simulation of profile		σprof	mm	0,17		
Defomation top of parapet due to profile deformation/rotation - extrapolation		σprof.top	mm	1,7		
Total deformation at top of parapet = σglass + σprof		δtot.top	mm	6,8		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δmax	mm	20		
Maximum utilization SLS		utilization	-	0,34		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	900	900
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	6,88	11,55	4,62
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	88,5	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,08	0,13	0,05
Minimum plate width based on profile resistance		bmin.prof	mm	-	117	47
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profilte	kN/m ²	-	-	7,21
Parapet System		DF88DK_E200				
Total height of the parapet		1100	mm			
Glass height		1000	mm			
Glass thickness nominal		8	mm			
Interlayer		SGP	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,16	0,5	0,2
Maximum utilization profile at ULS		ut.profile.ULS	-	0,08	0,13	0,05
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,43		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS		5,1		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	6,8		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,34		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²			3,57
Minimum plate width ULS glass		bmin.glass.ULS	mm		276	138
Minimum plate width ULS profile		bmin.profilte.ULS	mm		117	47
Minimum plate width residual check		bmin.glass.residual	mm			
Minimum plate width overall		bmin	mm	800		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88DK_E200			
Parapet System						
Total height of the parapet		Ltot	mm	1200		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1100		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,55		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv,i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg,k	N/mm ²	45		
Characteristic resistance of FTG		fb,k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,2	1
		Time of loading	s	60	86400	5
		Load area A	mm ²	-	40000	1100000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,076	1,076	0,942
Design resistance of FTG		f _{mt,ud}	N/mm ²	77,65	79,28	79,81
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		ασ	-	0,293	0,192	0,081
Coupling factor of the interlayer(s) at deformation		αw	-	0,549	0,427	0,217
Equivalent glass thickness ULS		teq,ult	mm	13,13	12,52	11,68
Equivalent glass thickness SLS		teq,serv	mm	13,42	12,77	11,47
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1000	1000
Section moduls with equivalent thickness W=b*teq ² /6		Wel	mm ³	28725	26123	22728
Bending moment at fixation		Med	kNm	0,495	0,750	0,300
Bending tensile stress at ULS		σEd,ULS*	N/mm ²	17,233	33,02	15,18
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,22	0,42	0,21
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin,ULS	mm	-	416	214
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max,ULS	kn/m ²	-	-	2,54
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending moment at fixation		Med,res	kNm	0,330	0,500	0,200
Section moduls with residual check		Wel,res	mm ³	9882	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=	
Bending tensile stress analytic based on bcalc		σEd,res**	N/mm ²	36,735	2,23	zone a decisive
Maximum utilization residual capacity based on bcalc		utilization	-	0,47		
Deformation glass panel at top		δglass,top	mm	9,44	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq,serv		Ieq,serv	mm ⁴	201480	** x1,1 to account for difference between constant tension and real tensor distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	26,5		
Characteristic force at top support glass into profile		Fp,k	kn/m	5,01		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp,k,max	kn/m	70,0		
Validation of linear iteration			-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Defomation top of profile based on numerical simulation of profile		δprof	mm	0,19		
Defomation top of parapet due to profile deformation/rotation - extrapolation		δprof,top	mm	2,0		
Total deformation at top of parapet = δglass + δprofile		δtot,top	mm	11,5		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δmax	mm	20		
Maximum utilization SLS		utilization	-	0,57		
Calculation width with 1m for qk and wk and maximum 45° distrubution for Fk		bcalc	mm	1000	1000	1000
Design acting force at top support glass into profile based on bmin for Fk		Fp,Ed	kn/m	7,52	11,46	4,59
Maximum allowed design acting force based on numerical simulations of profiles		Fp,Rd	kn/m	88,5	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,09	0,13	0,05
Minimum plate width based on profile resistance		bmin,prof	mm	-	130	52
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max,profile	kn/m ²	-	-	6,03
Parapet System		DF88DK_E200				
Total height of the parapet		1200	mm			
Glass height		1100	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,22	0,5	0,2
Maximum utilization profile at ULS		ut.profile.ULS	-	0,09	0,13	0,05
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,47		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	9,4		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	11,5		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,57		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kn/m ²			2,54
Minimum plate width ULS glass		bmin.glass.ULS	mm		416	214
Minimum plate width ULS profile		bmin.profile.ULS	mm		130	52
Minimum plate width residual check		bmin.glass.residual	mm		880	
Minimum plate width overall		bmin	mm		880	

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88DK_E200			
Parapet System						
Total height of the parapet		Ltot	mm	1200		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1100		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,55		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	SGP		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1100000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt.ud}	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm ²	6,89	6,89	2,80
Young modulus interlayer		Eint	N/mm ²	20,54	20,54	8,36
Coupling factor of the interlayer(s) at stress		α _{st}	-	0,792	0,685	0,470
Coupling factor of the interlayer(s) at deformation		α _{de}	-	0,918	0,873	0,736
Equivalent glass thickness ULS		teq.ult	mm	14,95	14,66	13,94
Equivalent glass thickness SLS		teq.serv	mm	15,08	14,89	14,31
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1000	1000
Section moduli with equivalent thickness W=b ² teq ² /6		Wel	mm ³	37233	35838	32400
Bending moment at fixation		Med	kNm	0,495	0,750	0,300
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	13,294	24,07	10,65
Maximum utilization ULS = σEd/f _{mt.ud}		utilization	-	0,17	0,30	0,15
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	304	150
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	2,96
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending moment at fixation		Med.res	kNm	0,330	0,500	0,200
Section moduli with residual check		Wel.res	mm ³	9882	(Ma/Mab) ² (f _{mt.ud.ab} /f _{mt.ud.a})=	
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm ²	36,735	2,23	zone a decisive
Maximum utilization residual capacity based on bcalc		utilization	-	0,47		
Deformation glass panel at top		δ _{glass.top}	mm	6,66		* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation
Moment of inertia with equivalent thickness teq.serv		I _{eq.serv}	mm ⁴	285634		** x 1,1 to account for difference between constant tension and real tensor distribution acc. to comparative Mepla-calculation
Linear profile stiffness		k _{prof}	(kN/m)/mm	26,5		Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary
Characteristic force at top support glass into profile		Fp.k	kN/m	5,01		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k.max	kN/m	70,0		
Validation of linear iteration		vald	-	OK		
Deformation top of profile based on numerical simulation of profile		δ _{prof}	mm	0,19		
Deformation top of parapet due to profile deformation/rotation - extrapolation		δ _{prof.top}	mm	2,0		
Total deformation at top of parapet = δ _{glass} + δ _{profile}		δ _{tot.top}	mm	8,7		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		δ _{max}	mm	20		
Maximum utilization SLS		utilization	-	0,43		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	1000	1000
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	7,52	11,46	4,59
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	88,5	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,09	0,13	0,05
Minimum plate width based on profile resistance		bmin.prof	mm	-	130	52
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	6,03
Parapet System						
Total height of the parapet			mm	1200		
Glass height			mm	1100		
Glass thickness nominal			mm	8		
Interlayer			-	SGP		
Thickness interlayer			mm	1,52		
Load category			-	A1		
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,17		
Maximum utilization profile at ULS		ut.profile.ULS	-	0,09	0,13	0,05
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,47		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	-	6,7		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	8,7		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,43		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	2,96
Minimum plate width ULS glass		bmin.glass.ULS	mm	-	304	150
Minimum plate width ULS profile		bmin.profile.ULS	mm	-	130	52
Minimum plate width residual check		bmin.glass.residual	mm	880		
Minimum plate width overall		bmin	mm	880		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88DK_E200			
Parapet System						
Total height of the parapet		Ltot	mm	1300		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1200		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,55		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1200000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt.ud}	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		G _{int}	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		E _{int}	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		ω _σ	-	0,319	0,211	0,091
Coupling factor of the interlayer(s) at deformation		ω _w	-	0,591	0,469	0,247
Equivalent glass thickness ULS		teq.ult	mm	13,26	12,65	11,76
Equivalent glass thickness SLS		teq.serv	mm	13,63	13,00	11,67
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		b _{calc}	mm	1000	1100	1000
Section moduls with equivalent thickness W=b ³ teq ² /6		W _{el}	mm ³	29320	29322	25351
Bending moment at fixation		M _{ed}	kNm	0,540	0,825	0,330
Bending tensile stress at ULS		σ _{Ed,ULS*}	N/mm ²	18,417	32,36	14,97
Maximum utilization ULS = σ _{Ed} /f _{mt.ud}		utilization	-	0,24	0,41	0,21
Minimum plate width based ULS-checks as maximum of Fk-loads		b _{min,ULS}	mm	-	449	232
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	2,18
Calculation width glass panel - for Fk based on Mepla calculation		b _{calc}	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		M _{ed,res}	kNm	0,360	0,550	0,220
Section moduls with residual check		W _{el,res}	mm ³	9882	(M _a /M _{ab})*(f _{mt.ud.ab} /f _{mt.ud.a})=	
Bending tensile stress analytic based on b _{calc}		σ _{Ed,res**}	N/mm ²	40,074	2,23	zone a decisive
Maximum utilization residual capacity based on b _{calc}		utilization	-	0,52		
Deformation glass panel at top		δ _{glass,top}	mm	11,70	* x 1,15 for wind and Fk to account for difference between constant	
Moment of inertia with equivalent thickness teq.serv		I _{eq.serv}	mm ⁴	210997	tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		k _{prof}	(kN/m)/mm	26,5	** x1,1 to account for difference between constant tension and real tension	
Characteristic force at top support glass into profile		F _{p,k}	kN/m	5,44	distribution acc. to comparative Mepla-calculation	
Maximum char. force at top support glass/profile at end of linear stiffness		F _{p,k,max}	kN/m	70,0		
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Defomation top of profile based on numerical simulation of profile		δ _{prof}	mm	0,21		
Defomation top of parapet due to profile deformation/rotation - extrapolation		δ _{prof,top}	mm	2,4		
Total deformation at top of parapet = δ _{glass} + δ _{profile}		δ _{tot,top}	mm	14,1		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δ _{max}	mm	20		
Maximum utilization SLS		utilization	-	0,70		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		b _{calc}	mm	1000	1100	1100
Design acting force at top support glass into profile based on b _{min} for Fk		F _{p,Ed}	kN/m	8,16	11,40	4,56
Maximum allowed design acting force based on numerical simulations of profiles		F _{p,Rd}	kN/m	88,5	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,09	0,13	0,05
Minimum plate width based on profile resistance		b _{min,prof}	mm	-	142	57
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	5,12
Parapet System		DF88DK_E200				
Total height of the parapet		1300	mm			
Glass height		1200	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
				0,3	0,5	0,2
Maximum utilization glass at ULS		ut.glass.ULS	-	0,24		
Maximum utilization profile at ULS		ut.profile.ULS	-	0,09	0,13	0,05
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,52		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	11,7		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	14,1		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,70		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	2,18
Minimum plate width ULS glass		b _{min.glass.ULS}	mm	-	449	232
Minimum plate width ULS profile		b _{min.profile.ULS}	mm	-	142	57
Minimum plate width residual check		b _{min.glass.residual}	mm	980		
Minimum plate width overall		b _{min}	mm	980		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF88DK_E200			
Total height of the parapet		Ltot	mm	1300		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1200		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,55		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		interlayer	-	SGP		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1200000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm ²	6,89	6,89	2,80
Young modulus interlayer		Eint	N/mm ²	20,54	20,54	8,36
Coupling factor of the interlayer(s) at stress		αw	-	0,811	0,711	0,500
Coupling factor of the interlayer(s) at deformation		αw	-	0,890	0,930	0,768
Equivalent glass thickness ULS		teq,ult	mm	14,99	14,74	14,06
Equivalent glass thickness SLS		teq,serv	mm	15,13	14,97	14,45
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1100	1100
Section moduls with equivalent thickness W=b ² teq ² /6		Wel	mm ³	37468	39806	36235
Bending moment at fixation		Med	kNm	0,540	0,825	0,330
Bending tensile stress at ULS		σEd,ULS*	N/mm ²	14,412	23,83	10,47
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,19	0,30	0,15
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin,ULS	mm	-	331	163
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	2,49
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med,res	kNm	0,360	0,550	0,220
Section moduls with residual check		Wel,res	mm ³	9882	(Ma/Mab) ² (f _{mt,ud} .ab/f _{mt,ud} .a) ²	
Bending tensile stress analytic based on bcalc		σEd,res**	N/mm ²	40,074	2,23	
Maximum utilization residual capacity based on bcalc		utilization	-	0,52	zone a decisive	
Deformation glass panel at top		δglass,top	mm	8,96		
Moment of inertia with equivalent thickness teq,serv		Ieq,serv	mm ⁴	288359		
Linear profile stiffness		kprof	(kN/m)/mm	26,5		
Characteristic force at top support glass into profile		Fp,k	kN/m	5,44		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp,k,max	kN/m	70,0		
Validation of linear iteration		valid	-	OK		
Deformation top of profile based on numerical simulation of profile		δprof	mm	0,21		
Deformation top of parapet due to profile deformation/rotation - extrapolation		δprof,top	mm	2,4		
Total deformation at top of parapet = δglass + δprofile		δtot,top	mm	11,0		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		δmax	mm	20		
Maximum utilization SLS		utilization	-	0,55		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	1100	1100
Design acting force at top support glass into profile based on bmin for Fk		Fp,Ed	kN/m	8,16	11,40	4,56
Maximum allowed design acting force based on numerical simulations of profiles		Fp,Rd	kN/m	88,5		17,28
Maximum utilization aluminum profile for single loads qk and Fk		utilization	-	0,09	0,13	0,05
Minimum plate width based on profile resistance		bmin,prof	mm	-	142	57
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	5,12
Parapet System		DF88DK_E200				
Total height of the parapet		1300	mm			
Glass height		1200	mm			
Glass thickness nominal		8	mm			
Interlayer		SGP	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,19		
Maximum utilization profile at ULS		ut.profile.ULS	-	0,09	0,13	0,05
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,52		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	-	8,6		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	11,0		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,55		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²			2,49
Minimum plate width ULS glass		bmin.glass.ULS	mm		331	163
Minimum plate width ULS profile		bmin.profile.ULS	mm		142	57
Minimum plate width residual check		bmin.glass.residual	mm	980		
Minimum plate width overall		bmin	mm	980		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

4.2.2 DF88DK_E400

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88DK_E400			
Parapet System		Ltot	mm	1000		
Total height of the parapet		L1	mm	900		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	12		
Vertical distance between top of profile and top support of glass into profile		L3	mm	70		
Vertical distance between top and bottom support of glass into profile		L4	mm	29,55		
Distance between fixations		efix	mm	400		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer		PVB		
Thickness of interlayer		tv,i	mm	1,52		
Number of sheets of glass of laminated plate		ng		2		
Maximum temperature of glass panel at loading for PVB		Tg,pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg,sgp	°C	50		
Load category		Cat		A1		
Consequence class		CC		CC2		
Multiplication factor for consequence class		KF1		1		
Load safety factor variable loads as basic value		γQb		1,5		
Load safety factor variable loads considering CC		γQ		1,5		
Load combination factor for variable life load		ψ0 LL		0,4		
Load combination factor for variable wind load		ψ0 Wind		0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm,A		1,8		
Material safety factor FTG		γm,V		1,2		
Factor for the edge quality of the glass panel		ke		1		
Corrosion constant as a function		c		16		
Factor for the surface structure of float glass		ksp		1		
Factor for the zone for FTG and edge zone		kz		0,9		
Characteristic resistance of float glass		fg,k	N/mm ²	45		
Characteristic resistance of FTG		fb,k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						900000
Modification factor for the load time		kmod		0,856	0,856	0,543
Surface effect factor		ka		1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		ω _σ		0,239	0,152	0,063
Coupling factor of the interlayer(s) at deformation		ω _w		0,451	0,335	0,158
Equivalent glass thickness ULS		teq,ult	mm	12,82	12,24	11,51
Equivalent glass thickness SLS		teq,serv	mm	12,91	12,23	11,04
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	800	800
Section moduls with equivalent thickness W=b ² teq ² /6		W _{el}	mm ³	27384	19987	17673
Bending moment at fixation		Med	kNm	0,405	0,600	0,240
Bending tensile stress at ULS		σE _{ULS} *	N/mm ²	14,790	34,52	15,62
Maximum utilization ULS = σE _{ULS} /f _{mt,ud}		utilization		0,19	0,44	0,22
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin,ULS	mm	-	348	176
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max,ULS	kN/m ²	-	-	3,62
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med,res	kNm	0,270	0,400	0,160
Section moduls with residual check		W _{el,res}	mm ³	9882	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=	
Bending tensile stress analytic based on bcalc		σE _{res} **	N/mm ²	30,056	2,23	-
Maximum utilization residual capacity based on bcalc		utilization		0,39	zone a decisive	
Deformation glass panel at top		δ _{glass,top}	mm	5,81	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq,sev		I _{eq,sev}	mm ⁴	179147	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	22,3		
Characteristic force at top support glass into profile		Fp,k	kN/m	4,16		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp,k,max	kN/m	45,0		
Validation of linear iteration		valid		OK	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Deformation top of parapet based on numerical simulation of profile		δ _{prof}	mm	0,19		
Deformation top of parapet due to profile deformation/rotation - extrapolation		δ _{prof,top}	mm	1,7		
Total deformation at top of parapet = δ _{glass} + δ _{profile}		δ _{tot,top}	mm	7,5		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δ _{max}	mm	20		
Maximum utilization SLS		utilization		0,37		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	800	800
Design acting force at top support glass into profile based on bmin for Fk		Fp,Ed	kN/m	6,24	11,65	4,66
Maximum allowed design acting force based on numerical simulations of profiles		Fp,Rd	kN/m	55,3	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization		0,11	0,21	0,08
Minimum plate width based on profile resistance		bmin,prof	mm	-	169	67
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max,profile	kN/m ²	-	-	5,48
Parapet System		DF88DK_E400				
Total height of the parapet		1000	mm			
Glass height		900	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB				
Thickness interlayer		1,52	mm			
Load category		A1				
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS		0,19	0,5	0,2
Maximum utilization profile at ULS		ut.profile.ULS		0,11	0,21	0,08
Maximum utilization residual capacity glass for linear load qk		ut.residual		0,39		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS		5,8		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	7,5		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS		0,37		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²			3,62
Minimum plate width ULS glass		bmin.glass.ULS	mm		348	176
Minimum plate width ULS profile		bmin.profile.ULS	mm		169	67
Minimum plate width residual check		bmin.glass.residual	mm		670	
Minimum plate width overall		bmin	mm		670	

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88DK_E400			
Parapet System						
Total height of the parapet		Ltot	mm	1100		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1000		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,55		
Distance between fixations		efix	mm	400		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm²	45		
Characteristic resistance of FTG		fb.k	N/mm²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm²	-	40000	40000
				0,856	0,856	0,543
		Surface effect factor	ka	1,0	1,076	1,076
		Design resistance of FTG	fmt.ud	N/mm²	77,65	79,28
		Shear modulus interlayer	Gint	N/mm²	0,75	0,75
		Young modulus interlayer	Eint	N/mm²	2,25	2,25
		Coupling factor of the interlayer(s) at stress	αs	-	0,266	0,172
		Coupling factor of the interlayer(s) at deformation	αw	-	0,503	0,382
		Equivalent glass thickness ULS	teq.ult	mm	12,98	12,39
		Equivalent glass thickness SLS	teq.serv	mm	13,18	12,51
		Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	900
		Section moduli with equivalent thickness W=b³teq²/6	WeI	mm³	28080	23009
		Bending moment at fixation	Med	kNm	0,450	0,675
		Bending tensile stress at ULS	σEd.ULS*	N/mm²	16,026	33,74
		Maximum utilization ULS = σEd/fmt.ud	utilization	-	0,21	0,43
		Minimum plate width based ULS-checks as maximum of Fk-loads	bmin.ULS	mm	-	383
		Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m²	-	196
		Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	900
		Bending moment at fixation	Med.res	kNm	0,300	0,450
		Section moduli with residual check	WeI.res	mm³	9882	0,180
		Bending tensile stress analytic based on bcalc	σEd.res**	N/mm²	33,395	2,23
		Maximum utilization residual capacity based on bcalc	utilization	-	0,43	zone a decisive
		Deformation glass panel at top	σglass.top	mm	7,48	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation
		Moment of inertia with equivalent thickness teq.serv	Ieq.serv	mm⁴	190875	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation
		Linear profile stiffness	kprof	(kN/m)/mm	22,3	
		Characteristic force at top support glass into profile	Fp.k	kN/m	4,59	
		Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k.max	kN/m	45,0	
		Validation of linear iteration	valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary
		Defomation top of profile based on numerical simulation of profile	σprof	mm	0,21	
		Defomation top of parapet due to profile deformation/rotation - extrapolation	σprof.top	mm	2,0	
		Total deformation at top of parapet = σglass + σprof	σtot.top	mm	9,5	
		Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	σmax	mm	20	
		Maximum utilization SLS	utilization	-	0,48	
		Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	900
		Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	6,88	11,55
		Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	55,3	-
		Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,12	0,21
		Minimum plate width based on profile resistance	bmin.prof	mm	-	188
		Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m²	-	75
						4,51
		Parapet System	DF88DK_E400			
		Total height of the parapet	1100	mm		
		Glass height	1000	mm		
		Glass thickness nominal	8	mm		
		Interlayer	PVB	-		
		Thickness interlayer	1,52	mm		
		Load category	A1	-		
				qk [kN/m]	Fk [kN]	wk [kN/m²]
		Load		0,3	0,5	0,2
		Maximum utilization glass at ULS	ut.glass.ULS	-	0,21	0,08
		Maximum utilization profile at ULS	ut.profile.ULS	-	0,12	0,21
		Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,43	
		Maximum deformation glass at SLS for linear load qk	def.glass.SLS	mm	7,5	
		Maximum deformation glass + profile at SLS for linear load qk	def.glass-prof.SLS	mm	9,5	
		Maximum utilization glass + profile at SLS for linear load qk	ut.glass-prof.SLS	-	0,48	
		Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m²	-	3,01
		Minimum plate width ULS glass	bmin.glass.ULS	mm	383	196
		Minimum plate width ULS profile	bmin.profile.ULS	mm	188	75
		Minimum plate width residual check	bmin.glass.residual	mm	800	
		Minimum plate width overall	bmin	mm	800	

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88DK_E400			
Parapet System						
Total height of the parapet		Ltot	mm	1200		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1100		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,55		
Distance between fixations		efix	mm	400		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
		Modification factor for the load time	kmod	-	0,856	0,543
		Surface effect factor	ka	-	1,076	1,076
		Design resistance of FTG	f _{mt,ud}	N/mm ²	77,65	79,87
		Shear modulus interlayer	Gint	N/mm ²	0,75	0,28
		Young modulus interlayer	Eint	N/mm ²	2,25	0,84
		Coupling factor of the interlayer(s) at stress	ωσ	-	0,293	0,081
		Coupling factor of the interlayer(s) at deformation	ωw	-	0,549	0,217
		Equivalent glass thickness ULS	teq,ult	mm	13,13	11,68
		Equivalent glass thickness SLS	teq,serv	mm	13,42	11,47
		Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	1000
		Section moduls with equivalent thickness W=b ³ teq ² /6	Wel	mm ³	28725	22728
		Bending moment at fixation	Med.res	kNm	0,495	0,300
		Bending tensile stress at ULS	σEd,ULS*	N/mm ²	17,233	15,18
		Maximum utilization ULS = σEd/f _{mt,ud}	utilization	-	0,22	0,21
		Minimum plate width based ULS-checks as maximum of Fk-loads	bmin,ULS	mm	-	416
		Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	214
		Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	1000
		Bending moment at fixation	Med.res	kNm	0,330	0,200
		Section moduls with residual check	Wel.res	mm ³	9882	(Ma/Mab) ³ (f _{mt,ud,ab} /f _{mt,ud,a})=
		Bending tensile stress analytic based on bcalc	σEd,res**	N/mm ²	36,735	2,23
		Maximum utilization residual capacity based on bcalc	utilization	-	0,47	zone a decisive
		Deformation glass panel at top	δglass.top	mm	9,44	* x 1,15 for wind and Fk to account for difference between constant
		Moment of inertia with equivalent thickness teq,serv	Ieq,serv	mm ⁴	201480	tension and real tension distribution acc. to comparative Mepla-calculation
		Linear profile stiffness	kpr.of	(kN/m)/mm	22,3	** x1,1 to account for difference between constant tension and real tension
		Characteristic force at top support glass into profile	Fp.k	kN/m	5,01	distribution acc. to comparative Mepla-calculation
		Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k,max	kN/m	45,0	
		Validation of linear iteration	valid	-	OK	Note: if linear automatic iteration is not valid, manual
		Deformation top of profile based on numerical simulation of profile	δprof	mm	0,23	iteration in the load deformation curves of the single profiles is necessary
		Deformation top of parapet due to profile deformation/rotation - extrapolation	δprof.top	mm	2,4	
		Total deformation at top of parapet = δglass + δprof	δtot.top	mm	11,9	
		Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δmax	mm	20	
		Maximum utilization SLS	utilization	-	0,59	
		Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	1000
		Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	7,52	11,46
		Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	55,3	4,59
		Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,14	0,21
		Minimum plate width based on profile resistance	bmin.prof	mm	-	207
		Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	83
		Parapet System				
		Total height of the parapet		1200		
		Glass height		1100		
		Glass thickness nominal		8		
		Interlayer		PVB		
		Thickness interlayer		1,52		
		Load category		A1		
		Load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Maximum utilization glass at ULS	ut.glass.ULS	-	0,22	0,21
		Maximum utilization profile at ULS	ut.profile.ULS	-	0,14	0,08
		Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,47	
		Maximum deformation glass at SLS for linear load qk	def.glass.SLS	-	9,4	
		Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	11,9	
		Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,59	
		Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²	-	2,54
		Minimum plate width ULS glass	bmin.glass.ULS	mm	-	416
		Minimum plate width ULS profile	bmin.profile.ULS	mm	-	207
		Minimum plate width residual check	bmin.glass.residual	mm	-	83
		Minimum plate width overall	bmin	mm	-	880

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88DK_E400			
Parapet System						
Total height of the parapet		Ltot	mm	1300		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1200		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,55		
Distance between fixations		efix	mm	400		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg,k	N/mm ²	45		
Characteristic resistance of FTG		fb,k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1200000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	77,65	79,28	79,73
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		ωσ	-	0,319	0,211	0,091
Coupling factor of the interlayer(s) at deformation		ωω	-	0,591	0,469	0,247
Equivalent glass thickness ULS		teq.ult	mm	13,26	12,65	11,76
Equivalent glass thickness SLS		teq.serv	mm	13,63	13,00	11,67
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1100	1100
Section moduls with equivalent thickness W=b ³ teq ² /6		Wel	mm ³	29320	29322	25351
Bending moment at fixation		Med	kNm	0,540	0,825	0,330
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	18,417	32,36	14,97
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,24	0,41	0,21
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	449	232
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	-
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	-
Bending moment at fixation		Med.res	kNm	0,360	0,550	0,220
Section moduls with residual check		Wel.res	mm ³	9882	(Ma/Mab)*(f _{mt,ud} .ab/f _{mt,ud} .a)=	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm ²	40,074	2,23	-
Maximum utilization residual capacity based on bcalc		utilization	-	0,52	-	zone a decisive
Deformation glass panel at top		δglass.top	mm	11,70	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-
Moment of inertia with equivalent thickness teq.serv		Ieq.serv	mm ⁴	210997	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-
Linear profile stiffness		kprof	(kN/m)/mm	22,3	-	-
Characteristic force at top support glass into profile		Fp,k	kN/m	5,44	-	-
Maximum char. force at top support glass/profile at end of linear stiffness		Fp,k,max	kN/m	45,0	-	-
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	-
Deformation top of profile based on numerical simulation of profile		δprof	mm	0,24	-	-
Deformation top of parapet due to profile deformation/rotation - extrapolation		δprof.top	mm	2,8	-	-
Total deformation at top of parapet = δglass + δprofile		δtot.top	mm	14,5	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δmax	mm	20	-	-
Maximum utilization SLS		utilization	-	0,73	-	-
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	1100	1100
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	8,16	11,40	4,56
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	55,3	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,15	0,21	0,08
Minimum plate width based on profile resistance		bmin.prof	mm	-	227	91
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	-
						3,20
Parapet System		DF88DK_E400				
Total height of the parapet		1300	mm			
Glass height		1200	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Load				0,3	0,5	0,2
Maximum utilization glass at ULS		ut.glass.ULS	-	0,24	-	-
Maximum utilization profile at ULS		ut.profile.ULS	-	0,15	0,21	0,08
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,52	-	-
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	-	11,7	-	-
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	14,5	-	-
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,73	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	2,18
Minimum plate width ULS glass		bmin.glass.ULS	mm	-	449	232
Minimum plate width ULS profile		bmin.profile.ULS	mm	-	227	91
Minimum plate width residual check		bmin.glass.residual	mm	980	-	-
Minimum plate width overall		bmin	mm	980	-	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88DK_E400			
Parapet System						
Total height of the parapet		Ltot	mm	1300		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1200		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,55		
Distance between fixations		efix	mm	400		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm²	45		
Characteristic resistance of FTG		fb.k	N/mm²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m²]
		Zone of load		a	a	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm²	-	40000	40000
						1200000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		fmt.ud	N/mm²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		σσ	-	0,319	0,211	0,091
Coupling factor of the interlayer(s) at deformatio		ωω	-	0,591	0,469	0,247
Equivalent glass thickness ULS		teq.ult	mm	13,26	12,65	11,76
Equivalent glass thickness SLS		teq.serv	mm	13,63	13,00	11,67
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1100	1100
Section moduls with equivalent thickness W=b²teq²/6		WeL	mm³	29320	29322	25351
Bending moment at fixation		Med	kNm	0,540	0,825	0,330
Bending tensile stress at ULS		σEd.ULS*	N/mm²	18,417	32,36	14,97
Maximum utilization ULS = σEd/fmt.ud		utilization	-	0,24	0,41	0,21
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	449	232
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m²	-	-	2,18
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med.res	kNm	0,360	0,550	0,220
Section moduls with residual check		WeL.res	mm³	9882	(Ma/Mab)^(fmt.ud.ab/fmt.ud.a)=	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm²	40,074	2,23	
Maximum utilization residual capacity based on bcalc		utilization	-	0,52	zone a decisive	
Deformation glass panel at top		σglass.top	mm	11,70	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq.serv		Ieq.serv	mm⁴	210997	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	22,3		
Characteristic force at top support glass into profile		Fp.k	kN/m	5,44		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k.max	kN/m	45,0		
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Defomation top of profile based on numerical simulation of profile		σprof	mm	0,24		
Defomation top of parapet due to profile deformation/rotation - extrapolation		σprof.top	mm	2,8		
Total deformation at top of parapet = σglass + σprof		δtot.top	mm	14,5		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δmax	mm	20		
Maximum utilization SLS		utilization	-	0,73		
Calculation width with 1m for qk and wk and maximum 45° distrubution for Fk		bcalc	mm	1000	1100	1100
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	8,16	11,40	4,56
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	55,3	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,15	0,21	0,08
Minimum plate width based on profile resistance		bmin.prof	mm	-	227	91
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profilte	kN/m²	-	-	3,20
Parapet System		DF88DK_E400				
Total height of the parapet		1300	mm			
Glass height		1200	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,24	0,5	0,2
Maximum utilization profile at ULS		ut.profile.ULS	-	0,15	0,21	0,08
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,52		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	11,7		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	14,5		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,73		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m²			2,18
Minimum plate width ULS glass		bmin.glass.ULS	mm		449	232
Minimum plate width ULS profile		bmin.profilte.ULS	mm		227	91
Minimum plate width residual check		bmin.glass.residual	mm	980		
Minimum plate width overall		bmin	mm	980		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

4.2.3 DF88LM_E200

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88LM_E200																																																																																																																																																																																																																																																																																																																																						
Parapet System		Ltot	mm	1000																																																																																																																																																																																																																																																																																																																																					
Total height of the parapet		L1	mm	900																																																																																																																																																																																																																																																																																																																																					
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	12																																																																																																																																																																																																																																																																																																																																					
Vertical distance between top of profile and top support of glass into profile		L3	mm	70																																																																																																																																																																																																																																																																																																																																					
Vertical distance between top and bottom support of glass into profile		L4	mm	29,55																																																																																																																																																																																																																																																																																																																																					
Vertical distance between bottom support of glass into profile and base ground		eFix	mm	200																																																																																																																																																																																																																																																																																																																																					
Distance between fixations		tnom	mm	8																																																																																																																																																																																																																																																																																																																																					
Nominal glass thickness		tp1	mm	7,7																																																																																																																																																																																																																																																																																																																																					
Glass thickness for calculation tp1 for inner plate at loading side		tp2	mm	7,7																																																																																																																																																																																																																																																																																																																																					
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	PVB																																																																																																																																																																																																																																																																																																																																					
Type of interlayer		tv.1	mm	1,52																																																																																																																																																																																																																																																																																																																																					
Thickness of interlayer		ng	-	2																																																																																																																																																																																																																																																																																																																																					
Number of sheets of glass of laminated plate		Tg.pvb	°C	30																																																																																																																																																																																																																																																																																																																																					
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50																																																																																																																																																																																																																																																																																																																																					
Maximum temperature of glass panel at loading for SGP		Cat	-	A1																																																																																																																																																																																																																																																																																																																																					
Load category		CC	-	CC2																																																																																																																																																																																																																																																																																																																																					
Consequence class		KF1	-	1																																																																																																																																																																																																																																																																																																																																					
Multiplication factor for consequence class		γQ0	-	1,5																																																																																																																																																																																																																																																																																																																																					
Load safety factor variable loads as basis value		γQ	-	1,5																																																																																																																																																																																																																																																																																																																																					
Load safety factor variable loads considering CC		ψ0_LL	-	0,44																																																																																																																																																																																																																																																																																																																																					
Load combination factor for variable life load		ψ0_Wind	-	0																																																																																																																																																																																																																																																																																																																																					
Load combination factor for variable wind load				Life load																																																																																																																																																																																																																																																																																																																																					
Predominant load		γm.A	-	1,8																																																																																																																																																																																																																																																																																																																																					
Material safety factor float glass for predominant load		γm.V	-	1,2																																																																																																																																																																																																																																																																																																																																					
Material safety factor FTG		ke	-	1																																																																																																																																																																																																																																																																																																																																					
Factor for the edge quality of the glass panel		c	-	16																																																																																																																																																																																																																																																																																																																																					
Corrosion constant as a function		ksp	-	1																																																																																																																																																																																																																																																																																																																																					
Factor for the surface structure of float glass		kz	-	0,9																																																																																																																																																																																																																																																																																																																																					
Factor for the zone for FTG and edge zone		fg.k	N/mm ²	45																																																																																																																																																																																																																																																																																																																																					
Characteristic resistance of float glass		fb.k	N/mm ²	120																																																																																																																																																																																																																																																																																																																																					
Characteristic resistance of FTG		<table border="1"> <thead> <tr> <th>Type of load</th> <th>qk [kN/m]</th> <th colspan="2">Fk [kN]</th> <th>wk [kN/m²]</th> </tr> <tr> <th>Zone of load</th> <th>a</th> <th>a</th> <th>a+b</th> <th>a+b</th> </tr> </thead> <tbody> <tr> <td>Value of load</td> <td>0,3</td> <td>0,5</td> <td>0,2</td> <td>1</td> </tr> <tr> <td>Time of loading</td> <td>s</td> <td>60</td> <td>60</td> <td>86400</td> </tr> <tr> <td>Load area A</td> <td>mm²</td> <td>-</td> <td>40000</td> <td>40000</td> </tr> <tr> <td>Modification factor for the load time</td> <td>kmod</td> <td>-</td> <td>0,856</td> <td>0,856</td> </tr> <tr> <td>Surface effect factor</td> <td>ka</td> <td>-</td> <td>1,0</td> <td>1,076</td> </tr> <tr> <td>Design resistance of FTG</td> <td>f_{mt,ud}</td> <td>N/mm²</td> <td>77,65</td> <td>79,28</td> </tr> <tr> <td>Shear modulus interlayer</td> <td>Gint</td> <td>N/mm²</td> <td>0,75</td> <td>0,75</td> </tr> <tr> <td>Young modulus interlayer</td> <td>Eint</td> <td>N/mm²</td> <td>2,25</td> <td>2,25</td> </tr> <tr> <td>Coupling factor of the interlayer(s) at stress</td> <td>α_{st}</td> <td>-</td> <td>0,239</td> <td>0,152</td> </tr> <tr> <td>Coupling factor of the interlayer(s) at deformation</td> <td>α_{de}</td> <td>-</td> <td>0,451</td> <td>0,335</td> </tr> <tr> <td>Equivalent glass thickness ULS</td> <td>teq,ult</td> <td>mm</td> <td>12,82</td> <td>12,24</td> </tr> <tr> <td>Equivalent glass thickness SLS</td> <td>teq,serv</td> <td>mm</td> <td>12,91</td> <td>12,23</td> </tr> <tr> <td>Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk</td> <td>bcalc</td> <td>mm</td> <td>1000</td> <td>800</td> </tr> <tr> <td>Section moduls with equivalent thickness W=b*teq²/6</td> <td>Wel</td> <td>mm³</td> <td>27384</td> <td>19987</td> </tr> <tr> <td>Bending moment at fixation</td> <td>Med</td> <td>kNm</td> <td>0,405</td> <td>0,600</td> </tr> <tr> <td>Bending tensile stress at ULS</td> <td>σEd.ULS*</td> <td>N/mm²</td> <td>14,790</td> <td>34,52</td> </tr> <tr> <td>Maximum utilization ULS = σEd/f_{mt,ud}</td> <td>utilization</td> <td>-</td> <td>0,19</td> <td>0,44</td> </tr> <tr> <td>Minimum plate width based ULS-checks as maximum of Fk-loads</td> <td>bmin.ULS</td> <td>mm</td> <td>-</td> <td>348</td> </tr> <tr> <td>Maximum characteristic wind load wk for only wind loads based on ULS glass</td> <td>wk,max.glass</td> <td>kN/m²</td> <td>-</td> <td>-</td> </tr> <tr> <td>Calculation width glass panel - 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Total deformation at top of parapet = δg _{lass} + δprof	δtot.top	mm	7,6																																																																																																																																																																																																																																																																																																																																						
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δmax	mm	20																																																																																																																																																																																																																																																																																																																																						
Maximum utilization SLS	utilization	-	0,38																																																																																																																																																																																																																																																																																																																																						
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	800																																																																																																																																																																																																																																																																																																																																					
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	6,24	11,65																																																																																																																																																																																																																																																																																																																																					
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	36,7	-																																																																																																																																																																																																																																																																																																																																					
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,17	0,32																																																																																																																																																																																																																																																																																																																																					
Minimum plate width based on profile resistance	bmin.prof	mm	-	254																																																																																																																																																																																																																																																																																																																																					
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-																																																																																																																																																																																																																																																																																																																																					
Parapet System		DF88LM_E200																																																																																																																																																																																																																																																																																																																																							
Total height of the parapet		1000	mm																																																																																																																																																																																																																																																																																																																																						
Glass height		900	mm																																																																																																																																																																																																																																																																																																																																						
Glass thickness nominal		8	mm																																																																																																																																																																																																																																																																																																																																						
Interlayer		PVB	-																																																																																																																																																																																																																																																																																																																																						
Thickness interlayer		1,52	mm																																																																																																																																																																																																																																																																																																																																						
Load category		A1	-																																																																																																																																																																																																																																																																																																																																						
Load		<table border="1"> <thead> <tr> <th></th> <th>qk [kN/m]</th> <th colspan="2">Fk [kN]</th> <th>wk [kN/m²]</th> </tr> </thead> <tbody> <tr> <td>Maximum utilization glass at ULS</td> <td>ut.glass.ULS</td> <td>0,3</td> <td>0,5</td> <td>0,2</td> </tr> <tr> <td>Maximum utilization profile at ULS</td> <td>ut.profile.ULS</td> <td>0,17</td> <td>0,32</td> <td>0,13</td> </tr> <tr> <td>Maximum utilization residual capacity glass for linear load qk</td> <td>ut.residual</td> <td>0,39</td> <td>-</td> <td>-</td> </tr> <tr> <td>Maximum deformation glass at SLS for linear load qk</td> <td>def.glass.SLS</td> <td>5,8</td> <td>-</td> <td>-</td> </tr> <tr> <td>Maximum deformation glass + profile at SLS for linear load qk</td> <td>def.glass+prof.SLS</td> <td>7,6</td> <td>-</td> <td>-</td> </tr> <tr> <td>Maximum utilization glass + profile at SLS for linear load qk</td> <td>ut.glass+prof.SLS</td> <td>0,38</td> <td>-</td> <td>-</td> </tr> <tr> <td>Maximum characteristic wind load wk for only wind loads based on ULS glass + profile</td> <td>wk,max</td> <td>kN/m²</td> <td>-</td> <td>-</td> </tr> <tr> <td>Minimum plate width ULS glass</td> <td>bmin.glass.ULS</td> <td>mm</td> <td>348</td> <td>176</td> </tr> <tr> <td>Minimum plate width ULS profile</td> <td>bmin.profile.ULS</td> <td>mm</td> <td>254</td> <td>102</td> </tr> <tr> <td>Minimum plate width residual check</td> <td>bmin.glass.residual</td> <td>mm</td> <td>670</td> <td>-</td> </tr> <tr> <td>Minimum plate width overall</td> <td>bmin</td> <td>mm</td> <td>670</td> <td>-</td> </tr> </tbody> </table>					qk [kN/m]	Fk [kN]		wk [kN/m ²]	Maximum utilization glass at ULS	ut.glass.ULS	0,3	0,5	0,2	Maximum utilization profile at ULS	ut.profile.ULS	0,17	0,32	0,13	Maximum utilization residual capacity glass for linear load qk	ut.residual	0,39	-	-	Maximum deformation glass at SLS for linear load qk	def.glass.SLS	5,8	-	-	Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	7,6	-	-	Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	0,38	-	-	Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²	-	-	Minimum plate width ULS glass	bmin.glass.ULS	mm	348	176	Minimum plate width ULS profile	bmin.profile.ULS	mm	254	102	Minimum plate width residual check	bmin.glass.residual	mm	670	-	Minimum plate width overall	bmin	mm	670	-																																																																																																																																																																																																																																																																								
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NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88LM_E200			
Parapet System		Ltot	mm	1100		
Total height of the parapet		L1	mm	1000		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	12		
Vertical distance between top of profile and top support of glass into profile		L3	mm	70		
Vertical distance between top and bottom support of glass into profile		L4	mm	29,55		
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200		
Distance between fixations		tnom	mm	8		
Nominal glass thickness		tpl1	mm	7,7		
Glass thickness for calculation tp1 for inner plate at loading side		tpl2	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	PVB		
Type of interlayer		tv.i	mm	1,52		
Thickness of interlayer		ng	-	2		
Number of sheets of glass of laminated plate		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50		
Maximum temperature of glass panel at loading for SGP		Cat	-	A1		
Load category		CC	-	CC2		
Consequence class		KFI	-	1		
Multiplication factor for consequence class		γQ0	-	1,5		
Load safety factor variable loads as basis value		γQ	-	1,5		
Load safety factor variable loads considering CC		γ0 LL	-	0,4		
Load combination factor for variable life load		γ0 Wind	-	0		
Load combination factor for variable wind load		Predominant load				
Predominant load		γm.A	-	1,8		
Material safety factor float glass for predominant load		γm.V	-	1,2		
Material safety factor FTG		ke	-	1		
Factor for the edge quality of the glass panel		c	-	16		
Corrosion constant as a function		ksp	-	1		
Factor for the surface structure of float glass		kz	-	0,9		
Factor for the zone for FTG and edge zone		fg.k	N/mm ²	45		
Characteristic resistance of float glass		fb.k	N/mm ²	120		
Characteristic resistance of FTG		Type of load				
		Zone of load				
		Value of load				
		Time of loading				
		Load area A				
		qm	qk [kN/m]	Fk [kN]	wk [kN/m ²]	
		ka	a	a+b	a+b	
		fmd.ud	0,3	0,5	0,2	1
		Gint	60	4000	86400	5
		Eint	-	6000	4000	100000
		σEd	0,856	0,856	0,543	1,000
		σEd.ULS*	1,0	1,076	1,076	0,946
		σEd.res**	77,65	79,28	70,87	79,90
		τEd	0,75	0,75	0,28	0,96
		σEd	2,25	2,25	0,84	2,87
		σEd	0,266	0,172	0,072	0,475
		σEd	0,503	0,382	0,187	0,463
		teq.ult	12,98	12,39	11,60	13,96
		teq.serv	13,18	12,51	11,25	12,97
		bcalc	1000	900	900	1000
		Wel	28080	23009	20168	32492
		Med	0,450	0,675	0,270	0,750
		σEd.ULS*	16,026	33,74	15,40	26,55
		utilization	0,21	0,43	0,22	0,33
		bmin.ULS	-	383	196	-
		wk,max.glass	-	-	-	3,01
		bcalc	1000	Check if zone (a) or (a+b) decisive	0,180	-
		Med.res	0,300	0,450	0,180	-
		Wel.res	9882	(Ma/Mab)*(fmdud.ab/fmdud.a)=	-	-
		σEd.res**	33,395	2,23	-	-
		utilization	0,43	zone a decisive	-	-
		σglass.top	7,48	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-	-
		Ieq.serv	190875	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-	-
		kprof	21,3	-	-	-
		Fp.k	4,59	-	-	-
		Fp.k,max	24,5	-	-	-
		valid	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	-	-
		σprof	0,22	-	-	-
		σprof.top	2,1	-	-	-
		σtop	9,6	-	-	-
		σmax	20	-	-	-
		utilization	0,48	-	-	-
		bcalc	1000	900	900	1000
		Fp.Ed	6,88	11,55	4,62	12,27
		Fp.Rd	36,7	-	-	-
		utilization	0,19	0,31	0,13	0,33
		bmin.prof	-	283	113	-
		wk,max.profile	-	-	-	2,99
Parapet System		DF88LM_E200				
Total height of the parapet		1100	mm			
Glass height		1000	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load		qk [kN/m]				
Maximum utilization glass at ULS		Fk [kN]				
Maximum utilization profile at ULS		wk [kN/m ²]				
Maximum utilization residual capacity glass for linear load qk		ut.glass.ULS	0,3	0,5	0,2	
Maximum deformation glass at SLS for linear load qk		ut.profile.ULS	0,21	0,31	0,13	
Maximum deformation glass + profile at SLS for linear load qk		ut.residual	0,19			
Maximum utilization glass + profile at SLS for linear load qk		ut.glass.SLS	0,43			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		def.glass.SLS	7,5			
Minimum plate width ULS glass		def.glass+prof.SLS	9,6			
Minimum plate width ULS profile		ut.glass+prof.SLS	0,48			
Minimum plate width residual check		wk,max				2,99
Minimum plate width overall		bmin.glass.ULS		383	196	
		bmin.profile.ULS		283	113	
		bmin.glass.residual	800			
		bmin	800			

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System
 Total height of the parapet
 Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4
 Vertical distance between top of profile and top support of glass into profile
 Vertical distance between top and bottom support of glass into profile
 Vertical distance between bottom support of glass into profile and base ground
 Distance between fixations
 Nominal glass thickness
 Glass thickness for calculation tp1 for inner plate at loading side
 Glass thickness for calculation tp2 for middle and outer plate
 Type of interlayer
 Thickness of interlayer
 Number of sheets of glass of laminated plate
 Maximum temperature of glass panel at loading for PVB
 Maximum temperature of glass panel at loading for SGP
 Load category
 Consequence class
 Multiplication factor for consequence class
 Load safety factor variable loads as basis value
 Load safety factor variable loads considering CC
 Load combination factor for variable life load
 Load combination factor for variable wind load
 Predominant load
 Material safety factor float glass for predominant load
 Material safety factor FTG
 Factor for the edge quality of the glass panel
 Corrosion constant as a function
 Factor for the surface structure of float glass
 Factor for the zone for FTG and edge zone
 Characteristic resistance of float glass
 Characteristic resistance of FTG

Profile	DF88LM_E200
Ltot	mm 1200
L1	mm 1100
L2	mm 12
L3	mm 70
L4	mm 29,55
efix	mm 200
tnom	mm 8
tp1	mm 7,7
tp2	mm 7,7
Interlayer	- PVB
tv.i	mm 1,52
ng	- 2
Tg.pvb	°C 30
Tg.sgp	°C 50
Cat	- A1
CC	- CC2
KF1	- 1
γQ0	- 1,5
γQ	- 1,5
ψ0 LL	- 0,4
ψ0 Wind	- 0
	Life load
γm.A	- 1,8
γm.V	- 1,2
ke	- 1
c	- 16
ksp	- 1
kz	- 0,9
fg,k	N/mm ² 45
fb,k	N/mm ² 120

		qk [kN/m]	Fk [kN]		wk [kN/m ²]
		a	a	a+b	a+b
Zone of load		0,3	0,5	0,2	1
Value of load		60	60	86400	5
Time of loading	s				
Load area A	mm ²		40000	40000	1100000
Modification factor for the load time	kmod	0,856	0,856	0,543	1,000
Surface effect factor	ka	1,0	1,076	1,076	0,942
Design resistance of FTG	f _{mt,ud}	N/mm ² 77,65	79,28	70,87	79,81
Shear modulus interlayer	Gint	N/mm ² 0,75	0,75	0,28	0,96
Young modulus interlayer	Eint	N/mm ² 2,25	2,25	0,84	2,87
Coupling factor of the interlayer(s) at stress	ωσ	0,293	0,192	0,081	0,518
Coupling factor of the interlayer(s) at deformation	ωω	0,549	0,427	0,217	0,510
Equivalent glass thickness ULS	teq,ult	mm 13,13	12,52	11,68	14,12
Equivalent glass thickness SLS	teq,serv	mm 13,42	12,77	11,47	13,22
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm 1000	1000	1000	1000
Section moduls with equivalent thickness W=b*teq ² /6	Wel	mm ³ 28725	26123	22728	33250
Bending moment at fixation	Med	kNm 0,495	0,750	0,300	0,908
Bending tensile stress at ULS	σEd,ULS*	N/mm ² 17,233	33,02	15,18	31,39
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	0,22	0,42	0,21	0,39
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin,ULS	mm -	416	214	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max,glass	kN/m ² -	-	-	2,54
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm 1000	Check if zone (a) or (a+b) decisive		
Bending moment at fixation	Med,res	kNm 0,330	0,500	0,200	-
Section moduls with residual check	Wel,res	mm ³ 9882	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=		For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc	σEd,res**	N/mm ² 36,735	2,23		
Maximum utilization residual capacity based on bcalc	utilization	0,47	zone a decisive		
Deformation glass panel at top	δglass,top	mm 9,44	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Moment of inertia with equivalent thickness teq,serv	Ieq,serv	mm ⁴ 201480	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Linear profile stiffness	kprof	(kN/m)/mm 21,3			
Characteristic force at top support glass into profile	Fp,k	kN/m 5,01			
Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k,max	kN/m 24,5			
Validation of linear iteration	valid	- OK	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary		
Deformation top of profile based on numerical simulation of profile	δprof	mm 0,24			
Deformation top of parapet due to profile deformation/rotation - extrapolation	δprof,top	mm 2,5			
Total deformation at top of parapet = δglass + δprof	δtot,top	mm 12,0			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δmax	mm 20			
Maximum utilization SLS	utilization	0,60			
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm 1000	1000	1000	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp,Ed	kN/m 7,52	11,46	4,59	14,67
Maximum allowed design acting force based on numerical simulations of profiles	Fp,Rd	kN/m 36,7			
Maximum utilization aluminium profile for single loads qk and Fk	utilization	0,20	0,31	0,12	0,40
Minimum plate width based on profile resistance	bmin,prof	mm -	312	125	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max,profile	kN/m ² -	-	-	2,50
Parapet System	DF88LM_E200				
Total height of the parapet	1200	mm			
Glass height	1100	mm			
Glass thickness nominal	8	mm			
Interlayer	PVB	-			
Thickness interlayer	1,52	mm			
Load category	A1				
Load		qk [kN/m]	Fk [kN]		wk [kN/m ²]
Maximum utilization glass at ULS	ut.glass.ULS	0,3	0,5	0,2	
Maximum utilization profile at ULS	ut.profile.ULS	0,22	0,31	0,12	
Maximum utilization residual capacity glass for linear load qk	ut.residual	0,20			
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	0,47			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	9,4			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	12,0			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	0,60			2,50
Minimum plate width ULS glass	bmin.glass.ULS		416	214	
Minimum plate width ULS profile	bmin.profile.ULS		312	125	
Minimum plate width residual check	bmin.glass.residual	mm 880			
Minimum plate width overall	bmin	mm 880			

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System
 Total height of the parapet
 Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4
 Vertical distance between top of profile and top support of glass into profile
 Vertical distance between top and bottom support of glass into profile
 Vertical distance between bottom support of glass into profile and base ground
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 Nominal glass thickness
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 Type of interlayer
 Thickness of interlayer
 Number of sheets of glass of laminated plate
 Maximum temperature of glass panel at loading for PVB
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 Load category
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 Multiplication factor for consequence class
 Load safety factor variable loads as basis value
 Load safety factor variable loads considering CC
 Load combination factor for variable life load
 Load combination factor for variable wind load
 Predominant load
 Material safety factor float glass for predominant load
 Material safety factor FTG
 Factor for the edge quality of the glass panel
 Corrosion constant as a function
 Factor for the surface structure of float glass
 Factor for the zone for FTG and edge zone
 Characteristic resistance of float glass
 Characteristic resistance of FTG

Profile	DF88LM_E200
Ltot	mm 1300
L1	mm 1200
L2	mm 12
L3	mm 70
L4	mm 29,55
efix	mm 200
tnom	mm 8
tp1	mm 7,7
tp2	mm 7,7
Interlayer	- PVB
tv.i	mm 1,52
ng	- 2
Tg.pvb	°C 30
Tg.sgp	°C 50
Cat	- A1
CC	- CC2
KF1	- 1
γQ	- 1,5
γQ	- 1,5
ψ0 LL	- 0,4
ψ0 Wind	- 0
	Life load
γm.A	- 1,8
γm.V	- 1,2
ke	- 1
c	- 16
ksp	- 1
kz	- 0,9
fg.k	N/mm ² 45
fb.k	N/mm ² 120

		qk [kN/m]	Fk [kN]	wk [kN/m ²]
Type of load	a			
Zone of load	a			
Value of load	0,3	0,5	0,2	1
Time of loading	60	60	86400	5
Load area A	mm ²	40000	40000	1200000
Modification factor for the load time	kmood	0,856	0,856	0,543
Surface effect factor	ka	1,0	1,076	0,939
Design resistance of FTG	f _{mt,ud}	77,65	79,28	79,73
Shear modulus interlayer	Gint	N/mm ² 0,75	0,75	0,28
Young modulus interlayer	Eint	N/mm ² 2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress	α _s	0,319	0,211	0,091
Coupling factor of the interlayer(s) at deformatio	α _w	0,591	0,469	0,247
Equivalent glass thickness ULS	teq,ult	mm 13,26	12,65	11,76
Equivalent glass thickness SLS	teq,serv	mm 13,63	13,00	11,67
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm 1000	1100	1000
Section moduls with equivalent thickness W=b*teq ² /6	Wel	mm ³ 29320	29322	23551
Bending moment at fixation	Med	kNm 0,540	0,825	0,330
Bending tensile stress at ULS	σEd.ULS*	N/mm ² 18,417	32,36	14,97
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	0,24	0,41	0,21
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin.ULS	mm 449	232	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	2,18
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm 1000	Check if zone (a) or (a-b) decisive	-
Bending moment at fixation	Med,res	kNm 0,360	0,550	0,220
Section moduls with residual check	Wel,res	mm ³ 9882	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc	σEd,res**	N/mm ² 40,074	2,23	-
Maximum utilization residual capacity based on bcalc	utilization	0,52	zone a decisive	-
Deformation glass panel at top	δglass,top	mm 11,70	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-
Moment of inertia with equivalent thickness teq,serv	Ieq,serv	mm ⁴ 210997	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-
Linear profile stiffness	kprof	(kN/m)/mm 21,3	-	-
Characteristic force at top support glass into profile	Fp,k	kN/m 5,44	-	-
Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k,max	kN/m 24,5	-	-
Validation of linear iteration	valid	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	-
Deformation top of profile based on numerical simulation of profile	δprof	mm 0,26	-	-
Deformation top of parapet due to profile deformation/rotation - extrapolation	δprof,top	mm 3,0	-	-
Total deformation at top of parapet = δglass + δprofile	δtot,top	mm 14,7	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δmax	mm 20	-	-
Maximum utilization SLS	utilization	0,73	-	-
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm 1000	1100	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp,Ed	kN/m 8,16	11,40	4,56
Maximum allowed design acting force based on numerical simulations of profiles	Fp,Rd	kN/m 36,7	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	0,22	0,31	0,12
Minimum plate width based on profile resistance	bmin,prof	mm 342	137	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	2,12
Parapet System	DF88LM_E200			
Total height of the parapet	1300	mm		
Glass height	1200	mm		
Glass thickness nominal	8	mm		
Interlayer	-			
Thickness interlayer	1,52	mm		
Load category	A1			
Load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS	ut.glass.ULS	0,3	0,5	0,2
Maximum utilization profile at ULS	ut.profile.ULS	0,22	0,31	0,12
Maximum utilization residual capacity glass for linear load qk	ut.residual	0,52		
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	11,7		
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	14,7		
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	0,73		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²		2,12
Minimum plate width ULS glass	bmin.glass.ULS	mm	449	232
Minimum plate width ULS profile	bmin.profile.ULS	mm	342	137
Minimum plate width residual check	bmin.glass.residual	mm	980	
Minimum plate width overall	bmin	mm	980	

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

4.2.4 DF88LM_E400

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88LM_E400			
Parapet System		Ltot	mm	1000		
Total height of the parapet		L1	mm	900		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	12		
Vertical distance between top of profile and top support of glass into profile		L3	mm	70		
Vertical distance between top and bottom support of glass into profile		L4	mm	29,55		
Vertical distance between bottom support of glass into profile and base ground		efix	mm	400		
Distance between fixations		tnom	mm	8		
Nominal glass thickness		tp1	mm	7,7		
Glass thickness for calculation tp1 for inner plate at loading side		tp2	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		Interlayer		PVB		
Type of interlayer		tv,i	mm	1,52		
Thickness of interlayer		ng		2		
Number of sheets of glass of laminated plate		Tg,pvb	°C	30		
Maximum temperature of glass panel at loading for PVB		Tg,sgp	°C	50		
Maximum temperature of glass panel at loading for SGP		Cat		A1		
Load category		CC		CC2		
Consequence class		KF1		1		
Multiplication factor for consequence class		γ ₀		1,5		
Load safety factor variable loads as basis value		γ _Q		1,5		
Load safety factor variable loads considering CC		ψ ₀ LL		0,4		
Load combination factor for variable life load		ψ ₀ Wind		0		
Load combination factor for variable wind load				Life load		
Predominant load		ym,A		1,8		
Material safety factor float glass for predominant load		ym,V		1,2		
Material safety factor FTG		ke		1		
Factor for the edge quality of the glass panel		c		16		
Corrosion constant as a function		ksp		1		
Factor for the surface structure of float glass		kz		0,9		
Factor for the zone for FTG and edge zone		fg,k	N/mm ²	45		
Characteristic resistance of float glass		fb,k	N/mm ²	120		
Characteristic resistance of FTG						
		Type of load	qk [kN/m]	Fk [kN]		wk [kN/m ²]
		Zone of load	a	a	a+b	a+b
		Value of load	0,3	0,5	0,2	1
		Time of loading	s	60	86400	5
		Load area A	mm ²	40000	40000	900000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	77,65	79,28	80,00
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		ω _σ	-	0,239	0,152	0,063
Coupling factor of the interlayer(s) at deformation		ω _w	-	0,451	0,335	0,158
Equivalent glass thickness ULS		te _{q,ult}	mm	12,82	12,24	11,51
Equivalent glass thickness SLS		te _{q,serv}	mm	12,91	12,23	11,04
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	800	800
Section moduls with equivalent thickness W=b ² te _q ² /6		Wel	mm ³	27384	19987	17673
Bending moment at fixation		Med	kNm	0,405	0,600	0,240
Bending tensile stress at ULS		σEd,ULS*	N/mm ²	14,790	34,52	15,62
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,19	0,44	0,22
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin,ULS	mm	-	348	176
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max, glass	kN/m ²	-	-	3,62
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med,res	kNm	0,270	0,400	0,160
Section moduls with residual check		Wel,res	mm ³	9882	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})	
Bending tensile stress analytic based on bcalc		σEd,res**	N/mm ²	30,056	2,23	-
Maximum utilization residual capacity based on bcalc		utilization	-	0,39	zone a decisive	
Deformation glass panel at top		δ _{glass,top}	mm	5,81	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness te _{q,serv}		I _{eq,serv}	mm ⁴	179147	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	13,4		
Characteristic force at top support glass into profile		Fp,k	kN/m	4,16		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp,k,max	kN/m	13,4		
Validation of linear iteration		valid	-	OK	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Deformation top of parapet based on numerical simulation of profile		δ _{prof,top}	mm	0,31		
Deformation top of parapet due to profile deformation/rotation - extrapolation		δ _{rot,top}	mm	2,8		
Total deformation at top of parapet = δ _{glass} + δ _{profile}		δ _{tot,top}	mm	8,6		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δ _{max}	mm	20		
Maximum utilization SLS		utilization	-	0,43		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	800	800
Design acting force at top support glass into profile based on bmin for Fk		Fp,Ed	kN/m	6,24	11,65	4,66
Maximum allowed design acting force based on numerical simulations of profiles		Fp,Rd	kN/m	18,4	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,34	0,63	0,25
Minimum plate width based on profile resistance		bmin,prof	mm	-	508	203
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max,profile	kN/m ²	-	-	1,82
Parapet System		DF88LM_E400				
Total height of the parapet		1000	mm			
Glass height		900	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,19	0,5	0,2
Maximum utilization profile at ULS		ut.profile.ULS	-	0,34	0,63	0,25
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,39	-	-
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	-	5,8	-	-
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	8,6	-	-
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,43	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	1,82
Minimum plate width ULS glass		bmin.glass.ULS	mm	-	348	176
Minimum plate width ULS profile		bmin.profile.ULS	mm	-	508	203
Minimum plate width residual check		bmin.glass.residual	mm	-	670	-
Minimum plate width overall		bmin	mm	-	670	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88LM_E400			
Parapet System		Ltot	mm	1100		
Total height of the parapet		L1	mm	1000		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	12		
Vertical distance between top of profile and top support of glass into profile		L3	mm	70		
Vertical distance between top and bottom support of glass into profile		L4	mm	29,55		
Vertical distance between bottom support of glass into profile and base ground		efix	mm	400		
Distance between fixations		tnom	mm	8		
Nominal glass thickness		tpl1	mm	7,7		
Glass thickness for calculation tp1 for inner plate at loading side		tpl2	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	PVB		
Type of interlayer		tv.i	mm	1,52		
Thickness of interlayer		ng	-	2		
Number of sheets of glass of laminated plate		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50		
Maximum temperature of glass panel at loading for SGP		Cat	-	A1		
Load category		CC	-	CC2		
Consequence class		KF1	-	1		
Multiplication factor for consequence class		γQ0	-	1,5		
Load safety factor variable loads as basis value		γQ	-	1,5		
Load safety factor variable loads considering CC		ψ0 LL	-	0,4		
Load combination factor for variable life load		ψ0 Wind	-	0		
Load combination factor for variable wind load				Life load		
Predominant load		γm.A	-	1,8		
Material safety factor float glass for predominant load		γm.V	-	1,2		
Material safety factor FTG		ke	-	1		
Factor for the edge quality of the glass panel		c	-	16		
Corrosion constant as a function		ksp	-	1		
Factor for the surface structure of float glass		kz	-	0,9		
Factor for the zone for FTG and edge zone		fg.k	N/mm ²	45		
Characteristic resistance of float glass		fb.k	N/mm ²	120		
Characteristic resistance of FTG		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1000000
Modification factor for the load time		km0d	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		ωσ	-	0,266	0,172	0,072
Coupling factor of the interlayer(s) at deformation		ωω	-	0,503	0,382	0,187
Equivalent glass thickness ULS		teq.ult	mm	12,98	12,39	11,60
Equivalent glass thickness SLS		teq.serv	mm	13,18	12,51	11,25
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	900	900
Section moduls with equivalent thickness W=b*teq ² /6		Wel	mm ³	28080	23009	20168
Bending moment at fixation		Med	kNm	0,450	0,675	0,270
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	16,026	33,74	15,40
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,21	0,43	0,22
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	383	196
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	3,01
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med.res	kNm	0,300	0,450	0,180
Section moduls with residual check		Wel.res	mm ³	9882	(Ma/Mab)*(f _{mtud.ab} /f _{mtud.a})=	
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm ²	33,395	2,23	zone a decisive
Maximum utilization residual capacity based on bcalc		utilization	-	0,43		
Deformation glass panel at top		σglass.top	mm	7,48	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq.serv		Ieq.serv	mm ⁴	190875	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	13,4		
Characteristic force at top support glass into profile		Fp.k	kN/m	4,59		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k.max	kN/m	13,4		
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Deformation top of profile based on numerical simulation of profile		σprof	mm	0,34		
Deformation top of parapet due to profile deformation/rotation - extrapolation		σprof.top	mm	3,4		
Total deformation at top of parapet = σglass + σprof		σtot.top	mm	10,9		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		σmax	mm	20		
Maximum utilization SLS		utilization	-	0,54		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	900	900
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	6,88	11,55	4,62
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	18,4	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,37	0,63	0,25
Minimum plate width based on profile resistance		bmin.prof	mm	-	566	227
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	1,50
Parapet System		DF88LM_E400				
Total height of the parapet		1100	mm			
Glass height		1000	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-	qk [kN/m]	Fk [kN]	wk [kN/m ²]
Load				0,3	0,5	0,2
Maximum utilization glass at ULS		ut.glass.ULS	-	0,21		
Maximum utilization profile at ULS		ut.profile.ULS	-	0,37	0,63	0,25
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,43		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	-	7,5		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	10,9		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,54		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²			1,50
Minimum plate width ULS glass		bmin.glass.ULS	mm		383	196
Minimum plate width ULS profile		bmin.profile.ULS	mm		566	227
Minimum plate width residual check		bmin.glass.residual	mm	800		
Minimum plate width overall		bmin	mm	800		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF88LM_E400			
Total height of the parapet		Ltot	mm	1200		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1100		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,55		
Distance between fixations		efix	mm	400		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a-b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1100000
Modification factor for the load time		kmot	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		σσ	-	0,293	0,192	0,081
Coupling factor of the interlayer(s) at deformation		σω	-	0,549	0,427	0,217
Equivalent glass thickness ULS		teq.ult	mm	13,13	12,52	11,68
Equivalent glass thickness SLS		teq.serv	mm	13,42	12,77	11,47
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1000	1000
Section moduli with equivalent thickness W=b ² teq ² /6		W _{el}	mm ³	28725	26123	22728
Bending moment at fixation		Med	kNm	0,495	0,750	0,300
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	17,233	33,02	15,18
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,22	0,42	0,21
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	416	214
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	2,54
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med.res	kNm	0,330	0,500	0,200
Section moduli with residual check		W _{el.res}	mm ³	9882	(W _a /W _b) ² *(f _{mt,ud.ab} /f _{mt,ud.a})=	
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm ²	36,735	2,23	2,23
Maximum utilization residual capacity based on bcalc		utilization	-	0,47	zone a decisive	
Deformation glass panel at top		σ _{glass,top}	mm	9,44	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq.serv		I _{eq.serv}	mm ⁴	201480	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	13,4	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Characteristic force at top support glass into profile		Fp.k	kN/m	5,01		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k.max	kN/m	13,4		
Validation of linear iteration		valid	-	OK		
Deformation top of profile based on numerical simulation of profile		σ _{prof}	mm	0,37		
Deformation top of parapet due to profile deformation/rotation - extrapolation		σ _{prof,top}	mm	4,0		
Total deformation at top of parapet = σ _{glass} + σ _{profile}		σ _{tot,top}	mm	13,5		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		σ _{max}	mm	20		
Maximum utilization deformation		utilization	-	0,67		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	1000	1000
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	7,52	11,46	4,59
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	18,4	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,41	0,62	0,25
Minimum plate width based on profile resistance		bmin.prof	mm	-	625	250
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	1,25
Parapet System		DF88LM_E400				
Total height of the parapet		1200	mm			
Glass height		1100	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,22	-	-
Maximum utilization profile at ULS		ut.profile.ULS	-	0,41	0,62	0,25
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,47	-	-
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	-	9,4	-	-
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	13,5	-	-
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,67	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	1,25
Minimum plate width ULS glass		bmin.glass.ULS	mm	-	416	214
Minimum plate width ULS profile		bmin.profile.ULS	mm	-	625	250
Minimum plate width residual check		bmin.glass.residual	mm	880	-	-
Minimum plate width overall		bmin	mm	880	-	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System
 Total height of the parapet
 Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4
 Vertical distance between top of profile and top support of glass into profile
 Vertical distance between top and bottom support of glass into profile
 Vertical distance between bottom support of glass into profile and base ground
 Distance between fixations
 Nominal glass thickness
 Glass thickness for calculation tp1 for inner plate at loading side
 Glass thickness for calculation tp2 for middle and outer plate
 Type of interlayer
 Thickness of interlayer
 Number of sheets of glass of laminated plate
 Maximum temperature of glass panel at loading for PVB
 Maximum temperature of glass panel at loading for SGP
 Load category
 Consequence class
 Multiplication factor for consequence class
 Load safety factor variable loads as basis value
 Load safety factor variable loads considering CC
 Load combination factor for variable life load
 Load combination factor for variable wind load
 Predominant load
 Material safety factor float glass for predominant load
 Material safety factor FTG
 Factor for the edge quality of the glass panel
 Corrosion constant as a function
 Factor for the surface structure of float glass
 Factor for the zone for FTG and edge zone
 Characteristic resistance of float glass
 Characteristic resistance of FTG

Profile	DF88LM_E400
Ltot	mm 1300
L1	mm 1200
L2	mm 12
L3	mm 70
L4	mm 29,55
efix	mm 400
tnom	mm 8
tp1	mm 7,7
tp2	mm 7,7
Interlayer	- PVB
tv,i	mm 1,52
ng	- 2
Tg.pvb	°C 30
Tg.sgp	°C 50
Cat	- A1
CC	- CC2
KF1	- 1
γQ0	- 1,5
γQ	- 1,5
ψ0 LL	- 0,4
ψ0 Wind	- 0
	Life load
γm.A	- 1,8
γm.V	- 1,2
ke	- 1
c	- 16
ksp	- 1
kz	- 0,9
fg,k	N/mm ² 45
fb,k	N/mm ² 120

		qk [kN/m]	Fk [kN]	wk [kN/m ²]
	Type of load	a	a+b	a+b
	Zone of load	0,3	0,5	0,2
	Value of load	60	86400	5
	Time of loading	-	40000	1200000
	Load area A	-	40000	1200000
	Modification factor for the load time	0,856	0,856	1,000
	Surface effect factor	1,0	1,076	0,939
	Design resistance of FTG	77,65	79,28	79,73
	Shear modulus interlayer	0,75	0,75	0,96
	Young modulus interlayer	2,25	2,25	2,87
	Coupling factor of the interlayer(s) at stress	0,319	0,211	0,091
	Coupling factor of the interlayer(s) at deformatio	0,591	0,469	0,247
	Equivalent glass thickness ULS	13,26	12,65	14,26
	Equivalent glass thickness SLS	13,63	13,00	13,44
ULS Glas	Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	1000	1100
	Section moduls with equivalent thickness W=b*teq ² /6	Wel	29320	29322
	Bending moment at fixation	Med	0,540	0,825
	Bending tensile stress at ULS	σEd.ULS*	18,417	32,36
	Maximum utilization ULS = σEd/fmt.ud	utilization	0,24	0,41
Residual load capacity	Minimum plate width based ULS-checks as maximum of Fk-loads	bmin.ULS	449	232
	Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	-	2,18
	Calculation width glass panel - for Fk based on Mepla calculation	bcalc	1000	1100
	Bending moment at fixation	Med.res	0,360	0,550
	Section moduls with residual check	Wel.res	9882	9882
SLS	Bending tensile stress analytic based on bcalc	σEd.res**	40,074	2,23
	Maximum utilization residual capacity based on bcalc	utilization	0,52	zone a decisive
	Deformation glass panel at top	σglass.top	11,70	* x 1,15 for wind and Fk to account for difference between constant
	Moment of inertia with equivalent thickness teq.serv	Ieq.serv	210997	tension and real tension distribution acc. to comparative Mepla-calculation
	Linear profile stiffness	kprof	13,4	** x1,1 to account for difference between constant tension and real tension
	Characteristic force at top support glass into profile	Fp,k	5,44	distribution acc. to comparative Mepla-calculation
	Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k.max	13,4	
	Validation of linear iteration	valid	OK	Note: If linear automatic iteration is not valid, manual
	Deformation top of profile based on numerical simulation of profile	σprof	0,41	iteration in the load deformation curves of the single profiles is necessary
	Deformation top of parapet due to profile deformation/rotation - extrapolation	σprof.top	4,7	
ULS Profile	Total deformation at top of parapet = σglass + σprofile	σtot.top	16,4	
	Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	σmax	20	
	Maximum utilization SLS	utilization	0,82	
	Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	1000	1100
	Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	8,16	11,40
SUMMARY	Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	18,4	4,56
	Maximum utilization aluminium profile for single loads qk and Fk	utilization	0,44	0,62
	Minimum plate width based on profile resistance	bmin.prof	683	273
	Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	-	1,06
	Parapet System	DF88LM_E400		
Total height of the parapet	1300			
Glass height	1200			
Glass thickness nominal	8			
Interlayer	PVB			
Thickness interlayer	1,52			
Load category	A1			
Load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS	ut.glass.ULS	0,24	0,5	0,2
Maximum utilization profile at ULS	ut.profile.ULS	0,44	0,62	0,25
Maximum utilization residual capacity glass for linear load qk	ut.residual	0,52		
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	11,7		
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	16,4		
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	0,82		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max			1,06
Minimum plate width ULS glass	bmin.glass.ULS		449	232
Minimum plate width ULS profile	bmin.profile.ULS		683	273
Minimum plate width residual check	bmin.glass.residual	980		
Minimum plate width overall	bmin	980		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

4.2.5 DF88FR_E200

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88FR_E200			
Parapet System						
Total height of the parapet	Ltot	mm	1000			
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	900			
Vertical distance between top of profile and top support of glass into profile	L2	mm	12			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	29,5			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	7,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	7,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	A1			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,4			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load		-	Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm²	45			
Characteristic resistance of FTG	fb.k	N/mm²	120			
Type of load			qk [kN/m]	Fk [kN]		wk [kN/m²]
Zone of load		a	0,3	0,5	a+b	a+b
Value of load			60	60	86400	5
Time of loading	s		60	60	40000	90000
Load area A	mm²		-	-	-	-
Modification factor for the load time	km0d	-	0,856	0,856	0,543	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,950
Design resistance of FTG	f _{mt,ud}	N/mm²	77,65	79,28	70,87	80,00
Shear modulus interlayer	τ _{int}	N/mm²	0,75	0,75	0,28	0,96
Young modulus interlayer	E _{int}	N/mm²	2,25	2,25	0,84	2,87
Coupling factor of the interlayer(s) at stress	α _σ	-	0,239	0,152	0,063	0,428
Coupling factor of the interlayer(s) at deformation	α _w	-	0,451	0,335	0,158	0,411
Equivalent glass thickness ULS	teq.ult	mm	12,82	12,24	11,51	13,77
Equivalent glass thickness SLS	teq.serv	mm	12,91	12,23	11,04	12,68
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	800	800	1000
Section moduli with equivalent thickness W=b*teq²/6	Wel	mm³	27384	19987	17673	31616
Bending moment at fixation	Med	kNm	0,405	0,600	0,240	0,608
Bending tensile stress at ULS	σEd.ULS*	N/mm²	14,790	34,52	15,62	22,10
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	-	0,19	0,44	0,22	0,28
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin.ULS	mm	-	348	176	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m²	-	-	-	3,62
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a+b) decisive		
Bending moment at fixation	Med.res	kNm	0,270	0,400	0,160	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Section moduli with residual check	Wel.res	mm³	9882	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=		
Bending tensile stress analytic based on bcalc	σEd.res**	N/mm²	30,056	2,23	zone a decisive	
Maximum utilization residual capacity based on bcalc	utilization	-	0,39	zone a decisive		
Deformation glass panel at top	δ _{glass,top}	mm	5,81	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Moment of inertia with equivalent thickness teq.serv	I _{eq.serv}	mm⁴	179147	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Linear profile stiffness	k _{prof}	(kN/m)/mm	15,5	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary		
Characteristic force at top support glass into profile	Fp,k	kN/m	4,16			
Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k,max	kN/m	26,8			
Validation of linear iteration	v _{allid}		OK			
Deformation top of profile based on numerical simulation of profile	δ _{prof}	mm	0,27			
Deformation top of parapet due to profile deformation/rotation - extrapolation	δ _{prof,top}	mm	2,4			
Total deformation at top of parapet = δ _{glass} + δ _{prof}	δ _{tot,top}	mm	8,2			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δ _{max}	mm	20			
Maximum utilization SLS	utilization	-	0,41			
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	800	800	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp,Ed	kN/m	6,24	11,65	4,66	10,08
Maximum allowed design acting force based on numerical simulations of profiles	Fp,Rd	kN/m	43,6	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,14	0,27	0,11	0,23
Minimum plate width based on profile resistance	bmin.prof	mm	-	214	86	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m²	-	-	-	4,32
Parapet System	DF88FR_E200					
Total height of the parapet		1000	mm			
Glass height		900	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load			qk [kN/m]	Fk [kN]		wk [kN/m²]
Maximum utilization glass at ULS	ut.glass.ULS	-	0,19	0,5	0,2	
Maximum utilization profile at ULS	ut.profile.ULS	-	0,14	0,27	0,11	
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,39			
Maximum deformation glass at SLS for linear load qk	def.glass.SLS		5,8			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	8,2			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,41			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m²				3,62
Minimum plate width ULS glass	bmin.glass.ULS	mm		348	176	
Minimum plate width ULS profile	bmin.profile.ULS	mm		214	86	
Minimum plate width residual check	bmin.glass.residual	mm	670			
Minimum plate width overall	bmin	mm	670			

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System
 Total height of the parapet
 Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4
 Vertical distance between top of profile and top support of glass into profile
 Vertical distance between top and bottom support of glass into profile
 Vertical distance between bottom support of glass into profile and base ground
 Distance between fixations
 Nominal glass thickness
 Glass thickness for calculation tp1 for inner plate at loading side
 Glass thickness for calculation tp2 for middle and outer plate
 Type of interlayer
 Thickness of interlayer
 Number of sheets of glass of laminated plate
 Maximum temperature of glass panel at loading for PVB
 Maximum temperature of glass panel at loading for SGP
 Load category
 Consequence class
 Multiplication factor for consequence class
 Load safety factor variable loads as basis value
 Load safety factor variable loads considering CC
 Load combination factor for variable life load
 Load combination factor for variable wind load
 Predominant load
 Material safety factor float glass for predominant load
 Material safety factor FTG
 Factor for the edge quality of the glass panel
 Corrosion constant as a function
 Factor for the surface structure of float glass
 Factor for the zone for FTG and edge zone
 Characteristic resistance of float glass
 Characteristic resistance of FTG

Profile	DF88FR_E200
Ltot	mm 1100
L1	mm 1000
L2	mm 12
L3	mm 70
L4	mm 29,5
efix	mm 200
tnom	mm 8
tp1	mm 7,7
tp2	mm 7,7
Interlayer	- PVB
tv.i	mm 1,52
ng	- 2
Tg.pvb	°C 30
Tg.sgp	°C 50
Cat	- A1
CC	- CC2
KF1	- 1
γQ0	- 1,5
γQ	- 1,5
ψ0 LL	- 0,4
ψ0 Wind	- 0
	Life load
γm.A	- 1,8
γm.V	- 1,2
ke	- 1
c	- 16
ksp	- 1
kz	- 0,9
fg,k	N/mm ² 45
fb,k	N/mm ² 120

		qk [kN/m]	Fk [kN]	wk [kN/m ²]
Type of load	a	a	a+b	a+b
Zone of load	0,3	0,5	0,2	1
Value of load	60	60	86400	5
Time of loading	s	-	-	1000000
Load area A	mm ²	40000	40000	1000000
Modification factor for the load time	km0d	0,856	0,856	1,000
Surface effect factor	ka	1,0	1,076	0,946
Design resistance of FTG	f_{mt,ud}	77,65	79,28	79,90
Shear modulus interlayer	Gint	N/mm ² 0,75	0,75	0,96
Young modulus interlayer	Eint	N/mm ² 2,25	2,25	2,87
Coupling factor of the interlayer(s) at stress	ωσ	0,266	0,172	0,475
Coupling factor of the interlayer(s) at deformation	ωω	0,503	0,382	0,463
Equivalent glass thickness ULS	teq.ult	mm 12,98	12,39	11,60
Equivalent glass thickness SLS	teq.serv	mm 13,18	12,51	11,25
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm 1000	900	1000
Section moduls with equivalent thickness W=b*teq ² /6	Wet	mm ³ 28080	23009	20168
Bending moment at fixation	Med	kNm 0,450	0,675	0,270
Bending tensile stress at ULS	σEd.ULS*	N/mm ² 16,026	33,74	15,40
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	0,21	0,43	0,33
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin.ULS	mm -	383	196
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ² -	-	3,01
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm 1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation	Med.res	kNm 0,300	0,450	0,180
Section moduls with residual check	Wet.res	mm ³ 9882	(Ma/Mab)*(f _{mtud.ab} /f _{mtud.a})=	
Bending tensile stress analytic based on bcalc	σEd.res**	N/mm ² 33,395	2,23	zone a decisive
Maximum utilization residual capacity based on bcalc	utilization	0,43	zone a decisive	
Deformation glass panel at top	σglass.top	mm 7,48	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq.serv	Ieq.serv	mm ⁴ 190875	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness	kprof	(kN/m)/mm 15,5		
Characteristic force at top support glass into profile	Fp,k	kN/m 4,59		
Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k.max	kN/m 26,8		
Validation of linear iteration	valid	- OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Deformation top of profile based on numerical simulation of profile	σprof	mm 0,30		
Deformation top of parapet due to profile deformation/rotation - extrapolation	σprof.top	mm 2,9		
Total deformation at top of parapet = σglass + σprofile	σtot.top	mm 10,4		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	σmax	mm 20		
Maximum utilization SLS	utilization	0,52	900	1000
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm 1000	900	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m 6,88	11,55	4,62
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m 43,6	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	0,16	0,27	0,11
Minimum plate width based on profile resistance	bmin.prof	mm -	239	95
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ² -	-	3,55
SUMMARY	DF88FR_E200			
Parapet System	1100	mm		
Total height of the parapet	1000	mm		
Glass height	8	mm		
Glass thickness nominal	PVB	-		
Interlayer	1,52	mm		
Thickness interlayer	A1	-	qk [kN/m]	Fk [kN]
Load category	Load	0,3	0,5	0,2
Load	ut.glass.ULS	0,21		
Maximum utilization glass at ULS	ut.profile.ULS	0,16	0,27	0,11
Maximum utilization profile at ULS	ut.residual	0,43		
Maximum utilization residual capacity glass for linear load qk	def.glass.SLS	7,5		
Maximum deformation glass at SLS for linear load qk	def.glass+prof.SLS	10,4		
Maximum deformation glass + profile at SLS for linear load qk	ut.glass+prof.SLS	0,52		
Maximum utilization glass + profile at SLS for linear load qk	wk,max			3,01
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	bmin.glass.ULS		383	196
Minimum plate width ULS glass	bmin.profile.ULS		239	95
Minimum plate width ULS profile	bmin.glass.residual	800		
Minimum plate width residual check	bmin	800		
Minimum plate width overall				

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88FR_E200			
Parapet System						
Total height of the parapet		Ltot	mm	1200		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1100		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,5		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv,i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg,k	N/mm ²	45		
Characteristic resistance of FTG		fb,k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1100000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		φ _σ	-	0,293	0,192	0,081
Coupling factor of the interlayer(s) at deformation		φ _w	-	0,549	0,427	0,217
Equivalent glass thickness ULS		teq,ult	mm	13,13	12,52	11,68
Equivalent glass thickness SLS		teq,serv	mm	13,42	12,77	11,47
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1000	1000
Section moduls with equivalent thickness W=b*teq ² /6		Wel	mm ³	28725	26123	22728
Bending moment at fixation		Med	kNm	0,495	0,750	0,300
Bending tensile stress at ULS		σEd,ULS*	N/mm ²	17,233	33,02	15,18
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,22	0,42	0,21
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin,ULS	mm	-	416	214
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max,ULS	kN/m ²	-	-	2,54
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med,res	kNm	0,330	0,500	0,200
Section moduls with residual check		Wel,res	mm ³	9882	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=	
Bending tensile stress analytic based on bcalc		σEd,res**	N/mm ²	36,735	2,23	zone a decisive
Maximum utilization residual capacity based on bcalc		utilization	-	0,47		
Deformation glass panel at top		δ _{glass,top}	mm	9,44	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq,serv		I _{eq,serv}	mm ⁴	201480	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		k _{prof}	(kN/m)/mm	15,5		
Characteristic force at top support glass into profile		Fp,k	kN/m	5,01		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp,k,max	kN/m	26,8		
Validation of linear iteration			valid	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Defomation top of profile based on numerical simulation of profile		δ _{prof}	mm	0,32		
Defomation top of parapet due to profile deformation/rotation - extrapolation		δ _{prof,top}	mm	3,5		
Total deformation at top of parapet = δ _{glass} + δ _{profile}		δ _{tot,top}	mm	12,9		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		δ _{max}	mm	20		
Maximum utilization SLS		utilization	-	0,65		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	1000	1000
Design acting force at top support glass into profile based on bmin for Fk		Fp,Ed	kNm	7,52	11,46	4,59
Maximum allowed design acting force based on numerical simulations of profiles		Fp,Rd	kN/m	43,6	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,17	0,26	0,11
Minimum plate width based on profile resistance		bmin,prof	mm	-	263	105
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max,profile	kN/m ²	-	-	2,97
Parapet System		DF88FR_E200				
Total height of the parapet		1200	mm			
Glass height		1100	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-	qk [kN/m]	Fk [kN]	wk [kN/m ²]
Load				0,3	0,5	0,2
Maximum utilization glass at ULS		ut.glass,ULS	-	0,22		
Maximum utilization profile at ULS		ut.profile,ULS	-	0,17	0,26	0,11
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,47		
Maximum deformation glass at SLS for linear load qk		def.glass,SLS	mm	9,4		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof,SLS	mm	12,9		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof,SLS	-	0,65		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	2,54
Minimum plate width ULS glass		bmin.glass,ULS	mm	-	416	214
Minimum plate width ULS profile		bmin.profile,ULS	mm	-	263	105
Minimum plate width residual check		bmin.glass.residual	mm	880		
Minimum plate width overall		bmin	mm	880		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88FR_E200			
Parapet System						
Total height of the parapet		Ltot	mm	1300		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1200		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,5		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv,i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1200000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		fmt.ud	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		ασ	-	0,319	0,211	0,091
Coupling factor of the interlayer(s) at deformation		αw	-	0,591	0,469	0,247
Equivalent glass thickness ULS		teq.ult	mm	13,26	12,65	11,76
Equivalent glass thickness SLS		teq.serv	mm	13,63	13,00	11,67
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1100	1100
Section moduls with equivalent thickness W=b ² teq ² /6		WeL	mm ³	29320	29322	25351
Bending moment at fixation		Med	kNm	0,540	0,825	0,330
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	18,417	32,36	14,97
Maximum utilization ULS = σEd/fmt.ud		utilization	-	0,24	0,41	0,21
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	449	232
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	2,18
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med.res	kNm	0,360	0,550	0,220
Section moduls with residual check		WeL.res	mm ³	9882	(Ma/Mab)*(fmt.ud.ab/fmt.ud.a)=	
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm ²	40,074	2,23	zone a decisive
Maximum utilization residual capacity based on bcalc		utilization	-	0,52		
Deformation glass panel at top		σglass.top	mm	11,70	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq.serv		Ieq.serv	mm ⁴	210997	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	15,5		
Characteristic force at top support glass into profile		Fp.k	kN/m	5,44		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k.max	kN/m	26,8		
Validation of linear iteration		valid	-	OK	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Defomation top of profile based on numerical simulation of profile		σprof	mm	0,35		
Defomation top of parapet due to profile deformation/rotation - extrapolation		σprof.top	mm	4,1		
Total deformation at top of parapet = σglass + σprofile		σtot.top	mm	15,8		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		σmax	mm	20		
Maximum utilization SLS		utilization	-	0,79		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	1100	1100
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	8,16	11,40	4,56
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	43,6	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,19	0,26	0,10
Minimum plate width based on profile resistance		bmin.prof	mm	-	288	115
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	2,52
Parapet System		DF88FR_E200				
Total height of the parapet		1300	mm			
Glass height		1200	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,24	0,5	0,2
Maximum utilization profile at ULS		ut.profile.ULS	-	0,19	0,26	0,10
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,52		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	11,7		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	15,8		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,79		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	2,18
Minimum plate width ULS glass		bmin.glass.ULS	mm	-	449	232
Minimum plate width ULS profile		bmin.profile.ULS	mm	-	288	115
Minimum plate width residual check		bmin.glass.residual	mm	980		
Minimum plate width overall		bmin	mm	980		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

4.2.6 DF88FR_E400

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88FR_E400			
Parapet System						
Total height of the parapet		Ltot	mm	1000		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	900		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,5		
Distance between fixations		efix	mm	400		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer		PVB		
Thickness of interlayer		tv.1	mm	1,52		
Number of sheets of glass of laminated plate		ng		2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat		A1		
Consequence class		CC		CC2		
Multiplication factor for consequence class		KF1		1		
Load safety factor variable loads as basis value		γQ0		1,5		
Load safety factor variable loads considering CC		γQ		1,5		
Load combination factor for variable life load		ψ0 LL		0,4		
Load combination factor for variable wind load		ψ0 Wind		0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A		1,8		
Material safety factor FTG		γm.V		1,2		
Factor for the edge quality of the glass panel		ke		1		
Corrosion constant as a function		c		16		
Factor for the surface structure of float glass		ksp		1		
Factor for the zone for FTG and edge zone		kz		0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						900000
Modification factor for the load time		kmod		0,856	0,856	0,543
Surface effect factor		ka		1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		α _σ		0,239	0,152	0,063
Coupling factor of the interlayer(s) at deformation		α _w		0,451	0,335	0,158
Equivalent glass thickness ULS		teq,uls	mm	12,82	12,24	11,51
Equivalent glass thickness SLS		teq,serv	mm	12,91	12,23	11,04
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	800	800
Section moduls with equivalent thickness W=b ³ /teq ² /6		W _{el}	mm ³	27384	19987	17673
Bending moment at fixation		Med	kNm	0,405	0,600	0,240
Bending tensile stress at ULS		σ _{Ed,ULS}	N/mm ²	14,790	34,52	15,62
Maximum utilization ULS = σ _{Ed} /f _{mt,ud}		utilization		0,19	0,44	0,22
Minimum plate width based ULS-checks as maximum of Fk-loads		b _{min,ULS}	mm	-	348	176
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	3,62
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med,res	kNm	0,270	0,400	0,160
Section moduls with residual check		W _{el,res}	mm ³	9882	(Ma/Mab)*(f _{mtud,ab} /f _{mtud,a})=	
Bending tensile stress analytic based on bcalc		σ _{Ed,res} **	N/mm ²	30,056	2,23	zone a decisive
Maximum utilization residual capacity based on bcalc		utilization		0,39	zone a decisive	
Deformation glass panel at top		δ _{glass,top}	mm	5,81	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq,serv		I _{eq,serv}	mm ⁴	179147	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		k _{prof}	(kN/m)/mm	9,1		
Characteristic force at top support glass into profile		F _{p,k}	kN/m	4,16		
Maximum char. force at top support glass/profile at end of linear stiffness		F _{p,k,max}	kN/m	14,5		
Validation of linear iteration		valid		OK	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Deformation top of profile based on numerical simulation of profile		δ _{prof}	mm	0,46		
Deformation top of parapet due to profile deformation/rotation - extrapolation		δ _{prof,top}	mm	4,1		
Total deformation at top of parapet = δ _{glass} + δ _{prof}		δ _{tot,top}	mm	9,9		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A:1.4.3 (7)		δ _{max}	mm	20		
Maximum utilization SLS		utilization		0,49		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	800	1000
Design acting force at top support glass into profile based on bmin for Fk		F _{p,Ed}	kN/m	6,24	11,65	4,66
Maximum allowed design acting force based on numerical simulations of profiles		F _{p,Rd}	kN/m	21,8	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization		0,29	0,54	0,21
Minimum plate width based on profile resistance		b _{min,prof}	mm	-	428	171
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	2,16
Parapet System		DF88FR_E400				
Total height of the parapet		1000	mm			
Glass height		900	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB				
Thickness interlayer		1,52	mm			
Load category		A1				
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS		0,3	0,5	0,2
Maximum utilization profile at ULS		ut.profile.ULS		0,29	0,54	0,21
Maximum utilization residual capacity glass for linear load qk		ut.residual		0,39	-	-
Maximum deformation glass at SLS for linear load qk		def.glass.SLS		5,8	-	-
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	9,9	-	-
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS		0,49	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	2,16
Minimum plate width ULS glass		b _{min.glass.ULS}	mm	-	348	176
Minimum plate width ULS profile		b _{min.profile.ULS}	mm	-	428	171
Minimum plate width residual check		b _{min.glass.residual}	mm	670	-	-
Minimum plate width overall		b _{min}	mm	670	-	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF88FR_E400			
Total height of the parapet		Ltot	mm	1100		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1000		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,5		
Distance between fixations		efix	mm	400		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv,i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg,pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg,sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm,A	-	1,8		
Material safety factor FTG		γm,V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg,k	N/mm²	45		
Characteristic resistance of FTG		fb,k	N/mm²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m²]
		Zone of load		a	a+b	a-b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm²	-	40000	40000
						1000000
Modification factor for the load time		kimod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		ωσ	-	0,266	0,172	0,072
Coupling factor of the interlayer(s) at deformation		ωω	-	0,503	0,382	0,187
Equivalent glass thickness ULS		teq,ult	mm	12,98	12,39	11,60
Equivalent glass thickness SLS		teq,serv	mm	13,18	12,51	11,25
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	900	900
Section modulus with equivalent thickness W=b*teq²/6		W _{el}	mm³	28080	23009	20168
Bending moment at fixation		Med	kNm	0,450	0,675	0,270
Bending tensile stress at ULS		σEd,ULS*	N/mm²	16,026	33,74	15,40
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,21	0,43	0,22
Minimum plate width based ULS-checks as maximum of Fk-loads		b _{min,ULS}	mm	-	383	196
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max,glass	kN/m²	-	-	3,01
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med,res	kNm	0,300	0,450	0,180
Section modulus with residual check		W _{el,res}	mm³	9882	(W _a /W _b) * (f _{mt,ud,ab} /f _{mt,ud,a}) =	
Bending tensile stress analytic based on bcalc		σEd,res**	N/mm²	33,395	2,23	zone a decisive
Maximum utilization residual capacity based on bcalc		utilization	-	0,43		
Deformation glass panel at top		σ _{glass,top}	mm	7,48	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq,serv		I _{eq,serv}	mm ⁴	190875	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	9,1		
Characteristic force at top support glass into profile		Fp,k	kN/m	4,59		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp,k,max	kN/m	14,5		
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Deformation top of profile based on numerical simulation of profile		σ _{prof}	mm	0,50		
Deformation top of parapet due to profile deformation/rotation - extrapolation		σ _{prof,top}	mm	5,0		
Total deformation at top of parapet = σ _{glass} + σ _{profile}		σ _{tot,top}	mm	12,4		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		σ _{max}	mm	20		
Maximum utilization SLS		utilization	-	0,62		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	900	900
Design acting force at top support glass into profile based on bmin for Fk		Fp,Ed	kN/m	6,88	11,55	4,62
Maximum allowed design acting force based on numerical simulations of profiles		Fp,Rd	kN/m	21,8	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,32	0,53	0,21
Minimum plate width based on profile resistance		b _{min,prof}	mm	-	477	191
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max,profile	kN/m²	-	-	1,78
Parapet System		DF88FR_E400				
Total height of the parapet		1100	mm			
Glass height		1000	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,21	-	-
Maximum utilization profile at ULS		ut.profile.ULS	-	0,32	0,53	0,21
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,43	-	-
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	-	7,5	-	-
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	12,4	-	-
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,62	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m²	-	-	1,78
Minimum plate width ULS glass		b _{min,glass.ULS}	mm	-	383	196
Minimum plate width ULS profile		b _{min,profile.ULS}	mm	-	477	191
Minimum plate width residual check		b _{min,glass.residual}	mm	800	-	-
Minimum plate width overall		b _{min}	mm	800	-	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System
 Total height of the parapet
 Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4
 Vertical distance between top of profile and top support of glass into profile
 Vertical distance between top and bottom support of glass into profile
 Vertical distance between bottom support of glass into profile and base ground
 Distance between fixations
 Nominal glass thickness
 Glass thickness for calculation tp1 for inner plate at loading side
 Glass thickness for calculation tp2 for middle and outer plate
 Type of interlayer
 Thickness of interlayer
 Number of sheets of glass of laminated plate
 Maximum temperature of glass panel at loading for PVB
 Maximum temperature of glass panel at loading for SGP
 Load category
 Consequence class
 Multiplication factor for consequence class
 Load safety factor variable loads as basis value
 Load safety factor variable loads considering CC
 Load combination factor for variable life load
 Load combination factor for variable wind load
 Predominant load
 Material safety factor float glass for predominant load
 Material safety factor FTG
 Factor for the edge quality of the glass panel
 Corrosion constant as a function
 Factor for the surface structure of float glass
 Factor for the zone for FTG and edge zone
 Characteristic resistance of float glass
 Characteristic resistance of FTG

Profile	DF88FR_E400
Ltot	mm 1200
L1	mm 1100
L2	mm 12
L3	mm 70
L4	mm 29,5
efix	mm 400
tnom	mm 8
tp1	mm 7,7
tp2	mm 7,7
Interlayer	- PVB
tv.i	mm 1,52
ng	- 2
Tg.pvb	°C 30
Tg.sgp	°C 50
Cat	- A1
CC	- CC2
KF1	- 1
γQ0	- 1,5
γQ	- 1,5
ψ0 LL	- 0,4
ψ0 Wind	- 0
	Life load
γm.A	- 1,8
γm.V	- 1,2
ke	- 1
c	- 16
ksp	- 1
kz	- 0,9
fg,k	N/mm ² 45
fb,k	N/mm ² 120

Type of load	qk [kN/m]	Fk [kN]	wk [kN/m ²]
Zone of load	a	a+b	a+b
Value of load	0,3	0,5	0,2
Time of loading	60	60	86400
Load area A	-	40000	40000
			1100000
Modification factor for the load time	kmod	0,856	0,856
Surface effect factor	ka	1,0	1,076
Design resistance of FTG	f _{mt,ud}	77,65	79,28
Shear modulus interlayer	G _{int}	0,75	0,28
Young modulus interlayer	E _{int}	2,25	0,84
Coupling factor of the interlayer(s) at stress	ω _s	0,293	0,192
Coupling factor of the interlayer(s) at deformation	ω _w	0,549	0,427
Equivalent glass thickness ULS	teq_ult	13,13	12,52
Equivalent glass thickness SLS	teq_serv	13,42	12,77
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	1000	1000
Section moduls with equivalent thickness W=b*teq ² /6	W _{el}	28725	26123
Bending moment at fixation	Med	0,495	0,750
Bending tensile stress at ULS	σEd.ULS*	17,233	33,02
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	0,22	0,42
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin.ULS	-	416
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	-	214
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	1000	Check if zone (a) or (a+b) decisive
Bending moment at fixation	Med.res	0,330	0,500
Section moduls with residual check	W _{el.res}	9882	0,200
Bending tensile stress analytic based on bcalc	σEd.res**	36,735	(Ma/Mab)*(f _{mt,ud.ab} /f _{mt,ud.a})=
Maximum utilization residual capacity based on bcalc	utilization	0,47	2,23
Deformation glass panel at top	σ _{glass,top}	9,44	zone a decisive
Moment of inertia with equivalent thickness teq.serv	I _{eq.serv}	201480	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation
Linear profile stiffness	k _{prof}	9,1	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation
Characteristic force at top support glass into profile	Fp,k	5,01	
Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k,max	14,5	
Validation of linear iteration	valid	OK	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary
Deformation top of profile based on numerical simulation of profile	σ _{prof,top}	0,55	
Deformation top of parapet due to profile deformation/rotation - extrapolation	σ _{tot,top}	5,9	
Total deformation at top of parapet = σ _{glass} + σ _{prof}	σ _{max}	15,3	
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	utilization	0,77	
Maximum utilization SLS	utilization	0,77	
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	1000	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	7,52	11,46
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	21,8	4,59
Maximum utilization aluminium profile for single loads qk and Fk	utilization	0,35	0,53
Minimum plate width based on profile resistance	bmin.prof	-	526
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	-	211
			1,48
Parapet System	DF88FR_E400		
Total height of the parapet	1200	mm	
Glass height	1100	mm	
Glass thickness nominal	8	mm	
Interlayer	PVB	-	
Thickness interlayer	1,52	mm	
Load category	A1		
Load		qk [kN/m]	Fk [kN]
		0,3	0,5
Maximum utilization glass at ULS	ut.glass.ULS	0,22	0,21
Maximum utilization profile at ULS	ut.profile.ULS	0,35	0,53
Maximum utilization residual capacity glass for linear load qk	ut.residual	0,47	
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	9,4	
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	15,3	
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	0,77	
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max		1,48
Minimum plate width ULS glass	bmin.glass.ULS		416
Minimum plate width ULS profile	bmin.profile.ULS		526
Minimum plate width residual check	bmin.glass.residual		211
Minimum plate width overall	bmin	880	

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF88FR_E400			
Total height of the parapet	Ltot	mm	1300			
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1200			
Vertical distance between top of profile and top support of glass into profile	L2	mm	12			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	29,5			
Distance between fixations	efix	mm	400			
Nominal glass thickness	tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	7,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	7,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	A1			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KFI	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,4			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load	-	-	Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
		Type of load	qk [kN/m]	Fk [kN]		wk [kN/m ²]
		Zone of load	a	a	a-b	a-b
		Value of load	0,3	0,5	0,2	1
		Time of loading	s	60	86400	5
		Load area A	mm ²	40000	40000	1200000
Modification factor for the load time	km0d	-	0,856	0,856	0,543	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,939
Design resistance of FTG	f _{mt,ud}	N/mm ²	77,65	79,28	70,87	79,73
Shear modulus interlayer	Gint	N/mm ²	0,75	0,75	0,28	0,96
Young modulus interlayer	Eint	N/mm ²	2,25	2,25	0,84	2,87
Coupling factor of the interlayer(s) at stress	α _{st}	-	0,319	0,211	0,091	0,557
Coupling factor of the interlayer(s) at deformation	α _w	-	0,591	0,469	0,247	0,553
Equivalent glass thickness ULS	teq.ult	mm	13,26	12,65	11,76	14,26
Equivalent glass thickness SLS	teq.serv	mm	13,63	13,00	11,67	13,44
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	1100	1100	1000
Section moduli with equivalent thickness W=b ³ teq ² /6	Wel	mm ³	29320	29322	25351	33906
Bending moment at fixation	Med	kNm	0,540	0,825	0,330	1,080
Bending tensile stress at ULS	σEd.ULS*	N/mm ²	18,417	32,36	14,97	36,63
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	-	0,24	0,41	0,21	0,46
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin.ULS	mm	-	449	232	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	-	2,18
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a-b) decisive	1100	1000
Bending moment at fixation	Med.res	kNm	0,360	0,550	0,220	-
Section moduli with residual check	Wel.res	mm ³	9882	(Ma/Mab) ³ (f _{mt,ud,ab} /f _{mt,ud,a})=	-	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc	σEd.res**	N/mm ²	40,074	2,23	-	-
Maximum utilization residual capacity based on bcalc	utilization	-	0,52	zone a decisive	-	-
Deformation glass panel at top	δ _{glass,top}	mm	11,70	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-	-
Moment of inertia with equivalent thickness teq.serv	I _{eq.serv}	mm ⁴	210997	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-	-
Linear profile stiffness	kprof	(kN/m)/mm	9,1	-	-	-
Characteristic force at top support glass into profile	Fp.k	kN/m	5,44	-	-	-
Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k,max	kN/m	14,5	-	-	-
Validation of linear iteration	valid	-	OK	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	-	-
Defomation top of profile based on numerical simulation of profile	δ _{prof}	mm	0,60	-	-	-
Defomation top of parapet due to profile deformation/rotation - extrapolation	δ _{prof,top}	mm	7,0	-	-	-
Total deformation at top of parapet = δ _{glass} + δ _{profile}	δ _{tot,top}	mm	18,7	-	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δ _{max}	mm	20	-	-	-
Maximum utilization SLS	utilization	-	0,93	-	-	-
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	1100	1100	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	8,16	11,40	4,56	17,28
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	21,8	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,37	0,52	0,21	0,79
Minimum plate width based on profile resistance	bmin.prof	mm	-	576	230	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	-	1,26
Parapet System		DF88FR_E400				
Total height of the parapet	1300	mm				
Glass height	1200	mm				
Glass thickness nominal	8	mm				
Interlayer	PVB	-				
Thickness interlayer	1,52	mm				
Load category	A1	-				
Load	-	-	qk [kN/m]	Fk [kN]		wk [kN/m ²]
Maximum utilization glass at ULS	ut.glass.ULS	-	0,24	0,5	0,2	-
Maximum utilization profile at ULS	ut.profile.ULS	-	0,37	0,52	0,21	-
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,52	-	-	-
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	mm	11,7	-	-	-
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	18,7	-	-	-
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,93	-	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²	-	-	-	1,26
Minimum plate width ULS glass	bmin.glass.ULS	mm	-	449	232	-
Minimum plate width ULS profile	bmin.profile.ULS	mm	-	576	230	-
Minimum plate width residual check	bmin.glass.residual	mm	980	-	-	-
Minimum plate width overall	bmin	mm	980	-	-	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

4.2.7 DF88PICO_E125

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88PICO_E125			
Parapet System		Ltot	mm	966		
Total height of the parapet		L1	mm	900		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	9		
Vertical distance between top of profile and top support of glass into profile		L3	mm	46		
Vertical distance between top and bottom support of glass into profile		L4	mm	20		
Vertical distance between bottom support of glass into profile and base ground		efix	mm	125		
Distance between fixations		tnom	mm	8		
Nominal glass thickness		tp1	mm	7,7		
Glass thickness for calculation tp1 for inner plate at loading side		tp2	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		Interlayer		PVB		
Type of interlayer		tv,i	mm	1,52		
Thickness of interlayer		ng		2		
Number of sheets of glass of laminated plate		Tg,pvb	°C	30		
Maximum temperature of glass panel at loading for PVB		Tg,sgp	°C	50		
Maximum temperature of glass panel at loading for SGP		Cat		A1		
Load category		CC		CC2		
Consequence class		KF1		1		
Multiplication factor for consequence class		γ _{0p}		1,5		
Load safety factor variable loads as basis value		γ ₀		1,5		
Load safety factor variable loads considering CC		ψ _{0 LL}		0,4		
Load combination factor for variable life load		ψ _{0 Wind}		0		
Load combination factor for variable wind load				Life load		
Predominant load		γ _{m,A}		1,8		
Material safety factor float glass for predominant load		γ _{m,V}		1,2		
Material safety factor FTG		ke		1		
Factor for the edge quality of the glass panel		c		16		
Corrosion constant as a function		ksp		1		
Factor for the surface structure of float glass		kz		0,9		
Factor for the zone for FTG and edge zone		fg,k	N/mm ²	45		
Characteristic resistance of float glass		fb,k	N/mm ²	120		
Characteristic resistance of FTG						
		Type of load	qk [kN/m]	Fk [kN]		wk [kN/m ²]
		Zone of load	a	a	a+b	a+b
		Value of load	0,3	0,5	0,2	1
		Time of loading	s	60	86400	5
		Load area A	mm ²	40000	40000	900000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	77,65	79,28	80,00
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		ω _σ	-	0,239	0,152	0,063
Coupling factor of the interlayer(s) at deformation		ω _w	-	0,451	0,335	0,158
Equivalent glass thickness ULS		te _{q,ult}	mm	12,82	12,24	11,51
Equivalent glass thickness SLS		te _{q,serv}	mm	12,91	12,23	11,04
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	800	800
Section moduli with equivalent thickness W=b ² te _q ² /6		Wel	mm ³	27384	19987	17673
Bending moment at fixation		Med	kNm	0,405	0,600	0,240
Bending tensile stress at ULS		σEd,ULS*	N/mm ²	14,790	34,52	15,62
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,19	0,44	0,22
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin,ULS	mm	-	348	176
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max,glass	kN/m ²	-	-	3,62
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med,res	kNm	0,270	0,400	0,160
Section moduli with residual check		Wel,res	mm ³	9882	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})	
Bending tensile stress analytic based on bcalc		σEd,res**	N/mm ²	30,056	2,23	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Maximum utilization residual capacity based on bcalc		utilization	-	0,39	zone a decisive	
Deformation glass panel at top		δ _{glass,top}	mm	5,81	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness te _{q, serv}		I _{eq, serv}	mm ⁴	179147	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	40,0	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Characteristic force at top support glass into profile		Fp,k	kN/m	6,17		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp,k,max	kN/m	48,0		
Validation of linear iteration		valid	-	OK		
Deformation top of profile based on numerical simulation of profile		δ _{prof,top}	mm	0,15		
Deformation top of parapet due to profile deformation/rotation - extrapolation		δ _{stat,top}	mm	2,0		
Total deformation at top of parapet = δ _{glass} + δ _{profile}		δ _{max}	mm	7,8		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		utilization	mm	20		
Maximum utilization SLS		utilization	-	0,39		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	800	800
Design acting force at top support glass into profile based on bmin for Fk		Fp,Ed	kN/m	9,25	17,24	6,90
Maximum allowed design acting force based on numerical simulations of profiles		Fp,Rd	kN/m	72,2	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,13	0,24	0,10
Minimum plate width based on profile resistance		bmin,prof	mm	-	191	76
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max,profile	kN/m ²	-	-	4,95
Parapet System		DF88PICO_E125				
Total height of the parapet		966	mm			
Glass height		900	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,19	0,5	0,2
Maximum utilization profile at ULS		ut.profile.ULS	-	0,13	0,24	0,10
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,39	-	-
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	5,8	-	-
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	7,8	-	-
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,39	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	3,62
Minimum plate width ULS glass		bmin.glass.ULS	mm	-	348	176
Minimum plate width ULS profile		bmin.profile.ULS	mm	-	191	76
Minimum plate width residual check		bmin.glass.residual	mm	-	670	-
Minimum plate width overall		bmin	mm	-	670	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88PICO_E125			
Parapet System						
Total height of the parapet		Ltot	mm	1066		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1000		
Vertical distance between top of profile and top support of glass into profile		L2	mm	9		
Vertical distance between top and bottom support of glass into profile		L3	mm	46		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	20		
Distance between fixations		efix	mm	125		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1000000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt.ud}	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		α _{ov}	-	0,266	0,172	0,072
Coupling factor of the interlayer(s) at deformation		α _w	-	0,503	0,382	0,187
Equivalent glass thickness ULS		teq.ult	mm	12,98	12,39	11,60
Equivalent glass thickness SLS		teq.serv	mm	13,18	12,51	11,25
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	900	900
Section moduls with equivalent thickness W=b*teq ² /6		Wel	mm ²	28080	23009	20168
Bending moment at fixation		Med	kNm	0,450	0,675	0,270
Bending tensile stress at ULS		σ _{Ed.ULS*}	N/mm ²	16,026	33,74	15,40
Maximum utilization ULS = σ _{Ed} /f _{mt.ud}		utilization	-	0,21	0,43	0,22
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	383	196
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	3,01
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Section moduls with residual check		Med.res	kNm	0,300	0,450	0,180
Bending tensile stress analytic based on bcalc		Wel.res	mm ³	9882	(Ma/Mab)*(f _{mt.ud.ab} /f _{mt.ud.a})=	
Maximum utilization residual capacity based on bcalc		σ _{Ed.res**}	N/mm ²	33,395	2,23	zone a decisive
Deformation glass panel at top		sglass.top	mm	7,48	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq.serv		Ieq.serv	mm ⁴	190875	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	40,0		
Characteristic force at top support glass into profile		Fp.k	kN/m	6,82		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k.max	kN/m	48,0		
Validation of linear iteration		valid	-	OK	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Deformation top of profile based on numerical simulation of profile		sprof	mm	0,17		
Deformation top of parapet due to profile deformation/rotation - extrapolation		sprof.top	mm	2,4		
Total deformation at top of parapet = sglass + sprof		stot.top	mm	9,9		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		smax	mm	20		
Maximum utilization SLS		utilization	-	0,50		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	900	900
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	10,23	17,14	6,86
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	72,2	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,14	0,24	0,09
Minimum plate width based on profile resistance		bmin.prof	mm	-	214	85
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	4,05
Parapet System		DF88PICO_E125				
Total height of the parapet		1066	mm			
Glass height		1000	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,21	-	-
Maximum utilization profile at ULS		ut.profile.ULS	-	0,14	0,24	0,09
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,43	-	-
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	7,5	-	-
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	9,9	-	-
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,50	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	3,01
Minimum plate width ULS glass		bmin.glass.ULS	mm	-	383	196
Minimum plate width ULS profile		bmin.profile.ULS	mm	-	214	85
Minimum plate width residual check		bmin.glass.residual	mm	800	-	-
Minimum plate width overall		bmin	mm	800	-	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88PICO_E125			
Parapet System						
Total height of the parapet	Ltot	mm	1166			
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1100			
Vertical distance between top of profile and top support of glass into profile	L2	mm	9			
Vertical distance between top and bottom support of glass into profile	L3	mm	46			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	20			
Distance between fixations	efix	mm	125			
Nominal glass thickness	tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	7,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	7,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.1	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	A1			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,4			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm²	45			
Characteristic resistance of FTG	fb.k	N/mm²	120			
	Type of load		qk [kN/m]		Fk [kN]	wk [kN/m²]
	Zone of load		a	a	a+b	a+b
	Value of load		0,3	0,5	0,2	1
	Time of loading	s	60	60	86400	5
	Load area A	mm²	-	40000	40000	1100000
Modification factor for the load time	kmod	-	0,856	0,856	0,543	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,942
Design resistance of FTG	frmtLud	N/mm²	77,65	79,28	70,87	79,81
Shear modulus interlayer	Gint	N/mm²	0,75	0,75	0,28	0,96
Young modulus interlayer	Eint	N/mm²	2,25	2,25	0,84	2,87
Coupling factor of the interlayer(s) at stress	αov	-	0,293	0,192	0,081	0,518
Coupling factor of the interlayer(s) at deformation	αov	-	0,549	0,427	0,217	0,510
Equivalent glass thickness ULS	teq.ult	mm	13,13	12,52	11,68	14,12
Equivalent glass thickness SLS	teq.serv	mm	13,42	12,77	11,47	13,22
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	1000	1000	1000
Section modulus with equivalent thickness W=b³teq³/6	Med	kNm	0,495	0,750	0,300	0,908
Bending moment at fixation	Med.res	kNm	0,330	0,500	0,200	-
Bending tensile stress at ULS	σEd.ULS*	N/mm²	17,233	33,02	15,18	31,39
Maximum utilization ULS = σEd/frmt.ud	utilization	-	0,22	0,42	0,21	0,39
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin.ULS	mm	-	416	214	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m²	-	-	-	2,54
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	1000	1000	1000
Bending moment at fixation	Med.res	kNm	0,330	0,500	0,200	-
Section modulus with residual check	Med.res	kNm	9882	(Ma/Mab)*(frmt.ud.ab/frmt.ud.a)	-	-
Bending tensile stress analytic based on bcalc	σEd.res**	N/mm²	36,735	2,23	-	-
Maximum utilization residual capacity based on bcalc	utilization	-	0,47	-	-	-
Deformation glass panel at top	δglass.top	mm	9,44	-	-	-
Moment of inertia with equivalent thickness teq.serv	Ieq.serv	mm⁴	201480	-	-	-
Linear profile stiffness	kprof	(kN/m)/mm	40,0	-	-	-
Characteristic force at top support glass into profile	Fp.k	kN/m	7,47	-	-	-
Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k.max	kN/m	48,0	-	-	-
Validation of linear iteration	valid	-	OK	-	-	-
Deformation top of profile based on numerical simulation of profile	δprof	mm	0,19	-	-	-
Deformation top of parapet due to profile deformation/rotation - extrapolation	δprof.top	mm	2,9	-	-	-
Total deformation at top of parapet = δglass + δprofile	δtot.top	mm	12,3	-	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δmax	mm	20	-	-	-
Maximum utilization SLS	utilization	-	0,62	-	-	-
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	1000	1000	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	11,21	17,05	6,82	21,41
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	72,2	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,16	0,24	0,09	0,30
Minimum plate width based on profile resistance	bmin.prof	mm	-	236	94	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m²	-	-	-	3,37
Parapet System						
Total height of the parapet	1166	mm				
Glass height	1100	mm				
Glass thickness nominal	8	mm				
Interlayer	PVB	-				
Thickness interlayer	1,52	mm				
Load category	A1	-				
	Load		qk [kN/m]		Fk [kN]	wk [kN/m²]
	Maximum utilization glass at ULS	ut.glass.ULS	0,22	0,5	0,2	
	Maximum utilization profile at ULS	ut.profile.ULS	0,16	0,24	0,09	
	Maximum utilization residual capacity glass for linear load qk	ut.residual	0,47			
	Maximum deformation glass at SLS for linear load qk	def.glass.SLS	9,4			
	Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	12,3			
	Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	0,62			
	Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max				2,54
	Minimum plate width ULS glass	bmin.glass.ULS		416	214	
	Minimum plate width ULS profile	bmin.profile.ULS		236	94	
	Minimum plate width residual check	bmin.glass.residual	880			
	Minimum plate width overall	bmin	880			

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88PICO_E125			
Parapet System						
Total height of the parapet		Ltot	mm	1266		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1200		
Vertical distance between top of profile and top support of glass into profile		L2	mm	9		
Vertical distance between top and bottom support of glass into profile		L3	mm	46		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	20		
Distance between fixations		efix	mm	125		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1200000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	77,65	79,28	79,73
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		α _σ	-	0,319	0,211	0,091
Coupling factor of the interlayer(s) at deformation		α _w	-	0,591	0,469	0,247
Equivalent glass thickness ULS		teq.ult	mm	13,26	12,65	11,76
Equivalent glass thickness SLS		teq.serv	mm	13,63	13,00	11,67
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1100	1000
Section moduls with equivalent thickness W=b ³ teq ² /6		Wel	mm ³	29320	29322	25351
Bending moment at fixation		Med	kNm	0,540	0,825	0,330
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	18,417	32,36	14,97
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,24	0,41	0,21
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	449	232
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	-
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	-
Bending moment at fixation		Med.res	kNm	0,360	0,550	0,220
Section moduls with residual check		Wel.res	mm ³	9882	(Ma/Mab)*(f _{mt,ud.ab} /f _{mt,ud.a})=	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm ²	40,074	2,23	-
Maximum utilization residual capacity based on bcalc		utilization	-	0,52	-	zone a decisive
Deformation glass panel at top		δ _{glass,top}	mm	11,70	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-
Moment of inertia with equivalent thickness teq.serv		I _{eq.serv}	mm ⁴	210997	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-
Linear profile stiffness		k _{prof}	(kN/m)/mm	40,0	-	-
Characteristic force at top support glass into profile		F _{p,k}	kN/m	8,13	-	-
Maximum char. force at top support glass/profile at end of linear stiffness		F _{p,k,max}	kN/m	48,0	-	-
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	-
Deformation top of profile based on numerical simulation of profile		δ _{prof}	mm	0,20	-	-
Deformation top of parapet due to profile deformation/rotation - extrapolation		δ _{prof,top}	mm	3,4	-	-
Total deformation at top of parapet = δ _{glass} + δ _{profile}		δ _{tot,top}	mm	15,1	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δ _{max}	mm	20	-	-
Maximum utilization SLS		utilization	-	0,76	-	-
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	1100	1100
Design acting force at top support glass into profile based on bmin for Fk		F _{p,Ed}	kN/m	12,19	16,99	6,79
Maximum allowed design acting force based on numerical simulations of profiles		F _{p,Rd}	kN/m	72,2	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,17	0,24	0,09
Minimum plate width based on profile resistance		bmin_prof	mm	-	259	103
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	-
Parapet System						
Total height of the parapet		1266	mm			
Glass height		1200	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,24	0,5	0,2
Maximum utilization profile at ULS		ut.profile.ULS	-	0,17	0,24	0,09
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,52	-	-
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	-	11,7	-	-
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	15,1	-	-
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,76	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	2,18
Minimum plate width ULS glass		bmin.glass.ULS	mm	-	449	232
Minimum plate width ULS profile		bmin.profile.ULS	mm	-	259	103
Minimum plate width residual check		bmin.glass.residual	mm	980	-	-
Minimum plate width overall		bmin	mm	980	-	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

4.2.8 DF88PICO_E250

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile			
Total height of the parapet		Ltot	mm	966	
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	900	
Vertical distance between top of profile and top support of glass into profile		L2	mm	9	
Vertical distance between top and bottom support of glass into profile		L3	mm	46	
Vertical distance between bottom support of glass into profile and base ground		L4	mm	20	
Distance between fixations		efix	mm	250	
Nominal glass thickness		tnom	mm	8	
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7	
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7	
Type of interlayer		Interlayer	-	PVB	
Thickness of interlayer		tv.i	mm	1,52	
Number of sheets of glass of laminated plate		ng	-	2	
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30	
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50	
Load category		Cat	-	A1	
Consequence class		CC	-	CC2	
Multiplication factor for consequence class		KF1	-	1	
Load safety factor variable loads as basis value		γQ0	-	1,5	
Load safety factor variable loads considering CC		γQ	-	1,5	
Load combination factor for variable life load		ψ0 LL	-	0,4	
Load combination factor for variable wind load		ψ0 Wind	-	0	
Predominant load				Life load	
Material safety factor float glass for predominant load		γm.A	-	1,8	
Material safety factor FTG		γm.V	-	1,2	
Factor for the edge quality of the glass panel		ke	-	1	
Corrosion constant as a function		c	-	16	
Factor for the surface structure of float glass		ksp	-	1	
Factor for the zone for FTG and edge zone		kz	-	0,9	
Characteristic resistance of float glass		fg.k	N/mm ²	45	
Characteristic resistance of FTG		fb.k	N/mm ²	120	
		Type of load	qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load	a	a+b	a+b
		Value of load	0,3	0,5	0,2
		Time of loading	s	60	86400
		Load area A	mm ²	40000	900000
Modification factor for the load time		kmod	-	0,856	0,856
Surface effect factor		ka	-	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	77,65	79,28
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75
Young modulus interlayer		Eint	N/mm ²	2,25	2,25
Coupling factor of the interlayer(s) at stress		α _{cr}	-	0,239	0,152
Coupling factor of the interlayer(s) at deformato		α _w	-	0,451	0,335
Equivalent glass thickness ULS		teq,ult	mm	12,82	12,24
Equivalent glass thickness SLS		teq,serv	mm	12,91	12,23
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	800
Section moduls with equivalent thickness W=b ² teq ² /6		Wel	mm ³	27384	19987
Bending moment at fixation		Med	kNm	0,405	0,600
Bending tensile stress at ULS		σEd,ULS*	N/mm ²	14,790	34,52
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,19	0,44
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin,ULS	mm	-	348
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	176
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	800
Bending moment at fixation		Med,res	kNm	0,270	0,400
Section moduls with residual check		Wel,res	mm ³	9882	0,160
Bending tensile stress analytic based on bcalc		σEd,res**	N/mm ²	30,056	2,23
Maximum utilization residual capacity based on bcalc		utilization	-	0,39	zone a decisive
Deformation glass panel at top		δglass.serv	mm	5,81	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation
Moment of inertia with equivalent thickness teq,serv		Ieq,serv	mm ⁴	179147	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation
Linear profile stiffness		kprof	(kN/m)/mm	20,4	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary
Characteristic force at top support glass into profile		Fp.k	kN/m	6,17	
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k,max	kN/m	34,0	
Validation of linear iteration		valid	-	OK	
Deformation top of profile based on numerical simulation of profile		δprof	mm	0,30	
Deformation top of parapet due to profile deformation/rotation - extrapolation		δprof.top	mm	3,9	
Total deformation at top of parapet = δglass + δprofile		δtot.top	mm	9,7	
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		δmax	mm	20	
Maximum utilization SLS		utilization	-	0,49	
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	800
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	9,25	17,24
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	50,6	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,18	0,34
Minimum plate width based on profile resistance		bmin.prof	mm	-	273
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	109
Parapet System		DF88PICO_E250			
Total height of the parapet		966	mm		
Glass height		900	mm		
Glass thickness nominal		8	mm		
Interlayer		PVB	-		
Thickness interlayer		1,52	mm		
Load category		A1	-		
			qk [kN/m]	Fk [kN]	wk [kN/m ²]
Load			0,3	0,5	0,2
Maximum utilization glass at ULS		ut.glass.ULS	-	0,19	
Maximum utilization profile at ULS		ut.profile.ULS	-	0,18	0,34
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,39	
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	5,8	
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	9,7	
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,49	
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	3,47
Minimum plate width ULS glass		bmin.glass.ULS	mm	348	176
Minimum plate width ULS profile		bmin.profile.ULS	mm	273	109
Minimum plate width residual check		bmin.glass.residual	mm	670	
Minimum plate width overall		bmin	mm	670	
NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation					

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88PICO_E250			
Parapet System						
Total height of the parapet		Ltot	mm	1066		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1000		
Vertical distance between top of profile and top support of glass into profile		L2	mm	9		
Vertical distance between top and bottom support of glass into profile		L3	mm	46		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	20		
Distance between fixations		efix	mm	250		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv,i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm,A	-	1,8		
Material safety factor FTG		γm,V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg,k	N/mm ²	45		
Characteristic resistance of FTG		fb,k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1000000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		φ _σ	-	0,266	0,172	0,072
Coupling factor of the interlayer(s) at deformation		φ _w	-	0,503	0,382	0,187
Equivalent glass thickness ULS		teq,ult	mm	12,98	12,39	11,60
Equivalent glass thickness SLS		teq,serv	mm	13,18	12,51	11,25
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	900	900
Section moduls with equivalent thickness W=b ³ teq ² /6		Wel	mm ³	28080	23009	20168
Bending moment at fixation		Med	kNm	0,450	0,675	0,270
Bending tensile stress at ULS		σEd,ULS*	N/mm ²	16,026	33,74	15,40
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,21	0,43	0,22
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin,ULS	mm	-	383	196
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max,ULS	mm ²	-	-	-
						3,01
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med,res	kNm	0,300	0,450	0,180
Section moduls with residual check		Wel,res	mm ³	9882	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc		σEd,res**	N/mm ²	33,395	2,23	
Maximum utilization residual capacity based on bcalc		utilization	-	0,43	zone a decisive	
Deformation glass panel at top		δglass,top	mm	7,48	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq,serv		Ieq,serv	mm ⁴	190875	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	20,4		
Characteristic force at top support glass into profile		Fp,k	kN/m	6,82		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp,k,max	kN/m	34,0		
Validation of linear iteration				valid	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary
Defomation top of profile based on numerical simulation of profile		δprof	mm	0,33		
Defomation top of parapet due to profile deformation/rotation - extrapolation		δprof,top	mm	4,8		
Total deformation at top of parapet = δglass + δprofile		δtot,top	mm	12,2		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δmax	mm	20		
Maximum utilization SLS		utilization	-	0,61		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	900	900
Design acting force at top support glass into profile based on bmin for Fk		Fp,Ed	kNm	10,23	17,14	6,86
Maximum allowed design acting force based on numerical simulations of profiles		Fp,Rd	kN/m	50,6	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,20	0,34	0,14
Minimum plate width based on profile resistance		bmin,prof	mm	-	305	122
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max,profile	mm ²	-	-	-
						2,83
Parapet System		DF88PICO_E250				
Total height of the parapet		1066	mm			
Glass height		1000	mm			
Glass thickness nominal		8	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-	qk [kN/m]	Fk [kN]	wk [kN/m ²]
Load				0,3	0,5	0,2
Maximum utilization glass at ULS		ut.glass,ULS	-	0,21		
Maximum utilization profile at ULS		ut.profile,ULS	-	0,20	0,34	0,14
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,43		
Maximum deformation glass at SLS for linear load qk		def.glass,SLS	mm	7,5		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof,SLS	mm	12,2		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof,SLS	-	0,61		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	mm ²			2,83
Minimum plate width ULS glass		bmin.glass,ULS	mm		383	196
Minimum plate width ULS profile		bmin.profile,ULS	mm		305	122
Minimum plate width residual check		bmin.glass.residual	mm	800		
Minimum plate width overall		bmin	mm	800		

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SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF88PICO_E250			
Total height of the parapet	Ltot	mm	1166			
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1100			
Vertical distance between top of profile and top support of glass into profile	L2	mm	9			
Vertical distance between top and bottom support of glass into profile	L3	mm	46			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	20			
Distance between fixations	efix	mm	250			
Nominal glass thickness	tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	7,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	7,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	A1			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,4			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
		Type of load	qk [kN/m]	Fk [kN]		wk [kN/m ²]
		Zone of load	a	a	a+b	a+b
		Value of load	0,3	0,5	0,2	1
		Time of loading	s	60	86400	5
		Load area A	mm ²	40000	40000	1100000
Modification factor for the load time	kmod	-	0,856	0,856	0,543	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,942
Design resistance of FTG	f_{mt,ud}	N/mm²	77,65	79,28	70,87	79,81
Shear modulus interlayer	Gint	N/mm ²	0,75	0,75	0,28	0,96
Young modulus interlayer	Eint	N/mm ²	2,25	2,25	0,84	2,87
Coupling factor of the interlayer(s) at stress	ασ	-	0,293	0,192	0,081	0,518
Coupling factor of the interlayer(s) at deformatio	αω	-	0,549	0,427	0,217	0,510
Equivalent glass thickness ULS	teq,ult	mm	13,13	12,52	11,68	14,12
Equivalent glass thickness SLS	teq,serv	mm	13,42	12,77	11,47	13,22
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	1000	1000	1000
Section moduls with equivalent thickness W=b ³ teq ² /6	Wel	mm ³	28725	26123	22728	33250
Bending moment at fixation	Med	kNm	0,495	0,750	0,300	0,908
Bending tensile stress at ULS	σEd,ULS*	N/mm ²	17,233	33,02	15,18	31,39
Maximum utilization ULS = σEd/fmt.ud	utilization	-	0,22	0,42	0,21	0,39
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin,ULS	mm	-	416	214	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	-	2,54
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a+b) decisive	0,500	2000
Bending moment at fixation	Med,res	kNm	0,330	0,500	0,200	0,942
Section moduls with residual check	Wel,res	mm ³	9882	(Ma/Mab)*(f _{mt,ud} .ab/f _{mt,ud} .a)=	-	-
Bending tensile stress analytic based on bcalc	σEd,res**	N/mm ²	36,735	2,23	-	-
Maximum utilization residual capacity based on bcalc	utilization	-	0,47	zone a decisive	-	-
Deformation glass panel at top	σglass.top	mm	9,44	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-	-
Moment of inertia with equivalent thickness teq,serv	Ieq,serv	mm ⁴	201480	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-	-
Linear profile stiffness	kprof	(kN/m)/mm	20,4	-	-	-
Characteristic force at top support glass into profile	Fp.k	kN/m	7,47	-	-	-
Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k,max	kN/m	34,0	-	-	-
Validation of linear iteration	valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	-	-
Deformation top of profile based on numerical simulation of profile	σprof	mm	0,37	-	-	-
Deformation top of parapet due to profile deformation/rotation - extrapolation	σrot.top	mm	5,7	-	-	-
Total deformation at top of parapet = σglass + σprofile	σtot.top	mm	15,1	-	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	σmax	mm	20	-	-	-
Maximum utilization SLS	utilization	-	0,76	-	-	-
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	1000	1000	1000
Design acting force at top support glass into profile based on Fk	Fp.Ed	kN/m	11,21	17,05	6,82	21,41
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	50,6	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,22	0,34	0,13	0,42
Minimum plate width based on profile resistance	bmin,prof	mm	-	337	135	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	-	2,36
Parapet System		DF88PICO_E250				
Total height of the parapet		mm	1166			
Glass height		mm	1100			
Glass thickness nominal		mm	8			
Interlayer		-	PVB			
Thickness interlayer		mm	1,52			
Load category		-	A1			
Load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Maximum utilization glass at ULS	ut.glass.ULS	-	0,22	0,5	0,2	-
Maximum utilization profile at ULS	ut.profile.ULS	-	0,22	0,34	0,13	-
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,47	-	-	-
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	-	9,4	-	-	-
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	15,1	-	-	-
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,76	-	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²	-	-	-	2,36
Minimum plate width ULS glass	bmin.glass.ULS	mm	-	416	214	-
Minimum plate width ULS profile	bmin.profile.ULS	mm	-	337	135	-
Minimum plate width residual check	bmin.glass.residual	mm	880	-	-	-
Minimum plate width overall	bmin	mm	880	-	-	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF88PICO_E250			
Parapet System						
Total height of the parapet	Ltot	mm	1266			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1200			
Vertical distance between top of profile and top support of glass into profile	L2	mm	9			
Vertical distance between top and bottom support of glass into profile	L3	mm	46			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	20			
Distance between fixations	efix	mm	250			
Nominal glass thickness	tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	7,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	7,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	A1			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,4			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm²	45			
Characteristic resistance of FTG	fb.k	N/mm²	120			
	Type of load		qk [kN/m]	Fk [kN]		wk [kN/m²]
	Zone of load		a	a	a+b	a+b
	Value of load		0,3	0,5	0,2	1
	Time of loading	s	60	60	86400	5
	Load area A	mm²	-	40000	40000	1200000
Modification factor for the load time	kmod	-	0,856	0,856	0,543	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,939
Design resistance of FTG	f _{mt,ud}	N/mm²	77,65	79,28	70,87	79,73
Shear modulus interlayer	Gint	N/mm²	0,75	0,75	0,28	0,96
Young modulus interlayer	Eint	N/mm²	2,25	2,25	0,84	2,87
Coupling factor of the interlayer(s) at stress	ω _σ	-	0,319	0,211	0,091	0,557
Coupling factor of the interlayer(s) at deformation	ω _w	-	0,591	0,469	0,247	0,553
Equivalent glass thickness ULS	teq,ult	mm	13,26	12,65	11,76	14,26
Equivalent glass thickness SLS	teq,serv	mm	13,63	13,00	11,67	13,44
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	b _{calc}	mm	1000	1100	1100	1000
Section moduls with equivalent thickness W=b*teq ² /6	W _{el}	mm³	29320	29322	25351	33906
Bending moment at fixation	Med	kNm	0,540	0,825	0,330	1,080
Bending tensile stress at ULS	σ _{Ed,ULS*}	N/mm²	18,417	32,36	14,97	36,63
Maximum utilization ULS = σ _{Ed} /f _{mt,ud}	utilization	-	0,24	0,41	0,21	0,46
Minimum plate width based ULS-checks as maximum of Fk-loads	b _{min,ULS}	mm	-	449	232	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m²	-	-	-	2,18
Calculation width glass panel - for Fk based on Mepla calculation	b _{calc}	mm	1000	Check if zone (a) or (a+b) decisive		-
Bending moment at fixation	Med,res	kNm	0,360	0,550	0,220	-
Section moduls with residual check	W _{el,res}	mm³	9882	(M _a /M _{ab})*(f _{mt,ud,ab} /f _{mt,ud,a})=		For residual capacity check of Fk see Mepla calcs and related tables for b _{min}
Bending tensile stress analytic based on b _{calc}	σ _{Ed,res**}	N/mm²	40,074	2,23	zone a decisive	-
Maximum utilization residual capacity based on b _{calc}	utilization	-	0,52	-	-	-
Deformation glass panel at top	δ _{glass,top}	mm	11,70	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Moment of inertia with equivalent thickness teq,serv	I _{eq,serv}	mm ⁴	210997	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Linear profile stiffness	k _{prof}	(kN/m)/mm	20,4			
Characteristic force at top support glass into profile	F _{p,k}	kN/m	8,13			
Maximum char. force at top support glass/profile at end of linear stiffness	F _{p,k,max}	kN/m	34,0			
Validation of linear iteration	valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary		
Deformation top of profile based on numerical simulation of profile	δ _{prof}	mm	0,40			
Deformation top of parapet due to profile deformation/rotation - extrapolation	δ _{prof,top}	mm	6,7			
Total deformation at top of parapet = δ _{glass} + δ _{prof}	δ _{tot,top}	mm	18,4			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δ _{max}	mm	20			
Maximum utilization SLS	utilization	-	0,92			
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	b _{calc}	mm	1000	1100	1100	1000
Design acting force at top support glass into profile based on b _{min} for Fk	F _{p,Ed}	kN/m	12,19	16,99	6,79	25,31
Maximum allowed design acting force based on numerical simulations of profiles	F _{p,Rd}	kN/m	50,6	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,24	0,34	0,13	0,50
Minimum plate width based on profile resistance	b _{min,prof}	mm	-	370	148	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m²	-	-	-	2,00
Parapet System						
Total height of the parapet	1266	mm				
Glass height	1200	mm				
Glass thickness nominal	8	mm				
Interlayer	PVB	-				
Thickness interlayer	1,52	mm				
Load category	A1	-				
Load			qk [kN/m]	Fk [kN]		wk [kN/m²]
Maximum utilization glass at ULS	ut.glass.ULS	-	0,24	0,5	0,2	-
Maximum utilization profile at ULS	ut.profile.ULS	-	0,24	0,34	0,13	-
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,52	-	-	-
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	-	11,7	-	-	-
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	18,4	-	-	-
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,92	-	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m²	-	-	-	2,00
Minimum plate width ULS glass	b _{min.glass.ULS}	mm	-	449	232	-
Minimum plate width ULS profile	b _{min.profile.ULS}	mm	-	370	148	-
Minimum plate width residual check	b _{min.glass.residual}	mm	980	-	-	-
Minimum plate width overall	b _{min}	mm	980	-	-	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

4.2.9 DF1010LM_E200

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF1010LM_E200																																																																																																																																																																																																																																																																																																																																																																																																										
Parapet System		Ltot	mm	1001																																																																																																																																																																																																																																																																																																																																																																																																									
Total height of the parapet		L1	mm	900																																																																																																																																																																																																																																																																																																																																																																																																									
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	11																																																																																																																																																																																																																																																																																																																																																																																																									
Vertical distance between top of profile and top support of glass into profile		L3	mm	70																																																																																																																																																																																																																																																																																																																																																																																																									
Vertical distance between top and bottom support of glass into profile		L4	mm	31																																																																																																																																																																																																																																																																																																																																																																																																									
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200																																																																																																																																																																																																																																																																																																																																																																																																									
Distance between fixations		tnom	mm	10																																																																																																																																																																																																																																																																																																																																																																																																									
Nominal glass thickness		tp1	mm	9,7																																																																																																																																																																																																																																																																																																																																																																																																									
Glass thickness for calculation tp1 for inner plate at loading side		tp2	mm	9,7																																																																																																																																																																																																																																																																																																																																																																																																									
Glass thickness for calculation tp2 for middle and outer plate		Interlayer		PVB																																																																																																																																																																																																																																																																																																																																																																																																									
Type of interlayer		tv,i	mm	1,52																																																																																																																																																																																																																																																																																																																																																																																																									
Thickness of interlayer		ng		2																																																																																																																																																																																																																																																																																																																																																																																																									
Number of sheets of glass of laminated plate		Tg,pvb	°C	30																																																																																																																																																																																																																																																																																																																																																																																																									
Maximum temperature of glass panel at loading for PVB		Tg,sgp	°C	50																																																																																																																																																																																																																																																																																																																																																																																																									
Maximum temperature of glass panel at loading for SGP		Cat		other																																																																																																																																																																																																																																																																																																																																																																																																									
Load category		CC		CC2																																																																																																																																																																																																																																																																																																																																																																																																									
Consequence class		KF1		1																																																																																																																																																																																																																																																																																																																																																																																																									
Multiplication factor for consequence class		γQ		1,5																																																																																																																																																																																																																																																																																																																																																																																																									
Load safety factor variable loads as basis value		γQ		1,5																																																																																																																																																																																																																																																																																																																																																																																																									
Load safety factor variable loads considering CC		ψ0 LL		0,6																																																																																																																																																																																																																																																																																																																																																																																																									
Load combination factor for variable life load		ψ0 Wind		0																																																																																																																																																																																																																																																																																																																																																																																																									
Load combination factor for variable wind load				Life load																																																																																																																																																																																																																																																																																																																																																																																																									
Predominant load		ym,A		1,8																																																																																																																																																																																																																																																																																																																																																																																																									
Material safety factor float glass for predominant load		ym,V		1,2																																																																																																																																																																																																																																																																																																																																																																																																									
Material safety factor FTG		ke		1																																																																																																																																																																																																																																																																																																																																																																																																									
Factor for the edge quality of the glass panel		c		16																																																																																																																																																																																																																																																																																																																																																																																																									
Corrosion constant as a function		ksp		1																																																																																																																																																																																																																																																																																																																																																																																																									
Factor for the surface structure of float glass		kz		0,9																																																																																																																																																																																																																																																																																																																																																																																																									
Factor for the zone for FTG and edge zone		fg,k	N/mm ²	45																																																																																																																																																																																																																																																																																																																																																																																																									
Characteristic resistance of float glass		fb,k	N/mm ²	120																																																																																																																																																																																																																																																																																																																																																																																																									
Characteristic resistance of FTG		<table border="1"> <thead> <tr> <th>Type of load</th> <th>qk [kN/m]</th> <th>a</th> <th>Fk [kN]</th> <th>a+b</th> <th>wk [N/m²]</th> </tr> </thead> <tbody> <tr> <td>Zone of load</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Value of load</td> <td>0,8</td> <td>1</td> <td>0,5</td> <td>1</td> <td></td> </tr> <tr> <td>Time of loading</td> <td>300</td> <td>300</td> <td>604800</td> <td>5</td> <td></td> </tr> <tr> <td>Load area A</td> <td></td> <td>40000</td> <td>40000</td> <td>900000</td> <td></td> </tr> <tr> <td>Modification factor for the load time</td> <td>kmod</td> <td>0,774</td> <td>0,774</td> <td>0,481</td> <td>1,000</td> </tr> <tr> <td>Surface effect factor</td> <td>ka</td> <td>1,0</td> <td>1,076</td> <td>1,076</td> <td>0,950</td> </tr> <tr> <td>Design resistance of FTG</td> <td>ftg.ud</td> <td>N/mm²</td> <td>75,61</td> <td>77,08</td> <td>80,00</td> </tr> <tr> <td>Shear modulus interlayer</td> <td>Gint</td> <td>N/mm²</td> <td>0,53</td> <td>0,53</td> <td>0,11</td> </tr> <tr> <td>Young modulus interlayer</td> <td>Eint</td> <td>N/mm²</td> <td>1,60</td> <td>1,60</td> <td>0,32</td> </tr> <tr> <td>Coupling factor of the interlayer(s) at stress</td> <td>ωσ</td> <td></td> <td>0,150</td> <td>0,092</td> <td>0,020</td> </tr> <tr> <td>Coupling factor of the interlayer(s) at deformation</td> <td>ωδ</td> <td></td> <td>0,317</td> <td>0,221</td> <td>0,054</td> </tr> <tr> <td>Equivalent glass thickness ULS</td> <td>teq.ult</td> <td>mm</td> <td>15,41</td> <td>14,83</td> <td>13,98</td> </tr> <tr> <td>Equivalent glass thickness SLS</td> <td>teq.serv</td> <td>mm</td> <td>15,27</td> <td>14,48</td> <td>12,85</td> </tr> <tr> <td>Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk</td> <td>bcalc</td> <td>mm</td> <td>1000</td> <td>800</td> <td>1000</td> </tr> <tr> <td>Section moduls with equivalent thickness W=b²teq²/6</td> <td>Wcl</td> <td>mm³</td> <td>39562</td> <td>29315</td> <td>26066</td> </tr> <tr> <td>Bending moment at fixation</td> <td>Med</td> <td>kNm</td> <td>1,080</td> <td>1,200</td> <td>0,600</td> </tr> <tr> <td>Bending tensile stress at ULS</td> <td>σEd,ULS*</td> <td>N/mm²</td> <td>27,299</td> <td>47,07</td> <td>26,47</td> </tr> <tr> <td>Maximum utilization ULS = σEd/fmt.ud</td> <td>utilization</td> <td></td> <td>0,36</td> <td>0,61</td> <td>0,38</td> </tr> <tr> <td>Minimum plate width based ULS-checks as maximum of Fk-loads</td> <td>bmin,ULS</td> <td>mm</td> <td>-</td> <td>489</td> <td>306</td> </tr> <tr> <td>Maximum characteristic wind load wk for only wind loads based on ULS glass</td> <td>wk,max.glass</td> <td>kN/m²</td> <td>-</td> <td>-</td> <td>5,54</td> </tr> <tr> <td>Calculation width glass panel - for Fk based on Mepla calculation</td> <td>bcalc</td> <td>mm</td> <td>1000</td> <td>Check if zone (a) or (a+b) decisive</td> <td></td> </tr> <tr> <td>Bending moment at fixation</td> <td>Med.res</td> <td>kNm</td> <td>0,720</td> <td>0,800</td> <td>0,400</td> </tr> <tr> <td>Section moduls with residual check</td> <td>Wcl.res</td> <td>mm³</td> <td>15682</td> <td>(Ma/Mab)*(fmtud.ab/fmtud.a)=</td> <td>For residual capacity check of Fk see Mepla calcs and related tables for bmin</td> </tr> <tr> <td>Bending tensile stress analytic based on bcalc</td> <td>σEd.res**</td> <td>N/mm²</td> <td>50,505</td> <td>1,80</td> <td></td> </tr> <tr> <td>Maximum utilization residual capacity based on bcalc</td> <td>utilization</td> <td></td> <td>0,67</td> <td>zone a decisive</td> <td></td> </tr> <tr> <td>Deformation glass panel at top</td> <td>δglass.top</td> <td>mm</td> <td>9,36</td> <td>* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation</td> <td></td> </tr> <tr> <td>Moment of inertia with equivalent thickness teq.serv</td> <td>Ieq.serv</td> <td>mm⁴</td> <td>296797</td> <td>** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation</td> <td></td> </tr> <tr> <td>Linear profile stiffness</td> <td>kprof</td> <td>(kN/m)/mm</td> <td>34,5</td> <td></td> <td></td> </tr> <tr> <td>Characteristic force at top support glass into profile</td> <td>Fp,k</td> <td>kN/m</td> <td>11,09</td> <td></td> <td></td> </tr> <tr> <td>Maximum char. force at top support glass/profile at end of linear stiffness</td> <td>Fp,k.max</td> <td>kN/m</td> <td>35,0</td> <td></td> <td></td> </tr> <tr> <td>Validation of linear iteration</td> <td>valid</td> <td></td> <td>OK</td> <td>Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary</td> <td></td> </tr> <tr> <td>Deformation top of profile based on numerical simulation of profile</td> <td>δprof</td> <td>mm</td> <td>0,32</td> <td></td> <td></td> </tr> <tr> <td>Deformation top of parapet due to profile deformation/rotation - extrapolation</td> <td>δprof.top</td> <td>mm</td> <td>2,9</td> <td></td> <td></td> </tr> <tr> <td>Total deformation at top of parapet = δglass + δprofile</td> <td>δtot.top</td> <td>mm</td> <td>12,2</td> <td></td> <td></td> </tr> <tr> <td>Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)</td> <td>δmax</td> <td>mm</td> <td>20</td> <td></td> <td></td> </tr> <tr> <td>Maximum utilization SLS</td> <td>utilization</td> <td></td> <td>0,61</td> <td></td> <td></td> </tr> <tr> <td>Calculation width with 1m for qk and wk and maximum 45° distribution for Fk</td> <td>bcalc</td> <td>mm</td> <td>1000</td> <td>800</td> <td>1000</td> </tr> <tr> <td>Design acting force at top support glass into profile based on bmin for Fk</td> <td>Fp.Ed</td> <td>kN/m</td> <td>16,63</td> <td>23,30</td> <td>11,65</td> </tr> <tr> <td>Maximum allowed design acting force based on numerical simulations of profiles</td> <td>Fp.Rd</td> <td>kN/m</td> <td>68,8</td> <td>-</td> <td>-</td> </tr> <tr> <td>Maximum utilization aluminium profile for single loads qk and Fk</td> <td>utilization</td> <td></td> <td>0,24</td> <td>0,34</td> <td>0,17</td> </tr> <tr> <td>Minimum plate width based on profile resistance</td> <td>bmin.prof</td> <td>mm</td> <td>-</td> <td>271</td> <td>135</td> </tr> <tr> <td>Maximum characteristic wind load wk for only wind loads based on ULS profile</td> <td>wk,max.profile</td> <td>kN/m²</td> <td>-</td> <td>-</td> <td>6,82</td> </tr> <tr> <td colspan="2">Parapet System</td> <td colspan="5">DF1010LM_E200</td> </tr> <tr> <td colspan="2">Total height of the parapet</td> <td>1001</td> <td>mm</td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="2">Glass height</td> <td>900</td> <td>mm</td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="2">Glass thickness nominal</td> <td>10</td> <td>mm</td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="2">Interlayer</td> <td>PVB</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="2">Thickness interlayer</td> <td>1,52</td> <td>mm</td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="2">Load category</td> <td>other</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="2">Load</td> <td></td> <td></td> <td>qk [kN/m]</td> <td>Fk [kN]</td> <td>wk [kN/m²]</td> </tr> <tr> <td colspan="2">Maximum utilization glass at ULS</td> <td>ut.glass.ULS</td> <td></td> <td>0,8</td> <td>1</td> <td>0,5</td> </tr> <tr> <td colspan="2">Maximum utilization profile at ULS</td> <td>ut.profile.ULS</td> <td></td> <td>0,36</td> <td></td> <td></td> </tr> <tr> <td colspan="2">Maximum utilization residual capacity glass for linear load qk</td> <td>ut.residual</td> <td></td> <td>0,24</td> <td>0,34</td> <td>0,17</td> </tr> <tr> <td colspan="2">Maximum deformation glass at SLS for linear load qk</td> <td>def.glass.SLS</td> <td></td> <td>0,67</td> <td></td> <td></td> </tr> <tr> <td colspan="2">Maximum deformation glass + profile at SLS for linear load qk</td> <td>def.glass+prof.SLS</td> <td>mm</td> <td>9,4</td> <td></td> <td></td> </tr> <tr> <td colspan="2">Maximum utilization glass + profile at SLS for linear load qk</td> <td>ut.glass+prof.SLS</td> <td></td> <td>12,2</td> <td></td> <td></td> </tr> <tr> <td colspan="2">Maximum characteristic wind load wk for only wind loads based on ULS glass + profile</td> <td>wk,max</td> <td>kN/m²</td> <td>0,61</td> <td></td> <td>5,54</td> </tr> <tr> <td colspan="2">Minimum plate width ULS glass</td> <td>bmin.glass.ULS</td> <td>mm</td> <td></td> <td>489</td> <td>306</td> </tr> <tr> <td colspan="2">Minimum plate width ULS profile</td> <td>bmin.profile.ULS</td> <td>mm</td> <td></td> <td>271</td> <td>135</td> </tr> <tr> <td colspan="2">Minimum plate width residual check</td> <td>bmin.glass.residual</td> <td>mm</td> <td></td> <td>1550</td> <td></td> </tr> <tr> <td colspan="2">Minimum plate width overall</td> <td>bmin</td> <td>mm</td> <td></td> <td>1550</td> <td></td> </tr> </tbody> </table>					Type of load	qk [kN/m]	a	Fk [kN]	a+b	wk [N/m ²]	Zone of load						Value of load	0,8	1	0,5	1		Time of loading	300	300	604800	5		Load area A		40000	40000	900000		Modification factor for the load time	kmod	0,774	0,774	0,481	1,000	Surface effect factor	ka	1,0	1,076	1,076	0,950	Design resistance of FTG	ftg.ud	N/mm ²	75,61	77,08	80,00	Shear modulus interlayer	Gint	N/mm ²	0,53	0,53	0,11	Young modulus interlayer	Eint	N/mm ²	1,60	1,60	0,32	Coupling factor of the interlayer(s) at stress	ωσ		0,150	0,092	0,020	Coupling factor of the interlayer(s) at deformation	ωδ		0,317	0,221	0,054	Equivalent glass thickness ULS	teq.ult	mm	15,41	14,83	13,98	Equivalent glass thickness SLS	teq.serv	mm	15,27	14,48	12,85	Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	800	1000	Section moduls with equivalent thickness W=b ² teq ² /6	Wcl	mm ³	39562	29315	26066	Bending moment at fixation	Med	kNm	1,080	1,200	0,600	Bending tensile stress at ULS	σEd,ULS*	N/mm ²	27,299	47,07	26,47	Maximum utilization ULS = σEd/fmt.ud	utilization		0,36	0,61	0,38	Minimum plate width based ULS-checks as maximum of Fk-loads	bmin,ULS	mm	-	489	306	Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	5,54	Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a+b) decisive		Bending moment at fixation	Med.res	kNm	0,720	0,800	0,400	Section moduls with residual check	Wcl.res	mm ³	15682	(Ma/Mab)*(fmtud.ab/fmtud.a)=	For residual capacity check of Fk see Mepla calcs and related tables for bmin	Bending tensile stress analytic based on bcalc	σEd.res**	N/mm ²	50,505	1,80		Maximum utilization residual capacity based on bcalc	utilization		0,67	zone a decisive		Deformation glass panel at top	δglass.top	mm	9,36	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		Moment of inertia with equivalent thickness teq.serv	Ieq.serv	mm ⁴	296797	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		Linear profile stiffness	kprof	(kN/m)/mm	34,5			Characteristic force at top support glass into profile	Fp,k	kN/m	11,09			Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k.max	kN/m	35,0			Validation of linear iteration	valid		OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary		Deformation top of profile based on numerical simulation of profile	δprof	mm	0,32			Deformation top of parapet due to profile deformation/rotation - extrapolation	δprof.top	mm	2,9			Total deformation at top of parapet = δglass + δprofile	δtot.top	mm	12,2			Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δmax	mm	20			Maximum utilization SLS	utilization		0,61			Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	800	1000	Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	16,63	23,30	11,65	Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	68,8	-	-	Maximum utilization aluminium profile for single loads qk and Fk	utilization		0,24	0,34	0,17	Minimum plate width based on profile resistance	bmin.prof	mm	-	271	135	Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	6,82	Parapet System		DF1010LM_E200					Total height of the parapet		1001	mm				Glass height		900	mm				Glass thickness nominal		10	mm				Interlayer		PVB					Thickness interlayer		1,52	mm				Load category		other					Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]	Maximum utilization glass at ULS		ut.glass.ULS		0,8	1	0,5	Maximum utilization profile at ULS		ut.profile.ULS		0,36			Maximum utilization residual capacity glass for linear load qk		ut.residual		0,24	0,34	0,17	Maximum deformation glass at SLS for linear load qk		def.glass.SLS		0,67			Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	9,4			Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS		12,2			Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	0,61		5,54	Minimum plate width ULS glass		bmin.glass.ULS	mm		489	306	Minimum plate width ULS profile		bmin.profile.ULS	mm		271	135	Minimum plate width residual check		bmin.glass.residual	mm		1550		Minimum plate width overall		bmin	mm		1550	
Type of load	qk [kN/m]	a	Fk [kN]	a+b	wk [N/m ²]																																																																																																																																																																																																																																																																																																																																																																																																								
Zone of load																																																																																																																																																																																																																																																																																																																																																																																																													
Value of load	0,8	1	0,5	1																																																																																																																																																																																																																																																																																																																																																																																																									
Time of loading	300	300	604800	5																																																																																																																																																																																																																																																																																																																																																																																																									
Load area A		40000	40000	900000																																																																																																																																																																																																																																																																																																																																																																																																									
Modification factor for the load time	kmod	0,774	0,774	0,481	1,000																																																																																																																																																																																																																																																																																																																																																																																																								
Surface effect factor	ka	1,0	1,076	1,076	0,950																																																																																																																																																																																																																																																																																																																																																																																																								
Design resistance of FTG	ftg.ud	N/mm ²	75,61	77,08	80,00																																																																																																																																																																																																																																																																																																																																																																																																								
Shear modulus interlayer	Gint	N/mm ²	0,53	0,53	0,11																																																																																																																																																																																																																																																																																																																																																																																																								
Young modulus interlayer	Eint	N/mm ²	1,60	1,60	0,32																																																																																																																																																																																																																																																																																																																																																																																																								
Coupling factor of the interlayer(s) at stress	ωσ		0,150	0,092	0,020																																																																																																																																																																																																																																																																																																																																																																																																								
Coupling factor of the interlayer(s) at deformation	ωδ		0,317	0,221	0,054																																																																																																																																																																																																																																																																																																																																																																																																								
Equivalent glass thickness ULS	teq.ult	mm	15,41	14,83	13,98																																																																																																																																																																																																																																																																																																																																																																																																								
Equivalent glass thickness SLS	teq.serv	mm	15,27	14,48	12,85																																																																																																																																																																																																																																																																																																																																																																																																								
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	800	1000																																																																																																																																																																																																																																																																																																																																																																																																								
Section moduls with equivalent thickness W=b ² teq ² /6	Wcl	mm ³	39562	29315	26066																																																																																																																																																																																																																																																																																																																																																																																																								
Bending moment at fixation	Med	kNm	1,080	1,200	0,600																																																																																																																																																																																																																																																																																																																																																																																																								
Bending tensile stress at ULS	σEd,ULS*	N/mm ²	27,299	47,07	26,47																																																																																																																																																																																																																																																																																																																																																																																																								
Maximum utilization ULS = σEd/fmt.ud	utilization		0,36	0,61	0,38																																																																																																																																																																																																																																																																																																																																																																																																								
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin,ULS	mm	-	489	306																																																																																																																																																																																																																																																																																																																																																																																																								
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	5,54																																																																																																																																																																																																																																																																																																																																																																																																								
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a+b) decisive																																																																																																																																																																																																																																																																																																																																																																																																									
Bending moment at fixation	Med.res	kNm	0,720	0,800	0,400																																																																																																																																																																																																																																																																																																																																																																																																								
Section moduls with residual check	Wcl.res	mm ³	15682	(Ma/Mab)*(fmtud.ab/fmtud.a)=	For residual capacity check of Fk see Mepla calcs and related tables for bmin																																																																																																																																																																																																																																																																																																																																																																																																								
Bending tensile stress analytic based on bcalc	σEd.res**	N/mm ²	50,505	1,80																																																																																																																																																																																																																																																																																																																																																																																																									
Maximum utilization residual capacity based on bcalc	utilization		0,67	zone a decisive																																																																																																																																																																																																																																																																																																																																																																																																									
Deformation glass panel at top	δglass.top	mm	9,36	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation																																																																																																																																																																																																																																																																																																																																																																																																									
Moment of inertia with equivalent thickness teq.serv	Ieq.serv	mm ⁴	296797	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation																																																																																																																																																																																																																																																																																																																																																																																																									
Linear profile stiffness	kprof	(kN/m)/mm	34,5																																																																																																																																																																																																																																																																																																																																																																																																										
Characteristic force at top support glass into profile	Fp,k	kN/m	11,09																																																																																																																																																																																																																																																																																																																																																																																																										
Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k.max	kN/m	35,0																																																																																																																																																																																																																																																																																																																																																																																																										
Validation of linear iteration	valid		OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary																																																																																																																																																																																																																																																																																																																																																																																																									
Deformation top of profile based on numerical simulation of profile	δprof	mm	0,32																																																																																																																																																																																																																																																																																																																																																																																																										
Deformation top of parapet due to profile deformation/rotation - extrapolation	δprof.top	mm	2,9																																																																																																																																																																																																																																																																																																																																																																																																										
Total deformation at top of parapet = δglass + δprofile	δtot.top	mm	12,2																																																																																																																																																																																																																																																																																																																																																																																																										
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δmax	mm	20																																																																																																																																																																																																																																																																																																																																																																																																										
Maximum utilization SLS	utilization		0,61																																																																																																																																																																																																																																																																																																																																																																																																										
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	800	1000																																																																																																																																																																																																																																																																																																																																																																																																								
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	16,63	23,30	11,65																																																																																																																																																																																																																																																																																																																																																																																																								
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	68,8	-	-																																																																																																																																																																																																																																																																																																																																																																																																								
Maximum utilization aluminium profile for single loads qk and Fk	utilization		0,24	0,34	0,17																																																																																																																																																																																																																																																																																																																																																																																																								
Minimum plate width based on profile resistance	bmin.prof	mm	-	271	135																																																																																																																																																																																																																																																																																																																																																																																																								
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	6,82																																																																																																																																																																																																																																																																																																																																																																																																								
Parapet System		DF1010LM_E200																																																																																																																																																																																																																																																																																																																																																																																																											
Total height of the parapet		1001	mm																																																																																																																																																																																																																																																																																																																																																																																																										
Glass height		900	mm																																																																																																																																																																																																																																																																																																																																																																																																										
Glass thickness nominal		10	mm																																																																																																																																																																																																																																																																																																																																																																																																										
Interlayer		PVB																																																																																																																																																																																																																																																																																																																																																																																																											
Thickness interlayer		1,52	mm																																																																																																																																																																																																																																																																																																																																																																																																										
Load category		other																																																																																																																																																																																																																																																																																																																																																																																																											
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]																																																																																																																																																																																																																																																																																																																																																																																																							
Maximum utilization glass at ULS		ut.glass.ULS		0,8	1	0,5																																																																																																																																																																																																																																																																																																																																																																																																							
Maximum utilization profile at ULS		ut.profile.ULS		0,36																																																																																																																																																																																																																																																																																																																																																																																																									
Maximum utilization residual capacity glass for linear load qk		ut.residual		0,24	0,34	0,17																																																																																																																																																																																																																																																																																																																																																																																																							
Maximum deformation glass at SLS for linear load qk		def.glass.SLS		0,67																																																																																																																																																																																																																																																																																																																																																																																																									
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	9,4																																																																																																																																																																																																																																																																																																																																																																																																									
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS		12,2																																																																																																																																																																																																																																																																																																																																																																																																									
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	0,61		5,54																																																																																																																																																																																																																																																																																																																																																																																																							
Minimum plate width ULS glass		bmin.glass.ULS	mm		489	306																																																																																																																																																																																																																																																																																																																																																																																																							
Minimum plate width ULS profile		bmin.profile.ULS	mm		271	135																																																																																																																																																																																																																																																																																																																																																																																																							
Minimum plate width residual check		bmin.glass.residual	mm		1550																																																																																																																																																																																																																																																																																																																																																																																																								
Minimum plate width overall		bmin	mm		1550																																																																																																																																																																																																																																																																																																																																																																																																								

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System
 Total height of the parapet
 Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4
 Vertical distance between top of profile and top support of glass into profile
 Vertical distance between top and bottom support of glass into profile
 Vertical distance between bottom support of glass into profile and base ground
 Distance between fixations
 Nominal glass thickness
 Glass thickness for calculation tp1 for inner plate at loading side
 Glass thickness for calculation tp2 for middle and outer plate
 Type of interlayer
 Thickness of interlayer
 Number of sheets of glass of laminated plate
 Maximum temperature of glass panel at loading for PVB
 Maximum temperature of glass panel at loading for SGP
 Load category
 Consequence class
 Multiplication factor for consequence class
 Load safety factor variable loads as basis value
 Load safety factor variable loads considering CC
 Load combination factor for variable life load
 Load combination factor for variable wind load
 Predominant load
 Material safety factor float glass for predominant load
 Material safety factor FTG
 Factor for the edge quality of the glass panel
 Corrosion constant as a function
 Factor for the surface structure of float glass
 Factor for the zone for FTG and edge zone
 Characteristic resistance of float glass
 Characteristic resistance of FTG

Profile	DF1010LM_E200
Ltot	mm 1101
L1	mm 1000
L2	mm 11
L3	mm 70
L4	mm 31
efix	mm 200
tnom	mm 10
tp1	mm 9,7
tp2	mm 9,7
Interlayer	- PVB
tv.i	mm 1,52
ng	- 2
Tg.pvb	°C 30
Tg.sgp	°C 50
Cat	- A2
CC	- CC2
KF1	- 1
γQ0	- 1,5
γQ	- 1,5
ψ0 LL	- 0,4
ψ0 Wind	- 0
	Life load
γm.A	- 1,8
γm.V	- 1,2
ke	- 1
c	- 16
ksp	- 1
kz	- 0,9
fg.k	N/mm² 45
fb.k	N/mm² 120

Type of load	Zone of load	qk [kN/m]	Fk [kN]	wk [kN/m²]
a	a	a	a+b	a-b
Value of load		0,5	1	0,3
Time of loading	s	60	86400	5
Load area A	mm²	-	40000	40000
				1000000
Modification factor for the load time	kinod	-	0,856	0,856
Surface effect factor	ka	-	1,0	1,076
Design resistance of FTG	f _{mt,ud}	N/mm²	77,65	79,28
Shear modulus interlayer	Gint	N/mm²	0,75	0,75
Young modulus interlayer	Eint	N/mm²	2,25	2,25
Coupling factor of the interlayer(s) at stress	σ _σ	-	0,224	0,142
Coupling factor of the interlayer(s) at deformation	σ _ω	-	0,445	0,329
Equivalent glass thickness ULS	teq.ult	mm	16,03	15,33
Equivalent glass thickness SLS	teq.serv	mm	16,22	15,37
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	900
Section modulus with equivalent thickness W=b*teq²/6	W _{el}	mm³	42836	35229
Bending moment at fixation	Med	kNm	0,750	1,350
Bending tensile stress at ULS	σ _{Ed,ULS}	N/mm²	17,509	44,07
Maximum utilization ULS = σ _{Ed} /f _{mt,ud}	utilization	-	0,23	0,56
Minimum plate width based ULS-checks as maximum of Fk-loads	b _{min,ULS}	mm	-	500
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m²	-	189
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	900
Bending moment at fixation	Med.res	kNm	0,500	0,270
Section modulus with residual check	W _{el.res}	mm³	15682	(Wa/Mab)*((f _{mtud.ab} /f _{mtud.a})=
Bending tensile stress analytic based on bcalc	σ _{Ed,res**}	N/mm²	35,073	2,98
Maximum utilization residual capacity based on bcalc	utilization	-	0,45	zone a decisive
Deformation glass panel at top	σ _{glass,top}	mm	6,70	* x 1,15 for wind and Fk to account for difference between constant
Moment of inertia with equivalent thickness teq.serv	I _{eq.serv}	mm ⁴	355344	tension and real tension distribution acc. to comparative Mepla-calculation
Linear profile stiffness	kprof	(kN/m)/mm	34,5	** x 1,1 to account for difference between constant tension and real tension
Characteristic force at top support glass into profile	Fp.k	kN/m	7,64	distribution acc. to comparative Mepla-calculation
Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k.max	kN/m	35,0	
Validation of linear iteration	valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary
Deformation top of profile based on numerical simulation of profile	σ _{prof}	mm	0,22	
Deformation top of parapet due to profile deformation/rotation - extrapolation	σ _{prof.top}	mm	2,2	
Total deformation at top of parapet = σ _{glass} + σ _{profile}	σ _{tot.top}	mm	8,9	
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	σ _{max}	mm	20	
Maximum utilization SLS	utilization	-	0,44	
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	900
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	11,46	23,10
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	68,8	6,93
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,17	0,34
Minimum plate width based on profile resistance	b _{min.prof}	mm	-	302
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m²	-	91
				5,61
Parapet System	DF1010LM_E200			
Total height of the parapet	1101	mm		
Glass height	1000	mm		
Glass thickness nominal	10	mm		
Interlayer	PVB	-		
Thickness interlayer	1,52	mm		
Load category	A2	-		
Load		qk [kN/m]	Fk [kN]	wk [kN/m²]
		0,5	1	0,3
Maximum utilization glass at ULS	ut.glass.ULS	-	0,23	
Maximum utilization profile at ULS	ut.profile.ULS	-	0,17	0,34
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,45	
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	-	6,7	
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	8,9	
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,44	
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m²		4,62
Minimum plate width ULS glass	b _{min.glass.ULS}	mm	500	189
Minimum plate width ULS profile	b _{min.profile.ULS}	mm	302	91
Minimum plate width residual check	b _{min.glass.residual}	mm	1600	
Minimum plate width overall	bmin	mm	1600	

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF1010LM_E200			
Total height of the parapet		Ltot	mm	1201		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1100		
Vertical distance between top of profile and top support of glass into profile		L2	mm	11		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	31		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	10		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	9,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	9,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1100000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{td,ud}	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		α _σ	-	0,248	0,158	0,065
Coupling factor of the interlayer(s) at deformatio		α _w	-	0,492	0,372	0,180
Equivalent glass thickness ULS		teq,ult	mm	16,21	15,48	14,54
Equivalent glass thickness SLS		teq,serv	mm	16,53	15,69	14,12
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1000	1000
Section moduls with equivalent thickness W=b ³ teq ² /6		Wel	mm ³	43816	39944	35217
Bending moment at fixation		Med	kNm	0,495	0,750	0,300
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	11,297	21,59	9,80
Maximum utilization ULS = σEd/f _{td,ud}		utilization	-	0,15	0,27	0,14
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	272	138
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	3,91
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	1000
Bending moment at fixation		Med,res	kNm	0,330	0,500	0,200
Section moduls with residual check		Wel,res	mm ³	15682	(Ma/Mab)*(f _{td,ud} .ab/f _{td,ud} .a)=	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc		σEd,res**	N/mm ²	23,148	2,23	
Maximum utilization residual capacity based on bcalc		utilization	-	0,30	zone a decisive	
Deformation glass panel at top		σglass,top	mm	5,05	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq,serv		Ieq,serv	mm ⁴	376517	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	34,5		
Characteristic force at top support glass into profile		Fp.k	kN/m	5,01		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k,max	kN/m	35,0		
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Deformation top of profile based on numerical simulation of profile		σprof	mm	0,15		
Deformation top of parapet due to profile deformation/rotation - extrapolation		σrot,top	mm	1,6		
Total deformation at top of parapet = σglass + σprofile		σtot,top	mm	6,6		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		σmax	mm	20		
Maximum utilization SLS		utilization	-	0,33		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	1000	1000
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	7,52	11,46	4,59
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	68,8	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,11	0,17	0,07
Minimum plate width based on profile resistance		bmin.prof	mm	-	167	67
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	4,69
Parapet System		DF1010LM_E200				
Total height of the parapet		1201	mm			
Glass height		1100	mm			
Glass thickness nominal		10	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,15	0,5	0,2
Maximum utilization profile at ULS		ut.profile.ULS	-	0,11	0,17	0,07
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,30		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	5,1		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	6,6		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,33		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²			3,91
Minimum plate width ULS glass		bmin.glass.ULS	mm		272	138
Minimum plate width ULS profile		bmin.profile.ULS	mm		167	67
Minimum plate width residual check		bmin.glass.residual	mm	470		
Minimum plate width overall		bmin	mm	470		
NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation						

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF1010LM_E200			
Total height of the parapet		Ltot	mm	1301		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1200		
Vertical distance between top of profile and top support of glass into profile		L2	mm	11		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	31		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	10		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	9,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	9,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1200000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{td,ud}	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		o _o	-	0,271	0,175	0,073
Coupling factor of the interlayer(s) at deformatio		o _w	-	0,534	0,412	0,207
Equivalent glass thickness ULS		teq.ult	mm	16,38	15,63	14,62
Equivalent glass thickness SLS		teq.serv	mm	16,81	15,98	14,36
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1100	1100
Section moduls with equivalent thickness W=b ³ teq ² /6		W _{el}	mm ³	44735	44791	39210
Bending moment at fixation		Med	kNm	0,540	0,825	0,330
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	12,071	21,18	9,68
Maximum utilization ULS = σEd/f _{td,ud}		utilization	-	0,16	0,27	0,14
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	294	150
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	3,36
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	-
Bending moment at fixation		Med.res	kNm	0,360	0,550	0,220
Section moduls with residual check		W _{el.res}	mm ³	15682	(Ma/Mab)*(f _{td,ud} .ab/f _{td,ud} .a)=	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm ²	25,252	2,23	-
Maximum utilization residual capacity based on bcalc		utilization	-	0,33	zone a decisive	-
Deformation glass panel at top		δ _{glass.top}	mm	6,24	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-
Moment of inertia with equivalent thickness teq.serv		I _{eq.serv}	mm ⁴	395913	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-
Linear profile stiffness		kprof	(kN/m)/mm	34,5	-	-
Characteristic force at top support glass into profile		Fp.k	kN/m	5,44	-	-
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k.max	kN/m	35,0	-	-
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	-
Deformation top of profile based on numerical simulation of profile		δ _{prof}	mm	0,16	-	-
Deformation top of parapet due to profile deformation/rotation - extrapolation		δ _{rot.top}	mm	1,8	-	-
Total deformation at top of parapet = δ _{glass} + δ _{profile}		δ _{tot.top}	mm	8,1	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δ _{max}	mm	20	-	-
Maximum utilization SLS		utilization	-	0,40	-	-
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	1100	1100
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	8,16	11,40	4,56
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	68,8	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,12	0,17	0,07
Minimum plate width based on profile resistance		bmin.prof	mm	-	182	73
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	3,98
Parapet System		DF1010LM_E200				
Total height of the parapet		1301	mm			
Glass height		1200	mm			
Glass thickness nominal		10	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
				0,3	0,5	0,2
Maximum utilization glass at ULS		ut.glass.ULS	-	0,16		
Maximum utilization profile at ULS		ut.profile.ULS	-	0,12	0,17	0,07
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,33		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	6,2		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	8,1		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,40		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²			3,36
Minimum plate width ULS glass		bmin.glass.ULS	mm		294	150
Minimum plate width ULS profile		bmin.profile.ULS	mm		182	73
Minimum plate width residual check		bmin.glass.residual	mm	520		
Minimum plate width overall		bmin	mm	520		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

4.2.10 DF1010FR_E200

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile				DF1010FR_E200			
Total height of the parapet		Ltot	mm	1001					
Glass length top of parapet until first fixation into profile L1-Ltot-L3-L4		L1	mm	900					
Vertical distance between top of profile and top support of glass into profile		L2	mm	11					
Vertical distance between top and bottom support of glass into profile		L3	mm	70					
Vertical distance between bottom support of glass into profile and base ground		L4	mm	31					
Distance between fixations		efix	mm	200					
Nominal glass thickness		tnom	mm	10					
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	9,7					
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	9,7					
Type of interlayer		Interlayer	-	PVB					
Thickness of interlayer		tv.i	mm	1,52					
Number of sheets of glass of laminated plate		ng	-	2					
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30					
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50					
Load category		Cat	-	other					
Consequence class		CC	-	CC2					
Multiplication factor for consequence class		KF1	-	1					
Load safety factor variable loads as basis value		γQ0	-	1,5					
Load safety factor variable loads considering CC		γQ	-	1,5					
Load combination factor for variable life load		ψ0 LL	-	0,6					
Load combination factor for variable wind load		ψ0 Wind	-	0					
Predominant load			-	Life load					
Material safety factor float glass for predominant load		γm.A	-	1,8					
Material safety factor FTG		γm.V	-	1,2					
Factor for the edge quality of the glass panel		ke	-	1					
Corrosion constant as a function		c	-	16					
Factor for the surface structure of float glass		ksp	-	1					
Factor for the zone for FTG and edge zone		kz	-	0,9					
Characteristic resistance of float glass		fg.k	N/mm ²	45					
Characteristic resistance of FTG		fb.k	N/mm ²	120					
		Type of load		qk [kN/m]	Fk [kN]		wk [kN/m ²]		
		Zone of load		a	a	a+b	a+b		
		Value of load		0,8	1	0,5	1		
		Time of loading	s	300	300	604800	5		
		Load area A	mm ²	-	40000	40000	900000		
Modification factor for the load time		kmod	-	0,774	0,774	0,481	1,000		
Surface effect factor		ka	-	1,0	1,076	1,076	0,950		
Design resistance of FTG		f _{mt,ud}	N/mm ²	75,61	77,08	69,19	80,00		
Shear modulus interlayer		Gint	N/mm ²	0,53	0,53	0,11	0,96		
Young modulus interlayer		Eint	N/mm ²	1,60	1,60	0,32	2,87		
Coupling factor of the interlayer(s) at stress		σ _{or}	-	0,150	0,092	0,020	0,373		
Coupling factor of the interlayer(s) at deformation		σ _w	-	0,317	0,221	0,054	0,357		
Equivalent glass thickness ULS		teq.ult	mm	15,41	14,83	13,98	17,04		
Equivalent glass thickness SLS		teq.serv	mm	15,27	14,48	12,85	15,58		
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	800	800	1000		
Section moduls with equivalent thickness W=b*teq ² /6		Wel	mm ³	39562	29315	26066	48402		
Bending moment at fixation		Med	kNm	1,080	1,200	0,600	0,608		
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	27,299	47,07	26,47	14,43		
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,36	0,61	0,38	0,18		
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	489	306	-		
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	-	5,54		
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive		-		
Bending moment at fixation		Med.res	kNm	0,720	0,800	0,400	-	For residual capacity check of Fk see Mepla calcs and related tables	
Section moduls with residual check		Wel.res	mm ³	15682	(Ma/Mab)*(f _{mt,ud} .ab/f _{mt,ud} .a)=		-		
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm ²	50,505	1,80	-	-		
Maximum utilization residual capacity based on bcalc		utilization	-	0,67	zone a decisive		-		
Deformation glass panel at top		δ _{glass,top}	mm	9,36	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation				
Moment of inertia with equivalent thickness teq.serv		I _{eq.serv}	mm ⁴	296797	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation				
Linear profile stiffness		kprof	(kN/m)/mm	19,0					
Characteristic force at top support glass into profile		Fp.k	kN/m	11,09					
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k,max	kN/m	45,0					
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary				
Deformation top of profile based on numerical simulation of profile		δ _{prof,top}	mm	0,58					
Deformation top of parapet due to profile deformation/rotation - extrapolation		δ _{tot,top}	mm	5,2					
Total deformation at top of parapet = δ _{glass} + δ _{profile}		δ _{tot,top}	mm	14,6					
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		δ _{max}	mm	20					
Maximum utilization SLS		utilization	-	0,73					
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	800	800	1000		
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	16,63	23,30	11,65	10,08		
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	78,5	-	-	-		
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,21	0,30	0,15	0,13		
Minimum plate width based on profile resistance		bmin.prof	mm	-	238	119	-		
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	-	7,78		
Parapet System		DF1010FR_E200							
Total height of the parapet		1001	mm						
Glass height		900	mm						
Glass thickness nominal		10	mm						
Interlayer		PVB	-						
Thickness interlayer		1,52	mm						
Load category		other	-	qk [kN/m]		Fk [kN]		wk [kN/m ²]	
Load				0,8	1	0,5			
Maximum utilization glass at ULS		ut.glass.ULS	-	0,36					
Maximum utilization profile at ULS		ut.profile.ULS	-	0,21	0,30	0,15			
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,67					
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	9,4					
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	14,6					
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,73					
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²				5,54		
Minimum plate width ULS glass		bmin.glass.ULS	mm		489	306			
Minimum plate width ULS profile		bmin.profile.ULS	mm		238	119			
Minimum plate width residual check		bmin.glass.residual	mm	1550					
Minimum plate width overall		bmin	mm	1550					

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF 1010FR_E200			
Parapet System						
Total height of the parapet		Ltot	mm	1101		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1000		
Vertical distance between top of profile and top support of glass into profile		L2	mm	11		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	31		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	10		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	9,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	9,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv,i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A2		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm,A	-	1,8		
Material safety factor FTG		γm,V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg,k	N/mm ²	45		
Characteristic resistance of FTG		fb,k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,5	1	0,3
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
						1000000
Modification factor for the load time		kmod	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm ²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		φ _σ	-	0,224	0,142	0,058
Coupling factor of the interlayer(s) at deformation		φ _w	-	0,445	0,329	0,154
Equivalent glass thickness ULS		teq,ult	mm	16,03	15,33	14,45
Equivalent glass thickness SLS		teq,serv	mm	16,22	15,37	13,87
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	900	900
Section moduls with equivalent thickness W=b*teq ² /6		Wel	mm ³	42836	35229	31312
Bending moment at fixation		Med	kNm	0,750	1,350	0,405
Bending tensile stress at ULS		σEd,ULS*	N/mm ²	17,509	44,07	14,87
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,23	0,56	0,21
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin,ULS	mm	-	500	189
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max,ULS	KN/m ²	-	-	4,62
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med,res	kNm	0,500	0,900	0,270
Section moduls with residual check		Wel,res	mm ³	15682	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc		σEd,res**	N/mm ²	35,073	2,98	
Maximum utilization residual capacity based on bcalc		utilization	-	0,45	zone a decisive	
Deformation glass panel at top		δglass,top	mm	6,70	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq,serv		Ieq,serv	mm ⁴	355344	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	19,0		
Characteristic force at top support glass into profile		Fp,k	kN/m	7,64		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp,k,max	kN/m	45,0		
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Defomation top of profile based on numerical simulation of profile		δprof	mm	0,40		
Defomation top of parapet due to profile deformation/rotation - extrapolation		δprof,top	mm	4,0		
Total deformation at top of parapet = δglass + δprof		δtot,top	mm	10,7		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δmax	mm	20		
Maximum utilization SLS		utilization	-	0,53		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	900	900
Design acting force at top support glass into profile based on bmin for Fk		Fp,Ed	kNm	11,46	23,10	6,93
Maximum allowed design acting force based on numerical simulations of profiles		Fp,Rd	kN/m	78,5	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,15	0,29	0,09
Minimum plate width based on profile resistance		bmin,prof	mm	-	265	79
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max,profile	KN/m ²	-	-	6,40
Parapet System		DF 1010FR_E200				
Total height of the parapet		1101	mm			
Glass height		1000	mm			
Glass thickness nominal		10	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A2	-	qk [kN/m]	Fk [kN]	wk [kN/m ²]
Load				0,5	1	0,3
Maximum utilization glass at ULS		ut.glass,ULS	-	0,23		
Maximum utilization profile at ULS		ut.profile,ULS	-	0,15	0,29	0,09
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,45		
Maximum deformation glass at SLS for linear load qk		def.glass,SLS	mm	6,7		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof,SLS	mm	10,7		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof,SLS	-	0,53		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	KN/m ²			4,62
Minimum plate width ULS glass		bmin.glass,ULS	mm		500	189
Minimum plate width ULS profile		bmin.profile,ULS	mm		265	79
Minimum plate width residual check		bmin.glass.residual	mm	1600		
Minimum plate width overall		bmin	mm	1600		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF1010FR_E200			
Parapet System						
Total height of the parapet		Ltot	mm	1201		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1100		
Vertical distance between top of profile and top support of glass into profile		L2	mm	11		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	31		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	10		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	9,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	9,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A1		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KFI	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm²	45		
Characteristic resistance of FTG		fb.k	N/mm²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m²]
		Zone of load	a	a	a+b	a-b
		Value of load		0,3	0,5	0,2
		Time of loading	s	60	60	86400
		Load area A	mm²	-	40000	40000
						1100000
Modification factor for the load time		kmot	-	0,856	0,856	0,543
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm²	77,65	79,28	70,87
Shear modulus interlayer		Gint	N/mm²	0,75	0,75	0,28
Young modulus interlayer		Eint	N/mm²	2,25	2,25	0,84
Coupling factor of the interlayer(s) at stress		ω _σ	-	0,248	0,158	0,065
Coupling factor of the interlayer(s) at deformation		ω _w	-	0,492	0,372	0,180
Equivalent glass thickness ULS		teq.ult	mm	16,21	15,48	14,54
Equivalent glass thickness SLS		teq.serv	mm	16,53	15,69	14,12
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1000	1000
Section modulus with equivalent thickness W=b ² teq ² /6		W _{el}	mm³	43816	39944	35217
Bending moment at fixation		Med	kNm	0,495	0,750	0,300
Bending tensile stress at ULS		σ _{Ed,ULS} *	N/mm²	11,297	21,59	9,80
Maximum utilization ULS = σ _{Ed} /f _{mt,ud}		utilization	-	0,15	0,27	0,14
Minimum plate width based ULS-checks as maximum of Fk-loads		b _{min,ULS}	mm	-	272	138
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m²	-	-	3,91
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med.res	kNm	0,330	0,500	0,200
Section modulus with residual check		W _{el,res}	mm³	15682	(Wa/Mab) ² (f _{mt,ud,ab} /f _{mt,ud,a})=	
Bending tensile stress analytic based on bcalc		σ _{Ed,res} **	N/mm²	23,148	2,23	zone a decisive
Maximum utilization residual capacity based on bcalc		utilization	-	0,30		
Deformation glass panel at top		σ _{glass,top}	mm	5,05	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq.serv		I _{eq.serv}	mm ⁴	376517	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	19,0		
Characteristic force at top support glass into profile		Fp.k	kN/m	5,01		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k,max	kN/m	45,0		
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Deformation top of profile based on numerical simulation of profile		σ _{prof,top}	mm	0,26		
Deformation top of parapet due to profile deformation/rotation - extrapolation		σ _{prof,top}	mm	2,8		
Total deformation at top of parapet = σ _{glass} + σ _{profile}		σ _{tot,top}	mm	7,9		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		σ _{max}	mm	20		
Maximum utilization SLS		utilization	-	0,39		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	1000	1000
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	7,52	11,46	4,59
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	78,5	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,10	0,15	0,06
Minimum plate width based on profile resistance		b _{min,prof}	mm	-	146	58
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m²	-	-	5,35
Parapet System		DF1010FR_E200				
Total height of the parapet		1201	mm			
Glass height		1100	mm			
Glass thickness nominal		10	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		A1	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,15	-	-
Maximum utilization profile at ULS		ut.profile.ULS	-	0,10	0,15	0,06
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,30	-	-
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	-	5,1	-	-
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	7,9	-	-
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,39	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m²	-	-	3,91
Minimum plate width ULS glass		b _{min.glass.ULS}	mm	-	272	138
Minimum plate width ULS profile		b _{min.profile.ULS}	mm	-	146	58
Minimum plate width residual check		b _{min.glass.residual}	mm	470	-	-
Minimum plate width overall		b _{min}	mm	470	-	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF1010FR_E200			
Parapet System		Ltot	mm	1301		
Total height of the parapet		L1	mm	1200		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	11		
Vertical distance between top of profile and top support of glass into profile		L3	mm	70		
Vertical distance between top and bottom support of glass into profile		L4	mm	31		
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200		
Distance between fixations		tnom	mm	10		
Nominal glass thickness		tp1	mm	9,7		
Glass thickness for calculation tp1 for inner plate at loading side		tp2	mm	9,7		
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	PVB		
Type of interlayer		tv.1	mm	1,52		
Thickness of interlayer		ng	-	2		
Number of sheets of glass of laminated plate		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50		
Maximum temperature of glass panel at loading for SGP		Cat	-	A1		
Load category		CC	-	CC2		
Consequence class		KF1	-	1		
Multiplication factor for consequence class		γQ0	-	1,5		
Load safety factor variable loads as basis value		γQ	-	1,5		
Load safety factor variable loads considering CC		ψ0 LL	-	0,4		
Load combination factor for variable life load		ψ0 Wind	-	0		
Load combination factor for variable wind load				Life load		
Predominant load		γm.A	-	1,8		
Material safety factor float glass for predominant load		γm.V	-	1,2		
Material safety factor FTG		ke	-	1		
Factor for the edge quality of the glass panel		c	-	16		
Corrosion constant as a function		ksp	-	1		
Factor for the surface structure of float glass		kz	-	0,9		
Factor for the zone for FTG and edge zone		fg.k	N/mm ²	45		
Characteristic resistance of float glass		fb.k	N/mm ²	120		
Characteristic resistance of FTG				Type of load		
				Zone of load		
				Value of load		
				Time of loading		
				Load area A		
				Modification factor for the load time		
				Surface effect factor		
				Design resistance of FTG		
				Shear modulus interlayer		
				Young modulus interlayer		
				Coupling factor of the interlayer(s) at stress		
				Coupling factor of the interlayer(s) at deformation		
				Equivalent glass thickness ULS		
				Equivalent glass thickness SLS		
				Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		
				Section moduls with equivalent thickness W=b*teq ² /6		
				Bending moment at fixation		
				Bending tensile stress at ULS		
				Maximum utilization ULS = σEd/fmt.ud		
				Minimum plate width based ULS-checks as maximum of Fk-loads		
				Maximum characteristic wind load wk for only wind loads based on ULS glass		
				Calculation width glass panel - for Fk based on Mepla calculation		
				Bending moment at fixation		
				Section moduls with residual check		
				Bending tensile stress analytic based on bcalc		
				Maximum utilization residual capacity based on bcalc		
				Deformation glass panel at top		
				Moment of inertia with equivalent thickness teq.serv		
				Linear profile stiffness		
				Characteristic force at top support glass into profile		
				Maximum char. force at top support glass/profile at end of linear stiffness		
				Validation of linear iteration		
				Deformation top of profile based on numerical simulation of profile		
				Deformation top of parapet due to profile deformation/rotation - extrapolation		
				Total deformation at top of parapet = δglass + δprofile		
				Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		
				Maximum utilization SLS		
				Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		
				Design acting force at top support glass into profile based on bmin for Fk		
				Maximum allowed design acting force based on numerical simulations of profiles		
				Maximum utilization aluminium profile for single loads qk and Fk		
				Minimum plate width based on profile resistance		
				Maximum characteristic wind load wk for only wind loads based on ULS profile		
				Parapet System		
				DF1010FR_E200		
				Total height of the parapet		
				Glass height		
				Glass thickness nominal		
				Interlayer		
				Thickness interlayer		
				Load category		
				A1		
				Load		
				Maximum utilization glass at ULS		
				Maximum utilization profile at ULS		
				Maximum utilization residual capacity glass for linear load qk		
				Maximum deformation glass at SLS for linear load qk		
				Maximum deformation glass + profile at SLS for linear load qk		
				Maximum utilization glass + profile at SLS for linear load qk		
				Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		
				Minimum plate width ULS glass		
				Minimum plate width ULS profile		
				Minimum plate width residual check		
				Minimum plate width overall		
				NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation		

4.2.11 DF1212LM_E200

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF1212LM_E200			
Parapet System		Ltot	mm	1001		
Total height of the parapet		L1	mm	900		
Glass height		L2	mm	11		
Glass thickness nominal		L3	mm	70		
Vertical distance between top of profile and top support of glass into profile		L4	mm	31		
Vertical distance between top and bottom support of glass into profile		efix	mm	200		
Vertical distance between bottom support of glass into profile and base ground		tnom	mm	12		
Distance between fixations		tpl1	mm	11,7		
Nominal glass thickness		tpl2	mm	11,7		
Glass thickness for calculation tp1 for inner plate at loading side		Interlayer	-	PVB		
Glass thickness for calculation tp2 for middle and outer plate		tv.1	mm	1,52		
Type of interlayer		ng	-	2		
Thickness of interlayer		Tg.pvb	°C	30		
Number of sheets of glass of laminated plate		Tg.sgp	°C	50		
Maximum temperature of glass panel at loading for PVB		Cat	-	other		
Maximum temperature of glass panel at loading for SGP		CC	-	CC2		
Load category		KF1	-	1		
Consequence class		γQ0	-	1,5		
Multiplication factor for consequence class		γQ	-	1,5		
Load safety factor variable loads as basis value		γ0 LL	-	0,6		
Load safety factor variable loads considering CC		γ0 Wind	-	0		
Load safety factor variable life load				Life load		
Load combination factor for variable wind load		γm.A	-	1,8		
Predominant load		γm.V	-	1,2		
Material safety factor float glass for predominant load		ke	-	1		
Material safety factor FTG		c	-	16		
Factor for the edge quality of the glass panel		ksp	-	1		
Corrosion constant as a function		kz	-	0,9		
Factor for the surface structure of float glass		fg.k	N/mm ²	45		
Factor for the zone for FTG and edge zone		fb.k	N/mm ²	120		
Characteristic resistance of float glass				Type of load		
Characteristic resistance of FTG				Zone of load		
				Value of load		
				Time of loading		
				Load area A		
				Modification factor for the load time		
				Surface effect factor		
				Design resistance of FTG		
				Shear modulus interlayer		
				Young modulus interlayer		
				Coupling factor of the interlayer(s) at stress		
				Coupling factor of the interlayer(s) at deformation		
				Equivalent glass thickness ULS		
				Equivalent glass thickness SLS		
				Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		
				Section moduls with equivalent thickness W=b*teq ² /6		
				Bending moment at fixation		
				Bending tensile stress at ULS		
				Maximum utilization ULS = σEd/fmt.ud		
				Minimum plate width based ULS-checks as maximum of Fk-loads		
				Maximum characteristic wind load wk for only wind loads based on ULS glass		
				Calculation width glass panel - for Fk based on Mepla calculation		
				Bending moment at fixation		
				Section moduls with residual check		
				Bending tensile stress analytic based on bcalc		
				Maximum utilization residual capacity based on bcalc		
				Deformation glass panel at top		
				Moment of inertia with equivalent thickness teq.serv		
				Linear profile stiffness		
				Characteristic force at top support glass into profile		
				Maximum char. force at top support glass/profile at end of linear stiffness		
				Validation of linear iteration		
				Deformation top of profile based on numerical simulation of profile		
				Deformation top of parapet due to profile deformation/rotation - extrapolation		
				Total deformation at top of parapet = σglass + sprof		
				Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		
				Maximum utilization SLS		
				Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		
				Design acting force at top support glass into profile based on bmin for Fk		
				Maximum allowed design acting force based on numerical simulations of profiles		
				Maximum utilization aluminium profile for single loads qk and Fk		
				Minimum plate width based on profile resistance		
				Maximum characteristic wind load wk for only wind loads based on ULS profile		
				Parapet System		
				DF1212LM_E200		
				Total height of the parapet		
				Glass height		
				Glass thickness nominal		
				Interlayer		
				Thickness interlayer		
				Load category		
				Load		
				Maximum utilization glass at ULS		
				Maximum utilization profile at ULS		
				Maximum utilization residual capacity glass for linear load qk		
				Maximum deformation glass at SLS for linear load qk		
				Maximum deformation glass + profile at SLS for linear load qk		
				Maximum utilization glass + profile at SLS for linear load qk		
				Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		
				Minimum plate width ULS glass		
				Minimum plate width ULS profile		
				Minimum plate width residual check		
				Minimum plate width overall		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF1212LM_E200			
Parapet System						
Total height of the parapet	Ltot	mm	1101			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1000			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	12			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	11,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	11,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	other			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant	ym.A	-	1,8			
Material safety factor FTG	ym.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
	Type of load		qk [kN/m]		Fk [kN]	wk [kN/m ²]
	Zone of load		a		a+b	a+b
	Value of load		0,8		1	0,5
	Time of loading	s	300		300	604800
	Load area A	mm ²	-		40000	40000
						1000000
Modification factor for the load time	kmod	-	0,774		0,774	0,481
Surface effect factor	ka	-	1,0		1,076	0,946
Design resistance of FTG	f _{mt.ud}	N/mm ²	75,61		77,08	69,19
Shear modulus interlayer	Gint	N/mm ²	0,53		0,53	0,11
Young modulus interlayer	Eint	N/mm ²	1,60		1,60	0,32
Coupling factor of the interlayer(s) at stress	ωσ	-	0,145		0,089	0,019
Coupling factor of the interlayer(s) at deformation	ωω	-	0,321		0,224	0,055
Equivalent glass thickness ULS	teq.ult	mm	18,53		17,84	16,85
Equivalent glass thickness SLS	teq.serv	mm	18,46		17,50	15,51
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000		900	1000
Section moduls with equivalent thickness W=b ² teq ² /6	Wel	mm ³	57202		47749	42603
Bending moment at fixation	Med	kNm	1,200		1,350	0,675
Bending tensile stress at ULS	σEd.ULS*	N/mm ²	20,978		32,51	18,22
Maximum utilization ULS = σEd/f _{mt.ud}	utilization	-	0,28		0,42	0,26
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin.ULS	mm	-		380	237
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-		-	6,52
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000		Check if zone (a) or (a+b) decisive	
Bending moment at fixation	Med.res	kNm	0,800		0,900	0,450
Section moduls with residual check	Wel.res	mm ³	22815		(Ma/Mab)*(f _{mtud.ab} /f _{mtud.a})=	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc	σEd.res**	N/mm ²	38,571		1,80	
Maximum utilization residual capacity based on bcalc	utilization	-	0,51		zone a decisive	
Deformation glass panel at top	δglass.top	mm	7,27		* x 1,15 for wind and Fk to account for difference between constant	
Moment of inertia with equivalent thickness teq.serv	Ieq.serv	mm ⁴	524086		tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness	kprof	(kN/m)/mm	34,5		** x1,1 to account for difference between constant tension and real tension	
Characteristic force at top support glass into profile	Fp.k	kN/m	12,23		distribution acc. to comparative Mepla-calculation	
Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k,max	kN/m	35,0			
Validation of linear iteration	valid	-	OK		Note: if linear automatic iteration is not valid, manual	
Deformation top of profile based on numerical simulation of profile	δprof	mm	0,35		iteration in the load deformation curves of the single profiles is necessary	
Deformation top of parapet due to profile deformation/rotation - extrapolation	δprot.top	mm	3,5			
Total deformation at top of parapet = δglass + δprofile	δtot.top	mm	10,8			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δmax	mm	20			
Maximum utilization SLS	utilization	-	0,54			
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000		900	900
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	18,34		23,10	11,55
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	68,8		-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,27		0,34	0,17
Minimum plate width based on profile resistance	bmin.prof	mm	-		302	151
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-		-	5,61
Parapet System	DF1212LM_E200					
Total height of the parapet	1101	mm				
Glass height	1000	mm				
Glass thickness nominal	12	mm				
Interlayer	PVB	-				
Thickness interlayer	1,52	mm				
Load category	other	-				
Load			qk [kN/m]		Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS	ut.glass.ULS	-	0,28		1	0,5
Maximum utilization profile at ULS	ut.profile.ULS	-	0,27		0,34	0,17
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,51			
Maximum deformation glass at SLS for linear load qk	def.glass.SLS		7,3			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	10,8			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,54			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²				5,61
Minimum plate width ULS glass	bmin.glass.ULS	mm			380	237
Minimum plate width ULS profile	bmin.profile.ULS	mm			302	151
Minimum plate width residual check	bmin.glass.residual	mm			640	
Minimum plate width overall	bmin	mm			640	

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF1212LM_E200			
Parapet System		Ltot	mm	1201		
Total height of the parapet		L1	mm	1100		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	11		
Vertical distance between top of profile and top support of glass into profile		L3	mm	70		
Vertical distance between top and bottom support of glass into profile		L4	mm	31		
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200		
Distance between fixations		tnom	mm	12		
Nominal glass thickness		tpl1	mm	11,7		
Glass thickness for calculation tp1 for inner plate at loading side		tpl2	mm	11,7		
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	PVB		
Type of interlayer		tv.i	mm	1,52		
Thickness of interlayer		ng	-	2		
Number of sheets of glass of laminated plate		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50		
Maximum temperature of glass panel at loading for SGP		Cat	-	other		
Load category		CC	-	CC2		
Consequence class		KFI	-	1		
Multiplication factor for consequence class		γQ0	-	1,5		
Load safety factor variable loads as basis value		γQ	-	1,5		
Load safety factor variable loads considering CC		ψ0 LL	-	0,6		
Load combination factor for variable life load		ψ0 Wind	-	0		
Load combination factor for variable wind load					Life load	
Predominant load		γm.A	-	1,8		
Material safety factor float glass for predominant load		γm.V	-	1,2		
Material safety factor FTG		ke	-	1		
Factor for the edge quality of the glass panel		c	-	16		
Corrosion constant as a function		ksp	-	1		
Factor for the surface structure of float glass		kz	-	0,9		
Factor for the zone for FTG and edge zone		fg.k	N/mm ²	45		
Characteristic resistance of float glass		fb.k	N/mm ²	120		
Characteristic resistance of FTG		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,8	1	0,5
		Time of loading	s	300	300	604800
		Load area A	mm ²	-	40000	40000
						1100000
Modification factor for the load time		kimod	-	0,774	0,774	0,481
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	75,61	77,08	69,19
Shear modulus interlayer		Gint	N/mm ²	0,53	0,53	0,11
Young modulus interlayer		Eint	N/mm ²	1,60	1,60	0,32
Coupling factor of the interlayer(s) at stress		σ _{or}	-	0,162	0,100	0,022
Coupling factor of the interlayer(s) at deformation		σ _w	-	0,363	0,258	0,065
Equivalent glass thickness ULS		teq,ult	mm	18,72	17,99	16,89
Equivalent glass thickness SLS		teq,serv	mm	18,84	17,85	15,64
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1000	1000
Section moduls with equivalent thickness W=b ³ teq ² /6		Wel	mm ³	58384	53916	47568
Bending moment at fixation		Med	kNm	1,320	1,500	0,750
Bending tensile stress at ULS		σ _{Ed,ULS*}	N/mm ²	22,609	31,99	18,13
Maximum utilization ULS = σ _{Ed} /f _{mt,ud}		utilization	-	0,30	0,42	0,26
Minimum plate width based ULS-checks as maximum of Fk-loads		b _{min,ULS}	mm	-	415	262
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max,glass	kN/m ²	-	-	5,53
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med,res	kNm	0,880	1,000	0,522
Section moduls with residual check		Wel,res	mm ³	22815	(Ma/Mab) ³ (f _{mtud,ab} /f _{mtud,a})=	
Bending tensile stress analytic based on bcalc		σ _{Ed,res**}	N/mm ²	42,428	1,80	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Maximum utilization residual capacity based on bcalc		utilization	-	0,56	zone a decisive	
Deformation glass panel at top		δ _{glass,top}	mm	9,09	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq,serv		I _{eq,serv}	mm ⁴	557661	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	34,5	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profile is necessary	
Characteristic force at top support glass into profile		Fp,k	kN/m	13,37		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp,k,max	kN/m	35,0		
Validation of linear iteration		valid	-	OK		
Deformation top of profile based on numerical simulation of profile		δ _{prof}	mm	0,39		
Deformation top of parapet due to profile deformation/rotation - extrapolation		δ _{prof,top}	mm	4,2		
Total deformation at top of parapet = δ _{glass} + δ _{profile}		δ _{tot,top}	mm	13,2		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		δ _{max}	mm	20		
Maximum utilization SLS		utilization	-	0,66		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	1000	1000
Design acting force at top support glass into profile based on bmin for Fk		Fp,Ed	kN/m	20,06	22,93	11,46
Maximum allowed design acting force based on numerical simulations of profiles		Fp,Rd	kN/m	68,8	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,29	0,33	0,17
Minimum plate width based on profile resistance		b _{min,prof}	mm	-	333	167
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max,profile	kN/m ²	-	-	4,69
Parapet System		DF1212LM_E200				
Total height of the parapet		1201	mm			
Glass height		1100	mm			
Glass thickness nominal		12	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		other	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,30	-	-
Maximum utilization profile at ULS		ut.profile.ULS	-	0,29	0,33	0,17
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,56	-	-
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	9,1	-	-
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	13,2	-	-
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,66	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	4,69
Minimum plate width ULS glass		b _{min,glass.ULS}	mm	-	415	262
Minimum plate width ULS profile		b _{min,profile.ULS}	mm	-	333	167
Minimum plate width residual check		b _{min,glass.residual}	mm	720	-	-
Minimum plate width overall		b _{min}	mm	720	-	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF1212LM_E200			
Parapet System						
Total height of the parapet	Ltot	mm	1301			
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1200			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	12			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	11,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	11,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	other			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
	Type of load		qk [kN/m]	Fk [kN]		wk [kN/m ²]
	Zone of load		a	a	a+b	a+b
	Value of load		0,8	1	0,5	1
	Time of loading	s	300	300	604800	5
	Load area A	mm ²	-	40000	40000	1200000
Modification factor for the load time	kmod	-	0,774	0,774	0,481	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,939
Design resistance of FTG	f _{mt,ud}	N/mm ²	75,61	77,08	69,19	79,73
Shear modulus interlayer	Gint	N/mm ²	0,53	0,53	0,11	0,96
Young modulus interlayer	Eint	N/mm ²	1,60	1,60	0,32	2,87
Coupling factor of the interlayer(s) at stress	α _σ	-	0,180	0,111	0,024	0,453
Coupling factor of the interlayer(s) at deformatio	α _w	-	0,403	0,292	0,076	0,449
Equivalent glass thickness ULS	teq,ult	mm	18,90	18,13	16,94	21,08
Equivalent glass thickness SLS	teq,serv	mm	19,20	18,18	15,79	19,59
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	1100	1100	1000
Section moduls with equivalent thickness W=b ³ teq ² /6	Wel	mm ³	59525	60245	52586	74081
Bending moment at fixation	Med	kNm	1,440	1,650	0,825	1,080
Bending tensile stress at ULS	σEd,ULS*	N/mm ²	24,192	31,50	18,04	16,77
Maximum utilization ULS = σEd/fmt.ud	utilization	-	0,32	0,41	0,26	0,21
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin,ULS	mm	-	449	287	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	-	4,76
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a+b) decisive		
Bending moment at fixation	Med,res	kNm	0,960	1,100	0,550	
Section moduls with residual check	Wel,res	mm ³	22815	(Ma/Mab)*(f _{mt,ud} .ab/f _{mt,ud} .a)=		For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc	σEd,res**	N/mm ²	46,285	1,80		
Maximum utilization residual capacity based on bcalc	utilization	-	0,61	zone a decisive		
Deformation glass panel at top	σglass.top	mm	11,16	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Moment of inertia with equivalent thickness teq,serv	Ieq,serv	mm ⁴	589858	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Linear profile stiffness	kprof	(kN/m)/mm	34,5			
Characteristic force at top support glass into profile	Fp.k	kN/m	14,51			
Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k,max	kN/m	35,0			
Validation of linear iteration	valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary		
Deformation top of profile based on numerical simulation of profile	σprof	mm	0,42			
Deformation top of parapet due to profile deformation/rotation - extrapolation	σprof.top	mm	4,9			
Total deformation at top of parapet = σglass + σprofile	σtot.top	mm	16,0			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	σmax	mm	20			
Maximum utilization SLS	utilization	-	0,80			
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	1100	1100	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	21,77	22,79	11,40	17,28
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	68,8	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,32	0,33	0,17	0,25
Minimum plate width based on profile resistance	bmin,prof	mm	-	364	182	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	-	3,98
Parapet System	DF1212LM_E200					
Total height of the parapet	1301	mm				
Glass height	1200	mm				
Glass thickness nominal	12	mm				
Interlayer	PVB	-				
Thickness interlayer	1,52	mm				
Load category	other	-				
			qk [kN/m]	Fk [kN]		wk [kN/m ²]
	Load		0,8	1	0,5	
Maximum utilization glass at ULS	ut.glass.ULS	-	0,32			
Maximum utilization profile at ULS	ut.profile.ULS	-	0,32	0,33	0,17	
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,61			
Maximum deformation glass at SLS for linear load qk	def.glass.SLS		11,2			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	16,0			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,80			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²				3,98
Minimum plate width ULS glass	bmin.glass.ULS	mm		449	287	
Minimum plate width ULS profile	bmin.profile.ULS	mm		364	182	
Minimum plate width residual check	bmin.glass.residual	mm	810			
Minimum plate width overall	bmin	mm	810			

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

4.2.12 DF1212FR_E200

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF1212FR_E200																																																																																																																																																																																																																																																																																																																																																																																							
Parapet System		Ltot	mm	1001																																																																																																																																																																																																																																																																																																																																																																																						
Total height of the parapet		L1	mm	900																																																																																																																																																																																																																																																																																																																																																																																						
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	11																																																																																																																																																																																																																																																																																																																																																																																						
Vertical distance between top of profile and top support of glass into profile		L3	mm	70																																																																																																																																																																																																																																																																																																																																																																																						
Vertical distance between top and bottom support of glass into profile		L4	mm	31																																																																																																																																																																																																																																																																																																																																																																																						
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200																																																																																																																																																																																																																																																																																																																																																																																						
Distance between fixations		tnom	mm	12																																																																																																																																																																																																																																																																																																																																																																																						
Nominal glass thickness		tp1	mm	11,7																																																																																																																																																																																																																																																																																																																																																																																						
Glass thickness for calculation tp1 for inner plate at loading side		tp2	mm	11,7																																																																																																																																																																																																																																																																																																																																																																																						
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	PVB																																																																																																																																																																																																																																																																																																																																																																																						
Type of interlayer		tv.1	mm	1,52																																																																																																																																																																																																																																																																																																																																																																																						
Thickness of interlayer		ng	-	2																																																																																																																																																																																																																																																																																																																																																																																						
Number of sheets of glass of laminated plate		Tg.pvb	°C	30																																																																																																																																																																																																																																																																																																																																																																																						
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50																																																																																																																																																																																																																																																																																																																																																																																						
Maximum temperature of glass panel at loading for SGP		Cat	-	other																																																																																																																																																																																																																																																																																																																																																																																						
Load category		CC	-	CC2																																																																																																																																																																																																																																																																																																																																																																																						
Consequence class		KF1	-	1																																																																																																																																																																																																																																																																																																																																																																																						
Multiplication factor for consequence class		γQp	-	1,5																																																																																																																																																																																																																																																																																																																																																																																						
Load safety factor variable loads as basis value		γQ	-	1,5																																																																																																																																																																																																																																																																																																																																																																																						
Load safety factor variable loads considering CC		ψ0 LL	-	0,6																																																																																																																																																																																																																																																																																																																																																																																						
Load combination factor for variable life load		ψ0 Wind	-	0																																																																																																																																																																																																																																																																																																																																																																																						
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Predominant load		γm.A	-	1,8																																																																																																																																																																																																																																																																																																																																																																																						
Material safety factor float glass for predominant load		γm.V	-	1,2																																																																																																																																																																																																																																																																																																																																																																																						
Material safety factor FTG		ke	-	1																																																																																																																																																																																																																																																																																																																																																																																						
Factor for the edge quality of the glass panel		c	-	16																																																																																																																																																																																																																																																																																																																																																																																						
Corrosion constant as a function		ksp	-	1																																																																																																																																																																																																																																																																																																																																																																																						
Factor for the surface structure of float glass		kz	-	0,9																																																																																																																																																																																																																																																																																																																																																																																						
Factor for the zone for FTG and edge zone		fg.k	N/mm ²	45																																																																																																																																																																																																																																																																																																																																																																																						
Characteristic resistance of float glass		fb.k	N/mm ²	120																																																																																																																																																																																																																																																																																																																																																																																						
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<td>Gint</td> <td>N/mm²</td> <td>0,53</td> <td>0,53</td> <td>0,11</td> </tr> <tr> <td>Young modulus interlayer</td> <td>Eint</td> <td>N/mm²</td> <td>1,60</td> <td>1,60</td> <td>0,32</td> </tr> <tr> <td>Coupling factor of the interlayer(s) at stress</td> <td>ε_{st}</td> <td>-</td> <td>0,128</td> <td>0,077</td> <td>0,016</td> </tr> <tr> <td>Coupling factor of the interlayer(s) at deformation</td> <td>ε_w</td> <td>-</td> <td>0,278</td> <td>0,191</td> <td>0,045</td> </tr> <tr> <td>Equivalent glass thickness ULS</td> <td>teq,ult</td> <td>mm</td> <td>18,33</td> <td>17,70</td> <td>16,81</td> </tr> <tr> <td>Equivalent glass thickness SLS</td> <td>teq,serv</td> <td>mm</td> <td>18,04</td> <td>17,14</td> <td>15,38</td> </tr> <tr> <td>Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk</td> <td>bcalc</td> <td>mm</td> <td>1000</td> <td>800</td> <td>800</td> </tr> <tr> <td>Section moduls with equivalent thickness W=b³teq²/6</td> <td>W_{el}</td> <td>mm³</td> <td>55982</td> <td>41750</td> <td>37689</td> </tr> <tr> <td>Bending moment at fixation</td> <td>Med</td> <td>kNm</td> <td>1,080</td> <td>1,200</td> <td>0,600</td> </tr> <tr> <td>Bending tensile stress at ULS</td> <td>σ_{Ed,ULS*}</td> <td>N/mm²</td> <td>19,292</td> <td>33,05</td> <td>18,31</td> </tr> <tr> <td>Maximum utilization ULS = σ_{Ed}/f_{mt,ud}</td> <td>utilization</td> <td>-</td> <td>0,26</td> <td>0,43</td> <td>0,13</td> </tr> <tr> <td>Minimum plate width based ULS-checks as maximum of Fk-loads</td> <td>b_{min,ULS}</td> <td>mm</td> <td>-</td> <td>343</td> <td>212</td> </tr> <tr> <td>Maximum characteristic wind load wk for only wind loads based on ULS glass</td> <td>wk_{max,ULS}</td> <td>kN/m²</td> <td>-</td> <td>-</td> <td>7,82</td> </tr> <tr> <td>Calculation width glass panel - for Fk based on Mepla calculation</td> <td>bcalc</td> <td>mm</td> <td>1000</td> <td>Check if zone (a) or (a-b) decisive</td> <td>-</td> </tr> <tr> <td>Bending moment at fixation</td> <td>Med_{res}</td> <td>kNm</td> <td>0,720</td> <td>0,800</td> <td>0,400</td> </tr> <tr> <td>Section moduls with residual check</td> <td>W_{el,RES}</td> <td>mm³</td> <td>22815</td> <td>(M_{el}/k_{ab})*(f_{mt,ud,ab}/f_{mt,ud,a})=</td> <td>For residual capacity check of Fk see Mepla calcs and related tables for b_{min}</td> </tr> <tr> <td>Bending tensile stress analytic based on bcalc</td> <td>σ_{Ed,RES**}</td> <td>N/mm²</td> <td>34,714</td> <td>1,80</td> <td>zone a decisive</td> </tr> <tr> <td>Maximum utilization residual capacity based on bcalc</td> <td>utilization</td> <td>-</td> <td>0,46</td> <td>-</td> <td>-</td> </tr> <tr> <td>Deformation glass panel at top</td> <td>δ_{glass,top}</td> <td>mm</td> <td>5,67</td> <td>* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation</td> <td>-</td> </tr> <tr> <td>Moment of inertia with equivalent thickness teq,serv</td> <td>I_{eq,serv}</td> <td>mm⁴</td> <td>489497</td> <td>** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation</td> <td>-</td> </tr> <tr> <td>Linear profile stiffness</td> <td>k_{prof}</td> <td>(kN/m)/mm</td> <td>19,0</td> <td>-</td> <td>-</td> </tr> <tr> <td>Characteristic force at top support glass into profile</td> <td>F_{p,k}</td> <td>kN/m</td> <td>11,09</td> <td>-</td> <td>-</td> </tr> <tr> <td>Maximum char. force at top support glass/profile at end of linear stiffness</td> <td>F_{p,k,max}</td> <td>kN/m</td> <td>45,0</td> <td>-</td> <td>-</td> </tr> <tr> <td>Validation of linear iteration</td> <td>valid</td> <td>-</td> <td>OK</td> <td>Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary</td> <td>-</td> </tr> <tr> <td>Deformation top of profile based on numerical simulation of profile</td> <td>δ_{prof}</td> <td>mm</td> <td>0,58</td> <td>-</td> <td>-</td> </tr> <tr> <td>Deformation top of parapet due to profile deformation/rotation - extrapolation</td> <td>δ_{prof,top}</td> <td>mm</td> <td>5,2</td> <td>-</td> <td>-</td> </tr> <tr> <td>Total deformation at top of parapet = δ_{glass} + δ_{profile}</td> <td>δ_{tot,top}</td> <td>mm</td> <td>10,9</td> <td>-</td> <td>-</td> </tr> <tr> <td>Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)</td> <td>δ_{max}</td> <td>mm</td> <td>20</td> <td>-</td> <td>-</td> </tr> <tr> <td>Maximum utilization SLS</td> <td>utilization</td> <td>-</td> <td>0,54</td> <td>-</td> <td>-</td> </tr> <tr> <td>Calculation width with 1m for qk and wk and maximum 45° distribution for Fk</td> <td>bcalc</td> <td>mm</td> <td>1000</td> <td>800</td> <td>800</td> </tr> <tr> <td>Design acting force at top support glass into profile based on b_{min} for Fk</td> <td>F_{p,Ed}</td> <td>kN/m</td> <td>16,63</td> <td>23,30</td> <td>11,65</td> </tr> <tr> <td>Maximum allowed design acting force based on numerical simulations of profiles</td> <td>F_{p,Rd}</td> <td>kN/m</td> <td>78,5</td> <td>-</td> <td>-</td> </tr> <tr> <td>Maximum utilization aluminium profile for single loads qk and Fk</td> <td>utilization</td> <td>-</td> <td>0,21</td> <td>0,30</td> <td>0,15</td> </tr> <tr> <td>Minimum plate width based on profile resistance</td> <td>b_{min,prof}</td> <td>mm</td> <td>-</td> <td>238</td> <td>119</td> </tr> <tr> <td>Maximum characteristic wind load wk for only wind loads based on ULS profile</td> <td>wk_{max,profile}</td> <td>kN/m²</td> <td>-</td> <td>-</td> <td>7,78</td> </tr> <tr> <td colspan="2">Parapet System</td> <td colspan="4">DF1212FR_E200</td> </tr> <tr> <td colspan="2">Total height of the parapet</td> <td>1001</td> <td>mm</td> <td></td> <td></td> </tr> <tr> <td colspan="2">Glass height</td> <td>900</td> <td>mm</td> <td></td> <td></td> </tr> <tr> <td colspan="2">Glass thickness nominal</td> <td>12</td> <td>mm</td> <td></td> <td></td> </tr> <tr> <td colspan="2">Interlayer</td> <td>PVB</td> <td>-</td> <td></td> <td></td> </tr> <tr> <td colspan="2">Thickness interlayer</td> <td>1,52</td> <td>mm</td> <td></td> <td></td> </tr> <tr> <td colspan="2">Load category</td> <td>other</td> <td>-</td> <td></td> <td></td> </tr> <tr> <td colspan="2">Load</td> <td></td> <td>qk [kN/m]</td> <td>Fk [kN]</td> <td>wk [kN/m²]</td> </tr> <tr> <td colspan="2">Maximum utilization glass at ULS</td> <td>ut.glass.ULS</td> <td>0,26</td> <td>1</td> <td>0,5</td> </tr> <tr> <td colspan="2">Maximum utilization profile at ULS</td> <td>ut.profile.ULS</td> <td>0,21</td> <td>0,30</td> <td>0,15</td> </tr> <tr> <td colspan="2">Maximum utilization residual capacity glass for linear load qk</td> <td>ut.residual</td> <td>0,46</td> <td></td> <td></td> </tr> <tr> <td colspan="2">Maximum deformation glass at SLS for linear load qk</td> <td>def.glass.SLS</td> <td>5,7</td> <td></td> <td></td> </tr> <tr> <td colspan="2">Maximum deformation glass + profile at SLS for linear load qk</td> <td>def.glass-prof.SLS</td> <td>10,9</td> 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loading	300	300	604800	5	5	Load area A	mm ²	4000	4000	90000	90000	Modification factor for the load time	kmmod	0,774	0,774	0,481	1,000	Surface effect factor	ka	1,0	1,076	1,076	0,950	Design resistance of FTG	f _{mt,ud}	N/mm ²	75,61	77,08	80,00	Shear modulus interlayer	Gint	N/mm ²	0,53	0,53	0,11	Young modulus interlayer	Eint	N/mm ²	1,60	1,60	0,32	Coupling factor of the interlayer(s) at stress	ε _{st}	-	0,128	0,077	0,016	Coupling factor of the interlayer(s) at deformation	ε _w	-	0,278	0,191	0,045	Equivalent glass thickness ULS	teq,ult	mm	18,33	17,70	16,81	Equivalent glass thickness SLS	teq,serv	mm	18,04	17,14	15,38	Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	800	800	Section moduls with equivalent thickness W=b ³ teq ² /6	W _{el}	mm ³	55982	41750	37689	Bending moment at fixation	Med	kNm	1,080	1,200	0,600	Bending tensile stress at ULS	σ _{Ed,ULS*}	N/mm ²	19,292	33,05	18,31	Maximum utilization ULS = σ _{Ed} /f _{mt,ud}	utilization	-	0,26	0,43	0,13	Minimum plate width based ULS-checks as maximum of Fk-loads	b _{min,ULS}	mm	-	343	212	Maximum characteristic wind load wk for only wind loads based on ULS glass	wk _{max,ULS}	kN/m ²	-	-	7,82	Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a-b) decisive	-	Bending moment at fixation	Med _{res}	kNm	0,720	0,800	0,400	Section moduls with residual check	W _{el,RES}	mm ³	22815	(M _{el} /k _{ab})*(f _{mt,ud,ab} /f _{mt,ud,a})=	For residual capacity check of Fk see Mepla calcs and related tables for b _{min}	Bending tensile stress analytic based on bcalc	σ _{Ed,RES**}	N/mm ²	34,714	1,80	zone a decisive	Maximum utilization residual capacity based on bcalc	utilization	-	0,46	-	-	Deformation glass panel at top	δ _{glass,top}	mm	5,67	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-	Moment of inertia with equivalent thickness teq,serv	I _{eq,serv}	mm ⁴	489497	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-	Linear profile stiffness	k _{prof}	(kN/m)/mm	19,0	-	-	Characteristic force at top support glass into profile	F _{p,k}	kN/m	11,09	-	-	Maximum char. force at top support glass/profile at end of linear stiffness	F _{p,k,max}	kN/m	45,0	-	-	Validation of linear iteration	valid	-	OK	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	-	Deformation top of profile based on numerical simulation of profile	δ _{prof}	mm	0,58	-	-	Deformation top of parapet due to profile deformation/rotation - extrapolation	δ _{prof,top}	mm	5,2	-	-	Total deformation at top of parapet = δ _{glass} + δ _{profile}	δ _{tot,top}	mm	10,9	-	-	Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δ _{max}	mm	20	-	-	Maximum utilization SLS	utilization	-	0,54	-	-	Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	800	800	Design acting force at top support glass into profile based on b _{min} for Fk	F _{p,Ed}	kN/m	16,63	23,30	11,65	Maximum allowed design acting force based on numerical simulations of profiles	F _{p,Rd}	kN/m	78,5	-	-	Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,21	0,30	0,15	Minimum plate width based on profile resistance	b _{min,prof}	mm	-	238	119	Maximum characteristic wind load wk for only wind loads based on ULS profile	wk _{max,profile}	kN/m ²	-	-	7,78	Parapet System		DF1212FR_E200				Total height of the parapet		1001	mm			Glass height		900	mm			Glass thickness nominal		12	mm			Interlayer		PVB	-			Thickness interlayer		1,52	mm			Load category		other	-			Load			qk [kN/m]	Fk [kN]	wk [kN/m ²]	Maximum utilization glass at ULS		ut.glass.ULS	0,26	1	0,5	Maximum utilization profile at ULS		ut.profile.ULS	0,21	0,30	0,15	Maximum utilization residual capacity glass for linear load qk		ut.residual	0,46			Maximum deformation glass at SLS for linear load qk		def.glass.SLS	5,7			Maximum deformation glass + profile at SLS for linear load qk		def.glass-prof.SLS	10,9			Maximum utilization glass + profile at SLS for linear load qk		ut.glass-prof.SLS	0,54			Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk _{max}	kN/m ²		7,78	Minimum plate width ULS glass		b _{min.glass.ULS}	mm	343	212	Minimum plate width ULS profile		b _{min.profile.ULS}	mm	238	119	Minimum plate width residual check		b _{min.glass.residual}	mm	560		Minimum plate width overall		b _{min}	mm	560	
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Section moduls with equivalent thickness W=b ³ teq ² /6	W _{el}	mm ³	55982	41750	37689																																																																																																																																																																																																																																																																																																																																																																																					
Bending moment at fixation	Med	kNm	1,080	1,200	0,600																																																																																																																																																																																																																																																																																																																																																																																					
Bending tensile stress at ULS	σ _{Ed,ULS*}	N/mm ²	19,292	33,05	18,31																																																																																																																																																																																																																																																																																																																																																																																					
Maximum utilization ULS = σ _{Ed} /f _{mt,ud}	utilization	-	0,26	0,43	0,13																																																																																																																																																																																																																																																																																																																																																																																					
Minimum plate width based ULS-checks as maximum of Fk-loads	b _{min,ULS}	mm	-	343	212																																																																																																																																																																																																																																																																																																																																																																																					
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk _{max,ULS}	kN/m ²	-	-	7,82																																																																																																																																																																																																																																																																																																																																																																																					
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a-b) decisive	-																																																																																																																																																																																																																																																																																																																																																																																					
Bending moment at fixation	Med _{res}	kNm	0,720	0,800	0,400																																																																																																																																																																																																																																																																																																																																																																																					
Section moduls with residual check	W _{el,RES}	mm ³	22815	(M _{el} /k _{ab})*(f _{mt,ud,ab} /f _{mt,ud,a})=	For residual capacity check of Fk see Mepla calcs and related tables for b _{min}																																																																																																																																																																																																																																																																																																																																																																																					
Bending tensile stress analytic based on bcalc	σ _{Ed,RES**}	N/mm ²	34,714	1,80	zone a decisive																																																																																																																																																																																																																																																																																																																																																																																					
Maximum utilization residual capacity based on bcalc	utilization	-	0,46	-	-																																																																																																																																																																																																																																																																																																																																																																																					
Deformation glass panel at top	δ _{glass,top}	mm	5,67	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-																																																																																																																																																																																																																																																																																																																																																																																					
Moment of inertia with equivalent thickness teq,serv	I _{eq,serv}	mm ⁴	489497	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-																																																																																																																																																																																																																																																																																																																																																																																					
Linear profile stiffness	k _{prof}	(kN/m)/mm	19,0	-	-																																																																																																																																																																																																																																																																																																																																																																																					
Characteristic force at top support glass into profile	F _{p,k}	kN/m	11,09	-	-																																																																																																																																																																																																																																																																																																																																																																																					
Maximum char. force at top support glass/profile at end of linear stiffness	F _{p,k,max}	kN/m	45,0	-	-																																																																																																																																																																																																																																																																																																																																																																																					
Validation of linear iteration	valid	-	OK	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	-																																																																																																																																																																																																																																																																																																																																																																																					
Deformation top of profile based on numerical simulation of profile	δ _{prof}	mm	0,58	-	-																																																																																																																																																																																																																																																																																																																																																																																					
Deformation top of parapet due to profile deformation/rotation - extrapolation	δ _{prof,top}	mm	5,2	-	-																																																																																																																																																																																																																																																																																																																																																																																					
Total deformation at top of parapet = δ _{glass} + δ _{profile}	δ _{tot,top}	mm	10,9	-	-																																																																																																																																																																																																																																																																																																																																																																																					
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δ _{max}	mm	20	-	-																																																																																																																																																																																																																																																																																																																																																																																					
Maximum utilization SLS	utilization	-	0,54	-	-																																																																																																																																																																																																																																																																																																																																																																																					
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	800	800																																																																																																																																																																																																																																																																																																																																																																																					
Design acting force at top support glass into profile based on b _{min} for Fk	F _{p,Ed}	kN/m	16,63	23,30	11,65																																																																																																																																																																																																																																																																																																																																																																																					
Maximum allowed design acting force based on numerical simulations of profiles	F _{p,Rd}	kN/m	78,5	-	-																																																																																																																																																																																																																																																																																																																																																																																					
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,21	0,30	0,15																																																																																																																																																																																																																																																																																																																																																																																					
Minimum plate width based on profile resistance	b _{min,prof}	mm	-	238	119																																																																																																																																																																																																																																																																																																																																																																																					
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk _{max,profile}	kN/m ²	-	-	7,78																																																																																																																																																																																																																																																																																																																																																																																					
Parapet System		DF1212FR_E200																																																																																																																																																																																																																																																																																																																																																																																								
Total height of the parapet		1001	mm																																																																																																																																																																																																																																																																																																																																																																																							
Glass height		900	mm																																																																																																																																																																																																																																																																																																																																																																																							
Glass thickness nominal		12	mm																																																																																																																																																																																																																																																																																																																																																																																							
Interlayer		PVB	-																																																																																																																																																																																																																																																																																																																																																																																							
Thickness interlayer		1,52	mm																																																																																																																																																																																																																																																																																																																																																																																							
Load category		other	-																																																																																																																																																																																																																																																																																																																																																																																							
Load			qk [kN/m]	Fk [kN]	wk [kN/m ²]																																																																																																																																																																																																																																																																																																																																																																																					
Maximum utilization glass at ULS		ut.glass.ULS	0,26	1	0,5																																																																																																																																																																																																																																																																																																																																																																																					
Maximum utilization profile at ULS		ut.profile.ULS	0,21	0,30	0,15																																																																																																																																																																																																																																																																																																																																																																																					
Maximum utilization residual capacity glass for linear load qk		ut.residual	0,46																																																																																																																																																																																																																																																																																																																																																																																							
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	5,7																																																																																																																																																																																																																																																																																																																																																																																							
Maximum deformation glass + profile at SLS for linear load qk		def.glass-prof.SLS	10,9																																																																																																																																																																																																																																																																																																																																																																																							
Maximum utilization glass + profile at SLS for linear load qk		ut.glass-prof.SLS	0,54																																																																																																																																																																																																																																																																																																																																																																																							
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk _{max}	kN/m ²		7,78																																																																																																																																																																																																																																																																																																																																																																																					
Minimum plate width ULS glass		b _{min.glass.ULS}	mm	343	212																																																																																																																																																																																																																																																																																																																																																																																					
Minimum plate width ULS profile		b _{min.profile.ULS}	mm	238	119																																																																																																																																																																																																																																																																																																																																																																																					
Minimum plate width residual check		b _{min.glass.residual}	mm	560																																																																																																																																																																																																																																																																																																																																																																																						
Minimum plate width overall		b _{min}	mm	560																																																																																																																																																																																																																																																																																																																																																																																						

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF1212FR_E200			
Parapet System						
Total height of the parapet	Ltot	mm	1101			
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1000			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	12			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	11,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	11,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	other			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm²	45			
Characteristic resistance of FTG	fb.k	N/mm²	120			
	Type of load		qk [kN/m]	Fk [kN]		wk [kN/m²]
	Zone of load		a	a	a+b	a+b
	Value of load		0,8	1	0,5	1
	Time of loading	s	300	300	604800	5
	Load area A	mm²	-	40000	40000	1000000
Modification factor for the load time	kmod	-	0,774	0,774	0,481	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,946
Design resistance of FTG	f _{td}	N/mm²	75,61	77,08	69,19	79,90
Shear modulus interlayer	G _{int}	N/mm²	0,53	0,53	0,11	0,96
Young modulus interlayer	E _{int}	N/mm²	1,60	1,60	0,32	2,87
Coupling factor of the interlayer(s) at stress	α _{oc}	-	0,145	0,089	0,019	0,373
Coupling factor of the interlayer(s) at deformatio	α _{ow}	-	0,321	0,224	0,055	0,362
Equivalent glass thickness ULS	teq.ult	mm	18,53	17,84	16,85	20,56
Equivalent glass thickness SLS	teq.serv	mm	18,46	17,50	15,51	18,83
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	b _{calc}	mm	1000	900	900	1000
Section moduls with equivalent thickness W=b³teq²/6	W _{el}	mm³	57202	47749	42603	70432
Bending moment at fixation	M _{ed}	kNm	1,200	1,350	0,675	0,750
Bending tensile stress at ULS	σ _{Ed,ULS*}	N/mm²	20,978	32,51	18,22	12,25
Maximum utilization ULS = σ _{Ed} /f _{td}	utilization	-	0,28	0,42	0,26	0,15
Minimum plate width based ULS-checks as maximum of Fk-loads	b _{min,ULS}	mm	-	380	237	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m²	-	-	-	6,52
Calculation width glass panel - for Fk based on Mepla calculation	b _{calc}	mm	1000	Check if zone (a) or (a+b) decisive		
Bending moment at fixation	M _{ed,res}	kNm	0,800	0,900	0,450	-
Section moduls with residual check	W _{el,res}	mm³	22815	(M _a /M _{ab})*(f _{td} ab/f _{td} a)=		
Bending tensile stress analytic based on b _{calc}	σ _{Ed,res**}	N/mm²	38,571	1,80		
Maximum utilization residual capacity based on b _{calc}	utilization	-	0,51	zone a decisive		
Deformation glass panel at top	σ _{glass,top}	mm	7,27	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Moment of inertia with equivalent thickness teq.serv	I _{eq.serv}	mm⁴	524086	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Linear profile stiffness	k _{prof}	(kN/m)/mm	19,0			
Characteristic force at top support glass into profile	F _{p,k}	kN/m	12,23			
Maximum char. force at top support glass/profile at end of linear stiffness	F _{p,k,max}	kN/m	45,0			
Validation of linear iteration	valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary		
Defomation top of profile based on numerical simulation of profile	σ _{prof}	mm	0,64			
Defomation top of parapet due to profile deformation/rotation - extrapolation	σ _{rot,top}	mm	6,3			
Total deformation at top of parapet = σ _{glass} + σ _{profile}	σ _{tot,top}	mm	13,6			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	σ _{max}	mm	20			
Maximum utilization SLS	utilization	-	0,68			
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	b _{calc}	mm	1000	900	900	1000
Design acting force at top support glass into profile based on b _{min} for Fk	F _{p,Ed}	kN/m	18,34	23,10	11,55	12,27
Maximum allowed design acting force based on numerical simulations of profiles	F _{p,Rd}	kN/m	78,5	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,23	0,29	0,15	0,16
Minimum plate width based on profile resistance	b _{min,prof}	mm	-	265	132	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m²	-	-	-	6,40
Parapet System	DF1212FR_E200					
Total height of the parapet	1101	mm				
Glass height	1000	mm				
Glass thickness nominal	12	mm				
Interlayer	PVB	-				
Thickness interlayer	1,52	mm				
Load category	other	-				
	Load		qk [kN/m]	Fk [kN]		wk [kN/m²]
	Load		0,8	1	0,5	
Maximum utilization glass at ULS	ut.glass.ULS	-	0,28			
Maximum utilization profile at ULS	ut.profile.ULS	-	0,23	0,29	0,15	
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,51			
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	mm	7,3			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	13,6			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,68			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m²				6,40
Minimum plate width ULS glass	b _{min.glass.ULS}	mm		380	237	
Minimum plate width ULS profile	b _{min.profile.ULS}	mm		265	132	
Minimum plate width residual check	b _{min.glass.residual}	mm	640			
Minimum plate width overall	b _{min}	mm	640			

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF1212FR_E200																																																																																																																																																																																																																																																																																																																																								
Parapet System		Ltot	mm	1201																																																																																																																																																																																																																																																																																																																																							
Total height of the parapet		L1	mm	1100																																																																																																																																																																																																																																																																																																																																							
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	11																																																																																																																																																																																																																																																																																																																																							
Vertical distance between top of profile and top support of glass into profile		L3	mm	70																																																																																																																																																																																																																																																																																																																																							
Vertical distance between top and bottom support of glass into profile		L4	mm	31																																																																																																																																																																																																																																																																																																																																							
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200																																																																																																																																																																																																																																																																																																																																							
Distance between fixations		tnom	mm	12																																																																																																																																																																																																																																																																																																																																							
Nominal glass thickness		tpl1	mm	11,7																																																																																																																																																																																																																																																																																																																																							
Glass thickness for calculation tp1 for inner plate at loading side		tpl2	mm	11,7																																																																																																																																																																																																																																																																																																																																							
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	PVB																																																																																																																																																																																																																																																																																																																																							
Type of interlayer		tv.i	mm	1,52																																																																																																																																																																																																																																																																																																																																							
Thickness of interlayer		ng	-	2																																																																																																																																																																																																																																																																																																																																							
Number of sheets of glass of laminated plate		Tg.pvb	°C	30																																																																																																																																																																																																																																																																																																																																							
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50																																																																																																																																																																																																																																																																																																																																							
Maximum temperature of glass panel at loading for SGP		Cat	-	other																																																																																																																																																																																																																																																																																																																																							
Load category		CC	-	CC2																																																																																																																																																																																																																																																																																																																																							
Consequence class		KF1	-	1																																																																																																																																																																																																																																																																																																																																							
Multiplication factor for consequence class		γQ0	-	1,5																																																																																																																																																																																																																																																																																																																																							
Load safety factor variable loads as basis value		γQ	-	1,5																																																																																																																																																																																																																																																																																																																																							
Load safety factor variable loads considering CC		γ0 LL	-	0,6																																																																																																																																																																																																																																																																																																																																							
Load combination factor for variable life load		γ0 Wind	-	0																																																																																																																																																																																																																																																																																																																																							
Load combination factor for variable wind load				Life load																																																																																																																																																																																																																																																																																																																																							
Predominant load		γm.A	-	1,8																																																																																																																																																																																																																																																																																																																																							
Material safety factor float glass for predominant load		γm.V	-	1,2																																																																																																																																																																																																																																																																																																																																							
Material safety factor FTG		ke	-	1																																																																																																																																																																																																																																																																																																																																							
Factor for the edge quality of the glass panel		c	-	16																																																																																																																																																																																																																																																																																																																																							
Corrosion constant as a function		ksp	-	1																																																																																																																																																																																																																																																																																																																																							
Factor for the surface structure of float glass		kz	-	0,9																																																																																																																																																																																																																																																																																																																																							
Factor for the zone for FTG and edge zone		fg.k	N/mm ²	45																																																																																																																																																																																																																																																																																																																																							
Characteristic resistance of float glass		fb.k	N/mm ²	120																																																																																																																																																																																																																																																																																																																																							
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colspan="2"></td> </tr> <tr> <td colspan="2">Glass height</td> <td>1100</td> <td>mm</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">Glass thickness nominal</td> <td>12</td> <td>mm</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">Interlayer</td> <td>PVB</td> <td>-</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">Thickness interlayer</td> <td>1,52</td> <td>mm</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">Load category</td> <td>other</td> <td>-</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">Load</td> <td colspan="4"> <table border="1"> <thead> <tr> <th>qk [kN/m]</th> <th>Fk [kN]</th> <th>wk [kN/m²]</th> </tr> </thead> <tbody> <tr> <td>0,8</td> <td>1</td> <td>0,5</td> </tr> <tr> <td>ut.glass.ULS</td> <td>-</td> <td>0,30</td> </tr> <tr> <td>ut.profile.ULS</td> <td>0,29</td> <td>0,15</td> </tr> <tr> <td>ut.residual</td> <td>-</td> <td>0,56</td> </tr> <tr> <td>def.glass.SLS</td> <td>-</td> <td>9,1</td> </tr> <tr> <td>def.glass+prof.SLS</td> <td>16,6</td> 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Interlayer		PVB	-																																																																																																																																																																																																																																																																																																																																								
Thickness interlayer		1,52	mm																																																																																																																																																																																																																																																																																																																																								
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NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF1212FR_E200			
Total height of the parapet	Ltot	mm	1301			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1200			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	12			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	11,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	11,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	other			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KFI	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
	Type of load		qk [kN/m]	Fk [kN]		wk [kN/m ²]
	Zone of load		a	a	a+b	a+b
	Value of load		0,8	1	0,5	1
	Time of loading	s	300	300	604800	5
	Load area A	mm ²	-	40000	40000	1200000
Modification factor for the load time	km0d	-	0,774	0,774	0,481	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,939
Design resistance of FTG	f _{mt,ud}	N/mm ²	75,61	77,08	69,19	79,73
Shear modulus interlayer	Gint	N/mm ²	0,53	0,53	0,11	0,96
Young modulus interlayer	Eint	N/mm ²	1,60	1,60	0,32	2,87
Coupling factor of the interlayer(s) at stress	σ _{int}	-	0,180	0,111	0,024	0,453
Coupling factor of the interlayer(s) at deformation	σ _w	-	0,403	0,292	0,076	0,449
Equivalent glass thickness ULS	teq,ult	mm	18,90	18,13	16,94	21,08
Equivalent glass thickness SLS	teq,serv	mm	19,20	18,18	15,79	19,59
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	1100	1100	1000
Section moduli with equivalent thickness W=b ³ teq ² /6	Wel	mm ³	59525	60245	52586	74081
Bending moment at fixation	Med	kNm	1,440	1,650	0,825	1,080
Bending tensile stress at ULS	σEd,ULS*	N/mm ²	24,192	31,50	18,04	16,77
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	-	0,32	0,41	0,26	0,21
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin,ULS	mm	-	449	287	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	-	4,76
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a+b) decisive		-
Bending moment at fixation	Med,res	kNm	0,960	1,100	0,560	-
Section moduli with residual check	Wel,res	mm ³	22815	(Ma/Mab) ³ (f _{mt,ud,ab} /f _{mt,ud,a})=		For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc	σEd,res**	N/mm ²	46,285	1,80	-	-
Maximum utilization residual capacity based on bcalc	utilization	-	0,61	zone a decisive		-
Deformation glass panel at top	σ _{glass,top}	mm	11,16	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Moment of inertia with equivalent thickness teq,serv	I _{eq,serv}	mm ⁴	589858	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Linear profile stiffness	kprof	(kN/m)/mm	19,0	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary		
Characteristic force at top support glass into profile	Fp,k	kN/m	14,51			
Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k,max	kN/m	45,0			
Validation of linear iteration	valid	-	OK			
Deformation top of profile based on numerical simulation of profile	σ _{prof}	mm	0,76			
Deformation top of parapet due to profile deformation/rotation - extrapolation	σ _{prof,top}	mm	8,9			
Total deformation at top of parapet = σ _{glass} + σ _{profile}	σ _{tot,top}	mm	20,0			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	σ _{max}	mm	20			
Maximum utilization SLS	utilization	-	1,00			
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	1100	1100	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp,Ed	kN/m	21,77	22,79	11,40	17,28
Maximum allowed design acting force based on numerical simulations of profiles	Fp,Rd	kN/m	78,5	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,28	0,29	0,15	0,22
Minimum plate width based on profile resistance	bmin,prof	mm	-	320	160	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	-	4,54
SUMMARY						
Parapet System DF1212FR_E200						
Total height of the parapet	1301	mm				
Glass height	1200	mm				
Glass thickness nominal	12	mm				
Interlayer	PVB	-				
Thickness interlayer	1,52	mm				
Load category	other	-				
Load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Maximum utilization glass at ULS	ut.glass.ULS	-	0,32			
Maximum utilization profile at ULS	ut.profile.ULS	-	0,28	0,29	0,15	
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,61			
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	mm	11,2			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	20,0			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	1,00			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²				
Minimum plate width ULS glass	bmin.glass.ULS	mm			449	287
Minimum plate width ULS profile	bmin.profile.ULS	mm			320	160
Minimum plate width residual check	bmin.glass.residual	mm	810			
Minimum plate width overall	bmin	mm	810			

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

4.2.13 DF1010LM_E200 with 8+8+4 glass

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF884LM_E200																																	
Parapet System		Ltot	mm	1001																																
Total height of the parapet		L1	mm	900																																
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	11																																
Vertical distance between top of profile and top support of glass into profile		L3	mm	70																																
Vertical distance between top and bottom support of glass into profile		L4	mm	31																																
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200																																
Distance between fixations		tnom	mm	8																																
Nominal glass thickness		tp1	mm	3,8																																
Glass thickness for calculation tp1 for inner plate at loading side		tp2	mm	7,7																																
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	SGP																																
Type of interlayer		tv.i	mm	1,52																																
Thickness of interlayer		ng	-	3																																
Number of sheets of glass of laminated plate		Tg.pvb	°C	30																																
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50																																
Maximum temperature of glass panel at loading for SGP		Cat	-	other																																
Load category		CC	-	CC2																																
Consequence class		KF1	-	1																																
Multiplication factor for consequence class		γQ0	-	1,5																																
Load safety factor variable loads as basis value		γQ	-	1,5																																
Load safety factor variable loads considering CC		ψ0 LL	-	0,6																																
Load combination factor for variable life load		ψ0 Wind	-	0																																
Load combination factor for variable wind load				Life load																																
Predominant load		γm.A	-	1,8																																
Material safety factor glass for predominant load		γm.V	-	1,2																																
Material safety factor FTG		ke	-	1																																
Factor for the edge quality of the glass panel		c	-	16																																
Corrosion constant as a function		ksp	-	1																																
Factor for the surface structure of float glass		kz	-	0,9																																
Factor for the zone for FTG and edge zone		fg.k	N/mm ²	45																																
Characteristic resistance of float glass		fb.k	N/mm ²	120																																
Characteristic resistance of FTG		<table border="1"> <thead> <tr> <th>Type of load</th> <th>qk [kN/m]</th> <th colspan="2">Fk [kN]</th> <th>wk [kN/m²]</th> </tr> <tr> <th>Zone of load</th> <th>a</th> <th>a</th> <th>a+b</th> <th>a+b</th> </tr> </thead> <tbody> <tr> <td>Value of load</td> <td>0,8</td> <td>1</td> <td>0,5</td> <td>1</td> </tr> <tr> <td>Time of loading</td> <td>s</td> <td>300</td> <td>300</td> <td>604800</td> </tr> <tr> <td>Load area A</td> <td>mm²</td> <td>-</td> <td>40000</td> <td>40000</td> </tr> <tr> <td>900000</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>					Type of load	qk [kN/m]	Fk [kN]		wk [kN/m ²]	Zone of load	a	a	a+b	a+b	Value of load	0,8	1	0,5	1	Time of loading	s	300	300	604800	Load area A	mm ²	-	40000	40000	900000				
Type of load	qk [kN/m]	Fk [kN]		wk [kN/m ²]																																
Zone of load	a	a	a+b	a+b																																
Value of load	0,8	1	0,5	1																																
Time of loading	s	300	300	604800																																
Load area A	mm ²	-	40000	40000																																
900000																																				
Modification factor for the load time		km0d	-	0,774	0,774	0,481	1,000																													
Surface effect factor		ka	-	1,0	1,076	1,076	0,950																													
Design resistance of FTG		f _{mt,ud}	N/mm ²	75,61	77,08	69,19	80,00																													
Shear modulus interlayer		Gint	N/mm ²	4,65	4,65	1,08	10,00																													
Young modulus interlayer		Eint	N/mm ²	13,87	13,87	3,22	29,80																													
Coupling factor of the interlayer(s) at stress		α _{st}	-	0,493	0,358	0,114	0,796																													
Coupling factor of the interlayer(s) at deformation		α _w	-	0,718	0,609	0,266	0,785																													
Equivalent glass thickness ULS		teq.ult	mm	17,25	16,34	13,60	18,60																													
Equivalent glass thickness SLS		teq.serv	mm	17,50	16,74	13,74	17,93																													
ULS Glas	Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	800	800	1000																													
	Section moduls with equivalent thickness W=b ² teq ² /6	W _{el}	mm ³	49621	35585	24652	57675																													
	Bending moment at fixation	M _{ed}	kNm	1,080	1,200	0,600	0,608																													
	Bending tensile stress at ULS	σ _{Ed,ULS} *	N/mm ²	21,765	38,78	27,99	12,11																													
Residual load capacity	Maximum utilization ULS = σ _{Ed} /f _{mt,ud}	utilization	-	0,29	0,50	0,40	0,15																													
	Minimum plate width based ULS-checks as maximum of Fk-loads	b _{min,ULS}	mm	-	403	324	-																													
	Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max,glass	kN/m ²	-	-	-	6,60																													
	Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a+b) decisive																															
SLS	Bending moment at fixation	M _{ed,res}	kNm	0,720	0,800	0,400	For residual capacity check of Fk see Mepla calcs and related tables for bmin																													
	Section moduls with residual check	W _{el,res}	mm ³	35486	(M _a /M _{ab})*(f _{mt,ud} ab/f _{mt,ud} a)=																															
	Bending tensile stress analytic based on bcalc	σ _{Ed,res} **	N/mm ²	22,318	1,80	zone a decisive																														
	Maximum utilization residual capacity based on bcalc	utilization	-	0,30	zone a decisive																															
ULS Profile	Deformation glass panel at top	δ _{glass,top}	mm	6,22	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation																															
	Moment of inertia with equivalent thickness teq.serv	I _{eq.serv}	mm ⁴	446483	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation																															
	Linear profile stiffness	k _{prof}	(kN/m)/mm	34,5	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary																															
	Characteristic force at top support glass into profile	F _{p,k}	kN/m	11,09																																
	Maximum char. force at top support glass/profile at end of linear stiffness	F _{p,k,max}	kN/m	35,0																																
	Validation of linear iteration	valid	-	OK																																
	Deformation top of profile based on numerical simulation of profile	δ _{prof}	mm	0,32																																
	Deformation top of parapet due to profile deformation/rotation - extrapolation	δ _{prof,top}	mm	2,9																																
	Total deformation at top of parapet = δ _{glass} + δ _{prof}	δ _{tot,top}	mm	9,1																																
	Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δ _{max}	mm	20																																
SUMMARY	Maximum utilization SLS	utilization	-	0,45																																
	Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	800	800	1000																													
	Design acting force at top support glass into profile based on bmin for Fk	F _{p,Ed}	kN/m	16,63	23,30	11,65	10,08																													
	Maximum allowed design acting force based on numerical simulations of profiles	F _{p,Rd}	kN/m	68,8	-	-	-																													
SUMMARY	Maximum utilization aluminum profile for single loads qk and Fk	utilization	-	0,24	0,34	0,17	0,15																													
	Minimum plate width based on profile resistance	b _{min,prof}	mm	-	271	135	-																													
	Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max,profile	kN/m ²	-	-	-	6,82																													
	Parapet System	DF884LM_E200																																		
	Total height of the parapet	1001	mm																																	
	Glass height	900	mm																																	
	Glass thickness nominal	8	mm																																	
	Interlayer	SGP	-																																	
	Thickness interlayer	1,52	mm																																	
	Load category	other	-																																	
SUMMARY	Load		qk [kN/m]	1	Fk [kN]	0,5	wk [kN/m ²]																													
	Maximum utilization glass at ULS	ut.glass.ULS	-	0,29																																
	Maximum utilization profile at ULS	ut.profile.ULS	-	0,24	0,34	0,17																														
	Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,30																																
	Maximum deformation glass at SLS for linear load qk	def.glass.SLS	-	6,2																																
	Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	9,1																																
	Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,45																																
	Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²	-	-	-	6,60																													
	Minimum plate width ULS glass	b _{min.glass.ULS}	mm	-	403	324	-																													
	Minimum plate width ULS profile	b _{min.profile.ULS}	mm	-	271	135	-																													
Minimum plate width residual check	b _{min.glass.residual}	mm	300																																	
Minimum plate width overall	b _{min}	mm	403																																	

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF884LM_E200			
Parapet System		Ltot	mm	1101		
Total height of the parapet		L1	mm	1000		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	11		
Vertical distance between top of profile and top support of glass into profile		L3	mm	70		
Vertical distance between top and bottom support of glass into profile		L4	mm	31		
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200		
Distance between fixations		tnom	mm	8		
Nominal glass thickness		tpl1	mm	3,8		
Glass thickness for calculation tp1 for inner plate at loading side		tpl2	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	SGP		
Type of interlayer		tv.i	mm	1,52		
Thickness of interlayer		ng	-	3		
Number of sheets of glass of laminated plate		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50		
Maximum temperature of glass panel at loading for SGP		Cat	-	other		
Load category		CC	-	CC2		
Consequence class		KFI	-	1		
Multiplication factor for consequence class		γQ0	-	1,5		
Load safety factor variable loads as basis value		γQ	-	1,5		
Load safety factor variable loads considering CC		γ0 LL	-	0,6		
Load combination factor for variable life load		γ0 Wind	-	0		
Load combination factor for variable wind load						
Predominant load						Life load
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]		Fk [kN]
		Zone of load		a		a+b
		Value of load		0,8	1	0,5
		Time of loading	s	300	300	604800
		Load area A	mm ²	-	40000	40000
						wk [kN/m ²]
						a+b
						1
						5
						1000000
Modification factor for the load time		km0d	-	0,774	0,774	0,481
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		fmd.ud	N/mm ²	75,61	77,08	69,19
Shear modulus interlayer		Gint	N/mm ²	4,65	4,65	1,08
Young modulus interlayer		Eint	N/mm ²	13,87	13,87	3,22
Coupling factor of the interlayer(s) at stress		σσ	-	0,530	0,392	0,130
Coupling factor of the interlayer(s) at deformation		σω	-	0,758	0,657	0,308
Equivalent glass thickness ULS		teq.ult	mm	17,46	16,60	13,85
Equivalent glass thickness SLS		teq.serv	mm	17,76	17,08	14,18
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	900	1000
Section moduls with equivalent thickness W=b*teq ² /6		Wel	mm ³	50810	41316	28754
Bending moment at fixation		Med	kNm	1,200	1,350	0,675
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	23,618	37,58	27,00
Maximum utilization ULS = σEd/fmd.ud		utilization	-	0,31	0,49	0,39
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	439	351
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	5,40
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	900	1000
Bending moment at fixation		Med.res	kNm	0,800	0,900	0,450
Section moduls with residual check		Wel.res	mm ³	35937	(Ma/Mab)*(fmdud.ab/fmdud.a)=	
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm ²	24,487	1,80	
Maximum utilization residual capacity based on bcalc		utilization	-	0,32	zone a decisive	
Deformation glass panel at top		σglass.top	mm	8,16		
Moment of inertia with equivalent thickness teq.serv		Ieq.serv	mm ⁴	466728		
Linear profile stiffness		kprof	(kN/m)/mm	34,5		
Characteristic force at top support glass into profile		Fp.k	kN/m	12,23		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k.max	kN/m	35,0		
Validation of linear iteration		valid	-	OK		
Deformation top of profile based on numerical simulation of profile		σprof	mm	0,35		
Deformation top of parapet due to profile deformation/rotation - extrapolation		σprof.top	mm	3,5		
Total deformation at top of parapet = σglass + σprofile		σtot.top	mm	11,6		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		σmax	mm	20		
Maximum utilization SLS		utilization	-	0,58		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	900	1000
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	18,34	23,10	11,55
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	68,8	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,27	0,34	0,17
Minimum plate width based on profile resistance		bmin.prof	mm	-	302	151
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	5,61
Parapet System		DF884LM_E200				
Total height of the parapet		1101	mm			
Glass height		1000	mm			
Glass thickness nominal		8	mm			
Interlayer		SGP	-			
Thickness interlayer		1,52	mm			
Load category		other	-			
Load				qk [kN/m]		Fk [kN]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,31		0,5
Maximum utilization profile at ULS		ut.profile.ULS	-	0,27	0,34	0,17
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,32		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	-	8,2		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	11,6		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,58		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²			5,40
Minimum plate width ULS glass		bmin.glass.ULS	mm		439	351
Minimum plate width ULS profile		bmin.profile.ULS	mm		302	151
Minimum plate width residual check		bmin.glass.residual	mm	330		
Minimum plate width overall		bmin	mm	439		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System
 Total height of the parapet
 Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4
 Vertical distance between top of profile and top support of glass into profile
 Vertical distance between top and bottom support of glass into profile
 Vertical distance between bottom support of glass into profile and base ground
 Distance between fixations
 Nominal glass thickness
 Glass thickness for calculation tp1 for inner plate at loading side
 Glass thickness for calculation tp2 for middle and outer plate
 Type of interlayer
 Thickness of interlayer
 Number of sheets of glass of laminated plate
 Maximum temperature of glass panel at loading for PVB
 Maximum temperature of glass panel at loading for SGP
 Load category
 Consequence class
 Multiplication factor for consequence class
 Load safety factor variable loads as basis value
 Load safety factor variable loads considering CC
 Load combination factor for variable life load
 Load combination factor for variable wind load
 Predominant load
 Material safety factor float glass for predominant load
 Material safety factor FTG
 Factor for the edge quality of the glass panel
 Corrosion constant as a function
 Factor for the surface structure of float glass
 Factor for the zone for FTG and edge zone
 Characteristic resistance of float glass
 Characteristic resistance of FTG

Profile	DF884LM_E200
Ltot	mm 1201
L1	mm 1100
L2	mm 11
L3	mm 70
L4	mm 31
efix	mm 200
tnom	mm 8
tp1	mm 3,8
tp2	mm 7,7
Interlayer	- SGP
tv.i	mm 1,52
ng	- 3
Tg.pvb	°C 30
Tg.sgp	°C 50
Cat	- other
CC	- CC2
KF1	- 1
γQ0	- 1,5
γQ	- 1,5
ψ0 LL	- 0,6
ψ0 Wind	- 0
	Life load
γm.A	- 1,8
γm.V	- 1,2
ke	- 1
c	- 16
ksp	- 1
kz	- 0,9
fg,k	N/mm ² 45
fb,k	N/mm ² 120

Type of load	qk [kN/m]	Fk [kN]	wk [kN/m ²]
Zone of load	a	a+b	a+b
Value of load	0,8	1	0,5
Time of loading	300	300	604800
Load area A	mm ²	40000	40000
			1100000
Modification factor for the load time	kmod	0,774	0,774
Surface effect factor	ka	1,0	1,076
Design resistance of FTG	f _{mt,ud}	N/mm ² 75,61	77,08
Shear modulus interlayer	G _{int}	N/mm ² 4,65	4,65
Young modulus interlayer	E _{int}	N/mm ² 13,87	13,87
Coupling factor of the interlayer(s) at stress	ω _s	0,563	0,424
Coupling factor of the interlayer(s) at deformation	ω _w	0,791	0,698
Equivalent glass thickness ULS	teq,ult	mm 17,63	16,82
Equivalent glass thickness SLS	teq,serv	mm 17,97	17,36
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm 1000	1000
Section moduls with equivalent thickness W=b*teq ² /6	W _{el}	mm ³ 51816	47154
Bending moment at fixation	Med	kNm 1,320	1,500
Bending tensile stress at ULS	σEd,ULS*	N/mm ² 25,475	36,58
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	0,34	0,47
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin,ULS	mm -	475
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max,ULS	kN/m ² -	377
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm 1000	Check if zone (a) or (a+b) decisive
Bending moment at fixation	Med,res	kNm 0,880	1,000
Section moduls with residual check	W _{el,res}	mm ³ 36310	0,500
Bending tensile stress analytic based on bcalc	σEd,res**	N/mm ² 26,659	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=
Maximum utilization residual capacity based on bcalc	utilization	0,35	1,80
Deformation glass panel at top	σglass,top	mm 10,49	zone a decisive
Moment of inertia with equivalent thickness teq,serv	Ieq,serv	mm ⁴ 483287	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation
Linear profile stiffness	kprof	(kN/m)/mm 34,5	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation
Characteristic force at top support glass into profile	Fp,k	kN/m 13,37	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary
Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k,max	kN/m 35,0	
Validation of linear iteration	valid	- OK	
Deformation top of profile based on numerical simulation of profile	σprof	mm 0,39	
Deformation top of parapet due to profile deformation/rotation - extrapolation	σprof,top	mm 4,2	
Total deformation at top of parapet = σglass + σprofile	σtot,top	mm 14,6	
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	σmax	mm 20	
Maximum utilization SLS	utilization	0,73	
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm 1000	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp,Ed	kN/m 20,06	22,93
Maximum allowed design acting force based on numerical simulations of profiles	Fp,Rd	kN/m 68,8	11,46
Maximum utilization aluminium profile for single loads qk and Fk	utilization	0,29	0,33
Minimum plate width based on profile resistance	bmin,prof	mm -	333
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max,profile	kN/m ² -	167
			4,69
Parapet System	DF884LM_E200		
Total height of the parapet	1201	mm	
Glass height	1100	mm	
Glass thickness nominal	8	mm	
Interlayer	SGP	-	
Thickness interlayer	1,52	mm	
Load category	other		
Load		qk [kN/m]	Fk [kN]
		0,8	1
Maximum utilization glass at ULS	ut.glass.ULS	0,34	0,5
Maximum utilization profile at ULS	ut.profile.ULS	0,29	0,33
Maximum utilization residual capacity glass for linear load qk	ut.residual	0,35	-
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	10,5	-
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	14,6	-
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	0,73	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ² -	4,49
Minimum plate width ULS glass	bmin.glass.ULS	mm -	475
Minimum plate width ULS profile	bmin.profile.ULS	mm -	333
Minimum plate width residual check	bmin.glass.residual	mm -	370
Minimum plate width overall	bmin	mm -	475

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF884LM_E200			
Total height of the parapet	Ltot	mm	1301			
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1200			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	3,8			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	7,7			
Type of interlayer	Interlayer	-	SGP			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	3			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	other			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KFI	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
Type of load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Zone of load			a	a	a-b	a-b
Value of load			0,8	1	0,5	1
Time of loading	s		300	300	604800	5
Load area A	mm ²		-	40000	40000	1200000
Modification factor for the load time	km0d	-	0,774	0,774	0,481	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,939
Design resistance of FTG	f _{mt,ud}	N/mm ²	75,61	77,08	69,19	79,73
Shear modulus interlayer	Gint	N/mm ²	4,65	4,65	1,08	10,00
Young modulus interlayer	Eint	N/mm ²	13,87	13,87	3,22	29,80
Coupling factor of the interlayer(s) at stress	α _{st}	-	0,592	0,454	0,162	0,868
Coupling factor of the interlayer(s) at deformation	α _{ow}	-	0,818	0,733	0,389	0,866
Equivalent glass thickness ULS	teq.ult	mm	17,78	17,02	14,30	18,83
Equivalent glass thickness SLS	teq.serv	mm	18,13	17,59	14,95	18,43
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	1100	1100	1000
Section moduli with equivalent thickness W=b ³ teq ² /6	Wel	mm ³	52675	53078	37502	59110
Bending moment at fixation	Med	kNm	1,440	1,650	0,825	1,080
Bending tensile stress at ULS	σEd.ULS*	N/mm ²	27,337	35,75	25,30	21,01
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	-	0,36	0,46	0,37	0,26
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin.ULS	mm	-	510	402	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	-	3,79
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a-b) decisive	0,500	1000
Bending moment at fixation	Med.res	kNm	0,960	1,100	0,550	-
Section moduli with residual check	Wel.res	mm ³	36623	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=	-	-
Bending tensile stress analytic based on bcalc	σEd.res**	N/mm ²	28,834	1,80	-	-
Maximum utilization residual capacity based on bcalc	utilization	-	0,38	zone a decisive	-	-
Deformation glass panel at top	δ _{glass,top}	mm	13,25	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-	-
Moment of inertia with equivalent thickness teq.serv	I _{eq.serv}	mm ⁴	496921	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-	-
Linear profile stiffness	kprof	(kN/m)/mm	34,5	-	-	-
Characteristic force at top support glass into profile	Fp.k	kN/m	14,51	-	-	-
Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k,max	kN/m	35,0	-	-	-
Validation of linear iteration	valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	-	-
Defomation top of profile based on numerical simulation of profile	δ _{prof}	mm	0,42	-	-	-
Defomation top of parapet due to profile deformation/rotation - extrapolation	δ _{prof,top}	mm	4,9	-	-	-
Total deformation at top of parapet = δ _{glass} + δ _{prof}	δ _{tot,top}	mm	18,1	-	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δ _{max}	mm	20	-	-	-
Maximum utilization SLS	utilization	-	0,91	-	-	-
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	1100	1100	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	21,77	22,79	11,40	17,28
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	68,8	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,32	0,33	0,17	0,25
Minimum plate width based on profile resistance	bmin.prof	mm	-	364	182	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	-	3,98
Parapet System	DF884LM_E200					
Total height of the parapet	1301	mm				
Glass height	1200	mm				
Glass thickness nominal	8	mm				
Interlayer	SGP	-				
Thickness interlayer	1,52	mm				
Load category	other	-				
Load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Maximum utilization glass at ULS	ut.glass.ULS	-	0,36	1	0,5	-
Maximum utilization profile at ULS	ut.profile.ULS	-	0,32	0,33	0,17	-
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,38	-	-	-
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	mm	13,2	-	-	-
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	18,1	-	-	-
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,91	-	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²	-	-	-	3,79
Minimum plate width ULS glass	bmin.glass.ULS	mm	-	510	402	-
Minimum plate width ULS profile	bmin.profile.ULS	mm	-	364	182	-
Minimum plate width residual check	bmin.glass.residual	mm	400	-	-	-
Minimum plate width overall	bmin	mm	510	-	-	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

4.2.14 DF1010FR_E200 with 8+8+4 glass

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile		DF884FR_E200	
Total height of the parapet	Ltot	mm	1001		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	900		
Vertical distance between top of profile and top support of glass into profile	L2	mm	11		
Vertical distance between top and bottom support of glass into profile	L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31		
Distance between fixations	efix	mm	200		
Nominal glass thickness	tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	3,8		
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	7,7		
Type of interlayer	Interlayer	-	SGP		
Thickness of interlayer	tv.i	mm	1,52		
Number of sheets of glass of laminated plate	ng	-	3		
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50		
Load category	Cat	-	other		
Consequence class	CC	-	CC2		
Multiplication factor for consequence class	KF1	-	1		
Load safety factor variable loads as basis value	γQ0	-	1,5		
Load safety factor variable loads considering CC	γQ	-	1,5		
Load combination factor for variable life load	ψ0 LL	-	0,6		
Load combination factor for variable wind load	ψ0 Wind	-	0		
Predominant load			Life load		
Material safety factor float glass for predominant load	γm.A	-	1,8		
Material safety factor FTG	γm.V	-	1,2		
Factor for the edge quality of the glass panel	ke	-	1		
Corrosion constant as a function	c	-	16		
Factor for the surface structure of float glass	ksp	-	1		
Factor for the zone for FTG and edge zone	kz	-	0,9		
Characteristic resistance of float glass	fg.k	N/mm ²	45		
Characteristic resistance of FTG	fb.k	N/mm ²	120		
		Type of load	qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load	a	a	a+b
		Value of load	0,8	1	0,5
		Time of loading	s	300	604800
		Load area A	mm ²	40000	900000
		Modification factor for the load time	kmod	0,774	0,774
		Surface effect factor	ka	1,0	1,076
		Design resistance of FTG	f _{mt,ud}	N/mm ²	75,61
		Shear modulus interlayer	Gint	N/mm ²	4,65
		Young modulus interlayer	Eint	N/mm ²	13,87
		Coupling factor of the interlayer(s) at stress	α _{st}	0,493	0,358
		Coupling factor of the interlayer(s) at deformation	α _w	0,718	0,609
		Equivalent glass thickness ULS	teq,ult	mm	17,25
		Equivalent glass thickness SLS	teq,serv	mm	17,50
		Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000
		Section moduls with equivalent thickness W=b ² teq ² /6	W _{el}	mm ³	49621
		Bending moment at fixation	Med	kNm	1,080
		Bending tensile stress at ULS	σ _{Ed,ULS*}	N/mm ²	21,765
		Maximum utilization ULS = σ _{Ed} /f _{mt,ud}	utilization	-	0,29
		Minimum plate width based ULS checks as maximum of Fk-loads	bmin,ULS	mm	403
		Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max,ULS	kN/m ²	324
		Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000
		Bending moment at fixation	Med,res	kNm	0,720
		Section moduls with residual check	W _{el,res}	mm ³	35486
		Bending tensile stress analytic based on bcalc	σ _{Ed,res**}	N/mm ²	22,318
		Maximum utilization residual capacity based on bcalc	utilization	-	0,30
		Deformation glass panel at top	δ _{glass,top}	mm	6,22
		Moment of inertia with equivalent thickness teq,serv	I _{eq,serv}	mm ⁴	446483
		Linear profile stiffness	k _{prof}	(kN/m)/mm	19,0
		Characteristic force at top support glass into profile	Fp,k	kN/m	11,09
		Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k,max	kN/m	45,0
		Validation of linear iteration	valid	-	OK
		Deformation top of profile based on numerical simulation of profile	δ _{prof}	mm	0,58
		Deformation top of parapet due to profile deformation/rotation - extrapolation	δ _{prof,top}	mm	5,2
		Total deformation at top of parapet = δ _{glass} + δ _{prof}	δ _{tot,top}	mm	11,4
		Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δ _{max}	mm	20
		Maximum utilization SLS	utilization	-	0,57
		Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000
		Design acting force at top support glass into profile based on bmin for Fk	Fp,Ed	kN/m	16,63
		Maximum allowed design acting force based on numerical simulations of profiles	Fp,Rd	kN/m	78,5
		Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,21
		Minimum plate width based on profile resistance	bmin,prof	mm	238
		Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max,profile	kN/m ²	119
		Parapet System	DF884FR_E200		
		Total height of the parapet	1001	mm	
		Glass height	900	mm	
		Glass thickness nominal	8	mm	
		Interlayer	SGP	-	
		Thickness interlayer	1,52	mm	
		Load category	other	-	
		Load	qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Maximum utilization glass at ULS	ut.glass.ULS	-	0,29
		Maximum utilization profile at ULS	ut.profile.ULS	-	0,21
		Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,30
		Maximum deformation glass at SLS for linear load qk	def.glass.SLS	-	6,2
		Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	11,4
		Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,57
		Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²	6,60
		Minimum plate width ULS glass	bmin.glass.ULS	mm	403
		Minimum plate width ULS profile	bmin.profile.ULS	mm	238
		Minimum plate width residual check	bmin.glass.residual	mm	300
		Minimum plate width overall	bmin	mm	403
		NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation			

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF884FR_E200			
Total height of the parapet	Ltot	mm	1101			
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1000			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	3,8			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	7,7			
Type of interlayer	Interlayer	-	SGP			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	3			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	other			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
		Type of load	qk [kN/m]	Fk [kN]		wk [kN/m ²]
		Zone of load	a	a	a+b	a+b
		Value of load	0,8	1	0,5	1
		Time of loading	s	300	604800	5
		Load area A	mm ²	40000	40000	1000000
Modification factor for the load time		kmod	-	0,774	0,774	0,481
Surface effect factor		ka	-	1,076	1,076	0,946
Design resistance of FTG		f _{mt,ud}	N/mm ²	75,61	77,08	69,19
Shear modulus interlayer		Gint	N/mm ²	4,65	4,65	1,08
Young modulus interlayer		Eint	N/mm ²	13,87	13,87	29,80
Coupling factor of the interlayer(s) at stress		ω _{st}	-	0,530	0,392	0,130
Coupling factor of the interlayer(s) at deformation		ω _w	-	0,758	0,657	0,308
Equivalent glass thickness ULS		teq,ult	mm	17,46	16,60	13,85
Equivalent glass thickness SLS		teq,serv	mm	17,76	17,08	14,18
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		b _{calc}	mm	1000	900	900
Section moduls with equivalent thickness W=b ³ teq ² /6		W _{el}	mm ³	50810	41316	28754
Bending moment at fixation		Med	kNm	1,200	1,350	0,675
Bending tensile stress at ULS		σ _{Ed,ULS} *	N/mm ²	23,618	37,58	27,00
Maximum utilization ULS = σ _{Ed} /f _{mt,ud}		utilization	-	0,31	0,49	0,39
Minimum plate width based ULS-checks as maximum of Fk-loads		b _{min,ULS}	mm	-	439	351
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max,glass	kN/m ²	-	-	5,40
Calculation width glass panel - for Fk based on Mepla calculation		b _{calc}	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med,res	kNm	0,800	0,900	0,450
Section moduls with residual check		W _{el,res}	mm ³	35937	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=	
Bending tensile stress analytic based on b _{calc}		σ _{Ed,res} **	N/mm ²	24,487	1,80	For residual capacity check of Fk see Mepla calcs and related tables for b _{min}
Maximum utilization residual capacity based on b _{calc}		utilization	-	0,32	zone a decisive	
Deformation glass panel at top		δ _{glass,top}	mm	8,16	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq,serv		I _{eq,serv}	mm ⁴	466728	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		k _{prof}	(kN/m)/mm	19,0	distribution acc. to comparative Mepla-calculation	
Characteristic force at top support glass into profile		F _{p,k}	kN/m	12,23		
Maximum char. force at top support glass/profile at end of linear stiffness		F _{p,k,max}	kN/m	45,0		
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Deformation top of profile based on numerical simulation of profile		δ _{prof}	mm	0,64		
Deformation top of parapet due to profile deformation/rotation - extrapolation		δ _{rot,top}	mm	6,3		
Total deformation at top of parapet = δ _{glass} + δ _{prof}		δ _{tot,top}	mm	14,5		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		δ _{max}	mm	20		
Maximum utilization SLS		utilization	-	0,72		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		b _{calc}	mm	1000	900	900
Design acting force at top support glass into profile based on b _{min} for Fk		F _{p,Ed}	kN/m	18,34	23,10	11,55
Maximum allowed design acting force based on numerical simulations of profiles		F _{p,Rd}	kN/m	78,5	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,23	0,29	0,15
Minimum plate width based on profile resistance		b _{min,prof}	mm	-	265	132
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max,profile	kN/m ²	-	-	6,40
Parapet System		DF884FR_E200				
Total height of the parapet	1101	mm				
Glass height	1000	mm				
Glass thickness nominal	8	mm				
Interlayer	SGP	-				
Thickness interlayer	1,52	mm				
Load category	other	-				
Load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
			0,8	1	0,5	
Maximum utilization glass at ULS		ut.glass.ULS	-	0,31		
Maximum utilization profile at ULS		ut.profile.ULS	-	0,23	0,29	0,15
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,32		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	8,2		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	14,5		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,72		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	5,40
Minimum plate width ULS glass		b _{min,glass,ULS}	mm	-	439	351
Minimum plate width ULS profile		b _{min,profile,ULS}	mm	-	265	132
Minimum plate width residual check		b _{min,glass.residual}	mm	330		
Minimum plate width overall		b _{min}	mm	439		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF884FR_E200			
Total height of the parapet	Ltot	mm	1201			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1100			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	3,8			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	7,7			
Type of interlayer	Interlayer	-	SGP			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	3			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	other			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
Type of load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Zone of load			a	a	a+b	a+b
Value of load			0,8	1	0,5	1
Time of loading	s		300	300	604800	5
Load area A	mm ²		-	40000	40000	1100000
Modification factor for the load time	kmod	-	0,774	0,774	0,481	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,942
Design resistance of FTG	f _{mt,ud}	N/mm ²	75,61	77,08	69,19	79,81
Shear modulus interlayer	Gint	N/mm ²	4,65	4,65	1,08	10,00
Young modulus interlayer	Eint	N/mm ²	13,87	13,87	3,22	29,80
Coupling factor of the interlayer(s) at stress	ωσ	-	0,563	0,424	0,146	0,849
Coupling factor of the interlayer(s) at deformation	ωw	-	0,791	0,698	0,349	0,845
Equivalent glass thickness ULS	teq,ult	mm	17,63	16,82	14,08	18,77
Equivalent glass thickness SLS	teq,serv	mm	17,97	17,36	14,58	18,30
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	1000	1000	1000
Section moduls with equivalent thickness W=b*teq ² /6	Wel	mm ³	51816	47154	33042	58738
Bending moment at fixation	Med	kNm	1,320	1,500	0,750	0,908
Bending tensile stress at ULS	σEd.ULS*	N/mm ²	25,475	36,58	26,10	17,77
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	-	0,34	0,47	0,38	0,22
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin.ULS	mm	-	475	377	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	-	4,49
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a+b) decisive	1000	1000
Bending moment at fixation	Med.res	kNm	0,880	1,000	0,500	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Section moduls with residual check	Wel.res	mm ³	36310	(Ma/Mab)*(f _{mt,ud} .ab/f _{mt,ud} .a)	-	-
Bending tensile stress analytic based on bcalc	σEd.res**	N/mm ²	26,659	1,80	-	-
Maximum utilization residual capacity based on bcalc	utilization	-	0,35	zone a decisive	-	-
Deformation glass panel at top	δglass.top	mm	10,49	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-	-
Moment of inertia with equivalent thickness teq,serv	Ieq,serv	mm ⁴	483287	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-	-
Linear profile stiffness	kprof	(kN/m)/mm	19,0	-	-	-
Characteristic force at top support glass into profile	Fp.k	kN/m	13,37	-	-	-
Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k,max	kN/m	45,0	-	-	-
Validation of linear iteration	valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	-	-
Deformation top of profile based on numerical simulation of profile	δprof	mm	0,70	-	-	-
Deformation top of parapet due to profile deformation/rotation - extrapolation	δprof.top	mm	7,5	-	-	-
Total deformation at top of parapet = δglass + δprofile	δtot.top	mm	18,0	-	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δmax	mm	20	-	-	-
Maximum utilization SLS	utilization	-	0,90	-	-	-
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	1000	1000	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	20,06	22,93	11,46	14,67
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	78,5	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,26	0,29	0,15	0,19
Minimum plate width based on profile resistance	bmin.prof	mm	-	292	146	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	-	5,35
Parapet System						
Total height of the parapet	1201	mm				
Glass height	1100	mm				
Glass thickness nominal	8	mm				
Interlayer	SGP	-				
Thickness interlayer	1,52	mm				
Load category	other	-				
Load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Load			0,8	1	0,5	
Maximum utilization glass at ULS	ut.glass.ULS	-	0,34			
Maximum utilization profile at ULS	ut.profile.ULS	-	0,26	0,29	0,15	
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,35			
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	-	10,5			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	18,0			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,90			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²	-	-	-	4,49
Minimum plate width ULS glass	bmin.glass.ULS	mm	-	475	377	-
Minimum plate width ULS profile	bmin.profile.ULS	mm	-	292	146	-
Minimum plate width residual check	bmin.glass.residual	mm	-	370	-	-
Minimum plate width overall	bmin	mm	-	475	-	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL		Profile	DF884FR_E200			
Parapet System		Ltot	mm	1301		
Total height of the parapet		L1	mm	1300		
Glass length top of parapet until first fixation into profile L1-Ltot-L3-L4		L2	mm	11		
Vertical distance between top of profile and top support of glass into profile		L3	mm	70		
Vertical distance between top and bottom support of glass into profile		L4	mm	31		
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200		
Distance between fixations		tnom	mm	8		
Nominal glass thickness		tp1	mm	3,8		
Glass thickness for calculation tp1 for inner plate at loading side		tp2	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	SGP		
Type of interlayer		tv,i	mm	1,52		
Thickness of interlayer		ng	-	3		
Number of sheets of glass of laminated plate		Tg,pvb	°C	30		
Maximum temperature of glass panel at loading for PVB		Tg,sgp	°C	50		
Maximum temperature of glass panel at loading for SGP		Cat	-	other		
Load category		CC	-	CC2		
Consequence class		KF1	-	1		
Multiplication factor for consequence class		γQp	-	1,5		
Load safety factor variable loads as basis value		γQ	-	1,5		
Load safety factor variable loads considering CC		γ0_LL	-	0,6		
Load combination factor for variable life load		γ0_Wind	-	0		
Load combination factor for variable wind load				Life load		
Predominant load		γm,A	-	1,8		
Material safety factor float glass for predominant		γm,V	-	1,2		
Material safety factor FTG		ke	-	1		
Factor for the edge quality of the glass panel		c	-	16		
Corrosion constant as a function		ksp	-	1		
Factor for the surface structure of float glass		kz	-	0,9		
Factor for the zone for FTG and edge zone		fg,k	N/mm ²	45		
Characteristic resistance of float glass		fb,k	N/mm ²	120		
Characteristic resistance of FTG		Type of load	qk [kN/m]	Fk [kN]	wk [kN/m ²]	
		Zone of load	a	a+b	a+b	
		Value of load	0,8	1	0,5	
		Time of loading	300	300	604900	
		Load area A	mm ²	40000	40000	1200000
Modification factor for the load time		kmod	-	0,774	0,774	0,481
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm ²	75,61	77,08	69,19
Shear modulus interlayer		G _{int}	N/mm ²	4,65	4,65	1,08
Young modulus interlayer		E _{int}	N/mm ²	13,87	13,87	3,22
Coupling factor of the interlayer(s) at stress		α _{int}	-	0,592	0,454	0,162
Coupling factor of the interlayer(s) at deformation		α _{ow}	-	0,818	0,733	0,389
Equivalent glass thickness ULS		teq,ult	mm	17,78	17,02	14,30
Equivalent glass thickness SLS		teq,serv	mm	18,13	17,59	14,95
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		b _{calc}	mm	1000	1100	1100
Section modulus with equivalent thickness W=b ² teq ² /6		W _{el}	mm ³	52675	53078	37502
Bending moment at fixation		Med	kNm	1,440	1,650	0,825
Bending tensile stress at ULS		σ _{Ed,ULS} *	N/mm ²	27,337	35,75	25,30
Maximum utilization ULS = σ _{Ed} /f _{mt,ud}		utilization	-	0,36	0,46	0,37
Minimum plate width based ULS-checks as maximum of Fk-loads		b _{min,ULS}	mm	510	402	-
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max,ULS	kN/m ²	-	-	3,79
Calculation width glass panel - for Fk based on Mepla calculation		b _{calc}	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med,res	kNm	0,960	1,100	0,550
Section modulus with residual check		W _{el,res}	mm ³	36623	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=	For residual capacity check of Fk see Mepla calcs and related tables for b _{min}
Bending tensile stress analytic based on b _{calc}		σ _{Ed,res} **	N/mm ²	28,834	1,80	
Maximum utilization residual capacity based on b _{calc}		utilization	-	0,38	zone a decisive	
Deformation glass panel at top		δ _{glass,top}	mm	13,25	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq,serv		I _{eq,serv}	mm ⁴	496921	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		k _{prof}	(kN/m)/mm	19,0	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Characteristic force at top support glass into profile		Fp,k	kN/m	14,51		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp,k,max	kN/m	45,0		
Validation of linear iteration		valid	-	OK		
Deformation top of profile based on numerical simulation of profile		δ _{prof}	mm	0,76		
Deformation top of parapet due to profile deformation/rotation - extrapolation		δ _{prof,top}	mm	8,9		
Total deformation at top of parapet = δ _{glass} + δ _{profile}		δ _{tot,top}	mm	22,1		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB: A.1.4.3 (7)		δ _{max}	mm	20		
Maximum utilization SLS		utilization	-	1,11		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		b _{calc}	mm	1000	1100	1100
Design acting force at top support glass into profile based on b _{min} for Fk		Fp,Ed	kN/m	21,77	22,79	11,40
Maximum allowed design acting force based on numerical simulations of profiles		Fp,Rd	kN/m	78,5	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,28	0,29	0,15
Minimum plate width based on profile resistance		b _{min,prof}	mm	-	320	160
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max-profile	kN/m ²	-	-	4,54
Parapet System		DF884FR_E200				
Total height of the parapet		1301	mm			
Glass height		1200	mm			
Glass thickness nominal		8	mm			
Interlayer		SGP	-			
Thickness interlayer		1,52	mm			
Load category		other	-	qk [kN/m]	Fk [kN]	wk [kN/m ²]
Load				0,8	1	0,5
Maximum utilization glass at ULS		ut.glass.ULS	-	0,36		
Maximum utilization profile at ULS		ut.profile.ULS	-	0,28	0,29	0,15
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,38		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	-	13,2		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	22,1		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	1,11		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²			3,79
Minimum plate width ULS glass		b _{min,glass.ULS}	mm		510	402
Minimum plate width ULS profile		b _{min.profile.ULS}	mm		320	160
Minimum plate width residual check		b _{min.glass.residual}	mm	400		
Minimum plate width overall		b _{min}	mm	510		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

Note: A slightly more accurate Mepla-calculation shows a total deformation of 20 mm → OK

4.2.15 DF1212LM_E200 with 10+10+4 glass

SYSTEM RESISTANCE WITHOUT HANDRAIL		Profile	DF10104LM_E200			
Parapet System		Ltot	mm	1001		
Total height of the parapet		L1	mm	900		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	11		
Vertical distance between top of profile and top support of glass into profile		L3	mm	70		
Vertical distance between top and bottom support of glass into profile		L4	mm	31		
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200		
Distance between fixations		tnom	mm	10		
Nominal glass thickness		tp11	mm	3,8		
Glass thickness for calculation tp1 for inner plate at loading side		tp12	mm	9,7		
Glass thickness for calculation tp2 for middle and outer plate		interlayer	-	SGP		
Type of interlayer		tv.i	mm	1,52		
Thickness of interlayer		ng	-	3		
Number of sheets of glass of laminated plate		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50		
Maximum temperature of glass panel at loading for SGP		Cat	-	C5		
Load category		CC	-	CC2		
Consequence class		KF1	-	1		
Multiplication factor for consequence class		γQe	-	1,5		
Load safety factor variable loads as basic value		γQ	-	1,5		
Load safety factor variable loads considering CC		v0 LL	-	0,6		
Load combination factor for variable life load		v0 Wind	-	0		
Load combination factor for variable wind load						
Predominant load		Life load				
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load	qk [kN/m]	Fk [kN]	wk [kN/m ²]	
		Zone of load	a	a+b	a+b	
		Value of load	3	1	0,5	1
		Time of loading	300	300	604800	5
		Load area A	mm ²	40000	40000	900000
		kmod	-	0,774	0,774	0,481
		ka	-	1,0	1,076	1,076
		Design resistance of FTG	f _{mt,ud} N/mm ²	75,61	77,08	69,19
		Shear modulus interlayer	G _{int} N/mm ²	4,65	4,65	1,08
		Young modulus interlayer	E _{int} N/mm ²	13,87	13,87	3,22
		Coupling factor of the interlayer(s) at stress	ω _{sr}	0,436	0,306	0,756
		Coupling factor of the interlayer(s) at deformation	ω _w	0,670	0,553	0,223
		Equivalent glass thickness ULS	teq,ult mm	20,43	19,26	16,18
		Equivalent glass thickness SLS	teq,serv mm	20,79	19,79	16,20
		Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc mm	1000	800	1000
		Section modulus with equivalent thickness W=b ² teq ² /6	W _{el} mm ³	69546	49436	34889
		Bending moment at fixation	M _{ed} kNm	4,050	1,200	0,600
		Bending tensile stress at ULS	σ _{Ed,ULS} * N/mm ²	58,235	27,92	19,78
		Maximum utilization ULS = σ _{Ed} /f _{mt,ud}	utilization	0,77	0,36	0,29
		Minimum plate width based ULS-checks as maximum of Fk-loads	bmin,ULS mm	290	229	-
		Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass kN/m ²	-	-	9,49
		Calculation width glass panel - for Fk based on Mepla calculation	bcalc mm	1000	Check if zone (a) or (a+b) decisive	
		Bending moment at fixation	M _{ed,res} kNm	2,700	0,800	0,400
		Section modulus with residual check	W _{el,res} mm ³	55057	(M _a /M _{ab})*(f _{mt,ud,ab} /f _{mt,ud,a})	
		Bending tensile stress analytic based on bcalc	σ _{Ed,res**} N/mm ²	53,944	1,80	zone a decisive
		Maximum utilization residual capacity based on bcalc	utilization	0,71	zone a decisive	
		Deformation glass panel at top	σ _{ig,ss,top} mm	13,91	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
		Moment of inertia with equivalent thickness teq,serv	I _{eq,serv} mm ⁴	748481	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
		Linear profile stiffness	k _{prof} (kN/m)/mm	34,5		
		Characteristic force at top support glass into profile	F _{p,k} kN/m	41,57		
		Maximum char. force at top support glass/profile at end of linear stiffness	F _{p,k,max} kN/m	35,0		
		Validation of linear iteration	valid	NG	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
		Deformation top of profile based on numerical simulation of profile	σ _{prof} mm	1,20		
		Deformation top of parapet due to profile deformation/rotation - extrapolation	σ _{prof,top} mm	10,8		
		Total deformation at top of parapet = σ _{glass} + σ _{profile}	σ _{tot,top} mm	not valid		
		Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	σ _{max} mm	20		
		Maximum utilization SLS	utilization	not valid		
		Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc mm	1000	800	1000
		Design acting force at top support glass into profile based on bmin for Fk	F _{p,Ed} kN/m	62,36	23,30	11,65
		Maximum allowed design acting force based on numerical simulations of profiles	F _{p,Rd} kN/m	68,8	-	-
		Maximum utilization aluminium profile for single loads qk and Fk	utilization	0,91	0,34	0,17
		Minimum plate width based on profile resistance	bmin,prof mm	-	271	135
		Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max,profile kN/m ²	-	-	6,82
		Parapet System	DF10104LM_E200			
		Total height of the parapet	1001	mm		
		Glass height	900	mm		
		Glass thickness nominal	10	mm		
		Interlayer	SGP	-		
		Thickness interlayer	1,52	mm		
		Load category	C5	-		
		Load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Maximum utilization glass at ULS	ut.glass,ULS	3	1	0,5
		Maximum utilization profile at ULS	ut.profile,ULS	0,91	0,34	0,17
		Maximum utilization residual capacity glass for linear load qk	ut.residual	0,71		
		Maximum deformation glass at SLS for linear load qk	def.glass,SLS	13,9		
		Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof,SLS	not valid		
		Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof,SLS	not valid		
		Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²		6,82
		Minimum plate width ULS glass	bmin.glass,ULS	mm	290	229
		Minimum plate width ULS profile	bmin.profile,ULS	mm	271	135
		Minimum plate width residual check	bmin.glass.residual	mm	200	
		Minimum plate width overall	bmin	mm	290	

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

Note: The deformation will be considered with load category "other" - see next sheet

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF10104LM_E200			
Total height of the parapet	Ltot	mm	1001			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	900			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	10			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	3,8			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	9,7			
Type of interlayer	Interlayer	-	SGP			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	3			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	other			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KFI	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
Type of load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Zone of load			a	a	a-b	a-b
Value of load			0,8	1	0,5	1
Time of loading	s		300	300	604800	5
Load area A	mm ²		-	40000	40000	900000
Modification factor for the load time	km0d	-	0,774	0,774	0,481	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,950
Design resistance of FTG	f _{mt,ud}	N/mm ²	75,61	77,08	69,19	80,00
Shear modulus interlayer	Gint	N/mm ²	4,65	4,65	1,08	10,00
Young modulus interlayer	Eint	N/mm ²	13,87	13,87	3,22	29,80
Coupling factor of the interlayer(s) at stress	α _{st}	-	0,436	0,306	0,093	0,756
Coupling factor of the interlayer(s) at deformation	α _w	-	0,670	0,553	0,223	0,743
Equivalent glass thickness ULS	teq.ult	mm	20,43	19,26	16,18	22,30
Equivalent glass thickness SLS	teq.serv	mm	20,79	19,79	16,20	21,37
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	800	800	1000
Section moduli with equivalent thickness W=b ³ teq ² /6	Wel	mm ³	69546	49436	34889	82895
Bending moment at fixation	Med	kNm	1,080	1,200	0,600	0,608
Bending tensile stress at ULS	σEd.ULS*	N/mm ²	15,529	27,92	19,78	8,43
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	-	0,21	0,36	0,29	0,11
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin.ULS	mm	-	290	229	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	-	9,49
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a-b) decisive		-
Bending moment at fixation	Med.res	kNm	0,720	0,800	0,400	-
Section moduli with residual check	Wel.res	mm ³	55057	(Ma/Mab)*(f _{mt,ud} .ab/f _{mt,ud} .a)=		-
Bending tensile stress analytic based on bcalc	σEd.res**	N/mm ²	14,385	1,80	-	-
Maximum utilization residual capacity based on bcalc	utilization	-	0,19	zone a decisive		-
Deformation glass panel at top	δ _{glass,top}	mm	3,71	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Moment of inertia with equivalent thickness teq.serv	I _{eq.serv}	mm ⁴	748481	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Linear profile stiffness	kprof	(kN/m)/mm	34,5			
Characteristic force at top support glass into profile	Fp.k	kN/m	11,09			
Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k,max	kN/m	35,0			
Validation of linear iteration	valid	-	OK	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary		
Defomation top of profile based on numerical simulation of profile	δ _{prof}	mm	0,32			
Defomation top of parapet due to profile deformation/rotation - extrapolation	δ _{prof,top}	mm	2,9			
Total deformation at top of parapet = δ _{glass} + δ _{profile}	δ _{tot,top}	mm	6,6			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δ _{max}	mm	20			
Maximum utilization SLS	utilization	-	0,33			
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	800	800	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	16,63	23,30	11,65	10,08
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	68,8	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,24	0,34	0,17	0,15
Minimum plate width based on profile resistance	bmin.prof	mm	-	271	135	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	-	6,82
Parapet System	DF10104LM_E200					
Total height of the parapet	1001	mm				
Glass height	900	mm				
Glass thickness nominal	10	mm				
Interlayer	SGP	-				
Thickness interlayer	1,52	mm				
Load category	other	-				
Load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Maximum utilization glass at ULS	ut.glass.ULS	-	0,21			
Maximum utilization profile at ULS	ut.profile.ULS	-		0,34	0,17	
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,19			
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	mm	3,7			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	6,6			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,33			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²				6,82
Minimum plate width ULS glass	bmin.glass.ULS	mm		290	229	
Minimum plate width ULS profile	bmin.profile.ULS	mm		271	135	
Minimum plate width residual check	bmin.glass.residual	mm	200			
Minimum plate width overall	bmin	mm	290			

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile		DF10104LM_E200	
Total height of the parapet	Ltot	mm	1101		
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1000		
Vertical distance between top of profile and top support of glass into profile	L2	mm	11		
Vertical distance between top and bottom support of glass into profile	L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31		
Distance between fixations	efix	mm	200		
Nominal glass thickness	tnom	mm	10		
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	3,8		
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	9,7		
Type of interlayer	Interlayer	-	SGP		
Thickness of interlayer	tv.i	mm	1,52		
Number of sheets of glass of laminated plate	ng	-	3		
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50		
Load category	Cat	-	C5		
Consequence class	CC	-	CC2		
Multiplication factor for consequence class	KF1	-	1		
Load safety factor variable loads as basis value	γQ0	-	1,5		
Load safety factor variable loads considering CC	γQ	-	1,5		
Load combination factor for variable life load	ψ0 LL	-	0,6		
Load combination factor for variable wind load	ψ0 Wind	-	0		
Predominant load			Life load		
Material safety factor float glass for predominant load	γm.A	-	1,8		
Material safety factor FTG	γm.V	-	1,2		
Factor for the edge quality of the glass panel	ke	-	1		
Corrosion constant as a function	c	-	16		
Factor for the surface structure of float glass	ksp	-	1		
Factor for the zone for FTG and edge zone	kz	-	0,9		
Characteristic resistance of float glass	fg.k	N/mm ²	45		
Characteristic resistance of FTG	fb.k	N/mm ²	120		

Type of load	Zone of load	qk [kN/m]	Fk [kN]	wk [kN/m ²]
		a	a+b	a+b
Value of load		3	0,5	1
Time of loading	s	300	604800	5
Load area A	mm ²	-	40000	1000000

Modification factor for the load time	kmod	-	0,774	0,774	0,481	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,946
Design resistance of FTG	f _{td,ud}	N/mm ²	75,61	77,08	69,19	79,90
Shear modulus interlayer	Gint	N/mm ²	4,65	4,65	1,08	10,00
Young modulus interlayer	Eint	N/mm ²	13,87	13,87	3,22	29,80
Coupling factor of the interlayer(s) at stress	α _σ	-	0,472	0,338	0,106	0,789
Coupling factor of the interlayer(s) at deformatio	α _w	-	0,713	0,604	0,261	0,781
Equivalent glass thickness ULS	teq,ult	mm	20,70	19,58	16,43	22,44
Equivalent glass thickness SLS	teq,serv	mm	21,14	20,23	16,69	21,66
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	b _{calc}	mm	1000	900	900	1000
Section moduls with equivalent thickness W=b ³ teq ² /6	W _{el}	mm ³	71418	57499	40500	83948
Bending moment at fixation	Med	kNm	4,500	1,350	0,675	0,750
Bending tensile stress at ULS	σ _{Ed,ULS*}	N/mm ²	63,009	27,00	19,17	10,27
Maximum utilization ULS = σ _{Ed} /f _{td,ud}	utilization	-	0,83	0,35	0,28	0,13
Minimum plate width based ULS-checks as maximum of Fk-loads	b _{min,ULS}	mm	-	315	249	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max,glass	kN/m ²	-	-	-	7,78
Calculation width glass panel - for Fk based on Mepla calculation	b _{calc}	mm	1000	900	900	1000
Bending moment at fixation	Med,res	kNm	3,000	0,900	0,450	-
Section moduls with residual check	W _{el,res}	mm ³	5874	(Ma/Mab)*(f _{td,ud} .ab/f _{td,ud} .a)=	-	-
Bending tensile stress analytic based on b _{calc}	σ _{Ed,res**}	N/mm ²	59,062	1,80	-	-
Maximum utilization residual capacity based on b _{calc}	utilization	-	0,78	zone a decisive	-	-
Deformation glass panel at top	σ _{glass,top}	mm	18,15	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-	-
Moment of inertia with equivalent thickness teq,serv	I _{eq,serv}	mm ⁴	787302	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	-	-
Linear profile stiffness	k _{prof}	(kN/m)/mm	34,5	-	-	-
Characteristic force at top support glass into profile	F _{p,k}	kN/m	45,86	-	-	-
Maximum char. force at top support glass/profile at end of linear stiffness	F _{p,k,max}	kN/m	35,0	-	-	-
Validation of linear iteration	valid	-	NG	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	-	-
Defomation top of profile based on numerical simulation of profile	σ _{prof}	mm	1,33	-	-	-
Defomation top of parapet due to profile deformation/rotation - extrapolation	σ _{rot,top}	mm	13,1	-	-	-
Total deformation at top of parapet = σ _{glass} + σ _{profile}	σ _{tot,top}	mm	not valid	-	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	σ _{max}	mm	20	-	-	-
Maximum utilization SLS	utilization	-	not valid	-	-	-
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	b _{calc}	mm	1000	900	900	1000
Design acting force at top support glass into profile based on b _{min} for Fk	F _{p,Ed}	kN/m	68,79	23,10	11,55	12,27
Maximum allowed design acting force based on numerical simulations of profiles	F _{p,Rd}	kN/m	68,8	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	1,00	0,34	0,17	0,18
Minimum plate width based on profile resistance	b _{min,prof}	mm	-	302	151	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max,profile	kN/m ²	-	-	-	5,61

Parapet System		DF10104LM_E200	
Total height of the parapet	1101	mm	
Glass height	1000	mm	
Glass thickness nominal	10	mm	
Interlayer	SGP	-	
Thickness interlayer	1,52	mm	
Load category	C5	-	
Load		qk [kN/m]	Fk [kN]
		3	0,5
Maximum utilization glass at ULS	ut.glass.ULS	-	0,83
Maximum utilization profile at ULS	ut.profile.ULS	-	1,00
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,78
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	-	18,1
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	not valid
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	not valid
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²	5,61
Minimum plate width ULS glass	b _{min,glass.ULS}	mm	315
Minimum plate width ULS profile	b _{min.profile.ULS}	mm	302
Minimum plate width residual check	b _{min.glass.residual}	mm	210
Minimum plate width overall	b _{min}	mm	315

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF10104LM_E200			
Total height of the parapet	Ltot	mm	1101			
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1000			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	10			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	3,8			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	9,7			
Type of interlayer	Interlayer	-	SGP			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	3			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	other			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KFI	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
Type of load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Zone of load			a	a	a-b	a-b
Value of load			0,8	1	0,5	1
Time of loading	s		300	300	604800	5
Load area A	mm ²		-	40000	40000	1000000
Modification factor for the load time	km0d	-	0,774	0,774	0,481	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,946
Design resistance of FTG	f _{mt,ud}	N/mm ²	75,61	77,08	69,19	79,90
Shear modulus interlayer	Gint	N/mm ²	4,65	4,65	1,08	10,00
Young modulus interlayer	Eint	N/mm ²	13,87	13,87	3,22	29,80
Coupling factor of the interlayer(s) at stress	α _{st}	-	0,472	0,338	0,106	0,789
Coupling factor of the interlayer(s) at deformation	α _w	-	0,713	0,604	0,261	0,781
Equivalent glass thickness ULS	teq.ult	mm	20,70	19,58	16,43	22,44
Equivalent glass thickness SLS	teq.serv	mm	21,14	20,23	16,69	21,66
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	900	900	1000
Section moduli with equivalent thickness W=b ³ teq ² /6	Wel	mm ³	71418	57499	40500	83948
Bending moment at fixation	Med	kNm	1,200	1,350	0,675	0,750
Bending tensile stress at ULS	σEd.ULS*	N/mm ²	16,802	27,00	19,17	10,27
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	-	0,22	0,35	0,28	0,13
Minimum plate width based ULS-checks as maximum of Fk-loads	bmin.ULS	mm	-	315	249	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	-	7,78
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a-b) decisive	0,450	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending moment at fixation	Med.res	kNm	0,800	0,900	0,450	
Section moduli with residual check	Wel.res	mm ³	55874	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=	1,80	
Bending tensile stress analytic based on bcalc	σEd.res**	N/mm ²	15,750	1,80	zone a decisive	
Maximum utilization residual capacity based on bcalc	utilization	-	0,21			
Deformation glass panel at top	δ _{glass,top}	mm	4,84	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Moment of inertia with equivalent thickness teq.serv	I _{eq.serv}	mm ⁴	787302	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Linear profile stiffness	kprof	(kN/m)/mm	34,5			
Characteristic force at top support glass into profile	Fp.k	kN/m	12,23			
Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k,max	kN/m	35,0			
Validation of linear iteration	valid	-	OK	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary		
Defomation top of profile based on numerical simulation of profile	δ _{prof}	mm	0,35			
Defomation top of parapet due to profile deformation/rotation - extrapolation	δ _{prof,top}	mm	3,5			
Total deformation at top of parapet = δ _{glass} + δ _{prof}	δ _{tot,top}	mm	8,3			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δ _{max}	mm	20			
Maximum utilization SLS	utilization	-	0,42			
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	900	900	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	18,34	23,10	11,55	12,27
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	68,8	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,27	0,34	0,17	0,18
Minimum plate width based on profile resistance	bmin.prof	mm	-	302	151	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	-	5,61
Parapet System	DF10104LM_E200					
Total height of the parapet	1101	mm				
Glass height	1000	mm				
Glass thickness nominal	10	mm				
Interlayer	SGP	-				
Thickness interlayer	1,52	mm				
Load category	other	-				
Load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Maximum utilization glass at ULS	ut.glass.ULS	-	0,22			
Maximum utilization profile at ULS	ut.profile.ULS	-	0,27	0,34	0,17	
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,21			
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	mm	4,8			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	8,3			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,42			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²				5,61
Minimum plate width ULS glass	bmin.glass.ULS	mm		315	249	
Minimum plate width ULS profile	bmin.profile.ULS	mm		302	151	
Minimum plate width residual check	bmin.glass.residual	mm	210			
Minimum plate width overall	bmin	mm	315			

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF10104LM_E200																											
Parapet System		Ltot	mm	1201																										
Total height of the parapet		L1	mm	1100																										
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	11																										
Vertical distance between top of profile and top support of glass into profile		L3	mm	70																										
Vertical distance between top and bottom support of glass into profile		L4	mm	31																										
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200																										
Distance between fixations		tnom	mm	10																										
Nominal glass thickness		tpl1	mm	3,8																										
Glass thickness for calculation tp1 for inner plate at loading side		tpl2	mm	9,7																										
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	SGP																										
Type of interlayer		tv.i	mm	1,52																										
Thickness of interlayer		ng	-	3																										
Number of sheets of glass of laminated plate		Tg.pvb	°C	30																										
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50																										
Maximum temperature of glass panel at loading for SGP		Cat	-	other																										
Load category		CC	-	CC2																										
Consequence class		KFI	-	1																										
Multiplication factor for consequence class		γQ0	-	1,5																										
Load safety factor variable loads as basis value		γQ	-	1,5																										
Load safety factor variable loads considering CC		γ0 LL	-	0,6																										
Load combination factor for variable life load		γ0 Wind	-	0																										
Load combination factor for variable wind load		Predominant load																												
Predominant load		γm.A	-	1,8	Life load																									
Material safety factor float glass for predominant load		γm.V	-	1,2																										
Material safety factor FTG		ke	-	1																										
Factor for the edge quality of the glass panel		c	-	16																										
Corrosion constant as a function		ksp	-	1																										
Factor for the surface structure of float glass		kz	-	0,9																										
Factor for the zone for FTG and edge zone		fg.k	N/mm ²	45																										
Characteristic resistance of float glass		fb.k	N/mm ²	120																										
Characteristic resistance of FTG		<table border="1"> <thead> <tr> <th>Type of load</th> <th>qk [kN/m]</th> <th>a</th> <th>Fk [kN]</th> <th>a+b</th> <th>wk [kN/m²]</th> </tr> </thead> <tbody> <tr> <td>Zone of load</td> <td>a</td> <td>0,8</td> <td>1</td> <td>0,5</td> <td>a+b</td> </tr> <tr> <td>Value of load</td> <td>s</td> <td>300</td> <td>300</td> <td>604800</td> <td>5</td> </tr> <tr> <td>Time of loading</td> <td>mm²</td> <td>-</td> <td>40000</td> <td>40000</td> <td>1100000</td> </tr> </tbody> </table>					Type of load	qk [kN/m]	a	Fk [kN]	a+b	wk [kN/m ²]	Zone of load	a	0,8	1	0,5	a+b	Value of load	s	300	300	604800	5	Time of loading	mm ²	-	40000	40000	1100000
Type of load	qk [kN/m]	a	Fk [kN]	a+b	wk [kN/m ²]																									
Zone of load	a	0,8	1	0,5	a+b																									
Value of load	s	300	300	604800	5																									
Time of loading	mm ²	-	40000	40000	1100000																									
Modification factor for the load time		km0d	-	0,774	0,774	0,481	1,000																							
Surface effect factor		ka	-	1,0	1,076	1,076	0,942																							
Design resistance of FTG		f _{mt,ud}	N/mm ²	75,61	77,08	69,19	79,81																							
Shear modulus interlayer		G _{int}	N/mm ²	4,65	4,65	1,08	10,00																							
Young modulus interlayer		E _{int}	N/mm ²	13,87	13,87	3,22	29,80																							
Coupling factor of the interlayer(s) at stress		σ _{or}	-	0,505	0,369	0,119	0,817																							
Coupling factor of the interlayer(s) at deformation		σ _{ow}	-	0,750	0,647	0,299	0,812																							
Equivalent glass thickness ULS		teq,ult	mm	20,93	19,86	16,68	22,55																							
Equivalent glass thickness SLS		teq,serv	mm	21,43	20,60	17,15	21,89																							
ULS Glas	Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	1000	1000	1000																							
	Section moduls with equivalent thickness W=b ³ teq ² /6	W _{el}	mm ³	73029	65796	46359	84780																							
	Bending moment at fixation	Med	kNm	1,320	1,500	0,750	0,908																							
	Bending tensile stress at ULS	σ _{Ed,ULS*}	N/mm ²	18,075	26,23	18,60	12,31																							
Residual load capacity	Maximum utilization ULS = σ _{Ed} /f _{mt,ud}	utilization	-	0,24	0,34	0,27	0,15																							
	Minimum plate width based ULS-checks as maximum of Fk-loads	b _{min,ULS}	mm	-	340	269	-																							
	Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	-	6,48																							
	Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	1000	1000	1000																							
SLS	Bending moment at fixation	Med,res	kNm	0,880	1,000	0,500	0,600																							
	Section moduls with residual check	W _{el,res}	mm ³	56557	(Ma/Mab) ³ (f _{mtud,ab} /f _{mtud,a})=		For residual capacity check of Fk see Mepla calcs and related tables for bmin																							
	Bending tensile stress analytic based on bcalc	σ _{Ed,res**}	N/mm ²	17,115	1,80	zone a decisive																								
	Maximum utilization residual capacity based on bcalc	utilization	-	0,23																										
ULS Profile	Deformation glass panel at top	δ _{glass,top}	mm	6,19	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation																									
	Moment of inertia with equivalent thickness teq,serv	I _{eq,serv}	mm ⁴	819619	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation																									
	Linear profile stiffness	k _{prof}	(kN/m)/mm	34,5	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary																									
	Characteristic force at top support glass into profile	F _{p,k}	kN/m	13,37																										
	Maximum char. force at top support glass/profile at end of linear stiffness	F _{p,k,max}	kN/m	35,0																										
	Validation of linear iteration	valid	-	OK																										
	Defomation top of profile based on numerical simulation of profile	δ _{prof}	mm	0,39																										
	Defomation top of parapet due to profile deformation/rotation - extrapolation	δ _{prof,top}	mm	4,2																										
	Total deformation at top of parapet = δ _{glass} + δ _{profile}	δ _{tot,top}	mm	10,3																										
	Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δ _{max}	mm	20																										
SUMMARY	Maximum utilization SLS	utilization	-	0,52																										
	Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	1000	1000	1000																							
	Design acting force at top support glass into profile based on bmin for Fk	F _{p,Ed}	kN/m	20,06	22,93	11,46	14,67																							
	Maximum allowed design acting force based on numerical simulations of profiles	F _{p,Rd}	kN/m	68,8	-	-	-																							
SUMMARY	Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,29	0,33	0,17	0,21																							
	Minimum plate width based on profile resistance	b _{min,prof}	mm	-	333	167	-																							
	Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	-	4,69																							
	Parapet System	DF10104LM_E200																												
	Total height of the parapet	1201	mm																											
	Glass height	1100	mm																											
	Glass thickness nominal	10	mm																											
	Interlayer	SGP	-																											
	Thickness interlayer	1,52	mm																											
	Load category	other	-																											
SUMMARY	Load	qk [kN/m]	0,8	1	0,5																									
	Maximum utilization glass at ULS	ut.glass.ULS	-	0,24																										
	Maximum utilization profile at ULS	ut.profile.ULS	-	0,29	0,33	0,17																								
	Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,23																										
	Maximum deformation glass at SLS for linear load qk	def.glass.SLS	-	6,2																										
	Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	10,3																										
	Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,52																										
	Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²	-	-	-	4,69																							
	Minimum plate width ULS glass	b _{min.glass.ULS}	mm	-	340	269																								
	Minimum plate width ULS profile	b _{min.profile.ULS}	mm	-	333	167																								
Minimum plate width residual check	b _{min.glass.residual}	mm	230																											
Minimum plate width overall	b _{min}	mm	340																											

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF10104LM_E200			
Total height of the parapet	Ltot	mm	1301			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1200			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	10			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	3,8			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	9,7			
Type of interlayer	Interlayer	-	SGP			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	3			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	other			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
		Type of load	qk [kN/m]	Fk [kN]		wk [kN/m ²]
		Zone of load	a	a	a+b	a+b
		Value of load	0,8	1	0,5	1
		Time of loading	s	300	604800	5
		Load area A	mm ²	40000	40000	1200000
Modification factor for the load time		kmod	0,774	0,774	0,481	1,000
Surface effect factor		ka	1,0	1,076	1,076	0,939
Design resistance of FTG		f _{mt,ud}	N/mm ²	75,61	77,08	79,73
Shear modulus interlayer		Gint	N/mm ²	4,65	4,65	10,08
Young modulus interlayer		Eint	N/mm ²	13,87	13,87	29,80
Coupling factor of the interlayer(s) at stress		ωσ	-	0,535	0,397	0,133
Coupling factor of the interlayer(s) at deformation		ωw	-	0,781	0,685	0,335
Equivalent glass thickness ULS		teq.ult	mm	21,13	20,11	16,91
Equivalent glass thickness SLS		teq.serv	mm	21,66	20,91	17,59
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1100	1100
Section modulus with equivalent thickness W=b ² teq ² /6		Wel	mm ³	74424	74169	52451
Bending moment at fixation		Med	kNm	1,440	1,650	0,825
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	19,349	25,58	18,09
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,26	0,33	0,26
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	365	288
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	5,49
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med.res	kNm	0,960	1,100	0,550
Section modulus with residual check		Wel.res	mm ³	57135	(Wa/Mab)*(f _{mtud,ab} /f _{mtud,a})=	
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm ²	18,482	1,80	zone a decisive
Maximum utilization residual capacity based on bcalc		utilization	-	0,24	For residual capacity check of Fk see Mepla calcs and related tables for bmin	
Deformation glass panel at top		δglass.top	mm	7,78	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq.serv		Ieq.serv	mm ⁴	846619	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		kprof	(kN/m)/mm	34,5		
Characteristic force at top support glass into profile		Fp.k	kN/m	14,51		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k,max	kN/m	35,0		
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Defomation top of profile based on numerical simulation of profile		δprof	mm	0,42		
Defomation top of parapet due to profile deformation/rotation - extrapolation		δprof.top	mm	4,9		
Total deformation at top of parapet = δglass + δprofile		δtot.top	mm	12,7		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δmax	mm	20		
Maximum utilization SLS		utilization	-	0,63		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	1100	1100
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	21,77	22,79	11,40
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	68,8	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,32	0,33	0,17
Minimum plate width based on profile resistance		bmin.prof	mm	-	364	182
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	3,98
Parapet System		DF10104LM_E200				
Total height of the parapet	1301	mm				
Glass height	1200	mm				
Glass thickness nominal	10	mm				
Interlayer	SGP	-				
Thickness interlayer	1,52	mm				
Load category	other	-				
Load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	0,26	1	0,5	
Maximum utilization profile at ULS		ut.profile.ULS	0,32	0,33	0,17	
Maximum utilization residual capacity glass for linear load qk		ut.residual	0,24			
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	7,8			
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	12,7			
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	0,63			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	3,98		
Minimum plate width ULS glass		bmin.glass.ULS	mm	365	288	
Minimum plate width ULS profile		bmin.profile.ULS	mm	364	182	
Minimum plate width residual check		bmin.glass.residual	mm	250		
Minimum plate width overall		bmin	mm	365		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

4.2.16 DF1212FR_E200 with 10+10+4 glass

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF10104FR_E200			
Total height of the parapet	Ltot	mm	1001			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	900			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	10			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	3,8			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	9,7			
Type of interlayer	Interlayer	-	SGP			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	3			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	C5			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fk.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
Type of load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Zone of load			a	a-b	a-b	a-b
Value of load			3	1	0,5	1
Time of loading	s		300	300	604800	5
Load area A	mm ²		-	40000	40000	900000
Modification factor for the load time	kmoad	-	0,774	0,774	0,481	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,950
Design resistance of FTG	f _{mt,ud}	N/mm ²	75,61	77,08	69,19	80,00
Shear modulus interlayer	Gint	N/mm ²	4,65	4,65	1,08	10,00
Young modulus interlayer	Eint	N/mm ²	13,87	13,87	3,22	29,80
Coupling factor of the interlayer(s) at stress	α _{st}	-	0,436	0,306	0,093	0,756
Coupling factor of the interlayer(s) at deformation	α _{dw}	-	0,670	0,553	0,223	0,743
Equivalent glass thickness ULS	teq.ult	mm	20,43	19,26	16,18	22,30
Equivalent glass thickness SLS	teq.serv	mm	20,79	19,79	16,20	21,37
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	800	800	1000
Section moduls with equivalent thickness W=b ² teq ² /6	W _{el}	mm ³	69546	49436	34889	82895
Bending moment at fixation	M _{ed}	kNm	4,050	1,200	0,600	0,608
Bending tensile stress at ULS	σ _{Ed,ULS*}	N/mm ²	58,235	27,92	19,78	8,43
Maximum utilization ULS = σ _{Ed} /f _{mt,ud}	utilization	-	0,77	0,36	0,29	0,11
Minimum plate width based ULS-checks as maximum of Fk-loads	b _{min,ULS}	mm	-	290	229	-
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	-	9,49
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a+b) decisive		-
Bending moment at fixation	M _{ed,res}	kNm	2,700	0,800	0,400	-
Section moduls with residual check	W _{el,res}	mm ³	55057	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=		For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc	σ _{Ed,res**}	N/mm ²	53,944	1,80	1,80	-
Maximum utilization residual capacity based on bcalc	utilization	-	0,71	zone a decisive		-
Deformation glass panel at top	δ _{gl,ass,top}	mm	13,91	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Moment of inertia with equivalent thickness teq.serv	I _{eq.serv}	mm ⁴	748481	** x 1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation		
Linear profile stiffness	k _{prof}	(kN/m)/mm	19,0	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary		
Characteristic force at top support glass into profile	F _{p,k}	kN/m	41,57			
Maximum char. force at top support glass/profile at end of linear stiffness	F _{p,k,max}	kN/m	45,0			
Validation of linear iteration	valid	-	OK			
Deformation top of profile based on numerical simulation of profile	δ _{prof}	mm	2,19			
Deformation top of parapet due to profile deformation/rotation - extrapolation	δ _{tot,prof}	mm	19,6			
Total deformation at top of parapet = δ _{gl,ass} + δ _{prof}	δ _{tot,top}	mm	33,5			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB: A.1.4.3 (7)	δ _{max}	mm	20			
Maximum utilization SLS	utilization	-	1,67			
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	800	800	1000
Design acting force at top support glass into profile based on bmin for Fk	F _{p,Ed}	kN/m	62,36	23,30	11,65	10,08
Maximum allowed design acting force based on numerical simulations of profiles	F _{p,Rd}	kN/m	78,5			
Maximum utilization aluminum profile for single loads qk and Fk	utilization	-	0,79	0,30	0,15	0,13
Minimum plate width based on profile resistance	b _{min,prof}	mm	-	238	119	-
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	-	7,78
Parapet System						
Total height of the parapet	1001	mm				
Glass height	900	mm				
Glass thickness nominal	10	mm				
Interlayer	SGP	-				
Thickness Interlayer	1,52	mm				
Load category	C5	-				
Load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Maximum utilization glass at ULS	ut.glass.ULS	-	0,77			
Maximum utilization profile at ULS	ut.profile.ULS	-	0,79	0,30	0,15	
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,71			
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	mm	13,9			
Maximum deformation glass + profile at SLS for linear load qk	def.glass-prof.SLS	mm	33,5			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass-prof.SLS	-	1,67			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²	-	-	-	7,78
Minimum plate width ULS glass	b _{min.glass.ULS}	mm	-	290	229	-
Minimum plate width ULS profile	b _{min.profile.ULS}	mm	-	238	119	-
Minimum plate width residual check	b _{min.glass.residual}	mm	200			
Minimum plate width overall	bmin	mm	290			

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

Note: The deformation will be considered with load category “other” - see next sheet

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF10104FR_E200			
Total height of the parapet		Ltot	mm	1001		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	900		
Vertical distance between top of profile and top support of glass into profile		L2	mm	11		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	31		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	10		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	3,8		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	9,7		
Type of interlayer		Interlayer	-	SGP		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	3		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	other		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,6		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,8	1	0,5
		Time of loading	s	300	300	604800
		Load area A	mm ²	-	40000	40000
		Modification factor for the load time	kmod	0,774	0,774	0,481
		Surface effect factor	ka	1,0	1,076	1,076
		Design resistance of FTG	f _{mt,ud}	N/mm ²	75,61	77,08
		Shear modulus interlayer	Gint	N/mm ²	4,65	4,65
		Young modulus interlayer	Eint	N/mm ²	13,87	13,87
		Coupling factor of the interlayer(s) at stress	α _σ	0,436	0,306	0,093
		Coupling factor of the interlayer(s) at deformatio	α _w	0,670	0,553	0,223
		Equivalent glass thickness ULS	teq,ult	mm	20,43	19,26
		Equivalent glass thickness SLS	teq,serv	mm	20,79	19,79
		Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	800
		Section moduls with equivalent thickness W=b ³ teq ² /6	Wel	mm ³	69546	49436
		Bending moment at fixation	Med	kNm	1,080	1,200
		Bending tensile stress at ULS	σEd,ULS*	N/mm ²	15,529	27,92
		Maximum utilization ULS = σEd/fmt.ud	utilization	-	0,21	0,36
		Minimum plate width based ULS-checks as maximum of Fk-loads	bmin,ULS	mm	-	290
		Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-
		Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	800
		Bending moment at fixation	Med,res	kNm	0,720	0,800
		Section moduls with residual check	Wel,res	mm ³	55057	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=
		Bending tensile stress analytic based on bcalc	σEd,res**	N/mm ²	14,385	1,80
		Maximum utilization residual capacity based on bcalc	utilization	-	0,19	zone a decisive
		Deformation glass panel at top	σglass,top	mm	3,71	* x 1,15 for wind and Fk to account for difference between constant
		Moment of inertia with equivalent thickness teq,serv	Ieq,serv	mm ⁴	748481	tension and real tension distribution acc. to comparative Mepla-calculation
		Linear profile stiffness	kprof	(kN/m)/mm	19,0	** x 1,1 to account for difference between constant tension and real tension
		Characteristic force at top support glass into profile	Fp.k	kN/m	11,09	distribution acc. to comparative Mepla-calculation
		Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k,max	kN/m	45,0	
		Validation of linear iteration	valid	-	OK	Note: if linear automatic iteration is not valid, manual
		Deformation top of profile based on numerical simulation of profile	σprof	mm	0,58	iteration in the load deformation curves of the single profiles is necessary
		Deformation top of parapet due to profile deformation/rotation - extrapolation	σrot,top	mm	5,2	
		Total deformation at top of parapet = σglass + σprofile	σtot,top	mm	8,9	
		Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	σmax	mm	20	
		Maximum utilization SLS	utilization	-	0,45	
		Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000	800
		Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	16,63	23,30
		Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	78,5	-
		Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,21	0,30
		Minimum plate width based on profile resistance	bmin,prof	mm	-	238
		Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-
		Parapet System	DF10104FR_E200			
		Total height of the parapet	1001	mm		
		Glass height	900	mm		
		Glass thickness nominal	10	mm		
		Interlayer	SGP	-		
		Thickness interlayer	1,52	mm		
		Load category	other	-		
		Load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Maximum utilization glass at ULS	ut.glass,ULS	-	0,21	0,30
		Maximum utilization profile at ULS	ut.profile,ULS	-	0,21	0,15
		Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,19	
		Maximum deformation glass at SLS for linear load qk	def.glass,SLS	-	3,7	
		Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof,SLS	mm	8,9	
		Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof,SLS	-	0,45	
		Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²	-	7,78
		Minimum plate width ULS glass	bmin.glass,ULS	mm	290	229
		Minimum plate width ULS profile	bmin.profile,ULS	mm	238	119
		Minimum plate width residual check	bmin.glass.residual	mm	200	
		Minimum plate width overall	bmin	mm	290	
		NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation				

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF10104FR_E200			
Parapet System		Ltot	mm	1101		
Total height of the parapet		L1	mm	1000		
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	11		
Vertical distance between top of profile and top support of glass into profile		L3	mm	70		
Vertical distance between top and bottom support of glass into profile		L4	mm	31		
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200		
Distance between fixations		tnom	mm	10		
Nominal glass thickness		tp1	mm	3,8		
Glass thickness for calculation tp1 for inner plate at loading side		tp2	mm	9,7		
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	SGP		
Type of interlayer		tv.i	mm	1,52		
Thickness of interlayer		ng	-	3		
Number of sheets of glass of laminated plate		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50		
Maximum temperature of glass panel at loading for SGP		Cat	-	C5		
Load category		CC	-	CC2		
Consequence class		KF1	-	1		
Multiplication factor for consequence class		γQ0	-	1,5		
Load safety factor variable loads as basis value		γQ	-	1,5		
Load safety factor variable loads considering CC		ψ0 LL	-	0,6		
Load combination factor for variable life load		ψ0 Wind	-	0		
Load combination factor for variable wind load				Life load		
Predominant load		γm.A	-	1,8		
Material safety factor float glass for predominant		γm.V	-	1,2		
Material safety factor FTG		ke	-	1		
Factor for the edge quality of the glass panel		c	-	16		
Corrosion constant as a function		ksp	-	1		
Factor for the surface structure of float glass		kz	-	0,9		
Factor for the zone for FTG and edge zone		fg.k	N/mm²	45		
Characteristic resistance of float glass		fb.k	N/mm²	120		
Characteristic resistance of FTG						
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m²]
		Zone of load		a	a+b	a+b
		Value of load		3	1	0,5
		Time of loading	s	300	300	604800
		Load area A	mm²	-	4000	4000
						1000000
Modification factor for the load time		kmod	-	0,774	0,774	0,481
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt,ud}	N/mm²	75,61	77,08	69,19
Shear modulus interlayer		Gint	N/mm²	4,65	4,65	1,08
Young modulus interlayer		Eint	N/mm²	13,87	13,87	3,22
Coupling factor of the interlayer(s) at stress		ωσ	-	0,472	0,338	0,106
Coupling factor of the interlayer(s) at deformation		ωω	-	0,713	0,604	0,261
Equivalent glass thickness ULS		teq,ult	mm	20,70	19,58	16,43
Equivalent glass thickness SLS		teq,serv	mm	21,14	20,23	16,69
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	900	900
Section moduls with equivalent thickness W=b*teq²/6		Wel	mm³	71418	57499	40500
Bending moment at fixation		Med	kNm	4,500	1,350	0,675
Bending tensile stress at ULS		σEd.ULS*	N/mm²	63,009	27,00	19,17
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,83	0,35	0,28
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	315	249
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m²	-	-	7,78
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	
Bending moment at fixation		Med,res	kNm	3,000	0,900	0,450
Section moduls with residual check		Wel,res	mm³	55874	(Ma/Mab)*(f _{mt,ud} .ab/f _{mtud} .a)=	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc		σEd,res**	N/mm²	59,062	1,80	
Maximum utilization residual capacity based on bcalc		utilization	-	0,78	zone a decisive	
Deformation glass panel at top		δ _{glass,top}	mm	18,15	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Moment of inertia with equivalent thickness teq,serv		I _{eq,serv}	mm⁴	787302	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
Linear profile stiffness		k _{prof}	(kN/m)/mm	19,0		
Characteristic force at top support glass into profile		Fp.k	kN/m	45,86		
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k,max	kN/m	45,0		
Validation of linear iteration		valid	-	NG	Note: If linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
Defomation top of profile based on numerical simulation of profile		δ _{prof}	mm	2,41		
Defomation top of parapet due to profile deformation/rotation - extrapolation		δ _{prof,top}	mm	23,7		
Total deformation at top of parapet = δ _{glass} + δ _{profile}		δ _{tot,top}	mm	not valid		
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δ _{max}	mm	20		
Maximum utilization SLS		utilization	-	not valid		
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	900	900
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	68,79	23,10	11,55
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	78,5	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,88	0,29	0,15
Minimum plate width based on profile resistance		bmin.prof	mm	-	265	132
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m²	-	-	6,40
Parapet System		DF10104FR_E200				
Total height of the parapet		1101	mm			
Glass height		1000	mm			
Glass thickness nominal		10	mm			
Interlayer		SGP	-			
Thickness interlayer		1,52	mm			
Load category		C5	-			
Load			qk [kN/m]	Fk [kN]		wk [kN/m²]
			3	1	0,5	
Maximum utilization glass at ULS		ut.glass.ULS	-	0,83		
Maximum utilization profile at ULS		ut.profile.ULS	-	0,88	0,29	0,15
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,78		
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	18,1		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	not valid		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	not valid		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m²			6,40
Minimum plate width ULS glass		bmin.glass.ULS	mm		315	249
Minimum plate width ULS profile		bmin.profile.ULS	mm		265	132
Minimum plate width residual check		bmin.glass.residual	mm	210		
Minimum plate width overall		bmin	mm	315		

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF10104FR_E200																																																																																	
Parapet System		Ltot	mm	1101																																																																																
Total height of the parapet		L1	mm	1000																																																																																
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	11																																																																																
Vertical distance between top of profile and top support of glass into profile		L3	mm	70																																																																																
Vertical distance between top and bottom support of glass into profile		L4	mm	31																																																																																
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200																																																																																
Distance between fixations		tnom	mm	10																																																																																
Nominal glass thickness		tpl1	mm	3,8																																																																																
Glass thickness for calculation tp1 for inner plate at loading side		tpl2	mm	9,7																																																																																
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	SGP																																																																																
Type of interlayer		tv.i	mm	1,52																																																																																
Thickness of interlayer		ng	-	3																																																																																
Number of sheets of glass of laminated plate		Tg.pvb	°C	30																																																																																
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50																																																																																
Maximum temperature of glass panel at loading for SGP		Cat	-	other																																																																																
Load category		CC	-	CC2																																																																																
Consequence class		KF1	-	1																																																																																
Multiplication factor for consequence class		γQ0	-	1,5																																																																																
Load safety factor variable loads as basis value		γQ	-	1,5																																																																																
Load safety factor variable loads considering CC		w0 LL	-	0,6																																																																																
Load combination factor for variable life load		w0 Wind	-	0																																																																																
Load combination factor for variable wind load				Life load																																																																																
Predominant load		γm.A	-	1,8																																																																																
Material safety factor float glass for predominant load		γm.V	-	1,2																																																																																
Material safety factor FTG		ke	-	1																																																																																
Factor for the edge quality of the glass panel		c	-	16																																																																																
Corrosion constant as a function		ksp	-	1																																																																																
Factor for the surface structure of float glass		kz	-	0,9																																																																																
Factor for the zone for FTG and edge zone		fg.k	N/mm ²	45																																																																																
Characteristic resistance of float glass		fb.k	N/mm ²	120																																																																																
Characteristic resistance of FTG		<table border="1"> <thead> <tr> <th>Type of load</th> <th>qk [kN/m]</th> <th>a</th> <th>Fk [kN]</th> <th>a+b</th> <th>wk [kN/m²]</th> </tr> </thead> <tbody> <tr> <td>Zone of load</td> <td>0,8</td> <td>1</td> <td>0,5</td> <td>1</td> <td>1,000</td> </tr> <tr> <td>Value of load</td> <td>300</td> <td>300</td> <td>604800</td> <td>5</td> <td>0,946</td> </tr> <tr> <td>Time of loading</td> <td>-</td> <td>40000</td> <td>40000</td> <td>-</td> <td>1000000</td> </tr> <tr> <td>Load area A</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table>					Type of load	qk [kN/m]	a	Fk [kN]	a+b	wk [kN/m ²]	Zone of load	0,8	1	0,5	1	1,000	Value of load	300	300	604800	5	0,946	Time of loading	-	40000	40000	-	1000000	Load area A	-	-	-	-	-																																																
Type of load	qk [kN/m]	a	Fk [kN]	a+b	wk [kN/m ²]																																																																															
Zone of load	0,8	1	0,5	1	1,000																																																																															
Value of load	300	300	604800	5	0,946																																																																															
Time of loading	-	40000	40000	-	1000000																																																																															
Load area A	-	-	-	-	-																																																																															
Modification factor for the load time		kmod	-	0,774																																																																																
Surface effect factor		ka	-	1,076																																																																																
Design resistance of FTG		fmt.ud	N/mm ²	75,61																																																																																
Shear modulus interlayer		Gint	N/mm ²	4,65																																																																																
Young modulus interlayer		Eint	N/mm ²	13,87																																																																																
Coupling factor of the interlayer(s) at stress		ωσ	-	0,472																																																																																
Coupling factor of the interlayer(s) at deformation		ωω	-	0,713																																																																																
Equivalent glass thickness ULS		teq.ult	mm	20,70																																																																																
Equivalent glass thickness SLS		teq.serv	mm	21,14																																																																																
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000																																																																																
Section moduls with equivalent thickness W=b*teq ² /6		Wel	mm ³	71418																																																																																
Bending moment at fixation		Med	kNm	1,200																																																																																
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	16,802																																																																																
Maximum utilization ULS = σEd/fmt.ud		utilization	-	0,22																																																																																
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	315																																																																																
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	7,78																																																																																
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000																																																																																
Bending moment at fixation		Med.res	kNm	0,800																																																																																
Section moduls with residual check		Wel.res	mm ³	55874																																																																																
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm ²	15,750																																																																																
Maximum utilization residual capacity based on bcalc		utilization	-	0,21																																																																																
Deformation glass panel at top		δglass.top	mm	4,84																																																																																
Moment of inertia with equivalent thickness teq.serv		Ieq.serv	mm ⁴	787302																																																																																
Linear profile stiffness		kprof	(kN/m)/mm	19,0																																																																																
Characteristic force at top support glass into profile		Fp.k	kN/m	12,23																																																																																
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k.max	kN/m	45,0																																																																																
Validation of linear iteration		valid	-	OK																																																																																
Deformation top of profile based on numerical simulation of profile		δprof	mm	0,64																																																																																
Deformation top of parapet due to profile deformation/rotation - extrapolation		δprof.top	mm	6,3																																																																																
Total deformation at top of parapet = δglass + δprofile		δtot.top	mm	11,2																																																																																
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δmax	mm	20																																																																																
Maximum utilization SLS		utilization	-	0,56																																																																																
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000																																																																																
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	18,34																																																																																
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	78,5																																																																																
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,23																																																																																
Minimum plate width based on profile resistance		bmin.prof	mm	265																																																																																
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	6,40																																																																																
Parapet System		DF10104FR_E200																																																																																		
Total height of the parapet		1101	mm																																																																																	
Glass height		1000	mm																																																																																	
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Interlayer		SGP	-																																																																																	
Thickness interlayer		1,52	mm																																																																																	
Load category		other	-																																																																																	
Load		<table border="1"> <thead> <tr> <th></th> <th>qk [kN/m]</th> <th>a</th> <th>Fk [kN]</th> <th>a+b</th> <th>wk [kN/m²]</th> </tr> </thead> <tbody> <tr> <td>Load</td> <td>0,8</td> <td>1</td> <td>0,5</td> <td></td> <td></td> </tr> <tr> <td>Maximum utilization glass at ULS</td> <td>ut.glass.ULS</td> <td>-</td> <td>0,22</td> <td></td> <td></td> </tr> <tr> <td>Maximum utilization profile at ULS</td> <td>ut.profile.ULS</td> <td>-</td> <td>0,23</td> <td>0,29</td> <td>0,15</td> </tr> <tr> <td>Maximum utilization residual capacity glass for linear load qk</td> <td>ut.residual</td> <td>-</td> <td>0,21</td> <td></td> <td></td> </tr> <tr> <td>Maximum deformation glass at SLS for linear load qk</td> <td>def.glass.SLS</td> <td>-</td> <td>4,8</td> <td></td> <td></td> </tr> <tr> <td>Maximum deformation glass + profile at SLS for linear load qk</td> <td>def.glass+prof.SLS</td> <td>mm</td> <td>11,2</td> <td></td> <td></td> </tr> <tr> <td>Maximum utilization glass + profile at SLS for linear load qk</td> <td>ut.glass+prof.SLS</td> <td>-</td> <td>0,56</td> <td></td> <td></td> </tr> <tr> <td>Maximum characteristic wind load wk for only wind loads based on ULS glass + profile</td> <td>wk,max</td> <td>kN/m²</td> <td></td> <td></td> <td>6,40</td> </tr> <tr> <td>Minimum plate width ULS glass</td> <td>bmin.glass.ULS</td> <td>mm</td> <td></td> <td>315</td> <td>249</td> </tr> <tr> <td>Minimum plate width ULS profile</td> <td>bmin.profile.ULS</td> <td>mm</td> <td></td> <td>265</td> <td>132</td> </tr> <tr> <td>Minimum plate width residual check</td> <td>bmin.glass.residual</td> <td>mm</td> <td>210</td> <td></td> <td></td> </tr> <tr> <td>Minimum plate width overall</td> <td>bmin</td> <td>mm</td> <td>315</td> <td></td> <td></td> </tr> </tbody> </table>						qk [kN/m]	a	Fk [kN]	a+b	wk [kN/m ²]	Load	0,8	1	0,5			Maximum utilization glass at ULS	ut.glass.ULS	-	0,22			Maximum utilization profile at ULS	ut.profile.ULS	-	0,23	0,29	0,15	Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,21			Maximum deformation glass at SLS for linear load qk	def.glass.SLS	-	4,8			Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	11,2			Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,56			Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²			6,40	Minimum plate width ULS glass	bmin.glass.ULS	mm		315	249	Minimum plate width ULS profile	bmin.profile.ULS	mm		265	132	Minimum plate width residual check	bmin.glass.residual	mm	210			Minimum plate width overall	bmin	mm	315		
	qk [kN/m]	a	Fk [kN]	a+b	wk [kN/m ²]																																																																															
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NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation																																																																																				

SYSTEM RESISTANCE WITHOUT HANDRAIL

		Profile	DF10104FR_E200																												
Parapet System		Ltot	mm	1201																											
Total height of the parapet		L1	mm	1100																											
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	11																											
Vertical distance between top of profile and top support of glass into profile		L3	mm	70																											
Vertical distance between top and bottom support of glass into profile		L4	mm	31																											
Vertical distance between bottom support of glass into profile and base ground		efix	mm	200																											
Distance between fixations		tnom	mm	10																											
Nominal glass thickness		tpl1	mm	3,8																											
Glass thickness for calculation tp1 for inner plate at loading side		tpl2	mm	9,7																											
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	SGP																											
Type of interlayer		tv,i	mm	1,52																											
Thickness of interlayer		ng	-	3																											
Number of sheets of glass of laminated plate		Tg.pvb	°C	30																											
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50																											
Maximum temperature of glass panel at loading for SGP		Cat	-	C5																											
Load category		CC	-	CC2																											
Consequence class		KF1	-	1																											
Multiplication factor for consequence class		γQ0	-	1,5																											
Load safety factor variable loads as basis value		γQ	-	1,5																											
Load safety factor variable loads considering CC		ψ0 LL	-	0,6																											
Load combination factor for variable life load		ψ0 Wind	-	0																											
Load combination factor for variable wind load				Life load																											
Predominant load		γm.A	-	1,8																											
Material safety factor float glass for predominant load		γm.V	-	1,2																											
Material safety factor FTG		ke	-	1																											
Factor for the edge quality of the glass panel		c	-	16																											
Corrosion constant as a function		ksp	-	1																											
Factor for the surface structure of float glass		kz	-	0,9																											
Factor for the zone for FTG and edge zone		fg.k	N/mm ²	45																											
Characteristic resistance of float glass		fb.k	N/mm ²	120																											
Characteristic resistance of FTG		<table border="1"> <thead> <tr> <th>Type of load</th> <th>qk [kN/m]</th> <th colspan="2">Fk [kN]</th> <th>wk [kN/m²]</th> </tr> <tr> <th>Zone of load</th> <th>a</th> <th>a</th> <th>a+b</th> <th>a+b</th> </tr> </thead> <tbody> <tr> <td>Value of load</td> <td>3</td> <td>1</td> <td>0,5</td> <td>1</td> </tr> <tr> <td>Time of loading</td> <td>300</td> <td>300</td> <td>604800</td> <td>5</td> </tr> <tr> <td>Load area A</td> <td>mm²</td> <td>40000</td> <td>40000</td> <td>1100000</td> </tr> </tbody> </table>					Type of load	qk [kN/m]	Fk [kN]		wk [kN/m ²]	Zone of load	a	a	a+b	a+b	Value of load	3	1	0,5	1	Time of loading	300	300	604800	5	Load area A	mm ²	40000	40000	1100000
Type of load	qk [kN/m]	Fk [kN]		wk [kN/m ²]																											
Zone of load	a	a	a+b	a+b																											
Value of load	3	1	0,5	1																											
Time of loading	300	300	604800	5																											
Load area A	mm ²	40000	40000	1100000																											
Modification factor for the load time		kmtd	-	0,774	0,774	0,481	1,000																								
Surface effect factor		ka	-	1,0	1,076	1,076	0,942																								
Design resistance of FTG		f _{mt,ud}	N/mm ²	75,61	77,08	69,19	79,81																								
Shear modulus interlayer		Gint	N/mm ²	4,65	4,65	1,08	10,00																								
Young modulus interlayer		Eint	N/mm ²	13,87	13,87	3,22	29,80																								
Coupling factor of the interlayer(s) at stress		ωσ	-	0,505	0,369	0,119	0,817																								
Coupling factor of the interlayer(s) at deformation		ωw	-	0,750	0,647	0,299	0,812																								
Equivalent glass thickness ULS		teq,ult	mm	20,93	19,86	16,68	22,55																								
Equivalent glass thickness SLS		teq,serv	mm	21,43	20,60	17,15	21,89																								
ULS Glass	Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000	1000	1000	1000																								
	Section moduls with equivalent thickness W=b*teq ² /6	Wel	mm ³	73029	65756	46359	84780																								
	Bending moment at fixation	Med	kNm	4,950	1,500	0,750	0,908																								
	Bending tensile stress at ULS	σEd.ULS*	N/mm ²	67,781	26,23	18,60	12,31																								
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,90	0,34	0,27	0,15																								
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	340	269	-																								
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	-	6,48																								
Residual load capacity	Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	Check if zone (a) or (a+b) decisive		-																								
	Bending moment at fixation	Med.res	kNm	3,300	1,000	0,500	-																								
	Section moduls with residual check	Wel.res	mm ³	56557	(Ma/Mab)*(f _{mt,ud.ab} /f _{mt,ud.a})=		For residual capacity check of Fk see Mepla calcs and related tables for bmin																								
	Bending tensile stress analytic based on bcalc	σEd.res**	N/mm ²	64,183	1,80	zone a decisive																									
Maximum utilization residual capacity based on bcalc		utilization	-	0,85																											
SLS	Deformation glass panel at top	δglass.top	mm	23,20	* x 1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation																										
	Moment of inertia with equivalent thickness teq,serv	Ieq,serv	mm ⁴	819619	** x1,1 to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation																										
	Linear profile stiffness	kprof	(kN/m)/mm	19,0																											
	Characteristic force at top support glass into profile	Fp.k	kN/m	50,14																											
	Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k.max	kN/m	45,0																											
	Validation of linear iteration	valid	-	NG	Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary																										
	Defomation top of profile based on numerical simulation of profile	δprof	mm	2,64																											
	Defomation top of parapet due to profile deformation/rotation - extrapolation	δprof.top	mm	28,3																											
	Total deformation at top of parapet = δglass + δprofile	δtot.top	mm	not valid																											
	Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δmax	mm	20																											
Maximum utilization SLS		utilization	-	not valid																											
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	1000	1000	1000																								
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	75,21	22,93	11,46	14,67																								
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	78,5	-	-	-																								
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,96	0,29	0,15	0,19																								
Minimum plate width based on profile resistance		bmin.prof	mm	-	292	146	-																								
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	-	5,35																								
Parapet System		DF10104FR_E200																													
Total height of the parapet		1201	mm																												
Glass height		1100	mm																												
Glass thickness nominal		10	mm																												
Interlayer		SGP	-																												
Thickness interlayer		1,52	mm																												
Load category		C5	-																												
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]																									
Maximum utilization glass at ULS		ut.glass.ULS	-	0,90	1	0,5																									
Maximum utilization profile at ULS		ut.profile.ULS	-	0,96	0,29	0,15																									
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,85																											
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	23,2																											
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	not valid																											
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	not valid																											
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²			5,35																									
Minimum plate width ULS glass		bmin.glass.ULS	mm			340	269																								
Minimum plate width ULS profile		bmin.profile.ULS	mm			292	146																								
Minimum plate width residual check		bmin.glass.residual	mm			230																									
Minimum plate width overall		bmin	mm			340																									

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile	DF10104FR_E200				
Total height of the parapet		Ltot	mm	1201			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1100			
Vertical distance between top of profile and top support of glass into profile		L2	mm	11			
Vertical distance between top and bottom support of glass into profile		L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground		L4	mm	31			
Distance between fixations		efix	mm	200			
Nominal glass thickness		tnom	mm	10			
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	3,8			
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	9,7			
Type of interlayer		Interlayer	-	SGP			
Thickness of interlayer		tv.i	mm	1,52			
Number of sheets of glass of laminated plate		ng	-	3			
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50			
Load category		Cat	-	other			
Consequence class		CC	-	CC2			
Multiplication factor for consequence class		KF1	-	1			
Load safety factor variable loads as basis value		γQ0	-	1,5			
Load safety factor variable loads considering CC		γQ	-	1,5			
Load combination factor for variable life load		ψ0 LL	-	0,6			
Load combination factor for variable wind load		ψ0 Wind	-	0			
Predominant load				Life load			
Material safety factor float glass for predominant load		γm.A	-	1,8			
Material safety factor FTG		γm.V	-	1,2			
Factor for the edge quality of the glass panel		ke	-	1			
Corrosion constant as a function		c	-	16			
Factor for the surface structure of float glass		ksp	-	1			
Factor for the zone for FTG and edge zone		kz	-	0,9			
Characteristic resistance of float glass		fg.k	N/mm ²	45			
Characteristic resistance of FTG		fb.k	N/mm ²	120			
		Type of load		qk [kN/m]	Fk [kN]		wk [kN/m ²]
		Zone of load		a	a	a+b	a+b
		Value of load		0,8	1	0,5	1
		Time of loading	s	300	300	604800	5
		Load area A	mm ²	-	40000	40000	1100000
Modification factor for the load time		kmod	-	0,774	0,774	0,481	1,000
Surface effect factor		ka	-	1,0	1,076	1,076	0,942
Design resistance of FTG		f _{mt,ud}	N/mm ²	75,61	77,08	69,19	79,81
Shear modulus interlayer		Gint	N/mm ²	4,65	4,65	1,08	10,00
Young modulus interlayer		Eint	N/mm ²	13,87	13,87	3,22	29,80
Coupling factor of the interlayer(s) at stress		ωσ	-	0,505	0,369	0,119	0,817
Coupling factor of the interlayer(s) at deformatio		ωw	-	0,750	0,647	0,299	0,812
Equivalent glass thickness ULS		teq.ult	mm	20,93	19,86	16,68	22,55
Equivalent glass thickness SLS		teq.serv	mm	21,43	20,60	17,15	21,89
Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk		bcalc	mm	1000	1000	1000	1000
Section moduls with equivalent thickness W=b ³ teq ² /6		Wel	mm ³	73029	65756	46359	84780
Bending moment at fixation		Med	kNm	1,320	1,500	0,750	0,908
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	18,075	26,23	18,60	12,31
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,24	0,34	0,27	0,15
Minimum plate width based ULS-checks as maximum of Fk-loads		bmin.ULS	mm	-	340	269	-
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	-	6,48
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	Check if zone (a) or (a+b) decisive	0,500	1000
Bending moment at fixation		Med.res	kNm	0,880	1,000	0,880	0,880
Section moduls with residual check		Wel.res	mm ³	56557	(Ma/Mab)*(f _{mt,ud,ab} /f _{mt,ud,a})=	-	For residual capacity check of Fk see Mepla calcs and related tables for bmin
Bending tensile stress analytic based on bcalc		σEd.res**	N/mm ²	17,115	1,80	zone a decisive	-
Maximum utilization residual capacity based on bcalc		utilization	-	0,23	-	-	-
Deformation glass panel at top		δglass.top	mm	6,19	* x 1,15 for wind and Fk to account for difference between constant	-	-
Moment of inertia with equivalent thickness teq.serv		Ieq.serv	mm ⁴	819619	tension and real tension distribution acc. to comparative Mepla-calculation	-	-
Linear profile stiffness		kprof	(kN/m)/mm	19,0	** x 1,1 to account for difference between constant tension and real tension	-	-
Characteristic force at top support glass into profile		Fp.k	kN/m	13,37	distribution acc. to comparative Mepla-calculation	-	-
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k,max	kN/m	45,0	-	-	-
Validation of linear iteration		valid	-	OK	Note: if linear automatic iteration is not valid, manual	-	-
Defomation top of profile based on numerical simulation of profile		δprof	mm	0,70	iteration in the load deformation curves of the single profiles is necessary	-	-
Defomation top of parapet due to profile deformation/rotation - extrapolation		δprof.top	mm	7,5	-	-	-
Total deformation at top of parapet = δglass + δprofile		δtot.top	mm	13,7	-	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δmax	mm	20	-	-	-
Maximum utilization SLS		utilization	-	0,69	-	-	-
Calculation width with 1m for qk and wk and maximum 45° distribution for Fk		bcalc	mm	1000	1000	1000	1000
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	20,06	22,93	11,46	14,67
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	78,5	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,26	0,29	0,15	0,19
Minimum plate width based on profile resistance		bmin.prof	mm	-	292	146	-
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	-	5,35
Parapet System		DF10104FR_E200					
Total height of the parapet		1201	mm				
Glass height		1100	mm				
Glass thickness nominal		10	mm				
Interlayer		SGP	-				
Thickness interlayer		1,52	mm				
Load category		other	-				
Load				qk [kN/m]	Fk [kN]		wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,24	1	0,5	-
Maximum utilization profile at ULS		ut.profile.ULS	-	0,26	0,29	0,15	-
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,23	-	-	-
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	-	6,2	-	-	-
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	13,7	-	-	-
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,69	-	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	-	5,35
Minimum plate width ULS glass		bmin.glass.ULS	mm	-	340	269	-
Minimum plate width ULS profile		bmin.profile.ULS	mm	-	292	146	-
Minimum plate width residual check		bmin.glass.residual	mm	230	-	-	-
Minimum plate width overall		bmin	mm	340	-	-	-

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

SYSTEM RESISTANCE WITHOUT HANDRAIL

Parapet System		Profile		DF10104FR_E200			
Total height of the parapet	Ltot	mm	1301				
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1200				
Vertical distance between top of profile and top support of glass into profile	L2	mm	11				
Vertical distance between top and bottom support of glass into profile	L3	mm	70				
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31				
Distance between fixations	efix	mm	200				
Nominal glass thickness	tnom	mm	10				
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	3,8				
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	9,7				
Type of interlayer	Interlayer	-	SGP				
Thickness of interlayer	tv,i	mm	1,52				
Number of sheets of glass of laminated plate	ng	-	3				
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30				
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50				
Load category	Cat	-	other				
Consequence class	CC	-	CC2				
Multiplication factor for consequence class	KF1	-	1				
Load safety factor variable loads as basis value	γQ0	-	1,5				
Load safety factor variable loads considering CC	γQ	-	1,5				
Load combination factor for variable life load	ψ0 LL	-	0,6				
Load combination factor for variable wind load	ψ0 Wind	-	0				
Predominant load			Life load				
Material safety factor float glass for predominant	γm.A	-	1,8				
Material safety factor FTG	γm.V	-	1,2				
Factor for the edge quality of the glass panel	ke	-	1				
Corrosion constant as a function	c	-	16				
Factor for the surface structure of float glass	ksp	-	1				
Factor for the zone for FTG and edge zone	kz	-	0,9				
Characteristic resistance of float glass	fg,k	N/mm ²	45				
Characteristic resistance of FTG	fb,k	N/mm ²	120				
				Type of load	qk [kN/m]	Fk [kN]	wk [kN/m ²]
				Zone of load	a	a+b	a+b
				Value of load	0,8	1	0,5
				Time of loading	s	300	604800
				Load area A	mm ²	-	40000
				Modification factor for the load time	kmod	0,774	0,774
				Surface effect factor	ka	1,0	1,076
				Design resistance of FTG	f _{mt,ud}	N/mm ²	75,61
				Shear modulus interlayer	Gint	N/mm ²	4,65
				Young modulus interlayer	Eint	N/mm ²	13,87
				Coupling factor of the interlayer(s) at stress	ω _{st}	-	0,535
				Coupling factor of the interlayer(s) at deformatio	ω _w	-	0,781
				Equivalent glass thickness ULS	teq,ult	mm	21,13
				Equivalent glass thickness SLS	teq,serv	mm	21,66
				Calculation width glass panel, with 1m for qk and wk and with asymmetric 45° distribution for Fk	bcalc	mm	1000
				Section moduls with equivalent thickness W-b*teq ² /6	W _{el}	mm ³	74424
				Bending moment at fixation	Med	kNm	1,440
				Bending tensile stress at ULS	σ _{Ed,ULS}	N/mm ²	19,349
				Maximum utilization ULS = σ _{Ed} /f _{mt,ud}	utilization	-	0,26
				Minimum plate width based ULS-checks as maximum of Fk-loads	bmin,ULS	mm	-
				Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-
				Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000
				Bending moment at fixation	Med,res	kNm	0,960
				Section moduls with residual check	W _{el,res}	mm ³	57135
				Bending tensile stress analytic based on bcalc	σ _{Ed,res} **	N/mm ²	18,482
				Maximum utilization residual capacity based on bcalc	utilization	-	0,24
				Deformation glass panel at top	δ _{glass,top}	mm	7,78
				Moment of inertia with equivalent thickness teq,serv	I _{eq,serv}	mm ⁴	846619
				Linear profile stiffness	k _{prof}	(kN/m)/mm	19,0
				Characteristic force at top support glass into profile	F _{p,k}	kN/m	14,51
				Maximum char. force at top support glass/profile at end of linear stiffness	F _{p,k,max}	kN/m	45,0
				Validation of linear iteration	valid	-	OK
				Defomation top of profile based on numerical simulation of profile	δ _{prof}	mm	0,76
				Defomation top of parapet due to profile deformation/rotation - extrapolation	δ _{prof,top}	mm	8,9
				Total deformation at top of parapet = δ _{glass} + δ _{profile}	δ _{tot,top}	mm	16,6
				Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δ _{max}	mm	20
				Maximum utilization SLS	utilization	-	0,83
				Calculation width with 1m for qk and wk and maximum 45° distribution for Fk	bcalc	mm	1000
				Design acting force at top support glass into profile based on bmin for Fk	F _{p,Ed}	kN/m	21,77
				Maximum allowed design acting force based on numerical simulations of profiles	F _{p,Rd}	kN/m	78,5
				Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,28
				Minimum plate width based on profile resistance	bmin,prof	mm	-
				Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-
Parapet System		DF10104FR_E200					
Total height of the parapet	1301	mm					
Glass height	1200	mm					
Glass thickness nominal	10	mm					
Interlayer	SGP	-					
Thickness interlayer	1,52	mm					
Load category	other	-					
Load			qk [kN/m]	Fk [kN]	wk [kN/m ²]		
Maximum utilization glass at ULS	ut.glass.ULS	-	0,8	1	0,5		
Maximum utilization profile at ULS	ut.profile.ULS	-	0,28	0,29	0,15		
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,24				
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	-	7,8				
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	16,6				
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	0,83				
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²				4,54	
Minimum plate width ULS glass	bmin.glass.ULS	mm		365	288		
Minimum plate width ULS profile	bmin.profile.ULS	mm		320	160		
Minimum plate width residual check	bmin.glass.residual	mm	250				
Minimum plate width overall	bmin	mm	365				

NOTE: If one check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation

4.3 Results ULS and SLS - with handrail

Note: As can be seen in the summary tables in chapter 5, for the parapet systems with handrail and glass composition 8+8, the maximum allowable category is A2, the maximum glass height L1 is 1200 mm. Therefore, only this combination will be documented below for the 8+8 profiles. Smaller glass length or loads will - could only lead to better results.

Furthermore, for some glass compositions and glass height, the maximum deformation of 20 mm is slightly exceeded.

However, the verification at ultimate limit state and the residual capacity check, is fulfilled.

An eventual higher tolerated deformation can be validated for each project individually in accordance with the client and the responsible technicians.

For some deformations, especially where they exceed the limit, the excel sheets reported in this chapter based on analytical calculation show slightly higher values than the summary tables. This is due to more precise additionally Mepla calculations done for those situations to come with the deformation nearer to the allowed limit.

For the load category C5, the deformation based on the load category “other” is reported.

The resistance values are given for the main direction of loads in direction of fall LCA (see figures 1.4). For LCB refer to chapter 5.5.

All the results are given in the summary tables in chapter 5.

If additional results or information is required, please contact Logli company

4.3.1 DF88... profiles

SYSTEM RESISTANCE WITH HANDRAIL

Profile	DF88DK_E200					
Parapet System						
Total height of the parapet	Ltot	mm	1300			
Glass height top of parapet until first fixation into profile L1-Ltot-L3-L4	L1	mm	1200			
Vertical distance between top of profile and top support of glass into profile	L2	mm	12			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	29,55			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	7,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	7,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	A2			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,4			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
Type of load		qk [kN/m]	Fk [kN]		wk [kN/m ²]	
Zone of load		a	a	a+b	a+b	
Value of load		0,5	1	0,3	1	
Time of loading	s	60	60	86400	5	
Load area A	mm ²	-	40000	40000	1200000	
Modification factor for the load time	kmod	-	0,856	0,856	0,543	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,939
Design resistance of FTG	f _{mt,ud}	N/mm ²	77,65	79,28	70,87	79,73
Shear modulus interlayer	Gint	N/mm ²	0,75	0,75	0,28	0,96
Young modulus interlayer	Eint	N/mm ²	2,25	2,25	0,84	2,87
Coupling factor of the interlayer(s) at stress	ωσ	-	0,319	0,211	0,091	0,557
Coupling factor of the interlayer(s) at deformatio	ωw	-	0,591	0,469	0,247	0,553
Equivalent glass thickness ULS	teq,ult	mm	13,26	12,65	11,76	14,26
Equivalent glass thickness SLS	teq,serv	mm	13,63	13,00	11,67	13,44
Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk	bcalc	mm	1000	2200	2200	1000
Section moduls with equivalent thickness W=b ³ teq ² /6	WeL	mm ³	29320	58643	50702	33906
Bending moment at fixation	Med	kNm	0,900	1,650	0,495	1,080
Bending tensile stress at ULS	σEd.ULS*	N/mm ²	30,70	32,36	11,23	36,63
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	-	0,40	0,41	0,16	0,46
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	-	2,18
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	2200	2200	
Section moduls with residual check	WeL,res	mm ³	9882	21740	21740	
Bending moment at fixation	Med,res	kNm	0,600	1,100	0,330	
Bending tensile stress for qk analytic and for Fk based on Mepla	σEd,res	N/mm ²	66,790	58,19	17,46	
Maximum utilization residual capacity based on bcalc	utilization	-	0,86	0,73	0,25	
Deformation glass panel at top	δglass,top	mm	19,50			* x1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation
Moment of inertia with equivalent thickness teq,serv	Ieq,serv	mm ⁴	210997			
Linear profile stiffness	kprof	(kN/m)/mm	26,5			* x1,10 for qk and x 1,15 for Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation
Characteristic force at top support glass into profile	Fp,k	kN/m	9,07			
Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k,max	kN/m	70,0			
Validation of linear iteration	valid	-	OK			* Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary
Deformation top of profile based on numerical simulation of profile	δprof	mm	0,34			
Deformation top of parapet due to profile deformation/rotation - extrapolation	δprof,top	mm	4			
Total deformation at top of parapet = δglass + δprofile	δtot,top	mm	23			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δmax	mm	20			
Maximum utilization SLS	utilization	-	1,17			
Calculation width	bcalc	mm	1000	2200	2200	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp,Ed	kN/m	13,61	11,40	3,42	17,28
Maximum allowed design acting force based on numerical simulations of profiles	Fp,Rd	kN/m	88,5	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,15	0,13	0,04	0,20
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	-	5,12
Parapet System	DF88DK_E200					
Total height of the parapet	1300	mm				
Glass height	1200	mm				
Glass thickness nominal	8	mm				
Interlayer	PVB	-				
Thickness interlayer	1,52	mm				
Load category	A2	-				
Load		qk [kN/m]	Fk [kN]		wk [kN/m ²]	
Maximum utilization glass at ULS	ut.glass.ULS	-	0,40	0,41	0,16	0,46
Maximum utilization profile at ULS	ut.profile.ULS	-	0,15	0,13	0,04	0,20
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,86	0,73	0,25	
Maximum deformation glass at SLS for linear load qk	def.glass.SLS	-	19,5			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	23,5			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	1,17			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²				2,18

NOTE: If one resistance check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation. For deformation see comments in report and overview tables

SYSTEM RESISTANCE WITH HANDRAIL

		Profile	DF88DK_E400			
Parapet System						
Total height of the parapet	Ltot	mm	1300			
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1200			
Vertical distance between top of profile and top support of glass into profile	L2	mm	12			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	29,55			
Distance between fixations	efix	mm	400			
Nominal glass thickness	tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	7,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	7,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	A2			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQo	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,4			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg,k	N/mm²	45			
Characteristic resistance of FTG	fb,k	N/mm²	120			
Type of load			qk [kN/m]	Fk [kN]	a+b	wk [kN/m²]
Zone of load			a	a	a+b	a+b
Value of load			0,5	1	0,3	1
Time of loading			60	60	86400	5
Load area A				40000	40000	1200000
Modification factor for the load time	kmod	-	0,856	0,856	0,543	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,939
Design resistance of FTG	fmt.ud	N/mm²	77,65	79,28	70,87	79,73
Shear modulus interlayer	Gint	N/mm²	0,75	0,75	0,28	0,96
Young modulus interlayer	Eint	N/mm²	2,25	2,25	0,84	2,87
Coupling factor of the interlayer(s) at stress	ωσ	-	0,319	0,211	0,091	0,557
Coupling factor of the interlayer(s) at deformation	ωw	-	0,591	0,469	0,247	0,553
Equivalent glass thickness ULS	teq.ult	mm	13,26	12,65	11,76	14,26
Equivalent glass thickness SLS	teq.serv	mm	13,63	13,00	11,67	13,44
Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk	bcalc	mm	1000	2200	2200	1000
Section moduls with equivalent thickness W=b*teq²/6	Wel	mm³	29320	58643	50702	33906
Bending moment at fixation	Med	kNm	0,900	1,650	0,495	1,080
Bending tensile stress at ULS	σEd.ULS*	N/mm²	30,70	32,36	11,23	36,63
Maximum utilization ULS = σEd/fmt.ud	utilization	-	0,40	0,41	0,16	0,46
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m²	-	-	-	2,18
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	2200	2200	-
Section moduls with residual check	Wel.res	mm³	9882	21740	21740	-
Bending moment at fixation	Med.res	kNm	0,600	1,100	0,330	-
Bending tensile stress for qk analytic and for Fk based on Mepla	σEd.res	N/mm²	66,790	58,19	17,46	-
Maximum utilization residual capacity based on bcalc	utilization	-	0,86	0,73	0,25	-
Deformation glass panel at top	δglass.top	mm	19,50	-	-	-
Moment of inertia with equivalent thickness teq.serv	Ieq.serv	mm⁴	210997	-	-	-
Linear profile stiffness	kprof	(kN/m)/mm	22,3	-	-	-
Characteristic force at top support glass into profile	Fp.k	kN/m	9,07	-	-	-
Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k.max	kN/m	45,0	-	-	-
Validation of linear iteration	valid	-	OK	-	-	-
Deformation top of profile based on numerical simulation of profile	δprof	mm	0,41	-	-	-
Deformation top of parapet due to profile deformation/rotation - extrapolation	δprof.top	mm	5	-	-	-
Total deformation at top of parapet = δglass + δprofile	δtot.top	mm	24	-	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δmax	mm	20	-	-	-
Maximum utilization SLS	utilization	-	1,21	-	-	-
Calculation width	bcalc	mm	1000	2200	2200	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	13,61	11,40	3,42	17,28
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	55,3	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,25	0,21	0,06	0,31
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m²	-	-	-	3,20
Parapet System						
Total height of the parapet	1300	mm				
Glass height	1200	mm				
Glass thickness nominal	8	mm				
Interlayer	PVB	-				
Thickness interlayer	1,52	mm				
Load category	A2	-				
Load			qk [kN/m]	Fk [kN]		wk [kN/m²]
Maximum utilization glass at ULS	ut.glass.ULS	-	0,40	0,41	0,16	0,46
Maximum utilization profile at ULS	ut.profile.ULS	-	0,25	0,21	0,06	0,31
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,86	0,73	0,25	
Maximum deformation glass at SLS for linear load qk	def.glass.SLS		19,5			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	24,2			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	1,21			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m²				2,18

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SYSTEM RESISTANCE WITH HANDRAIL

		Profile	DF88LM_E200			
Parapet System						
Total height of the parapet		Ltot	mm	1300		
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1200		
Vertical distance between top of profile and top support of glass into profile		L2	mm	12		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,55		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	8		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	A2		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,4		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,5	1	0,3
		Time of loading	s	60	60	86400
		Load area A	mm ²	-	40000	40000
				0,856	0,856	0,543
		Modification factor for the load time	km0d	-	0,856	0,543
		Surface effect factor	ka	-	1,076	1,076
		Design resistance of FTG	fmt.ud	N/mm ²	77,65	79,28
		Shear modulus interlayer	Gint	N/mm ²	0,75	0,75
		Young modulus interlayer	Eint	N/mm ²	2,25	2,25
		Coupling factor of the interlayer(s) at stress	σσ	-	0,319	0,211
		Coupling factor of the interlayer(s) at deformation	σω	-	0,591	0,469
		Equivalent glass thickness ULS	teq.ult	mm	13,26	12,65
		Equivalent glass thickness SLS	teq.serv	mm	13,63	13,00
		Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk	bcalc	mm	1000	2200
		Section modulus with equivalent thickness W=b*teq ² /6	Wel	mm ³	29320	58643
		Bending moment at fixation	Med	kNm	0,900	1,650
		Bending tensile stress at ULS	σEd.ULS*	N/mm ²	30,70	32,36
		Maximum utilization ULS = σEd/fmt.ud	utilization	-	0,40	0,41
		Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-
		Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	2200
		Section modulus with residual check	Wel.res	mm ³	9882	21740
		Bending moment at fixation	Med.res	kNm	0,600	1,100
		Bending tensile stress for qk analytic and for Fk based on Mepla	σEd.res	N/mm ²	66,790	58,19
		Maximum utilization residual capacity based on bcalc	utilization	-	0,86	0,73
		Deformation glass panel at top	δglass.top	mm	19,50	-
		Moment of inertia with equivalent thickness teq.serv	Ieq.serv	mm ⁴	210997	-
		Linear profile stiffness	kprof	(kN/m)/mm	21,3	-
		Characteristic force at top support glass into profile	Fp.k	kN/m	9,07	-
		Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k.max	kN/m	24,5	-
		Validation of linear iteration	valid	-	OK	-
		Deformation top of profile based on numerical simulation of profile	δprof	mm	0,43	-
		Deformation top of parapet due to profile deformation/rotation - extrapolation	δprof.top	mm	5	-
		Total deformation at top of parapet = δglass + δprofile	δtot.top	mm	24	-
		Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δmax	mm	20	-
		Maximum utilization SLS	utilization	-	1,22	-
		Calculation width	bcalc	mm	1000	2200
		Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	13,61	11,40
		Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	36,7	-
		Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,37	0,31
		Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-
		Parapet System		DF88LM_E200		
		Total height of the parapet		1300		
		Glass height		1200		
		Glass thickness nominal		8		
		Interlayer		PVB		
		Thickness interlayer		1,52		
		Load category		A2		
		Load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
				0,5	1	0,3
		Maximum utilization glass at ULS	ut.glass.ULS	-	0,40	0,41
		Maximum utilization profile at ULS	ut.profile.ULS	-	0,37	0,31
		Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,86	0,73
		Maximum deformation glass at SLS for linear load qk	def.glass.SLS	-	19,5	-
		Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	24,5	-
		Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	1,22	-
		Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²	-	2,12

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		Profile	DF88LM_E400		
Parapet System					
Total height of the parapet		Ltot	mm	1300	
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1200	
Vertical distance between top of profile and top support of glass into profile		L2	mm	12	
Vertical distance between top and bottom support of glass into profile		L3	mm	70	
Vertical distance between bottom support of glass into profile and base ground		L4	mm	29,55	
Distance between fixations		efix	mm	400	
Nominal glass thickness		tnom	mm	8	
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7	
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7	
Type of interlayer		Interlayer	-	PVB	
Thickness of interlayer		tv.i	mm	1,52	
Number of sheets of glass of laminated plate		ng	-	2	
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30	
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50	
Load category		Cat	-	A2	
Consequence class		CC	-	CC2	
Multiplication factor for consequence class		KF1	-	1	
Load safety factor variable loads as basis value		γQ0	-	1,5	
Load safety factor variable loads considering CC		γQ	-	1,5	
Load combination factor for variable life load		ψ0 LL	-	0,4	
Load combination factor for variable wind load		ψ Wind	-	0	
Predominant load				Life load	
Material safety factor float glass for predominant load		γm.A	-	1,8	
Material safety factor FTG		γm.V	-	1,2	
Factor for the edge quality of the glass panel		ke	-	1	
Corrosion constant as a function		c	-	16	
Factor for the surface structure of float glass		ksp	-	1	
Factor for the zone for FTG and edge zone		kz	-	0,9	
Characteristic resistance of float glass		fg.k	N/mm ²	45	
Characteristic resistance of FTG		fb.k	N/mm ²	120	
		Type of load		qk [kN/m]	
		Zone of load		a	a+b
		Value of load		0,5	0,3
		Time of loading	s	60	86400
		Load area A	mm ²	40000	40000
				qk [kN/m]	wk [kN/m ²]
				a	a+b
				1	1
				60	5
				40000	1200000
Modification factor for the load time		km0d	-	0,856	0,543
Surface effect factor		ka	-	1,076	1,076
Design resistance of FTG		fmt.ud	N/mm ²	77,65	79,28
Shear modulus interlayer		Gint	N/mm ²	0,75	0,28
Young modulus interlayer		Eint	N/mm ²	2,25	0,84
Coupling factor of the interlayer(s) at stress		σσ	-	0,319	0,091
Coupling factor of the interlayer(s) at deformation		σω	-	0,591	0,247
Equivalent glass thickness ULS		teq.ult	mm	13,26	11,76
Equivalent glass thickness SLS		teq.serv	mm	13,63	11,67
Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk		bcalc	mm	1000	2200
Section modulus with equivalent thickness W=b*teq ² /6		Wel	mm ³	29320	50702
Bending moment at fixation		Med	kNm	0,900	0,495
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	30,70	11,23
Maximum utilization ULS = σEd/fmt.ud		utilization	-	0,40	0,16
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	2,18
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	2200
Section modulus with residual check		Wel.res	mm ³	9882	21740
Bending moment at fixation		Med.res	kNm	0,600	0,330
Bending tensile stress for qk analytic and for Fk based on Mepla		σEd.res	N/mm ²	66,790	17,46
Maximum utilization residual capacity based on bcalc		utilization	-	0,86	0,25
Deformation glass panel at top		δglass.top	mm	19,50	
Moment of inertia with equivalent thickness teq.serv		Ieq.serv	mm ⁴	210997	
Linear profile stiffness		kprof	(kN/m)/mm	13,4	
Characteristic force at top support glass into profile		Fp.k	kN/m	9,07	
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k.max	kN/m	13,4	
Validation of linear iteration		valid	-	OK	
Deformation top of profile based on numerical simulation of profile		δprof	mm	0,68	
Deformation top of parapet due to profile deformation/rotation - extrapolation		δprof.top	mm	8	
Total deformation at top of parapet = δglass + δprofile		δtot.top	mm	27	
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δmax	mm	20	
Maximum utilization SLS		utilization	-	1,37	
Calculation width		bcalc	mm	1000	2200
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	13,61	3,42
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	18,4	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,74	0,19
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	1,06
Parapet System		DF88LM_E400			
Total height of the parapet		1300	mm		
Glass height		1200	mm		
Glass thickness nominal		8	mm		
Interlayer		PVB	-		
Thickness interlayer		1,52	mm		
Load category		A2	-		
				qk [kN/m]	wk [kN/m ²]
				0,5	0,3
Maximum utilization glass at ULS		ut.glass.ULS	-	0,40	0,16
Maximum utilization profile at ULS		ut.profile.ULS	-	0,74	0,19
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,86	0,25
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	-	19,5	
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	27,4	
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	1,37	
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²		1,06

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Parapet System		Profile	DF88FR_E200			
Total height of the parapet	Ltot	mm	1300			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1200			
Vertical distance between top of profile and top support of glass into profile	L2	mm	12			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	29,5			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	7,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	7,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	A2			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,4			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
Type of load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Zone of load			a	a	a+b	a+b
Value of load			0,5	1	0,3	1
Time of loading			s	60	86400	5
Load area A			mm ²	-	40000	40000
Modification factor for the load time			kmod	-	0,856	0,543
Surface effect factor			ka	-	1,076	1,076
Design resistance of FTG			f _{mt,ud}	N/mm ²	77,65	79,28
Shear modulus interlayer			Gint	N/mm ²	0,75	0,28
Young modulus interlayer			Eint	N/mm ²	2,25	0,84
Coupling factor of the interlayer(s) at stress			ωσ	-	0,319	0,211
Coupling factor of the interlayer(s) at deformatio			ωw	-	0,591	0,469
Equivalent glass thickness ULS			teq.ult	mm	13,26	12,65
Equivalent glass thickness SLS			teq.serv	mm	13,63	13,00
Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk			bcalc	mm	1000	2200
Section moduls with equivalent thickness W=b ³ teq ^{1/6}			W _{el}	mm ³	29320	58643
Bending moment at fixation			Med	kNm	0,900	1,650
Bending tensile stress at ULS			σEd.ULS*	N/mm ²	30,70	32,36
Maximum utilization ULS = σEd/f _{mt,ud}			utilization	-	0,40	0,41
Maximum characteristic wind load wk for only wind loads based on ULS glass			wk,max-glass	kN/m ²	-	0,16
Calculation width glass panel - for Fk based on Mepla calculation			bcalc	mm	1000	2200
Section moduls with residual check			W _{el,res}	mm ³	9882	21740
Bending moment at fixation			Med,res	kNm	0,600	1,100
Bending tensile stress for qk analytic and for Fk based on Mepla			σEd,res	N/mm ²	66,790	58,19
Maximum utilization residual capacity based on bcalc			utilization	-	0,86	0,73
Deformation glass panel at top			δ _{glass,top}	mm	19,50	19,50
Moment of inertia with equivalent thickness teq.serv			I _{eq,serv}	mm ⁴	210997	210997
Linear profile stiffness			k _{prof}	(kN/m)/mm	15,5	15,5
Characteristic force at top support glass into profile			Fp.k	kN/m	9,07	9,07
Maximum char. force at top support glass/profile at end of linear stiffness			Fp.k,max	kN/m	26,8	26,8
Validation of linear iteration			valid	-	OK	OK
Deformation top of profile based on numerical simulation of profile			δ _{prof}	mm	0,59	0,59
Deformation top of parapet due to profile deformation/rotation - extrapolation			δ _{prof,top}	mm	7	7
Total deformation at top of parapet = δ _{glass} + δ _{profile}			δ _{tot,top}	mm	26	26
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)			δ _{max}	mm	20	20
Maximum utilization SLS			utilization	-	1,32	1,32
Calculation width			bcalc	mm	1000	2200
Design acting force at top support glass into profile based on bmin for Fk			Fp.Ed	kN/m	13,61	11,40
Maximum allowed design acting force based on numerical simulations of profiles			Fp.Rd	kN/m	43,6	-
Maximum utilization aluminium profile for single loads qk and Fk			utilization	-	0,31	0,26
Maximum characteristic wind load wk for only wind loads based on ULS profile			wk,max-profile	kN/m ²	-	0,08
Parapet System			DF88FR_E200			
Total height of the parapet	1300	mm				
Glass height	1200	mm				
Glass thickness nominal	8	mm				
Interlayer	PVB	-				
Thickness interlayer	1,52	mm				
Load category	A2	-				
Load			qk [kN/m]	Fk [kN]		wk [kN/m ²]
Load			0,5	1	0,3	
Maximum utilization glass at ULS			ut.glass.ULS	-	0,40	0,16
Maximum utilization profile at ULS			ut.profile.ULS	-	0,31	0,08
Maximum utilization residual capacity glass for linear load qk			ut.residual	-	0,86	0,25
Maximum deformation glass at SLS for linear load qk			def.glass.SLS	-	19,5	
Maximum deformation glass + profile at SLS for linear load qk			def.glass+prof.SLS	mm	26,3	
Maximum utilization glass + profile at SLS for linear load qk			ut.glass+prof.SLS	-	1,32	
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile			wk,max	kN/m ²	-	2,18
NOTE: If one resistance check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation. For deformation see comments in report and overview tables						

SYSTEM RESISTANCE WITH HANDRAIL

		Profile	DF88FR_E400			
Parapet System						
Total height of the parapet	Ltot	mm	1300			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1200			
Vertical distance between top of profile and top support of glass into profile	L2	mm	12			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	29,5			
Distance between fixations	efix	mm	400			
Nominal glass thickness	tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	7,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	7,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	A2			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,4			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm²	45			
Characteristic resistance of FTG	fb.k	N/mm²	120			
	Type of load		qk [kN/m]	Fk [kN]	wk [kN/m²]	
	Zone of load		a	a+b	a+b	
	Value of load		0,5	1	0,3	1
	Time of loading	s	60	60	86400	5
	Load area A	mm²	-	40000	40000	1200000
Modification factor for the load time	kmod	-	0,856	0,856	0,543	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,939
Design resistance of FTG	f _{mt,ud}	N/mm²	77,65	79,28	70,87	79,73
Shear modulus interlayer	Gint	N/mm²	0,75	0,75	0,28	0,96
Young modulus interlayer	Eint	N/mm²	2,25	2,25	0,84	2,87
Coupling factor of the interlayer(s) at stress	α _σ	-	0,319	0,211	0,091	0,557
Coupling factor of the interlayer(s) at deformation	α _w	-	0,591	0,469	0,247	0,553
Equivalent glass thickness ULS	teq.ult	mm	13,26	12,65	11,76	14,26
Equivalent glass thickness SLS	teq.serv	mm	13,63	13,00	11,67	13,44
Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk	bcalc	mm	1000	2200	2200	1000
Section moduls with equivalent thickness W=b*teq²/6	Wel	mm³	29320	58643	50702	33906
Bending moment at fixation	Med	kNm	0,900	1,650	0,495	1,080
Bending tensile stress at ULS	σEd.ULS*	N/mm²	30,70	32,36	11,23	36,63
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	-	0,40	0,41	0,16	0,46
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m²	-	-	-	2,18
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	2200	2200	
Section moduls with residual check	Wel.res	mm³	9882	21740	21740	
Bending moment at fixation	Med.res	kNm	0,600	1,100	0,330	
Bending tensile stress for qk analytic and for Fk based on Mepla	σEd.res	N/mm²	66,790	58,19	17,46	
Maximum utilization residual capacity based on bcalc	utilization	-	0,86	0,73	0,25	
Deformation glass panel at top	δ _{glass,top}	mm	19,50			
Moment of inertia with equivalent thickness teq.serv	I _{eq.serv}	mm⁴	210997			
Linear profile stiffness	k _{prof}	(kN/m)/mm	9,1			
Characteristic force at top support glass into profile	F _{p,k}	kN/m	9,07			
Maximum char. force at top support glass/profile at end of linear stiffness	F _{p,k,max}	kN/m	14,5			
Validation of linear iteration	valid	-	OK			
Defomation top of profile based on numerical simulation of profile	δ _{prof}	mm	0,99			
Defomation top of parapet due to profile deformation/rotation - extrapolation	δ _{prof,top}	mm	12			
Total deformation at top of parapet = δ _{glass} + δ _{profile}	δ _{tot,top}	mm	31			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δ _{max}	mm	20			
Maximum utilization SLS	utilization	-	1,55			
Calculation width	bcalc	mm	1000	2200	2200	1000
Design acting force at top support glass into profile based on bmin for Fk	F _{p,Ed}	kN/m	13,61	11,40	3,42	17,28
Maximum allowed design acting force based on numerical simulations of profiles	F _{p,Rd}	kN/m	21,8	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,62	0,52	0,16	0,79
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m²	-	-	-	1,26
Parapet System	DF88FR_E400					
Total height of the parapet	1300	mm				
Glass height	1200	mm				
Glass thickness nominal	8	mm				
Interlayer	PVB	-				
Thickness interlayer	1,52	mm				
Load category	A2	-				
			qk [kN/m]	Fk [kN]	wk [kN/m²]	
	Load		0,5	1	0,3	
Maximum utilization glass at ULS	ut.glass.ULS	-	0,40	0,41	0,16	0,46
Maximum utilization profile at ULS	ut.profile.ULS	-	0,62	0,52	0,16	0,79
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,86	0,73	0,25	
Maximum deformation glass at SLS for linear load qk	def.glass.SLS		19,5			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	31,1			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	1,55			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m²				1,26

NOTE: If one resistance check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation. For deformation see comments in report and overview tables

SYSTEM RESISTANCE WITH HANDRAIL

Parapet System		Profile		DF88PICO_E125			
Total height of the parapet		Ltot	mm	1266			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1200			
Vertical distance between top of profile and top support of glass into profile		L2	mm	9			
Vertical distance between top and bottom support of glass into profile		L3	mm	46			
Vertical distance between bottom support of glass into profile and base ground		L4	mm	20			
Distance between fixations		efix	mm	125			
Nominal glass thickness		tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	7,7			
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	7,7			
Type of interlayer		Interlayer	-	PVB			
Thickness of interlayer		tv.i	mm	1,52			
Number of sheets of glass of laminated plate		ng	-	2			
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50			
Load category		Cat	-	A2			
Consequence class		CC	-	CC2			
Multiplication factor for consequence class		KF1	-	1			
Load safety factor variable loads as basis value		γQo	-	1,5			
Load safety factor variable loads considering CC		γQ	-	1,5			
Load combination factor for variable life load		ψ0 LL	-	0,4			
Load combination factor for variable wind load		ψ0 Wind	-	0			
Predominant load				Life load			
Material safety factor float glass for predominant load		γm.A	-	1,8			
Material safety factor FTG		γm.V	-	1,2			
Factor for the edge quality of the glass panel		ke	-	1			
Corrosion constant as a function		c	-	16			
Factor for the surface structure of float glass		ksp	-	1			
Factor for the zone for FTG and edge zone		kz	-	0,9			
Characteristic resistance of float glass		fg.k	N/mm²	45			
Characteristic resistance of FTG		fb.k	N/mm²	120			
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m²]	
		Zone of load		a	a+b	a+b	
		Value of load		0,5	1	0,3	
		Time of loading	s	60	60	86400	
		Load area A	mm²	-	40000	40000	
		Modification factor for the load time	kmod	-	0,856	0,543	
		Surface effect factor	ka	-	1,076	1,076	
		Design resistance of FTG	fmt.ud	N/mm²	77,65	79,28	
		Shear modulus interlayer	Gint	N/mm²	0,75	0,28	
		Young modulus interlayer	Eint	N/mm²	2,25	0,84	
		Coupling factor of the interlayer(s) at stress	ασ	-	0,319	0,211	
		Coupling factor of the interlayer(s) at deformation	αω	-	0,591	0,469	
		Equivalent glass thickness ULS	teq.ult	mm	13,26	12,65	
		Equivalent glass thickness SLS	teq.serv	mm	13,63	13,00	
		Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk	bcalc	mm	1000	2200	
		Section moduls with equivalent thickness W=b*teq²/6	Wel	mm³	29320	58643	
		Bending moment at fixation	Med	kNm	0,900	1,650	
		Bending tensile stress at ULS	σEd.ULS*	N/mm²	30,70	32,36	
		Maximum utilization ULS = σEd/fmt.ud	utilization	-	0,40	0,41	
		Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m²	-	-	
		Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	2200	
		Section moduls with residual check	Wel.res	mm³	9882	21740	
		Bending moment at fixation	Med.res	kNm	0,600	1,100	
		Bending tensile stress for qk analytic and for Fk based on Mepla	σEd.res	N/mm²	66,790	58,19	
		Maximum utilization residual capacity based on bcalc	utilization	-	0,86	0,73	
		Deformation glass panel at top	δglass.top	mm	19,50	-	
		Moment of inertia with equivalent thickness teq.serv	Ieq.serv	mm⁴	210997	-	
		Linear profile stiffness	kprof	(kN/m)/mm	40,0	-	
		Characteristic force at top support glass into profile	Fp.k	kN/m	13,54	-	
		Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k.max	kN/m	48,0	-	
		Validation of linear iteration	valid	-	OK	-	
		Defomation top of profile based on numerical simulation of profile	δprof	mm	0,34	-	
		Defomation top of parapet due to profile deformation/rotation - extrapolation	δprof.top	mm	6	-	
		Total deformation at top of parapet = δglass + δprofile	δtot.top	mm	25	-	
		Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δmax	mm	20	-	
		Maximum utilization SLS	utilization	-	1,26	-	
		Calculation width	bcalc	mm	1000	2200	
		Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	20,32	16,99	
		Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	72,2	-	
		Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,28	0,24	
		Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m²	-	-	
		Parapet System	DF88PICO_E125				
		Total height of the parapet	1266	mm			
		Glass height	1200	mm			
		Glass thickness nominal	8	mm			
		Interlayer	PVB	-			
		Thickness interlayer	1,52	mm			
		Load category	A2	-			
		Load		qk [kN/m]	Fk [kN]	wk [kN/m²]	
		Maximum utilization glass at ULS	ut.glass.ULS	-	0,40	0,41	
		Maximum utilization profile at ULS	ut.profile.ULS	-	0,28	0,24	
		Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,86	0,73	
		Maximum deformation glass at SLS for linear load qk	def.glass.SLS	mm	19,5	-	
		Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	25,2	-	
		Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	1,26	-	
		Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m²	-	2,18	

NOTE: If one resistance check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation. For deformation see comments in report and overview tables

4.3.1 DF1010... Profiles with 10+10 and 8+8+4

SYSTEM RESISTANCE WITH HANDRAIL

		Profile	DF1010LM_E200			
Parapet System						
Total height of the parapet	Ltot	mm	1301			
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1200			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	10			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	9,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	9,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	other			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
	Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]	
	Zone of load		a	a+b	a+b	
	Value of load		0,8	1	0,5	1
	Time of loading	s	300	300	604800	5
	Load area A	mm ²	-	40000	40000	1200000
Modification factor for the load time	kmod	-	0,774	0,774	0,481	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,939
Design resistance of FTG	f _{mt,ud}	N/mm ²	75,61	77,08	69,19	79,73
Shear modulus interlayer	Gint	N/mm ²	0,53	0,53	0,11	0,96
Young modulus interlayer	Eint	N/mm ²	1,60	1,60	0,32	2,87
Coupling factor of the interlayer(s) at stress	ωσ	-	0,209	0,131	0,029	0,500
Coupling factor of the interlayer(s) at deformatio	ωw	-	0,449	0,333	0,091	0,496
Equivalent glass thickness ULS	teq.ult	mm	15,91	15,23	14,10	17,71
Equivalent glass thickness SLS	teq.serv	mm	16,24	15,39	13,24	16,56
Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk	bcalc	mm	1000	2200	2200	1000
Section moduls with equivalent thickness W=b*teq ² /6	Wel	mm ³	42202	85006	72928	52264
Bending moment at fixation	Med	kNm	1,440	1,650	0,825	1,080
Bending tensile stress at ULS	σEd.ULS*	N/mm ²	34,12	22,32	13,01	23,76
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	-	0,45	0,29	0,19	0,30
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	-	3,36
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	2200	2200	
Section moduls with residual check	Wel.res	mm ³	15682	34500	34500	
Bending moment at fixation	Med.res	kNm	0,960	1,100	0,550	
Bending tensile stress for qk analytic and for Fk based on Mepla	σEd.res	N/mm ²	67,340	36,67	18,33	
Maximum utilization residual capacity based on bcalc	utilization	-	0,89	0,48	0,26	
Deformation glass panel at top	δg _{glass,top}	mm	18,44			
Moment of inertia with equivalent thickness teq.serv	Ieq.serv	mm ⁴	357032			
Linear profile stiffness	kprof	(kN/m)/mm	34,5			
Characteristic force at top support glass into profile	Fp.k	kN/m	14,51			
Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k,max	kN/m	35,0			
Validation of linear iteration	valid	-	OK			
Defomation top of profile based on numerical simulation of profile	δprof	mm	0,42			
Defomation top of parapet due to profile deformation/rotation - extrapolation	δprof.top	mm	5			
Total deformation at top of parapet = δ _{glass} + δ _{profile}	δtot.top	mm	23			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δmax	mm	20			
Maximum utilization SLS	utilization	-	1,17			
Calculation width	bcalc	mm	1000	2200	2200	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	21,77	11,40	5,70	17,28
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	68,8	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,32	0,17	0,08	0,25
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	-	3,98
Parapet System						
Total height of the parapet	1301	mm				
Glass height	1200	mm				
Glass thickness nominal	10	mm				
Interlayer	PVB	-				
Thickness interlayer	1,52	mm				
Load category	other					
Load			qk [kN/m]	Fk [kN]	wk [kN/m ²]	
Maximum utilization glass at ULS	ut.glass.ULS	-	0,45	0,29	0,19	0,30
Maximum utilization profile at ULS	ut.profile.ULS	-	0,32	0,17	0,08	0,25
Maximum utilization residual capacity glas for linear load qk	ut.residual	-	0,89	0,48	0,26	
Maximum deformation glass at SLS for linear load qk	def.glass.SLS		18,4			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	23,3			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	1,17			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²				3,36

NOTE: If one resistance check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation. For deformation see comments in report and overview tables

SYSTEM RESISTANCE WITH HANDRAIL

Parapet System		Profile	DF1010FR_E200			
Total height of the parapet		Ltot	mm	1301		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1200		
Vertical distance between top of profile and top support of glass into profile		L2	mm	11		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	31		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	10		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	9,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	9,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	other		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,6		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a+b	a+b
		Value of load		0,8	0,5	1
		Time of loading	s	300	604800	5
		Load area A	mm ²	-	40000	1200000
		Modification factor for the load time	kmod	0,774	0,774	0,481
		Surface effect factor	ka	1,0	1,076	0,939
		Design resistance of FTG	fmt.ud	N/mm ²	75,61	77,08
		Shear modulus interlayer	Gint	N/mm ²	0,53	0,11
		Young modulus interlayer	Eint	N/mm ²	1,60	0,32
		Coupling factor of the interlayer(s) at stress	ασ	0,209	0,131	0,029
		Coupling factor of the interlayer(s) at deformation	αω	0,449	0,333	0,091
		Equivalent glass thickness ULS	teq.ult	mm	15,91	14,10
		Equivalent glass thickness SLS	teq.serv	mm	16,24	13,24
ULS Glas	Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk	bcalc	mm	1000	2200	1000
	Section moduls with equivalent thickness W=b ² teq ² /6	Wel	mm ³	42202	85006	72928
	Bending moment at fixation	Med	kNm	1,440	1,650	0,825
	Bending tensile stress at ULS	σEd.ULS*	N/mm ²	34,12	22,32	13,01
	Maximum utilization ULS = σEd/fmt.ud	utilization	-	0,45	0,29	0,30
	Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	3,36
Residual load capacity	Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	2200	2200
	Section moduls with residual check	Wel.res	mm ³	15682	34500	34500
	Bending moment at fixation	Med.res	kNm	0,960	1,100	0,550
	Bending tensile stress for qk analytic and for Fk based on Mepla	σEd.res	N/mm ²	67,340	36,67	18,33
	Maximum utilization residual capacity based on bcalc	utilization	-	0,89	0,48	0,26
SLS	Deformation glass panel at top	δglass.top	mm	18,44	* x1,15 for wind and Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
	Moment of inertia with equivalent thickness teq.serv	Ieq.serv	mm ⁴	357032	* x1,10 for qk and x 1,15 for Fk to account for difference between constant tension and real tension distribution acc. to comparative Mepla-calculation	
	Linear profile stiffness	kprof	(kN/m)/mm	19,0	* Note: if linear automatic iteration is not valid, manual iteration in the load deformation curves of the single profiles is necessary	
	Characteristic force at top support glass into profile	Fp.k	kN/m	14,51		
	Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k.max	kN/m	45,0		
	Validation of linear iteration	valid	-	OK		
	Defonation top of profile based on numerical simulation of profile	δprof	mm	0,76		
	Defonation top of parapet due to profile deformation/rotation - extrapolation	δprof.top	mm	9		
	Total deformation at top of parapet = δglass + δprofile	δtot.top	mm	27		
	Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)	δmax	mm	20		
	Maximum utilization SLS	utilization	-	1,37		
ULS Profile	Calculation width	bcalc	mm	1000	2200	1000
	Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	21,77	11,40	5,70
	Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	78,5	-	-
	Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,28	0,15	0,07
	Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	4,54
Parapet System		DF1010FR_E200				
Total height of the parapet		1301	mm			
Glass height		1200	mm			
Glass thickness nominal		10	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		other	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,45	0,29	0,30
Maximum utilization profile at ULS		ut.profile.ULS	-	0,28	0,15	0,07
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,89	0,48	0,26
Maximum deformation glass at SLS for linear load qk		def.glass.SLS		18,4		
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	27,3		
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	1,37		
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²			3,36

NOTE: If one resistance check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation. For deformation see comments in report and overview tables

SYSTEM RESISTANCE WITH HANDRAIL

Parapet System		Profile		DF884LM_E200			
Total height of the parapet		Ltot	mm	1301			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1200			
Vertical distance between top of profile and top support of glass into profile		L2	mm	11			
Vertical distance between top and bottom support of glass into profile		L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground		L4	mm	31			
Distance between fixations		efix	mm	200			
Nominal glass thickness		tnom	mm	8			
Glass thickness for calculation tp1 for inner plate at loading side		tpl1	mm	3,8			
Glass thickness for calculation tp2 for middle and outer plate		tpl2	mm	7,7			
Type of interlayer		Interlayer	-	PVB			
Thickness of interlayer		tv.i	mm	1,52			
Number of sheets of glass of laminated plate		ng	-	3			
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50			
Load category		Cat	-	other			
Consequence class		CC	-	CC2			
Multiplication factor for consequence class		KF1	-	1			
Load safety factor variable loads as basis value		γQo	-	1,5			
Load safety factor variable loads considering CC		γQ	-	1,5			
Load combination factor for variable life load		ψ0 LL	-	0,6			
Load combination factor for variable wind load		ψ0 Wind	-	0			
Predominant load				Life load			
Material safety factor float glass for predominant load		γm.A	-	1,8			
Material safety factor FTG		γm.V	-	1,2			
Factor for the edge quality of the glass panel		ke	-	1			
Corrosion constant as a function		c	-	16			
Factor for the surface structure of float glass		ksp	-	1			
Factor for the zone for FTG and edge zone		kz	-	0,9			
Characteristic resistance of float glass		fg.k	N/mm²	45			
Characteristic resistance of FTG		fb.k	N/mm²	120			
		Type of load		qk [kN/m]	Fk [kN]		wk [kN/m²]
		Zone of load		a	a	a+b	a+b
		Value of load		0,8	1	0,5	1
		Time of loading	s	300	300	604800	5
		Load area A	mm²	-	40000	40000	1200000
Modification factor for the load time		kmod	-	0,774	0,774	0,481	1,000
Surface effect factor		ka	-	1,0	1,076	1,076	0,939
Design resistance of FTG		f _{mt,ud}	N/mm²	75,61	77,08	69,19	79,73
Shear modulus interlayer		Gint	N/mm²	0,53	0,53	0,11	0,96
Young modulus interlayer		Eint	N/mm²	1,60	1,60	0,32	2,87
Coupling factor of the interlayer(s) at stress		ασ	-	0,143	0,087	0,019	0,386
Coupling factor of the interlayer(s) at deformation		αω	-	0,339	0,239	0,059	0,382
Equivalent glass thickness ULS		teq.ult	mm	14,03	13,13	11,69	16,55
Equivalent glass thickness SLS		teq.serv	mm	14,49	13,44	10,99	14,89
Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk		bcalc	mm	1000	2200	2200	1000
Section moduls with equivalent thickness W=b*teq²/6		Wel	mm³	32820	63170	50124	45677
Bending moment at fixation		Med	kNm	1,440	1,650	0,825	1,080
Bending tensile stress at ULS		σEd.ULS*	N/mm²	43,88	30,04	18,93	27,19
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,58	0,39	0,27	0,34
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m²	-	-	-	2,93
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	2200	2200	-
Section moduls with residual check		Wel.res	mm³	27659	55464	46553	-
Bending moment at fixation		Med.res	kNm	0,960	1,100	0,550	-
Bending tensile stress for qk analytic and for Fk based on Mepla		σEd.res	N/mm²	38,179	22,81	13,59	-
Maximum utilization residual capacity based on bcalc		utilization	-	0,50	0,30	0,20	-
Deformation glass panel at top		δ _{glass,top}	mm	25,98	-	-	-
Moment of inertia with equivalent thickness teq.serv		I _{eq.serv}	mm ⁴	253384	-	-	-
Linear profile stiffness		kprof	(kN/m)/mm	34,5	-	-	-
Characteristic force at top support glass into profile		Fp.k	kN/m	14,51	-	-	-
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k,max	kN/m	35,0	-	-	-
Validation of linear iteration		valid	-	OK	-	-	-
Deformation top of profile based on numerical simulation of profile		δ _{prof}	mm	0,42	-	-	-
Deformation top of parapet due to profile deformation/rotation - extrapolation		δ _{prof,top}	mm	5	-	-	-
Total deformation at top of parapet = δ _{glass} + δ _{profile}		δ _{tot,top}	mm	31	-	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		δ _{max}	mm	20	-	-	-
Maximum utilization SLS		utilization	-	1,54	-	-	-
Calculation width		bcalc	mm	1000	2200	2200	1000
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	21,77	11,40	5,70	17,28
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	68,8	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,32	0,17	0,08	0,25
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m²	-	-	-	3,98
Parapet System		DF884LM_E200					
Total height of the parapet		1301	mm				
Glass height		1200	mm				
Glass thickness nominal		8	mm				
Interlayer		PVB	-				
Thickness interlayer		1,52	mm				
Load category		other	-				
Load				qk [kN/m]	Fk [kN]		wk [kN/m²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,58	0,39	0,27	0,34
Maximum utilization profile at ULS		ut.profile.ULS	-	0,32	0,17	0,08	0,25
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,50	0,30	0,20	-
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	26,0			
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	30,9			
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	1,54			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m²	2,93			

NOTE: If one resistance check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation. For deformation see comments in report and overview tables

SYSTEM RESISTANCE WITH HANDRAIL

		Profile	DF884FR_E200																																																																																																																																																																																																																																																																																																																																																																																							
Parapet System		Ltot	mm	1301																																																																																																																																																																																																																																																																																																																																																																																						
Total height of the parapet		L1	mm	1200																																																																																																																																																																																																																																																																																																																																																																																						
Glass height top of parapet until first fixation into profile L1=Ltot-L3-L4		L2	mm	11																																																																																																																																																																																																																																																																																																																																																																																						
Vertical distance between top of profile and top support of glass into profile		L3	mm	70																																																																																																																																																																																																																																																																																																																																																																																						
Vertical distance between top and bottom support of glass into profile		L4	mm	31																																																																																																																																																																																																																																																																																																																																																																																						
Distance between bottom support of glass into profile and base ground		efix	mm	200																																																																																																																																																																																																																																																																																																																																																																																						
Distance between fixations		tnom	mm	8																																																																																																																																																																																																																																																																																																																																																																																						
Nominal glass thickness		tpl1	mm	3,8																																																																																																																																																																																																																																																																																																																																																																																						
Glass thickness for calculation tp1 for inner plate at loading side		tpl2	mm	7,7																																																																																																																																																																																																																																																																																																																																																																																						
Glass thickness for calculation tp2 for middle and outer plate		Interlayer	-	PVB																																																																																																																																																																																																																																																																																																																																																																																						
Type of interlayer		tv,i	mm	1,52																																																																																																																																																																																																																																																																																																																																																																																						
Thickness of interlayer		ng	-	3																																																																																																																																																																																																																																																																																																																																																																																						
Number of sheets of glass of laminated plate		Tg.pvb	°C	30																																																																																																																																																																																																																																																																																																																																																																																						
Maximum temperature of glass panel at loading for PVB		Tg.sgp	°C	50																																																																																																																																																																																																																																																																																																																																																																																						
Maximum temperature of glass panel at loading for SGP		Cat	-	other																																																																																																																																																																																																																																																																																																																																																																																						
Load category		CC	-	CC2																																																																																																																																																																																																																																																																																																																																																																																						
Consequence class		KF1	-	1																																																																																																																																																																																																																																																																																																																																																																																						
Multiplication factor for consequence class		γQo	-	1,5																																																																																																																																																																																																																																																																																																																																																																																						
Load safety factor variable loads as basis value		γQ	-	1,5																																																																																																																																																																																																																																																																																																																																																																																						
Load safety factor variable loads considering CC		ψ0 LL	-	0,6																																																																																																																																																																																																																																																																																																																																																																																						
Load combination factor for variable life load		ψ0 Wind	-	0																																																																																																																																																																																																																																																																																																																																																																																						
Load combination factor for variable wind load				Life load																																																																																																																																																																																																																																																																																																																																																																																						
Predominant load		γm.A	-	1,8																																																																																																																																																																																																																																																																																																																																																																																						
Material safety factor float glass for predominant load		γm.V	-	1,2																																																																																																																																																																																																																																																																																																																																																																																						
Material safety factor FTG		ke	-	1																																																																																																																																																																																																																																																																																																																																																																																						
Factor for the edge quality of the glass panel		c	-	16																																																																																																																																																																																																																																																																																																																																																																																						
Corrosion constant as a function		ksp	-	1																																																																																																																																																																																																																																																																																																																																																																																						
Factor for the surface structure of float glass		kz	-	0,9																																																																																																																																																																																																																																																																																																																																																																																						
Factor for the zone for FTG and edge zone		fg,k	N/mm ²	45																																																																																																																																																																																																																																																																																																																																																																																						
Characteristic resistance of float glass		fb,k	N/mm ²	120																																																																																																																																																																																																																																																																																																																																																																																						
Characteristic resistance of FTG		<table border="1"> <thead> <tr> <th>Type of load</th> <th>qk [kN/m]</th> <th>Fk [kN]</th> <th>wk [kN/m²]</th> </tr> </thead> <tbody> <tr> <td>Zone of load</td> <td>a</td> <td>a+b</td> <td>a+b</td> </tr> <tr> <td>Value of load</td> <td>0,8</td> <td>1</td> <td>0,5</td> </tr> <tr> <td>Time of loading</td> <td>300</td> <td>300</td> <td>604800</td> </tr> <tr> <td>Load area A</td> <td>-</td> <td>40000</td> <td>40000</td> </tr> <tr> <td>Modification factor for the load time</td> <td>kmod</td> <td>0,774</td> <td>0,774</td> <td>0,481</td> <td>1,000</td> </tr> <tr> <td>Surface effect factor</td> <td>ka</td> <td>1,0</td> <td>1,076</td> <td>1,076</td> <td>0,939</td> </tr> <tr> <td>Design resistance of FTG</td> <td>fmt.ud</td> <td>N/mm²</td> <td>75,61</td> <td>77,08</td> <td>69,19</td> <td>79,73</td> </tr> <tr> <td>Shear modulus interlayer</td> <td>Gint</td> <td>N/mm²</td> <td>0,53</td> <td>0,53</td> <td>0,11</td> <td>0,96</td> </tr> <tr> <td>Young modulus interlayer</td> <td>Eint</td> <td>N/mm²</td> <td>1,60</td> <td>1,60</td> <td>0,32</td> <td>2,87</td> </tr> <tr> <td>Coupling factor of the interlayer(s) at stress</td> <td>ωσ</td> <td>-</td> <td>0,143</td> <td>0,087</td> <td>0,019</td> <td>0,386</td> </tr> <tr> <td>Coupling factor of the interlayer(s) at deformation</td> <td>ωw</td> <td>-</td> <td>0,339</td> <td>0,239</td> <td>0,059</td> <td>0,382</td> </tr> <tr> <td>Equivalent glass thickness ULS</td> <td>teq.ult</td> <td>mm</td> <td>14,03</td> <td>13,13</td> <td>11,69</td> <td>16,55</td> </tr> <tr> <td>Equivalent glass thickness SLS</td> <td>teq.serv</td> <td>mm</td> <td>14,49</td> <td>13,44</td> <td>10,99</td> <td>14,89</td> </tr> <tr> <td>Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk</td> <td>bcalc</td> <td>mm</td> <td>1000</td> <td>2200</td> <td>2200</td> <td>1000</td> </tr> <tr> <td>Section modulus with equivalent thickness W=b*teq²/6</td> <td>Wel</td> <td>mm³</td> <td>32820</td> <td>63170</td> <td>50124</td> <td>45677</td> </tr> <tr> <td>Bending moment at fixation</td> <td>Med</td> <td>kNm</td> <td>1,440</td> <td>1,650</td> <td>0,825</td> <td>1,080</td> </tr> <tr> <td>Bending tensile stress at ULS</td> <td>σEd.ULS*</td> <td>N/mm²</td> <td>43,88</td> <td>30,04</td> <td>18,93</td> <td>27,19</td> </tr> <tr> <td>Maximum utilization ULS = σEd/fmt.ud</td> <td>utilization</td> <td>-</td> <td>0,58</td> <td>0,39</td> <td>0,27</td> <td>0,34</td> </tr> <tr> <td>Maximum characteristic wind load wk for only wind loads based on ULS glass</td> <td>wk,max.glass</td> <td>kN/m²</td> <td>-</td> <td>-</td> <td>-</td> <td>2,93</td> </tr> <tr> <td>Calculation width glass panel - for Fk based on Mepla calculation</td> <td>bcalc</td> <td>mm</td> <td>1000</td> <td>2200</td> <td>2200</td> <td></td> </tr> <tr> <td>Section modulus with residual check</td> <td>Wel.res</td> <td>mm³</td> <td>27659</td> <td>55464</td> <td>46553</td> <td></td> </tr> <tr> <td>Bending moment at fixation</td> <td>Med.res</td> <td>kNm</td> <td>0,960</td> <td>1,100</td> <td>0,550</td> <td></td> </tr> <tr> <td>Bending tensile stress for qk analytic and for Fk based on Mepla</td> <td>σEd.res</td> <td>N/mm²</td> <td>38,179</td> <td>22,81</td> <td>13,59</td> <td></td> </tr> <tr> <td>Maximum utilization residual capacity based on bcalc</td> <td>utilization</td> <td>-</td> <td>0,50</td> <td>0,30</td> <td>0,20</td> <td></td> </tr> <tr> <td>Deformation glass panel at top</td> <td>δglass.top</td> <td>mm</td> <td>25,98</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Moment of inertia with equivalent thickness teq.serv</td> <td>Ieq.serv</td> <td>mm⁴</td> <td>253384</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Linear profile stiffness</td> <td>kprof</td> <td>(kN/m)/mm</td> <td>19,0</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Characteristic force at top support glass into profile</td> <td>Fp,k</td> <td>kN/m</td> <td>14,51</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Maximum char. force at top support glass/profile at end of linear stiffness</td> <td>Fp,k.max</td> <td>kN/m</td> <td>45,0</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Validation of linear iteration</td> <td>valid</td> <td>-</td> <td>OK</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Deformation top of profile based on numerical simulation of profile</td> <td>δprof</td> <td>mm</td> <td>0,76</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Deformation top of parapet due to profile deformation/rotation - extrapolation</td> <td>δprof.top</td> <td>mm</td> <td>9</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Total deformation at top of parapet = δglass + δprofile</td> <td>δtot.top</td> <td>mm</td> <td>35</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)</td> <td>δmax</td> <td>mm</td> <td>20</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Maximum utilization SLS</td> <td>utilization</td> <td>-</td> <td>1,74</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Calculation width</td> <td>bcalc</td> <td>mm</td> <td>1000</td> <td>2200</td> <td>2200</td> <td>1000</td> </tr> <tr> <td>Design acting force at top support glass into profile based on bmin for Fk</td> <td>Fp.Ed</td> <td>kN/m</td> <td>21,77</td> <td>11,40</td> <td>5,70</td> <td>17,28</td> </tr> <tr> <td>Maximum allowed design acting force based on numerical simulations of profiles</td> <td>Fp.Rd</td> <td>kN/m</td> <td>78,5</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>Maximum utilization aluminium profile for single loads qk and Fk</td> <td>utilization</td> <td>-</td> <td>0,28</td> <td>0,15</td> <td>0,07</td> <td>0,22</td> </tr> <tr> <td>Maximum characteristic wind load wk for only wind loads based on ULS profile</td> <td>wk,max.profile</td> <td>kN/m²</td> <td>-</td> <td>-</td> <td>-</td> <td>4,54</td> </tr> <tr> <td colspan="2">Parapet System</td> <td colspan="5">DF884FR_E200</td> </tr> <tr> <td colspan="2">Total height of the parapet</td> <td>1301</td> <td>mm</td> <td colspan="3"></td> </tr> <tr> <td colspan="2">Glass height</td> <td>1200</td> <td>mm</td> <td colspan="3"></td> </tr> <tr> <td colspan="2">Glass thickness nominal</td> <td>8</td> <td>mm</td> <td colspan="3"></td> </tr> <tr> <td colspan="2">Interlayer</td> <td>PVB</td> <td>-</td> <td colspan="3"></td> </tr> <tr> <td colspan="2">Thickness interlayer</td> <td>1,52</td> <td>mm</td> <td colspan="3"></td> </tr> <tr> <td colspan="2">Load category</td> <td>other</td> <td>-</td> <td colspan="3"></td> </tr> <tr> <td colspan="2">Load</td> <td colspan="5"> <table border="1"> <thead> <tr> <th></th> <th>qk [kN/m]</th> <th>Fk [kN]</th> <th>wk [kN/m²]</th> </tr> </thead> <tbody> <tr> <td>Maximum utilization glass at ULS</td> <td>ut.glass.ULS</td> <td>0,58</td> <td>0,39</td> <td>0,27</td> <td>0,34</td> </tr> <tr> <td>Maximum utilization profile at ULS</td> <td>ut.profile.ULS</td> <td>0,28</td> <td>0,15</td> <td>0,07</td> <td>0,22</td> </tr> <tr> <td>Maximum utilization residual capacity glass for linear load qk</td> <td>ut.residual</td> <td>0,50</td> <td>0,30</td> <td>0,20</td> <td></td> </tr> <tr> <td>Maximum deformation glass at SLS for linear load qk</td> <td>def.glass.SLS</td> <td>26,0</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Maximum deformation glass + profile at SLS for linear load qk</td> <td>def.glass+prof.SLS</td> <td>34,9</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Maximum utilization glass + profile at SLS for linear load qk</td> <td>ut.glass+prof.SLS</td> <td>1,74</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Maximum characteristic wind load wk for only wind loads based on ULS glass + profile</td> <td>wk,max</td> <td>kN/m²</td> <td></td> <td></td> <td>2,93</td> </tr> </tbody> </table> </td> </tr> </tbody> </table>					Type of load	qk [kN/m]	Fk [kN]	wk [kN/m ²]	Zone of load	a	a+b	a+b	Value of load	0,8	1	0,5	Time of loading	300	300	604800	Load area A	-	40000	40000	Modification factor for the load time	kmod	0,774	0,774	0,481	1,000	Surface effect factor	ka	1,0	1,076	1,076	0,939	Design resistance of FTG	fmt.ud	N/mm ²	75,61	77,08	69,19	79,73	Shear modulus interlayer	Gint	N/mm ²	0,53	0,53	0,11	0,96	Young modulus interlayer	Eint	N/mm ²	1,60	1,60	0,32	2,87	Coupling factor of the interlayer(s) at stress	ωσ	-	0,143	0,087	0,019	0,386	Coupling factor of the interlayer(s) at deformation	ωw	-	0,339	0,239	0,059	0,382	Equivalent glass thickness ULS	teq.ult	mm	14,03	13,13	11,69	16,55	Equivalent glass thickness SLS	teq.serv	mm	14,49	13,44	10,99	14,89	Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk	bcalc	mm	1000	2200	2200	1000	Section modulus with equivalent thickness W=b*teq ² /6	Wel	mm ³	32820	63170	50124	45677	Bending moment at fixation	Med	kNm	1,440	1,650	0,825	1,080	Bending tensile stress at ULS	σEd.ULS*	N/mm ²	43,88	30,04	18,93	27,19	Maximum utilization ULS = σEd/fmt.ud	utilization	-	0,58	0,39	0,27	0,34	Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	-	2,93	Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	2200	2200		Section modulus with residual check	Wel.res	mm ³	27659	55464	46553		Bending moment at fixation	Med.res	kNm	0,960	1,100	0,550		Bending tensile stress for qk analytic and for Fk based on Mepla	σEd.res	N/mm ²	38,179	22,81	13,59		Maximum utilization residual capacity based on bcalc	utilization	-	0,50	0,30	0,20		Deformation glass panel at top	δglass.top	mm	25,98				Moment of inertia with equivalent thickness teq.serv	Ieq.serv	mm ⁴	253384				Linear profile stiffness	kprof	(kN/m)/mm	19,0				Characteristic force at top support glass into profile	Fp,k	kN/m	14,51				Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k.max	kN/m	45,0				Validation of linear iteration	valid	-	OK				Deformation top of profile based on numerical simulation of profile	δprof	mm	0,76				Deformation top of parapet due to profile deformation/rotation - extrapolation	δprof.top	mm	9				Total deformation at top of parapet = δglass + δprofile	δtot.top	mm	35				Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δmax	mm	20				Maximum utilization SLS	utilization	-	1,74				Calculation width	bcalc	mm	1000	2200	2200	1000	Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	21,77	11,40	5,70	17,28	Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	78,5	-	-	-	Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,28	0,15	0,07	0,22	Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	-	4,54	Parapet System		DF884FR_E200					Total height of the parapet		1301	mm				Glass height		1200	mm				Glass thickness nominal		8	mm				Interlayer		PVB	-				Thickness interlayer		1,52	mm				Load category		other	-				Load		<table border="1"> <thead> <tr> <th></th> <th>qk [kN/m]</th> <th>Fk [kN]</th> <th>wk [kN/m²]</th> </tr> </thead> <tbody> <tr> <td>Maximum utilization glass at ULS</td> <td>ut.glass.ULS</td> <td>0,58</td> <td>0,39</td> <td>0,27</td> <td>0,34</td> </tr> <tr> <td>Maximum utilization profile at ULS</td> <td>ut.profile.ULS</td> <td>0,28</td> <td>0,15</td> <td>0,07</td> <td>0,22</td> </tr> <tr> <td>Maximum utilization residual capacity glass for linear load qk</td> <td>ut.residual</td> <td>0,50</td> <td>0,30</td> <td>0,20</td> <td></td> </tr> <tr> <td>Maximum deformation glass at SLS for linear load qk</td> <td>def.glass.SLS</td> <td>26,0</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Maximum deformation glass + profile at SLS for linear load qk</td> <td>def.glass+prof.SLS</td> <td>34,9</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Maximum utilization glass + profile at SLS for linear load qk</td> <td>ut.glass+prof.SLS</td> <td>1,74</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Maximum characteristic wind load wk for only wind loads based on ULS glass + profile</td> <td>wk,max</td> <td>kN/m²</td> <td></td> <td></td> <td>2,93</td> </tr> </tbody> </table>						qk [kN/m]	Fk [kN]	wk [kN/m ²]	Maximum utilization glass at ULS	ut.glass.ULS	0,58	0,39	0,27	0,34	Maximum utilization profile at ULS	ut.profile.ULS	0,28	0,15	0,07	0,22	Maximum utilization residual capacity glass for linear load qk	ut.residual	0,50	0,30	0,20		Maximum deformation glass at SLS for linear load qk	def.glass.SLS	26,0				Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	34,9				Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	1,74				Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m ²			2,93
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4.3.2 DF1212... Profiles with 12+12 and 10+10+4

SYSTEM RESISTANCE WITH HANDRAIL

		Profile	DF1212LM_E200			
Parapet System						
Total height of the parapet	Ltot	mm	1301			
Glass length top of parapet until first fixation into profile L1-Ltot-L3-L4	L1	mm	1200			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	12			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	11,7			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	11,7			
Type of interlayer	Interlayer	-	PVB			
Thickness of interlayer	tv.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	2			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	other			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg.k	N/mm ²	45			
Characteristic resistance of FTG	fb.k	N/mm ²	120			
	Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]	
	Zone of load		a	a+b	a+b	
	Value of load		0,8	1	0,5	1
	Time of loading	s	300	300	604800	5
	Load area A	mm ²	-	40000	40000	1200000
Modification factor for the load time	kmod	-	0,774	0,774	0,481	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,939
Design resistance of FTG	f _{mt,ud}	N/mm ²	75,61	77,08	69,19	79,73
Shear modulus interlayer	Gint	N/mm ²	0,53	0,53	0,11	0,96
Young modulus interlayer	Eint	N/mm ²	1,60	1,60	0,32	2,87
Coupling factor of the interlayer(s) at stress	ασ	-	0,180	0,111	0,024	0,453
Coupling factor of the interlayer(s) at deformation	αw	-	0,403	0,292	0,076	0,449
Equivalent glass thickness ULS	teq.ult	mm	18,90	18,13	16,94	21,08
Equivalent glass thickness SLS	teq.serv	mm	19,20	18,18	15,79	19,59
Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk	bcalc	mm	1000	2200	2200	1000
Section moduls with equivalent thickness W=b ² teq ³ /6	Wel	mm ³	59525	120491	105171	74081
Bending moment at fixation	Med	kNm	1,440	1,650	0,825	1,080
Bending tensile stress at ULS	σEd.ULS*	N/mm ²	24,19	15,75	9,02	16,77
Maximum utilization ULS - σEd/f _{mt,ud}	utilization	-	0,32	0,20	0,13	0,21
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m ²	-	-	-	4,76
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	2200	2200	
Section moduls with residual check	Wel.res	mm ³	22815	50193	50193	
Bending moment at fixation	Med.res	kNm	0,960	1,100	0,550	
Bending tensile stress for qk analytic and for Fk based on Mepla	σEd.res	N/mm ²	46,285	25,20	12,60	
Maximum utilization residual capacity based on bcalc	utilization	-	0,61	0,33	0,18	
Deformation glass panel at top	δ _{glass,top}	mm	11,16			
Moment of inertia with equivalent thickness teq.serv	I _{eq.serv}	mm ⁴	589858			
Linear profile stiffness	kprof	(kN/m)/mm	34,5			
Characteristic force at top support glass into profile	Fp.k	kN/m	14,51			
Maximum char. force at top support glass/profile at end of linear stiffness	Fp.k,max	kN/m	35,0			
Validation of linear iteration	valid	-	OK			
Defomation top of profile based on numerical simulation of profile	δ _{prof}	mm	0,42			
Defomation top of parapet due to profile deformation/rotation - extrapolation	δ _{prof,top}	mm	5			
Total deformation at top of parapet = δ _{glass} + δ _{profile}	δ _{tot,top}	mm	16			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δ _{max}	mm	20			
Maximum utilization SLS	utilization	-	0,80			
Calculation width	bcalc	mm	1000	2200	2200	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	21,77	11,40	5,70	17,28
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	68,8	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,32	0,17	0,08	0,25
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m ²	-	-	-	3,98
Parapet System	DF1212LM_E200					
Total height of the parapet	1301	mm				
Glass height	1200	mm				
Glass thickness nominal	12	mm				
Interlayer	PVB	-				
Thickness interlayer	1,52	mm				
Load category	other	-				
			qk [kN/m]	Fk [kN]	wk [kN/m ²]	
	Load		0,8	1	0,5	
	Maximum utilization glass at ULS	ut.glass.ULS	0,32	0,20	0,13	0,21
	Maximum utilization profile at ULS	ut.profile.ULS	0,32	0,17	0,08	0,25
	Maximum utilization residual capacity glas for linear load qk	ut.residual	0,61	0,33	0,18	
	Maximum deformation glass at SLS for linear load qk	def.glass.SLS	11,2			
	Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	16,0			
	Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	0,80			
	Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max				3,98

NOTE: If one resistance check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation. For deformation see comments in report and overview tables

SYSTEM RESISTANCE WITH HANDRAIL

Parapet System		Profile	DF1212FR_E200			
Total height of the parapet		Ltot	mm	1301		
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1200		
Vertical distance between top of profile and top support of glass into profile		L2	mm	11		
Vertical distance between top and bottom support of glass into profile		L3	mm	70		
Vertical distance between bottom support of glass into profile and base ground		L4	mm	31		
Distance between fixations		efix	mm	200		
Nominal glass thickness		tnom	mm	12		
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	11,7		
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	11,7		
Type of interlayer		Interlayer	-	PVB		
Thickness of interlayer		tv.i	mm	1,52		
Number of sheets of glass of laminated plate		ng	-	2		
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30		
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50		
Load category		Cat	-	other		
Consequence class		CC	-	CC2		
Multiplication factor for consequence class		KF1	-	1		
Load safety factor variable loads as basis value		γQ0	-	1,5		
Load safety factor variable loads considering CC		γQ	-	1,5		
Load combination factor for variable life load		ψ0 LL	-	0,6		
Load combination factor for variable wind load		ψ0 Wind	-	0		
Predominant load				Life load		
Material safety factor float glass for predominant load		γm.A	-	1,8		
Material safety factor FTG		γm.V	-	1,2		
Factor for the edge quality of the glass panel		ke	-	1		
Corrosion constant as a function		c	-	16		
Factor for the surface structure of float glass		ksp	-	1		
Factor for the zone for FTG and edge zone		kz	-	0,9		
Characteristic resistance of float glass		fg.k	N/mm ²	45		
Characteristic resistance of FTG		fb.k	N/mm ²	120		
		Type of load		qk [kN/m]	Fk [kN]	wk [kN/m ²]
		Zone of load		a	a	a+b
		Value of load		0,8	1	0,5
		Time of loading	s	300	300	604800
		Load area A	mm ²	-	40000	40000
						1200000
Modification factor for the load time		kmod	-	0,774	0,774	0,481
Surface effect factor		ka	-	1,0	1,076	1,076
Design resistance of FTG		f _{mt.ud}	N/mm ²	75,61	77,08	69,19
Shear modulus interlayer		Gint	N/mm ²	0,53	0,53	0,11
Young modulus interlayer		Eint	N/mm ²	1,60	1,60	0,32
Coupling factor of the interlayer(s) at stress		α _{cr}	-	0,180	0,111	0,024
Coupling factor of the interlayer(s) at deformation		α _w	-	0,403	0,292	0,076
Equivalent glass thickness ULS		teq.ult	mm	18,90	18,13	16,94
Equivalent glass thickness SLS		teq.serv	mm	19,20	18,18	15,79
Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk		bcalc	mm	1000	2200	2200
Section moduli with equivalent thickness W=b ³ teq ² /6		Wel	mm ³	59525	120491	105171
Bending moment at fixation		Med	kNm	1,440	1,650	0,825
Bending tensile stress at ULS		σEd.ULS*	N/mm ²	24,19	15,75	9,02
Maximum utilization ULS = σEd/f _{mt.ud}		utilization	-	0,32	0,20	0,13
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m ²	-	-	4,76
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	2200	2200
Section moduli with residual check		Wel.res	mm ³	22815	50193	50193
Bending moment at fixation		Med.res	kNm	0,960	1,100	0,550
Bending tensile stress for qk analytic and for Fk based on Mepla		σEd.res	N/mm ²	46,285	25,20	12,60
Maximum utilization residual capacity based on bcalc		utilization	-	0,61	0,33	0,18
Deformation glass panel at top		δ _{glass.top}	mm	11,16	-	-
Moment of inertia with equivalent thickness teq.serv		Ieq.serv	mm ⁴	589858	-	-
Linear profile stiffness		kprof	(kN/m)/mm	19,0	-	-
Characteristic force at top support glass into profile		Fp.k	kN/m	14,51	-	-
Maximum char. force at top support glass/profile at end of linear stiffness		Fp.k.max	kN/m	45,0	-	-
Validation of linear iteration		valid	-	OK	-	-
Defomation top of profile based on numerical simulation of profile		δ _{prof}	mm	0,76	-	-
Defomation top of parapet due to profile deformation/rotation - extrapolation		δ _{prof.top}	mm	9	-	-
Total deformation at top of parapet = δ _{glass} + δ _{profile}		δ _{tot.top}	mm	20	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB- A.1.4.3 (7)		δ _{max}	mm	20	-	-
Maximum utilization SLS		utilization	-	1,00	-	-
Calculation width		bcalc	mm	1000	2200	2200
Design acting force at top support glass into profile based on bmin for Fk		Fp.Ed	kN/m	21,77	11,40	5,70
Maximum allowed design acting force based on numerical simulations of profiles		Fp.Rd	kN/m	78,5	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,28	0,15	0,07
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m ²	-	-	4,54
Parapet System		DF1212FR_E200				
Total height of the parapet		1301	mm			
Glass height		1200	mm			
Glass thickness nominal		12	mm			
Interlayer		PVB	-			
Thickness interlayer		1,52	mm			
Load category		other	-			
Load				qk [kN/m]	Fk [kN]	wk [kN/m ²]
Maximum utilization glass at ULS		ut.glass.ULS	-	0,32	0,20	0,13
Maximum utilization profile at ULS		ut.profile.ULS	-	0,28	0,15	0,07
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,61	0,33	0,18
Maximum deformation glass at SLS for linear load qk		def.glass.SLS	mm	11,2	-	-
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	20,0	-	-
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	1,00	-	-
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m ²	-	-	4,54

NOTE: If one resistance check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation. For deformation see comments in report and overview tables

SYSTEM RESISTANCE WITH HANDRAIL

		Profile	DF10104LM_E200			
Parapet System						
Total height of the parapet	Ltot	mm	1101			
Glass height of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1000			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	10			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	3,8			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	9,7			
Type of interlayer	Interlayer	-	SGP			
Thickness of interlayer	tv,i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	3			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	C5			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg,k	N/mm²	45			
Characteristic resistance of FTG	fb,k	N/mm²	120			
Type of load		qk [kN/m]		Fk [kN]		wk [kN/m²]
Zone of load		a	a	a+b	a+b	
Value of load		3	1	0,5	1	
Time of loading	s	300	300	604800	5	
Load area A	mm²	-	40000	40000	1000000	
Modification factor for the load time	kmod	-	0,774	0,774	0,481	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,946
Design resistance of FTG	f _{mt,ud}	N/mm²	75,61	77,08	69,19	79,90
Shear modulus interlayer	Gint	N/mm²	4,65	4,65	1,08	10,00
Young modulus interlayer	Eint	N/mm²	13,87	13,87	3,22	29,80
Coupling factor of the interlayer(s) at stress	ωσ	-	0,472	0,338	0,106	0,789
Coupling factor of the interlayer(s) at deformation	ωw	-	0,713	0,604	0,261	0,781
Equivalent glass thickness ULS	teq,ult	mm	20,70	19,58	16,43	22,44
Equivalent glass thickness SLS	teq,serv	mm	21,14	20,23	16,69	21,66
Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk	bcalc	mm	1000	1800	1800	1000
Section moduls with equivalent thickness W=b*teq²/6	Wel	mm³	71418	114999	81001	83948
Bending moment at fixation	Med	kNm	4,500	1,350	0,675	0,750
Bending tensile stress at ULS	σEd.ULS*	N/mm²	63,01	13,50	9,58	10,27
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	-	0,83	0,18	0,14	0,13
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m²	-	-	-	7,78
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	1800	1800	
Section moduls with residual check	Wel.res	mm³	55874	94373	74631	
Bending moment at fixation	Med.res	kNm	3,000	0,900	0,450	
Bending tensile stress for qk analytic and for Fk based on Mepla	σEd.res	N/mm²	59,062	10,97	6,93	
Maximum utilization residual capacity based on bcalc	utilization	-	0,78	0,14	0,10	
Deformation glass panel at top	δglass.top	mm	18,15			
Moment of inertia with equivalent thickness teq,serv	Ieq,serv	mm⁴	787302			
Linear profile stiffness	kprof	(kN/m)/mm	34,5			
Characteristic force at top support glass into profile	Fp,k	kN/m	45,86			
Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k.max	kN/m	35,0			
Validation of linear iteration	valid	-	NG			
Deformation top of profile based on numerical simulation of profile	δprof	mm	1,33			
Deformation top of parapet due to profile deformation/rotation - extrapolation	δprof.top	mm	13			
Total deformation at top of parapet = δglass + δprof	δtot.top	mm	not valid			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δmax	mm	20			
Maximum utilization SLS	utilization	-	not valid			
Calculation width	bcalc	mm	1000	1800	1800	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp.Ed	kN/m	68,79	11,55	5,77	12,27
Maximum allowed design acting force based on numerical simulations of profiles	Fp.Rd	kN/m	68,8	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	1,00	0,17	0,08	0,18
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m²	-	-	-	5,61
Parapet System						
Total height of the parapet	1101	mm				
Glass height	1000	mm				
Glass thickness nominal	10	mm				
Interlayer	SGP	-				
Thickness interlayer	1,52	mm				
Load category	C5	-				
Load			qk [kN/m]	Fk [kN]		wk [kN/m²]
Maximum utilization glass at ULS	ut.glass.ULS	-	0,83	0,18	0,14	0,13
Maximum utilization profile at ULS	ut.profile.ULS	-	1,00	0,17	0,08	0,18
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,78	0,14	0,10	
Maximum deformation glass at SLS for linear load qk	def.glass.SLS		18,1			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	not valid			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	not valid			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m²				5,61

NOTE: If one resistance check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation. For deformation see comments in report and overview tables

SYSTEM RESISTANCE WITH HANDRAIL

		Profile	DF10104LM_E200				
Parapet System							
Total height of the parapet		Ltot	mm	1101			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1000			
Vertical distance between top of profile and top support of glass into profile		L2	mm	11			
Vertical distance between top and bottom support of glass into profile		L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground		L4	mm	31			
Distance between fixations		efix	mm	200			
Nominal glass thickness		tnom	mm	10			
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	3,8			
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	9,7			
Type of interlayer		Interlayer	-	SGP			
Thickness of interlayer		t.v.i	mm	1,52			
Number of sheets of glass of laminated plate		ng	-	3			
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50			
Load category		Cat	-	other			
Consequence class		CC	-	CC2			
Multiplication factor for consequence class		KF1	-	1			
Load safety factor variable loads as basis value		γQ0	-	1,5			
Load safety factor variable loads considering CC		γQ	-	1,5			
Load combination factor for variable life load		ψ0 LL	-	0,6			
Load combination factor for variable wind load		ψ0 Wind	-	0			
Predominant load				Life load			
Material safety factor float glass for predominant load		γm.A	-	1,8			
Material safety factor FTG		γm.V	-	1,2			
Factor for the edge quality of the glass panel		ke	-	1			
Corrosion constant as a function		c	-	16			
Factor for the surface structure of float glass		ksp	-	1			
Factor for the zone for FTG and edge zone		kz	-	0,9			
Characteristic resistance of float glass		fg,k	N/mm²	45			
Characteristic resistance of FTG		fb,k	N/mm²	120			
		Type of load		qk [kN/m]	Fk [kN]		wk [kN/m²]
		Zone of load		a	a	a+b	a+b
		Value of load		0,8	1	0,5	1
		Time of loading	s	300	300	604800	5
		Load area A	mm²	-	40000	40000	1000000
Modification factor for the load time		kmod	-	0,774	0,774	0,481	1,000
Surface effect factor		ka	-	1,0	1,076	1,076	0,946
Design resistance of FTG		f _{mt,ud}	N/mm²	75,61	77,08	69,19	79,90
Shear modulus interlayer		G _{int}	N/mm²	4,65	4,65	1,08	10,00
Young modulus interlayer		E _{int}	N/mm²	13,87	13,87	3,22	29,80
Coupling factor of the interlayer(s) at stress		ω _σ	-	0,472	0,338	0,106	0,789
Coupling factor of the interlayer(s) at deformation		ω _w	-	0,713	0,604	0,261	0,781
Equivalent glass thickness ULS		t _{eq,ult}	mm	20,70	19,58	16,43	22,44
Equivalent glass thickness SLS		t _{eq,serv}	mm	21,14	20,23	16,69	21,66
Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk		bcalc	mm	1000	1800	1800	1000
Section moduls with equivalent thickness W=b*t _{eq} ²/6		W _{el}	mm³	71418	114999	81001	83948
Bending moment at fixation		Med	kNm	1,200	1,350	0,675	0,750
Bending tensile stress at ULS		σ _{Ed,ULS} *	N/mm²	16,80	13,50	9,58	10,27
Maximum utilization ULS = σ _{Ed} /f _{mt,ud}		utilization	-	0,22	0,18	0,14	0,13
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max, glass	kN/m²	-	-	-	7,78
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	1800	1800	-
Section moduls with residual check		W _{el,res}	mm³	55874	94373	74631	-
Bending moment at fixation		Med,res	kNm	0,800	0,900	0,450	-
Bending tensile stress for qk analytic and for Fk based on Mepla		σ _{Ed,res} *	N/mm²	15,750	10,97	6,93	-
Maximum utilization residual capacity based on bcalc		utilization	-	0,21	0,14	0,10	-
Deformation glass panel at top		δ _{glass,top}	mm	4,84	-	-	-
Moment of inertia with equivalent thickness t _{eq,serv}		I _{eq,serv}	mm⁴	787302	-	-	-
Linear profile stiffness		k _{prof}	(kN/m)/mm	34,5	-	-	-
Characteristic force at top support glass into profile		F _{p,k}	kN/m	12,23	-	-	-
Maximum char. force at top support glass/profile at end of linear stiffness		F _{p,k,max}	kN/m	35,0	-	-	-
Validation of linear iteration		valid	-	OK	-	-	-
Deformation top of profile based on numerical simulation of profile		δ _{prof}	mm	0,35	-	-	-
Deformation top of parapet due to profile deformation/rotation - extrapolation		δ _{prof,top}	mm	3	-	-	-
Total deformation at top of parapet = δ _{glass} + δ _{prof}		δ _{tot,top}	mm	8	-	-	-
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		δ _{max}	mm	20	-	-	-
Maximum utilization SLS		utilization	-	0,42	-	-	-
Calculation width		bcalc	mm	1000	1800	1800	1000
Design acting force at top support glass into profile based on bmin for Fk		F _{p,Ed}	kN/m	18,34	11,55	5,77	12,27
Maximum allowed design acting force based on numerical simulations of profiles		F _{p,Rd}	kN/m	68,8	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,27	0,17	0,08	0,18
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max,profile	kN/m²	-	-	-	5,61
Parapet System		DF10104LM_E200					
Total height of the parapet		1101	mm				
Glass height		1000	mm				
Glass thickness nominal		10	mm				
Interlayer		SGP	-				
Thickness interlayer		1,52	mm				
Load category		other	-				
Load				qk [kN/m]	Fk [kN]		wk [kN/m²]
				0,8	1	0,5	
Maximum utilization glass at ULS		ut.glass.ULS	-	0,22	0,18	0,14	0,13
Maximum utilization profile at ULS		ut.profile.ULS	-	0,27	0,17	0,08	0,18
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,21	0,14	0,10	
Maximum deformation glass at SLS for linear load qk		def.glass.SLS		4,8			
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	8,3			
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,42			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m²				
				5,61			

NOTE: If one resistance check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation. For deformation see comments in report and overview tables

SYSTEM RESISTANCE WITH HANDRAIL

		Profile	DF10104FR_E200			
Parapet System						
Total height of the parapet	Ltot	mm	1201			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4	L1	mm	1100			
Vertical distance between top of profile and top support of glass into profile	L2	mm	11			
Vertical distance between top and bottom support of glass into profile	L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground	L4	mm	31			
Distance between fixations	efix	mm	200			
Nominal glass thickness	tnom	mm	10			
Glass thickness for calculation tp1 for inner plate at loading side	tp1	mm	3,8			
Glass thickness for calculation tp2 for middle and outer plate	tp2	mm	9,7			
Type of interlayer	Interlayer	-	SGP			
Thickness of interlayer	t.v.i	mm	1,52			
Number of sheets of glass of laminated plate	ng	-	3			
Maximum temperature of glass panel at loading for PVB	Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP	Tg.sgp	°C	50			
Load category	Cat	-	C5			
Consequence class	CC	-	CC2			
Multiplication factor for consequence class	KF1	-	1			
Load safety factor variable loads as basis value	γQ0	-	1,5			
Load safety factor variable loads considering CC	γQ	-	1,5			
Load combination factor for variable life load	ψ0 LL	-	0,6			
Load combination factor for variable wind load	ψ0 Wind	-	0			
Predominant load			Life load			
Material safety factor float glass for predominant load	γm.A	-	1,8			
Material safety factor FTG	γm.V	-	1,2			
Factor for the edge quality of the glass panel	ke	-	1			
Corrosion constant as a function	c	-	16			
Factor for the surface structure of float glass	ksp	-	1			
Factor for the zone for FTG and edge zone	kz	-	0,9			
Characteristic resistance of float glass	fg,k	N/mm²	45			
Characteristic resistance of FTG	fb,k	N/mm²	120			
Type of load			qk [kN/m]	Fk [kN]		wk [kN/m²]
Zone of load			a	a	a+b	a+b
Value of load			3	1	0,5	1
Time of loading	s		300	300	604800	5
Load area A	mm²		-	40000	40000	1100000
Modification factor for the load time	kmod	-	0,774	0,774	0,481	1,000
Surface effect factor	ka	-	1,0	1,076	1,076	0,942
Design resistance of FTG	f _{mt,ud}	N/mm²	75,61	77,08	69,19	79,81
Shear modulus interlayer	Gint	N/mm²	4,65	4,65	1,08	10,00
Young modulus interlayer	Eint	N/mm²	13,87	13,87	3,22	29,80
Coupling factor of the interlayer(s) at stress	ωσ	-	0,505	0,369	0,119	0,817
Coupling factor of the interlayer(s) at deformation	ωw	-	0,750	0,647	0,299	0,812
Equivalent glass thickness ULS	teq,ult	mm	20,93	19,86	16,68	22,55
Equivalent glass thickness SLS	teq,serv	mm	21,43	20,60	17,15	21,89
Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk	bcalc	mm	1000	2000	2000	1000
Section moduls with equivalent thickness W=b*teq²/6	Wel	mm³	73029	131512	92719	84780
Bending moment at fixation	Med	kNm	4,950	1,500	0,750	0,908
Bending tensile stress at ULS	σEd,ULS*	N/mm²	67,78	13,12	9,30	12,31
Maximum utilization ULS = σEd/f _{mt,ud}	utilization	-	0,90	0,17	0,13	0,15
Maximum characteristic wind load wk for only wind loads based on ULS glass	wk,max.glass	kN/m²	-	-	-	6,48
Calculation width glass panel - for Fk based on Mepla calculation	bcalc	mm	1000	2000	2000	
Section moduls with residual check	Wel,res	mm³	56557	106649	84780	
Bending moment at fixation	Med,res	kNm	3,300	1,000	0,500	
Bending tensile stress for qk analytic and for Fk based on Mepla	σEd,res	N/mm²	64,183	10,78	6,78	
Maximum utilization residual capacity based on bcalc	utilization	-	0,85	0,14	0,10	
Deformation glass panel at top	δglass,top	mm	23,20			
Moment of inertia with equivalent thickness teq,serv	Ieq,serv	mm⁴	819619			
Linear profile stiffness	kprof	(kN/m)/mm	19,0			
Characteristic force at top support glass into profile	Fp,k	kN/m	50,14			
Maximum char. force at top support glass/profile at end of linear stiffness	Fp,k,max	kN/m	45,0			
Validation of linear iteration	valid	-	NG			
Deformation top of profile based on numerical simulation of profile	δprof	mm	2,64			
Deformation top of parapet due to profile deformation/rotation - extrapolation	δprof,top	mm	28			
Total deformation at top of parapet = δglass + δprof	δtot,top	mm	not valid			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)	δmax	mm	20			
Maximum utilization SLS	utilization	-	not valid			
Calculation width	bcalc	mm	1000	2000	2000	1000
Design acting force at top support glass into profile based on bmin for Fk	Fp,Ed	kN/m	75,21	11,46	5,73	14,67
Maximum allowed design acting force based on numerical simulations of profiles	Fp,Rd	kN/m	78,5	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk	utilization	-	0,96	0,15	0,07	0,19
Maximum characteristic wind load wk for only wind loads based on ULS profile	wk,max.profile	kN/m²	-	-	-	5,35
Parapet System						
Total height of the parapet	1201	mm				
Glass height	1100	mm				
Glass thickness nominal	10	mm				
Interlayer	SGP	-				
Thickness interlayer	1,52	mm				
Load category	C5	-				
Load			qk [kN/m]	Fk [kN]		wk [kN/m²]
			3	1	0,5	
Maximum utilization glass at ULS	ut.glass.ULS	-	0,90	0,17	0,13	0,15
Maximum utilization profile at ULS	ut.profile.ULS	-	0,96	0,15	0,07	0,19
Maximum utilization residual capacity glass for linear load qk	ut.residual	-	0,85	0,14	0,10	
Maximum deformation glass at SLS for linear load qk	def.glass.SLS		23,2			
Maximum deformation glass + profile at SLS for linear load qk	def.glass+prof.SLS	mm	not valid			
Maximum utilization glass + profile at SLS for linear load qk	ut.glass+prof.SLS	-	not valid			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile	wk,max	kN/m²				5,35
NOTE: If one resistance check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation. For deformation see comments in report and overview tables						

SYSTEM RESISTANCE WITH HANDRAIL

		Profile	DF10104FR_E200				
Parapet System							
Total height of the parapet		Ltot	mm	1201			
Glass length top of parapet until first fixation into profile L1=Ltot-L3-L4		L1	mm	1100			
Vertical distance between top of profile and top support of glass into profile		L2	mm	11			
Vertical distance between top and bottom support of glass into profile		L3	mm	70			
Vertical distance between bottom support of glass into profile and base ground		L4	mm	31			
Distance between fixations		efix	mm	200			
Nominal glass thickness		tnom	mm	10			
Glass thickness for calculation tp1 for inner plate at loading side		tp1	mm	3,8			
Glass thickness for calculation tp2 for middle and outer plate		tp2	mm	9,7			
Type of interlayer		Interlayer	-	SGP			
Thickness of interlayer		ti	mm	1,52			
Number of sheets of glass of laminated plate		ng	-	3			
Maximum temperature of glass panel at loading for PVB		Tg.pvb	°C	30			
Maximum temperature of glass panel at loading for SGP		Tg.sgp	°C	50			
Load category		Cat	-	other			
Consequence class		CC	-	CC2			
Multiplication factor for consequence class		KF1	-	1			
Load safety factor variable loads as basis value		γQ0	-	1,5			
Load safety factor variable loads considering CC		γQ	-	1,5			
Load combination factor for variable life load		ψ0 LL	-	0,6			
Load combination factor for variable wind load		ψ0 Wind	-	0			
Predominant load				Life load			
Material safety factor float glass for predominant load		γm.A	-	1,8			
Material safety factor FTG		γm.V	-	1,2			
Factor for the edge quality of the glass panel		ke	-	1			
Corrosion constant as a function		c	-	16			
Factor for the surface structure of float glass		ksp	-	1			
Factor for the zone for FTG and edge zone		kz	-	0,9			
Characteristic resistance of float glass		fg,k	N/mm²	45			
Characteristic resistance of FTG		fb,k	N/mm²	120			
		Type of load		qk [kN/m]	Fk [kN]		wk [kN/m²]
		Zone of load		a	a+b	a+b	a+b
		Value of load		0,8	1	0,5	1
		Time of loading	s	300	300	604800	5
		Load area A	mm²	-	40000	40000	1100000
Modification factor for the load time		kmod	-	0,774	0,774	0,481	1,000
Surface effect factor		ka	-	1,0	1,076	1,076	0,942
Design resistance of FTG		f _{mt,ud}	N/mm²	75,61	77,08	69,19	79,81
Shear modulus interlayer		G _{int}	N/mm²	4,65	4,65	1,08	10,00
Young modulus interlayer		E _{int}	N/mm²	13,87	13,87	3,22	29,80
Coupling factor of the interlayer(s) at stress		ω _σ	-	0,505	0,369	0,119	0,817
Coupling factor of the interlayer(s) at deformation		ω _w	-	0,750	0,647	0,299	0,812
Equivalent glass thickness ULS		teq.ult	mm	20,93	19,86	16,68	22,55
Equivalent glass thickness SLS		teq.serv	mm	21,43	20,60	17,15	21,89
Calculation width glass panel, with 1m for qk and wk and with symmetric 45° distribution for Fk		bcalc	mm	1000	2000	2000	1000
Section moduls with equivalent thickness W=b*teq²/6		Wel	mm³	73029	131512	92719	84780
Bending moment at fixation		Med	kNm	1,320	1,500	0,750	0,908
Bending tensile stress at ULS		σEd.ULS*	N/mm²	18,07	13,12	9,30	12,31
Maximum utilization ULS = σEd/f _{mt,ud}		utilization	-	0,24	0,17	0,13	0,15
Maximum characteristic wind load wk for only wind loads based on ULS glass		wk,max.glass	kN/m²	-	-	-	6,48
Calculation width glass panel - for Fk based on Mepla calculation		bcalc	mm	1000	2000	2000	
Section moduls with residual check		Wel.res	mm³	56557	106649	84780	
Bending moment at fixation		Med.res	kNm	0,880	1,000	0,500	
Bending tensile stress for qk analytic and for Fk based on Mepla		σEd.res	N/mm²	17,115	10,78	6,78	
Maximum utilization residual capacity based on bcalc		utilization	-	0,23	0,14	0,10	
Deformation glass panel at top		δ _{glass,top}	mm	6,19			
Moment of inertia with equivalent thickness teq.serv		I _{eq.serv}	mm⁴	819619			
Linear profile stiffness		k _{prof}	(kN/m)/mm	19,0			
Characteristic force at top support glass into profile		Fp,k	kN/m	13,37			
Maximum char. force at top support glass/profile at end of linear stiffness		Fp,k,max	kN/m	45,0			
Validation of linear iteration		valid	-	OK			
Deformation top of profile based on numerical simulation of profile		δ _{prof}	mm	0,70			
Deformation top of parapet due to profile deformation/rotation - extrapolation		δ _{prof,top}	mm	8			
Total deformation at top of parapet = δ _{glass} + δ _{prof}		δ _{tot,top}	mm	14			
Maximum allowed deformation of parapet acc. to NEN-EN 1990-NB-A.1.4.3 (7)		δ _{max}	mm	20			
Maximum utilization SLS		utilization	-	0,69			
Calculation width		bcalc	mm	1000	2000	2000	1000
Design acting force at top support glass into profile based on bmin for Fk		Fp,Ed	kN/m	20,06	11,46	5,73	14,67
Maximum allowed design acting force based on numerical simulations of profiles		Fp,Rd	kN/m	78,5	-	-	-
Maximum utilization aluminium profile for single loads qk and Fk		utilization	-	0,26	0,15	0,07	0,19
Maximum characteristic wind load wk for only wind loads based on ULS profile		wk,max.profile	kN/m²	-	-	-	5,35
Parapet System		DF10104FR_E200					
Total height of the parapet		1201	mm				
Glass height		1100	mm				
Glass thickness nominal		10	mm				
Interlayer		SGP	-				
Thickness interlayer		1,52	mm				
Load category		other	-				
Load				qk [kN/m]	Fk [kN]		wk [kN/m²]
				0,8	1	0,5	
Maximum utilization glass at ULS		ut.glass.ULS	-	0,24	0,17	0,13	0,15
Maximum utilization profile at ULS		ut.profile.ULS	-	0,26	0,15	0,07	0,19
Maximum utilization residual capacity glass for linear load qk		ut.residual	-	0,23	0,14	0,10	
Maximum deformation glass at SLS for linear load qk		def.glass.SLS		6,2			
Maximum deformation glass + profile at SLS for linear load qk		def.glass+prof.SLS	mm	13,7			
Maximum utilization glass + profile at SLS for linear load qk		ut.glass+prof.SLS	-	0,69			
Maximum characteristic wind load wk for only wind loads based on ULS glass + profile		wk,max	kN/m²	5,35			

NOTE: If one resistance check in the table is not valid (red color), the entire glass system is not valid for the considered installation situation. For deformation see comments in report and overview tables

4.4 Residual capacity check - minimum plate width - no handrail

Following the results of the residual capacity check for a parapet with no handrail based on the requirements and information provided in chapter 1.3.5. are shown.

Thereby for the laminated glass panels with 2 glass sheets just one single unbroken plate is considered while for the glass panels with 3 glass sheets the glass sheet on the impact side is considered to be broken and therefore the calculation carried considering the two remaining glass sheets as a composite glass.

Attention: For the triple 4.8.8 and 4.10.10 glass compositions, the 4mm plate must be always placed at the attack side (higher side of the height difference) and is the plate which is broken. Furthermore, only application with stiffer SGP-interlayer is allowed.

Minimum plate width for residual capacity Fk zone a : L1=900mm					
Load category		A1	A2	C5	other
Load [kN]		0,5	1,0	1,0	1,0
time [sec]		60	60	300	300
Glass composition	Glass composition residual calc.	bmin mm	bmin mm	bmin mm	bmin mm
8+8	8	670			
10+10	10	370	1300	1550	1550
12+12	12	250	540	560	560
8+8+4*	8+8	200	290	300	300
10+10+4*	10+10	200	200	200	200

*only with SGP and maximum glass temperature =50°C

*4 mm glass plate must be on attack side (higher side of the height difference) and is considered to be the broken plate

Minimum plate width for residual capacity Fk zone a : L1=1000mm					
Load category		A1	A2	C5	other
Load [kN]		0,5	1,0	1,0	1,0
time [sec]		60	60	300	300
Glass composition	Glass composition residual calc.	bmin mm	bmin mm	bmin mm	bmin mm
8+8	8	800			
10+10	10	410	1600		
12+12	12	280	620	640	640
8+8+4*	8+8	200	320	330	330
10+10+4*	10+10	200	210	210	210

*only with SGP and maximum glass temperature =50° C

*4 mm glass plate must be on attack side (higher side of the height difference) and is considered to be the broken plate

Minimum plate width for residual capacity Fk zone a : L1=1100mm					
Load category		A1	A2	C5	other
Load [kN]		0,5	1,0	1,0	1,0
time [sec]		60	60	300	300
Glass composition	Glass composition residual calc.	bmin mm	bmin mm	bmin mm	bmin mm
8+8	8	880			
10+10	10	470			
12+12	12	315	700	720	720
8+8+4*	8+8	200	360	370	370
10+10+4*	10+10	200	230	230	230

*only with SGP and maximum glass temperature =50° C

*4 mm glass plate must be on attack side (higher side of the height difference) and is considered to be the broken plate

Minimum plate width for residual capacity Fk zone a : L1=1200mm					
Load category		A1	A2	C5	other
Load [kN]		0,5	1,0	1,0	1,0
time [sec]		60	60	300	300
Glass composition	Glass composition residual calc.	bmin mm	bmin mm	bmin mm	bmin mm
8+8	8	980			
10+10	10	520			
12+12	12	350	770	810	810
8+8+4*	8+8	200	390	400	400
10+10+4*	10+10	200	250	250	250

*only with SGP and maximum glass temperature =50° C

*4 mm glass plate must be on attack side (higher side of the height difference) and is considered to be the broken plate

5 Glass and aluminium profile summary results

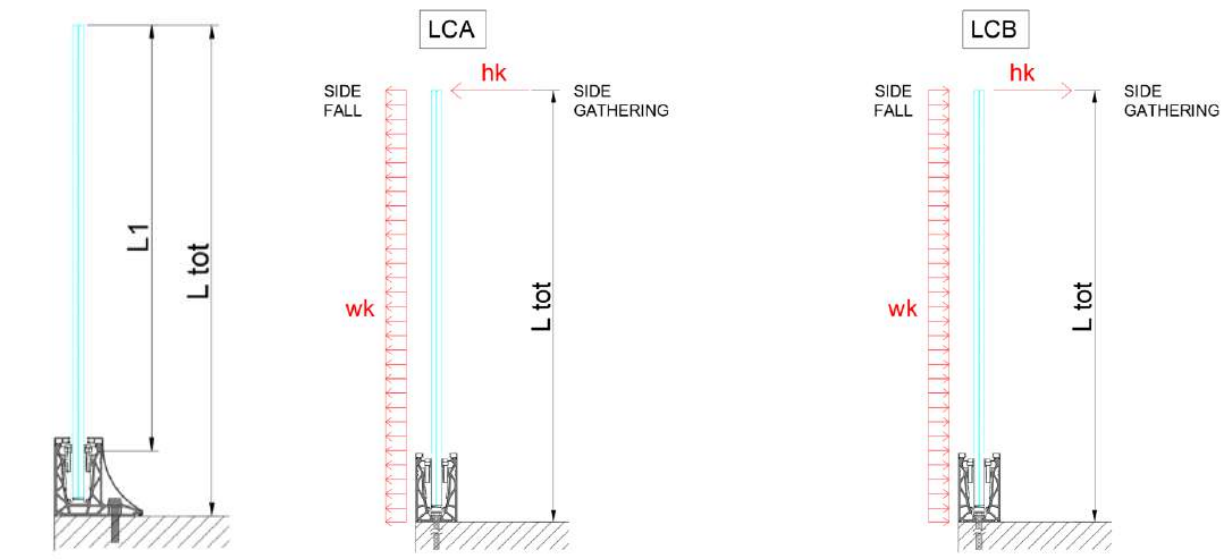
5.1 General notes

In the following overview tables at chapter 5.2 and 5.3, the possible application of Defender Logli glass parapet systems for different glass heights L_1 and load categories are listed, showing the allowed glass compositions, base profiles, fixing distances E and maximum deformations. Thereby the tables are provided for application with and without constructive handrail.

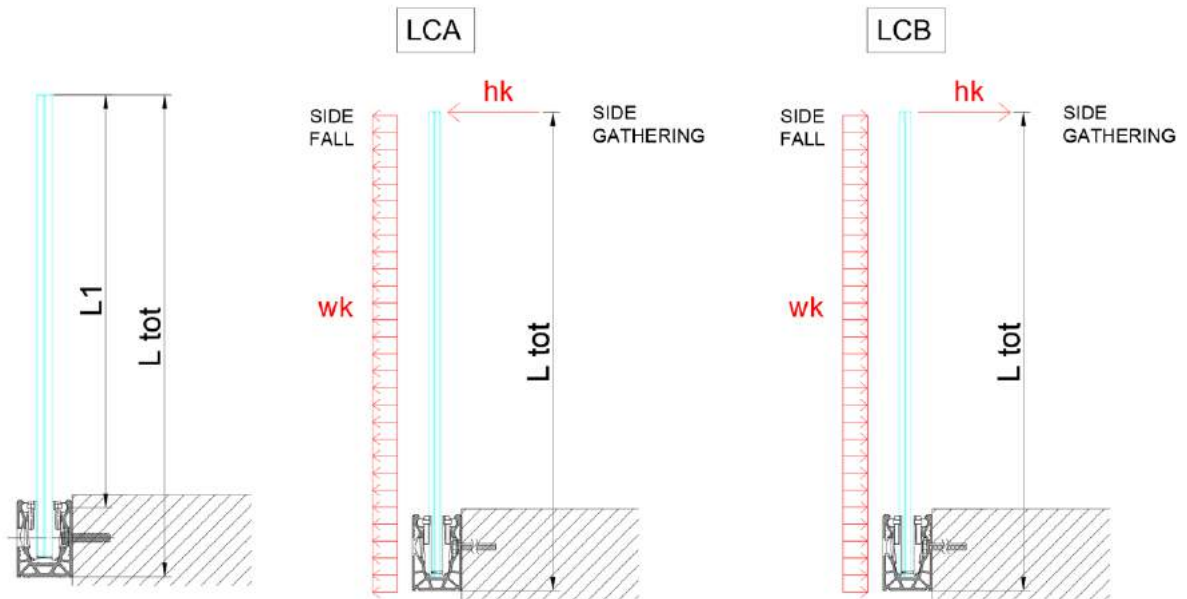
The tables in chapter 5.2 and 5.3 are for life load only, in chapter 5.4 equivalent wind loads (for wind only) are provided. An eventual combination of life-load and wind load must be done by the responsible technician based on National and European combination rules.

For geometry of profiles, assembly and setup drawings and other general parapet information see chapter 1 or contact directly Logli company.

The reference heights L_1 =free bending glass length and L_{tot} = total parapet height used in this entire document and therefore also in the following overview tables overview are shown in the figure below. They are valid for all the profiles fixed to the top of the slab: DF88DK, DF88PICO, DF88LM, DF1010LM, DF1212LM



For the profiles which are fixed onto the front side, the reference height is as shown below and valid for DF88FR, DF1010FR, DF1212FR:



5.2 Application Defender Logli without handrail - LCA

Glass resistance for panels without handrail: L1=900mm										
Type of profile with distance fixation	Load category		A1		A2		other		C5	
	Load		0,3 kN/m / 0.5 kN		0,5 kN/m / 1.0 kN		0,8 kN/m / 1.0 kN		3,0 kN/m / 1.0 kN	
	Ltot [mm]	Glass composition	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]
DF88DK_E200	1000	8+8 FTG with PVB	670	7,2						
		8+8 FTG with SGP	670	5,2						
DF88DK_E400	1000	8+8 FTG with PVB	670	7,5						
		8+8 FTG with SGP	670	5,4						
DF88LM_E200	1000	8+8 FTG with PVB	670	7,6						
		8+8 FTG with SGP	670	5,5						
DF88LM_E400	1000	8+8 FTG with PVB	670	8,6						
		8+8 FTG with SGP	670	6,5						
DF88FR_E200	1000	8+8 FTG with PVB	670	8,2						
		8+8 FTG with SGP	670	6,2						
DF88FR_E400	1000	8+8 FTG with PVB	670	9,9						
		8+8 FTG with SGP	670	7,8						
DF88PICO_E125	966	8+8 FTG with PVB	670	7,8						
		8+8 FTG with SGP	670	5,7						
DF88PICO_E250	966	8+8 FTG with PVB	670	9,7						
		8+8 FTG with SGP	670	7,6						
DF1010LM_E200	1000	10+10 FTG with PVB	370	4,2	1300	7,0	1550	12,2		
		10+10 FTG with SGP	370	3,0	1300	5,0	1550	8,2		
		8+8+4 FTG with SGP *	200	3,2	370	5,4	410	9,1		
DF1010FR_E200	1000	10+10 FTG with PVB	370	5,1	1300	8,5	1550	14,6		
		10+10 FTG with SGP	370	3,9	1300	6,5	1550	10,6		
		8+8+4 FTG with SGP *	200	4,1	370	6,9	410	11,4		
DF12120LM_E200	1000	12+12 FTG with PVB	250	3,0	540	5,0	560	8,5		
		12+12 FTG with SGP	250	2,2	540	3,7	560	6,0		
		10+10+4 FTG with SGP *	200	2,3	280	3,9	290	6,6	290	6,6
DF1212FR_E200	1000	12+12 FTG with PVB	250	3,9	540	6,4	560	10,9		
		12+12 FTG with SGP	250	3,1	540	5,1	560	8,4		
		10+10+4 FTG with SGP *	200	3,2	260	5,4	290	8,9	290	8,9

General notes:

Results valid for RS < 70 and CC2 according to NEN-EN 1990 and NEN 2608-2014

L1 is the free glass length from top of parapet until first fixation line into profile

Ltot is the total parapet height - see figures of different profile types

Valid for both 0.76mm and 1.52mm interlayer thicknesses

PVB-interlayer for maximum glass temperature at loading of 30°C

SGP-interlayer for maximum glass temperature at loading of 50°C

Def tot = deformation glass + deformation profile

* The 4 mm glass plate must be on gathering side (higher side of height difference) and is the plate which is considered to be broken at residual capacity check,

* Triple glasses with SGP interlayer only, Heat-soak-tested for FTG required

** Deformation for C5 as for cat. with 0.8 kN/m

Glass resistance for panels without handrail: L1=1000mm										
Type of profile with distance fixation	Load category		A1		A2		other		C5	
	Load		0,3 kN/m / 0.5 kN		0,5 kN/m / 1.0 kN		0,8 kN/m / 1.0 kN		3,0 kN/m / 1.0 kN	
	Ltot [mm]	Glass composition	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]
DF88DK_E200	1100	8+8 FTG with PVB	800	9,2						
		8+8 FTG with SGP	800	6,8						
DF88DK_E400	1100	8+8 FTG with PVB	800	9,5						
		8+8 FTG with SGP	800	7,1						
DF88LM_E200	1100	8+8 FTG with PVB	800	9,6						
		8+8 FTG with SGP	800	7,2						
DF88LM_E400	1100	8+8 FTG with PVB	800	10,9						
		8+8 FTG with SGP	800	8,4						
DF88FR_E200	1100	8+8 FTG with PVB	800	10,4						
		8+8 FTG with SGP	800	8,0						
DF88FR_E400	1100	8+8 FTG with PVB	800	12,4						
		8+8 FTG with SGP	800	10,0						
DF88PICO_E125	1066	8+8 FTG with PVB	800	9,9						
		8+8 FTG with SGP	800	7,5						
DF88PICO_E250	1066	8+8 FTG with PVB	800	12,2						
		8+8 FTG with SGP	800	9,8						
DF1010LM_E200	1100	10+10 FTG with PVB	410	5,3	1600	8,9				
		10+10 FTG with SGP	410	3,9	1600	6,5				
		8+8+4 FTG with SGP *	200	4,2	400	6,9	440	11,6		
DF1010FR_E200	1100	10+10 FTG with PVB	410	6,4	1600	10,7				
		10+10 FTG with SGP	410	5,0	1600	8,3				
		8+8+4 FTG with SGP *	200	5,2	400	8,7	440	14,5		
DF12120LM_E200	1100	12+12 FTG with PVB	280	3,7	620	6,2	640	10,8		
		12+12 FTG with SGP	280	2,8	620	4,7	640	7,7		
		10+10+4 FTG with SGP *	200	3,0	310	5,0	320	8,3	320	8,3
DF1212FR_E200	1100	12+12 FTG with PVB	280	4,8	620	8,0	640	13,6		
		12+12 FTG with SGP	280	3,9	620	6,4	640	10,5		
		10+10+4 FTG with SGP *	200	4,0	290	6,7	320	11,2	320	11,2

General notes:

Results valid for RS < 70 and CC2 according to NEN-EN 1990 and NEN 2608-2014

L1 is the free glass length from top of parapet until first fixation line into profile

Ltot is the total parapet height - see figures of different profile types

Valid for both 0.76mm and 1.52mm interlayer thicknesses

PVB-interlayer for maximum glass temperature at loading of 30 °C

SGP-interlayer for maximum glass temperature at loading of 50 °C

Def tot = deformation glass + deformation profile

* The 4 mm glass plate must be on gathering side (higher side of height difference) and is the plate which is considered to be broken at residual capacity check,

* Triple glasses with SGP interlayer only, Heat-soak-tested for FTG required

** Deformation for C5 as for cat. with 0.8 kN/m

Glas resistance for panels without handrail: L1=1100mm

Type of profile with distance fixation	Load category		A1		A2		other		C5	
	Ltot [mm]	Load	0,3 kN/m / 0.5 kN		0,5 kN/m / 1.0 kN		0,8 kN/m / 1.0 kN		3,0 kN/m / 1.0 kN	
			bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]
DF88DK_E200	1200	8+8 FTG with PVB	880	11,5						
		8+8 FTG with SGP	880	8,7						
DF88DK_E400	1200	8+8 FTG with PVB	880	11,9						
		8+8 FTG with SGP	880	9,1						
DF88LM_E200	1200	8+8 FTG with PVB	880	12,0						
		8+8 FTG with SGP	880	9,2						
DF88LM_E400	1200	8+8 FTG with PVB	880	13,5						
		8+8 FTG with SGP	880	10,7						
DF88FR_E200	1200	8+8 FTG with PVB	880	12,9						
		8+8 FTG with SGP	880	10,1						
DF88FR_E400	1200	8+8 FTG with PVB	880	15,3						
		8+8 FTG with SGP	880	12,6						
DF88PICO_E125	1166	8+8 FTG with PVB	880	12,3						
		8+8 FTG with SGP	880	9,6						
DF88PICO_E250	1166	8+8 FTG with PVB	880	15,1						
		8+8 FTG with SGP	880	12,4						
DF1010LM_E200	1200	10+10 FTG with PVB	470	6,6						
		10+10 FTG with SGP	470	4,9						
		8+8+4 FTG with SGP *	220	5,3	430	8,8	480	14,6		
DF1010FR_E200	1200	10+10 FTG with PVB	470	7,9						
		10+10 FTG with SGP	470	6,2						
		8+8+4 FTG with SGP *	220	6,5	430	10,9	480	18,0		
DF12120LM_E200	1200	12+12 FTG with PVB	320	4,6	700	7,7	720	13,2		
		12+12 FTG with SGP	320	3,5	700	5,9	720	9,6		
		10+10+4 FTG with SGP *	200	3,7	340	6,2	350	10,3		
DF1212FR_E200	1200	12+12 FTG with PVB	320	5,9	700	9,8	720	16,6		
		12+12 FTG with SGP	320	4,8	700	8,0	720	13,0		
		10+10+4 FTG with SGP *	200	5,0	310	8,3	340	13,7	340	13,7

General notes:

Results valid for RS < 70 and CC2 according to NEN-EN 1990 and NEN 2608-2014

L1 is the free glass length from top of parapet until first fixation line into profile

Ltot is the total parapet height - see figures of different profile types

Valid for both 0.76mm and 1.52mm interlayer thicknesses

PVB-interlayer for maximum glass temperature at loading of 30 °C

SGP-interlayer for maximum glass temperature at loading of 50 °C

Def tot = deformation glass + deformation profile

* The 4 mm glass plate must be on gathering side (higher side of height difference) and is the plate which is considered to be broken at residual capacity check,

* Triple glasses with SGP interlayer only, Heat-soak-tested for FTG required

** Deformation for C5 as for cat. with 0.8 kN/m

Glas resistance for panels without handrail: L1=1200mm

Type of profile with distance fixation	Load category		A1		A2		other		C5	
	Load		0,3 kN/m / 0.5 kN		0,5 kN/m / 1.0 kN		0,8 kN/m / 1.0 kN		3,0 kN/m / 1.0 kN	
	Ltot [mm]	Glass composition	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]
DF88DK_E200	1300	8+8 FTG with PVB	980	14,1						
		8+8 FTG with SGP	980	11,0						
DF88DK_E400	1300	8+8 FTG with PVB	980	14,5						
		8+8 FTG with SGP	980	11,4						
DF88LM_E200	1300	8+8 FTG with PVB	980	14,7						
		8+8 FTG with SGP	980	11,5						
DF88LM_E400	1300	8+8 FTG with PVB	980	16,4						
		8+8 FTG with SGP	980	13,3						
DF88FR_E200	1300	8+8 FTG with PVB	980	15,8						
		8+8 FTG with SGP	980	12,7						
DF88FR_E400	1300	8+8 FTG with PVB	980	18,7						
		8+8 FTG with SGP	980	15,5						
DF88PICO_E125	1266	8+8 FTG with PVB	980	15,1						
		8+8 FTG with SGP	980	12,0						
DF88PICO_E250	1266	8+8 FTG with PVB	980	18,4						
		8+8 FTG with SGP	980	15,3						
DF1010LM_E200	1300	10+10 FTG with PVB	520	8,1						
		10+10 FTG with SGP	520	6,2						
		8+8+4 FTG with SGP *	240	6,6	470	10,9	510	18,1		
DF1010FR_E200	1300	10+10 FTG with PVB	520	9,6						
		10+10 FTG with SGP	520	7,7						
		8+8+4 FTG with SGP *	240	8,0	470	13,4	510	20,0		
DF12120LM_E200	1300	12+12 FTG with PVB	350	5,6	770	9,3	810	16,0		
		12+12 FTG with SGP	350	4,3	770	7,2	810	11,8		
		10+10+4 FTG with SGP *	200	4,6	370	7,6	370	12,7		
DF1212FR_E200	1300	12+12 FTG with PVB	350	7,1	770	11,8	810	20,0		
		12+12 FTG with SGP	350	5,8	770	9,7	810	15,8		
		10+10+4 FTG with SGP *	200	6,1	340	10,1	370	16,6		

General notes:

Results valid for RS < 70 and CC2 according to NEN-EN 1990 and NEN 2608-2014

L1 is the free glass length from top of parapet until first fixation line into profile

Ltot is the total parapet height - see figures of different profile types

Valid for both 0.76mm and 1.52mm interlayer thicknesses

PVB-interlayer for maximum glass temperature at loading of 30°C

SGP-interlayer for maximum glass temperature at loading of 50°C

Def tot = deformation glass + deformation profile

* The 4 mm glass plate must be on gathering side (higher side of height difference) and is the plate which is considered to be broken at residual capacity check,

* Triple glasses with SGP interlayer only, Heat-soak-tested for FTG required

** Deformation for C5 as for cat. with 0.8 kN/m

5.3 Application Defender Logli with handrail - LCA

Glass resistance for panels with constructive continuous handrail: L1=900mm										
Type of profile with distance fixation	Load category		A1		A2		other		C5	
	Load		0,3 kN/m / 0.5 kN		0,5 kN/m / 1.0 kN		0,8 kN/m / 1.0 kN		3,0 kN/m / 1.0 kN	
	Ltot [mm]	Glass composition	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]
DF88DK_E200	1000	8+8 FTG with PVB	-	7,2	-	12,0				
		8+8 FTG with SGP	-	5,2	-	8,6				
DF88DK_E400	1000	8+8 FTG with PVB	-	7,5	-	12,5				
		8+8 FTG with SGP	-	5,4	-	6,3				
DF88LM_E200	1000	8+8 FTG with PVB	-	7,6	-	12,6				
		8+8 FTG with SGP	-	5,5	-	9,2				
DF88LM_E400	1000	8+8 FTG with PVB	-	8,6	-	14,3				
		8+8 FTG with SGP	-	6,5	-	10,9				
DF88FR_E200	1000	8+8 FTG with PVB	-	8,2	-	13,7				
		8+8 FTG with SGP	-	6,2	-	10,3				
DF88FR_E400	1000	8+8 FTG with PVB	-	9,9	-	16,5				
		8+8 FTG with SGP	-	7,8	-	13,1				
DF88PICO_E125	966	8+8 FTG with PVB	-	7,8	-	13,0				
		8+8 FTG with SGP	-	5,7	-	9,6				
DF88PICO_E250	966	8+8 FTG with PVB	-	9,7	-	16,2				
		8+8 FTG with SGP	-	7,6	-	12,7				
DF1010LM_E200	1000	10+10 FTG with PVB	-	4,2	-	7,0	-	12,2		
		10+10 FTG with SGP	-	3,0	-	5,0	-	8,2		
		8+8+4 FTG with SGP *	-	3,2	-	5,4	-	9,1		
DF1010FR_E200	1000	10+10 FTG with PVB	-	5,1	-	8,5	-	14,6		
		10+10 FTG with SGP	-	3,9	-	6,5	-	10,6		
		8+8+4 FTG with SGP *	-	4,1	-	6,9	-	11,4		
DF12120LM_E200	1000	12+12 FTG with PVB	-	3,0	-	5,0	-	8,5		
		12+12 FTG with SGP	-	2,2	-	3,7	-	6,0		
		10+10+4 FTG with SGP *	-	2,3	-	3,9	-	6,6	-	6,6
DF1212FR_E200	1000	12+12 FTG with PVB	-	3,9	-	6,4	-	10,9		
		12+12 FTG with SGP	-	3,1	-	5,1	-	8,4		
		10+10+4 FTG with SGP *	-	3,2	-	5,4	-	8,9	-	8,9

General notes:

Results valid for RS < 70 and CC2 according to NEN-EN 1990 and NEN 2608-2014

L1 is the free glass length from top of parapet until first fixation line into profile

Ltot is the total parapet height - see figures of different profile types

Valid for both 0.76mm and 1.52mm interlayer thicknesses

PVB-interlayer for maximum glass temperature at loading of 30 °C

SGP-interlayer for maximum glass temperature at loading of 50 °C

Def tot = deformation glass + deformation profile

* The 4 mm glass plate must be on gathering side (higher side of height difference) and is the plate which is considered to be broken at residual capacity check,

* Triple glasses with SGP interlayer only, Heat-soak-tested for FTG required

** Deformation for C5 as for cat. with 0.8 kN/m

- With usage of continuous constructive handrail, which covers and protects top border of glass panel, no minimum plate thickness must be considered

Glass resistance for panels with constructive continuous handrail: L1=1000mm

Type of profile with distance fixation	Load category		A1		A2		other		C5	
	Load		0,3 kN/m / 0.5 kN		0,5 kN/m / 1.0 kN		0,8 kN/m / 1.0 kN		3,0 kN/m / 1.0 kN	
	Ltot [mm]	Glass composition	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]
DF88DK_E200	1100	8+8 FTG with PVB	-	9,2	-	15,3				
		8+8 FTG with SGP	-	6,8	-	11,3				
DF88DK_E400	1100	8+8 FTG with PVB	-	9,5	-	15,0				
		8+8 FTG with SGP	-	7,1	-	11,8				
DF88LM_E200	1100	8+8 FTG with PVB	-	9,6	-	16,0				
		8+8 FTG with SGP	-	7,2	-	12,0				
DF88LM_E400	1100	8+8 FTG with PVB	-	10,9	-	18,1				
		8+8 FTG with SGP	-	8,4	-	14,1				
DF88FR_E200	1100	8+8 FTG with PVB	-	10,4	-	17,3				
		8+8 FTG with SGP	-	8,0	-	13,3				
DF88FR_E400	1100	8+8 FTG with PVB	-	12,4	-	19,3				
		8+8 FTG with SGP	-	10,0	-	16,7				
DF88PICO_E125	1066	8+8 FTG with PVB	-	9,9	-	16,5				
		8+8 FTG with SGP	-	7,5	-	12,5				
DF88PICO_E250	1066	8+8 FTG with PVB	-	12,2	-	19,0				
		8+8 FTG with SGP	-	9,8	-	16,4				
DF1010LM_E200	1100	10+10 FTG with PVB	-	5,3	-	8,9	-	15,5		
		10+10 FTG with SGP	-	3,9	-	6,5	-	10,6		
		8+8+4 FTG with SGP *	-	4,2	-	6,9	-	11,6		
DF1010FR_E200	1100	10+10 FTG with PVB	-	6,4	-	10,7	-	18,3		
		10+10 FTG with SGP	-	5,0	-	8,3	-	13,5		
		8+8+4 FTG with SGP *	-	5,2	-	8,7	-	14,5		
DF12120LM_E200	1100	12+12 FTG with PVB	-	3,7	-	6,2	-	10,8		
		12+12 FTG with SGP	-	2,8	-	4,7	-	7,7		
		10+10+4 FTG with SGP *	-	3,0	-	5,0	-	8,3	-	8,3
DF1212FR_E200	1100	12+12 FTG with PVB	-	4,8	-	8,0	-	13,6		
		12+12 FTG with SGP	-	3,9	-	6,4	-	10,5		
		10+10+4 FTG with SGP *	-	4,0	-	6,7	-	11,2	-	11,2

General notes:

Results valid for RS < 70 and CC2 according to NEN-EN 1990 and NEN 2608-2014

L1 is the free glass length from top of parapet until first fixation line into profile

Ltot is the total parapet height - see figures of different profile types

Valid for both 0.76mm and 1.52mm interlayer thicknesses

PVB-interlayer for maximum glass temperature at loading of 30 °C

SGP-interlayer for maximum glass temperature at loading of 50 °C

Def tot = deformation glass + deformation profile

* The 4 mm glass plate must be on gathering side (higher side of height difference) and is the plate which is considered to be broken at residual capacity check,

* Triple glasses with SGP interlayer only, Heat-soak-tested for FTG required

** Deformation for C5 as for cat. with 0.8 kN/m

- With usage of continuous constructive handrail, which covers and protects top border of glass panel, no minimum plate thickness must be considered

Glass resistance for panels with constructive continuous handrail: L1=1100mm

Type of profile with distance fixation	Load category		A1		A2		other		C5	
	Ltot [mm]	Load	0,3 kN/m / 0.5 kN		0,5 kN/m / 1.0 kN		0,8 kN/m / 1.0 kN		3,0 kN/m / 1.0 kN	
			Glass composition	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]
DF88DK_E200	1200	8+8 FTG with PVB	-	11,5	-	19,1				
		8+8 FTG with SGP	-	8,7	-	14,5				
DF88DK_E400	1200	8+8 FTG with PVB	-	11,9	-	19,8				
		8+8 FTG with SGP	-	9,1	-	15,1				
DF88LM_E200	1200	8+8 FTG with PVB	-	12,0	-	20,0				
		8+8 FTG with SGP	-	9,2	-	15,3				
DF88LM_E400	1200	8+8 FTG with PVB	-	13,5	-	22,4				
		8+8 FTG with SGP	-	10,7	-	17,8				
DF88FR_E200	1200	8+8 FTG with PVB	-	12,9	-	19,6				
		8+8 FTG with SGP	-	10,1	-	15,1				
DF88FR_E400	1200	8+8 FTG with PVB	-	15,3	-	23,6				
		8+8 FTG with SGP	-	12,6	-	19,2				
DF88PICO_E125	1166	8+8 FTG with PVB	-	12,3	-	18,6				
		8+8 FTG with SGP	-	9,6	-	14,1				
DF88PICO_E250	1166	8+8 FTG with PVB	-	15,1	-	23,3				
		8+8 FTG with SGP	-	12,4	-	18,8				
DF1010LM_E200	1200	10+10 FTG with PVB	-	6,6	-	11,0	-	19,2		
		10+10 FTG with SGP	-	4,9	-	8,2	-	13,5		
		8+8+4 FTG with SGP *	-	5,3	-	8,8	-	14,6		
DF1010FR_E200	1200	10+10 FTG with PVB	-	7,9	-	13,1	-	22,5		
		10+10 FTG with SGP	-	6,2	-	10,4	-	16,9		
		8+8+4 FTG with SGP *	-	6,5	-	10,9	-	18,0		
DF12120LM_E200	1200	12+12 FTG with PVB	-	4,6	-	7,7	-	13,2		
		12+12 FTG with SGP	-	3,5	-	5,9	-	9,6		
		10+10+4 FTG with SGP *	-	3,7	-	6,2	-	10,3		
DF1212FR_E200	1200	12+12 FTG with PVB	-	5,9	-	9,8	-	16,6		
		12+12 FTG with SGP	-	4,8	-	8,0	-	13,0		
		10+10+4 FTG with SGP *	-	5,0	-	8,3	-	13,7	-	13,7

General notes:

Results valid for RS < 70 and CC2 according to NEN-EN 1990 and NEN 2608-2014

L1 is the free glass length from top of parapet until first fixation line into profile

Ltot is the total parapet height - see figures of different profile types

Valid for both 0.76mm and 1.52mm interlayer thicknesses

PVB-interlayer for maximum glass temperature at loading of 30 °C

SGP-interlayer for maximum glass temperature at loading of 50 °C

Def tot = deformation glass + deformation profile

* The 4 mm glass plate must be on gathering side (higher side of height difference) and is the plate which is considered to be broken at residual capacity check,

* Triple glasses with SGP interlayer only, Heat-soak-tested for FTG required

** Deformation for C5 as for cat. with 0.8 kN/m

- With usage of continuous constructive handrail, which covers and protects top border of glass panel, no minimum plate thickness must be considered

Deformation limit acc. to NEN-EN 1990 and NEN 2608-2014 is 20 mm at top of parapet. Values highlighted in yellow do slightly exceed this limit but with verified resistance

Glass resistance for panels with constructive continuous handrail: L1=1200mm										
Type of profile with distance fixation	Load category		A1		A2		other		C5	
	Load		0,3 kN/m / 0.5 kN		0,5 kN/m / 1.0 kN		0,8 kN/m / 1.0 kN		3,0 kN/m / 1.0 kN	
	Ltot [mm]	Glass composition	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]	bmin [mm]	def tot [mm]
DF88DK_E200	1300	8+8 FTG with PVB	-	14,1	-	20,9				
		8+8 FTG with SGP	-	11,0	-	16,0				
DF88DK_E400	1300	8+8 FTG with PVB	-	14,5	-	21,6				
		8+8 FTG with SGP	-	11,4	-	16,7				
DF88LM_E200	1300	8+8 FTG with PVB	-	14,7	-	21,8				
		8+8 FTG with SGP	-	11,5	-	17,0				
DF88LM_E400	1300	8+8 FTG with PVB	-	16,4	-	24,8				
		8+8 FTG with SGP	-	13,3	-	19,9				
DF88FR_E200	1300	8+8 FTG with PVB	-	15,8	-	23,7				
		8+8 FTG with SGP	-	12,7	-	18,8				
DF88FR_E400	1300	8+8 FTG with PVB	-	18,7	-	28,5				
		8+8 FTG with SGP	-	15,5	-	23,6				
DF88PICO_E125	1266	8+8 FTG with PVB	-	15,1	-	22,6				
		8+8 FTG with SGP	-	12,0	-	17,7				
DF88PICO_E250	1266	8+8 FTG with PVB	-	18,4	-	28,1				
		8+8 FTG with SGP	-	15,3	-	23,2				
DF1010LM_E200	1300	10+10 FTG with PVB	-	8,1	-	13,4	-	23,3		
		10+10 FTG with SGP	-	6,2	-	10,3	-	16,8		
		8+8+4 FTG with SGP *	-	6,6	-	10,9	-	18,1		
DF1010FR_E200	1300	10+10 FTG with PVB	-	9,6	-	15,9	-	26,1		
		10+10 FTG with SGP	-	7,7	-	12,8	-	19,1		
		8+8+4 FTG with SGP *	-	8,0	-	13,4	-	20,0		
DF12120LM_E200	1300	12+12 FTG with PVB	-	5,6	-	9,3	-	16,0		
		12+12 FTG with SGP	-	4,3	-	7,2	-	11,8		
		10+10+4 FTG with SGP *	-	4,6	-	7,6	-	12,7		
DF1212FR_E200	1300	12+12 FTG with PVB	-	7,1	-	11,8	-	20,0		
		12+12 FTG with SGP	-	5,8	-	9,7	-	15,8		
		10+10+4 FTG with SGP *	-	6,1	-	10,1	-	16,6		

General notes:

Results valid for RS < 70 and CC2 according to NEN-EN 1990 and NEN 2608-2014

L1 is the free glass length from top of parapet until first fixation line into profile

Ltot is the total parapet height - see figures of different profile types

Valid for both 0.76mm and 1.52mm interlayer thicknesses

PVB-interlayer for maximum glass temperature at loading of 30°C

SGP-interlayer for maximum glass temperature at loading of 50°C

Def tot = deformation glass + deformation profile

* The 4 mm glass plate must be on gathering side (higher side of height difference) and is the plate which is considered to be broken at residual capacity check,

* Triple glasses with SGP interlayer only, Heat-soak-tested for FTG required

** Deformation for C5 as for cat. with 0.8 kN/m

- With usage of continuous constructive handrail, which covers and protects top border of glass panel, no minimum plate thickness must be considered

Deformation limit acc. to NEN-EN 1990 and NEN 2608-2014 is 20 mm at top of parapet. Values highlighted in yellow do slightly exceed this limit but with verified resistance

5.4 Maximum equivalent wind load w_k for wind only - LCA

Maximum characteristic wind load w_k based on glass and profile resistance in [kN/m ²] - wind load only - with and without handrail - LCA									
Type of profile with distance fixation	Glass height	L1=900mm		L1=1000mm		L1=1100mm		L1=1200mm	
	Glass composition	Ltot [mm]	w_k [kN/m ²]	Ltot [mm]	def tot [mm]	Ltot [mm]	def tot [mm]	Ltot [mm]	def tot [mm]
DF88DK_E200	8+8 FTG with PVB	1000	3,62	1100	3,01	1200	2,54	1300	2,18
	8+8 FTG with SGP		4,39		3,57		2,96		2,49
DF88DK_E400	8+8 FTG with PVB	1000	3,62	1100	3,01	1200	2,54	1300	2,18
	8+8 FTG with SGP		4,39		3,57		2,96		2,49
DF88LM_E200	8+8 FTG with PVB	1000	3,62	1100	2,99	1200	2,50	1300	2,12
	8+8 FTG with SGP		3,64		2,99		2,50		2,12
DF88LM_E400	8+8 FTG with PVB	1000	1,82	1100	1,50	1200	1,25	1300	1,06
	8+8 FTG with SGP		1,82		1,50		1,25		1,06
DF88FR_E200	8+8 FTG with PVB	1000	3,62	1100	3,01	1200	2,54	1300	2,18
	8+8 FTG with SGP		4,62		3,55		2,96		2,49
DF88FR_E400	8+8 FTG with PVB	1000	2,16	1100	1,78	1200	1,48	1300	1,26
	8+8 FTG with SGP		2,16		1,78		1,48		1,26
DF88PICO_E125	8+8 FTG with PVB	966	3,62	1066	3,01	1166	2,54	1266	2,18
	8+8 FTG with SGP		4,39		3,57		2,96		2,49
DF88PICO_E250	8+8 FTG with PVB	966	3,47	1066	2,83	1166	2,36	1266	2,00
	8+8 FTG with SGP		3,47		2,83		2,36		2,00
DF1010LM_E200	10+10 FTG with PVB	1000	5,54	1100	4,62	1200	3,91	1300	3,36
	10+10 FTG with SGP		6,82		5,61		4,67		3,93
	8+8+4 FTG with SGP *		6,60		5,40		4,49		3,79
DF1010FR_E200	10+10 FTG with PVB	1000	5,54	1100	4,62	1200	3,91	1300	3,36
	10+10 FTG with SGP		6,92		5,63		4,67		3,93
	8+8+4 FTG with SGP *		6,60		5,40		4,49		3,79
DF12120LM_E200	12+12 FTG with PVB	1000	6,82	1100	5,61	1200	4,69	1300	3,98
	12+12 FTG with SGP		6,82		5,61		4,69		3,98
	10+10+4 FTG with SGP *		6,82		5,61		4,69		3,98
DF1212FR_E200	12+12 FTG with PVB	1000	7,78	1100	6,40	1200	5,35	1300	4,54
	12+12 FTG with SGP		7,78		6,40		5,35		4,54
	10+10+4 FTG with SGP *		7,78		6,40		5,35		4,54

General notes:

Results valid for RS < 70 and CC2 according to NEN-EN 1990 and NEN 2608-2014

L1 is the free glass length from top of parapet until first fixation line into profile

Ltot is the total parapet height - see figures of different profile types

Valid for both 0.76mm and 1.52mm interlayer thicknesses

PVB-interlayer for maximum glass temperature at loading of 30 °C

SGP-interlayer for maximum glass temperature at loading of 50 °C

* The 4 mm glass plate must be on gathering side (higher side of height difference) and is the plate which is considered to be broken at residual capacity check,

* Triple glasses with SGP interlayer only, Heat-soak-tested for FTG required

IMPORTANT: The maximum wind loads given in this table or for wind only. An eventual combination of the wind load with life-load or other loads must be done by the responsible technician based on National Dutch and European combination rules.

5.5 Secondary load direction LCB against direction of fall

As provided in the next page table, the resistance of the profiles in “secondary” direction LCB against direction of fall is at least half of the resistance of the main direction (for description of direction LCB see following figures and chapter 1.4).

According to NEN-EN 1991-1-1 and prescribed in chapter 3, in direction against fall LCB half of the loads as in main direction LCA must be considered.

Therefore, the profiles are verified also for life-loads in direction LCB.

Based on the profile resistances given in the table next page, also for the wind loads at least half of the values as in main direction can be considered respectively the maximum wind load can be evaluated more precisely based on the resistance of the profiles in load direction LCB.

For the verification of the glass panel, the secondary load direction LCB is never decisive compared to LCA due to the half load and same cross section.

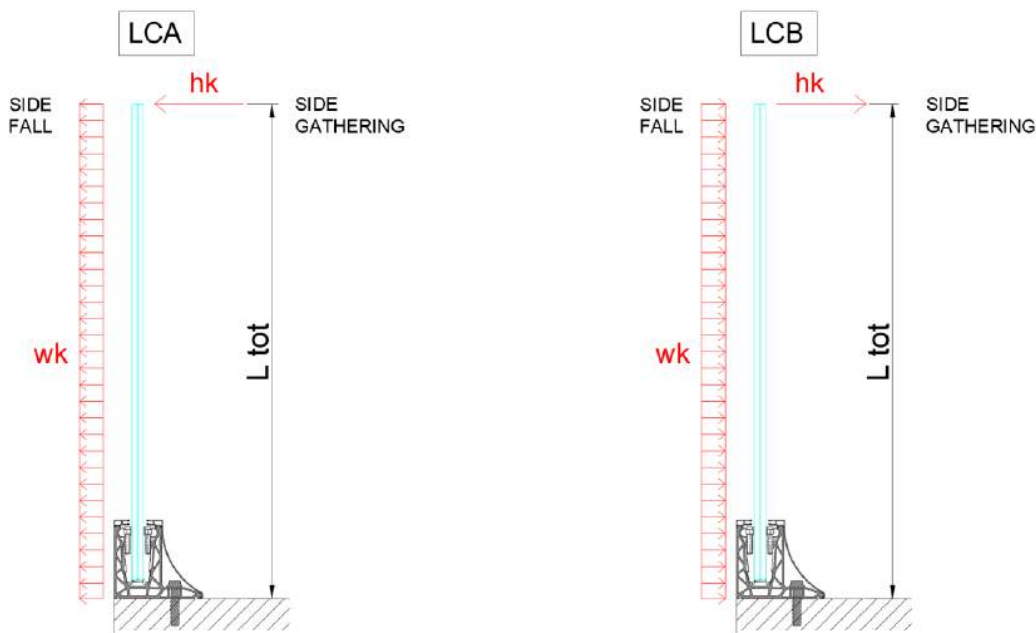
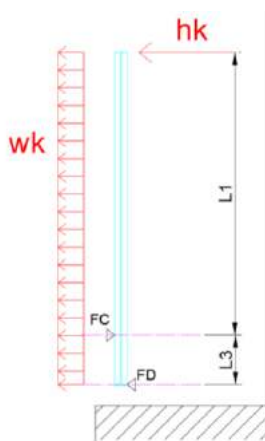


Fig: Load directions LCA and LCB exemplarily shown for DF88DK, for other profiles similar

Maximum design resistance profiles - LCA and LCB				
	FCRd.LCA [kN/m]	FCRd.LCB [kN/m]	FCRd.LCA / FCRd.LCB	Check if ≥0.5
DF88DK_E200	88,45	47,00	0,531	YES
DF88DK_E400	55,28	28,20	0,510	YES
DF88LM_E200	36,70	36,70	1,000	YES
DF88LM_E400	18,35	18,35	1,000	YES
DF88FR_E200	43,55	28,20	0,648	YES
DF88FR_E400	21,78	14,30	0,657	YES
DF88PICO_E125	72,24	72,24	1,000	YES
DF88PICO_E250	50,56	50,56	1,000	YES
DF1010LM_E200	68,80	68,80	1,000	YES
DF1010FR_E200	78,45	61,20	0,780	YES
DF12120LM_E200	68,80	68,80	1,000	YES
DF1212FR_E200	78,45	61,20	0,780	YES

General notes:

FCRd=maximum acting top contact force glass into profile at ULS based on numerical simulations



6 Appendix

6.1 Results glass calculation residual capacity with Mepla

Following for the installation situation without handrail, the residual capacity check for the single forces F_k applied in zone a for the different glass compositions and different glass heights from 900 mm to 1200 mm are given.

The result of these checks provides the minimum glass width based on the ultimate tensile strength (resistance) depending on the class of use and thereby on the load duration.

For further information to the residual capacity checks please refer to chapter 4.4.

For each glass height and load category, only the calculation for the decisive glass thickness with the maximum required plate width is shown. For the other glass thickness the calculation is done in the identical way but changing the appropriate glass thickness and varying the width on the glass plate until the present maximum tensile stress in the glass plate(s) is less than the ultimate resistance strength.

All other results are available on request - please contact Logli company.

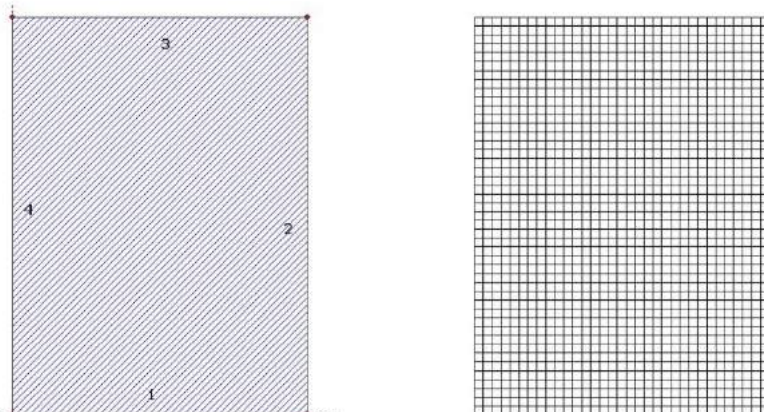
6.1.1 8+8 FTG for load category A1 - L1=900mm to 1200 mm

Projekt: 20027_Defender_Olanda - A1_8+8_Fk_a_900_SLC

28.04.2020

Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint	Arcoenter	Direction of rotation
	mm	mm	+/-
1	0,00	0,00	
2	670,00	0,00	

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Projekt: 20027_Defender_Olanda - A1_8+8_Fk_a_900_SLC

28.04.2020

Seite: 2

3	670,00	800,00
4	0,00	800,00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,p,0: fixed (all d.o.f supported and clamped)

Spring supports:

Package	Layer	x	y	z	C _x	C _y	C _z	C _φ	C _θ
		mm	mm	mm	N/mm	N/mm	N/mm	Nmm	Nmm
1	1	0,0	0,0	0,0	1,000e+00	1,000e+00	0,000e+00	0,00e+00	0,00e+00
1	1	670,0	0,0	0,0	0,000e+00	1,000e+00	0,000e+00	0,00e+00	0,00e+00

Layers:

Layer order:

Package	Layer	Description
1	1	ES0

Mechanical properties:

Package	Layer	E-mod.	ν	Thickness	Density	α _T	ΔT
		N/mm ²		mm	kg/m ³	1/K	K
1	1	20000,00	0,23	7,70	2550,00	1,0000e-05	0,00

Loads:

Concentrated loads:

Package	x	y	F _x	F _y	F _z	l _x	l _y
	mm	mm	N	N	N	mm	mm
1	100,00	800,00	0,00	0,00	500,00	200,00	200,00

Face loads:

= constant distributed:

Package	pressure
	N/mm ²
1	0,00000e+00

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Projekt: 20027_Defender_Olanda - A1_8+8_Fk_a_900_SLC

28.04.2020
Seite: 3

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size : 20.0 mm
Number of elements : 1485
Number of nodes : 6097 (per package)
Number of unknown : 50150

Calculation results:

Minimum and maximum displacements w:

Package	Position		Displacement w
	x	y	
	mm	mm	mm
1	670.00	10.00	-0.00 (min)
	0.00	900.00	63.80 (max)

Maximum principal stress:

Package	Layer	x	y	σ	
				N/mm²	σ (max) N/mm²
		mm	mm		
1	(Top)	144.41	882.25	10.68	78.78
	(bottom)	78.92	2.25		

Springs:

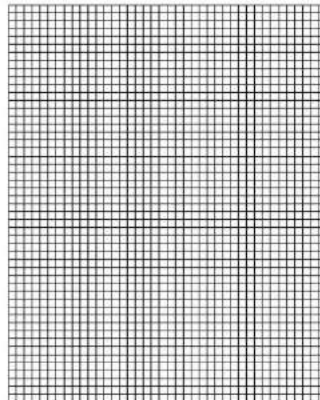
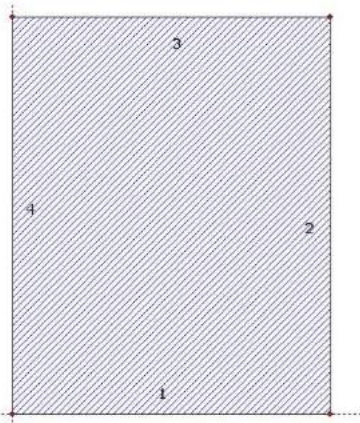
Package	Layer	u	v	w	φ	θ	Fx	Fy	Fz	M _x	M _y
(x / y)		mm	mm	mm	rad	rad	N	N	N	Nmm	Nmm
(0.00 / 0.00)											
1	1	0.00	0.00	-0.00	-0.0000	-0.0000	0.00	0.00	-0.00	-0.00	-0.00
(670.00 / 0.00)											
1	1	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00

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Projekt: 20027_Defender_Olanda - A1_8+8_Fk_a_1000_SLC

28.04.2020
Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint		Arcoenter	Direction of rotation
	mm	mm	mm	+/-
1	0.00	0.00		
2	800.00	0.00		

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Projekt: 20027_Defender_Olanda - A1_8+8_Fk_a_1000_SLC

28.04.2020
Seite: 2

3	800.00	1000.00
4	0.00	1000.00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,p,θ: fixed (all d.o.f supported and clamped)

Spring supports:

Package	Layer	x	y	s	C _x	C _y	C _z	C _φ	C _θ
		mm	mm	mm	N/mm	N/mm	N/mm	Nmm	Nmm
1	1	0.0	0.0	0.0	1.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00
1	1	800.0	0.0	0.0	0.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00

Layers:

Layer order:

Package	Layer	Description
1	1	ESG

Mechanical properties:

Package	Layer	E-mod.	ν	Thickness	Density	α	ΔT
		N/mm ²		mm	kg/m ³	1/K	K
1	1	70000.00	0.23	7.70	2550.00	1.0000e-05	0.00

Loads:

Concentrated loads:

Package	x	y	F _x	F _y	F _z	I _x	I _y
	mm	mm	N	N	N	mm	mm
1	100.00	900.00	0.00	0.00	500.00	200.00	200.00

Face loads:

= constant distributed:

Package	pressure
	N/mm ²
1	0.0000e+00

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Projekt: 20027_Defender_Olanda - A1_8+8_Fk_a_1000_SLC

28.04.2020
Seite: 3

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size	: 20.0 mm
Number of elements	: 2000
Number of nodes	: 8181 (per package)
Number of unknown	: 40500

Calculation results:

Minimum and maximum displacements w:

Package	Position		Displacement w
	x	y	
	mm	mm	mm
1	800.00	10.00	-0.00 (min)
	0.00	1000.00	76.94 (max)

Maximum principal stress:

Package	Layer	x	y	σ	σ (max)
		mm	mm	N/mm ²	N/mm ²
1	1 (top)	157.75	992.25	11.78	77.24
	(bottom)	77.75	2.25	77.24	

Springs:

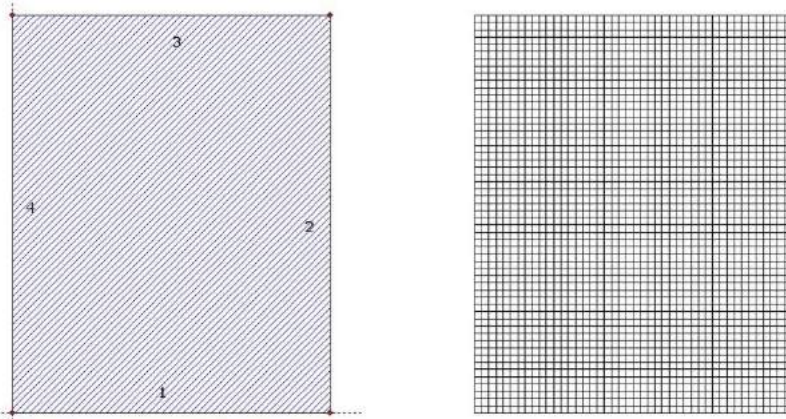
Package	Layer	u	v	w	φ	θ	F _x	F _y	F _z	M _φ	M _θ
		mm	mm	mm	rad	rad	N	N	N	Nmm	Nmm
1	1	(0.00 / 0.00)					0.00	0.00	0.00	0.00	0.00
1	1	(800.00 / 0.00)					0.00	0.00	0.00	0.00	0.00

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Projekt: 20027_Defender_Olanda - A1_8+8_Fk_a_1100_SLC

28.04.2020
Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint	Borderpoint	Arcoenter	Direction of rotation
	mm	mm	mm	mm
1	0.00	0.00		
2	880.00	0.00		

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Projekt: 20027_Defender_Olanda - A1_8+8_Fk_a_1100_SLC

28.04.2020
Seite: 2

3	880.00	1100.00
4	0.00	1100.00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,p,d: fixed (all d.o.f supported and clamped)

Spring supports:

Package	Layer	x	y	z	C_x	C_y	C_z	C_p	C_#
		mm	mm	mm	N/mm	N/mm	N/mm	Nmm	Nmm
1	1	0.0	0.0	0.0	1.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00
1	1	880.0	0.0	0.0	0.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00

Layers:

Layer order:

Package	Layer	Description
1	1	ESG

Mechanical properties:

Package	Layer	E-mod.	ν	Thickness	Density	αt	ΔT
		N/mm ²		mm	kg/m ³	1/K	K
1	1	70000.00	0.23	7.70	2538.00	1.0000e-05	0.50

Loads:

Concentrated loads:

Package	x	y	Fx	Fy	Fz	lx	ly
	mm	mm	N	N	N	mm	mm
1	100.00	1000.00	0.00	0.00	500.00	200.00	200.00

Face loads:

- constant distributed:

Package	pressure
	N/mm ²
1	0.00000e+00

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Projekt: 20027_Defender_Olanda - A1_8+8_Fk_a_1100_SLC

28.04.2020
Seite: 3

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size : 20.0 mm
Number of elements : 2420
Number of nodes : 9879 (per package)
Number of unknown : 48950

Calculation results:

Minimum and maximum displacements w:

Package	Position		Displacement w
	x	y	
	mm	mm	mm
1	880.00	20.00	-0.00 (min)
	0.00	1100.00	95.86 (max)

Maximum principal stress:

Package	Layer	x	y	σ	
				N/mm ²	σ (max) N/mm ²
		mm	mm		
1	(Top)	157.75	1082.25	12.44	78.56
	(bottom)	82.25	2.25		

Springs:

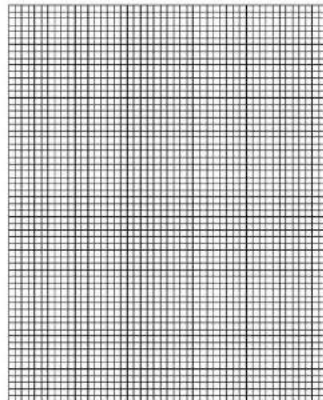
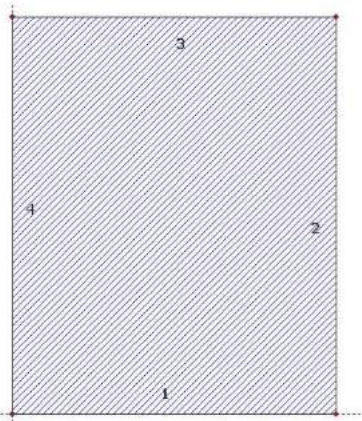
Package	Layer	u	v	w	φ	θ	Fx	Fy	Fz	M _x	M _y
(x / y)		mm	mm	mm	rad	rad	N	N	N	Nmm	Nmm
1		(0.00 / 0.00)									
1	1	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00
1		(880.00 / 0.00)									
1	1	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00

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Projekt: 20027_Defender_Olanda - A1_8+8_Fk_a_1200_SLC

28.04.2020
Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint		Arcoenter	Direction of rotation
	mm	mm	mm	+/-
1	0.00	0.00		
2	880.00	0.00		

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Projekt: 20027_Defender_Olanda - A1_8+8_Fk_a_1200_SLC

28.04.2020
Seite: 2

3	980.00	1200.00
4	0.00	1200.00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,p,θ: fixed (all d.o.f supported and clamped)

Spring supports:

Package	Layer	x	y	s	C _x	C _y	C _z	C _φ	C _θ
		mm	mm	mm	N/mm	N/mm	N/mm	Nmm	Nmm
1	1	0.0	0.0	0.0	1.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00
1	1	980.0	0.0	0.0	0.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00

Layers:

Layer order:

Package	Layer	Description
1	1	ESG

Mechanical properties:

Package	Layer	E-mod.	ν	Thickness	Density	α	ΔT
		N/mm ²		mm	kg/m ³	1/K	K
1	1	70000.00	0.23	7.70	2550.00	1.0000e-05	0.00

Loads:

Concentrated loads:

Package	x	y	F _x	F _y	F _z	I _x	I _y
	mm	mm	N	N	N	mm	mm
1	100.00	1100.00	0.00	0.00	500.00	200.00	200.00

Face loads:

= constant distributed:

Package	pressure
	N/mm ²
1	0.0000e+00

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Projekt: 20027_Defender_Olanda - A1_8+8_Fk_a_1200_SLC

28.04.2020
Seite: 3

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size	: 20.0 mm
Number of elements	: 5940
Number of nodes	: 11573 (per package)
Number of unknown	: 59400

Calculation results:

Minimum and maximum displacements w:

Package	Position		Displacement w
	x	y	
	mm	mm	mm
1	980.00	20.00	-0.00 (min)
	0.00	1200.00	113.57 (max)

Maximum principal stress:

Package	Layer	x	y	σ	σ (max)
		mm	mm	N/mm ²	N/mm ²
1	1 (top)	162.25	1192.25	13.10	78.79
	(bottom)	80.00	2.25		78.79

Springs:

Package	Layer	u	v	w	φ	θ	F _x	F _y	F _z	M _φ	M _θ
		mm	mm	mm	rad	rad	N	N	N	Nmm	Nmm
1	1	(0.00 / 0.00)									
1	1	(980.00 / 0.00)									

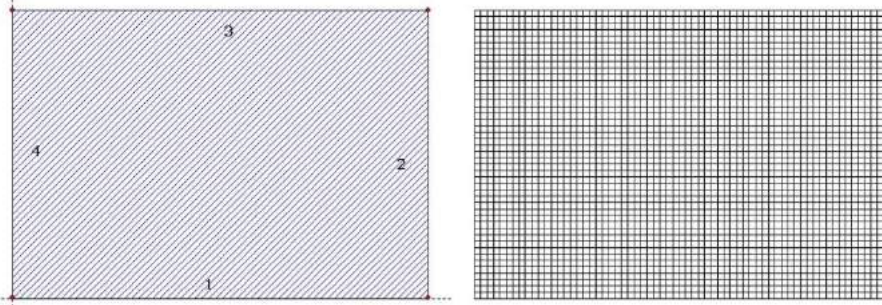
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6.1.2 10+10 FTG for load category A2- L1=900mm and 1000 mm

Projekt: 20027_Defender_Olanda - A2_10+10_Fk_a_900_SLC

28.04.2020
Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint	Arcoenter	Direction of rotation
	mm	mm	1/-
1	0.00	0.00	
2	1300.00	0.00	
3	1300.00	900.00	
4	0.00	900.00	

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,φ: fixed (all d.o.f supported and clamped)

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Projekt: 20027_Defender_Olanda - A2_10+10_Fk_a_900_SLC

28.04.2020
Seite: 2

Spring supports:

Package	Layer	x	y	z	C_x	C_y	C_z	C_φ	C_θ
		mm	mm	mm	N/mm	N/mm	N/mm	Nmm	Nmm
1	1	0.0	0.0	0.0	1.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00
1	1	1000.0	0.0	0.0	0.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00

Layers:

Layer order:

Package	Layer	Description
1	1	ESS

Mechanical properties:

Package	Layer	E-mod.	ν	Thickness	Density	ot	ΔT
		N/mm ²		mm	kg/m ³	1/K	K
1	1	70000.00	0.23	9.70	2550.00	1.0000e-05	0.00

Loads:

Concentrated loads:

Package	x	y	Fx	Fy	Fz	Ix	Iy
	mm	mm	N	N	N	mm	mm
1	100.00	800.00	0.00	0.00	1000.00	200.00	200.00

Face loads:

- constant distributed:

Package	pressure
	N/mm ²
1	0.000000e+00

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size	: 20.0 mm
Number of elements	: 2925
Number of nodes	: 11921 (per package)

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Projekt: 20027_Defender_Olanda - A2_10+10_Fk_a_900_SLC

28.04.2020

Seite: 3

Number of unknown : 58950

Calculation results:

Minimum and maximum displacements w:

Package	- Position -			Displacement
	x	y	w	
	mm	mm	mm	
1	1300.00	40.00	-0.01 (min)	
	0.00	900.00	46.49 (max)	

Maximum principal stress:

Package	Layer	x	y	σ	
				N/mm ²	σ (max)
		mm	mm		N/mm ²
1	1 (top)	163.25	883.25	16.46	78.27
	(bottom)	37.75	2.25	78.27	

Springs:

Package	Layer	u	v	w	α	β	Fx	Fy	Fz	M _x	M _y
(x / y)		mm	mm	mm	rad	rad	N	N	N	Nmm	Nmm
(0.00 / 0.00)											
1 1		0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00
(1000.00 / 0.00)											
1 1		0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00

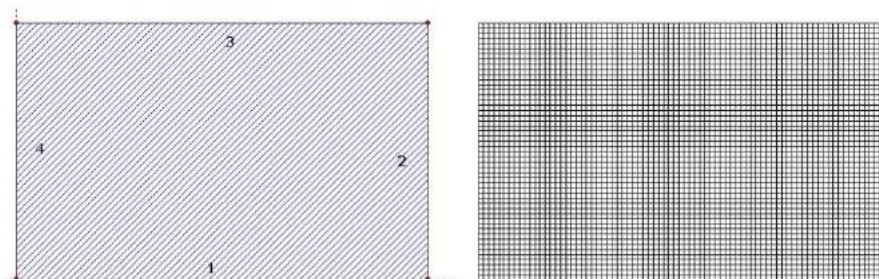
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Projekt: 20027_Defender_Olanda - A2_10+10_Fk_a_1000_SLC

28.04.2020

Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint		Arccenter		Direction of rotation
	mm	mm	mm	mm	
1	0.00	0.00			
2	1600.00	0.00			
3	1600.00	1000.00			
4	0.00	1000.00			

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,θ: fixed (all d.o.f supported and clamped)

Spring supports:

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Projekt: 20027_Defender_Olanda - A2_10+10_Fk_a_1000_SLC

28.04.2020
Seite: 2

Package	Layer	x	y	z	C _x	C _y	C _z	C _{xy}	C _{yz}
		mm	mm	mm	N/mm	N/mm	N/mm	Nmm	Nmm
1	1	0.0	0.0	0.0	1.000e+00	1.000e+00	0.000e+00	0.000e+00	0.000e+00
1	1	1600.0	0.0	0.0	0.000e+00	1.000e+00	0.000e+00	0.000e+00	0.000e+00

Layers:

Layer order:

Package	Layer	Description
1	1	ESG

Mechanical properties:

Package	Layer	E-mod.	ν	Thickness	Density	α _T	ΔT
		N/mm ²		mm	kg/m ³	1/K	K
1	1	70000.00	0.23	9.70	2550.00	1.0000e-05	0.00

Loads:

Concentrated loads:

Package	x	y	F _x	F _y	F _z	I _x	I _y
	mm	mm	N	N	N	mm	mm
1	100.00	900.00	0.00	0.00	1000.00	200.00	200.00

Face loads:

- constant distributed:

Package	pressure
	N/mm ²
1	0.00000e+00

Calculation approaches:

small deflections, linear static calculation

Characteristics of the finite element mesh:

Element size	: 20.0 mm
Number of elements	: 4000
Number of nodes	: 16261 (per package)
Number of unknown	: 80500

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Projekt: 20027_Defender_Olanda - A2_10+10_Fk_a_1000_SLC

28.04.2020
Seite: 3

Calculation results:

Minimum and maximum displacements w:

Package	- Position -		Displacement w
	x	y	
	mm	mm	mm
1	1600.00	60.00	-0.01 (min)
	0.00	1000.00	57.82 (max)

Maximum principal stress:

Package	Layer	x	y	σ	σ (max)
		mm	mm	N/mm ²	N/mm ²
1	1	(top)	162.25	982.25	17.53
		(bottom)	57.75	2.25	79.18

Springs:

Package	Layer	u	v	w	φ	θ	F _x	F _y	F _z	M _φ	M _θ
(x / y)		mm	mm	mm	rad	rad	N	N	N	Nmm	Nmm
(0.00 / 0.00)											
1 1	1	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00
(1600.00 / 0.00)											
1 1	1	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00

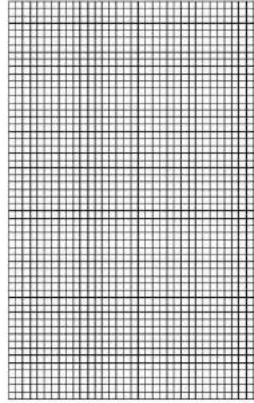
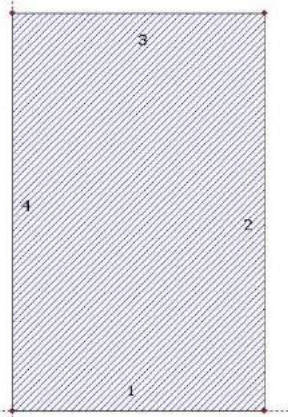
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6.1.3 12+12 FTG for load category A2- L1=1100mm and 1200 mm

Projekt: 20027_Defender_Olanda - A2_12+12_Fk_a_1100_SLC

28.04.2020
Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint	mm	mm	Arcoenter	Direction of rotation
		mm	mm	mm	+/-
1	0,00	0,00			
2	700,00	0,00			

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Projekt: 20027_Defender_Olanda - A2_12+12_Fk_a_1100_SLC

28.04.2020
Seite: 2

3	700,00	1100,00
4	0,00	1100,00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,p,θ: fixed (all d.o.f supported and clamped)

Spring supports:

Package	Layer	x	y	z	C _x	C _y	C _z	C _φ	C _θ
		mm	mm	mm	N/mm	N/mm	N/mm	Nmm	Nmm
1	1	0,0	0,0	0,0	1,000e+00	1,000e+00	0,000e+00	0,00e+00	0,00e+00
I	1	700,0	0,0	0,0	0,000e+00	1,000e+00	0,000e+00	0,00e+00	0,00e+00

Layers:

Layer order:

Package	Layer	Description
1	1	ESD

Mechanical properties:

Package	Layer	E-mod.	ν	Thickness	Density	α _T	ΔT
		N/mm ²		mm	kg/m ³	1/K	K
1	1	20000,00	0,23	11,70	2550,00	1,0000e-05	0,00

Loads:

Concentrated loads:

Package	x	y	F _x	F _y	F _z	l _x	l _y
	mm	mm	N	N	N	mm	mm
1	100,00	1000,00	0,00	0,00	1000,00	200,00	200,00

Face loads:

= constant distributed:

Package	pressure
	N/mm ²
1	0,00000e+00

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Projekt: 20027_Defender_Olanda - A2_12+12_Fk_a_1100_SLC

28.04.2020
Seite: 3

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size : 20.0 mm
Number of elements : 1905
Number of nodes : 7881 (per package)
Number of unknown : 39050

Calculation results:

Minimum and maximum displacements w:

Package	Position		Displacement w
	x	y	
	mm	mm	mm
1	700.00	10.00	-0.00 (min)
	0.00	1100.00	63.86 (max)

Maximum principal stress:

Package	Layer	x	y	σ	
				N/mm²	σ (max) N/mm²
		mm	mm		
1	(Top)	157.75	1082.25	9.87	78.50
	(bottom)	97.75	2.25		

Springs:

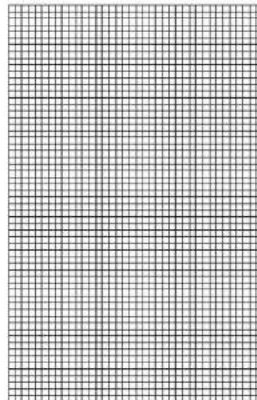
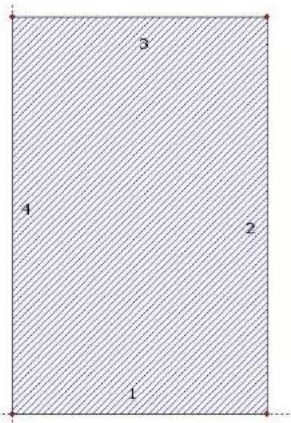
Package	Layer	u	v	w	φ	θ	Fx	Fy	Fz	M _x	M _y
(x / y)		mm	mm	mm	rad	rad	N	N	N	Nmm	Nmm
(0.00 / 0.00)											
1	1	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00
(700.00 / 0.00)											
1	1	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	5.00	0.00

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Projekt: 20027_Defender_Olanda - A2_12+12_Fk_a_1200_SLC

28.04.2020
Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint		Arcoenter	Direction of rotation
	mm	mm	mm	+/ -
1	0.00	0.00		
2	770.00	0.00		

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Projekt: 20027_Defender_Olanda - A2_12+12_Fk_a_1200_SLC

28.04.2020
Seite: 2

3	770.00	1200.00
4	0.00	1200.00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,p,θ: fixed (all d.o.f supported and clamped)

Spring supports:

Package	Layer	x	y	s	C _x	C _y	C _z	C _φ	C _θ
		mm	mm	mm	N/mm	N/mm	N/mm	Nmm	Nmm
1	1	0.0	0.0	0.0	1.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00
1	1	770.0	0.0	0.0	0.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00

Layers:

Layer order:

Package	Layer	Description
1	1	ESG

Mechanical properties:

Package	Layer	E-mod.	ν	Thickness	Density	α	ΔT
		N/mm ²		mm	kg/m ³	1/K	K
1	1	70000.00	0.23	11.70	2550.00	1.0000e-05	0.00

Loads:

Concentrated loads:

Package	x	y	F _x	F _y	F _z	I _x	I _y
	mm	mm	N	N	N	mm	mm
1	100.00	1100.00	0.00	0.00	1000.00	200.00	200.00

Face loads:

= constant distributed:

Package	pressure
	N/mm ²
1	0.0000e+00

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Projekt: 20027_Defender_Olanda - A2_12+12_Fk_a_1200_SLC

28.04.2020
Seite: 3

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size	: 20.0 mm
Number of elements	: 5280
Number of nodes	: 3317 (per package)
Number of unknown	: 46200

Calculation results:

Minimum and maximum displacements w:

Package	Position		Displacement w
	x	y	
	mm	mm	mm
1	770.00	10.00	-0.00 (min)
	0.00	1200.00	76.77 (max)

Maximum principal stress:

Package	Layer	x	y	σ	σ (max)
		mm	mm	N/mm ²	N/mm ²
1	1 (top)	159.82	1182.25	10.05	79.14
	(bottom)	89.03	2.25	79.14	

Springs:

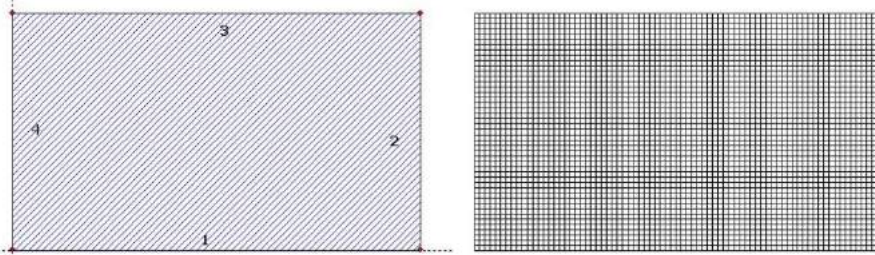
Package	Layer	u	v	w	φ	θ	F _x	F _y	F _z	M _φ	M _θ
		mm	mm	mm	rad	rad	N	N	N	Nmm	Nmm
1	1	(0.00 / 0.00)									
1	1	(0.00 / 0.00)									
1	1	(770.00 / 0.00)									
1	1	(0.00 / 0.00)									

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6.1.4 10+10 FTG for load category C5 and "Other" - L1=900mm

Projekt: 20027_Defender_Olanda - Other_C5_10+10_Fk_a_900_SLC 28.04.2020
Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint mm	mm	Arcoenter mm	Direction of rotation +/-
1	0.00	0.00		
2	1550.00	0.00		
3	1550.00	900.00		
4	0.00	900.00		

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,p,θ: fixed (all d.o.f supported and clamped)

Spring supports:

Package	Layer	x	y	z	C_x	C_y	C_z	C_φ

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Projekt: 20027_Defender_Olanda - Other_C5_10+10_Fk_a_900_SLC 28.04.2020
Seite: 2

	mm	mm	mm	N/mm	N/mm	N/mm	Nmm	Nmm
1	1	0.0	0.0	0.0	1.000e+00	1.000e+00	0.000e+00	0.00e+00
1	1	1550.0	0.0	0.0	0.000e+00	1.000e+00	0.000e+00	0.00e+00

Layers:

Layer order:

Package	Layer	Description
1	1	ESG

Mechanical properties:

Package	Layer	E-mod. N/mm ²	ν	Thickness mm	Density kg/m ³	αT 1/K	ΔT K
1	1	70000.00	0.23	9.70	2550.00	1.0000e-05	0.00

Loads:

Concentrated loads:

Package	x	y	Fx	Fy	Fz	lx	ly
	mm	mm	N	N	N	mm	mm
1	100.00	800.00	0.00	0.00	1000.00	200.00	200.00

Face loads:

- constant distributed:

Package	pressure N/mm ²
1	0.00000e+00

Calculation approaches:
small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size	: 20.0 mm
Number of elements	: 3465
Number of nodes	: 14105 (per package)
Number of unknown	: 69750

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Projekt: 20027_Defender_Olanda - Other_C5_10+10_Fk_a_900_SLC

28.04.2020

Seite: 3

Calculation results:

Minimum and maximum displacements w:

Package	Position		Displacement w
	x	y	
	mm	mm	mm
1	1550.00	60.00	-0.01 (min)
	0.00	900.00	45.01 (max)

Maximum principal stress:

Package	Layer	Position	x	y	σ	
					N/mm ²	N/mm ²
			mm	mm		
1	1	(top)	163.31	892.25	16.87	76.98
		(bottom)	50.32	2.25		

Springs:

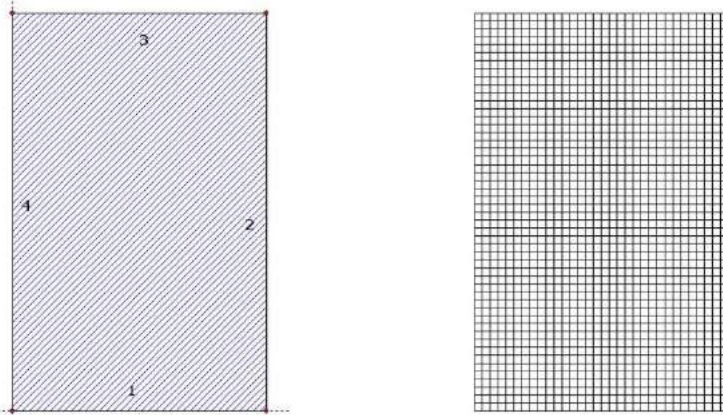
Package	Layer	(x / y)	u	v	w	φ	θ	F			M	
								N	N	N	Nmm	Nmm
			mm	mm	mm	rad	rad					
1	1	(0.00 / 0.00)	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00
1	1	(1550.00 / 0.00)	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00

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6.1.5 12+12 FTG for load category C5 and "Other" - L1=1000mm-1200mm

Projekt: 20027_Defender_Olanda - Other_C5_12+12_Fk_a_1000_SLC 28.04.2020
Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint	Arcoenter	Direction of rotation
	mm	mm	+/ -
1	0,00	0,00	
2	640,00	0,00	

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Projekt: 20027_Defender_Olanda - Other_C5_12+12_Fk_a_1000_SLC 28.04.2020
Seite: 2

3	640,00	1000,00
4	0,00	1000,00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,p,θ: fixed (all d.o.f supported and clamped)

Spring supports:

Package	Layer	x	y	z	C _x	C _y	C _z	C _φ	C _θ
		mm	mm	mm	N/mm	N/mm	N/mm	Nmm	Nmm
1	1	0,0	0,0	0,0	1,000e+00	1,000e+00	0,000e+00	0,00e+00	0,00e+00
I	1	640,0	0,0	0,0	0,000e+00	1,000e+00	0,000e+00	0,00e+00	0,00e+00

Layers:

Layer order:

Package	Layer	Description
1	1	ESD

Mechanical properties:

Package	Layer	E-mod.	ν	Thickness	Density	α _T	ΔT
		N/mm ²		mm	kg/m ³	1/K	K
1	1	20000,00	0,23	11,70	2550,00	1,0000e-05	0,00

Loads:

Concentrated loads:

Package	x	y	F _x	F _y	F _z	l _x	l _y
	mm	mm	N	N	N	mm	mm
1	100,00	900,00	0,00	0,00	1000,00	200,00	200,00

Face loads:
= constant distributed:

Package	pressure
	N/mm ²
1	0,00000e+00

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Projekt: 20027_Defender_Olanda - Other_C5_12+12_Fk_a_1000_SLC

28.04.2020
Seite: 3

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size : 20.0 mm
Number of elements : 1600
Number of nodes : 6565 (per package)
Number of unknown : 32500

Calculation results:

Minimum and maximum displacements w:

Package	Position		Displacement w
	x	y	
	mm	mm	mm
1	640.00	10.00	-0.00 (min)
	0.00	1000.00	51.51 (max)

Maximum principal stress:

Package	Layer	x	y	σ	
				N/mm²	σ (max) N/mm²
		mm	mm		
1	(Top)	142.25	982.25	9.29	76.89
	(bottom)	90.00	2.25		

Springs:

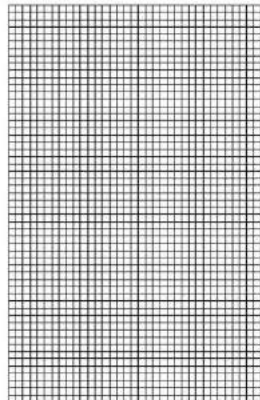
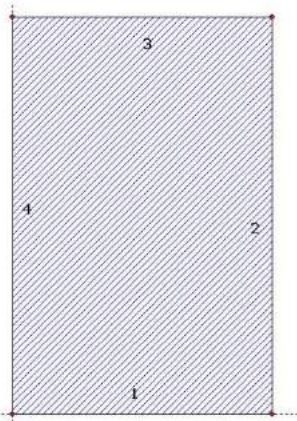
Package	Layer	u	v	w	φ	θ	Fx	Fy	Fz	M _x	M _y
(x / y)		mm	mm	mm	rad	rad	N	N	N	Nmm	Nmm
		(0.00 / 0.00)									
1	1	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00
		(640.00 / 0.00)									
1	1	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	5.00	0.00

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Projekt: 20027_Defender_Olanda - Other_C5_12+12_Fk_a_1100_SLC

28.04.2020
Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint		Arcocenter		Direction of rotation
	mm	mm	mm	mm	+/-
1	0.00	0.00			
2	720.00	0.00			

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Projekt: 20027_Defender_Olanda - Other_C5_12+12_Fk_a_1100_SLC

28.04.2020
Seite: 2

3	720.00	1100.00
4	0.00	1100.00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,p,θ: fixed (all d.o.f supported and clamped)

Spring supports:

Package	Layer	x	y	s	C _x	C _y	C _z	C _φ	C _θ
		mm	mm	mm	N/mm	N/mm	N/mm	Nmm	Nmm
1	1	0.0	0.0	0.0	1.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00
1	1	720.0	0.0	0.0	0.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00

Layers:

Layer order:

Package	Layer	Description
1	1	ESG

Mechanical properties:

Package	Layer	E-mod.	ν	Thickness	Density	α	ΔT
		N/mm ²		mm	kg/m ³	1/K	K
1	1	70000.00	0.23	11.70	2550.00	1.0000e-05	0.00

Loads:

Concentrated loads:

Package	x	y	F _x	F _y	F _z	I _x	I _y
	mm	mm	N	N	N	mm	mm
1	100.00	1000.00	0.00	0.00	1000.00	200.00	200.00

Face loads:

= constant distributed:

Package	pressure
	N/mm ²
1	0.00000e+00

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Projekt: 20027_Defender_Olanda - Other_C5_12+12_Fk_a_1100_SLC

28.04.2020
Seite: 3

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size	: 20.0 mm
Number of elements	: 1980
Number of nodes	: 8163 (per package)
Number of unknown	: 40150

Calculation results:

Minimum and maximum displacements w:

Package	Position		Displacement w
	x	y	
	mm	mm	mm
1	720.00	10.00	-0.00 (min)
	0.00	1100.00	62.50 (max)

Maximum principal stress:

Package	Layer	x	y	σ	σ (max)
		mm	mm	N/mm ²	N/mm ²
1	1 (top)	157.75	1092.25	10.01	77.00
	(bottom)	97.75	2.25		77.00

Springs:

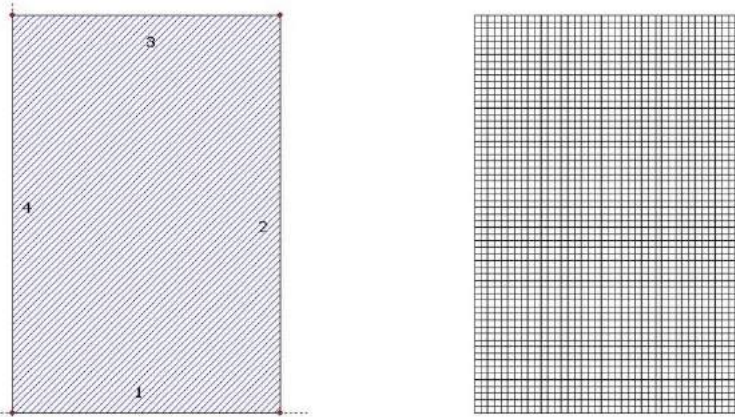
Package	Layer	u	v	w	φ	θ	F _x	F _y	F _z	M _φ	M _θ
		mm	mm	mm	rad	rad	N	N	N	Nmm	Nmm
	(x / y)										
	(0.00 / 0.00)										
1	1	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00
	(720.00 / 0.00)										
1	1	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00

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Projekt: 20027_Defender_Olanda - Other_C5_12+12_Fk_a_1200_SLC

28.04.2020
Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint		Arcoenter	Direction of rotation
	mm	mm	mm	mm +/-
1	0,00	0,00		
2	810,00	0,00		

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Projekt: 20027_Defender_Olanda - Other_C5_12+12_Fk_a_1200_SLC

28.04.2020
Seite: 2

3	810,00	1200,00
4	0,00	1200,00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,p,d: fixed (all d.o.f supported and clamped)

Spring supports:

Package	Layer	x	y	z	C_x	C_y	C_z	C_p	C_#
		mm	mm	mm	N/mm	N/mm	N/mm	Nmm	Nmm
1	1	0,0	0,0	0,0	1,000e+00	1,000e+00	0,000e+00	0,00e+00	0,00e+00
1	1	810,0	0,0	0,0	0,000e+00	1,000e+00	0,000e+00	0,00e+00	0,00e+00

Layers:

Layer order:

Package	Layer	Description
1	1	ESG

Mechanical properties:

Package	Layer	E-mod.	ν	Thickness	Density	αt	ΔT
		N/mm ²		mm	kg/m ³	1/K	K
1	1	70000,00	0,23	11,70	2538,00	1,0000e-05	0,50

Loads:

Concentrated loads:

Package	x	y	Fx	Fy	Fz	lx	ly
	mm	mm	N	N	N	mm	mm
1	100,00	1100,00	0,00	0,00	1000,00	200,00	200,00

Face loads:

- constant distributed:

Package	pressure
	N/mm ²
1	0,00000e+00

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Projekt: 20027_Defender_Olanda - Other_C5_12+12_Fk_a_1200_SLC

28.04.2020
Seite: 3

Calculation approaches:
small deflections, linear
static calculation

Characteristics of the finite element mesh:
Element size : 20.0 mm
Number of elements : 2400
Number of nodes : 9801 (per package)
Number of unknown : 48600

Calculation results:

Minimum and maximum displacements w:
- Position- Displacement
Package X Y w
mm mm mm
1 810.00 10.00 -0.00 (min)
0.00 1200.00 73.90 (max)

Maximum principal stress:
Package Layer X Y σ σ (max)
mm mm N/mm² N/mm²
1 1 (Top) 159.72 1182.25 10.68 76.50
1 (bottom) 98.97 2.25 76.50

Springs:
Package Layer u v w ϕ θ Fx Fy Fz M_x M_y
(x / y) mm mm mm rad rad N N N Nm Nm
(0.00 / 0.00)
1 1 0.00 0.00 0.00 0.0000 0.0000 0.00 0.00 0.00 0.00 0.00
(810.00 / 0.00)
1 1 0.00 0.00 0.00 0.0000 0.0000 0.00 0.00 0.00 0.00 0.00

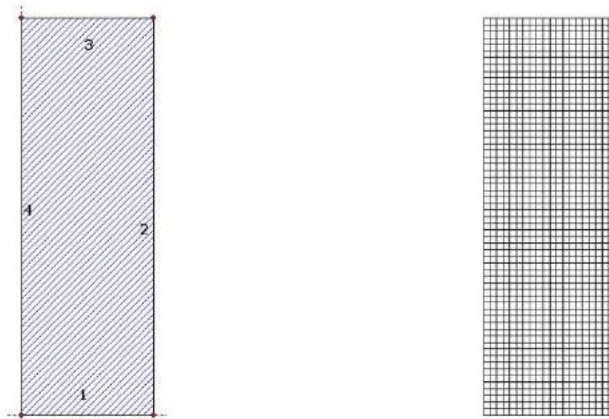
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6.1.6 8+8+4 FTG for load category C5 and "Other" - L1=1200mm

Projekt: 20027_Defender_Olanda - Other_C5_8+8+4_Fk_a_1200_SLC

28.04.2020
Seite: 1

SJ MEPLA Calculation protocol:



Geometry:
Edge Borderpoint Arccenter Direction of rotation
mm mm mm mm +/-
1 0.00 0.00
2 400.00 0.00

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Projekt: 20027_Defender_Olanda - Other_C5_6+8+4_Fk_a_1200_SLC

28.04.2020
Seite: 2

3	400.00	1200.00
4	0.00	1200.00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,p,θ: fixed (all d.o.f supported and clamped)

Spring supports:

Package	Layer	X	Y	S	C_X	C_Y	C_Z	C_φ	C_θ
		mm	mm	mm	N/mm	N/mm	N/mm	Nmm	Nmm
1	1	0.0	0.0	0.0	1.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00
1	1	400.0	0.0	0.0	0.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00

Layers:

Layer order:

Package	Layer	Description
1	3	ESG
1	2	MFR Langsoltbelastung
1	1	ESG

Mechanical properties:

Package	Layer	E-mod.	ν	Thickness	Density	ot	ΔT
		K/mm ²		mm	kg/m ³	1/R	K
1	3	70000.00	0.23	7.70	2550.00	1.0000e-05	0.00
1	2	13.87	0.49	0.76	1070.00	8.0000e-05	0.00
1	1	70000.00	0.23	7.70	2550.00	1.0000e-05	0.00

Loads:

Concentrated loads:

Package	x	y	Fx	Fy	Fz	lx	ly
	mm	mm	N	N	N	mm	mm
1	100.00	1100.00	0.00	0.00	1000.00	200.00	200.00

Face loads:

- constant distributed:

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Projekt: 20027_Defender_Olanda - Other_C5_6+8+4_Fk_a_1200_SLC

28.04.2020
Seite: 3

Package	pressure
	N/mm ²
1	0.00000e+00

Calculation approaches:
small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size	: 20.0 mm
Number of elements	: 1200
Number of nodes	: 4961 (per package)
Number of unknown	: 44280

Calculation results:

Minimum and maximum displacements w:

Package	- Position -		Displacement
	x	y	
	mm	mm	mm
1	400.00	10.00	-0.00 (min)
	0.00	1200.00	56.89 (max)

Maximum principal stress:

Package	Layer	x	y	σ	σ (max)
		mm	mm	N/mm ²	N/mm ²
1	3 (top)	122.25	1082.25	4.99	16.47
	(bottom)	82.25	2.25	18.47	
1	1 (top)	397.75	2.25	40.40	76.71
	(bottom)	97.75	2.25	76.71	

Springs:

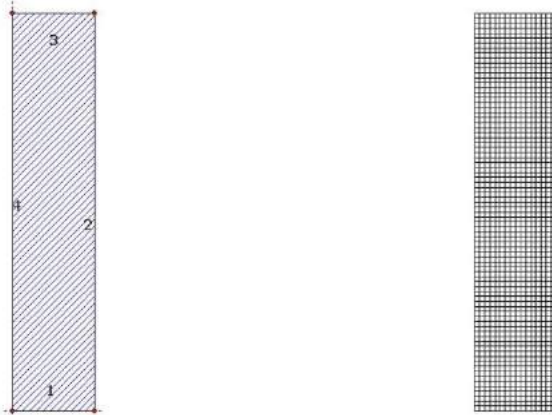
Package	Layer	u	v	w	φ	θ	Fx	Fy	Fz	M_φ	M_θ
		mm	mm	mm	rad	rad	N	N	N	Nmm	Nmm
1	3 (0.00 / 0.00)										
1	1 (0.00 / 0.00)										
1	1 (400.00 / 0.00)										
1	1 (0.00 / 0.00)										

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6.1.7 10+10+4 FTG for load category C5 and "Other" - L1=1200mm

Projekt: 20027_Defender_Olanda - Other_C5_10+10+4_Fk_a_1200_SLC_SGP 28.04.2020
Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint mm	mm	Arcoenter mm	Direction of rotation mm	+/-
1	0,00	0,00			
2	250,00	0,00			

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Projekt: 20027_Defender_Olanda - Other_C5_10+10+4_Fk_a_1200_SLC_SGP 28.04.2020
Seite: 2

3	250,00	1200,00
4	0,00	1200,00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,p,0: fixed (all d.o.f supported and clamped)

Spring supports:

Package	Layer	x	y	z	C _x	C _y	C _z	C _φ	C _ψ
		mm	mm	mm	N/mm	N/mm	N/mm	Nmm	Nmm
1	1	0,0	0,0	0,0	1,000e+00	1,000e+00	0,000e+00	0,00e+00	0,00e+00
1	1	250,0	0,0	0,0	0,000e+00	1,000e+00	0,000e+00	0,00e+00	0,00e+00

Layers:

Layer order:

Package	Layer	Description
1	3	ESG
1	2	PWS Langzeitbelastung
1	1	ESG

Mechanical properties:

Package	Layer	E-mod.	ν	Thickness	Density	ot	ΔT
		N/mm ²		mm	kg/m ³	1/K	K
1	3	70000,00	0,23	9,70	2530,00	1,0000e-05	0,00
1	2	13,87	0,49	0,76	1070,00	8,0000e-05	0,00
1	1	70000,00	0,23	9,70	2530,00	1,0000e-05	0,00

Loads:

concentrated loads:

Package	x	y	Fx	Fy	Fz	lx	ly
	mm	mm	N	N	N	mm	mm
1	100,00	1100,00	0,00	0,00	1000,00	200,00	200,00

Face loads:
- constant distributed:

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Projekt: 20027_Defender_Olanda - Other_C5_10+10+4_Fk_a_1200_SLC_SGP

28.04.2020

Seite: 3

Package pressure
N/mm²
1 0.0000e+00

Calculation approaches:
small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size : 15.0 mm
Number of elements : 1280
Number of nodes : 5313 (per package)
Number of unknown : 47520

Calculation results:

Minimum and maximum displacements w:

Package	Position		Displacement w
	x	y	
1	250.00	7.50	-0.00 (min)
	0.00	1200.00	45.95 (max)

Maximum principal stress:

Package	Layer	x	y	σ		
				N/mm ²	σ (max)	
1	3	(top)	95.51	1131.69	1.38	19.03
		(bottom)	91.99	1.69	19.03	
1	1	(top)	248.24	1.69	25.10	76.62
		(bottom)	101.56	1.69	76.62	

Springs:

Package	Layer	x / y	u	v	w	φ	θ	Fx	Fy	Fz	M _x	M _y
			mm	mm	mm	rad	rad	N	N	N	Nmm	Nmm
1	1	(0.00 / 0.00)	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00
		(250.00 / 0.00)	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00
1	1	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.00	0.00	0.00	

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6.2 Results profile calculation with finite element software Sofistik

6.2.1 General information and overview

For each Logli Defender aluminium profile and both load directions LCA in direction of fall and LCB against direction of fall a numerical simulations (verifications) were done using the finite element software Sofistik. Thereby an ideal elastic-plastic material property curve is used with horizontal yield plateau after reaching the yield stress.

The load pair applied in the model respectively the top load coming from the fixing of the glass into the profile is the reference value F_{pRd} used in the profile calculations shown in chapter 4. This is the maximum applicable force at ultimate limit state.

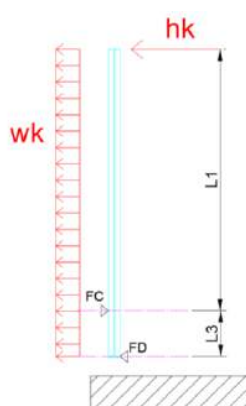
According to the findings obtained for each profile and load direction LCA and LCB, results are provided for a fixing distance E in mm.

All other results are available on request - please contact Logli company.

Maximum design resistance profiles - LCA and LCB				
	FCRd.LCA [kN/m]	FCRd.LCB [kN/m]	FCRd.LCA / FCRd.LCB	Check if ≥0.5
DF88DK_E200	88,45	47,00	0,531	YES
DF88DK_E400	55,28	28,20	0,510	YES
DF88LM_E200	36,70	36,70	1,000	YES
DF88LM_E400	18,35	18,35	1,000	YES
DF88FR_E200	43,55	28,20	0,648	YES
DF88FR_E400	21,78	14,30	0,657	YES
DF88PICO_E125	72,24	72,24	1,000	YES
DF88PICO_E250	50,56	50,56	1,000	YES
DF1010LM_E200	68,80	68,80	1,000	YES
DF1010FR_E200	78,45	61,20	0,780	YES
DF1212LM_E200	68,80	68,80	1,000	YES
DF1212FR_E200	78,45	61,20	0,780	YES

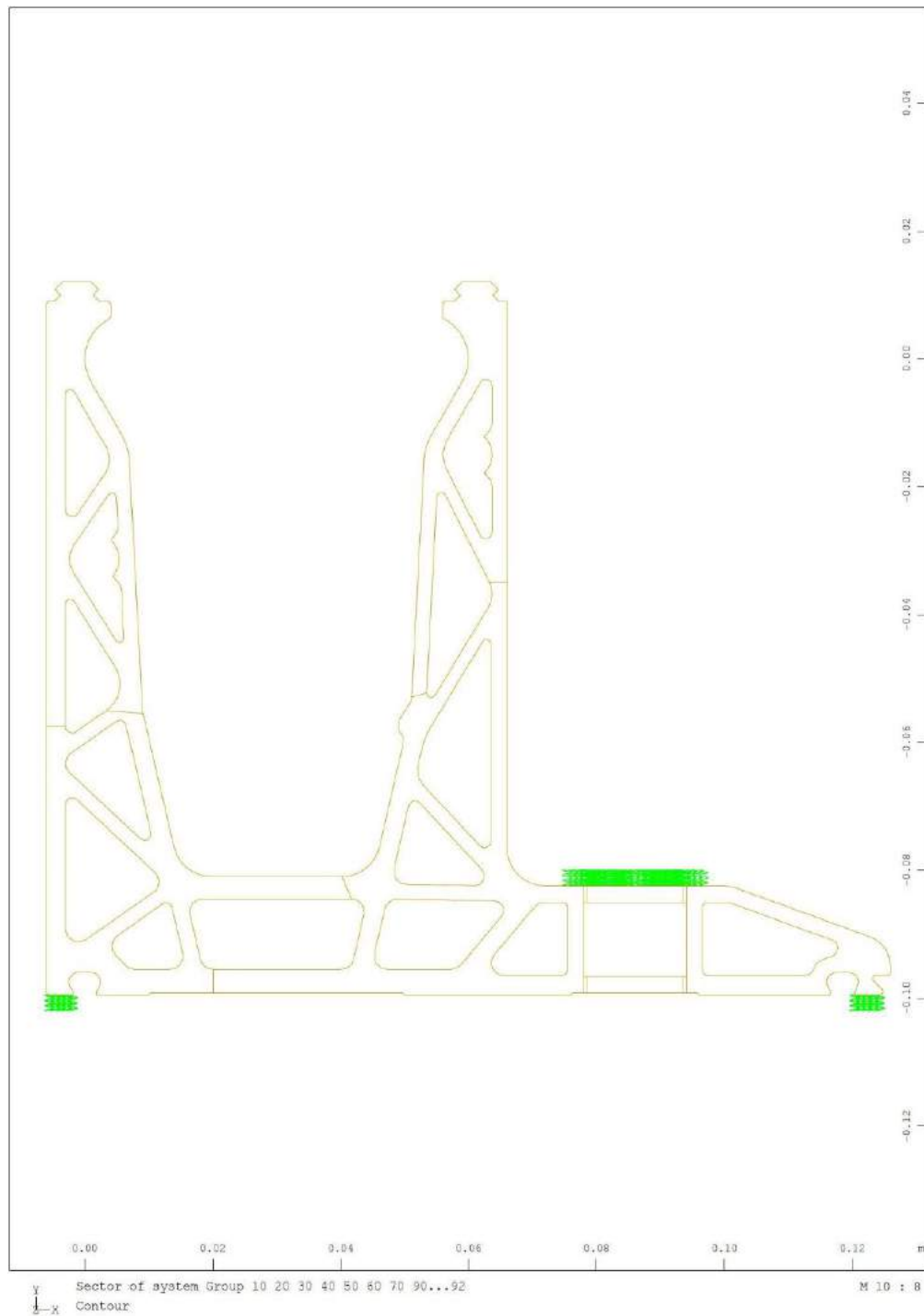
General notes:

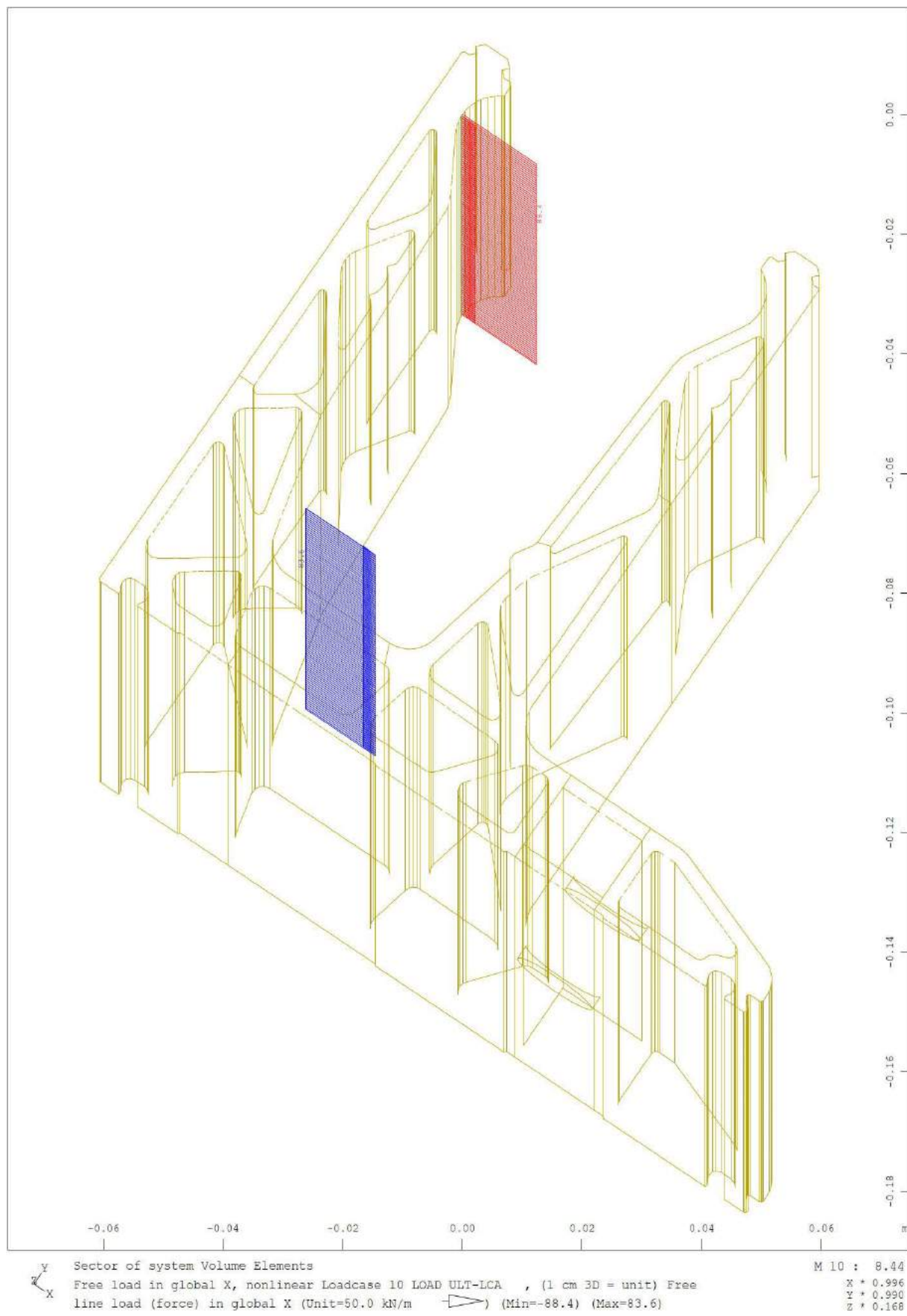
FCRd=maximum acting top contact force glass into profile at ULS based on numerical simulations

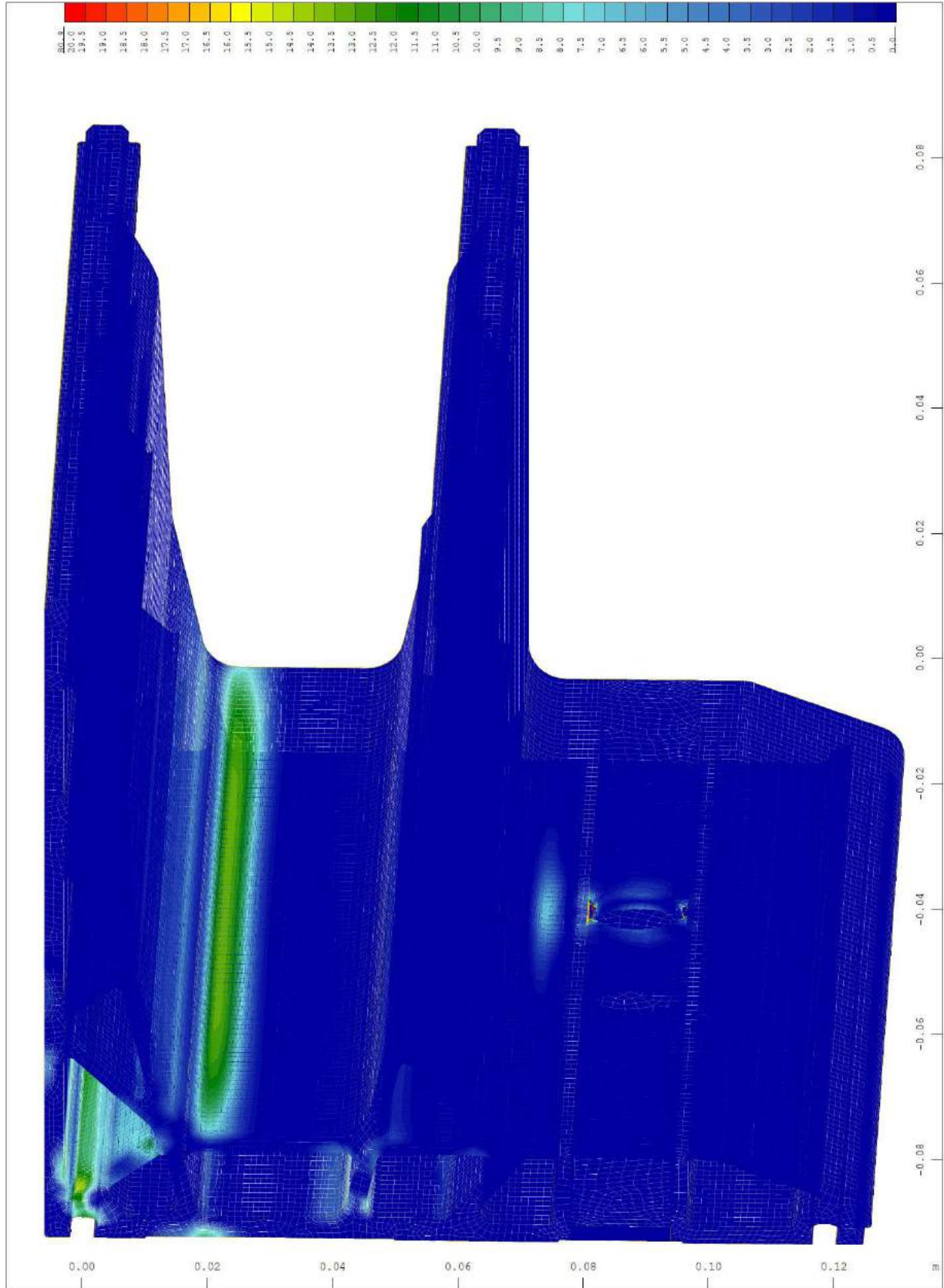


As can be seen in the overview table, the resistance of the profiles in “secondary” direction LCB against direction of fall is at least half of the resistance of the main direction.

6.2.2 Defender DF88DK_E200

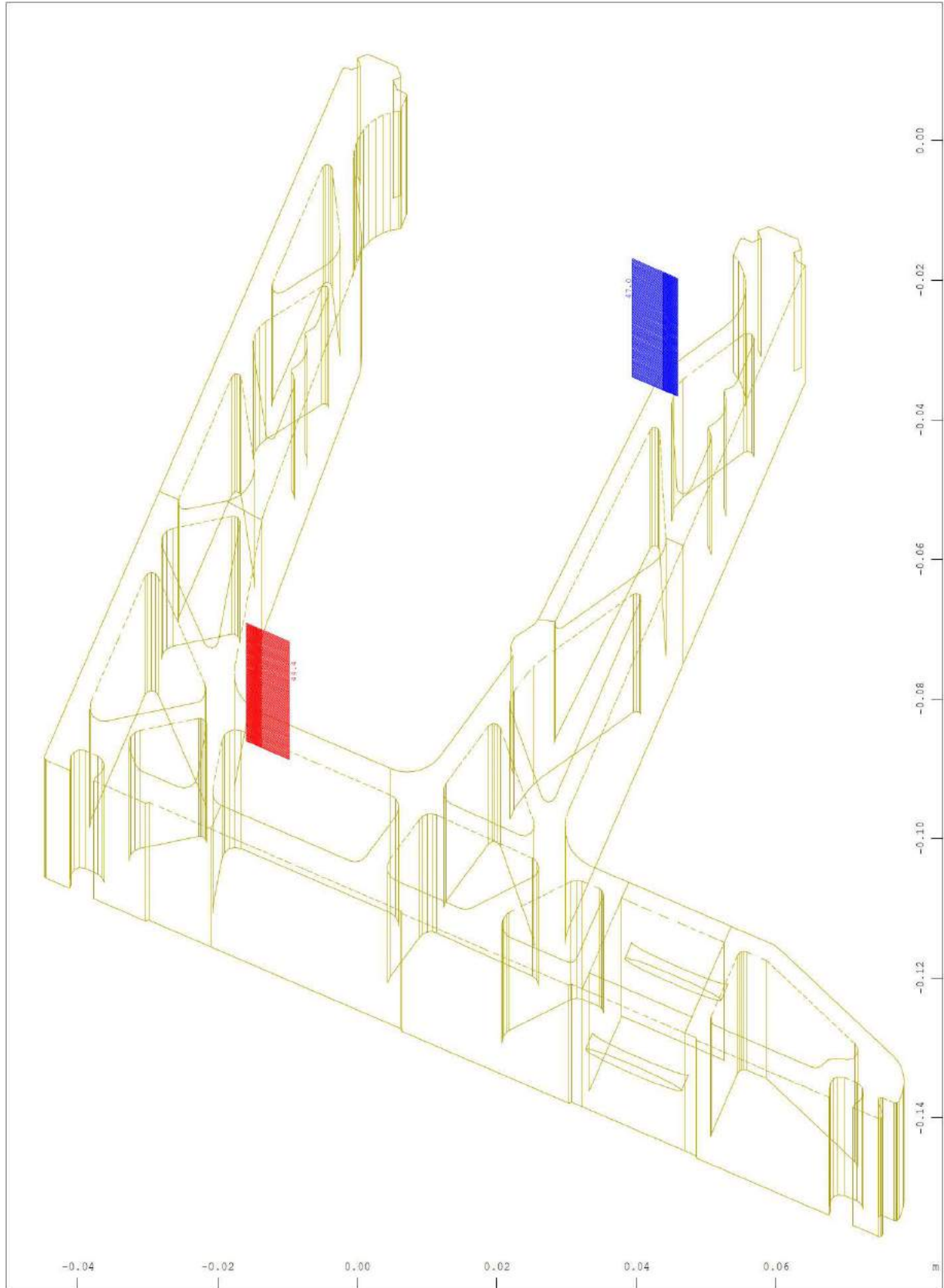






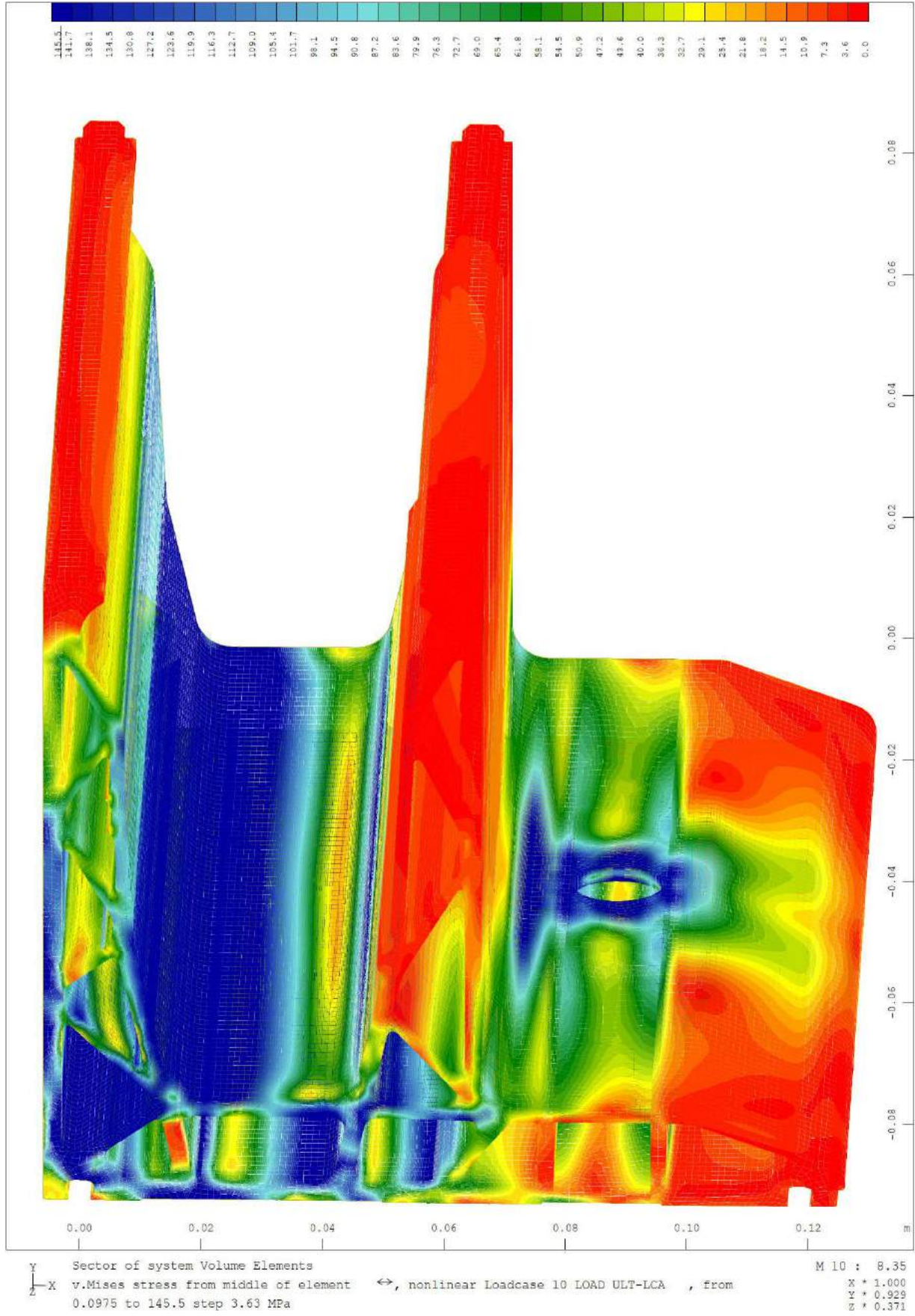
Y Sector of system Volume Elements
 X Plastic deviatoric strain ↔, nonlinear Loadcase 10 LOAD ULT-LCA, Material law Mat.type
 17 , BRIC Gauss points in Node o/oo, from 0 to 20.0 step 0.500

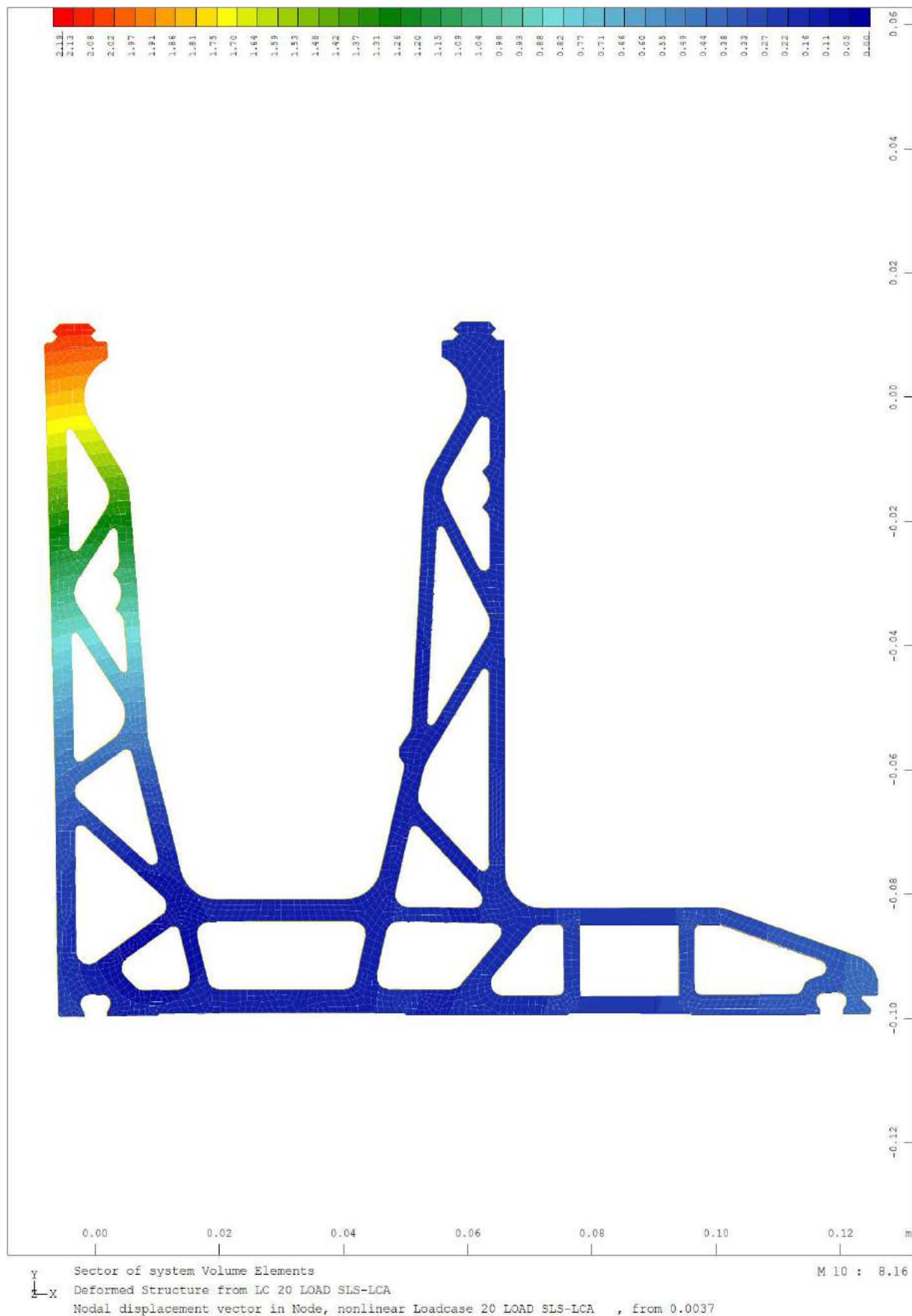
M 10 : 8.35
 X * 1.000
 Y * 0.929
 Z * 0.371

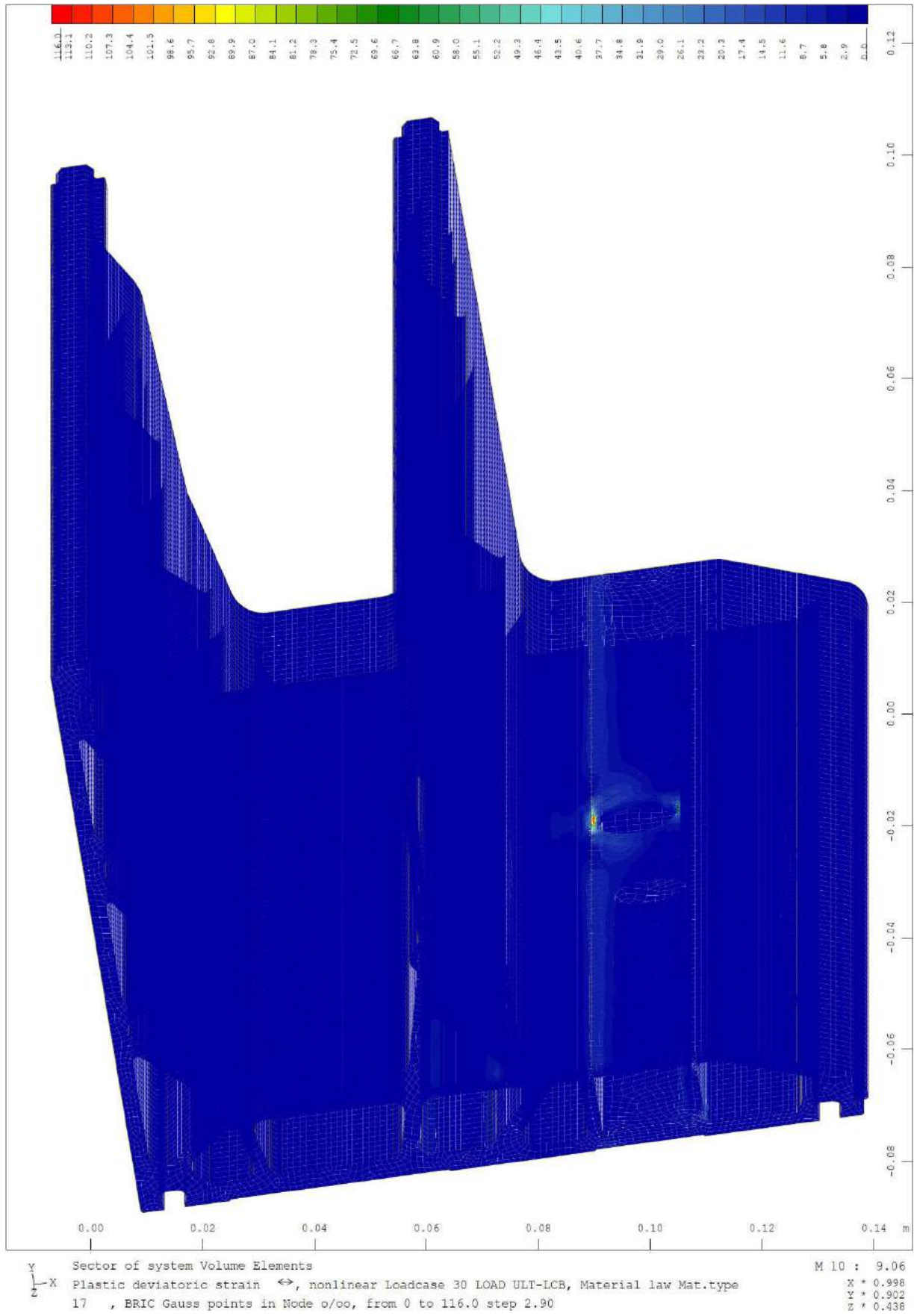


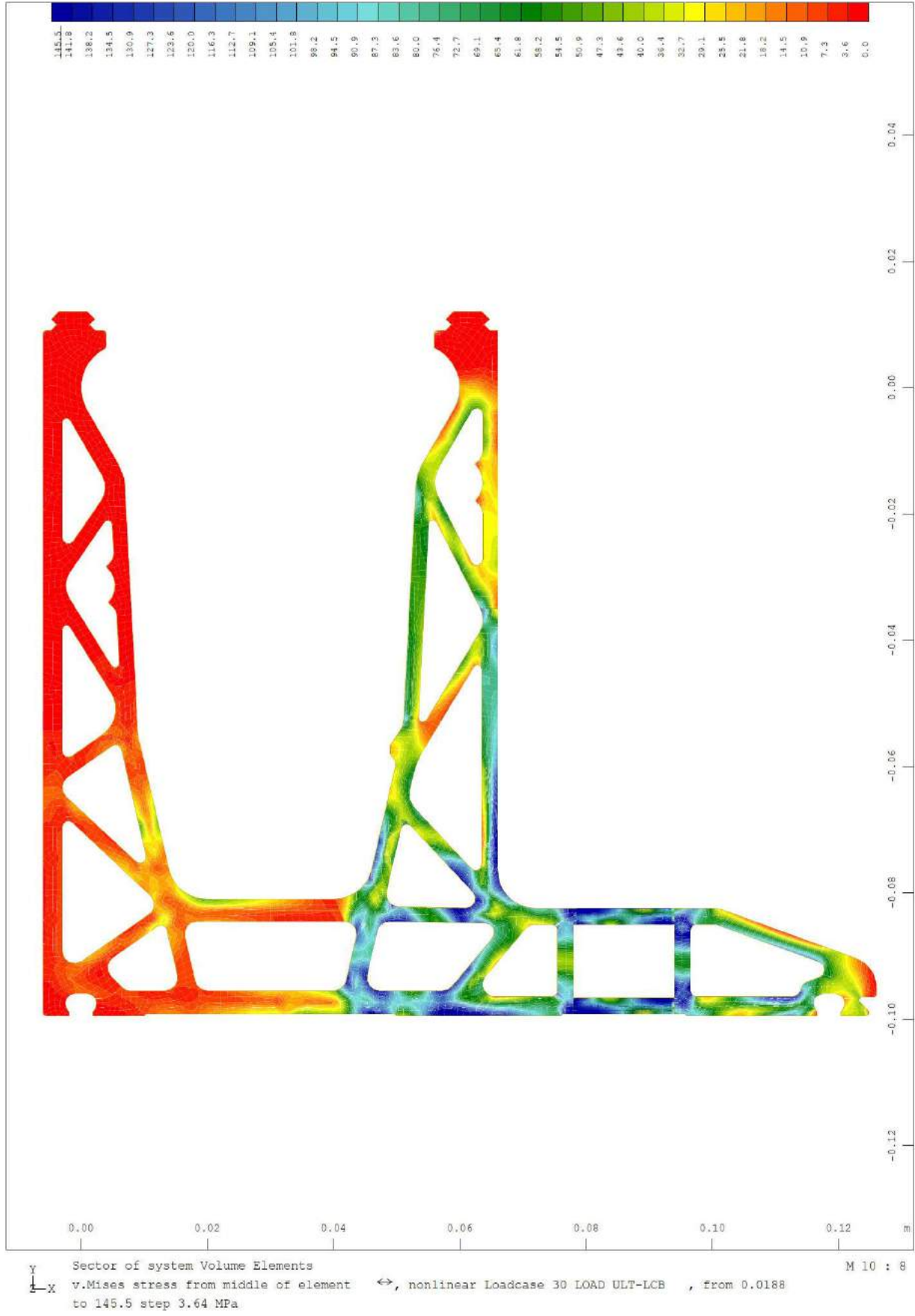
Sector of system Volume Elements
 Free load in global X, nonlinear Loadcase 30 LOAD ULT-LCB , (1 cm 3D = unit) Free
 line load (force) in global X (Unit=50.0 kN/m \rightarrow) (Min=-44.4) (Max=47.0)

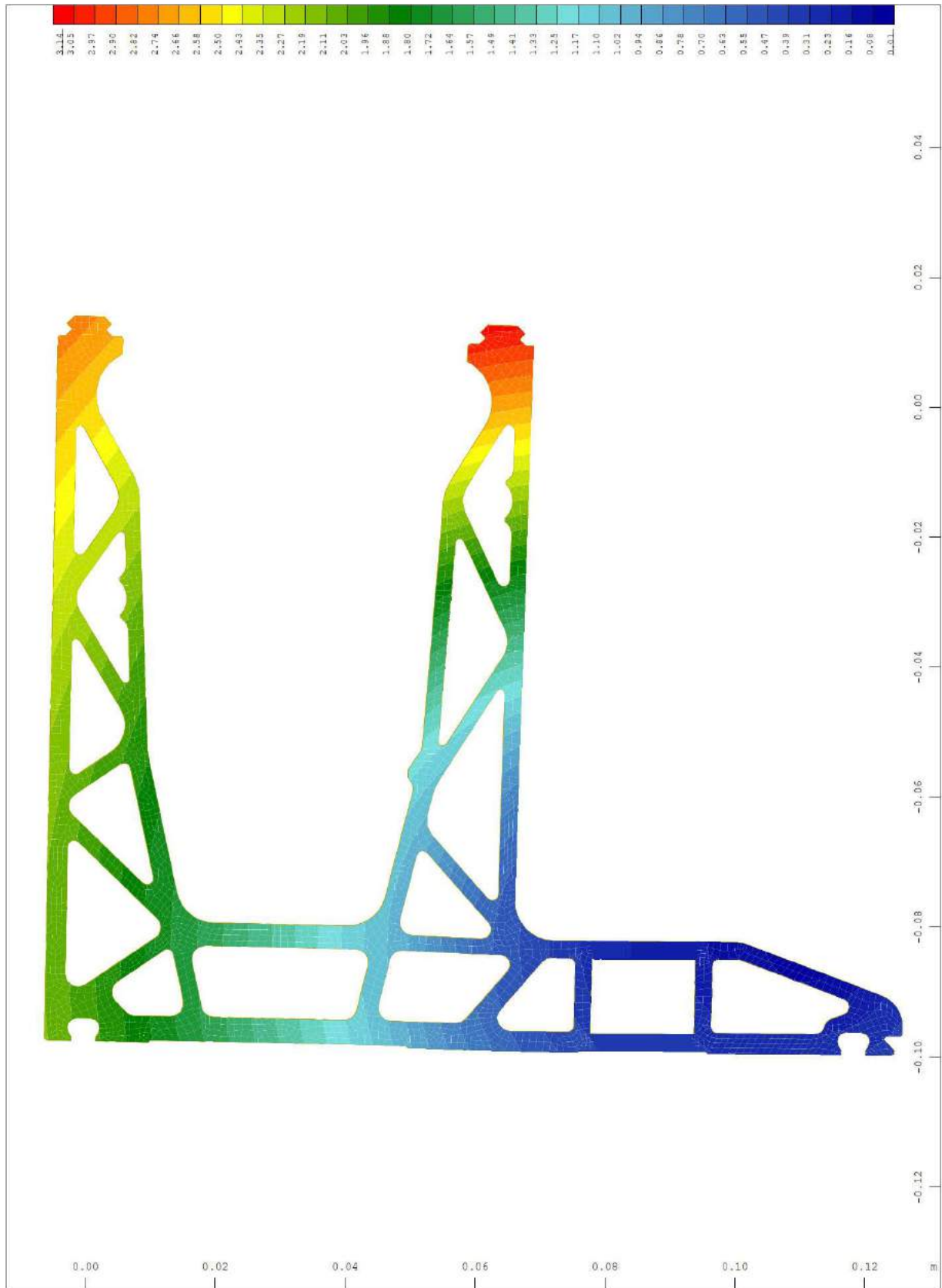
M 10 : 7.50
 X * 0.999
 Y * 0.997
 Z * 0.084





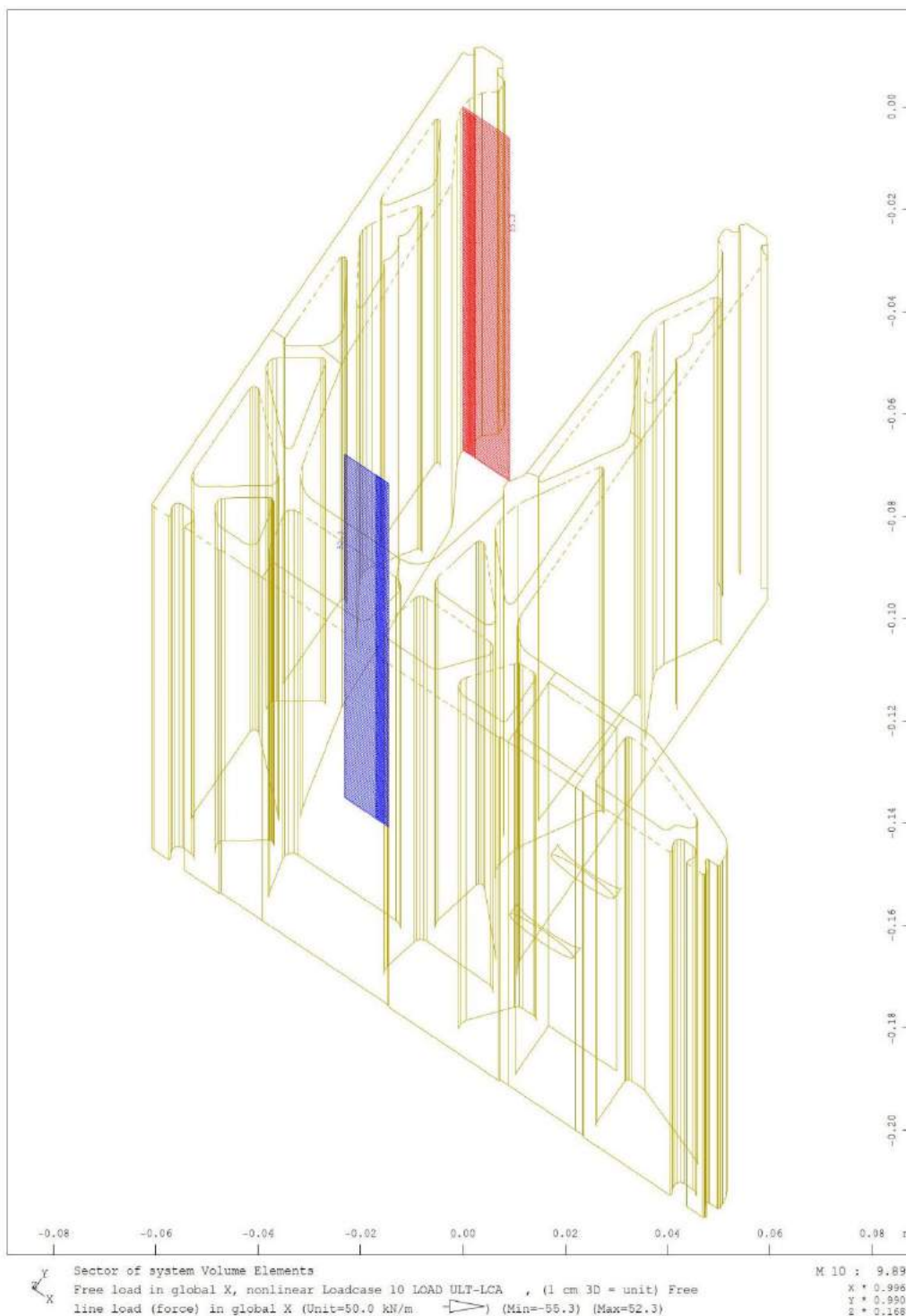


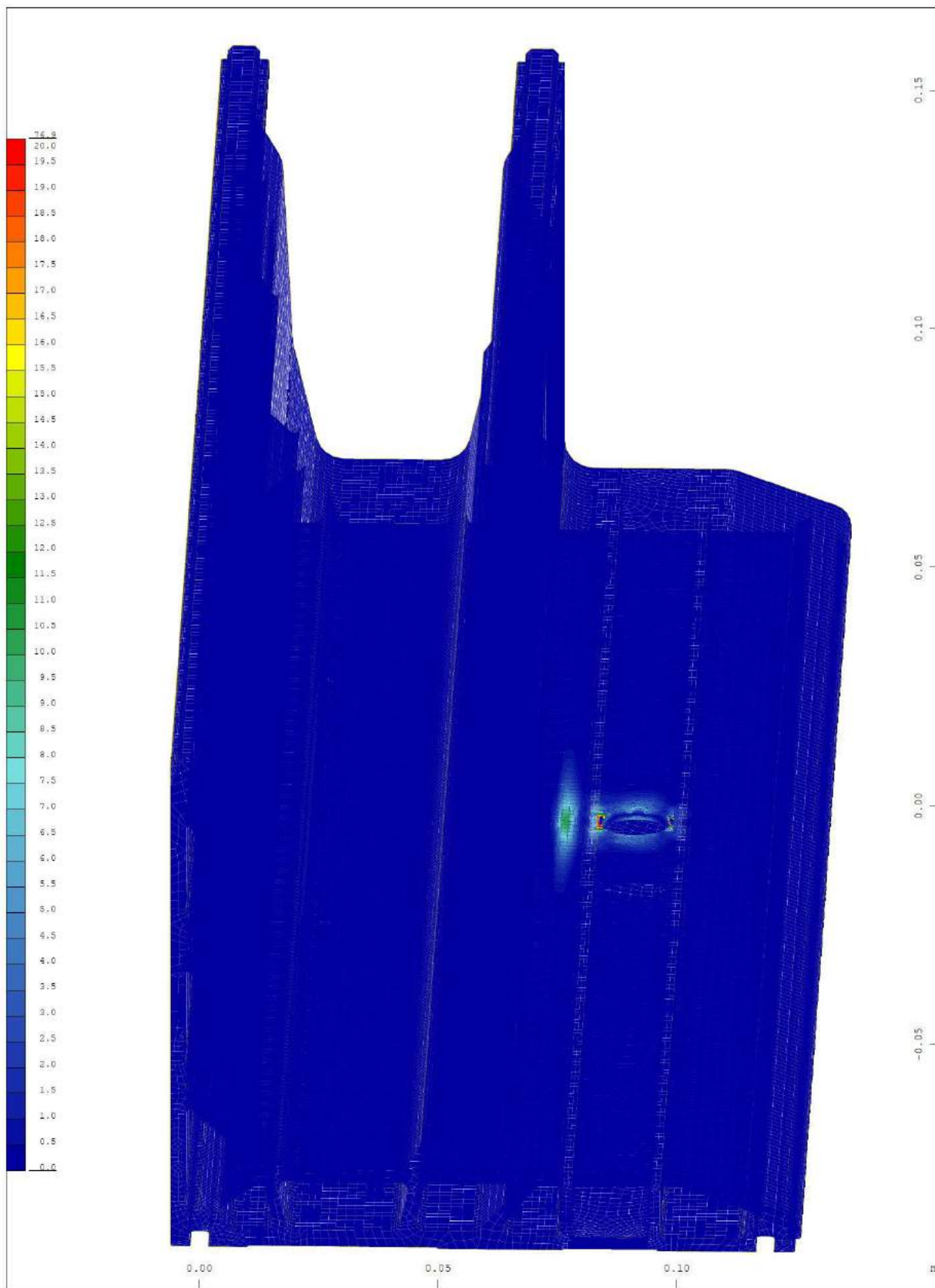




Y
X
Sector of system Volume Elements M 10 : 8
Deformed Structure from LC 40 LOAD SLS-LCB
Nodal displacement vector in Node, nonlinear Loadcase 40 LOAD SLS-LCB , from 0.0137 to

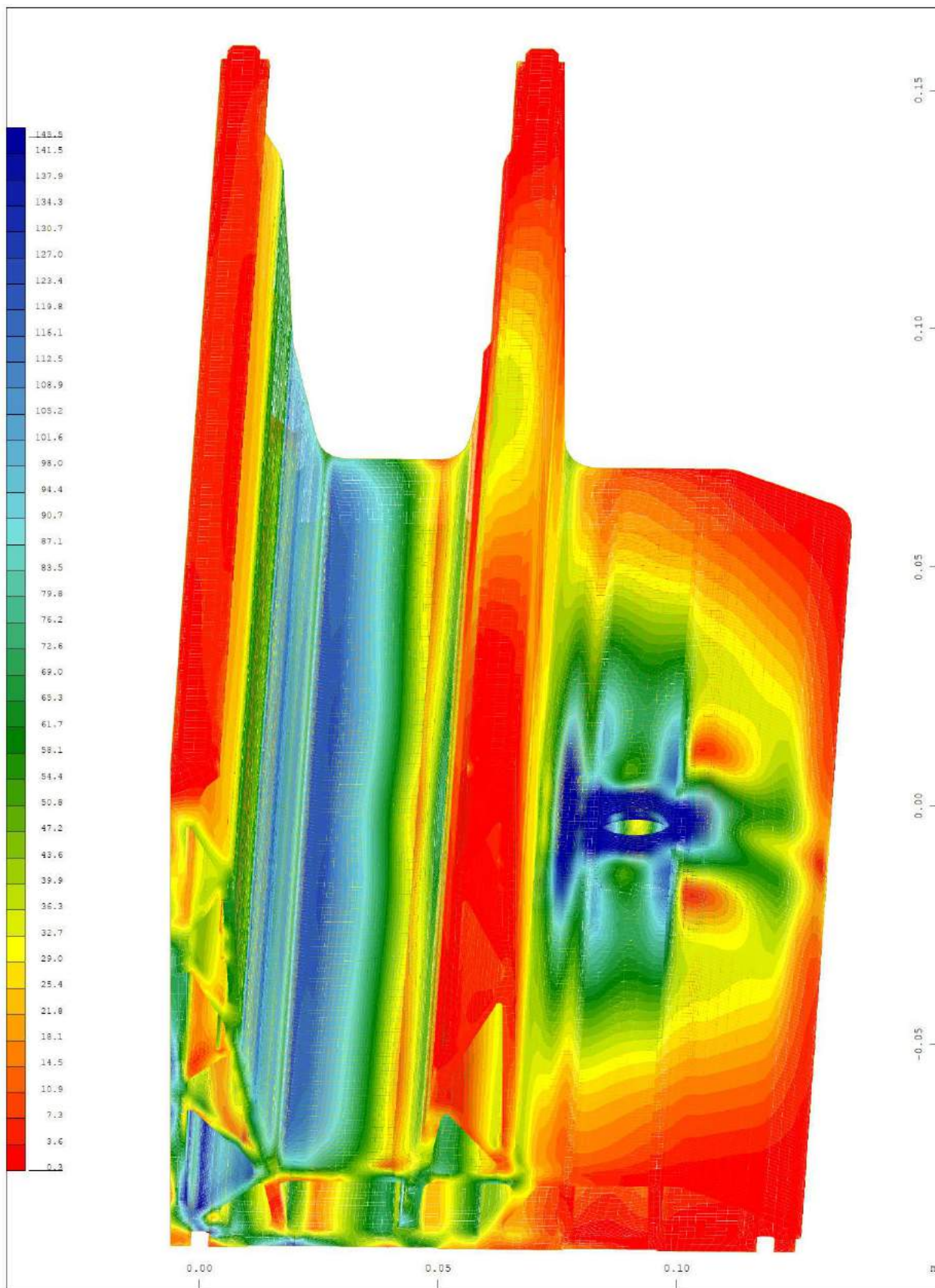
6.2.3 Defender DF88DK_E400





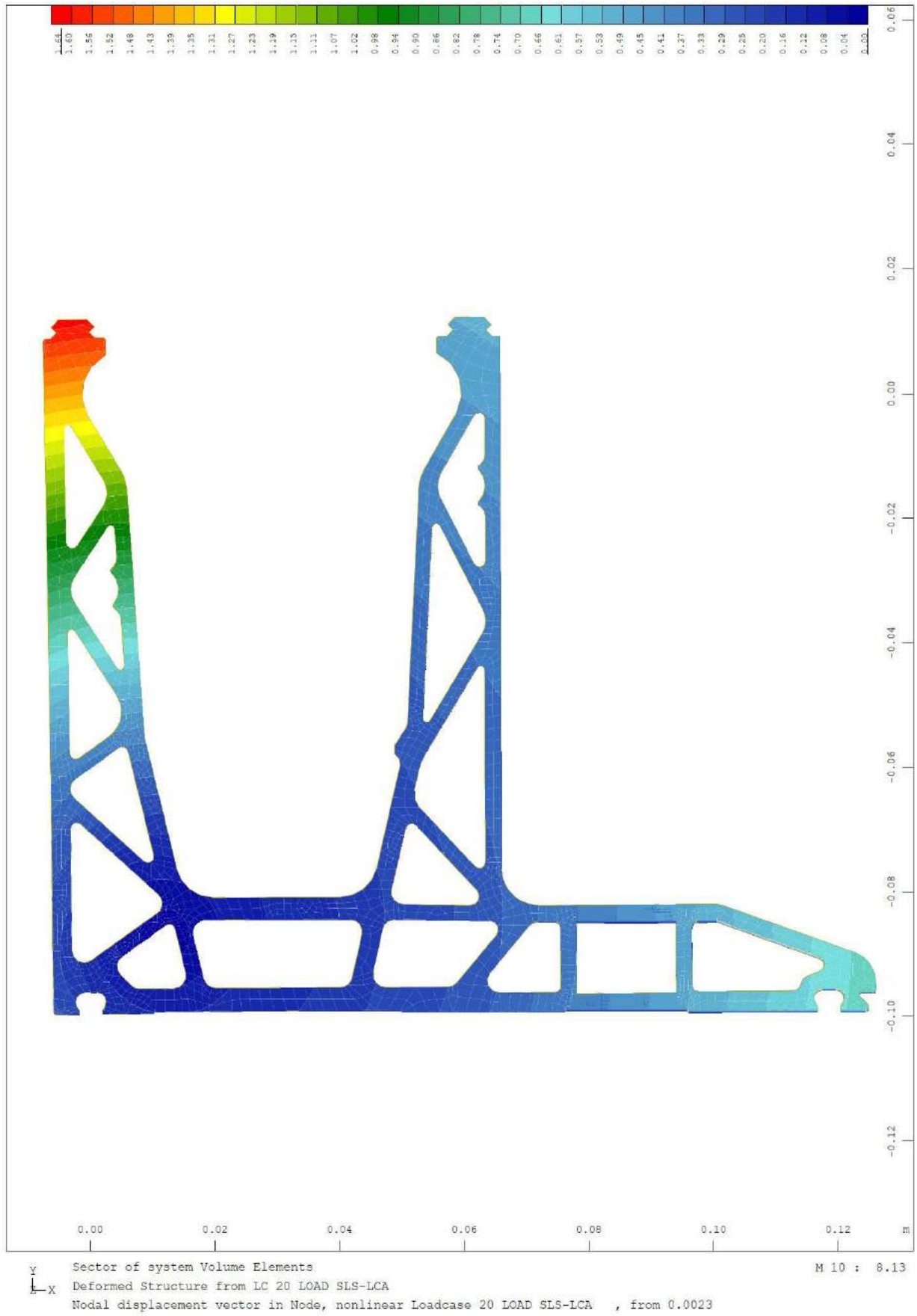
Y Sector of system Volume Elements
 X Plastic deviatoric strain ↔, nonlinear Loadcase 10 LOAD ULT-LCA, Material law Mat.type
 Z 17 , BRIC Gauss points in Node o/oo, from 0 to 20.0 step 0.500

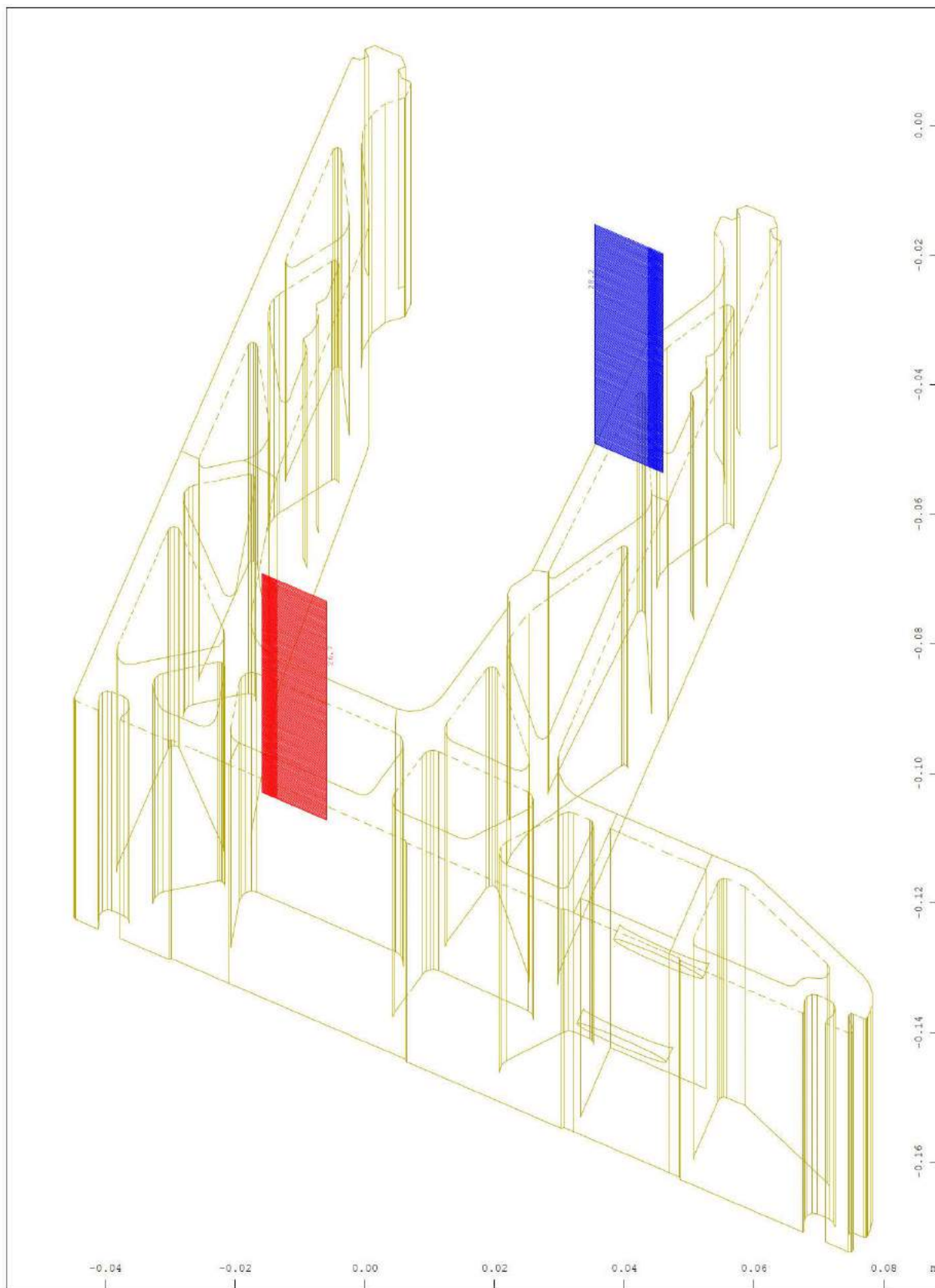
M 1 : 1.09
 X * 1.000
 Y * 0.929
 Z * 0.371



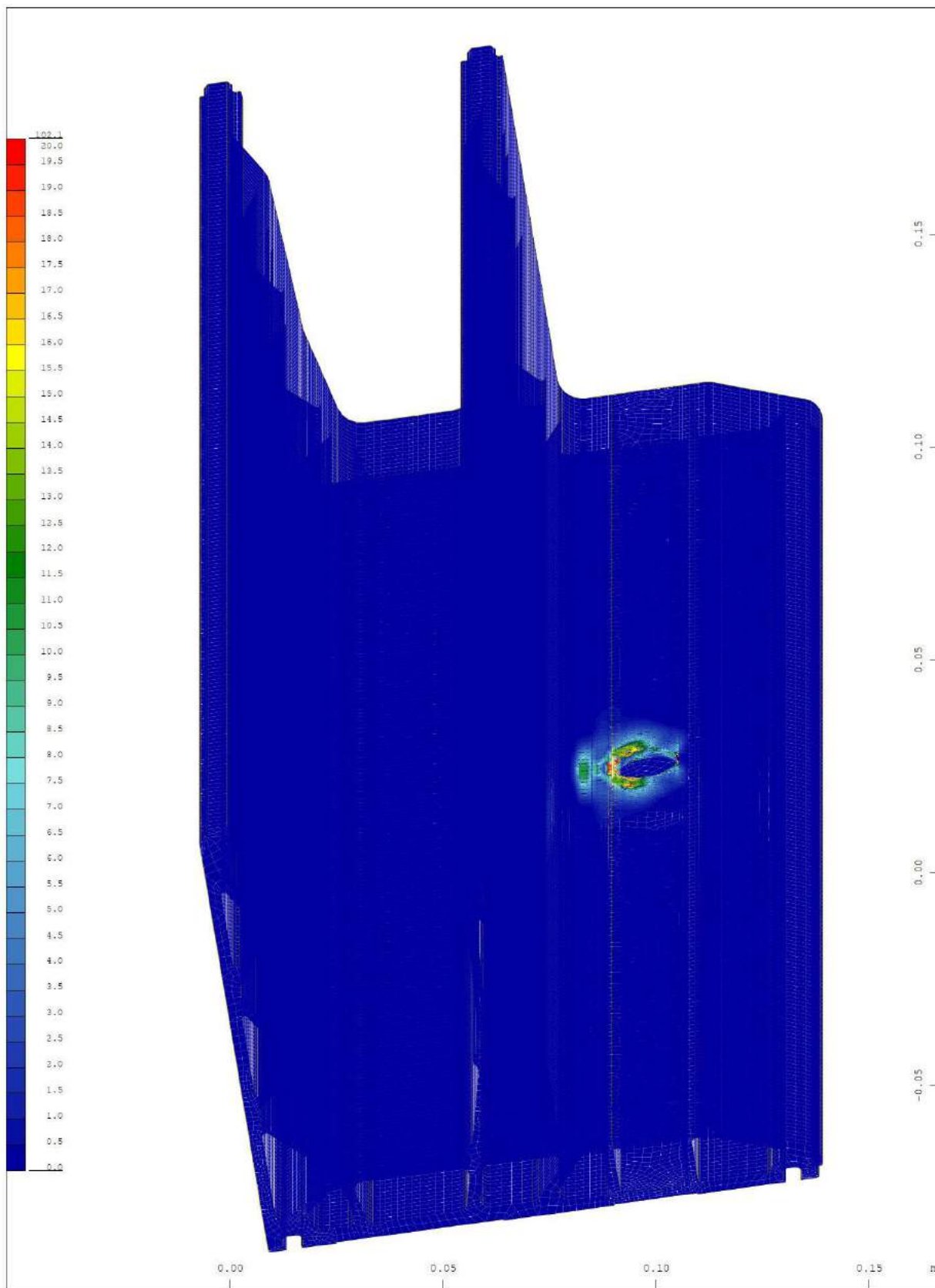
Y Sector of system Volume Elements
 X v.Mises stress from middle of element ↔, nonlinear Loadcase 10 LOAD ULT-LCA , from
 Z 0.287 to 145.5 step 3.63 MPa

M 1 : 1.09
 X * 1.000
 Y * 0.929
 Z * 0.371



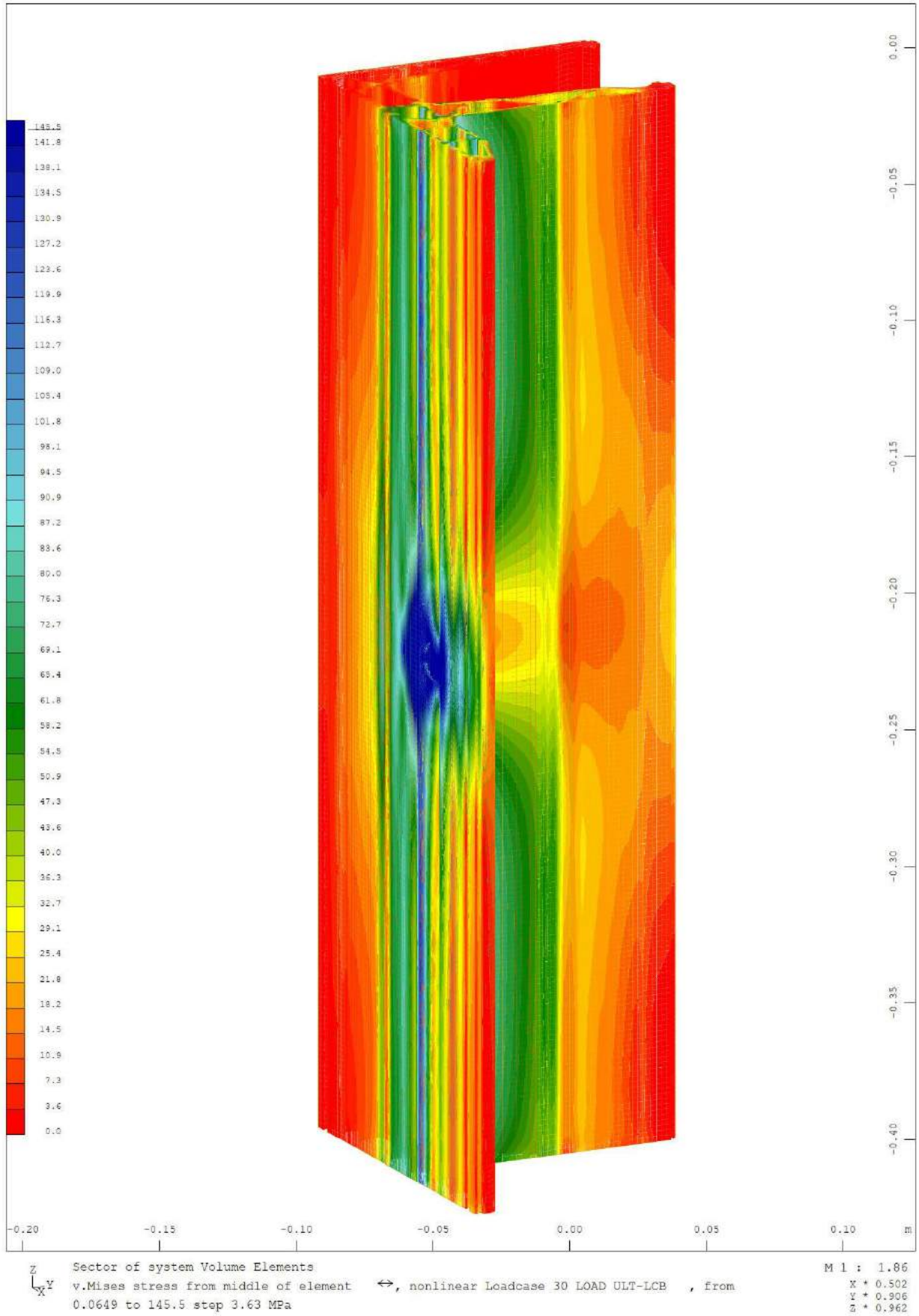


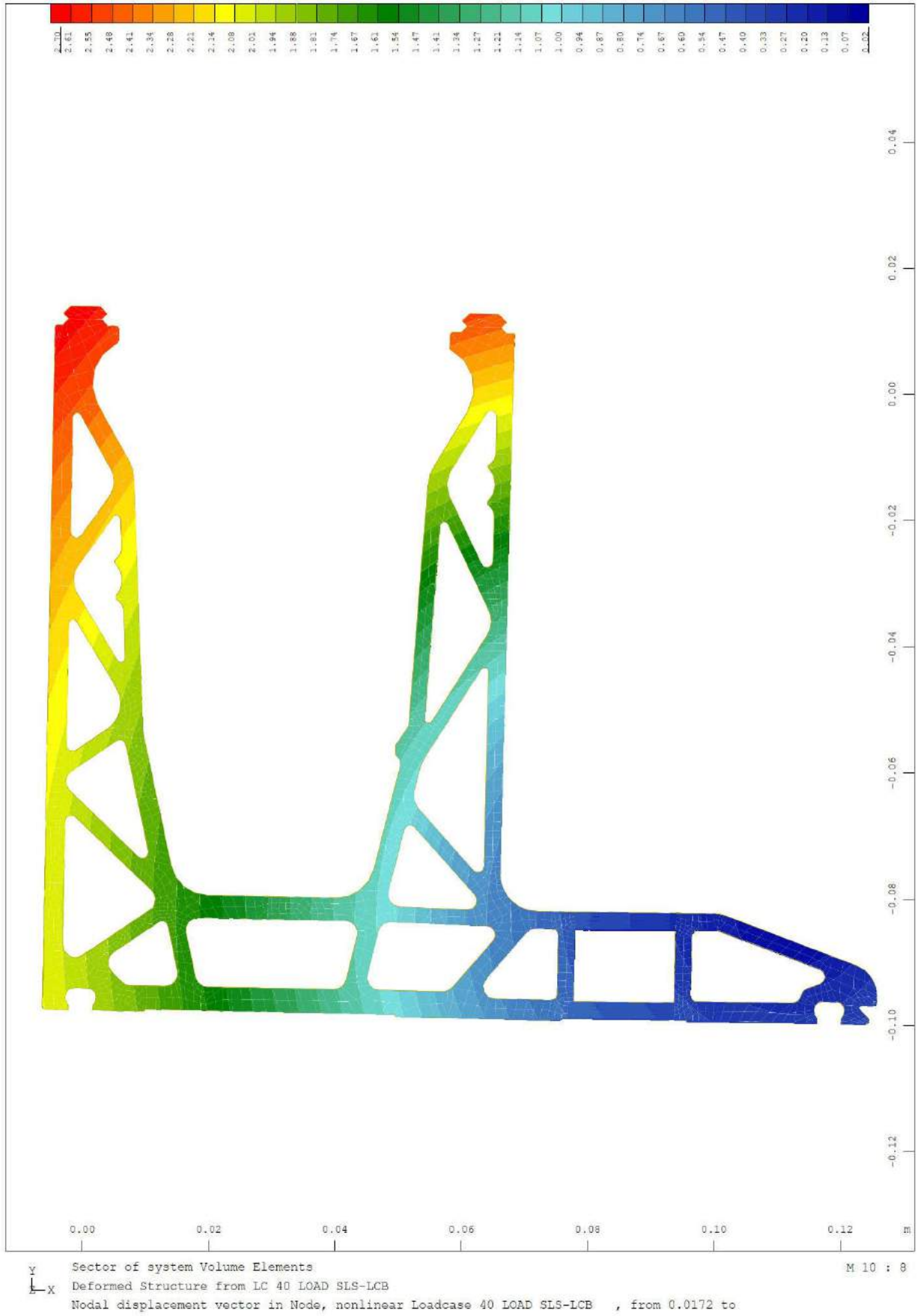
Sector of system Volume Elements M 10 : 8.05
 Free load in global X, nonlinear Loadcase 30 LOAD ULT-LCB , (1 cm 3D = unit) Free X * 0.999
 line load (force) in global X (Unit=20.0 kN/m  (Min=-26.7) (Max=28.2) V * 0.997
Σ * 0.084



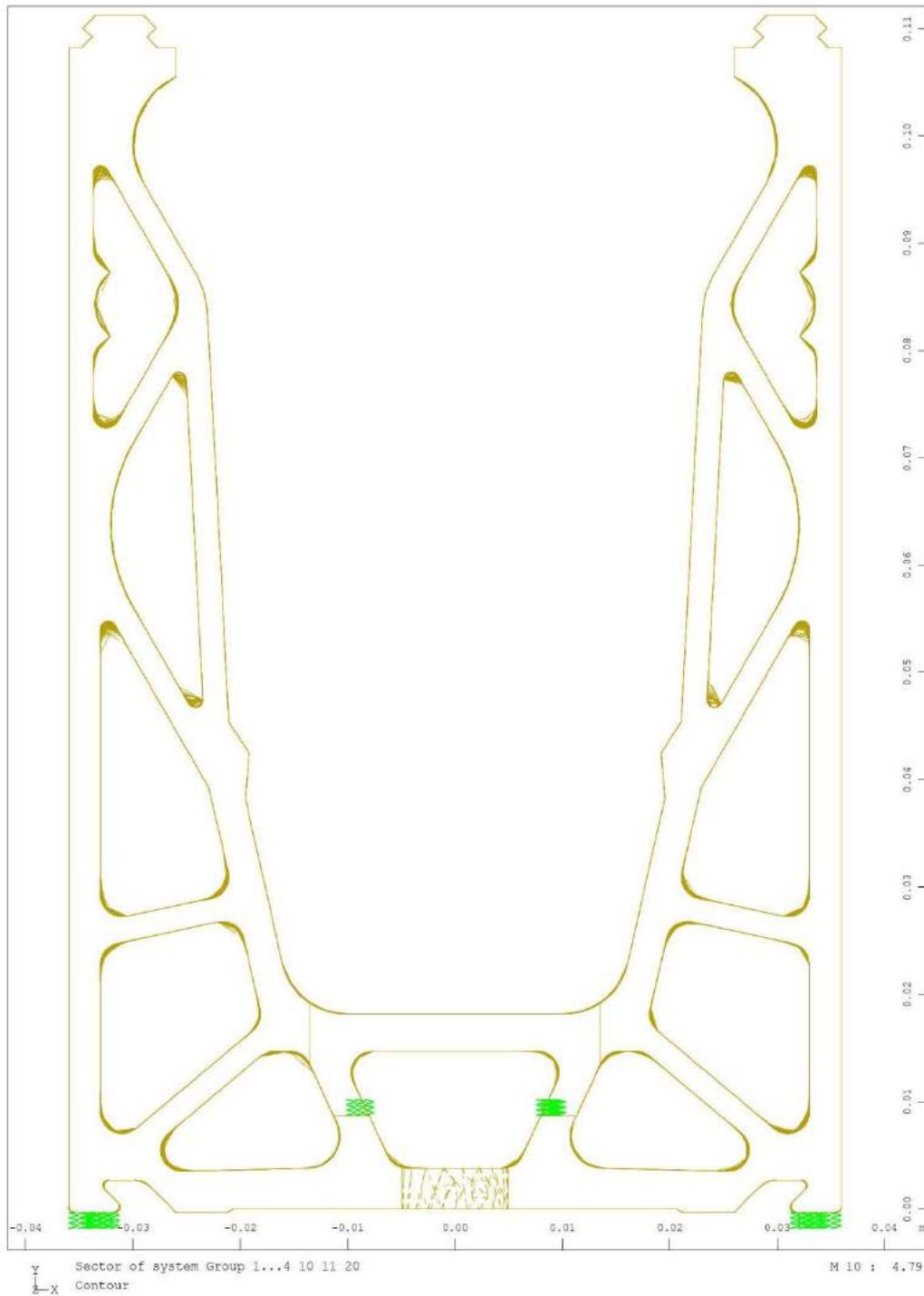
Y
X
Sector of system Volume Elements
Plastic deviatoric strain ↔, nonlinear Loadcase 30 LOAD ULT-LCB, Material law Mat.type
17 , BRIC Gauss points in Node o/oo, from 0 to 20.0 step 0.500

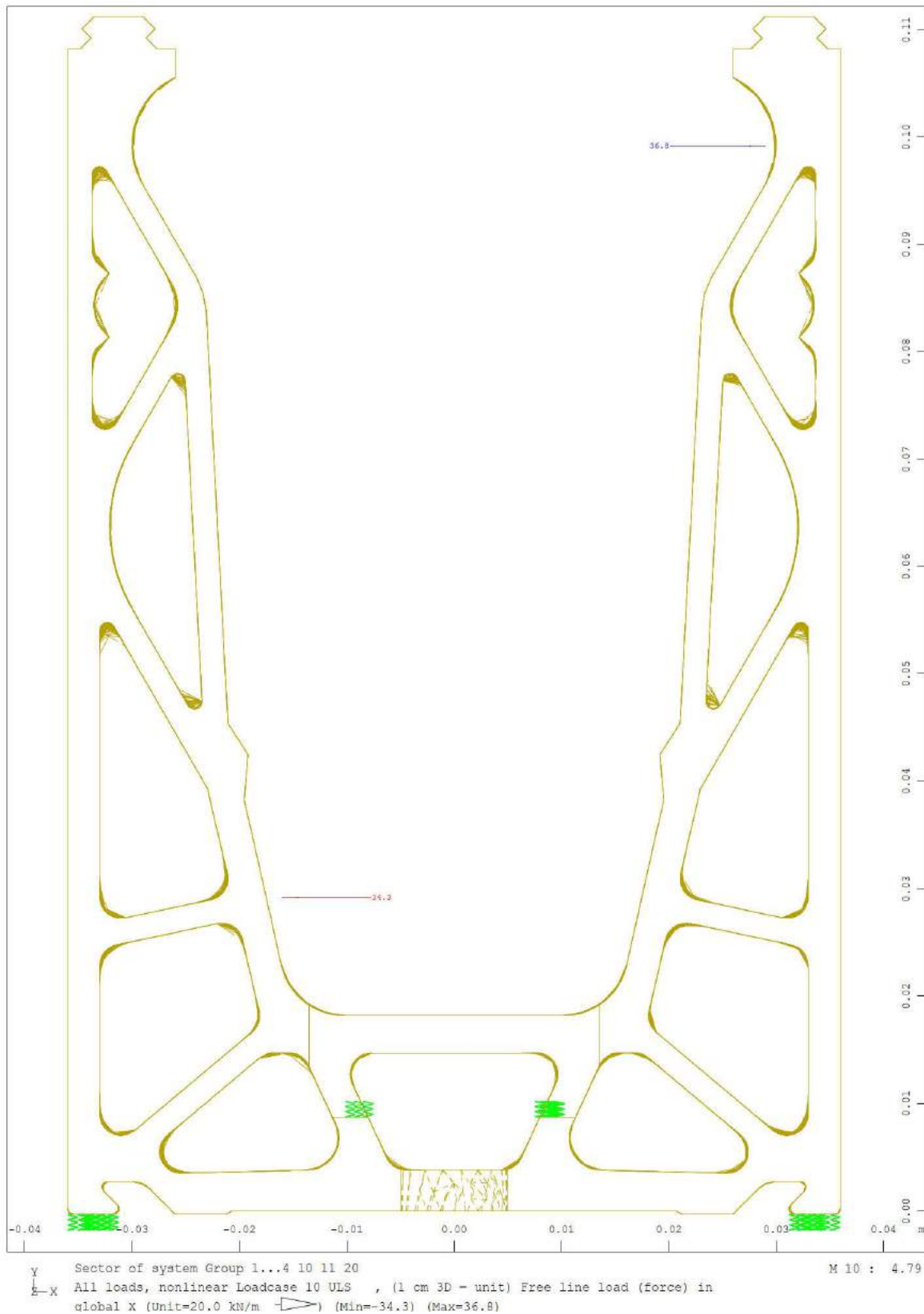
M 1 : 1.23
X * 0.998
Y * 0.902
Z * 0.438

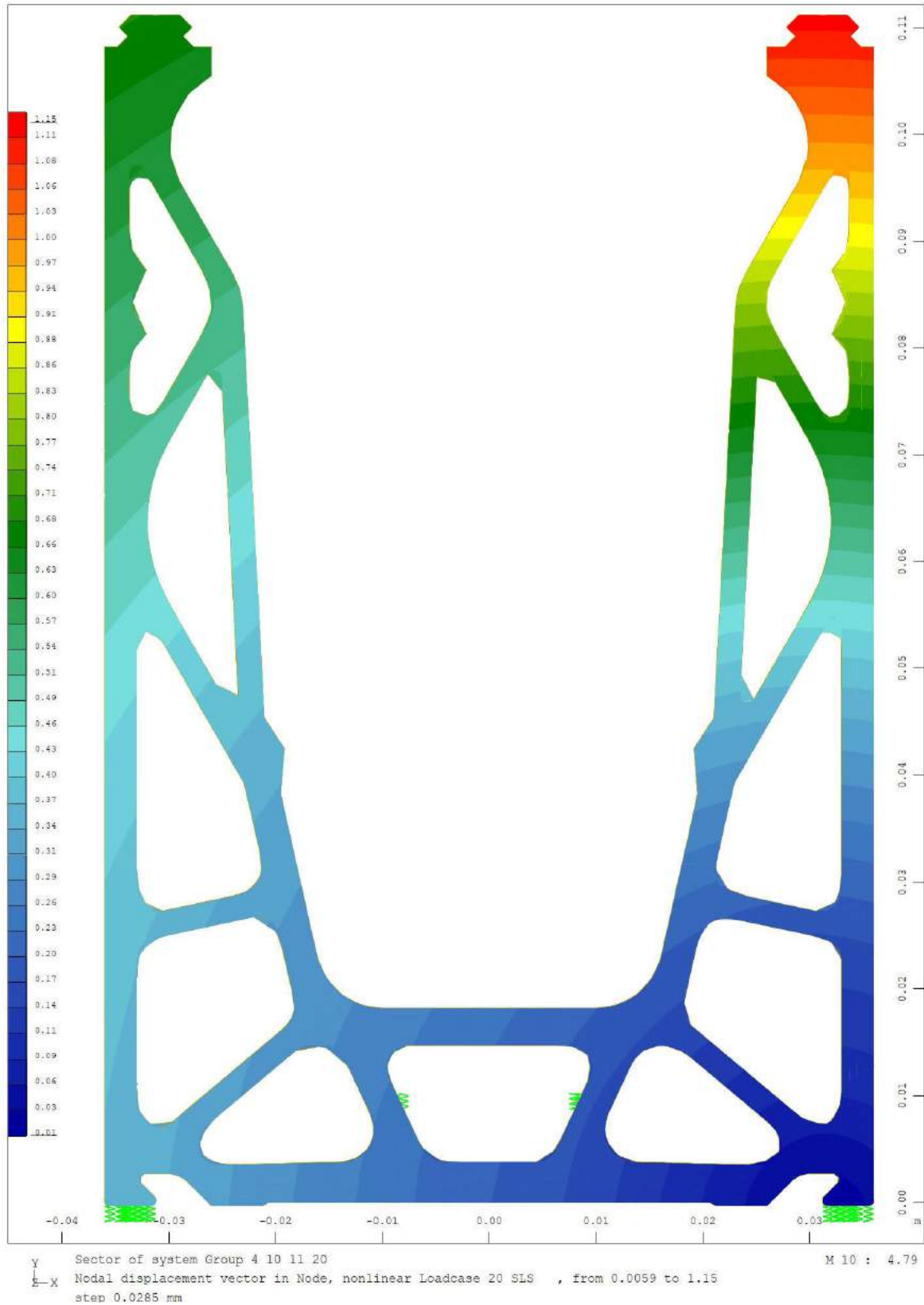


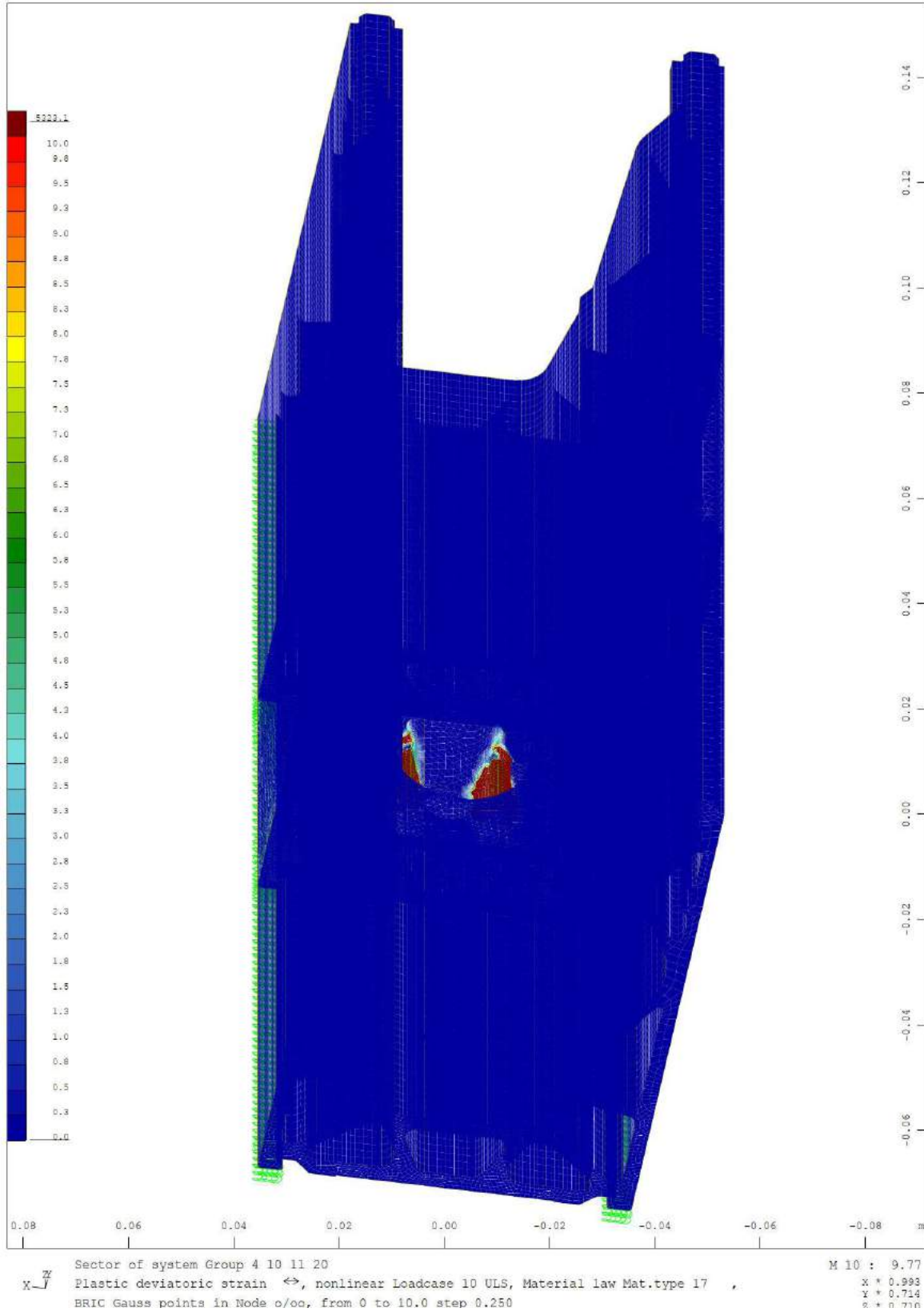


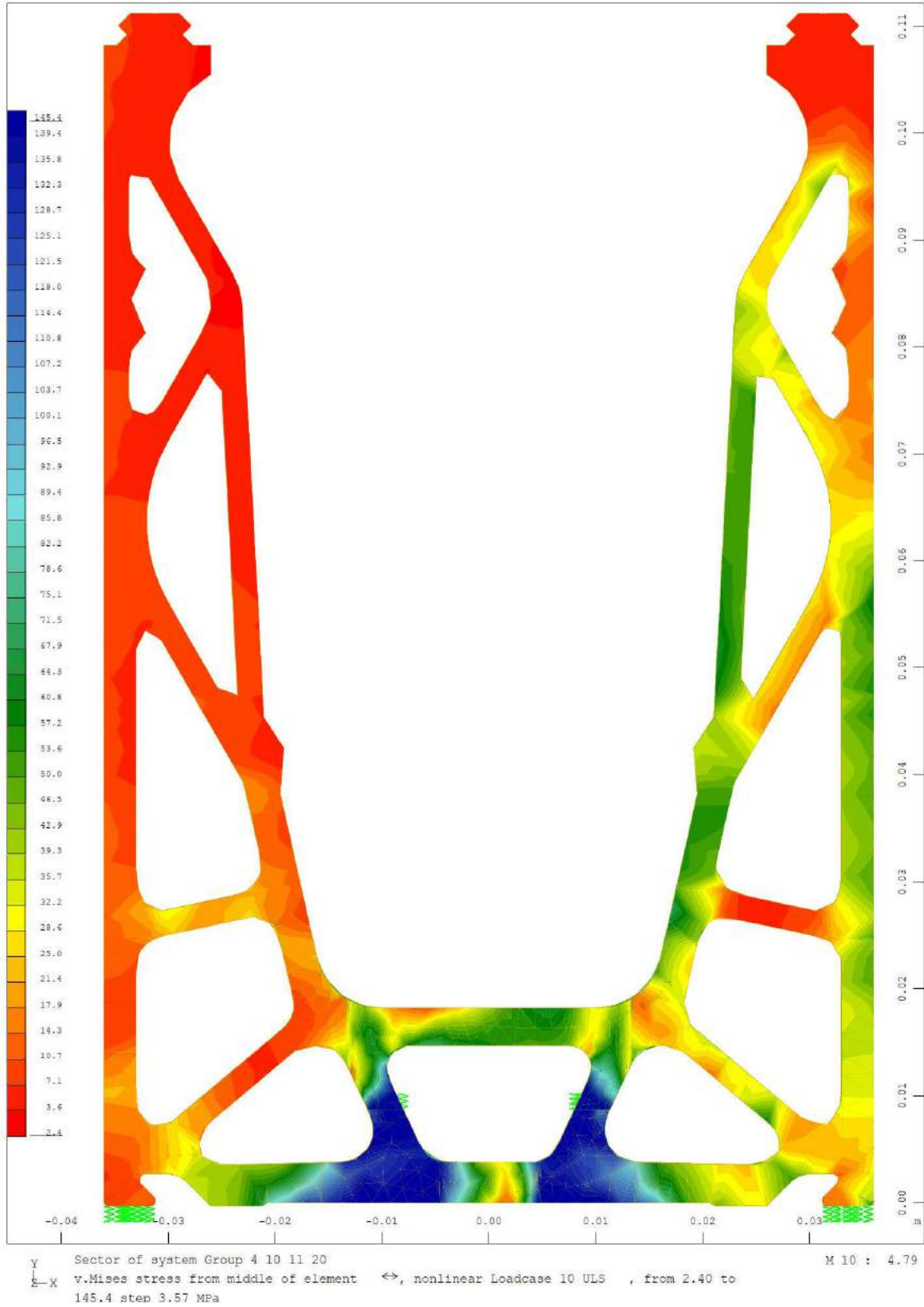
6.2.4 Defender DF88LM_E200



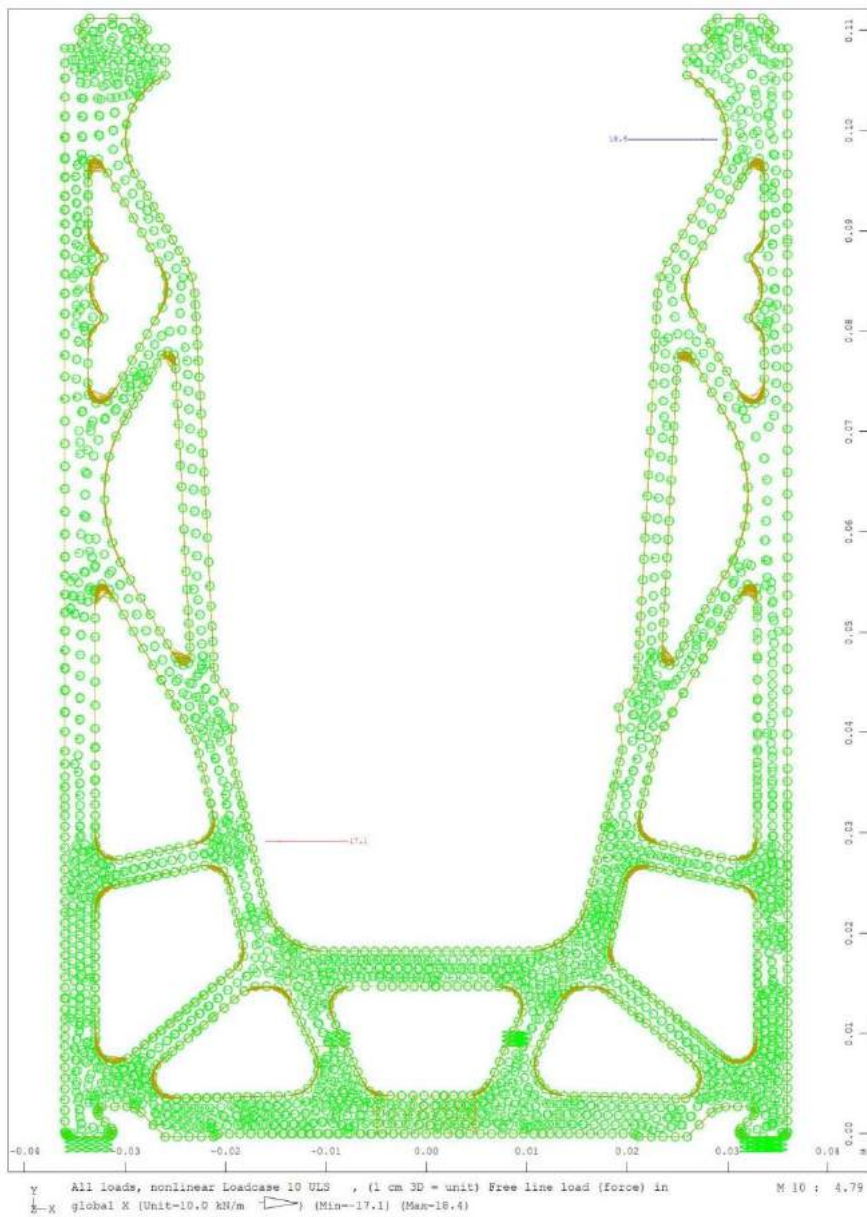


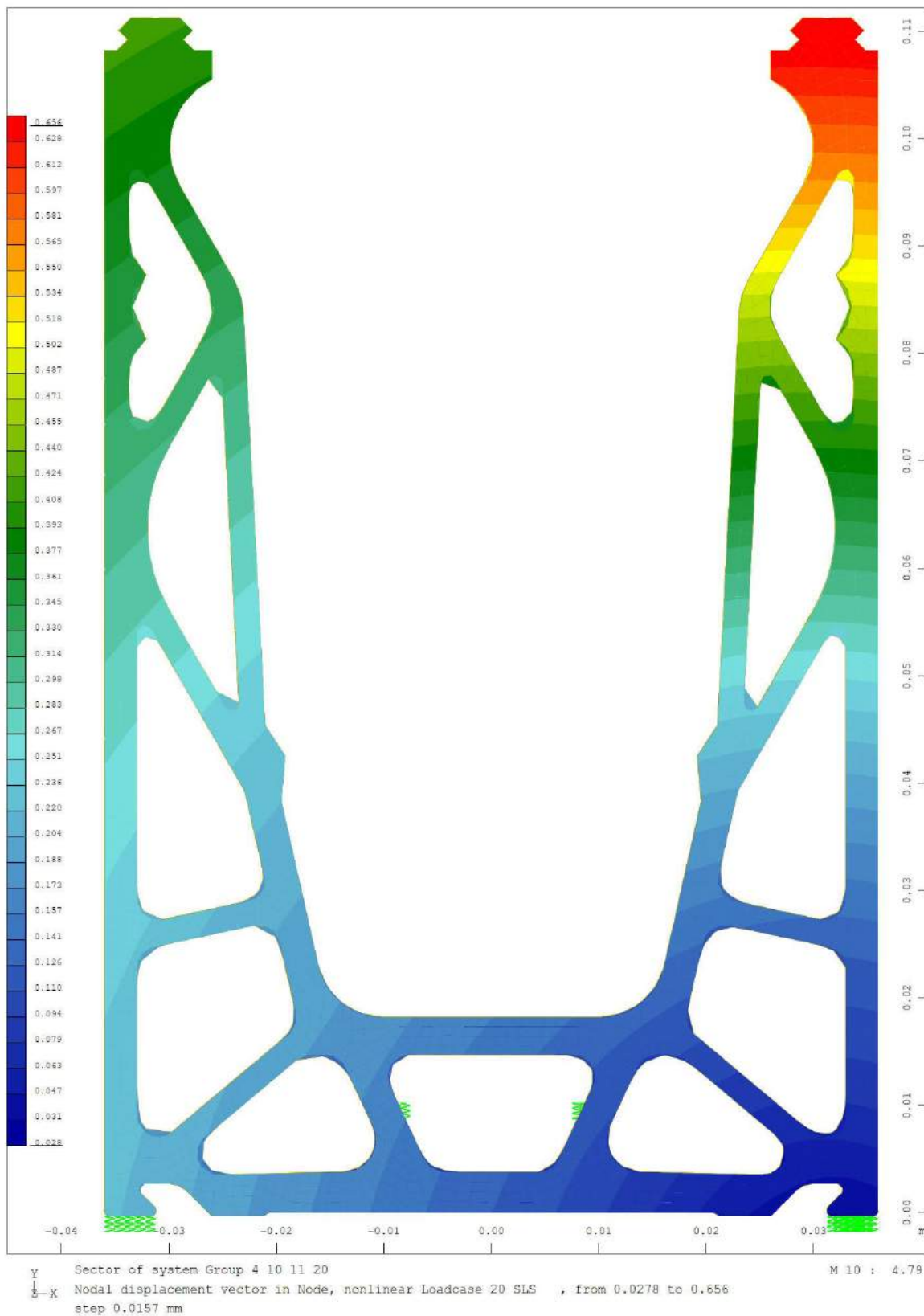


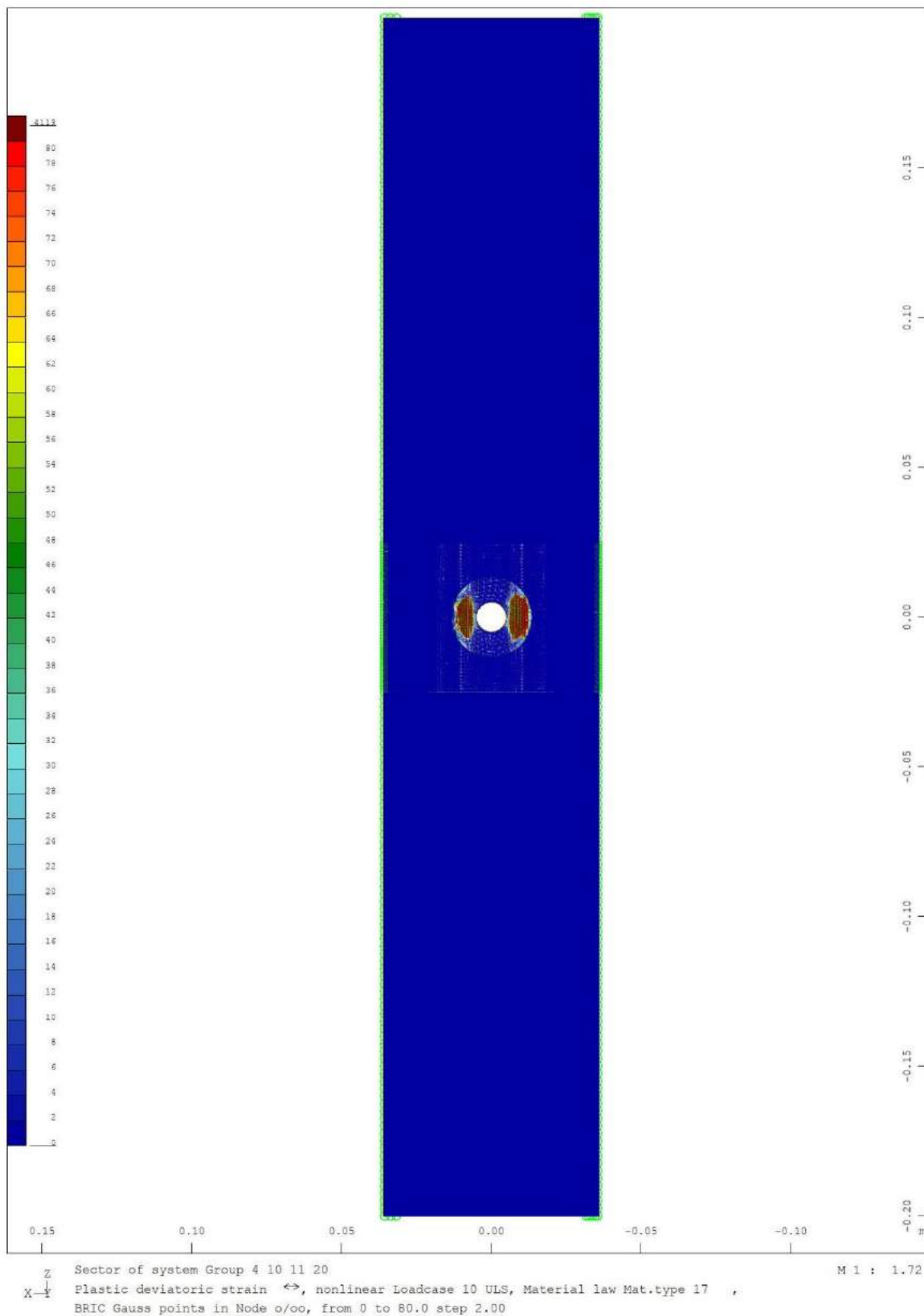


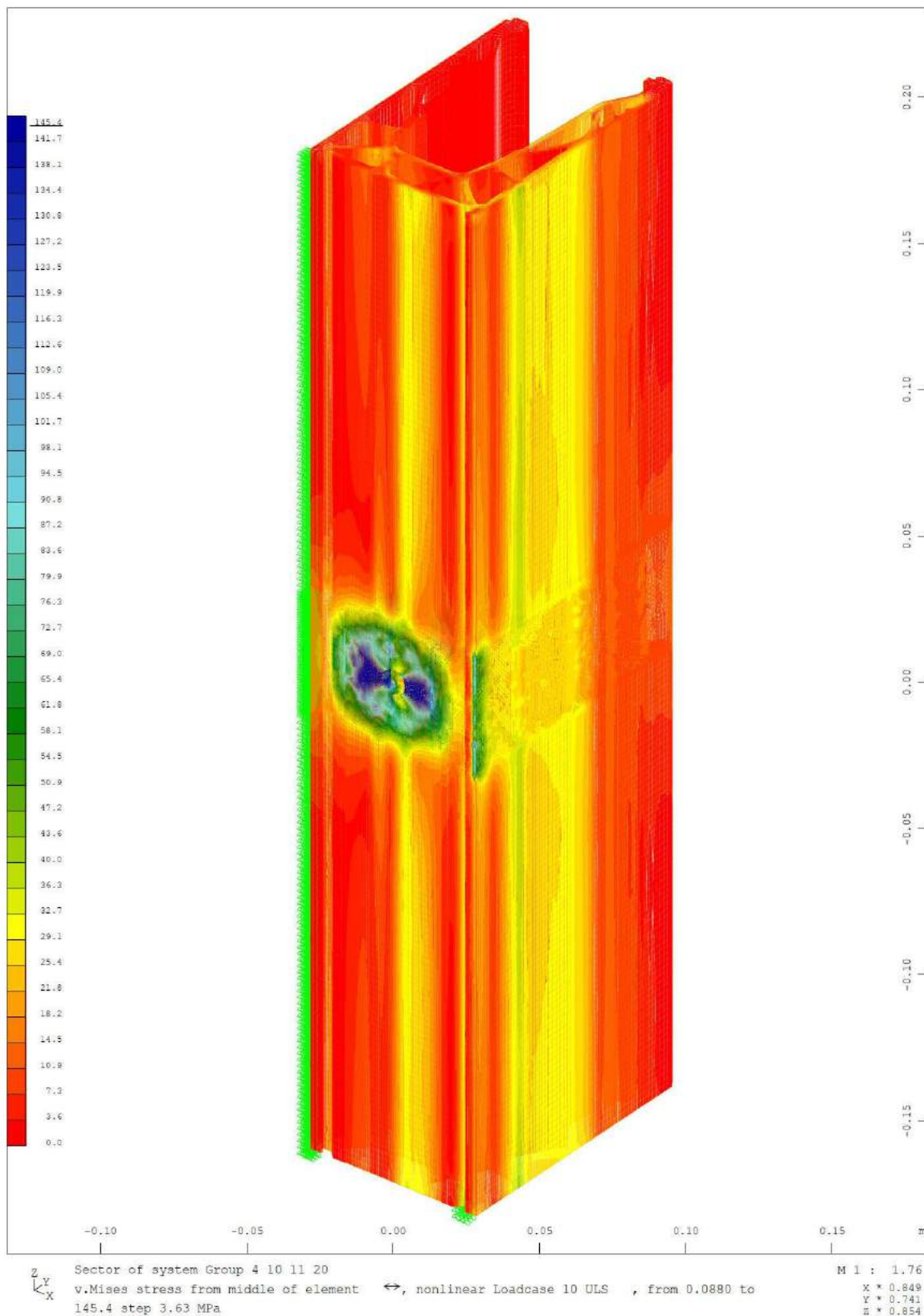


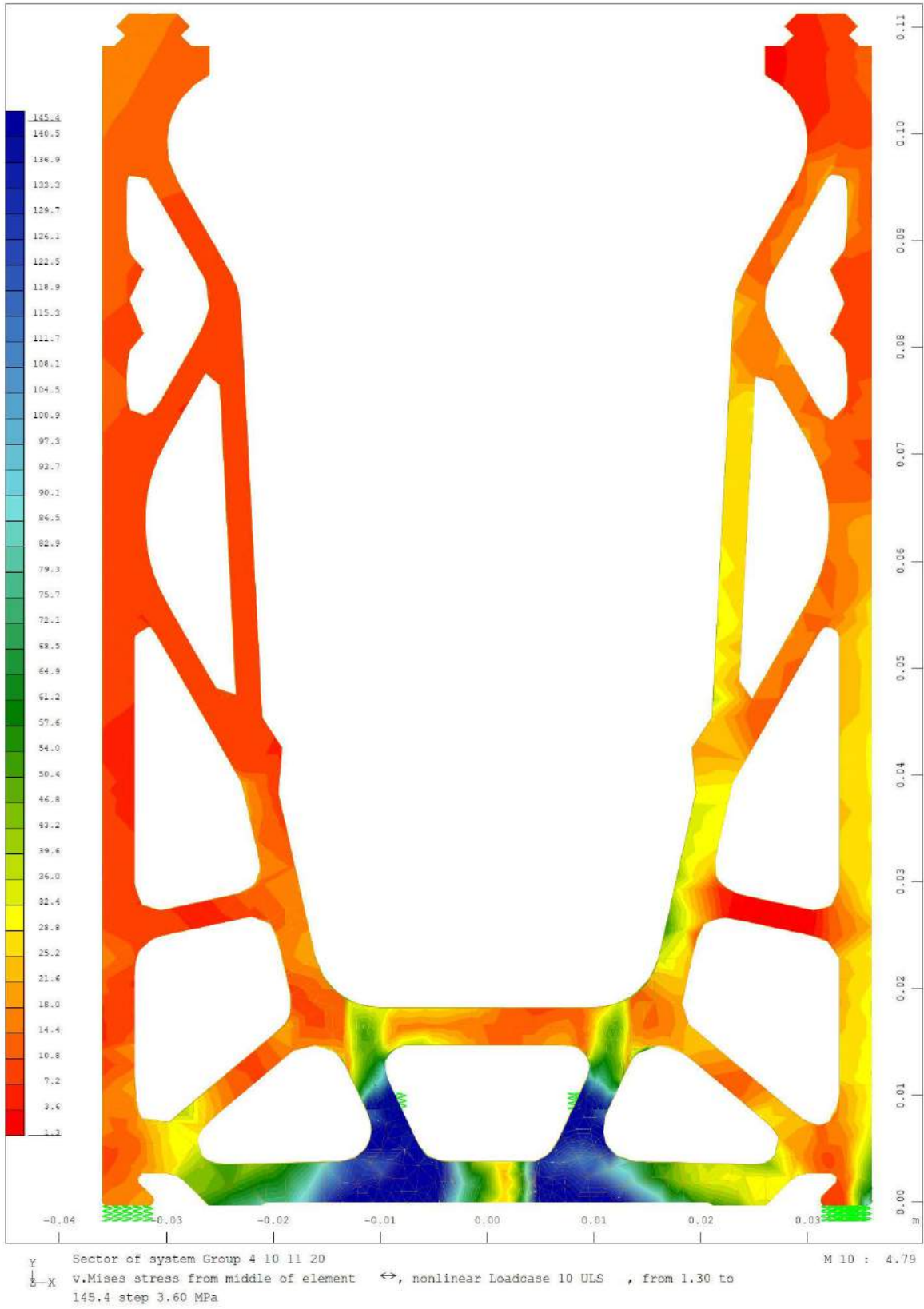
6.2.5 Defender DF88LM_E400



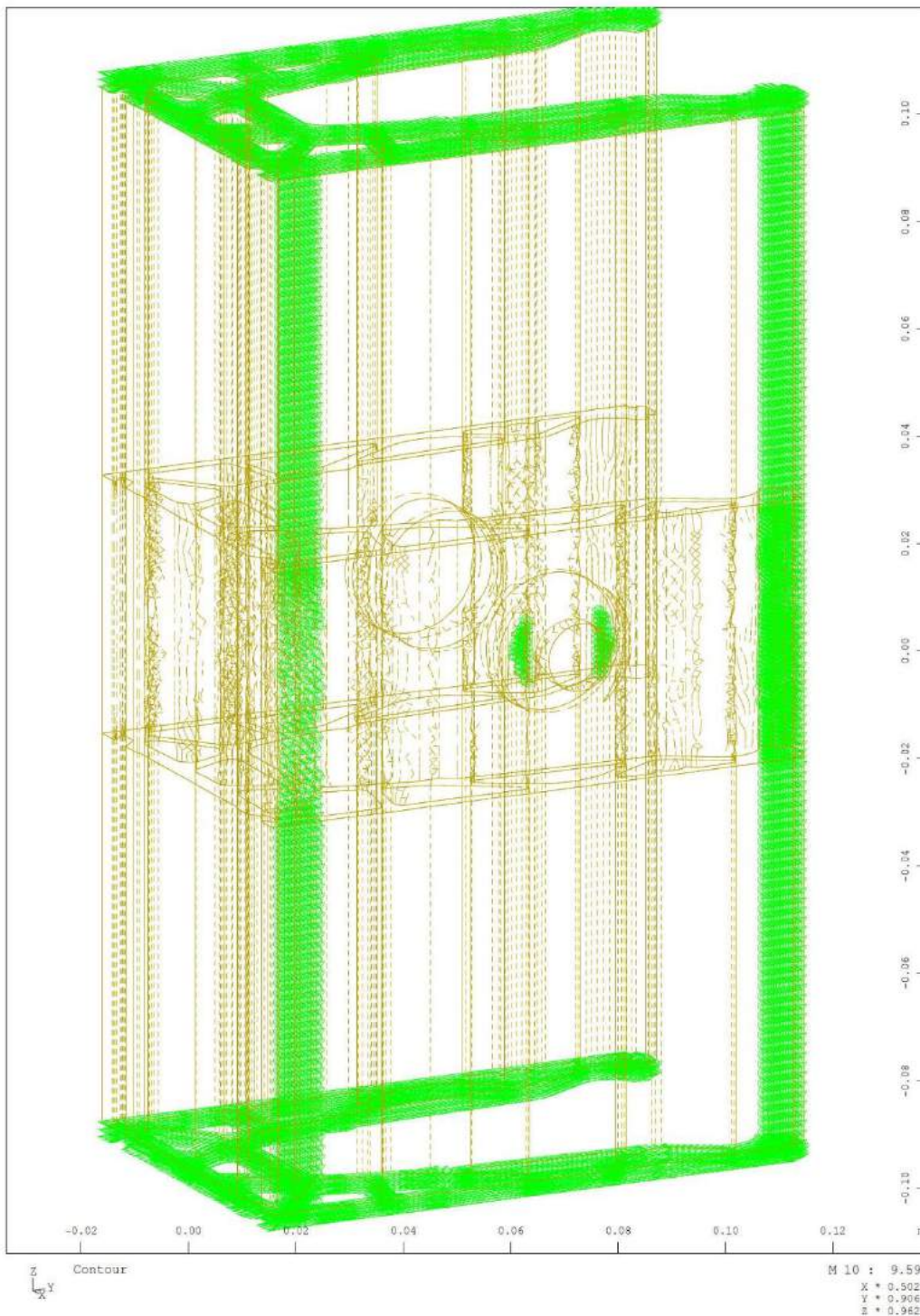


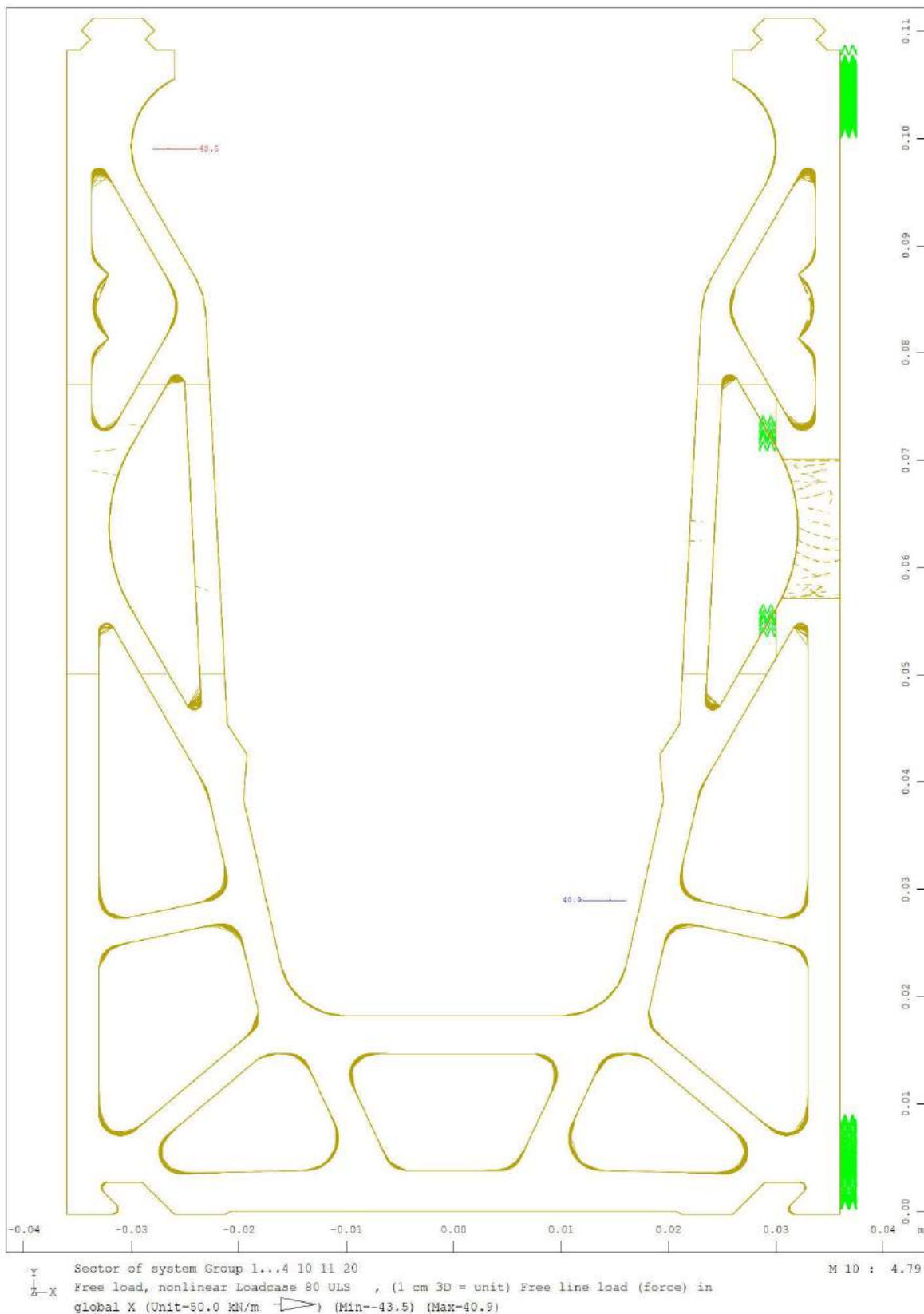


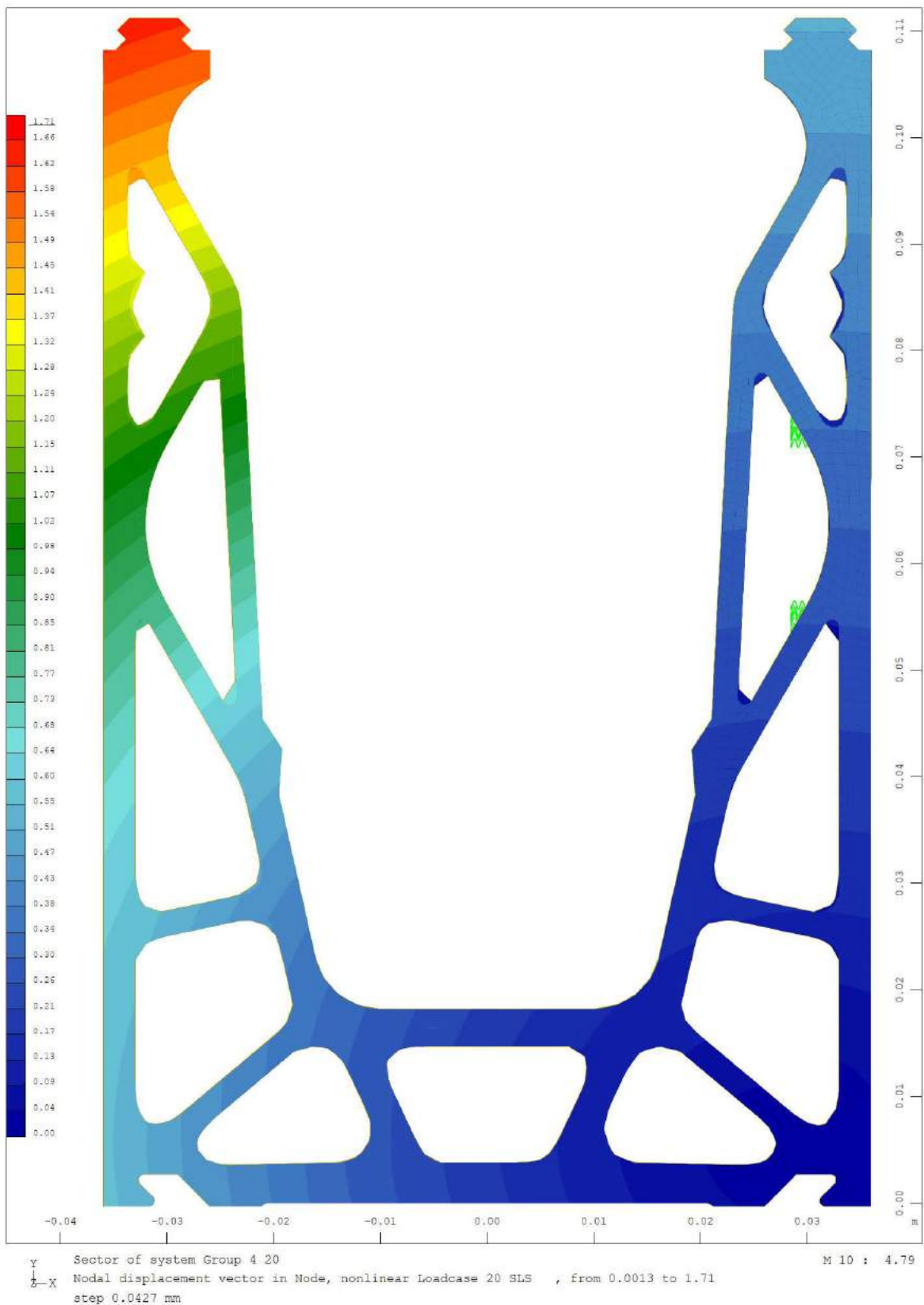


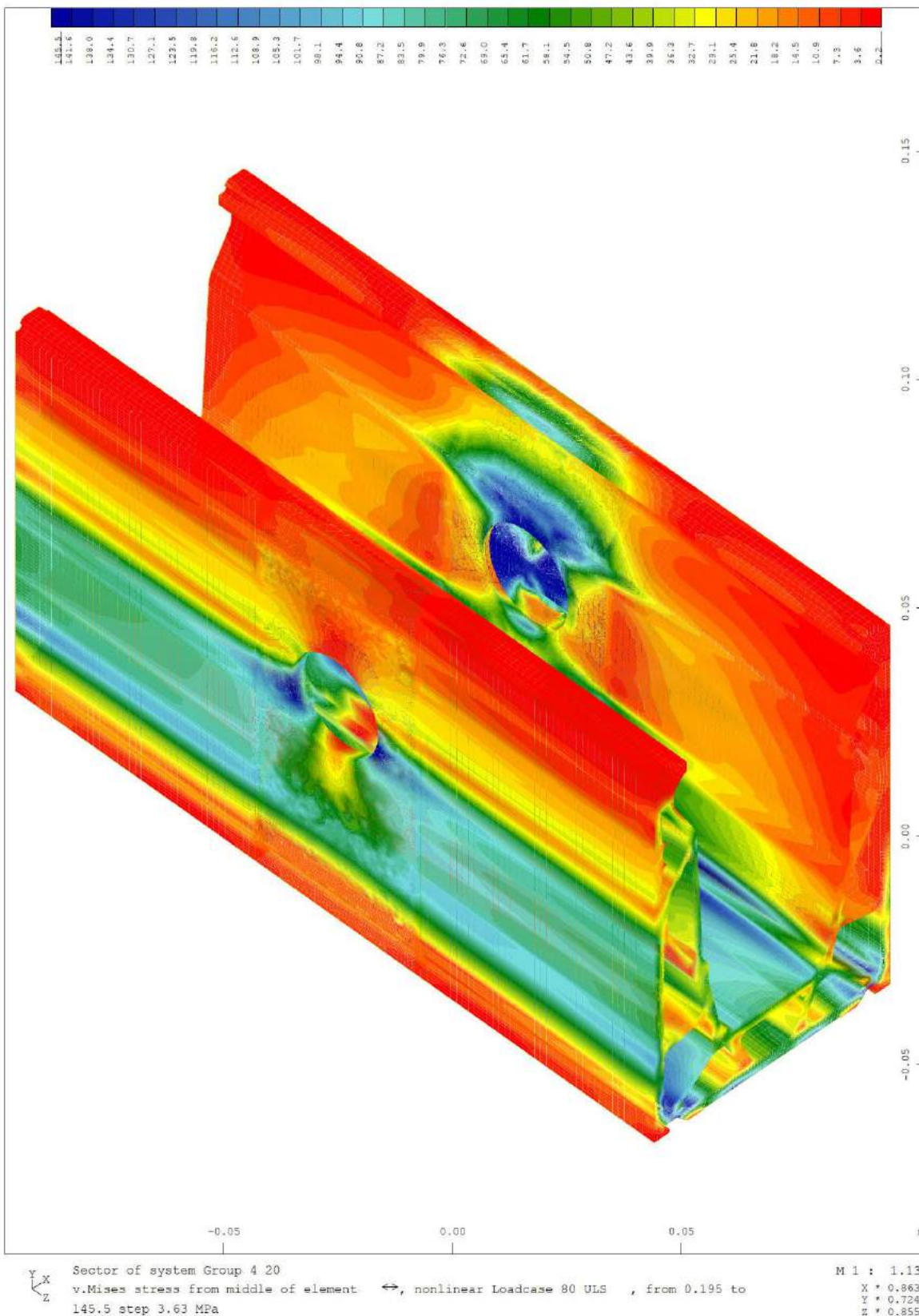


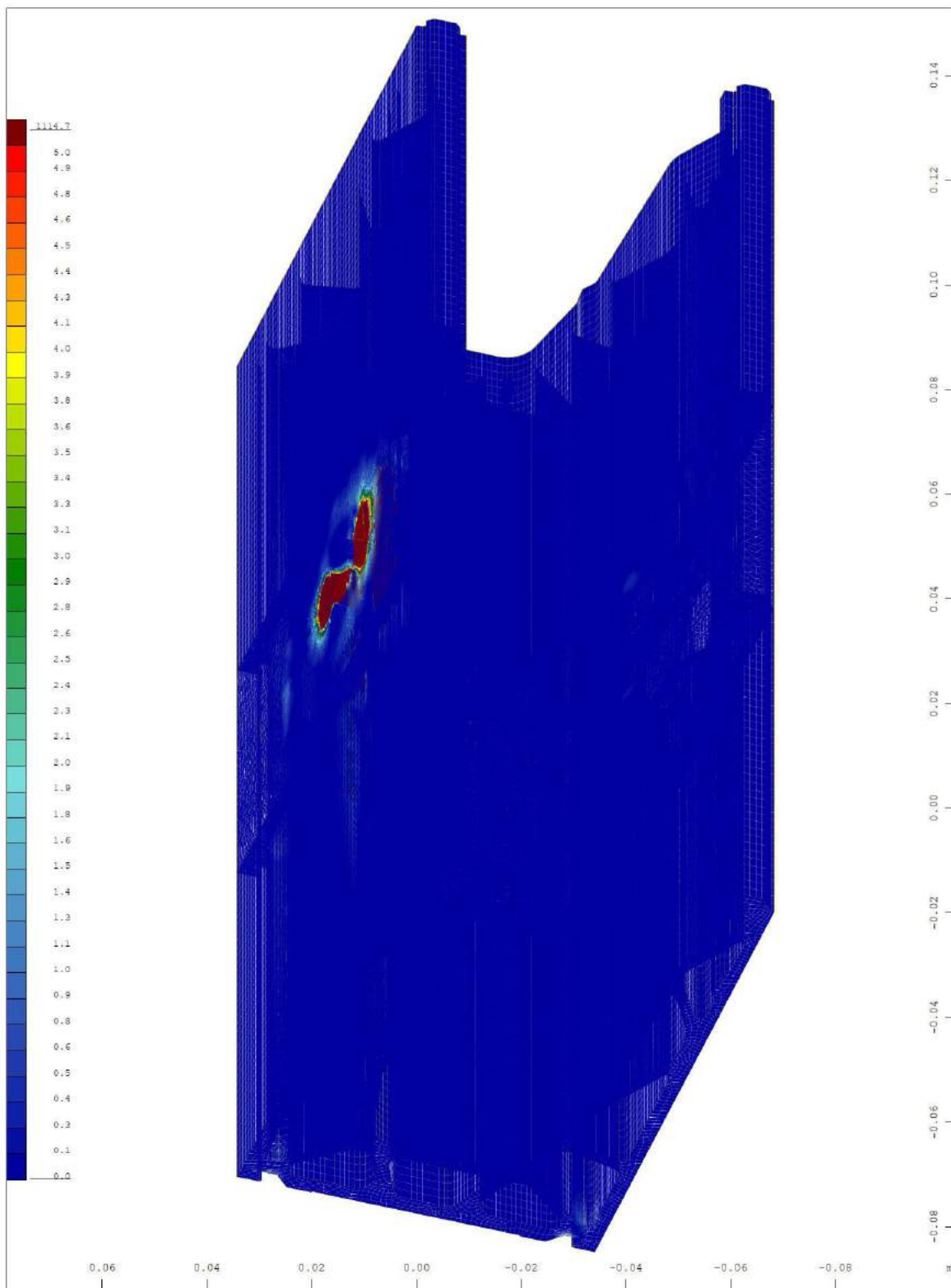
6.2.6 Defender DF88FR_E200





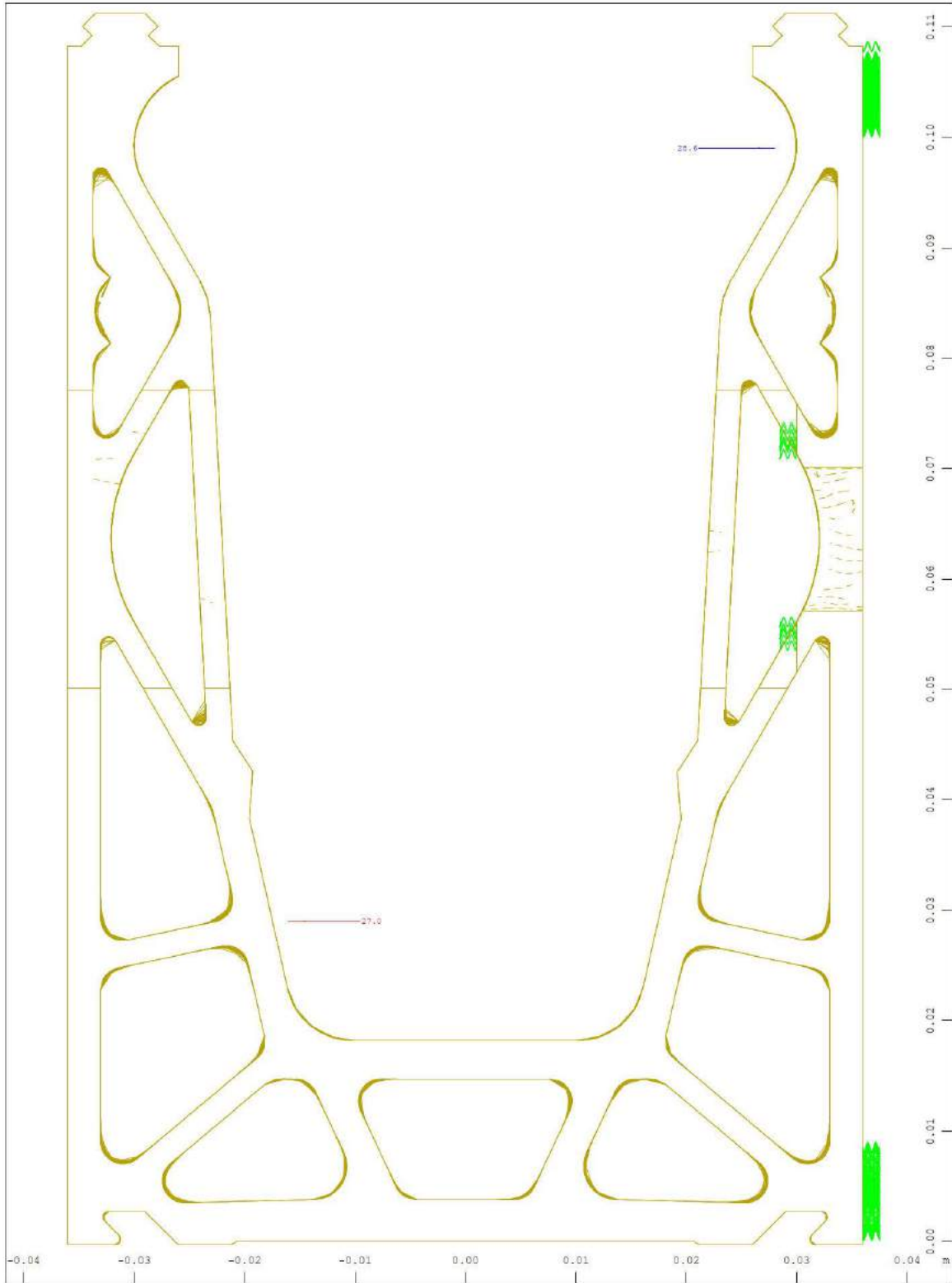




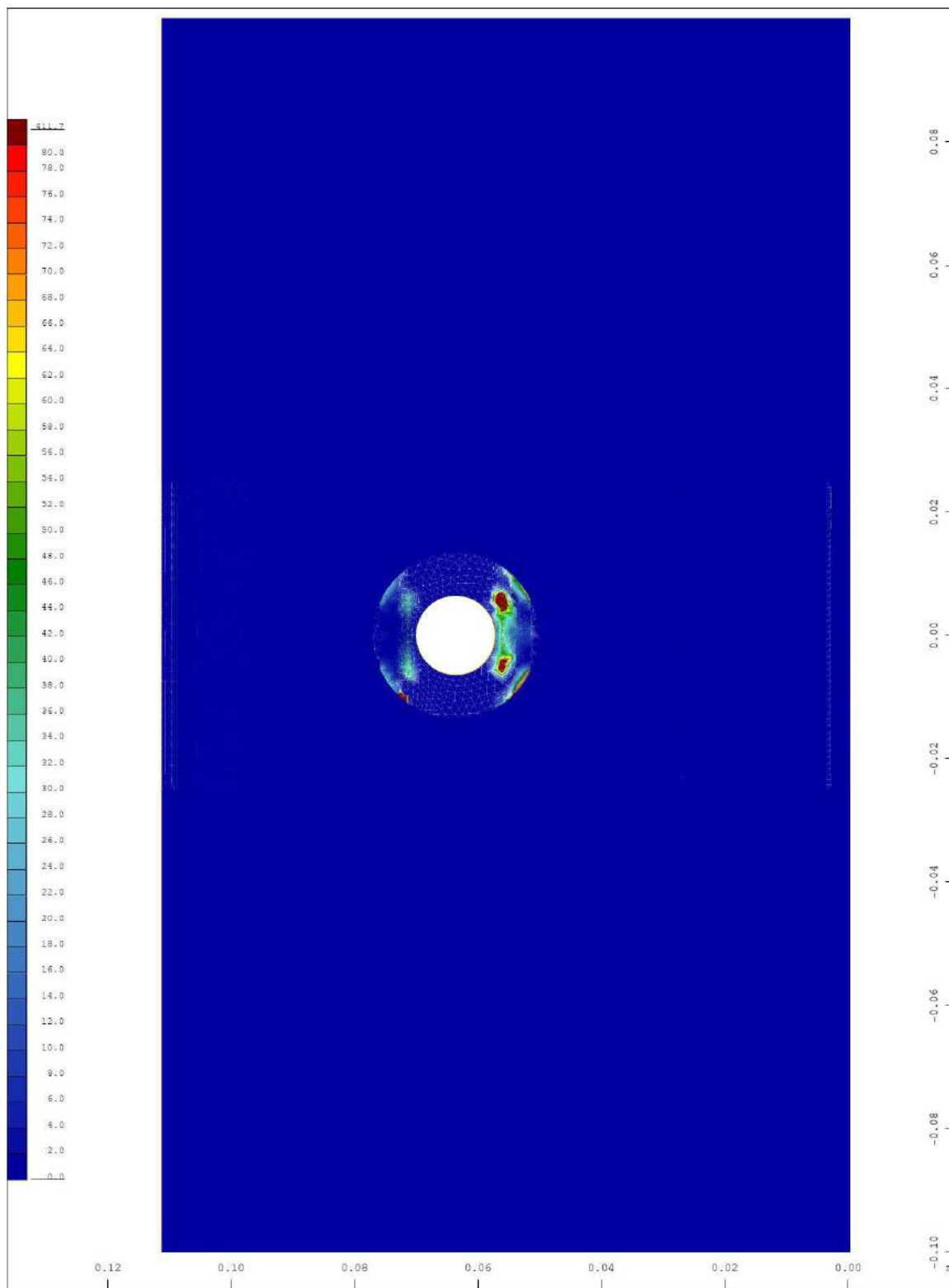


Sector of system Group 4 20
 Plastic deviatoric strain \leftrightarrow , nonlinear Loadcase 80 ULS, Material law Mat.type 17 , BRIC
 Gauss points in Node o/oo, from 0 to 5.00 step 0.125

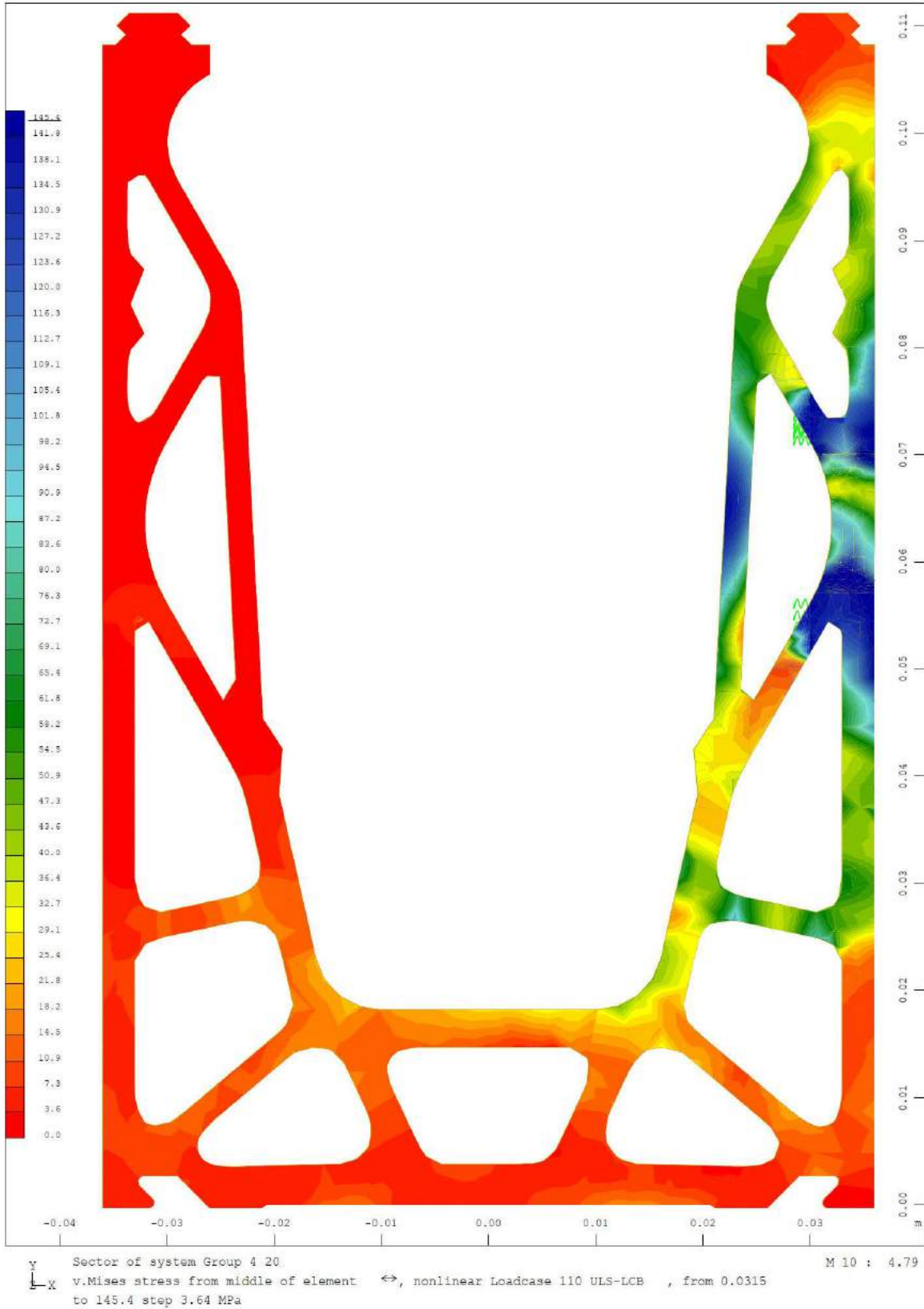
M 1 : 1
 X * 0.970
 Y * 0.678
 Z * 0.774



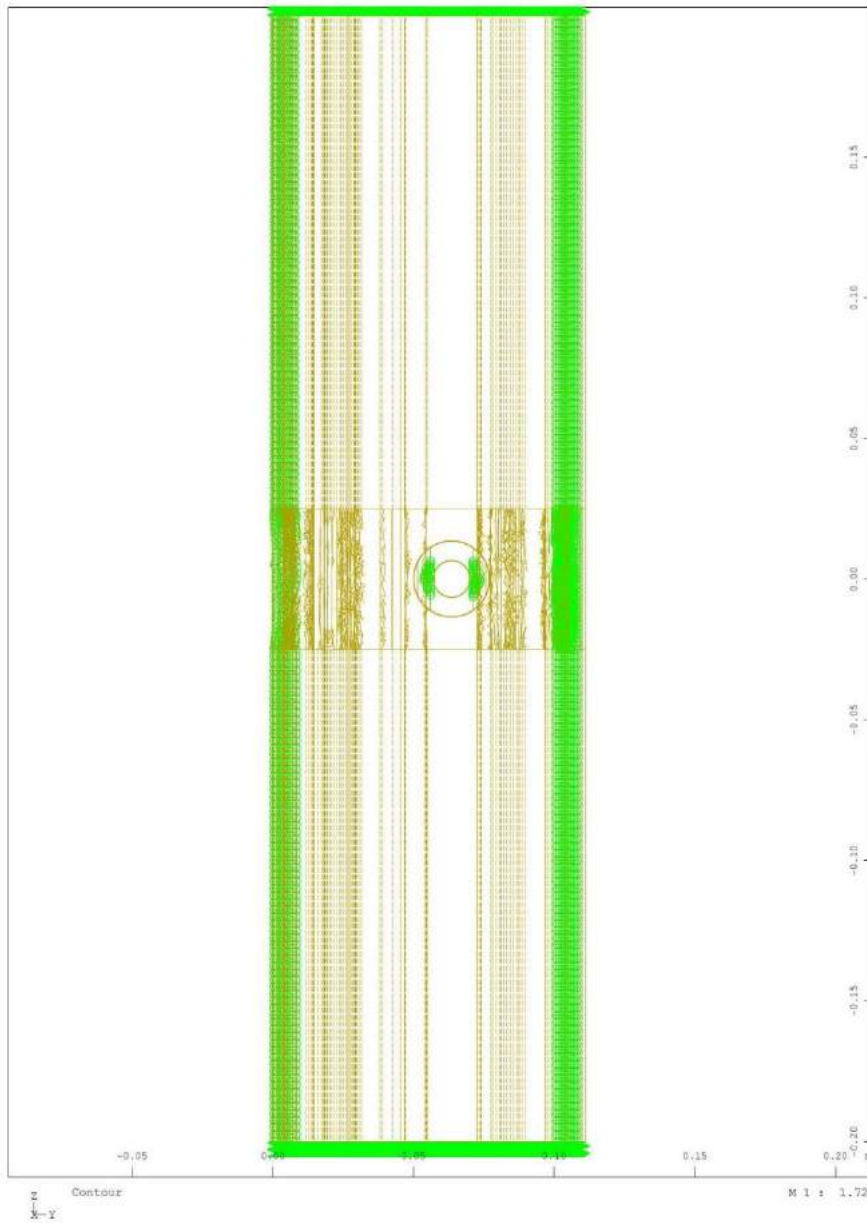
Sector of system Group 4 10 11 20
 All loads, nonlinear Loadcase 110 ULS-LCB , (1 cm 3D = unit) Free line load (force)
 in global X (Unit=20.0 kN/m ∇) (Min=-27.0) (Max=20.6)

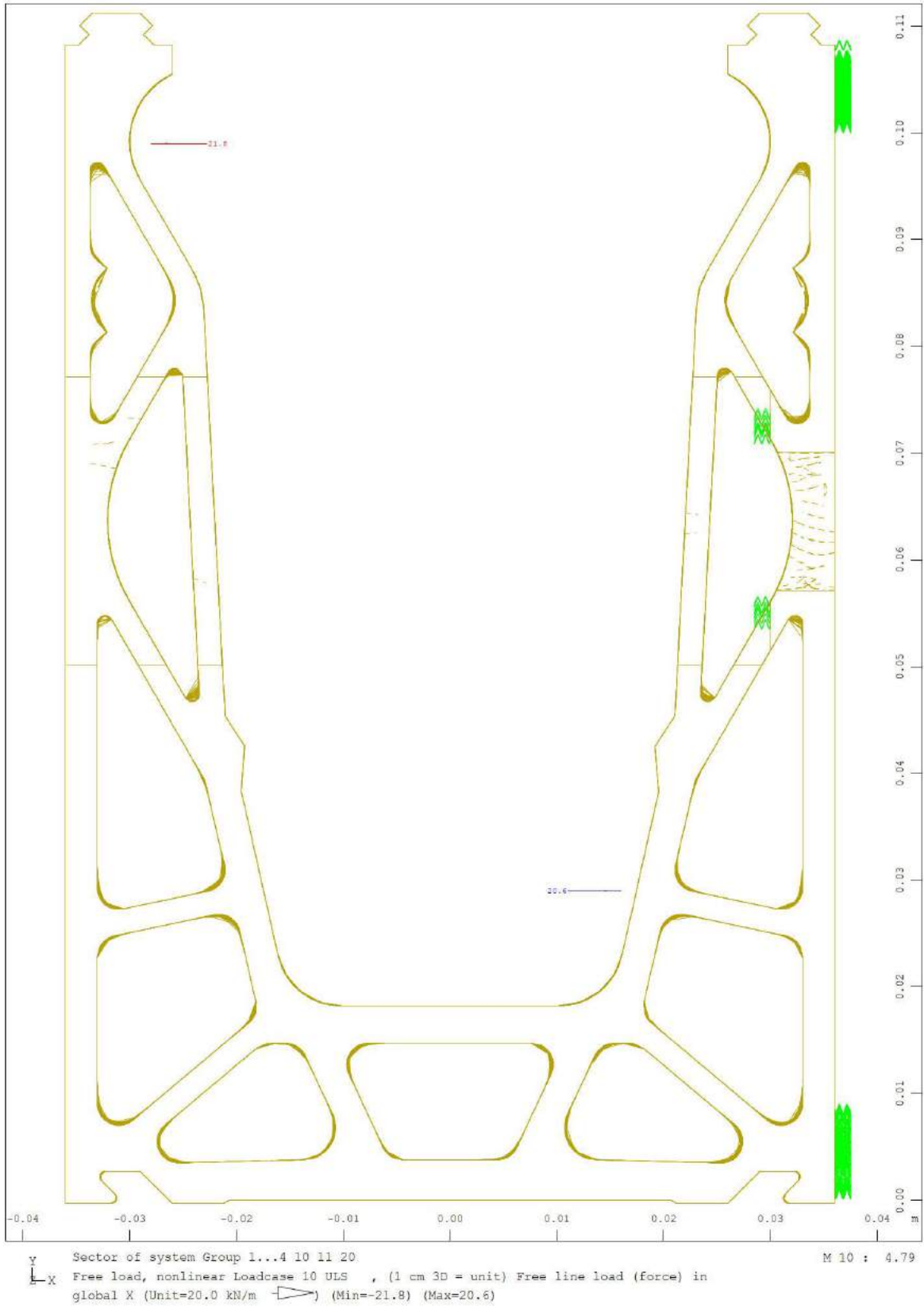


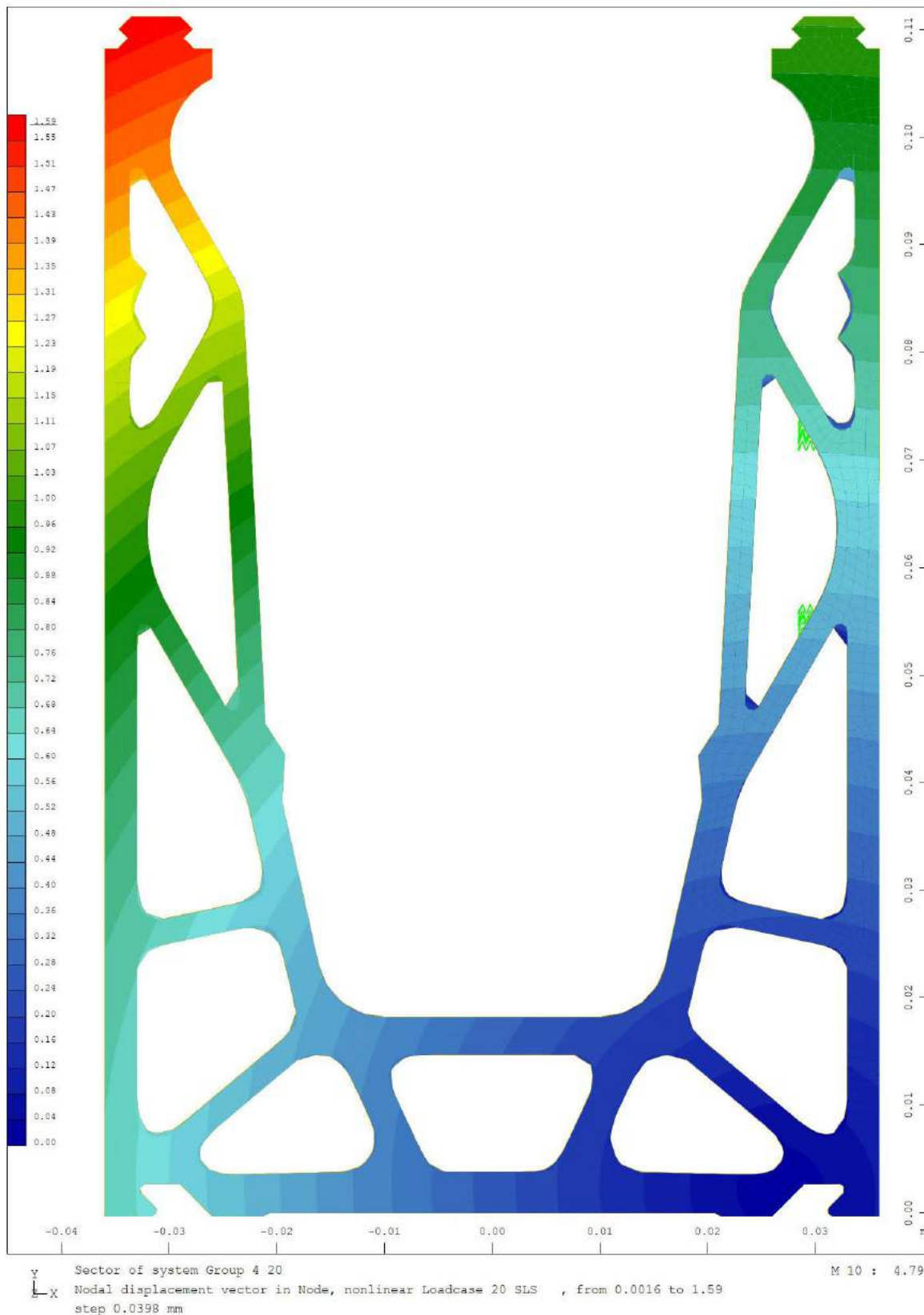
Sector of system Group 4 20
 Plastic deviatoric strain \leftrightarrow , nonlinear Loadcase 110 ULS-LCB, Material law Mat.type 17
 , BRIC Gauss points in Node o/oo, from 0 to 80.0 step 2.00
 M 10 : 8.60

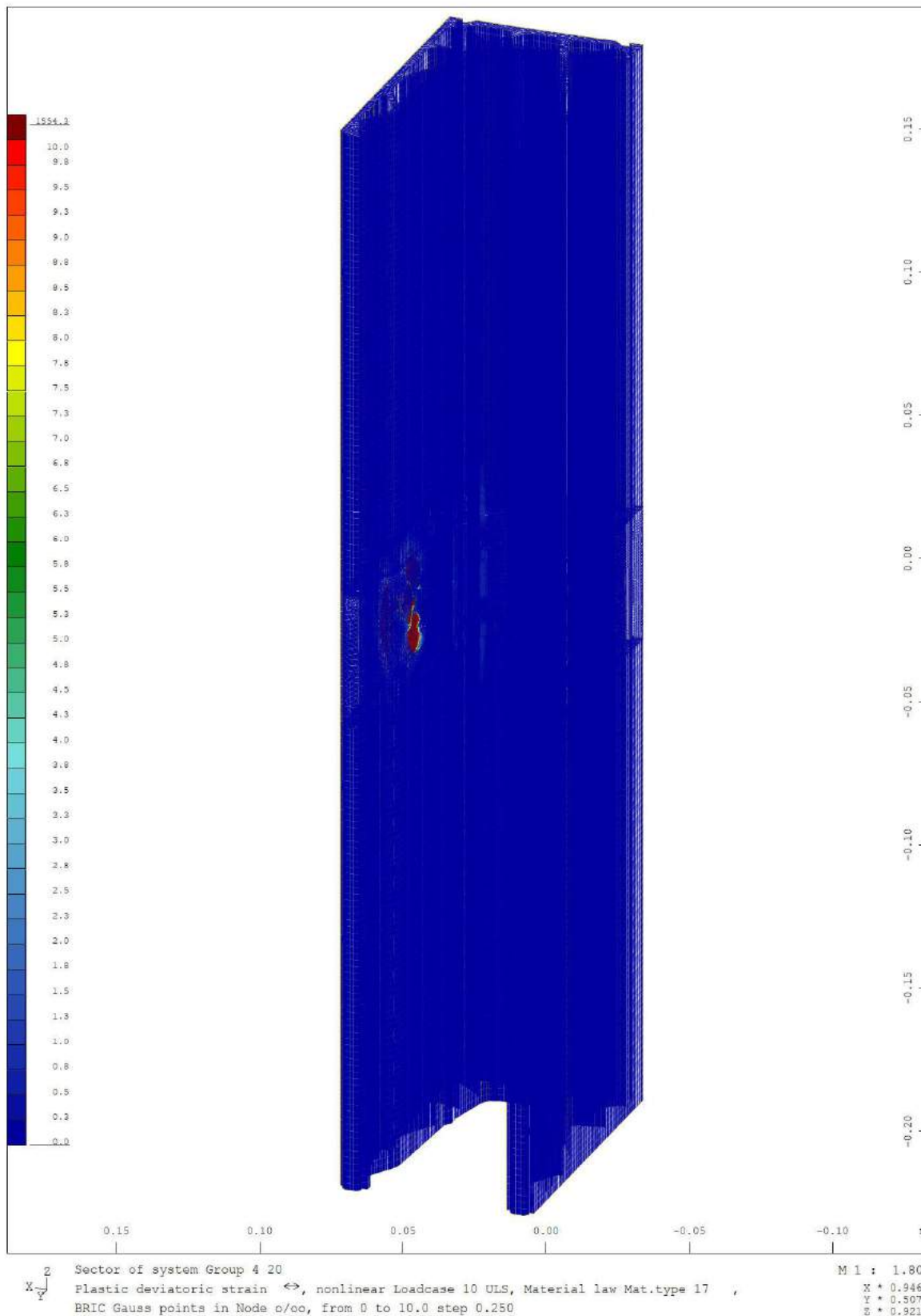


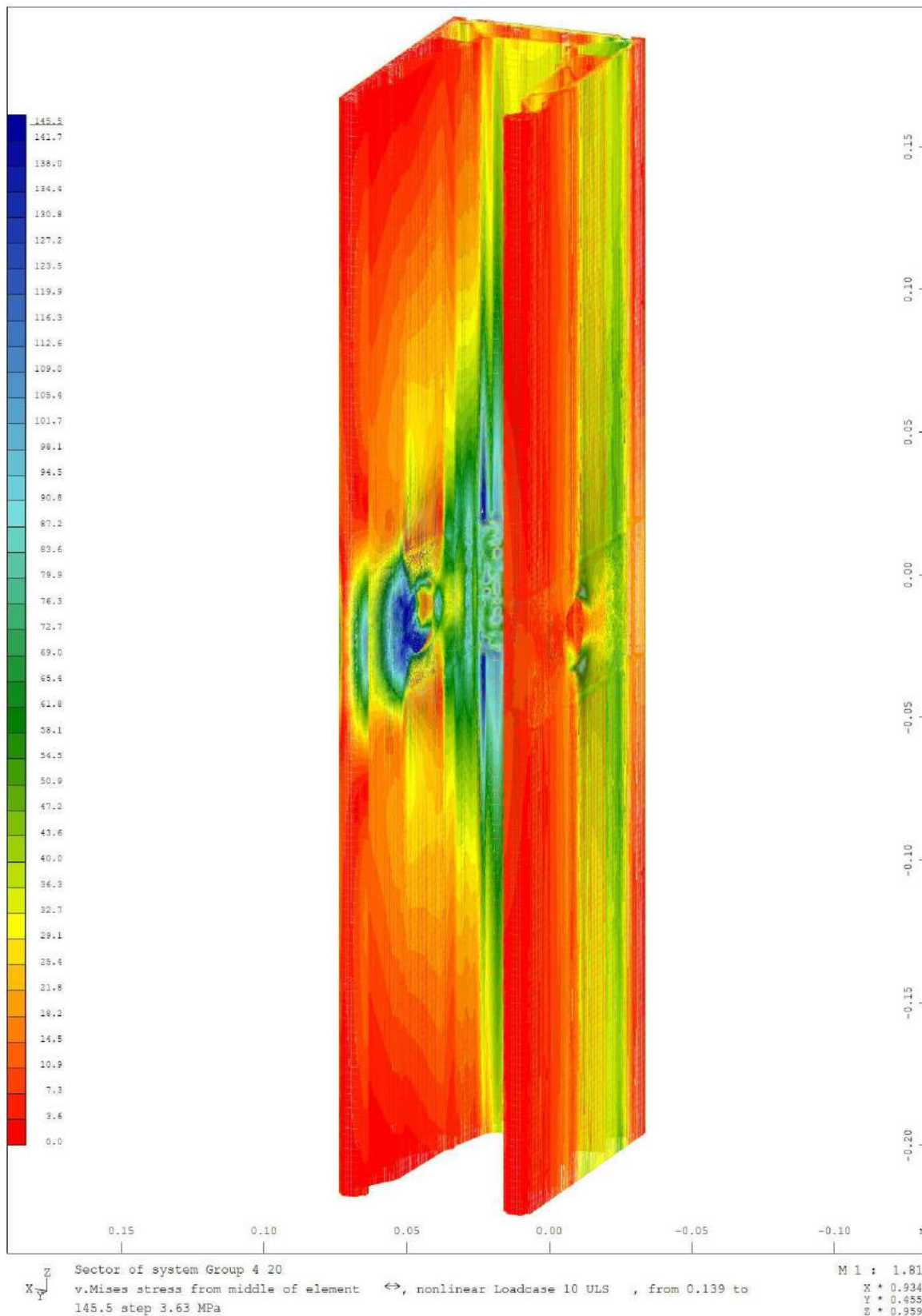
6.2.7 Defender DF88FR_E400

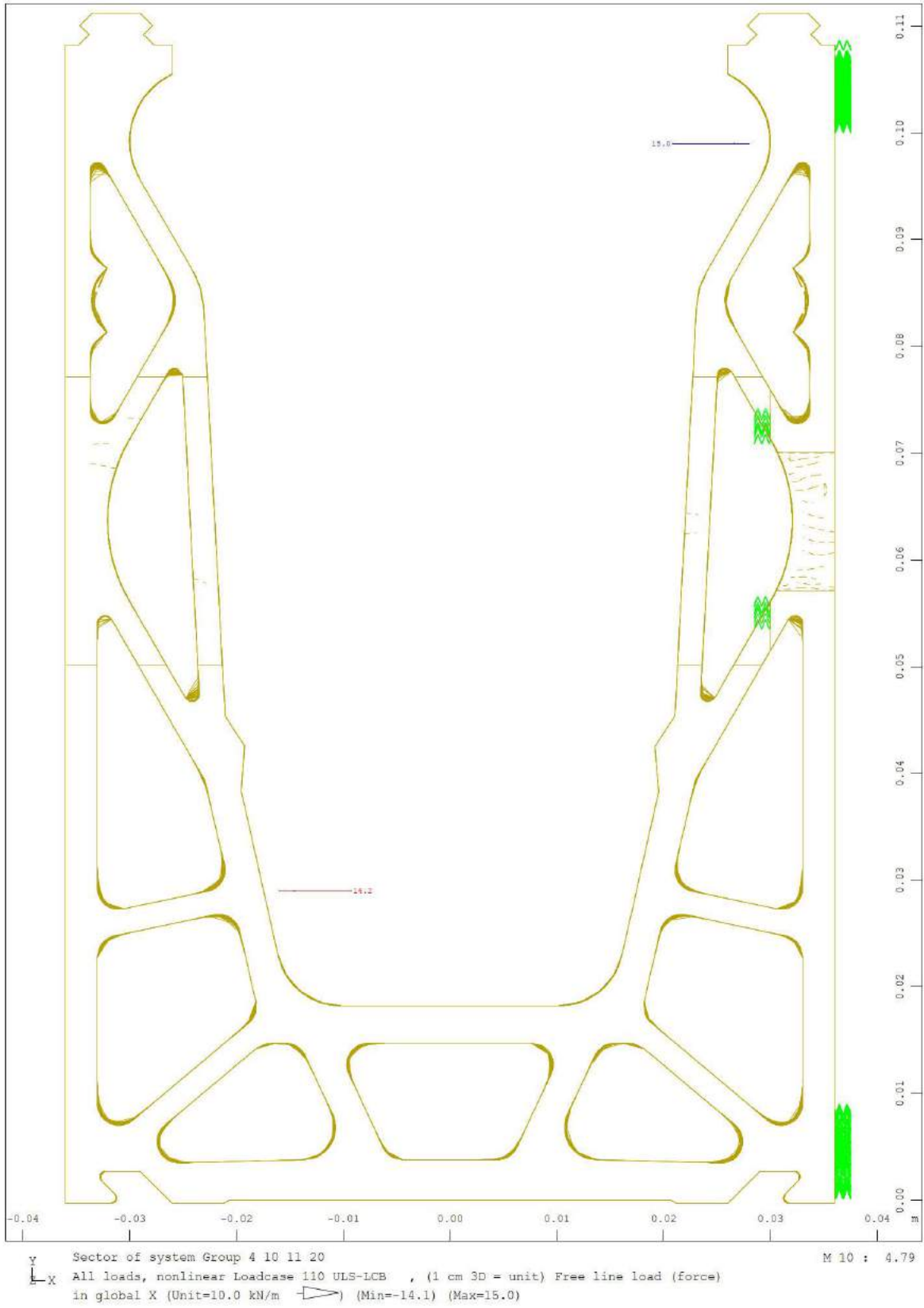


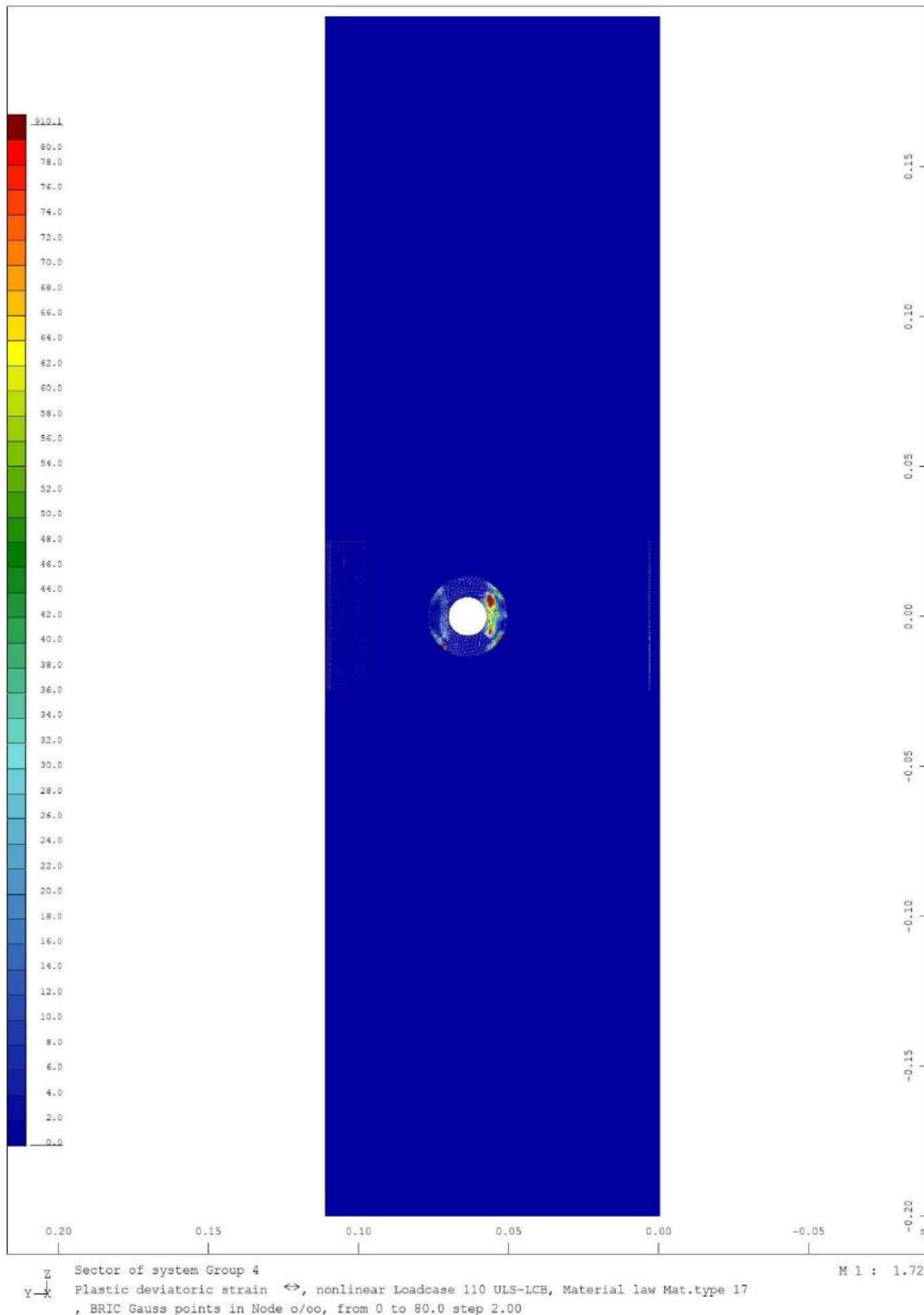


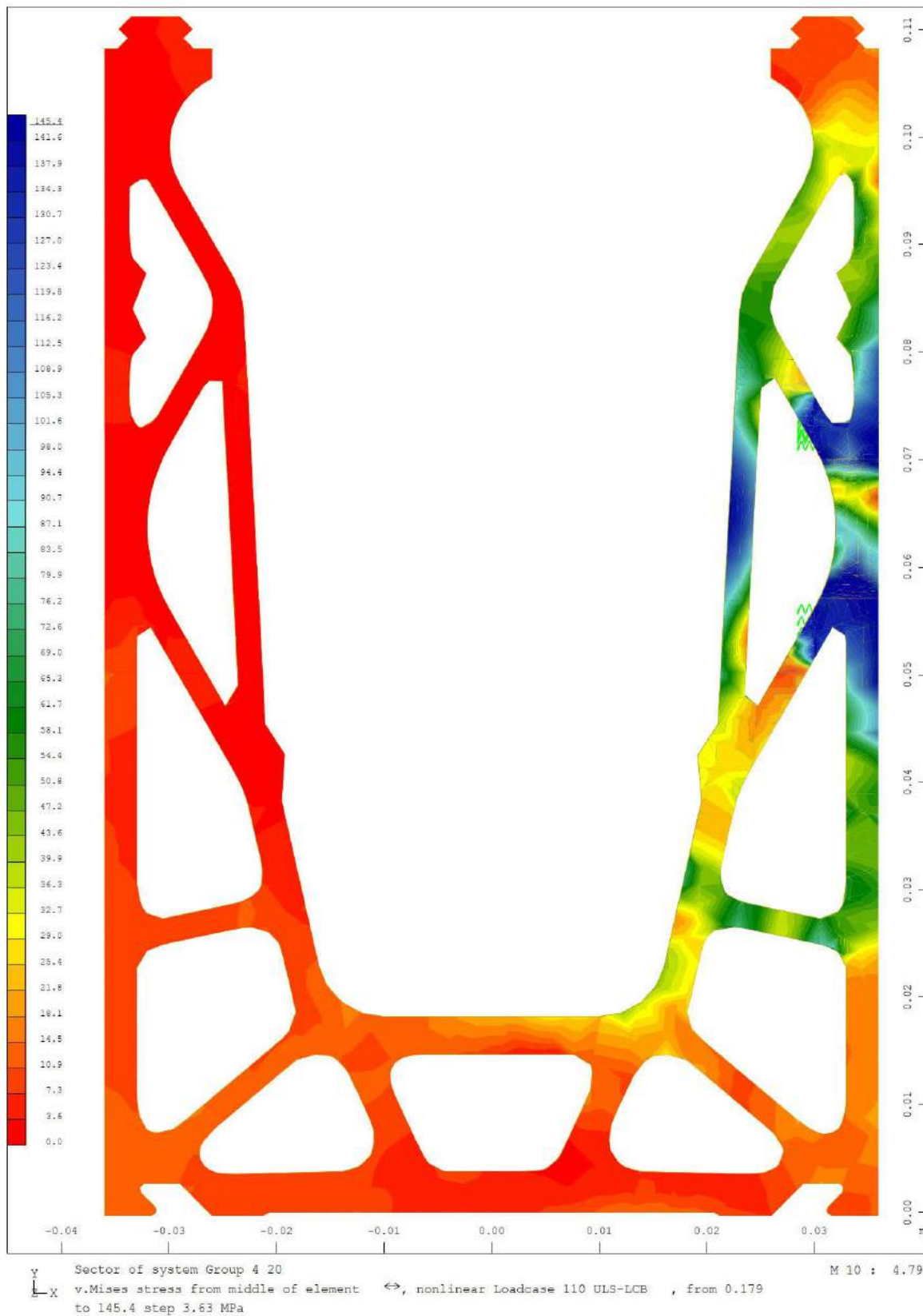






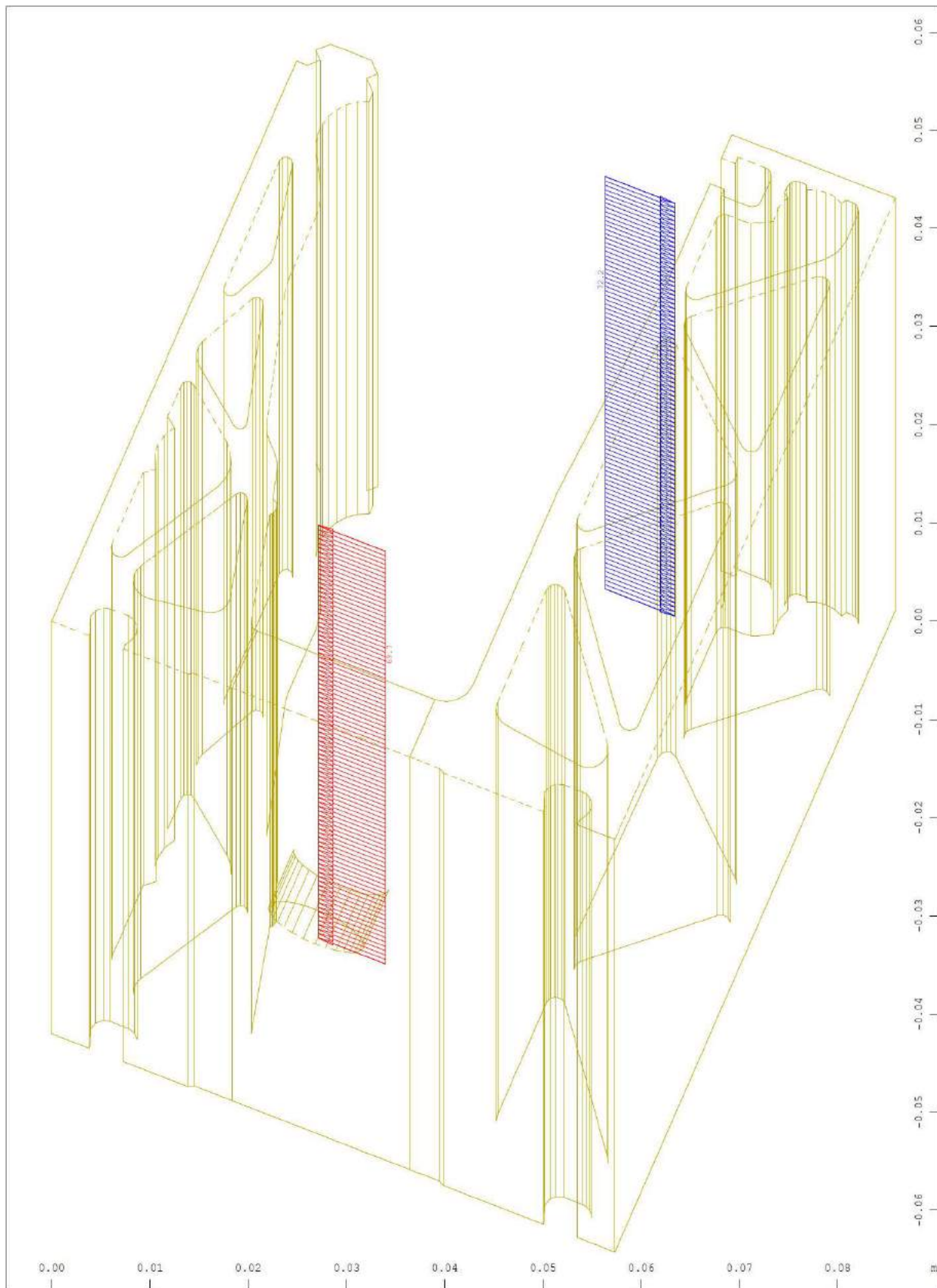





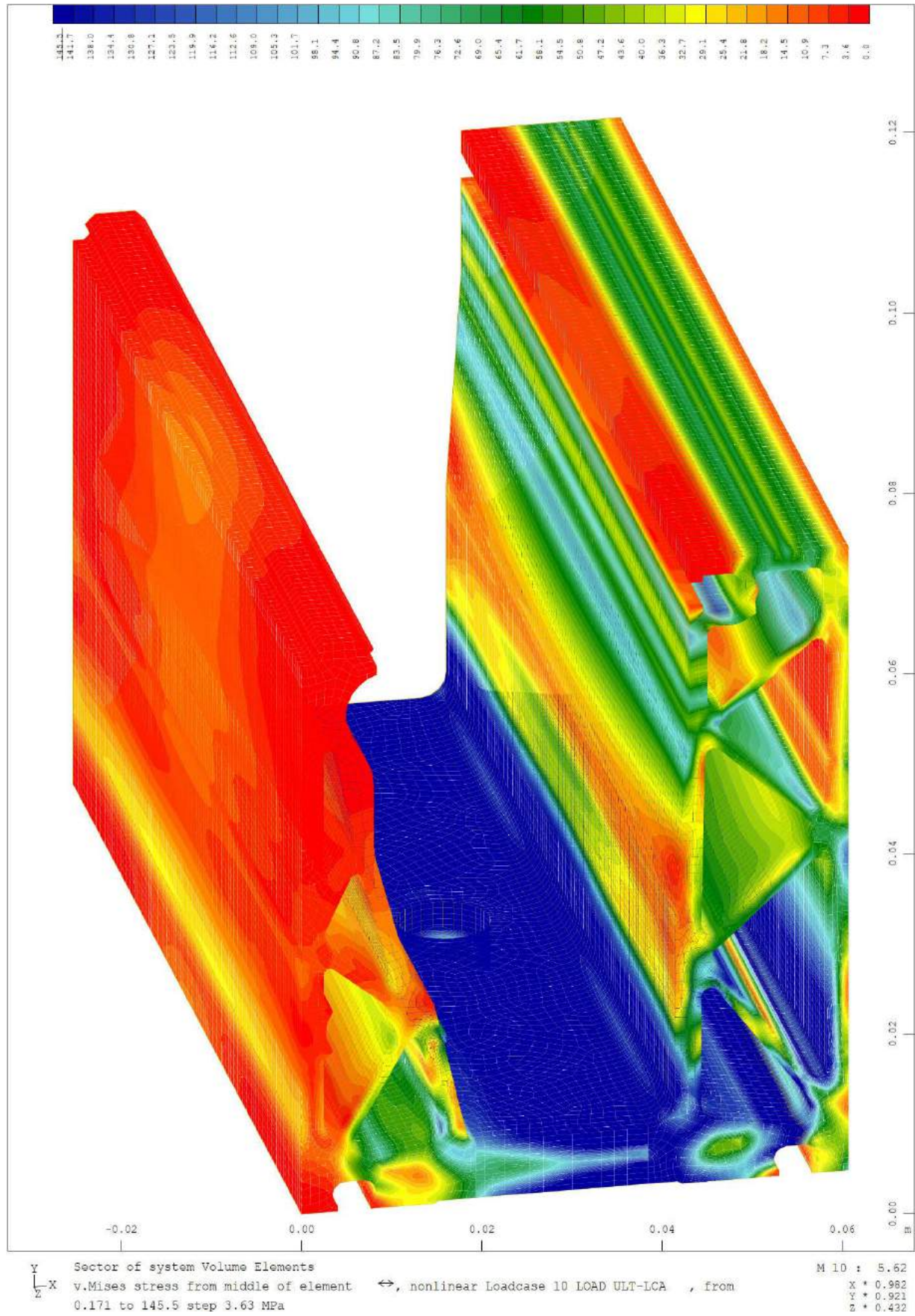


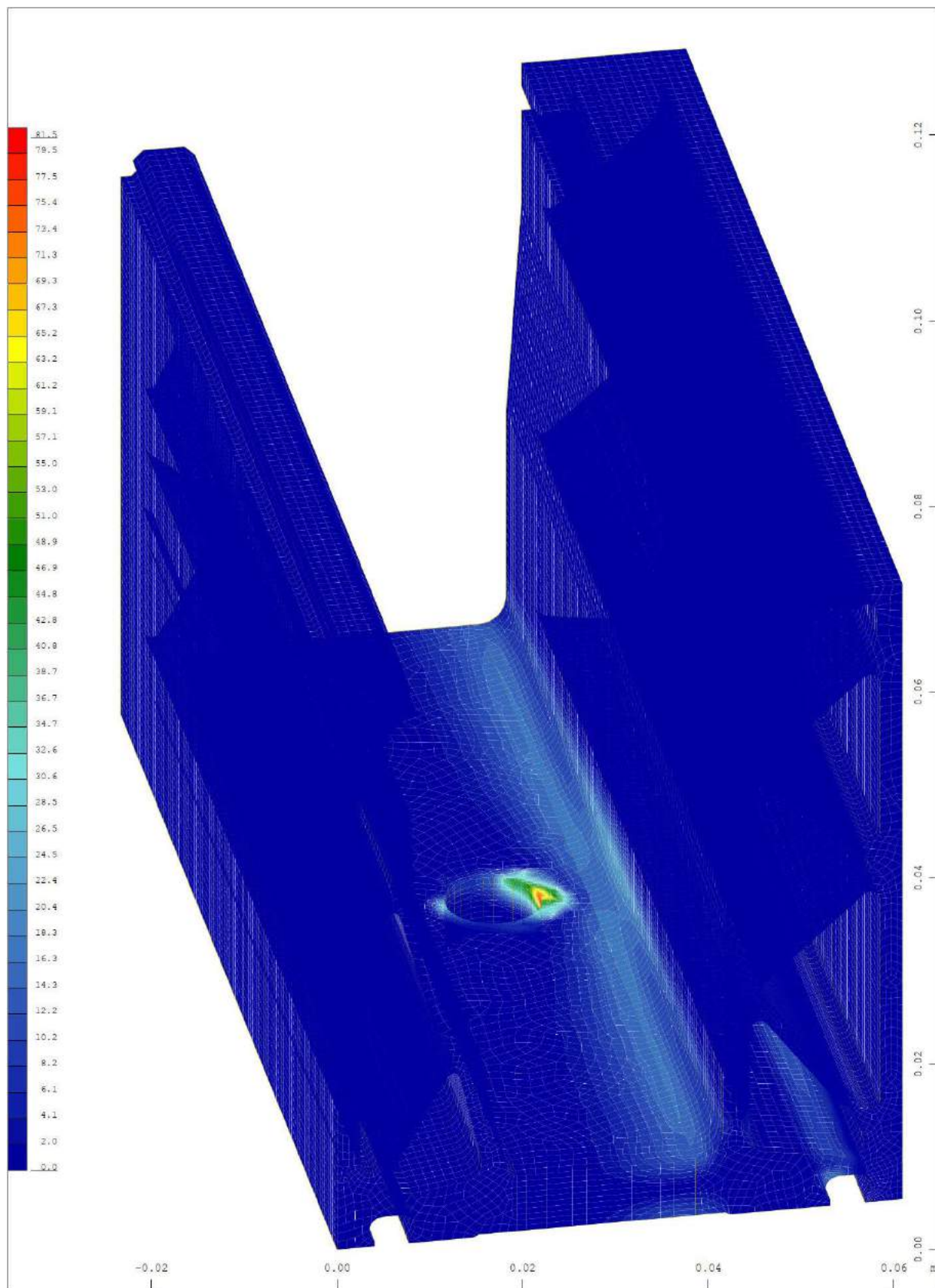
6.2.8 Defender DF88PICO_E125





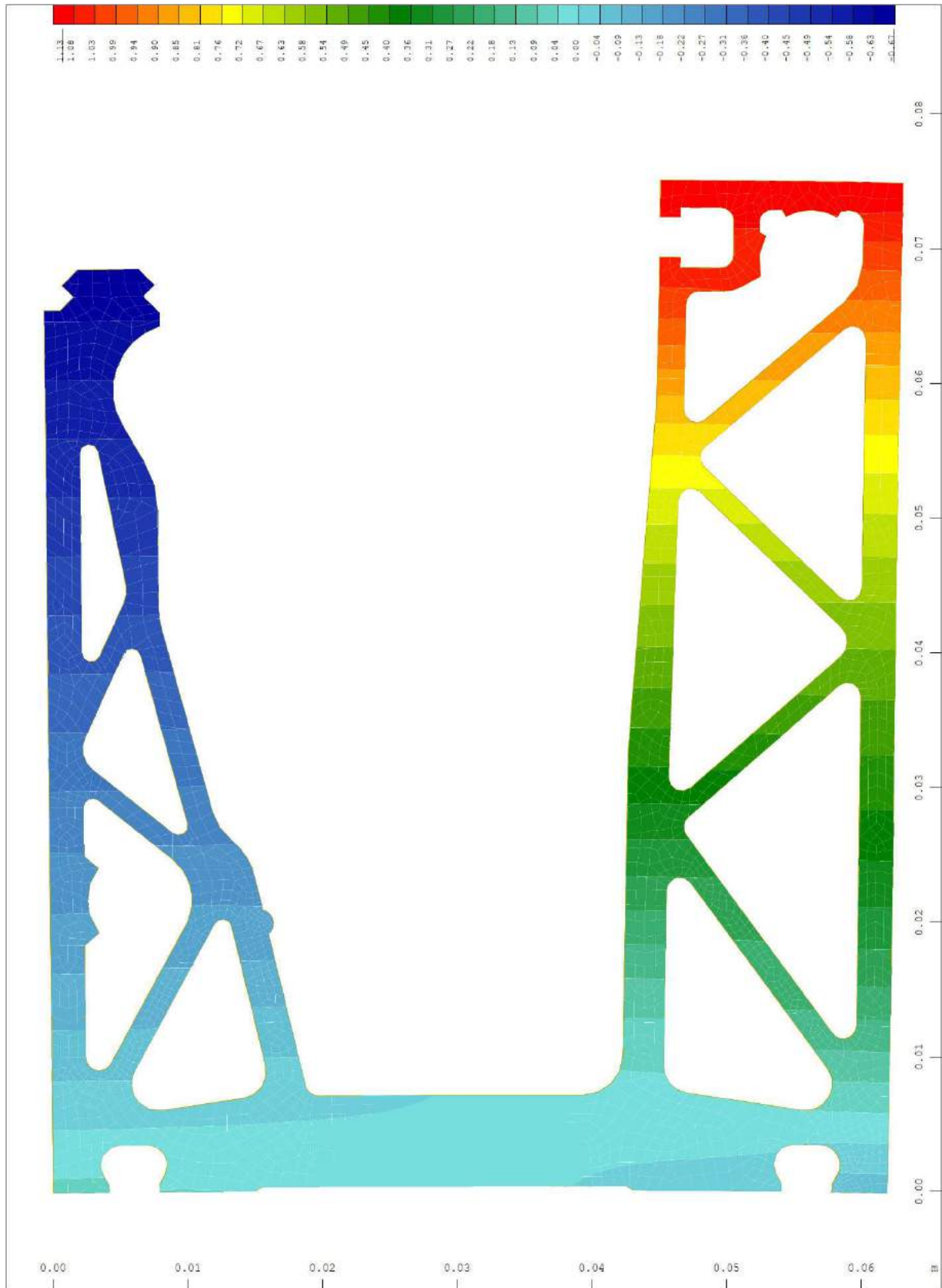
Sector of system Volume Elements M 10 : 5.32
 All loads, nonlinear Loadcase 10 LOAD ULT-LCA , (1 cm 3D = unit) Free line load X * 0.992
 (force) in global X (Unit=50.0 kN/m ) (Min=-69.7) (Max=72.2) Y * 0.950
Z * 0.336



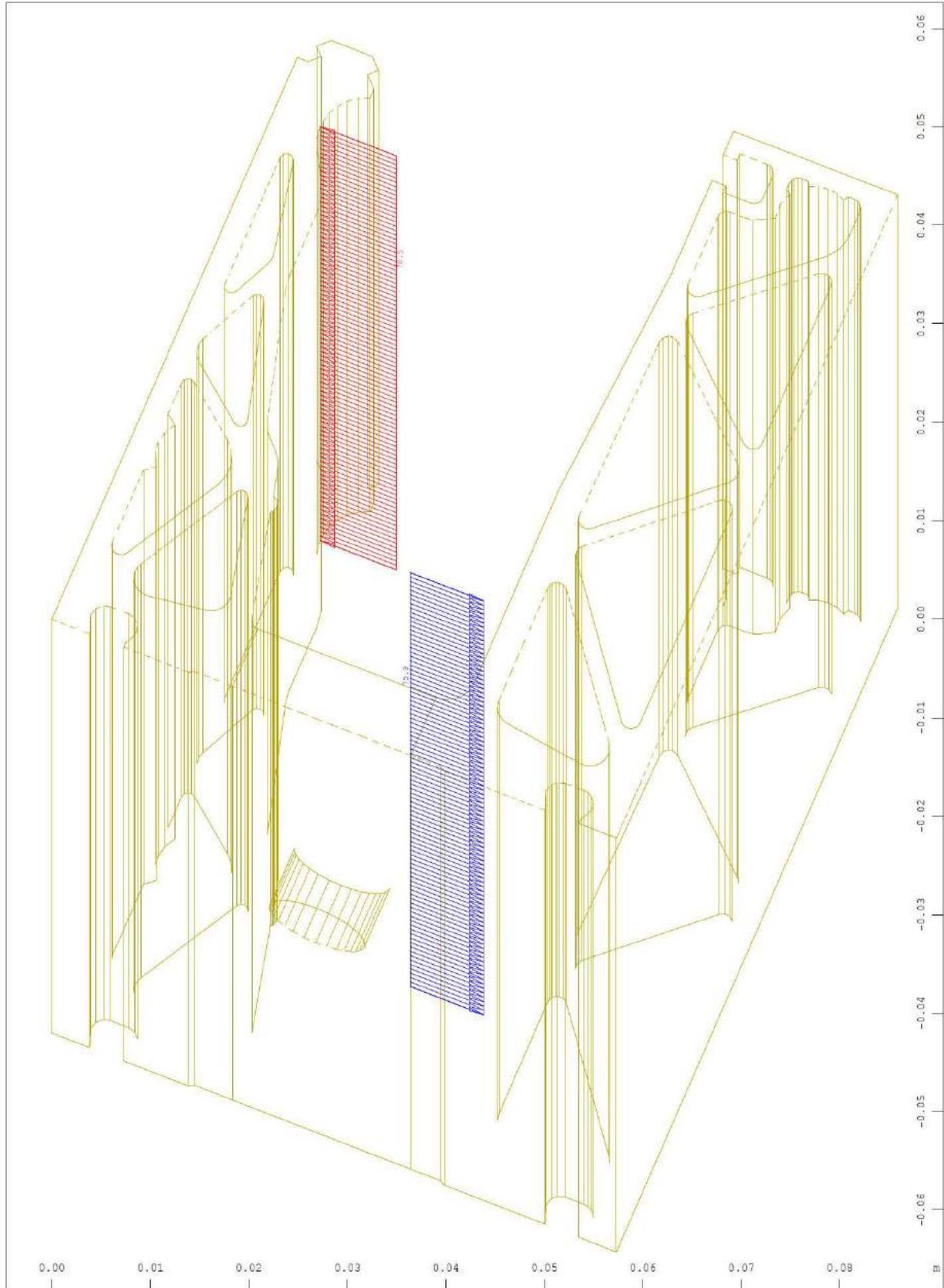



Y Sector of system Volume Elements
 X Plastic deviatoric strain ↔, nonlinear Loadcase 10 LOAD ULT-LCA, Material law Mat.type
 Z 17 , ERIC Gauss points in Node o/oo, from 0 to 81.5 step 2.04

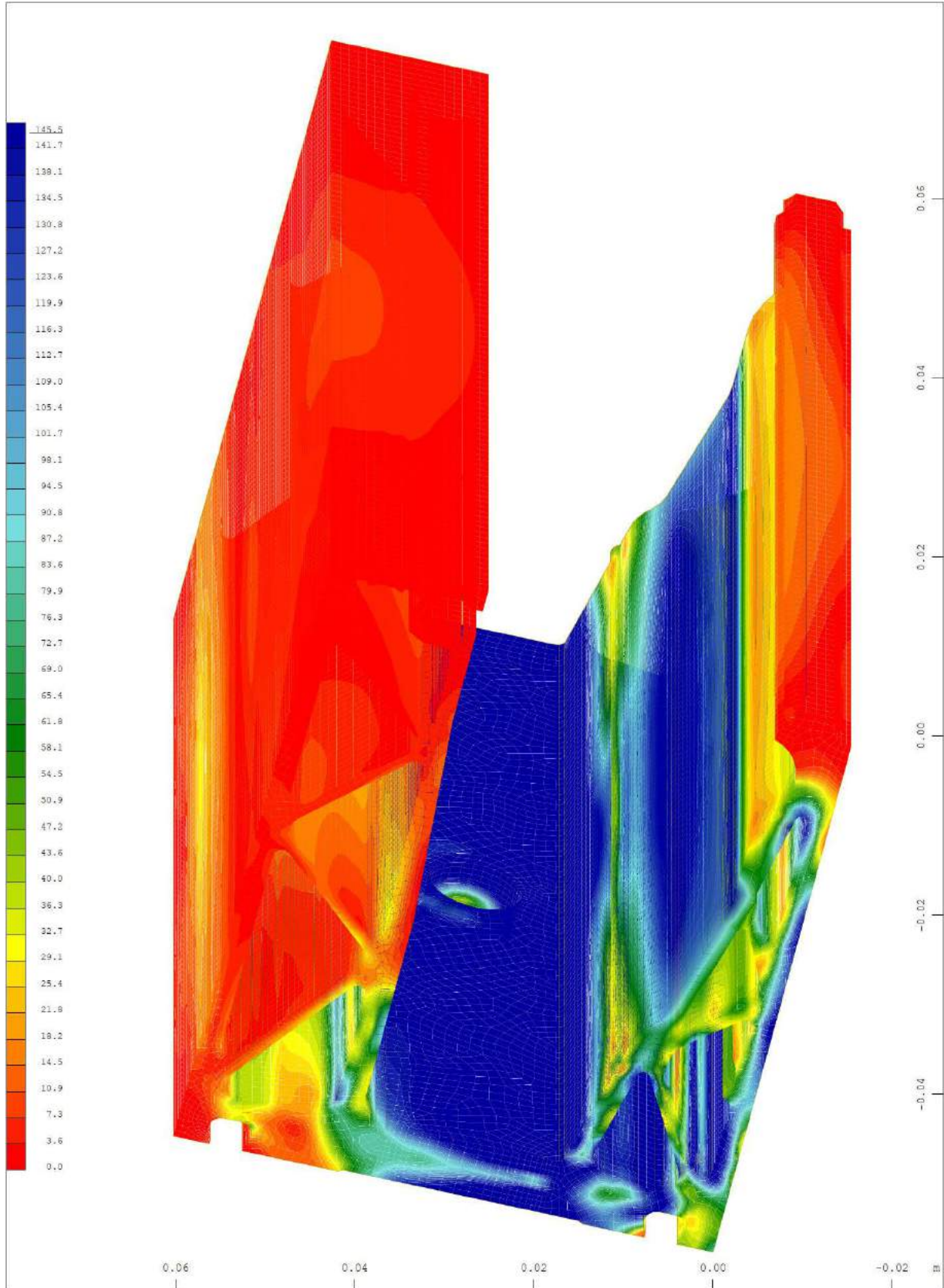
M 10 : 5.62
 X * 0.986
 Y * 0.883
 Z * 0.498



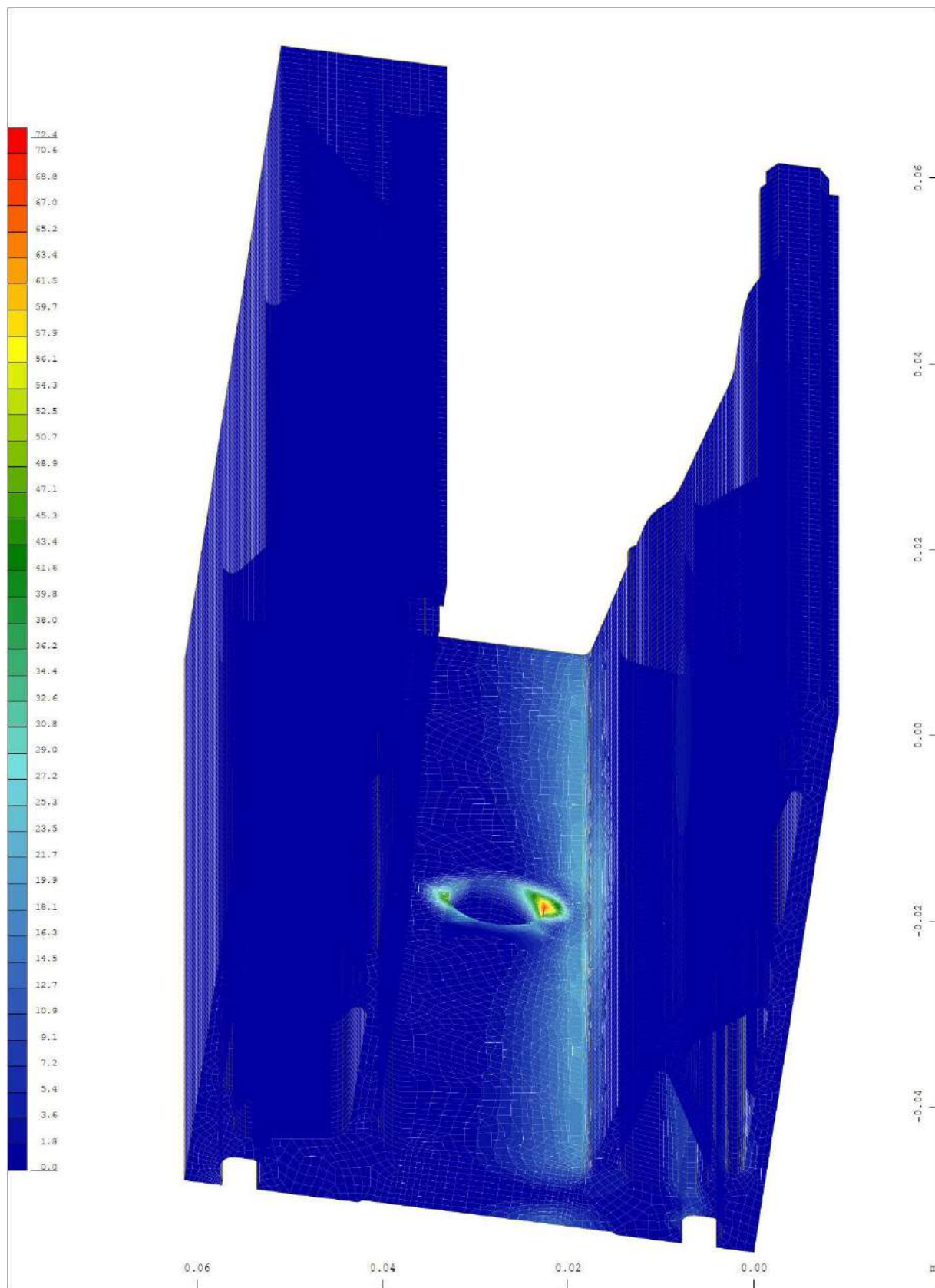
Y Sector of system Volume Elements M 10 : 3.88
 X Deformed Structure from LC 20 LOAD SLS-LCA
 Nodal displacement in global X in Node, nonlinear Loadcase 20 LOAD SLS-LCA , from



Sector of system Volume Elements M 10 : 5.32
 All loads, nonlinear Loadcase 30 LOAD ULT-LCB , (1 cm 3D = unit) Free line load X * 0.992
 (force) in global X (Unit=50.0 kN/m ) (Min=-78.5) (Max=75.9) Y * 0.950
Z * 0.336

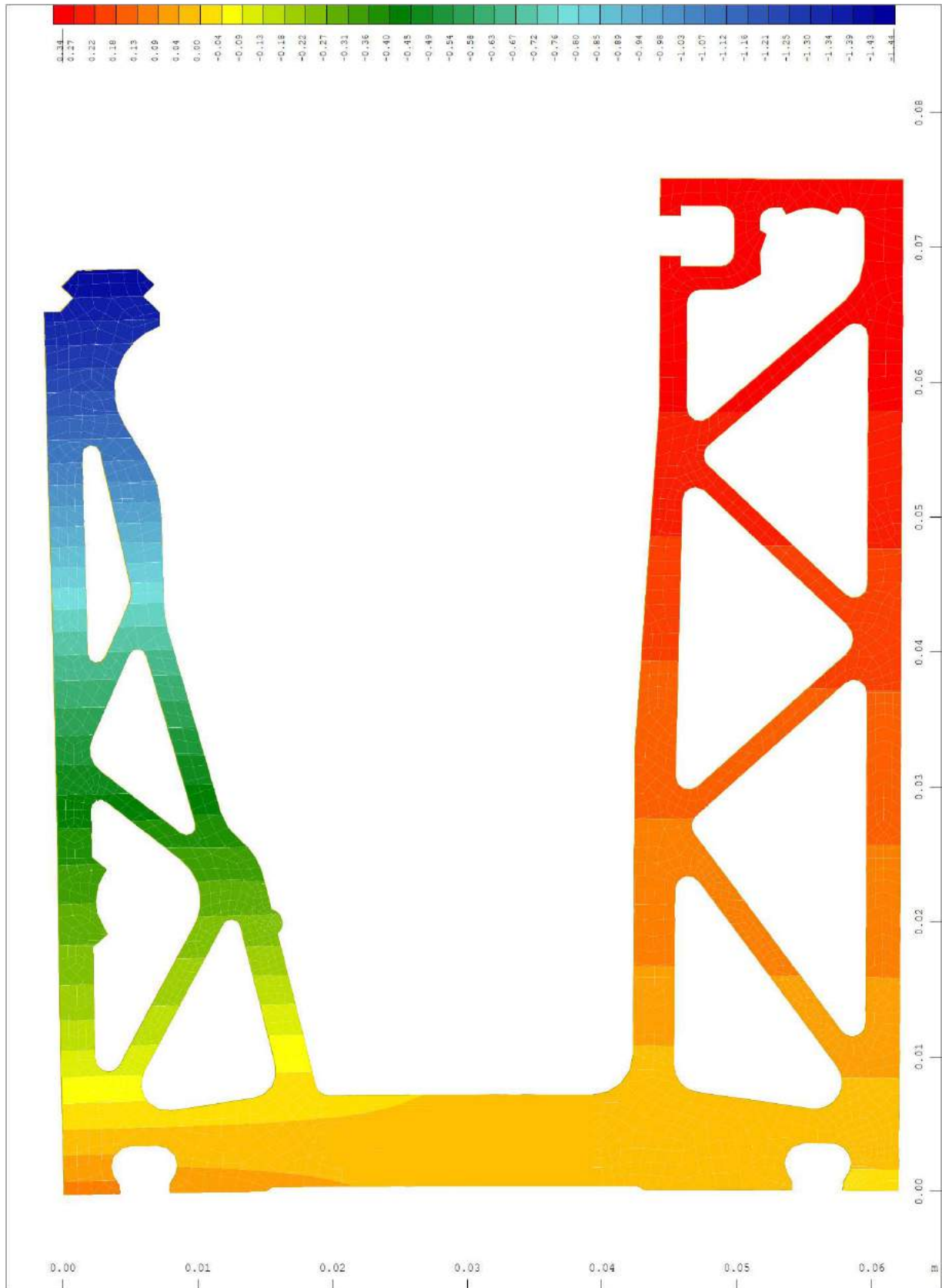


Sector of system Volume Elements M 10 : 5.85
 v.Mises stress from middle of element \leftrightarrow , nonlinear Loadcase 30 LOAD ULT-LCB , from X * 0.994
 0.0988 to 145.5 step 3.63 MPa Y * 0.894
Z * 0.461



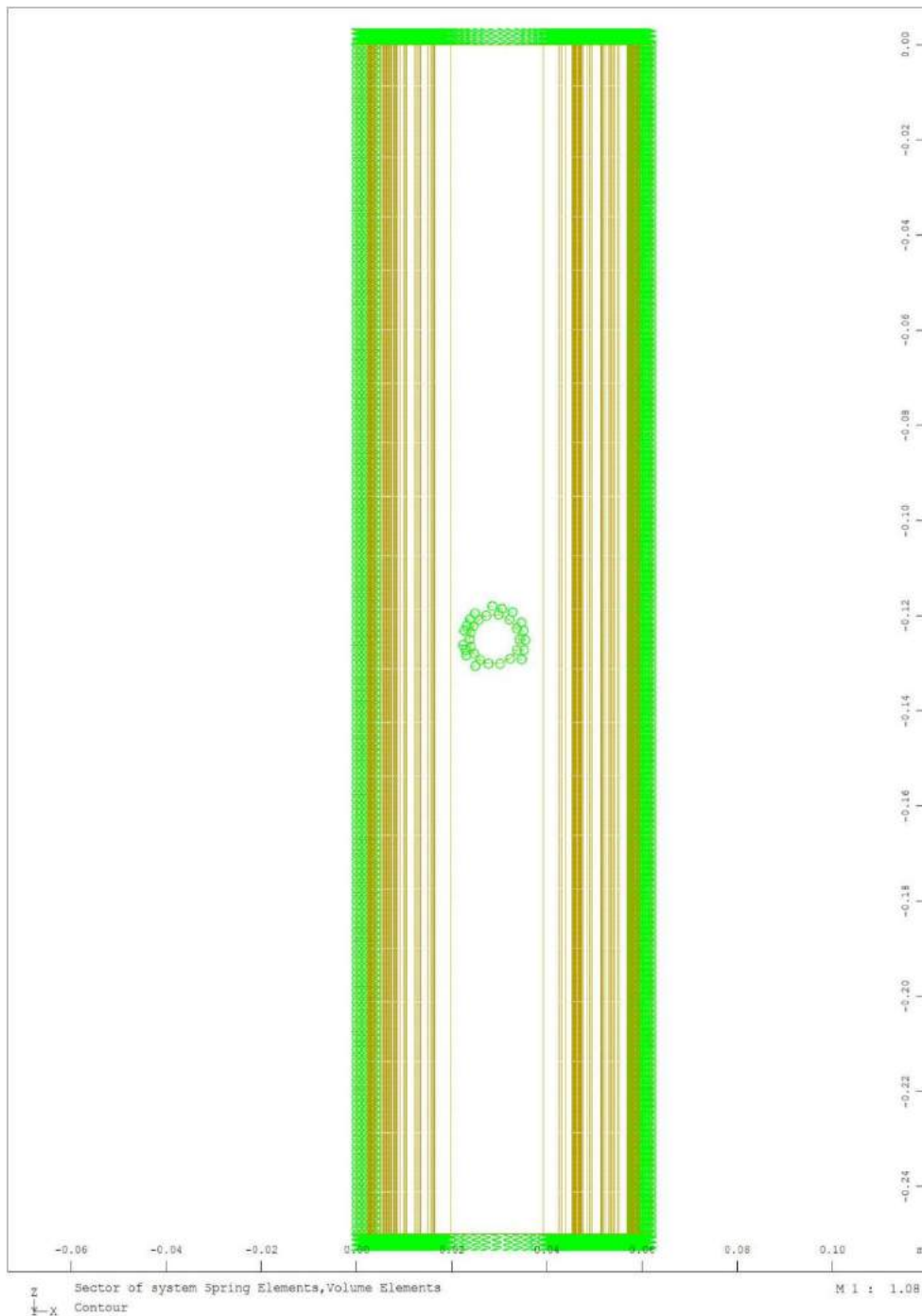
Sector of system Volume Elements
 Plastic deviatoric strain ↔, nonlinear Loadcase 30 LOAD ULT-LCB, Material law Mat.type
 17 , ERIC Gauss points in Node o/oo, from 0 to 72.4 step 1.81

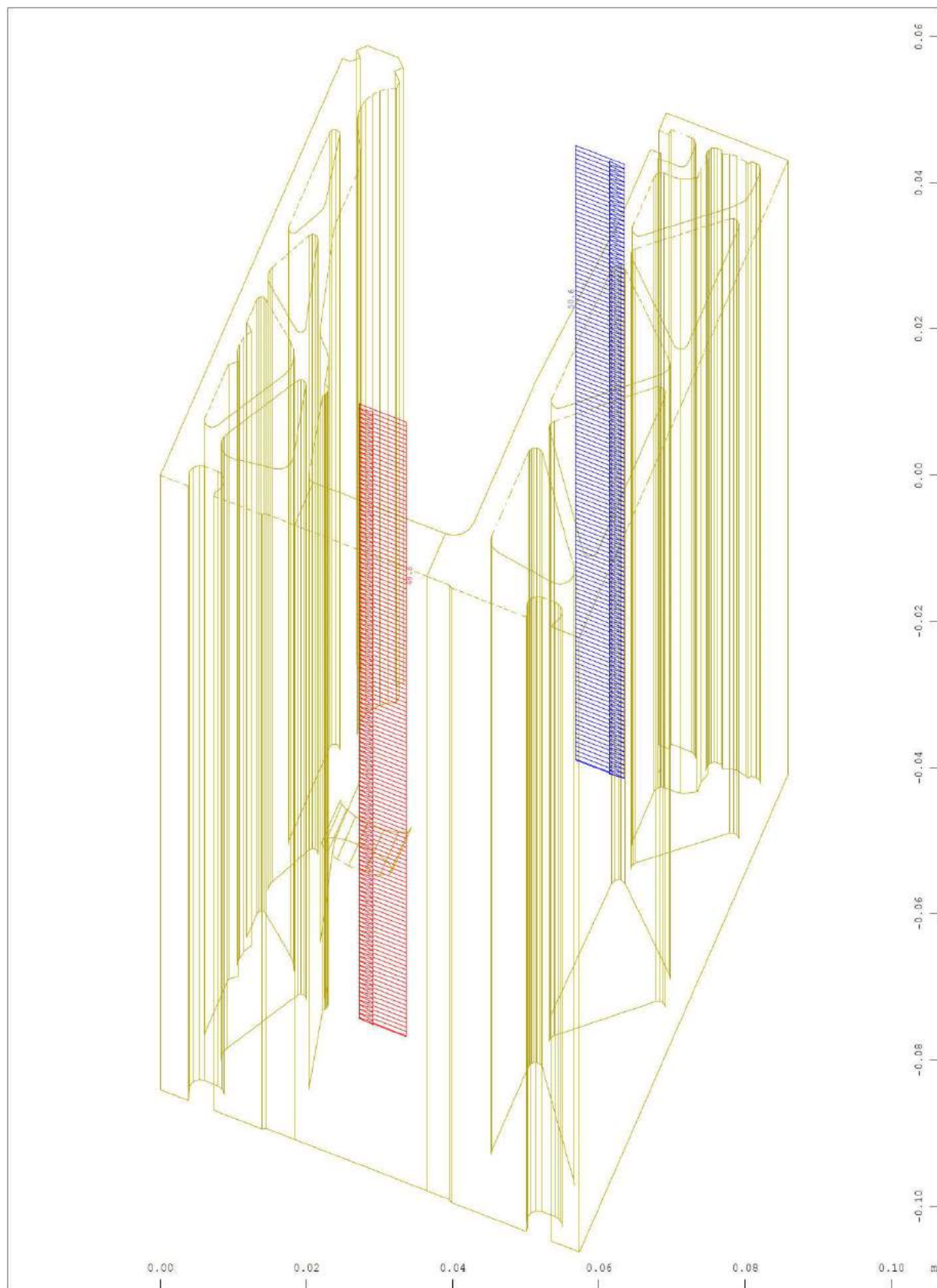
M 10 : 5.62
 X * 0.998
 Y * 0.898
 Z * 0.445



Y Sector of system Volume Elements M 10 : 3.88
 X Deformed Structure from LC 40 LOAD SLS-ICB
 Nodal displacement in global X in Node, nonlinear Loadcase 40 LOAD SLS-ICB , from

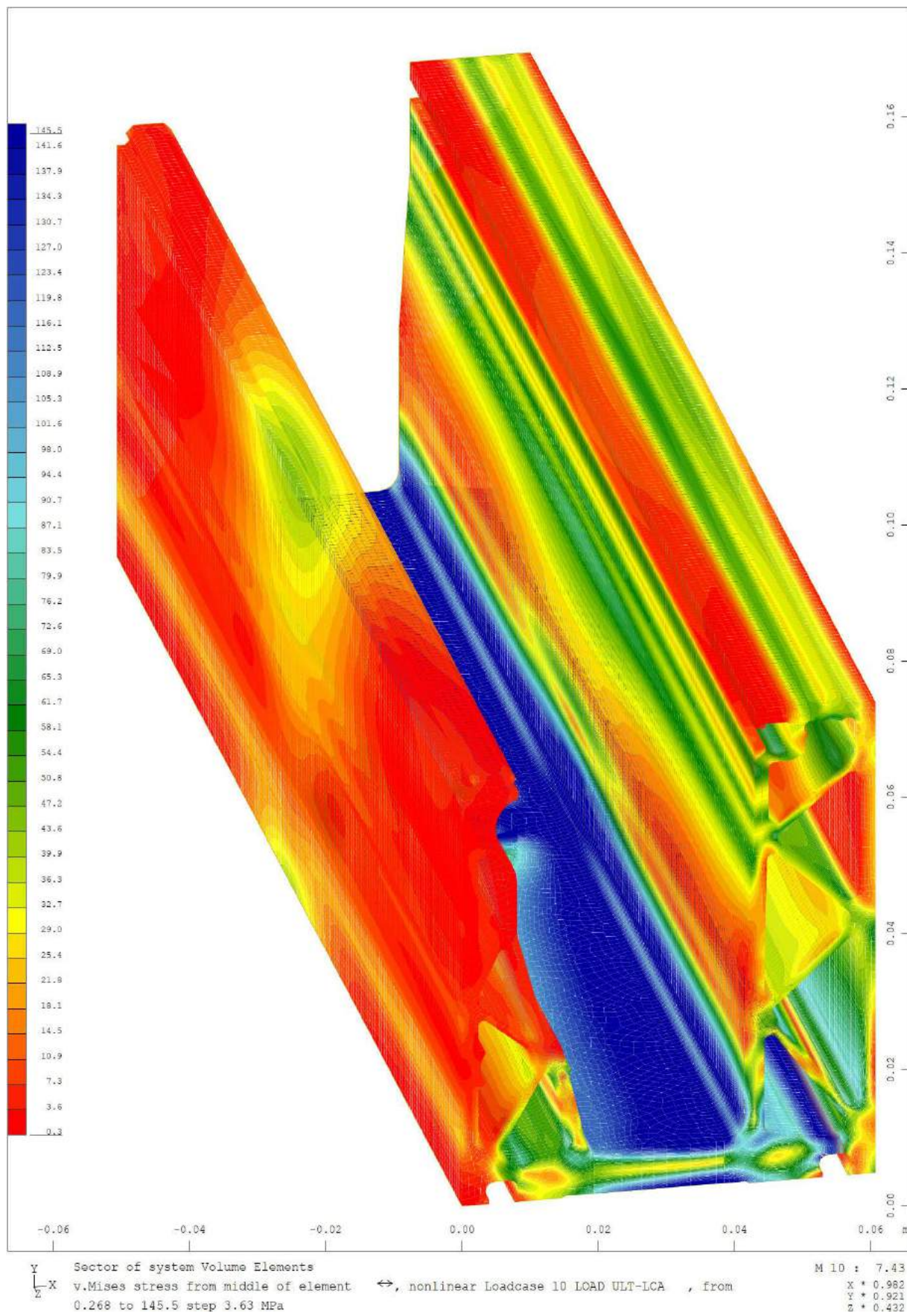
6.2.9 Defender DF88PICO_E250

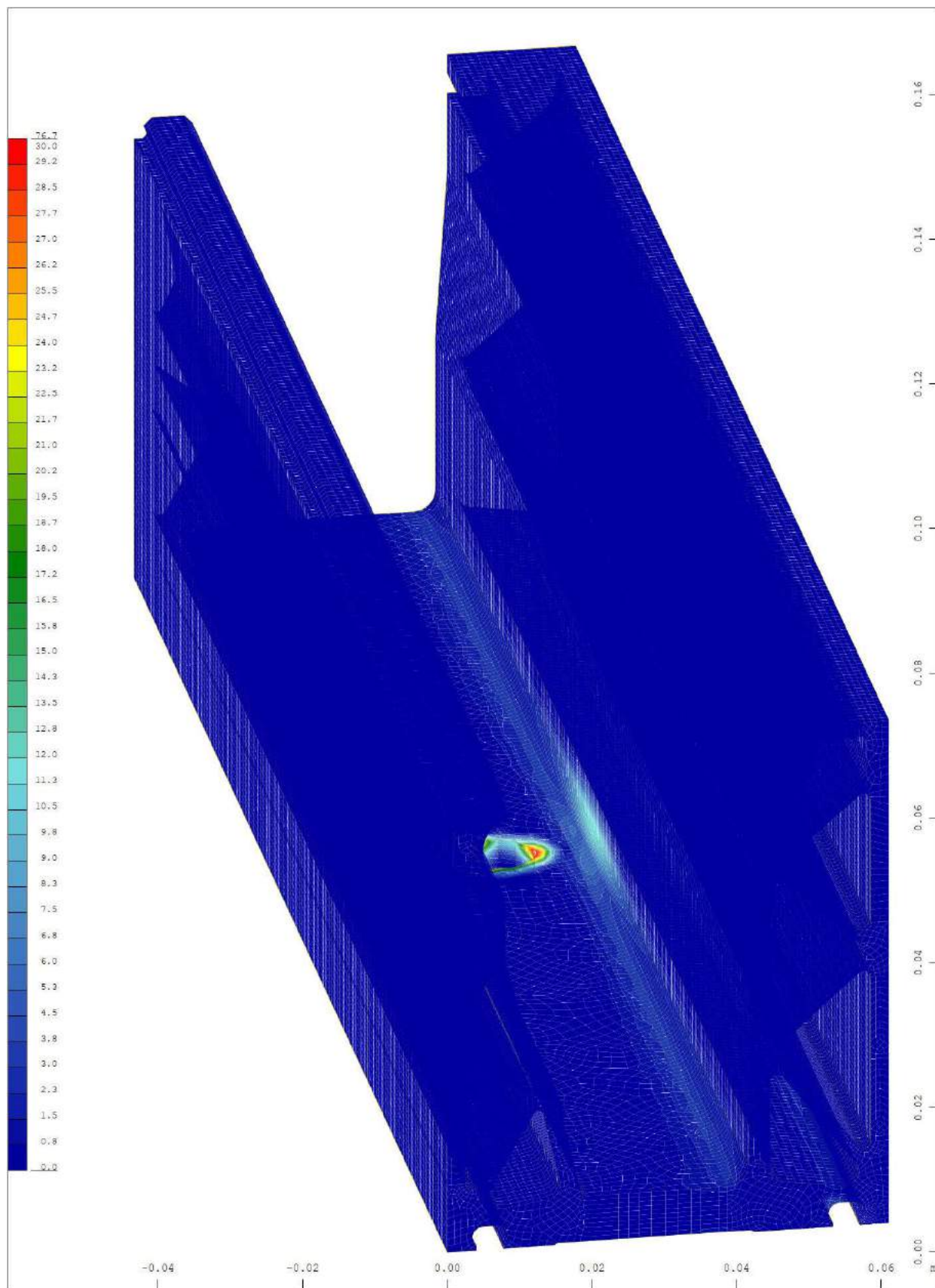




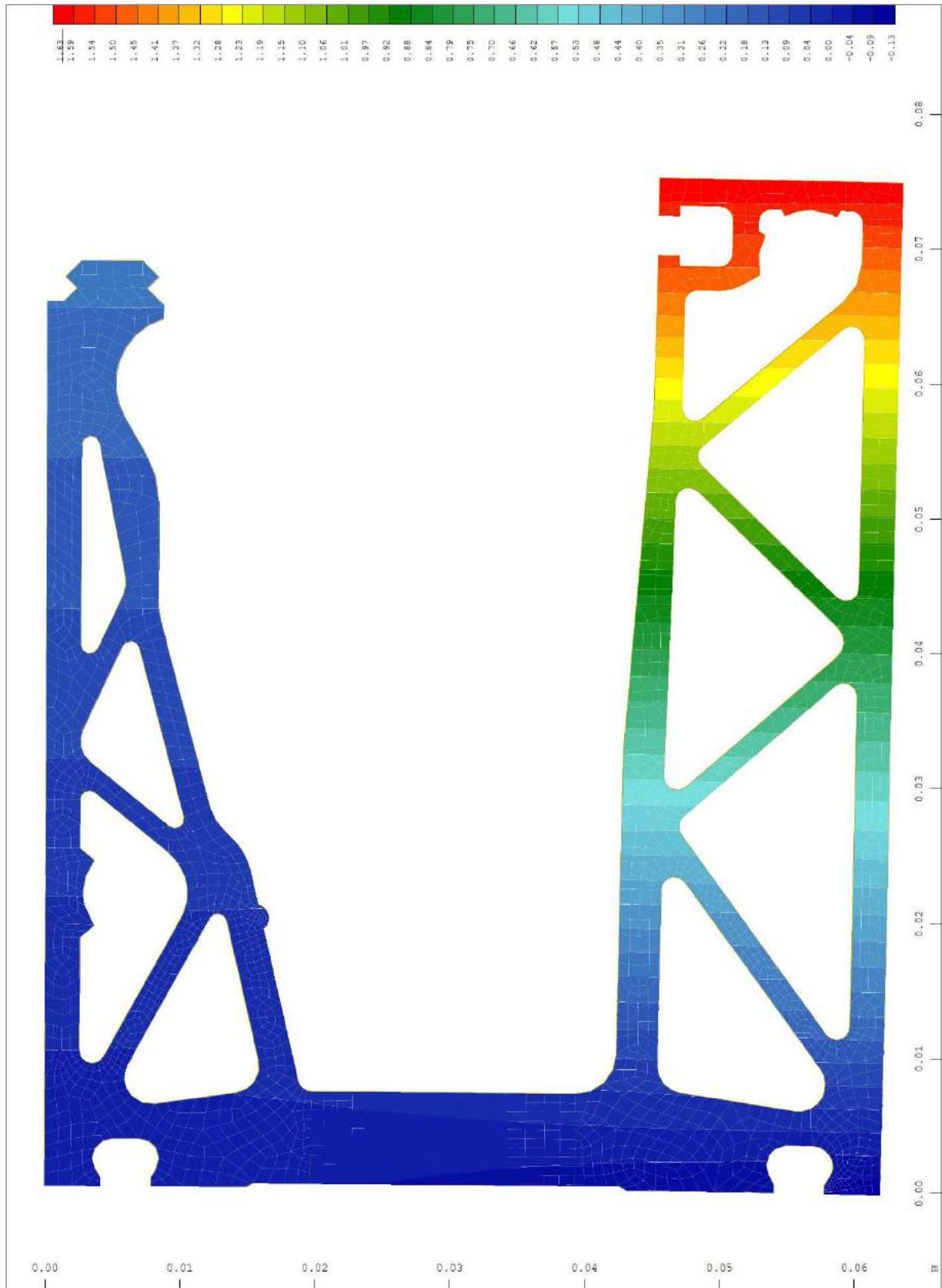
Sector of system Volume Elements
 All loads, nonlinear Loadcase 10 LOAD ULT-LCA , (1 cm 3D = unit) Free line load
 (force) in global X (Unit=50.0 kN/m ∇) (Min=-48.8) (Max=50.6)

M 10 : 7.13
 X * 0.992
 Y * 0.950
 Z * 0.336

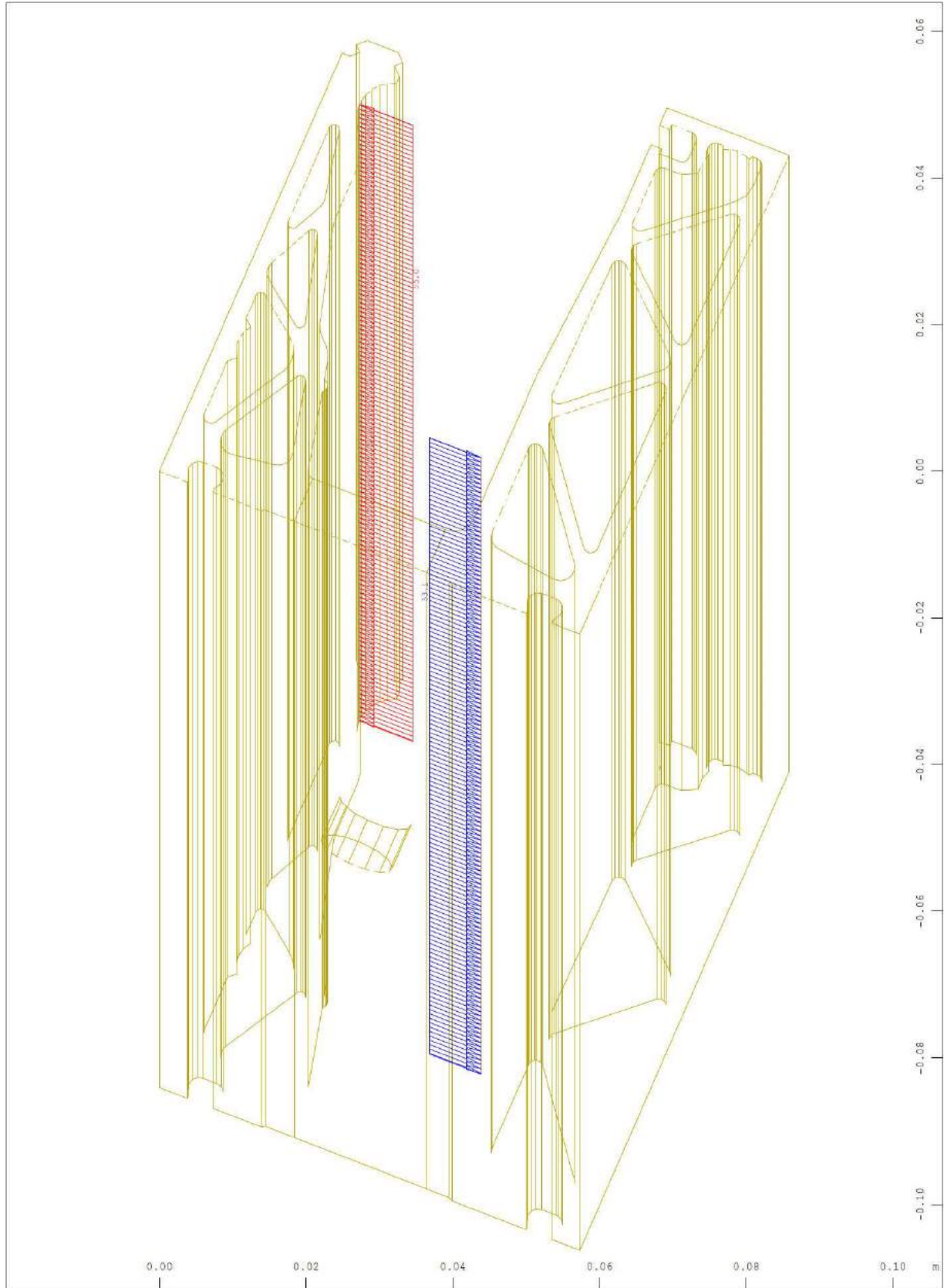




Y Sector of system Volume Elements M 10 : 7.21
 X Plastic deviatoric strain ↔, nonlinear Loadcase 10 LOAD ULT-LCA, Material law Mat.type X * 0.987
 Z 17 , ERIC Gauss points in Node o/oo, from 0 to 30.0 step 0.750 Y * 0.925
 Z * 0.411

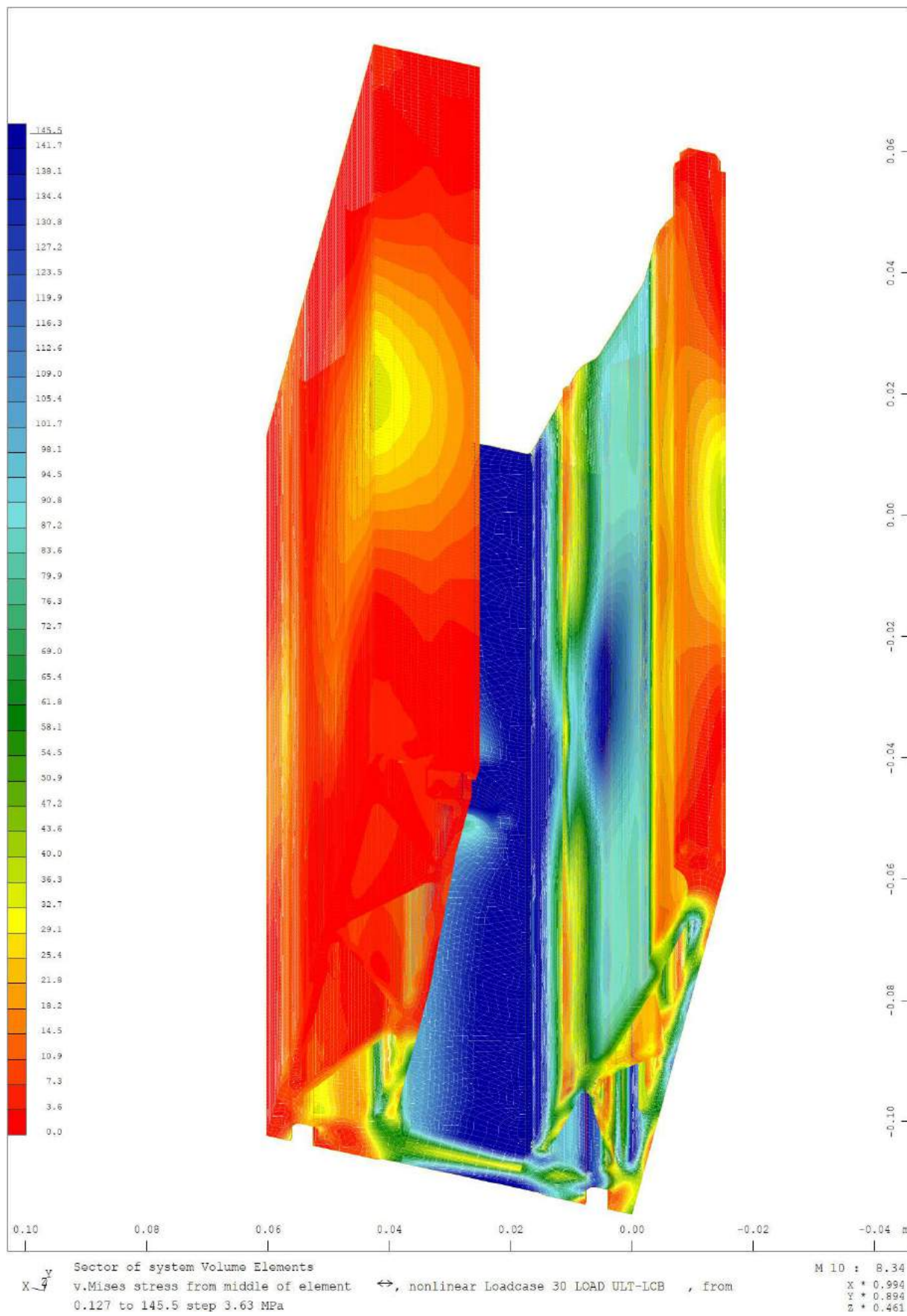


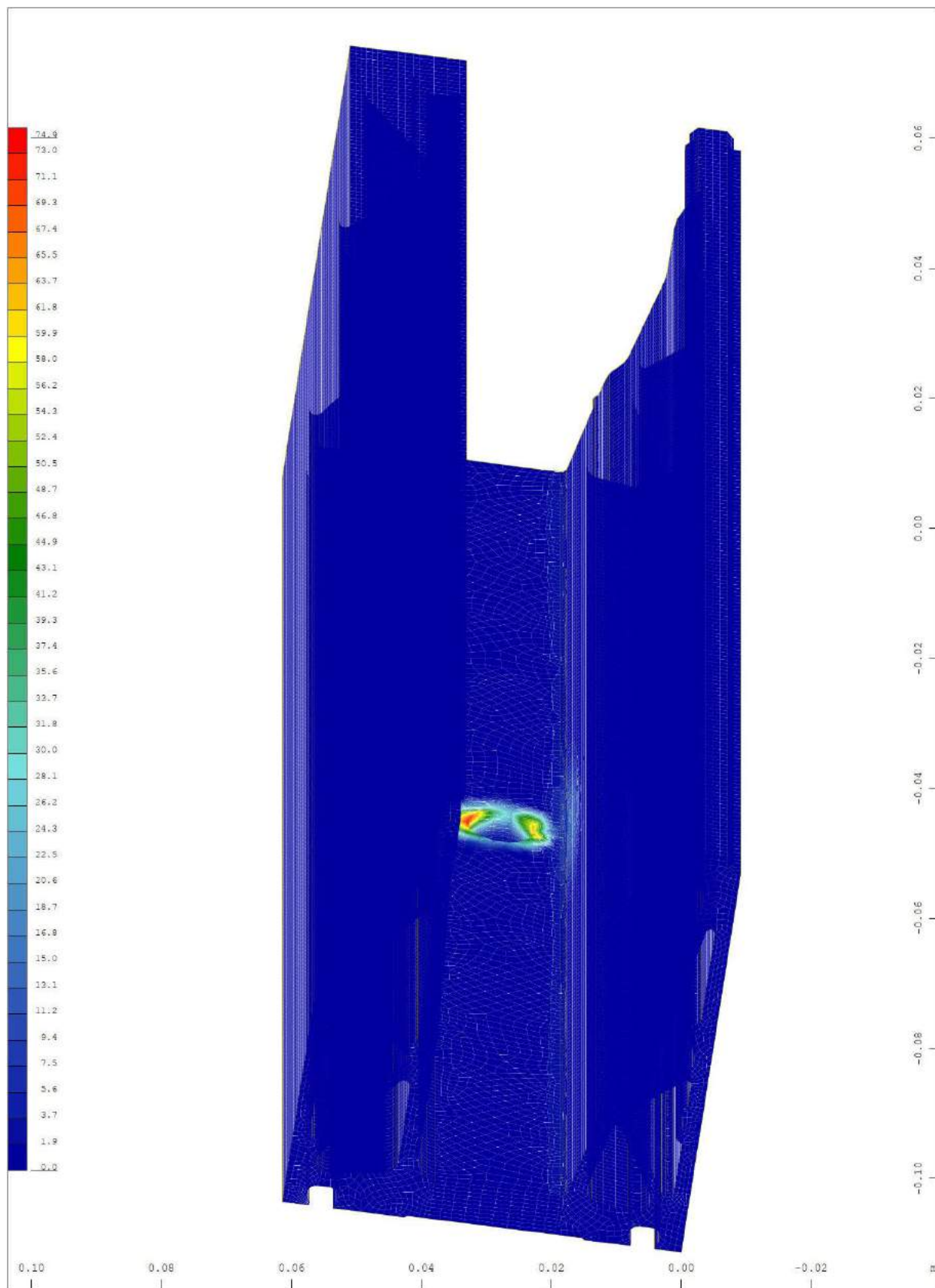
Y Sector of system Volume Elements M 10 : 3.87
 X Deformed Structure from LC 20 LOAD SLS-LCA
 Nodal displacement in global X in Node, nonlinear Loadcase 20 LOAD SLS-LCA , from



Sector of system Volume Elements
 All loads, nonlinear Loadcase 30 LOAD ULT-LCB , (1 cm 3D = unit) Free line load
 (force) in global X (Unit=50.0 kN/m ∇) (Min=-55.0) (Max=53.1)

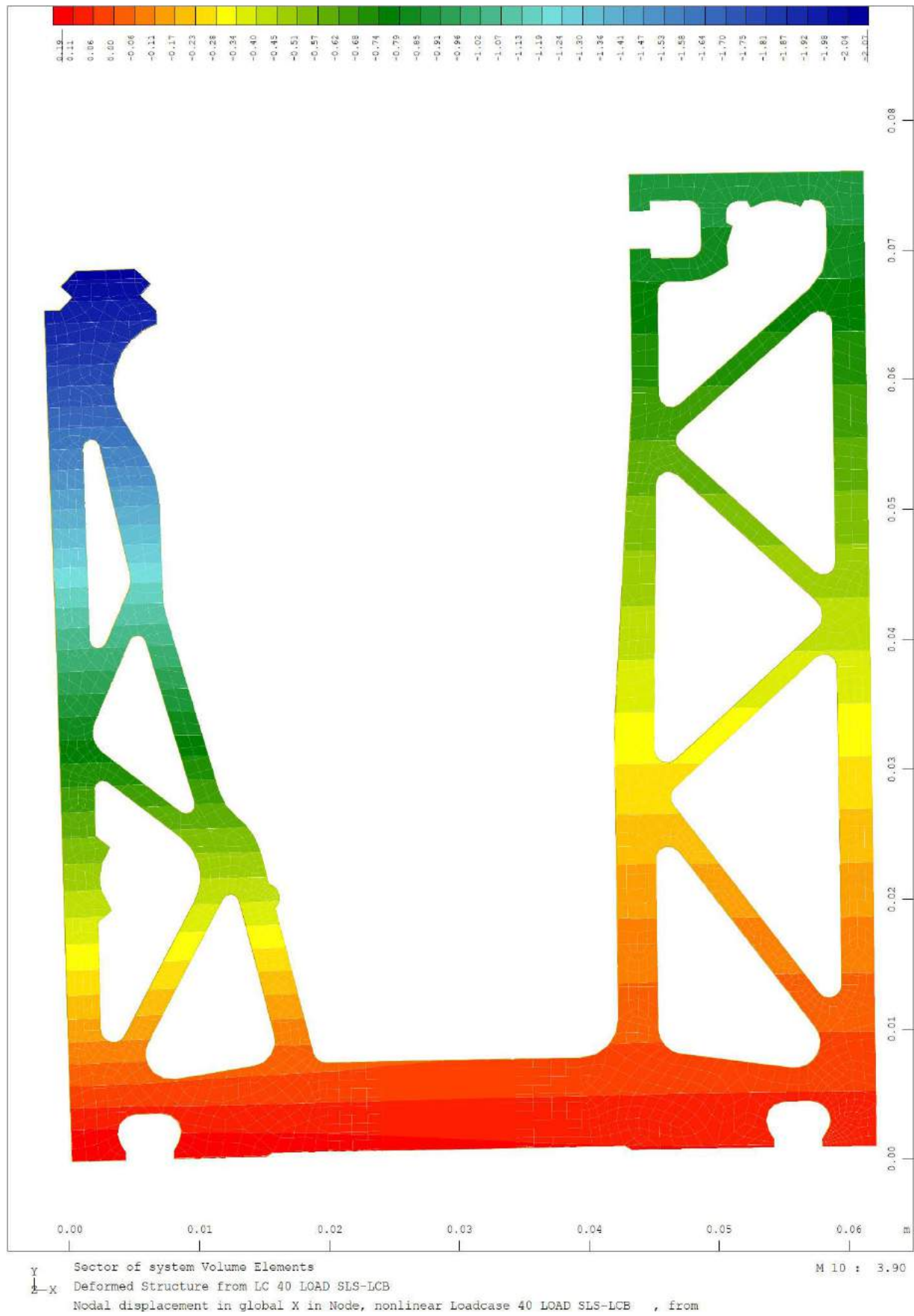
M 10 : 7.13
 X * 0.992
 Y * 0.950
 Z * 0.336



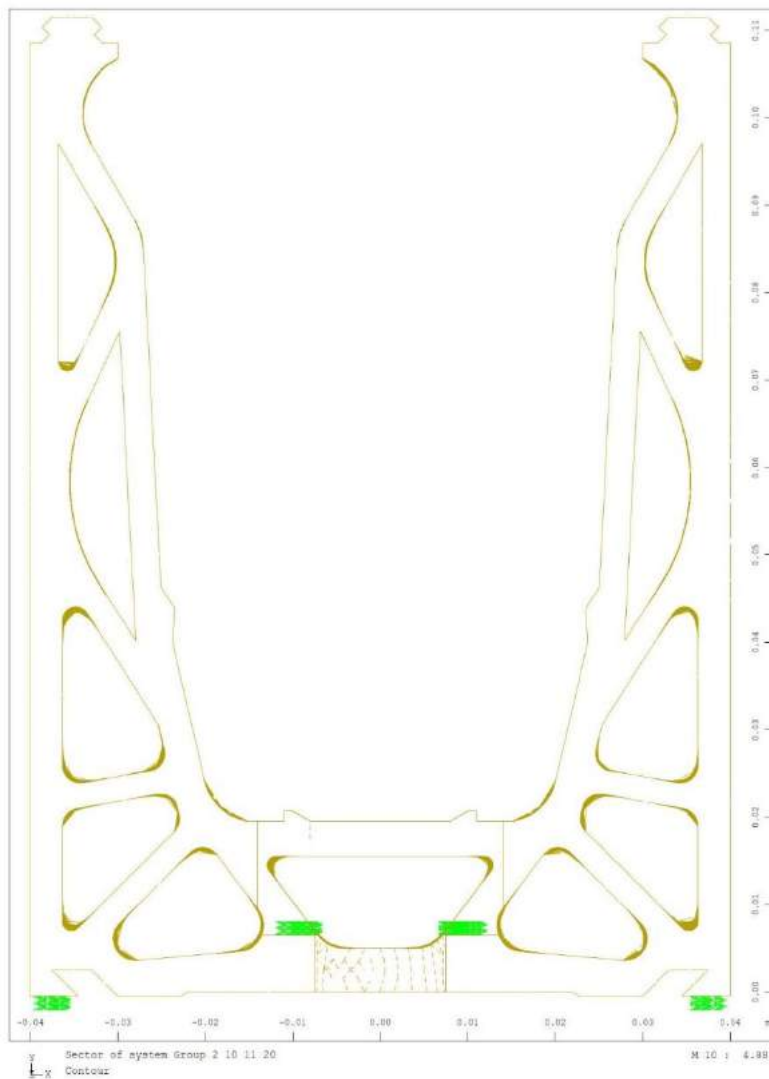


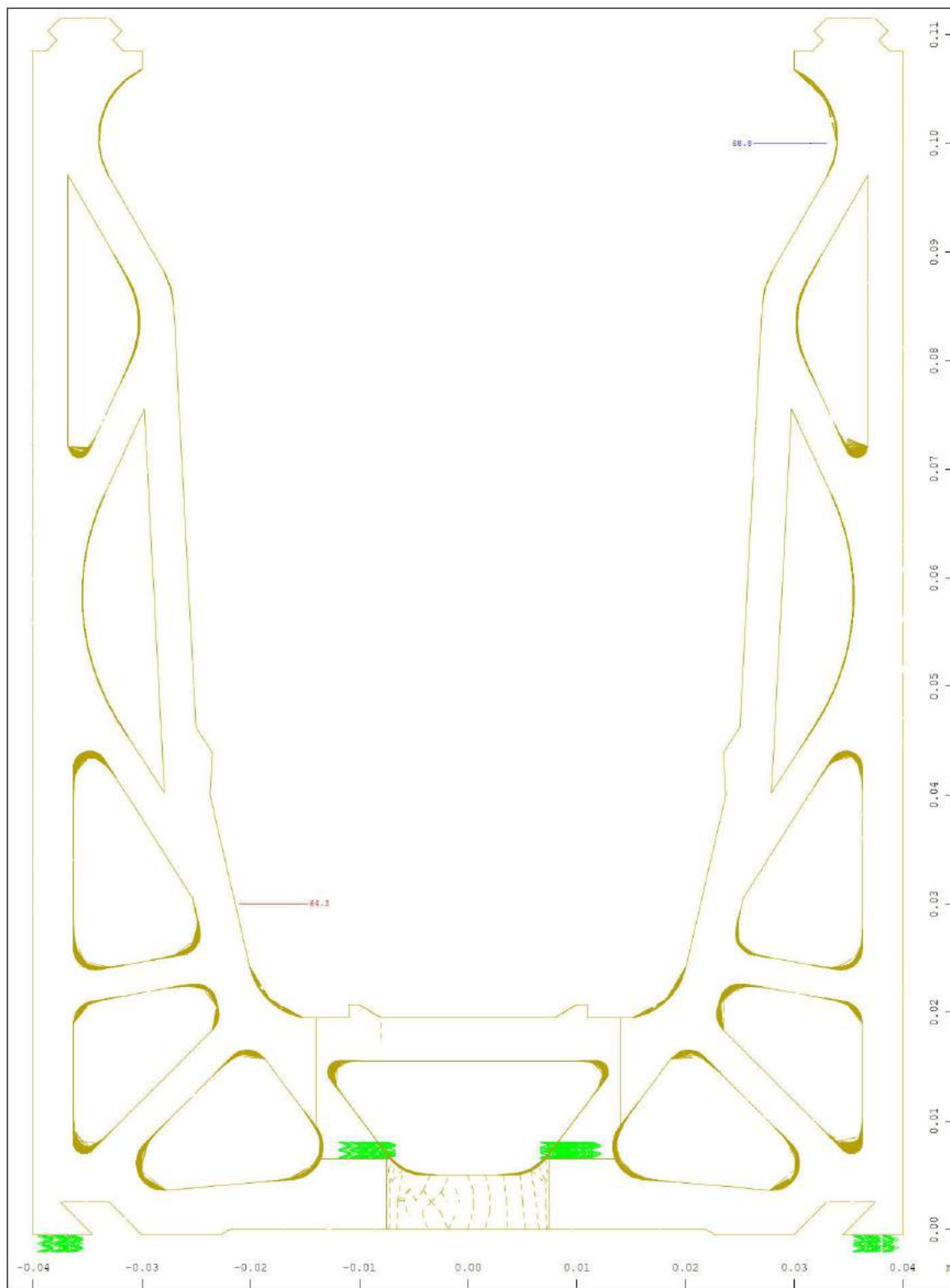
Sector of system Volume Elements
 Plastic deviatoric strain ↔, nonlinear Loadcase 30 LOAD ULT-LCB, Material law Mat.type 17
 , BRIC Gauss points in Node o/oo, from 0 to 74.9 step 1.87

M 10 : 8
 X * 0.998
 Y * 0.898
 Z * 0.445

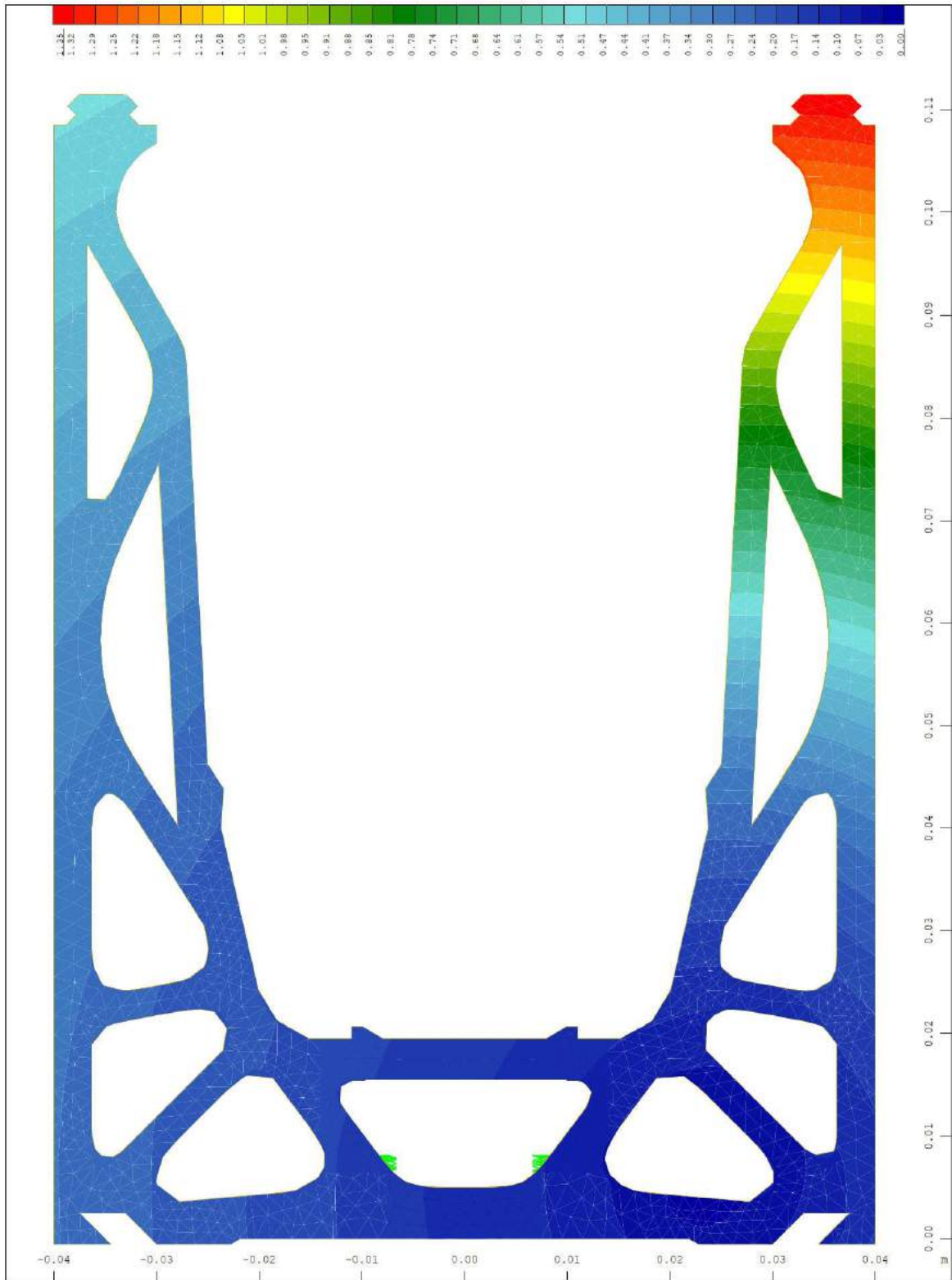


6.2.10 Defender DF1010LM_E200 / DF1212LM_E200

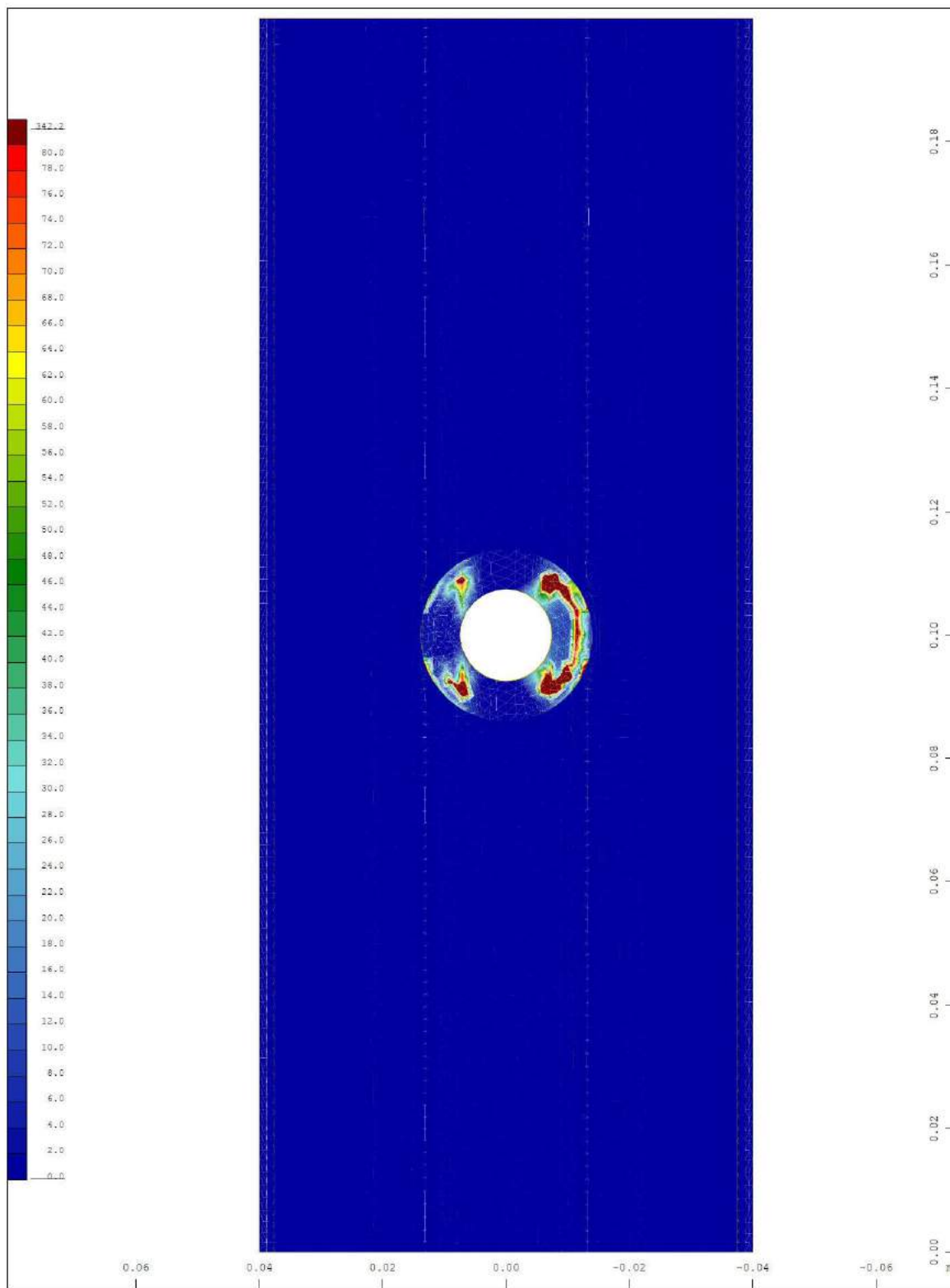




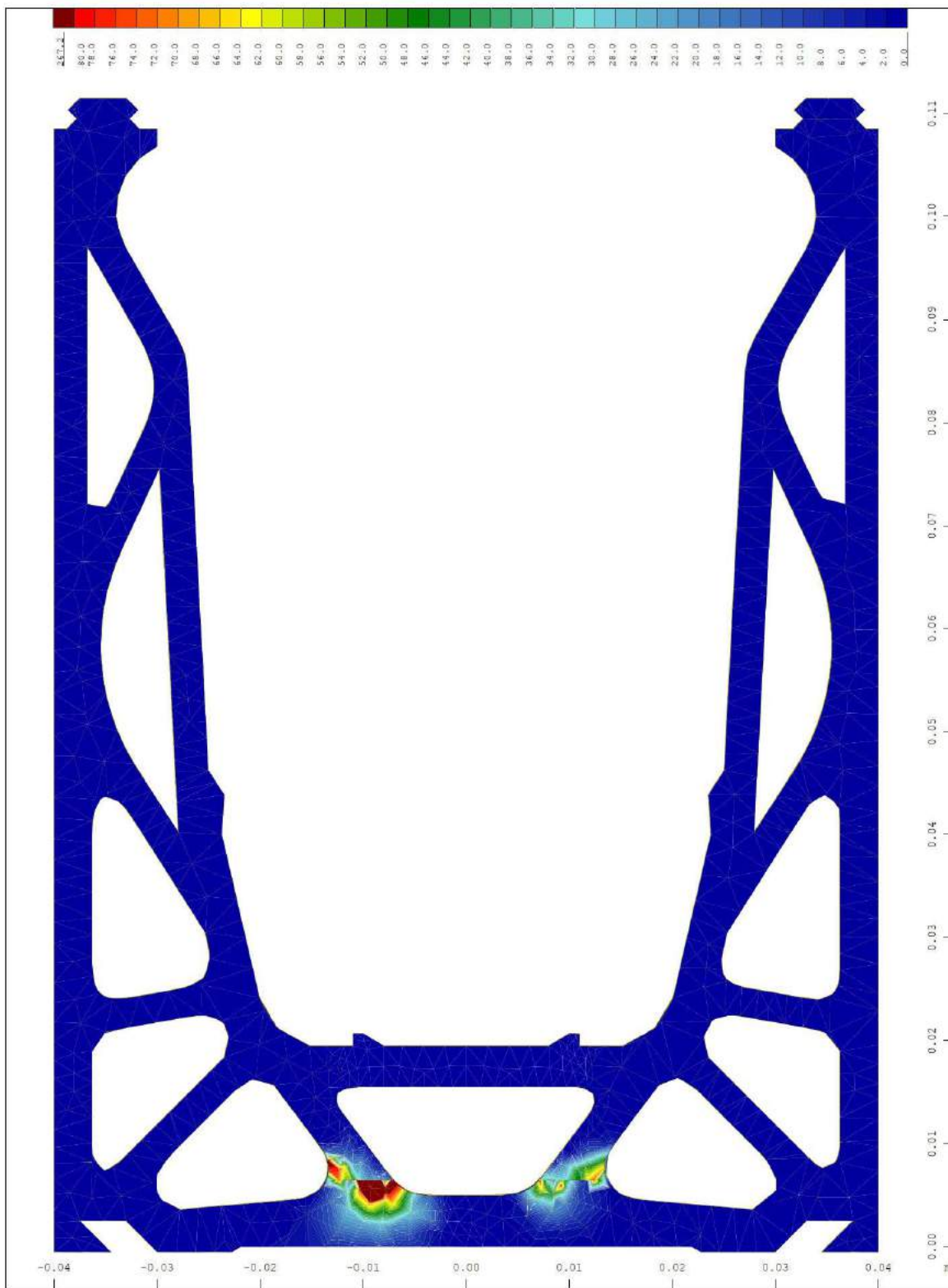
y Sector of system Group 2 10 11 20 M 10 : 4,88
 x All loads, nonlinear Loadcase 10 ULS , (1 cm 3D - unit) Free line load (force) in
 global X (Unit=50.0 kN/m \rightarrow) (Min=-64.3) (Max=68.8)



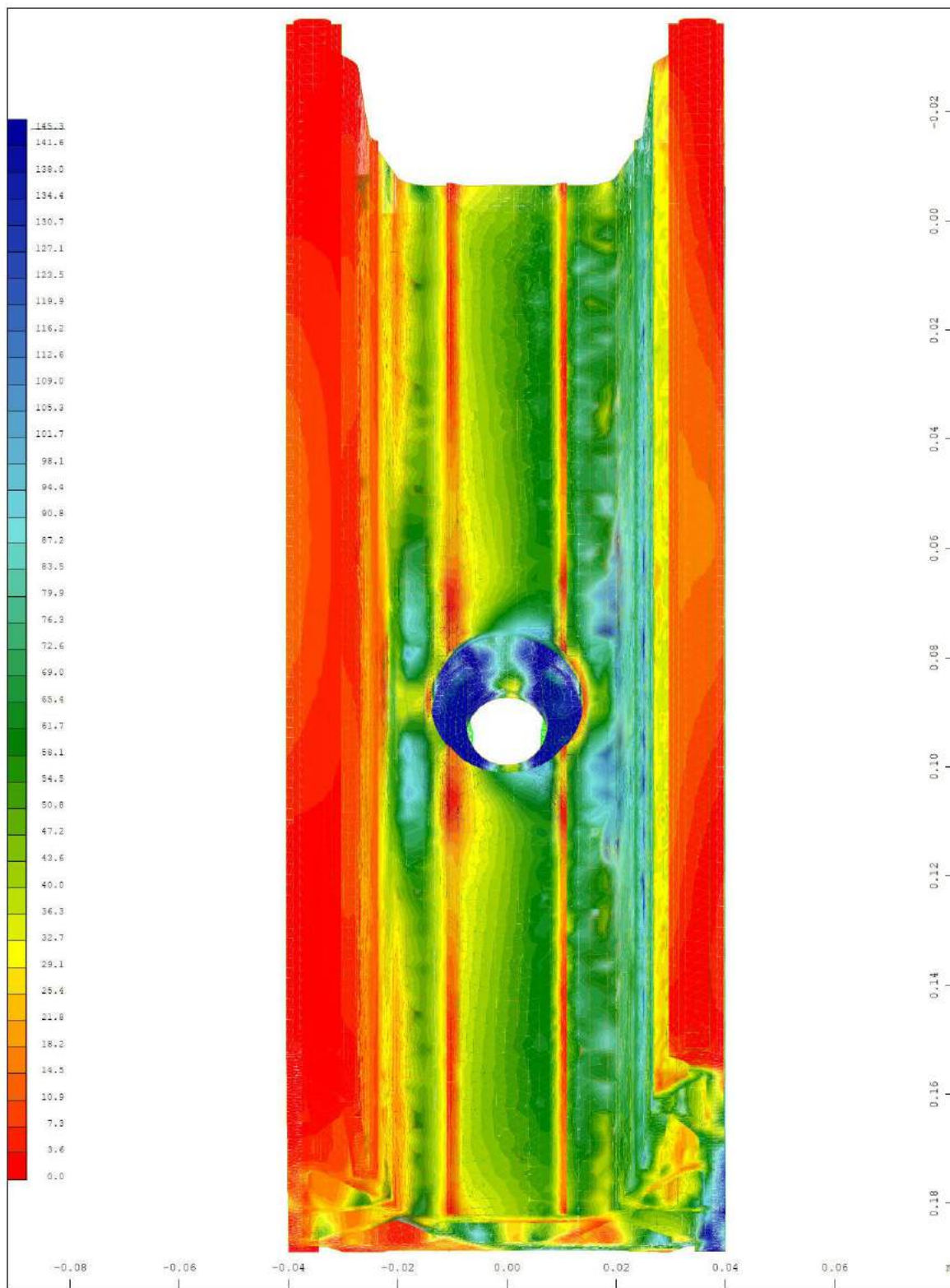
y Sector of system Group 2 20 M 10 : 5.15
 x Nodal displacement vector in Node, nonlinear Loadcase 20 SLS , from 0.0021 to 1.35
 step 0.0338 mm



2 Sector of system Group 2 M 10 : 8.60
 X-Y Plastic deviatoric strain \leftrightarrow , nonlinear Loadcase 10 ULS, Material law Mat.type 17 ,
 BRIC Gauss points in Node o/oo, from 0 to 80.0 step 2.00



y Sector of system Group 2 M 10 : 5.15
 x Plastic deviatoric strain \leftrightarrow , nonlinear Loadcase 10 ULS, Material law Mat.type 17
 BRIC Gauss points in Node o/oo, from 0 to 80.0 step 2.00

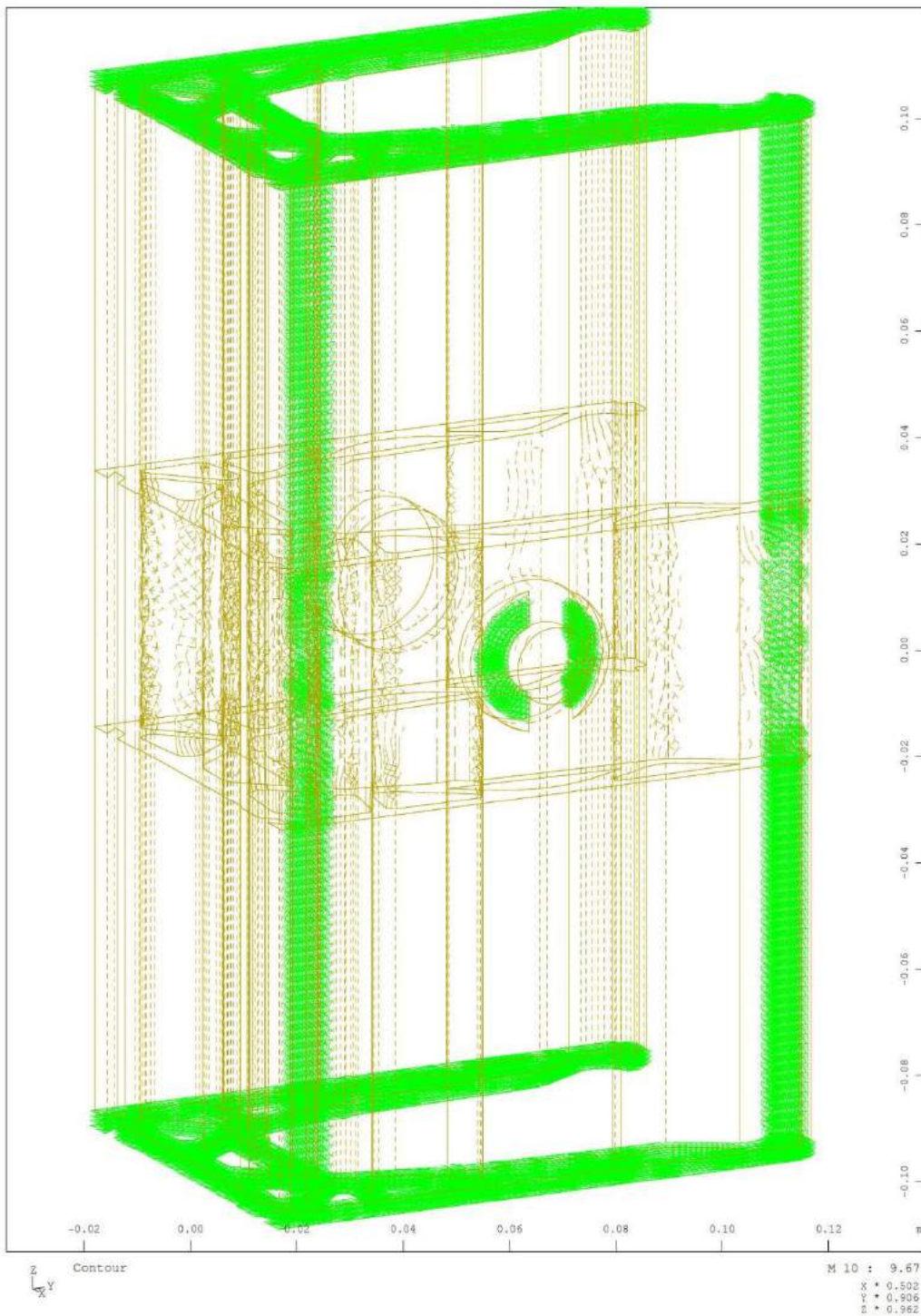


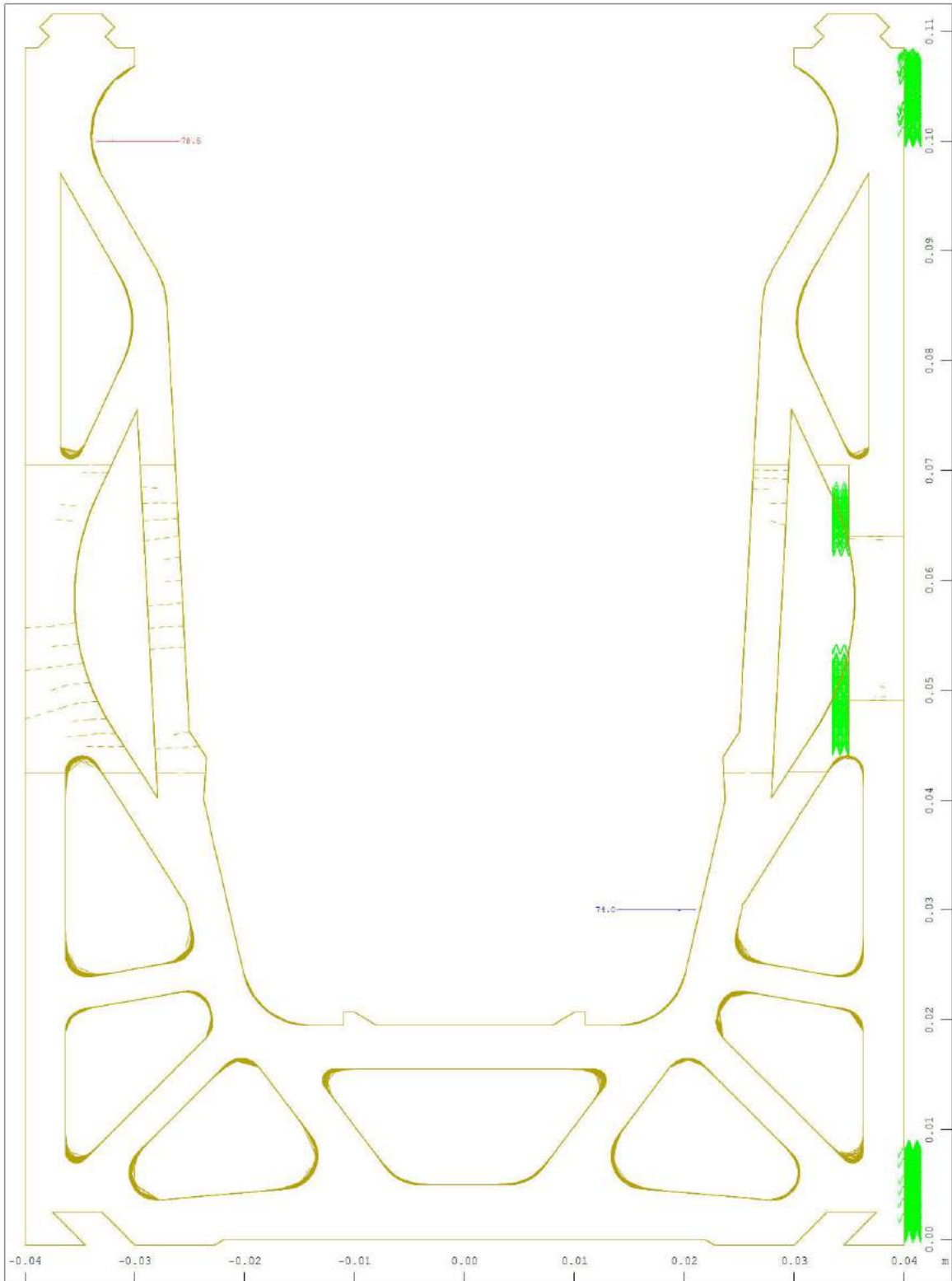
$\begin{matrix} y \\ | \\ -x \\ | \\ z \end{matrix}$

Sector of system Group 2 20
 v.Mises stress from middle of element \leftrightarrow , nonlinear Loadcase 10 ULS , from 0.0617 to
 145.3 step 3.63 MPa

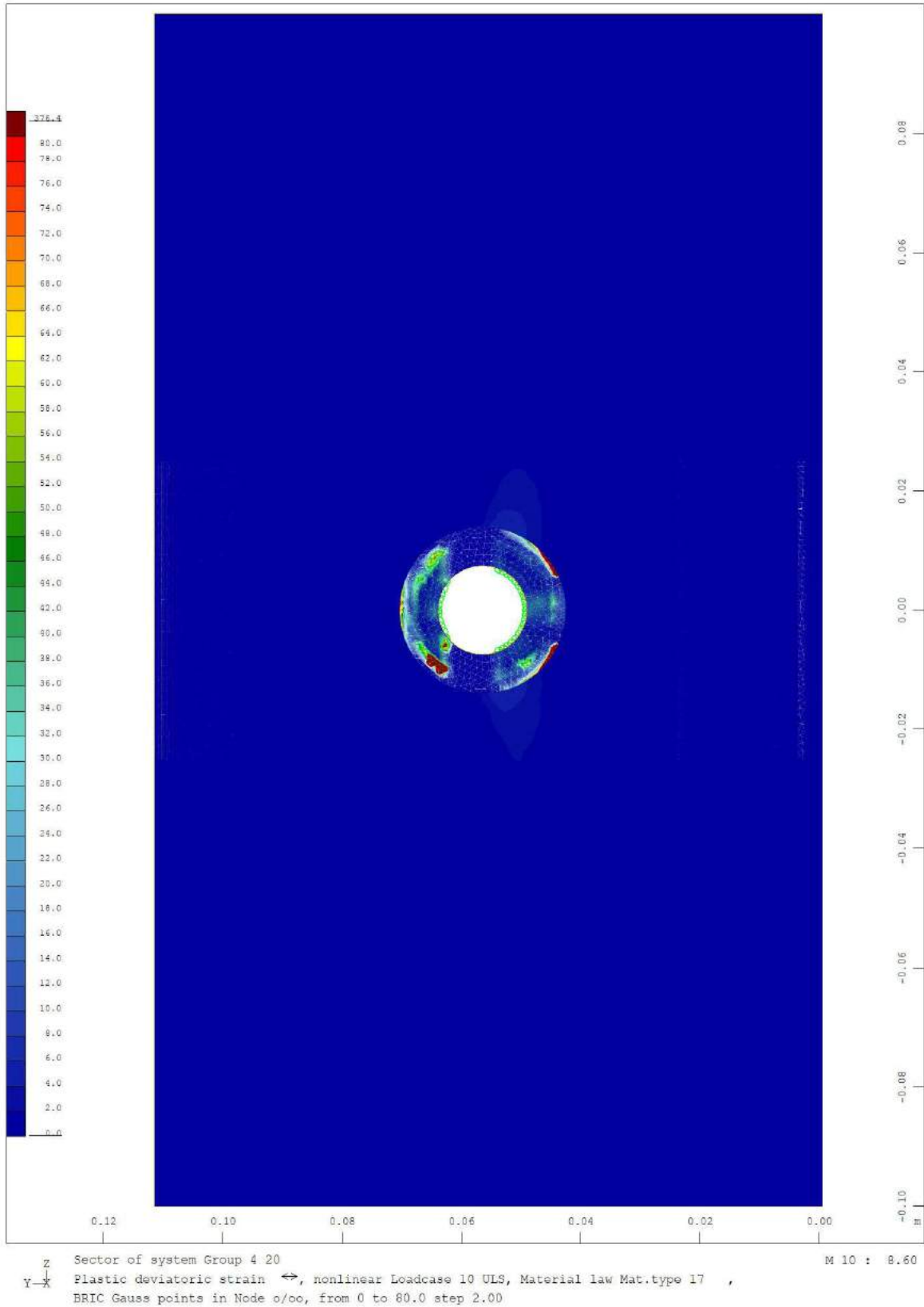
M 10 : 9.71
 x * 1.000
 y * 0.332
 z * 0.943

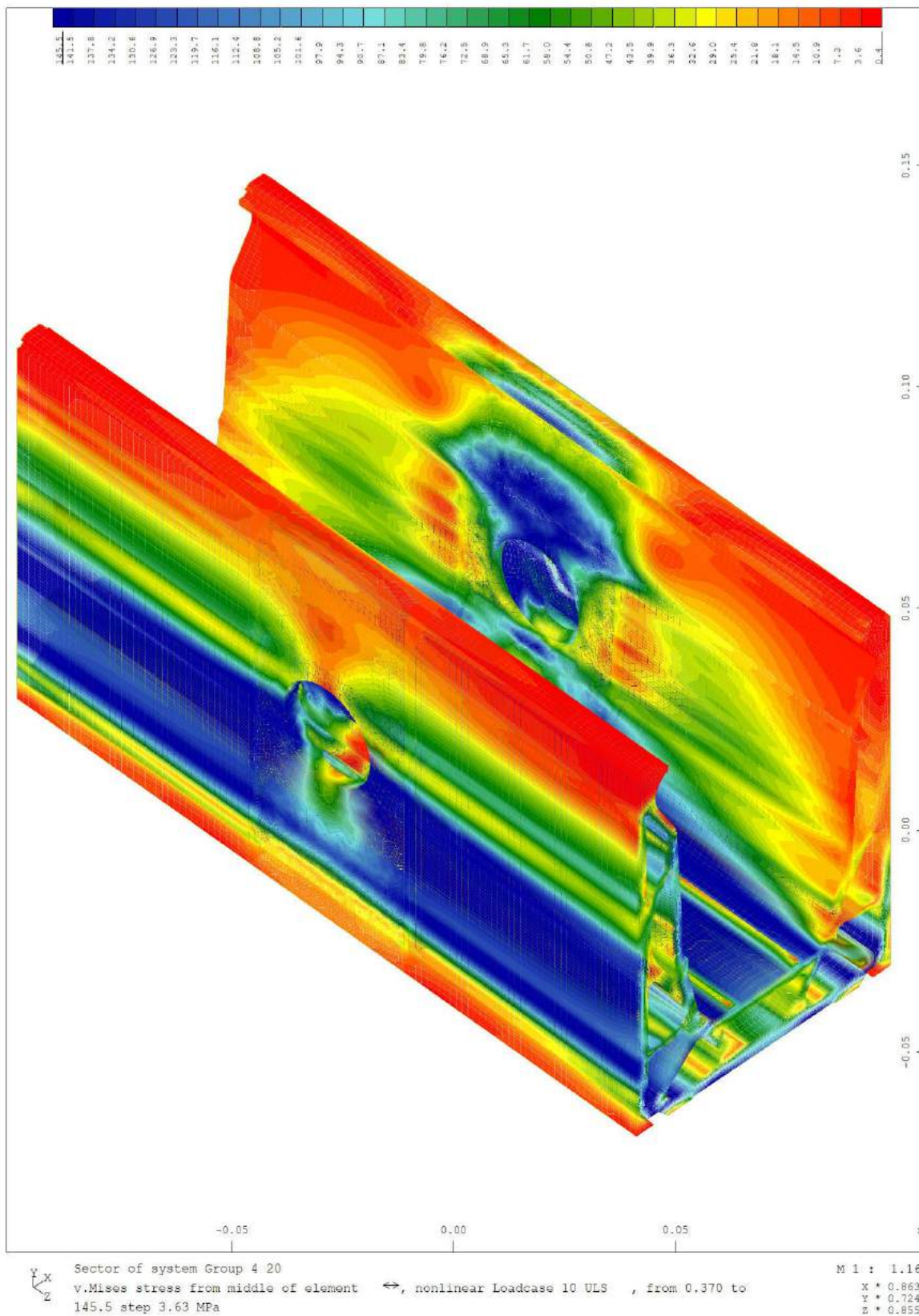
6.2.11 Defender DF1010FR_E200 / DF1212FR_E200

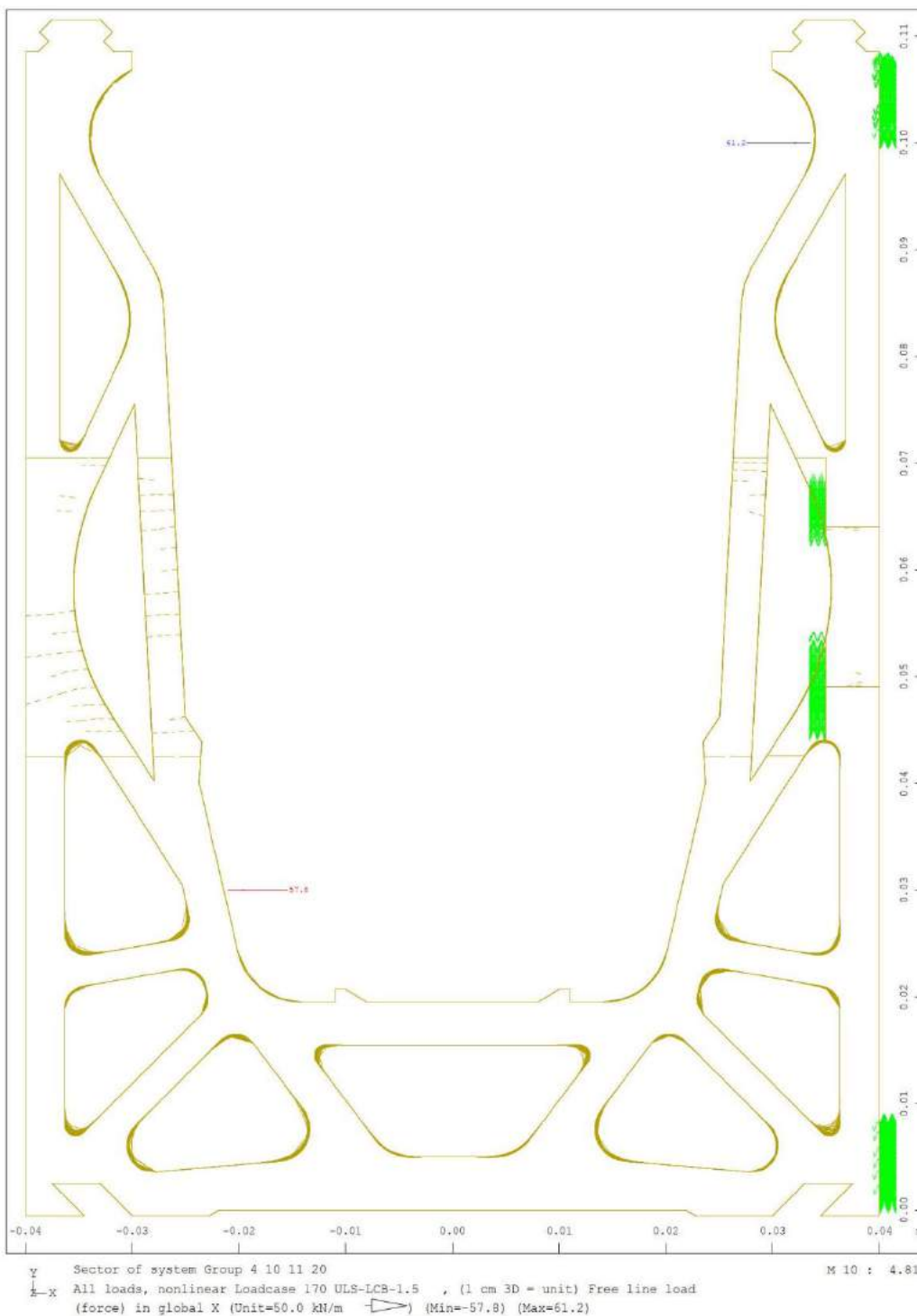


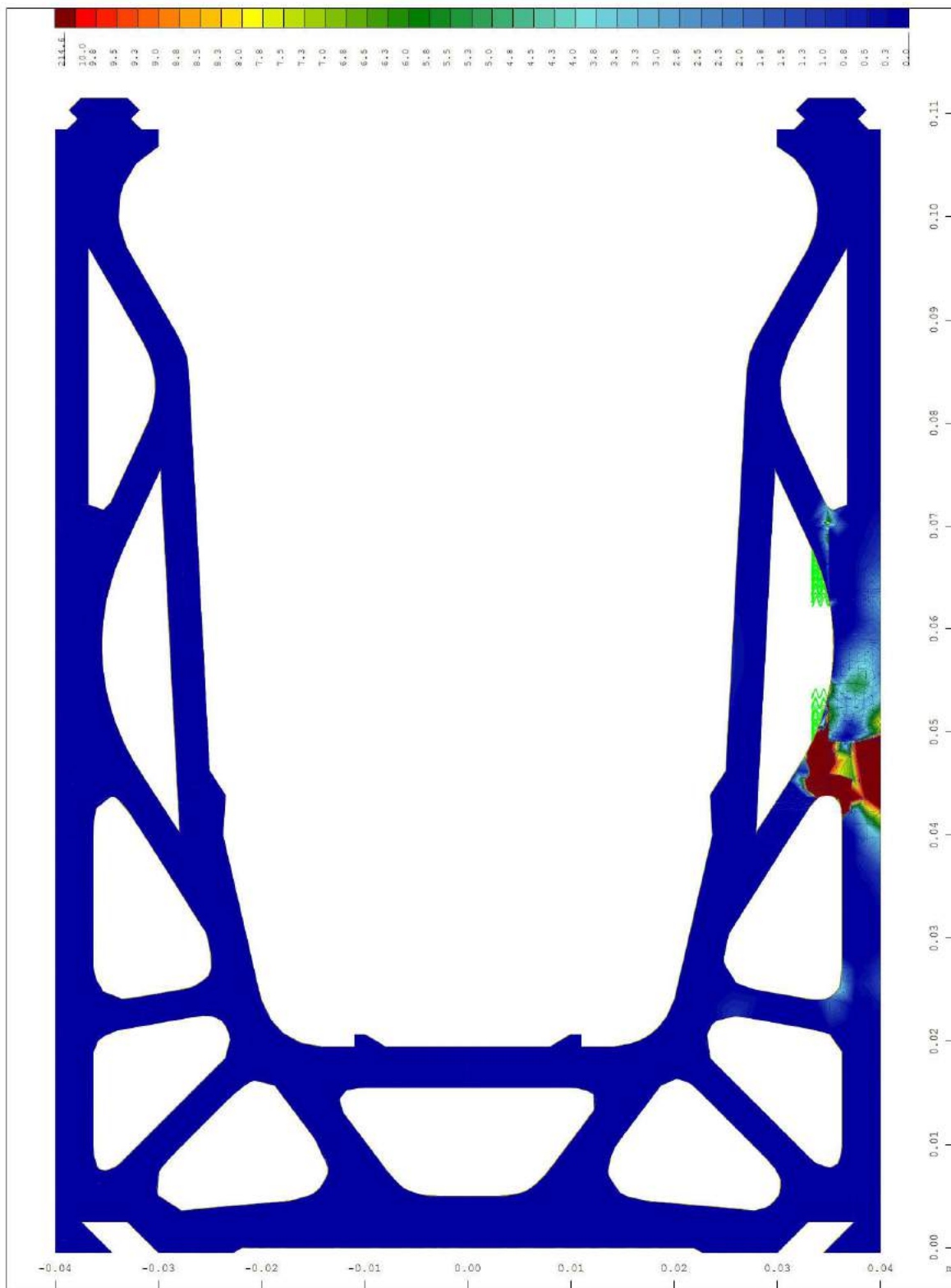


Y Sector of system Group 1...4 10 11 20 M 10 : 4.81
 X Free load, nonlinear Loadcase 10 ULS , (1 cm 3D = unit) Free line load (Force) in global X (Unit=50.0 kN/m) (Min=-78.4) (Max=73.9)

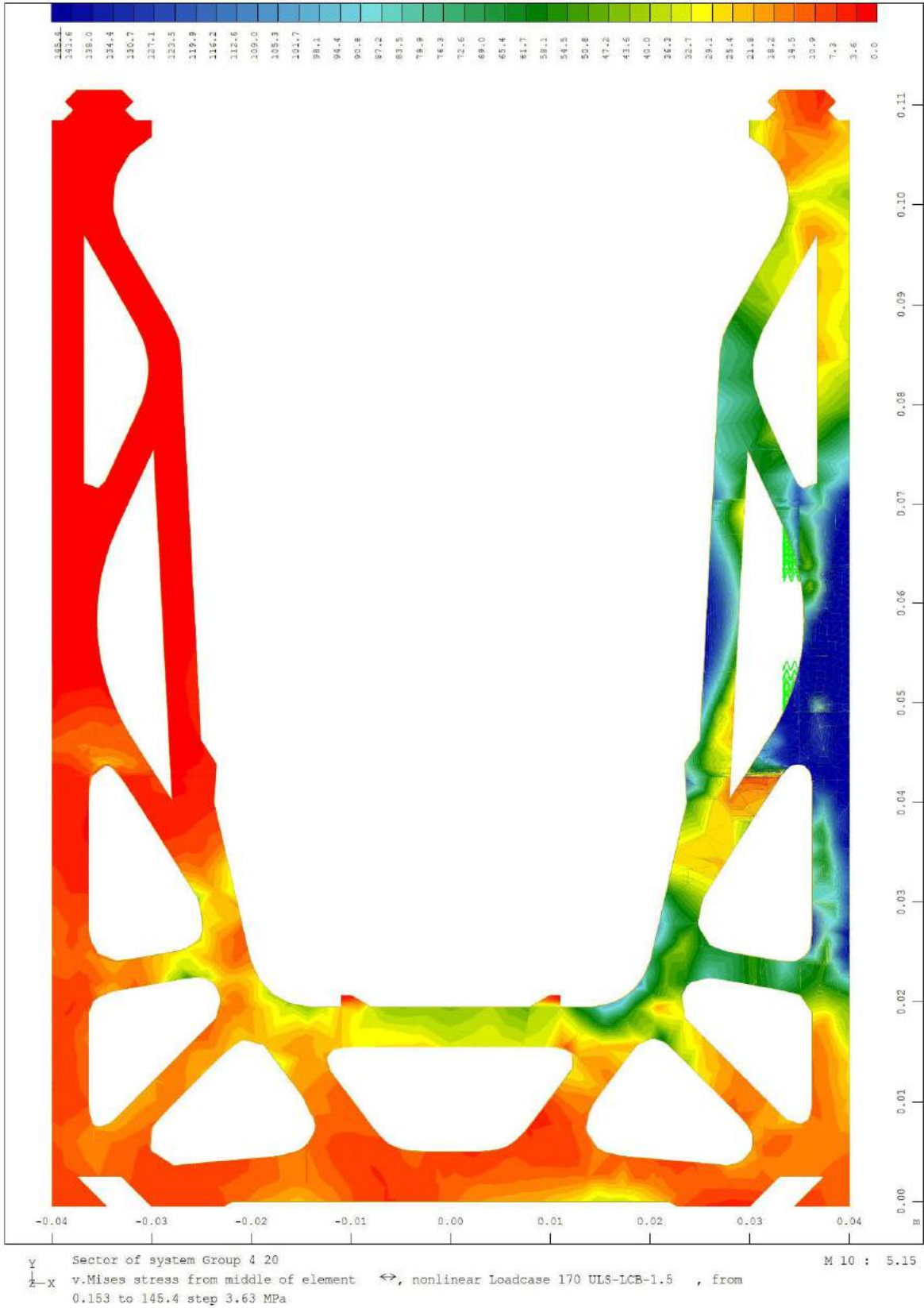


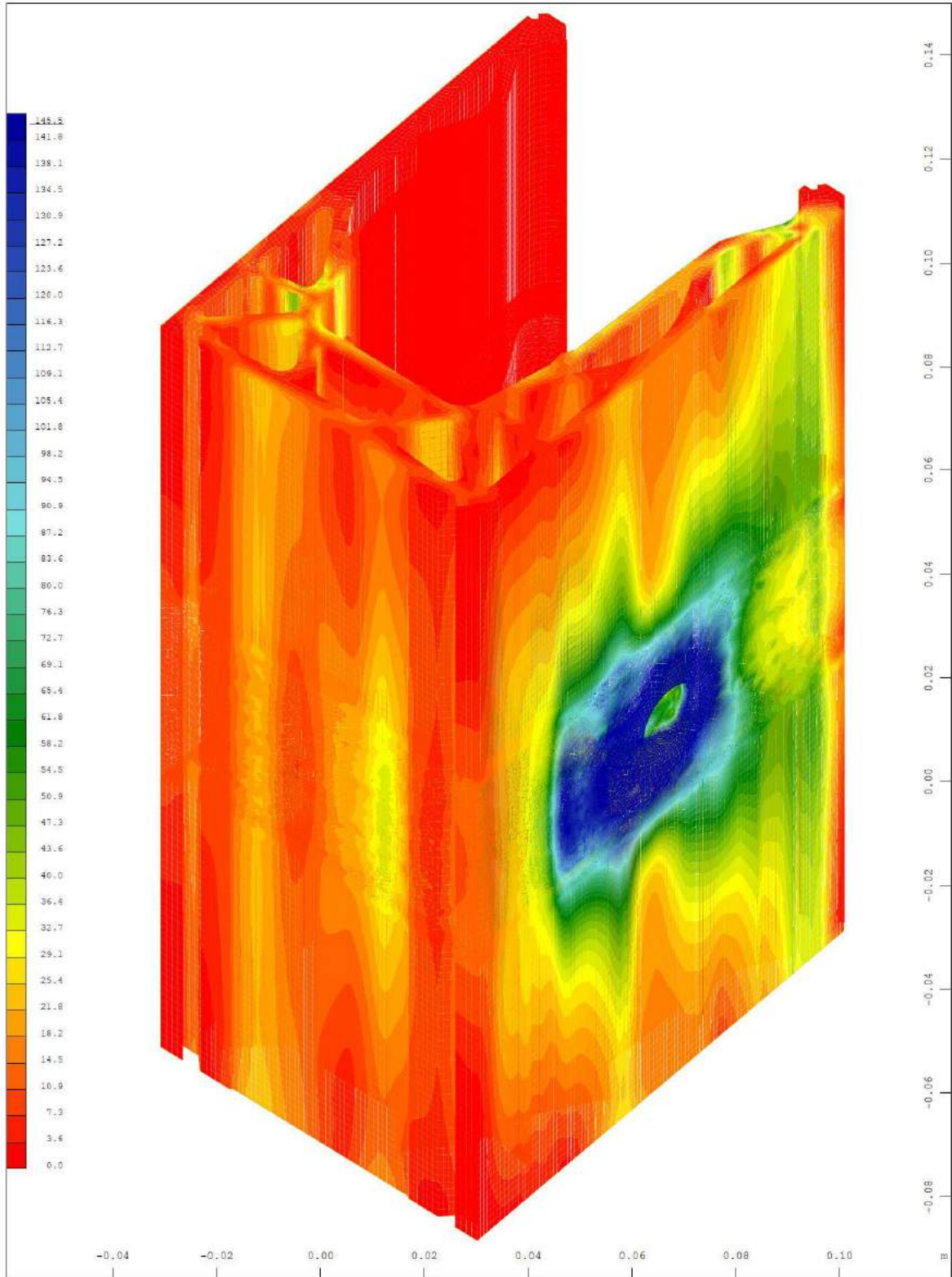






y Sector of system Group 4 20 M 10 : 5.15
 x Plastic deviatoric strain \leftrightarrow , nonlinear Loadcase 170 ULS-LCB-1.5, Material law Mat.type
 17 , BRIC Gauss points in Node o/oo, from 0 to 10.0 step 0.250





Z
Y
X

Sector of system Group 4 20
 v.Mises stress from middle of element ↔, nonlinear Loadcase 170 ULS-LCB-1.5 , from 0.0412
 to 145.5 step 3.64 MPa

M 1 : 1
 X * 0.893
 Y * 0.849
 Z * 0.695