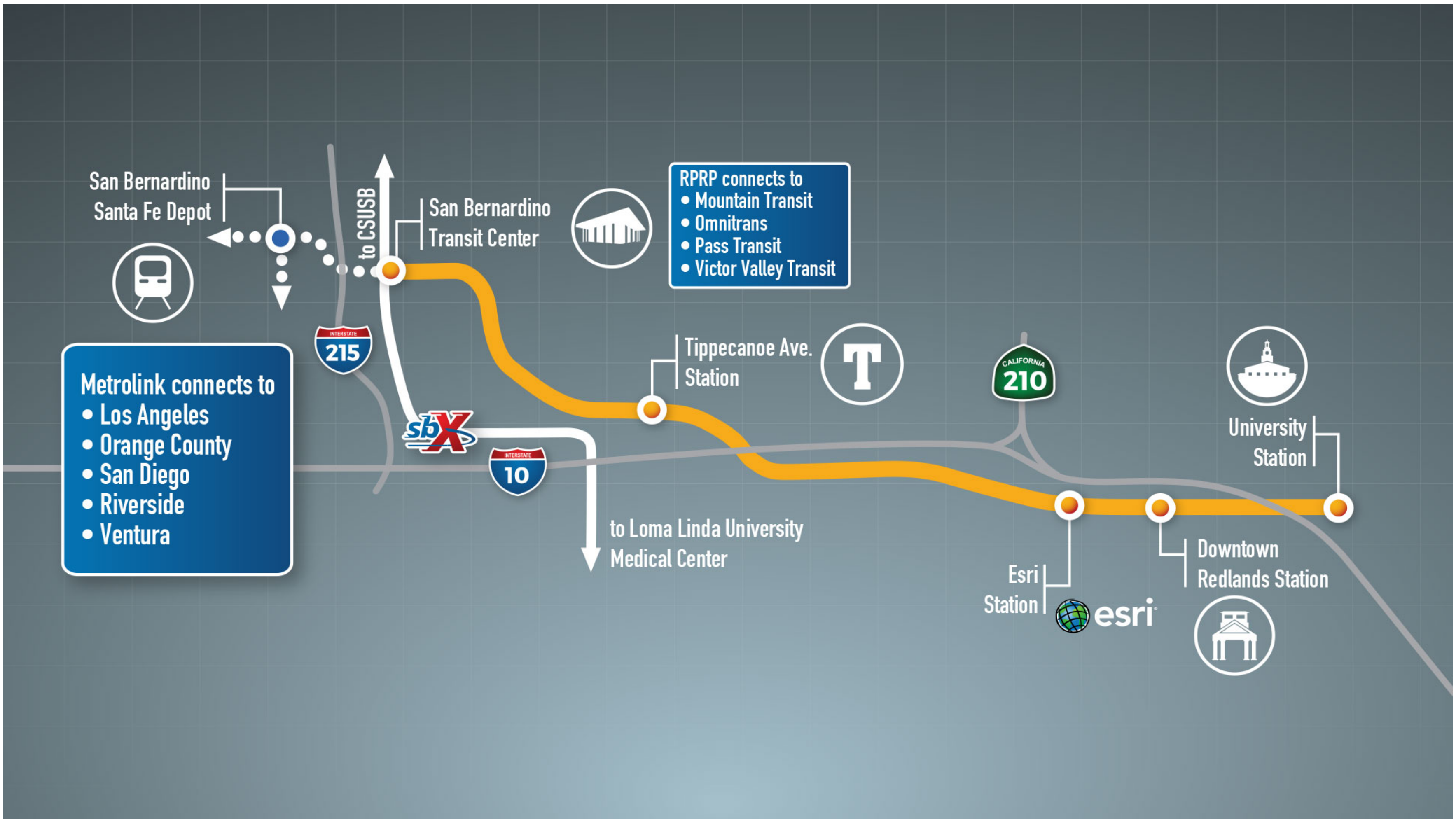
Received in RRS:
September 15, 2020

Appendix A: Arrow Track Map
(SCRRA Redlands Extension of the San Gabriel Sub)


San Bernardino
Santa Fe Depot
to CSUSB
San Bernardino
Transit Center
RPRP connects to
• Mountain Transit
• Omnitrans
• Pass Transit
• Victor Valley Transit
Metrolink connects to
• Los Angeles
• Orange County
• San Diego
• Riverside
• Ventura
215
Tippecanoe Ave.
Station
210
University
Station
10
to Loma Linda University
Medical Center
Esri
Station
esri
Downtown
Redlands Station

Appendix B: SCRRA Stadler FLIRT 3 Data Sheet

STADLER

DIESEL-ELECTRIC LOW-FLOOR MULTIPLE UNIT FLIRT

San Bernardino County Transportation Authority (SBCTA), California USA

In September 2017, the San Bernardino County Transportation Authority ordered three (3) diesel-electric low-floor multiple unit FLIRTs from Stadler for the Arrow passenger rail service, also known as the Redlands Passenger Rail Project. The trains operate on a nine (9) mile commuter route with five (5) stations in the corridor between San Bernardino Transit Center to the University of Redlands Station. The design of the vehicles allows operation of a mixed fleet including freight trains with the vehicles complies with new AVT requirements of the Federal Railroad Administration (FRA), and meet the Federal Transit Administration (FTA) Buy America requirements. The diesel generator units are low-emission, clean diesel engines which meet the Environmental Protection Agency (EPA) Tier 4 Final standard. The diesel engines are installed in a separate midsection, which allows the FLIRTs to offer exceptionally quiet passenger compartments and a large proportion of low-floor area. The vehicles are scalable, allowing the option to easily add an additional passenger car. Vehicles may also be outfitted with bimodal drive equipment, as the electrical traction unit is the same as in vehicles that are solely electrically powered, and have the same design. The FLIRTs for SBCTA offer 116 seats and additional standing room for 118 passengers.

www.stadlerrail.com

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Salt Lake City, Utah 84116
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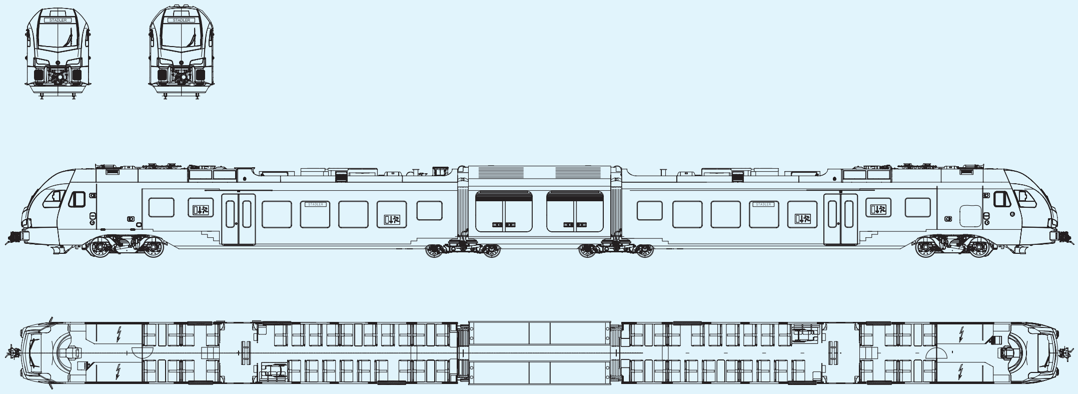
stadler.us@stadlerrail.com

STADLER



Technical Features

Technology

- Redundant traction power system consisting of two units, each with a diesel engine, asynchronous generator, IGBT power converter and asynchronous drive motor
- Lightweight aluminum car body design according to the newest Crashworthiness (EN 15227) and Structural Strength (EN 12663) standards
- Meets FRA Alternate Compliance requirements for operating in mixed traffic
- EPA Tier 4 Final compliant
- Traction equipment housed in a separate power car, efficiently insulating the passenger compartments from noise and vibrations

Comfort

- Extremely powerful, redundant HVAC system
- Comfortable seating with tables
- Fully ADA compliant with wide entrance doors
- Low-floor vehicle level boarding at all passenger doors

Personnel

- Ergonomic and comfortable working environment
- Intuitive design and arrangement of control elements

Reliability / Availability / Maintainability / Safety

- Crash absorption system for the protection of driver and passengers (fulfills FRA and EU crashworthiness standards)
- Latest generation of vehicle control systems including detailed diagnostic features
- Fire detection and suppression systems
- Emergency intercoms in passenger compartment
- Redundant traction power system and redundant HVAC system
- Low life-cycle costs due to light-weight design

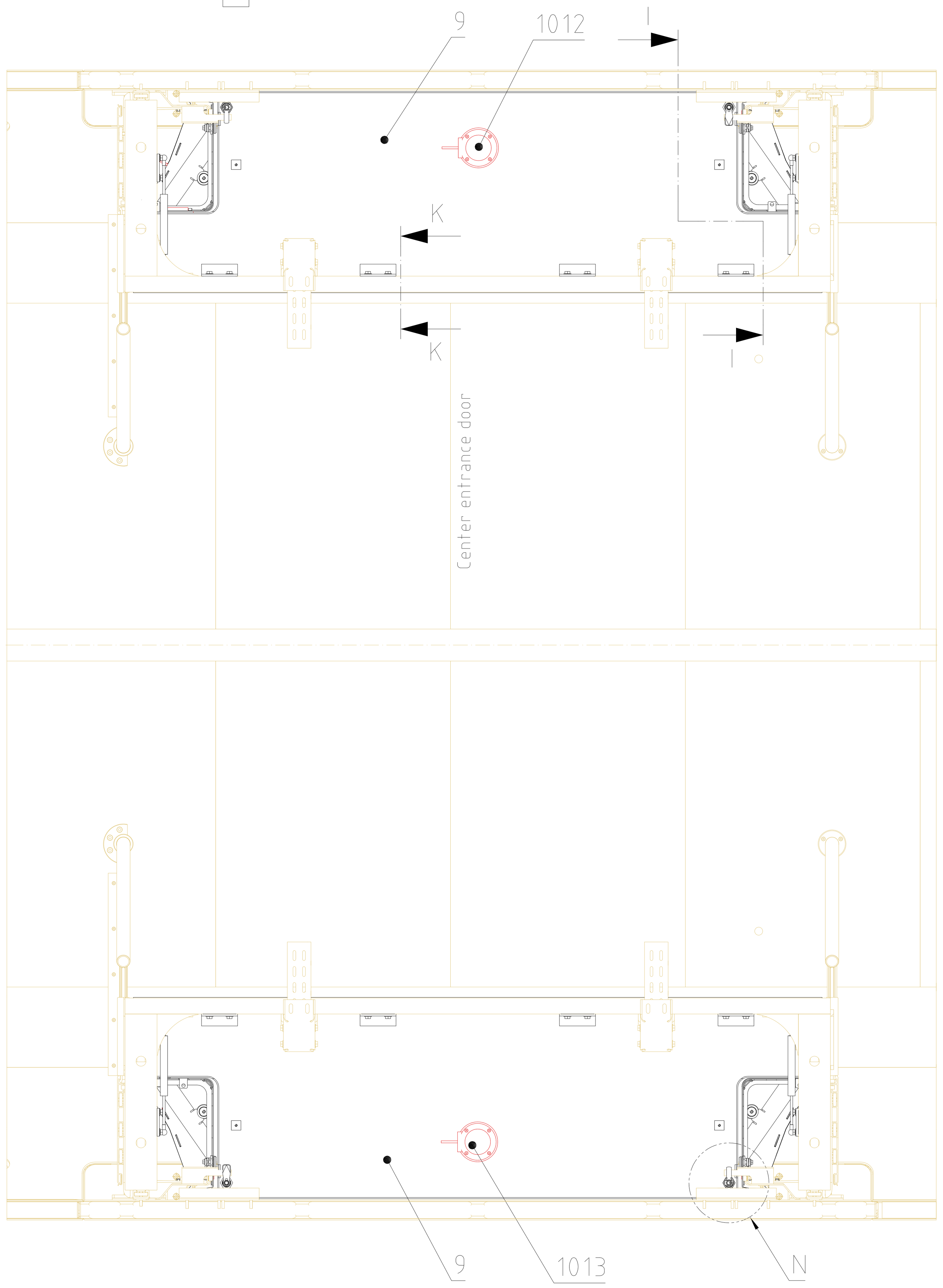
Vehicle Data

Customer	San Bernardino County Transportation Authority, California USA
Operated Networks	ARROW, From San Bernardino Transit Center to the University of Redlands Station
Gauge	1435 mm (4'–8.5")
Axle Arrangement	4 powered, 4 unpowered
Number of Vehicles	3
Delivery	Spring 2020
Seats	108
Flip-up Seats	8
Standing Spaces	317.5 ft2 (29.5 m2)
Floor Height	
Low-floor	24.02" (610 mm)
High-floor	47.64" (1210 mm)
Entrance Width	4' – 3.18" (1300 mm)
Longitudinal Force	1'500 kN
Length Over Coupling	163' – 0.68" (49700 mm)
Vehicle Width	9' – 5.4" (2880 mm)
Vehicle Height	14' – 0.71" (4285 mm)
Bogie Wheelbase	
Motor bogie	98.43" (2500 mm)
Trailer bogie	106.3" (2700 mm)
Driving Wheel Diameter, new	36.22" (920 mm)
Carrying Wheel Diameter, new	29.92" (760 mm)
Continuous Power at Wheel	550 kW
Max. Power at Wheel	700 kW
Starting Tractive Effort	160 kN
Starting Acceleration, gross	0.43 (MPHPS)
Maximum Speed	79 mph

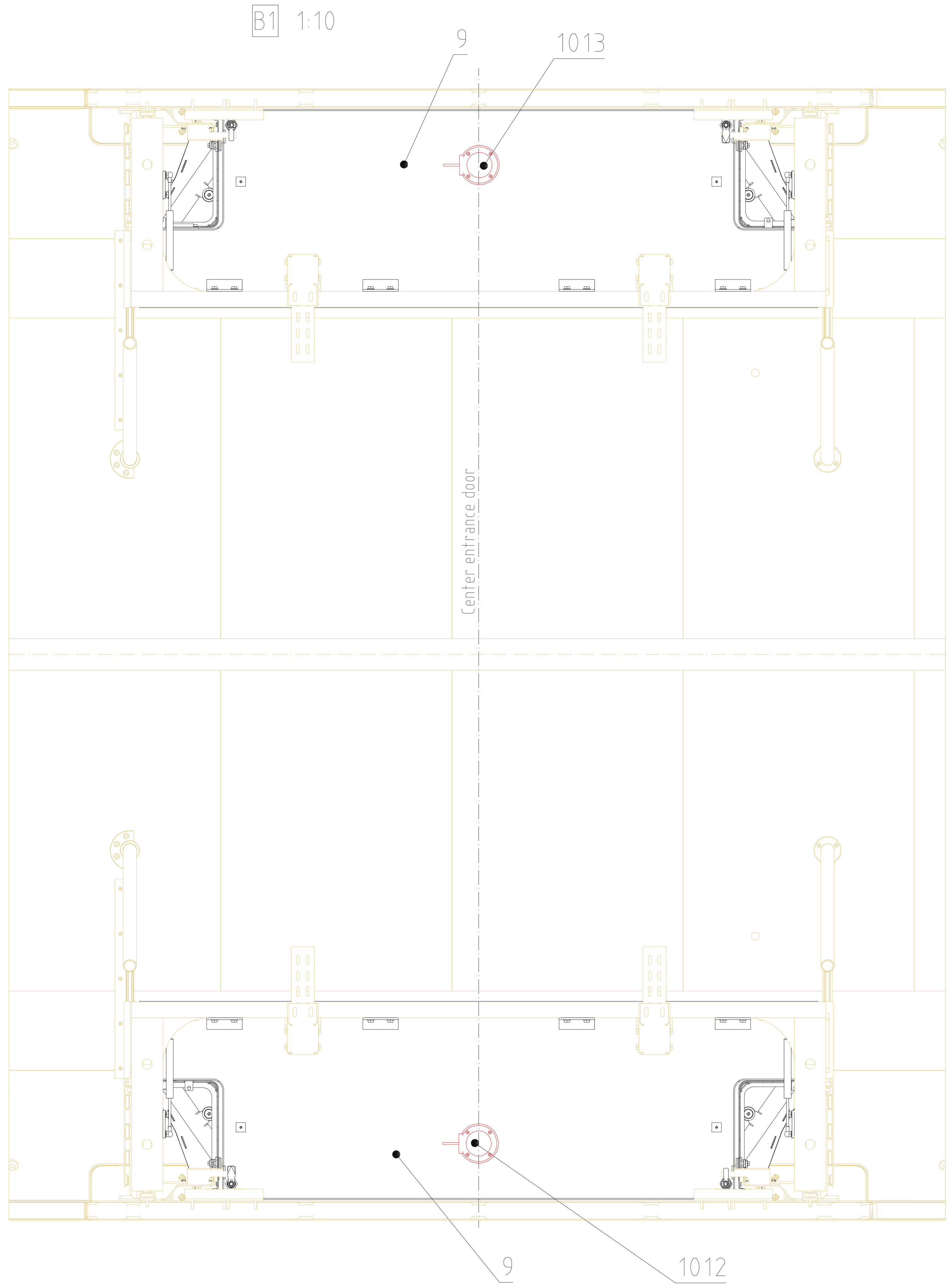
Appendix C: SCRRA Stadler FLIRT 3 Doorway Handhold Analysis

Total amount:	Order:	AVOR/Purchasing	Joinery	Mech. assembly	External	Released	
		Paintshop	Fitting shop	Electr. assembly	_	14.02.2017	sutfab
203 202 201 Used for:		Sharp edges removed or R0.3...0.5		Weight [kg]	Assembly:	STADLER	620
		Tolerance ISO 8015				DIN	C D
		General ISO 2768-mK		Surfaces DIN ISO 1302	Scale 1:50	Customer	
		Welding EN ISO 13920-BF					
			Date	Name	Door cladding installation, ECA/ECB		
		Created	04.07.2016	lanwal			
		Checked	14.02.2017	sutfab			
		Welding					
		Screwing					
		STADLER			BU_2568994	Index _	Sheet 1/2 A1
Status	Modification	Date	Name	Origin	Replacement for:	Replaced by:	

A1 1:10



B1 1:10



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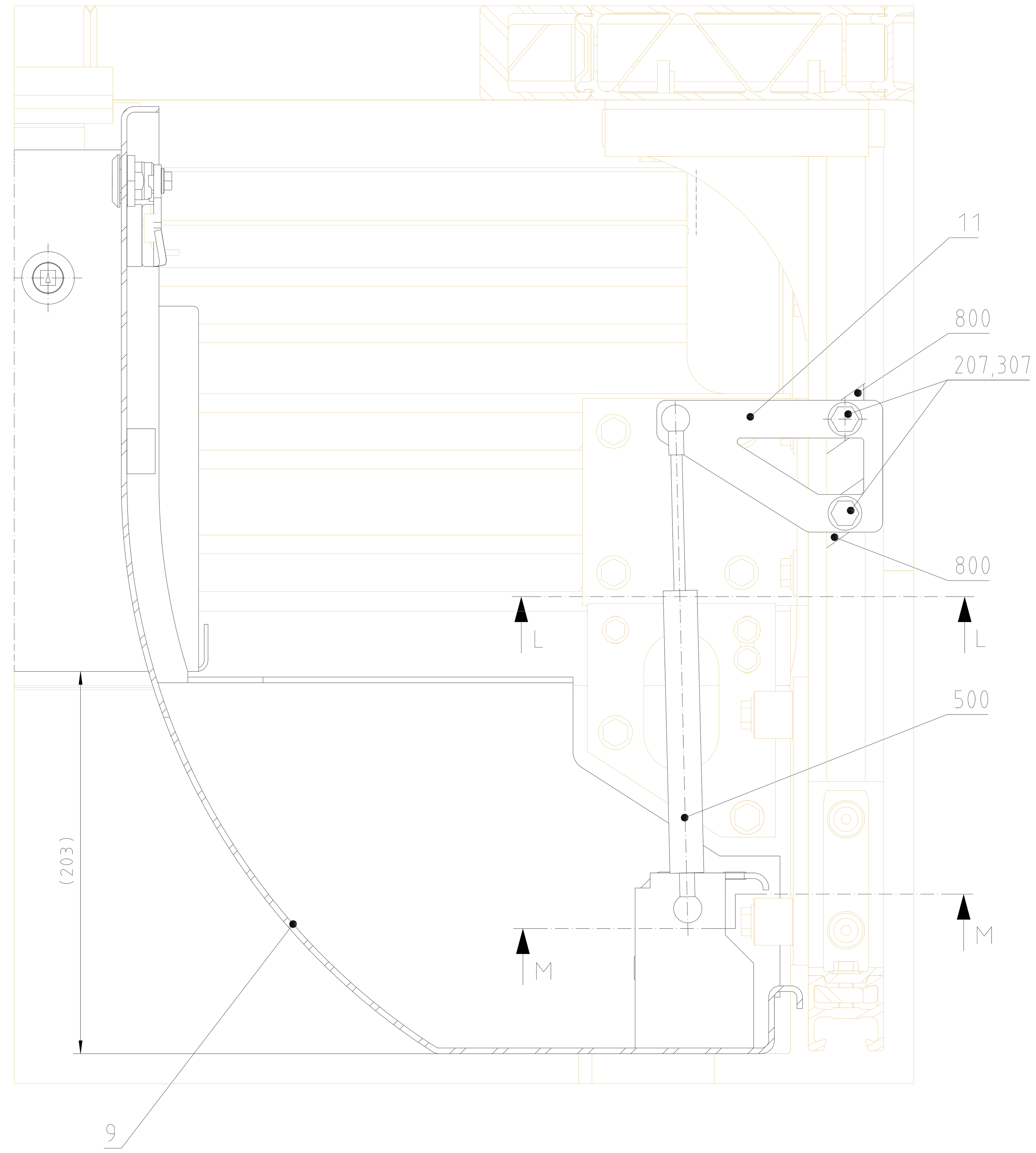

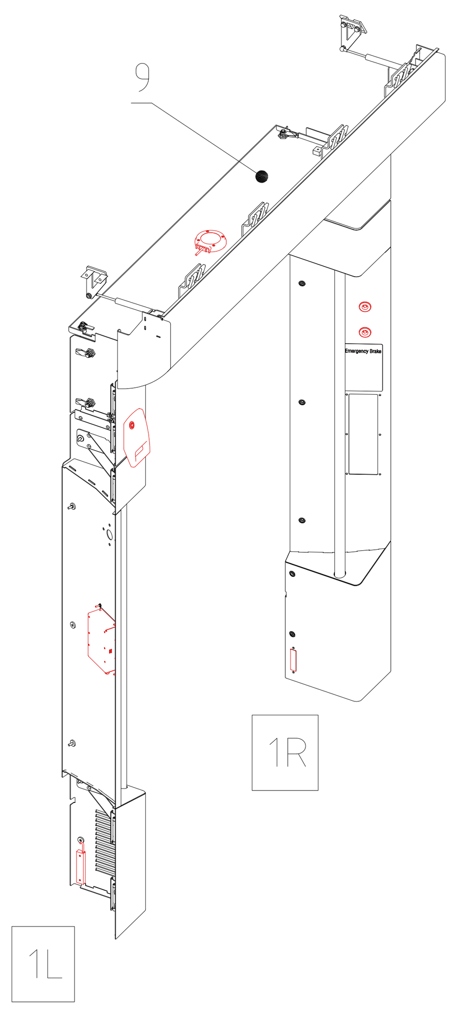

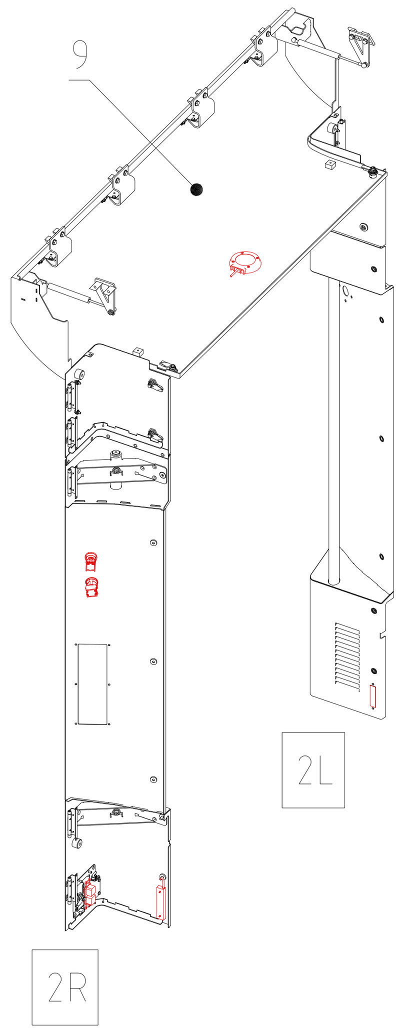

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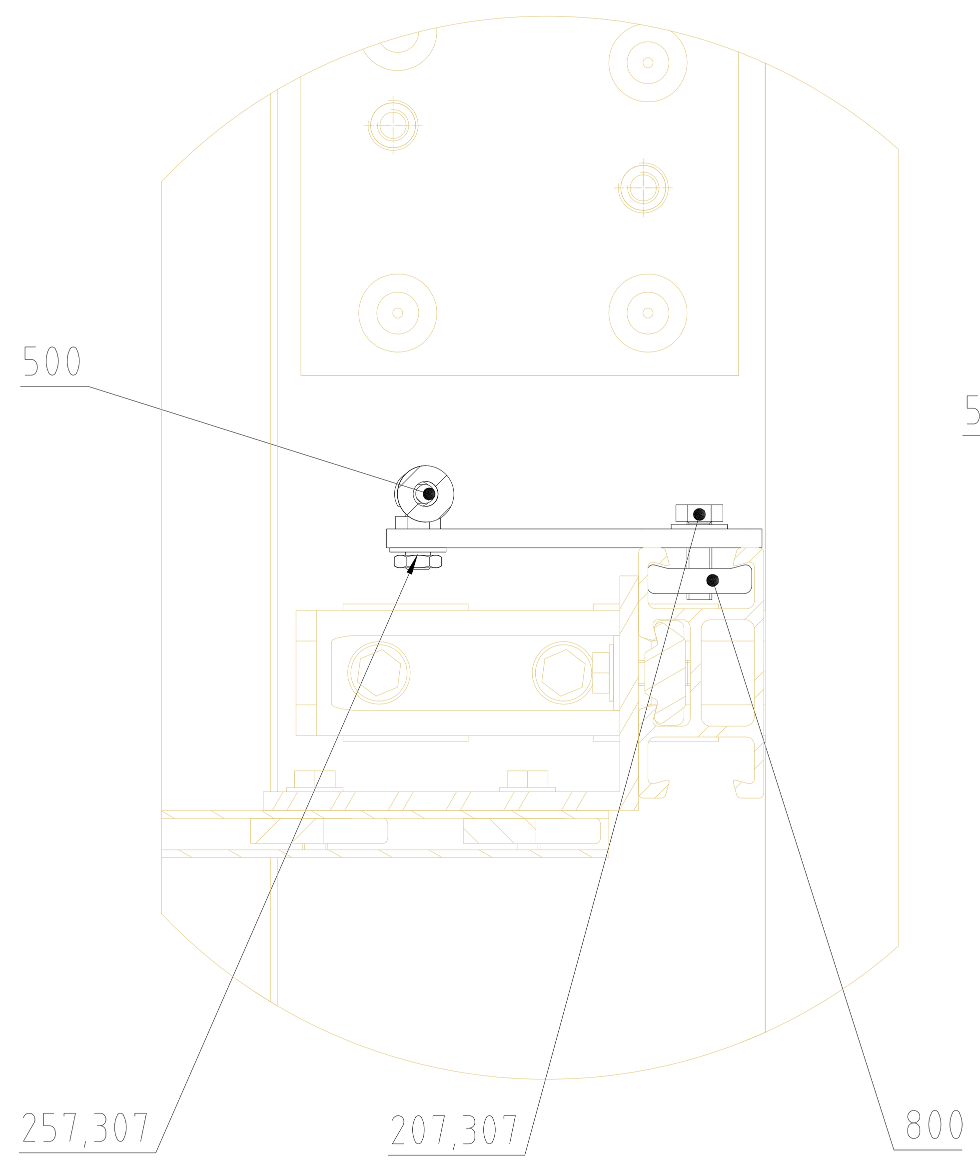
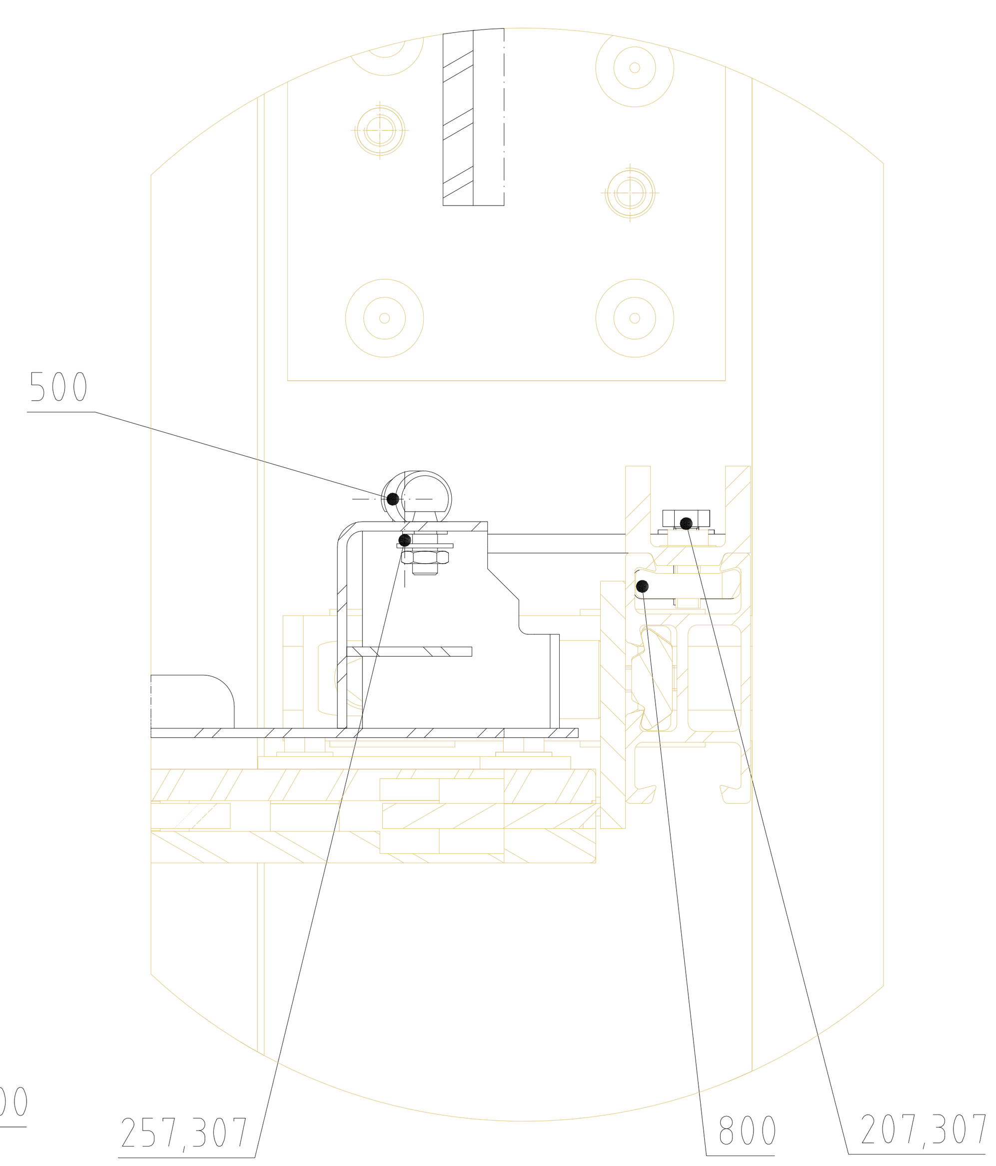
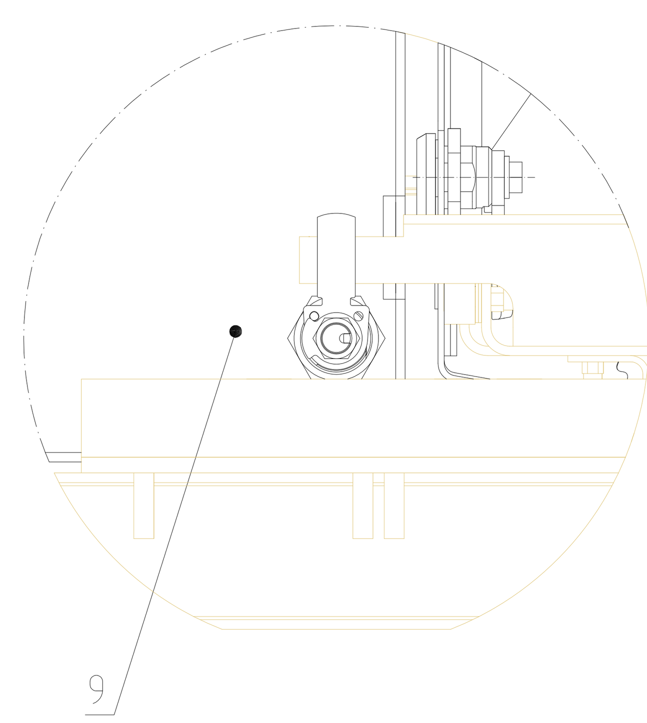


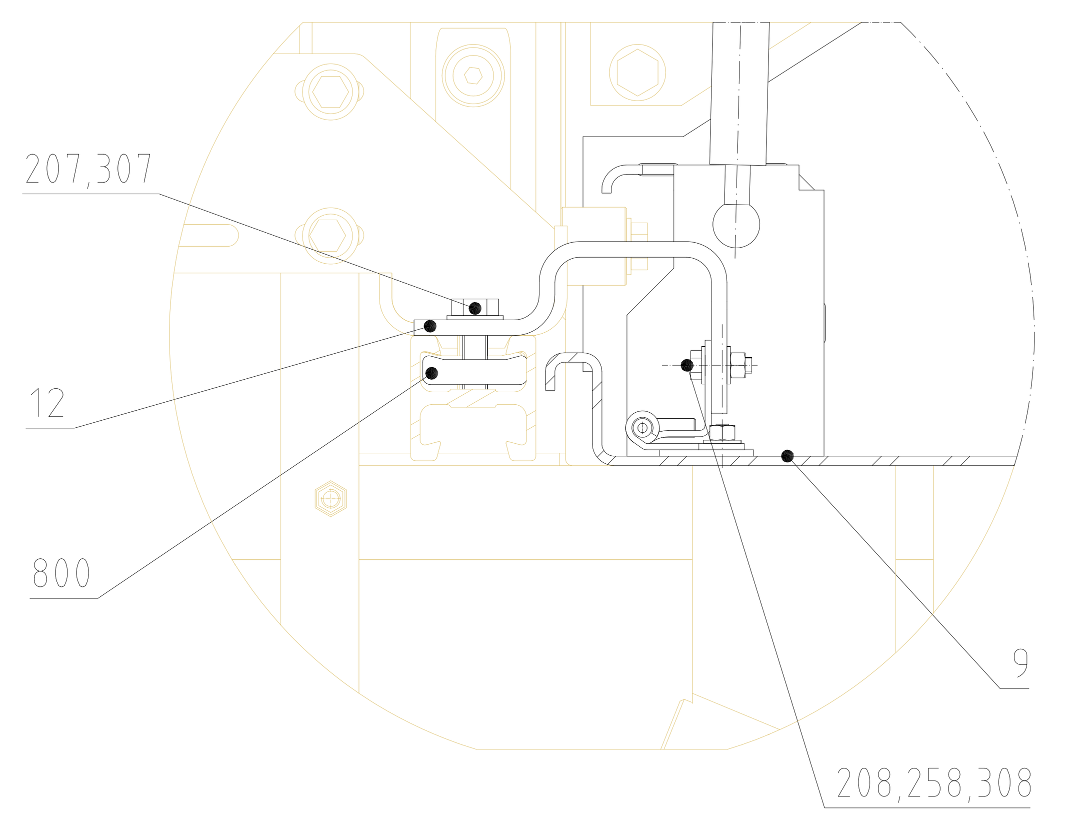
M-M 1:2



N 1:2



K-K 1:2



Total amount:	Order:	AVOR/Purchasing	Joinery	Mech. assembly	External
		Paintshop	Fitting shop	Electr. assembly	_
203 202 201 Used for:		Sharp edges removed or R0.3...0.5		Weight [kg]	Released 14.02.2017 sutfab
		Tolerance ISO 8015 General ISO 2768-mK Welding EN ISO 13920-BF	Surfaces DIN ISO 1302	Scale 1:50	Assembly: STADLER 620 / DIN C D / Customer

Status	Modification	Date	Name		Date	Name
				Created	04.07.2016	lanwal
				Checked	14.02.2017	sutfab
				Welding		
				Screwing		

Door cladding installation, ECA/ECB

STADLER

BU_2568994

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_	2/2
	A1

Origin | Replacement for: | Replaced by:

Sheet 1 of 2

Total amount:	Order:	AVOR/Purchasing	Joinery	Mech. assembly	External	Released 14.02.2017 sutfab
		Paintshop	Fitting shop	Electr. assembly	_	
203 202 201	Used for:	Sharp edges removed or R0.3...0.5		Weight [kg]	Assembly:	STADLER 620
		Tolerance ISO 8015				DIN CD
		General ISO 2768-mK	Surfaces DIN ISO 1302	Scale 1:50		Customer
		Welding EN ISO 13920-BF				

	Date	Name
Created	18.11.2016	jaemag
Checked	14.02.2017	sutfab
Welding		
Screwing		

Door cladding installation, ICD

STADLER

BU_2686320

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Status | Modification | Date | Name | Origin BU_2568994

Replacement for:

Replaced by:

Sheet 2 of 2

Total amount:	Order:	AVOR/Purchasing	Joinery	Mech. assembly	External	Released 14.02.2017 sutfab
		Paintshop	Fitting shop	Electr. assembly	_	

203 202 201 Used for:

Sharp edges removed or R0.3...0.5
Tolerance ISO 8015
General ISO 2768-mK
Welding EN ISO 13920-BF

Surfaces DIN ISO 1302 | Weight [kg] | Scale 1:50 | Assembly: STADLER 620 | DIN CD | Customer

	Date	Name
Created	18.11.2016	jaemag
Checked	14.02.2017	sutfab
Welding		
Screwing		

Door cladding installation, ICD

STADLER

BU_2686320

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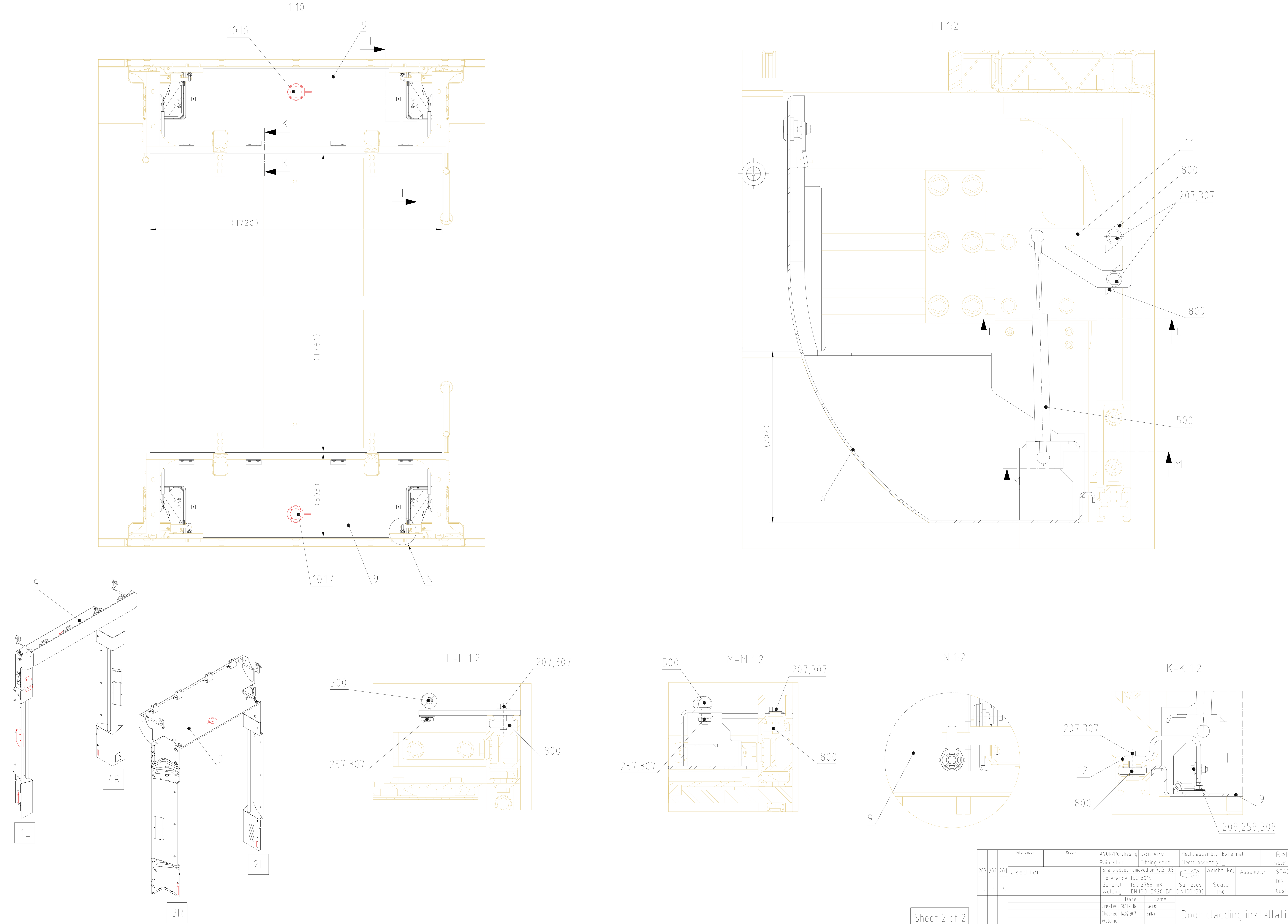
Status | Modification | Date | Name | Origin BU_2568994 | Replacement for: | Replaced by:


A-A 1:20
B-B 1:20
E-E 1:2
H 1:2
C-C 1:20
D-D 1:20
J-J 1:2
F-F 1:2
G 1:2
Center entrance door
Top of Floor
(2185.5)
(1540)
(2014.5)
(1087.5)
(1320)
(2166)
(100)
(7)
20
Car center
200,300
253,306
1001
1000
1002
1003
1004
1005
1006
201,302
250,301,303
204,305
201,250,301,302,303
202,252,304
Talk Hable
Ready Preparado
Wait/Listen Espere/Escuche
Push to activate
Apretar para activar
1L
4R
3R
2L
Sheet 1 of 2
Total amount:
Order:
AVOR/Purchasing
Joinery
Mech. assembly
External
Paintshop
Fitting shop
Electr. assembly
Released
14.02.2017 sutfab
203 202 201
Used for:
Sharp edges removed or R0.3...0.5
Tolerance ISO 8015
General ISO 2768-mK
Welding EN ISO 13920-BF
Weight [kg]
Surfaces DIN ISO 1302
Scale 1:50
Assembly:
STADLER 620
DIN CD
Customer
Date Name
Created 18.11.2016 jaemag
Checked 14.02.2017 sutfab
Welding
Screwing
Door cladding installation, ICC
BU_2686805
Index _
Sheet 1/2 A1
Status Modification Date Name
Origin BU_2568994
Replacement for:
Replaced by:



Sheet 2 of 2

Total amount:	Order:	
AVOR/Purchasing	Joinery	Mech. assembly
Paintshop	Fitting shop	Electr. assembly
External	_	
Released	14.02.2017	sutfab
203 202 201	Used for:	
Sharp edges removed or R0.3...0.5		
Tolerance	ISO 8015	
General	ISO 2768-mK	
Welding	EN ISO 13920-BF	
Surfaces	DIN ISO 1302	
Weight [kg]		
Scale	1:50	
Assembly:	STADLER	620
	DIN	C D
	Customer	
	Date	Name
Created	18.11.2016	jaemag
Checked	14.02.2017	sutfab
Welding		
Screwing		
Status	Modification	Date	Name
Origin	BU_2568994	
Door cladding installation, ICC		
BU_2686805		
Index	_	
Sheet	2/2	A1
Replacement for:		
Replaced by:		

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STADLER
TexRail
Door Panel

Technical Report No.:	TBR 111
Index:	A
Replacement for:	-
Pages:	27
Author:	C. Rohrmoser
Changed by:	C. Rohrmoser
Date of Issue:	14.12.2016
Released by:	C. Wolf

Printed paper version is not subject to the amendment service.

Date of print: 15.12.2016

MOLINARI

Index	Section / Modification Description	Creator	Auditor	Date
-	Initial release	C. Rohrmoser	C. Wolf	30.9.2016
A	Modifications	C. Rohrmoser	C. Wolf	14.12.2016

CONTENT

Chapter 1: General

1.1 General Statement

Based on the requirements for the objects to be calculated, the load assumptions, the modelling structure, the meshing, the boundary conditions as well as the result evaluation method are to be selected. On one hand this is done to fully ensure the due diligence considering all safety criteria and functional operational capabilities for the required service life in its full range at its best. On the other hand those are selected such to maintain an appropriate balance between the expenditure for the evidence of suitability and the object's application conditions and costs.

1.2 Problem Description

Strength calculation for a door panel with handhold.

Total weight for the whole panel inclusive handhold: 32kg

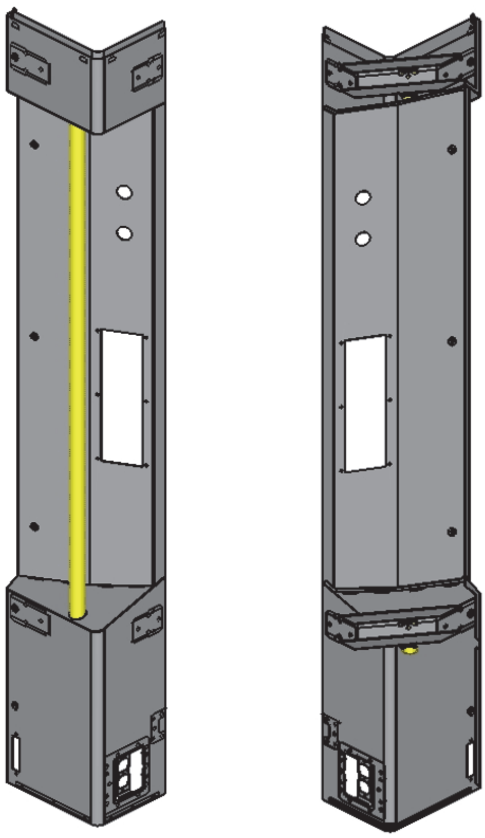

Figure 1: Door panel with handhold (yellow)

1.3 Technical Standards

The following given documents are the basis for the FE-modeling and the strength analysis.

Standards		
Ref.	**Abbreviation**	**Title**
[N1]	EN 10088-2: 2014	Stainless Steel – Part 2: Technical delivery conditions for sheet and strip made of corrosion-resistant steels for general purposes; (German version)
[N2]	EN 10025-1: 2005 EN 10025-2: 2005	Hot rolled products of structural steels – Part 1: General technical delivery conditions; (German version) Hot rolled products of structural steels – Part 2: Technical delivery conditions for unalloyed structural steels; (German version)
[N3]	EN 15085-3: 2007	Railway applications – Welding of railway vehicles and components - Part 3: Design requirements; (German version)
[N4]	FKM-Guideline 6^{th} Edition 2012	Fracture Mechanics Proof of Strength for Engineering Components; (German version)
[N5]	APTA PR-CS-S-006-98	Standard for attachment strength of interior fittings for passenger railroad;
[N6]	EN 12663-1: 2010	Railway applications - Structural requirements of railway vehicle bodies – Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons); (German version)
[N7]	EN 1993-1-9: 2005 + AC: 2009	Eurocode 3: Design of steel structures – Part 1-9: Fatigue

Table 1: European and American Standards

1.4 Vehicle Classification

The door panel for the railroad TexRail is classified according to the standard „American Public Transportation Association“ in APTA PR-CS-S-006-98.

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1.5 Nomenclature

Acronym	Unit	Description
g	mm/s^2	Earth gravity (-10000 mm/s^2)
A	-	Percentage elongation after fracture
ν	-	Poisson's ratio
ϱ	t/mm^3	Density
E	MPa	Young's modulus
R_{eh}	MPa	Yield strength
R_m	MPa	Ultimate strength
σ_{vM}	MPa	Equivalent stress according to von Mises
σ_{zul}	MPa	Maximum allowable stress under static loading
$\Delta\sigma_{xx}$	MPa	Normal stress in X-direction of the shell elements
$\Delta\sigma_{yy}$	MPa	Normal stress in Y-direction of the shell elements
$\Delta\tau_{xx}$	MPa	Shear stress of the shell elements
U_σ	-	Utilization factor – normal stress
U_τ	-	Utilization factor – shear stress
U_{2D}	-	Utilization factor – stress in space
γ_M	-	Safety factor for material
γ_F	-	Safety factor for loads
SF	-	Safety factor for fatigue load cases
SF_W	-	Safety factor for the welds under static loading
Z1/ Z2 / Mid	-	Negative direction of the shell normal / Positive direction of the shell normal / Middle surface
α	-	Tightening factor
μ_G / μ_K / μ_{Tr}	-	Friction number in thread / Friction number in head rest / Friction number in joint
FA_{min} / FA_{max} / FQ	N	Min. axial force / Max. axial force / Shear force

Table 2: Nomenclature

1.6 Units

Physical quantity	Length	Mass	Force	Pressure	Mass Density	Stress
Unit	mm	t	N	MPa	t/mm^3	MPa

Table 3: Units used

1.7 Coordinate System

All coordinates are Cartesian coordinates according to [N6].

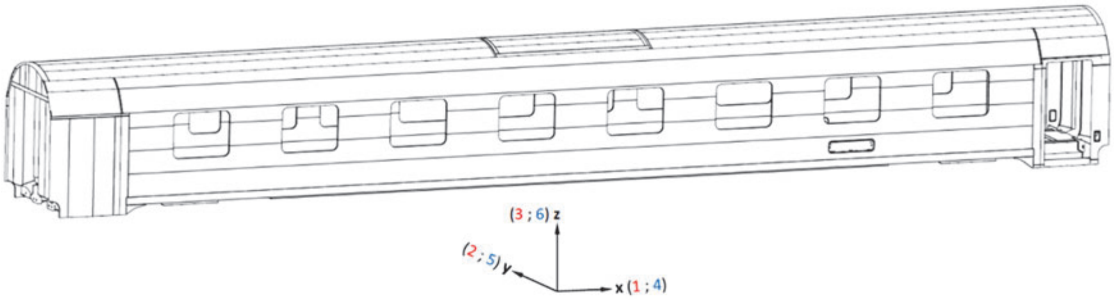

Figure 2: Coordinate system

Denotation	Description
X	Longitudinal direction (driving direction of the vehicle)
Y	Lateral direction
Z	Vertical direction
1	Displacement along the X - Axis
2	Displacement along the Y - Axis
3	Displacement along the Z - Axis
4	Rotation around longitudinal axis (X - Axis)
5	Rotation around lateral axis (Y - Axis)
6	Rotation around vertical axis (Z - Axis)

Table 4: Description of the coordinate system

Section 2: Design

2.1 Object Description

The object from Figure 3 is loaded transversal and longitudinal via the handhold (yellow).

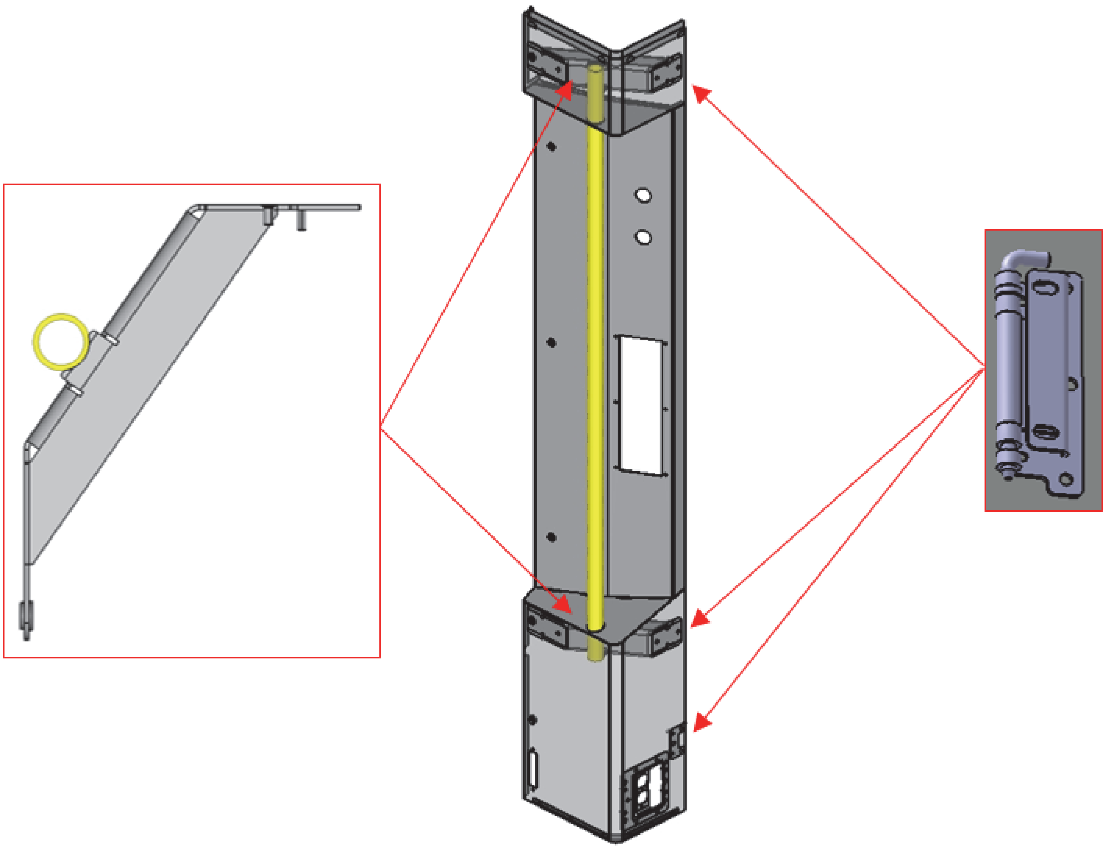

Figure 3: Door panel with attachments

The forces are introduced into the attachment consoles via the handhold. Further, they are introduced into the frame via screws and hinges. The strength calculation of the screw connections and hinges is not part of the report.

2.2 Material

The used Materials is listed in following table.

Material	Indicator	Color (Figure 4)	$Rp_{0,2}$ [MPa]	R_m [MPa]	E [MPa]	v	ϱ [t/mm³]	A [%]
S355	1.0045	Red	355	Min. 510	$2{,}1 \cdot 10^5$	0,3	$7{,}85 \cdot 10^{-9}$	18
S235	1.0038	Grey	235	360	$2{,}1 \cdot 10^5$	0,3	$7{,}85 \cdot 10^{-9}$	18
X5CrNi18-10	1.4301	Yellow	190	500	$2{,}0 \cdot 10^5$	0,3	$7{,}85 \cdot 10^{-9}$	25

Table 5: Material data

The allocation of the used material is represented in Figure 4.

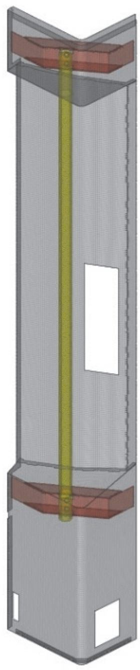

Figure 4: Material allocation

2.3 Material Specification

The strength assessment of the calculated construction is valid for the steel S235 as well as S355 with the strength properties and technical delivery conditions according to [N2] and for X5CrNi 18-10 according to [N1].

2.4 Manufacturing Standard

The assessment of the static and fatigue strength is done under the condition that the quality standards as well as the manufacturing tolerances are fulfilled by the manufacturer. This applies in particular to the observance of the necessary tolerances with regard to the requirements for conformity to the calculation model, as well as, in particular, the fulfillment of the [N3] for welding constructions.

2.5 Corrosion Protection

The assessment of the static and fatigue strength is done under the condition that the construction is protected against a corrosive atmosphere according to relevant standards.

2.6 Conformity of the Calculation Report with the Drawings

The calculation of the door panel is valid for the following main drawings.

Dr. No.	Name	Index
BU_2596815	Türsäulenverkleidung geschweißt	-
BU_2568994	Türsäulenverkleidung Anbau EW	-

Table 6: Drawings

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Section 3: Calculation Standards

3.1 General

The strength assessment of the door panel was done using the Finite Element Method (FEM), the calculated deformations respectively stresses were compared with allowable values.

The static load cases are based on the requirements from [N5].

3.2 Allowable Material Resistance

3.2.1 General Approach of Stress Evaluation

Stress evaluation is done at the center node of shell elements according "von Mises".

The dimensions of the shell elements are adapted to the nominal dimension of the welds. So it is guaranteed that the place of stress evaluation is approximately indented with the place of "Hot Spot Stresses" for weld stress evaluation according to the nominal stress concept.

The evaluation is done with the stress difference of load case pairs in all particular stress directions and in combination of them.

3.2.2 Safety Factors

Symbol / Value	Description
γ_M = 1,15	Material safety factor for static load cases
γ_M = 1,00	Material safety factor for fatigue load cases
γ_F = 1,00	Safety factor of loads for design loads according to [N7]
γ_F = 1,35	Safety factor of general loads[N7]
γ_F = 1,5	Safety factor of varying loads[N7]
SF = 0,9	Safety factor according to [N3] for dynamic loading for welds with quality class CPC2 CT3 for the safety need "middle" and stress conditions "middle"
SF_W = 0.8	Seam factor for static load cases according to [N4] (generally applied)
SF_W = 1.0	Seam factor for static load cases according to [N4] (only for special areas)

Table 7: Safety factors

3.2.3 Material Resistance for Static Analyses

3.2.3.1 Allowable Stress of S235 in the Area of Base Material

Input parameters		Allowable stress
$R_{eh} = 235\ MPa$ $\gamma_M = 1{,}15$ $\gamma_F = 1{,}00$	*(Yield strength)* *(Material safety factor)* *(Design load safety factor)*	$\sigma_{zul} = \frac{R_{eh}}{\gamma_M \cdot \gamma_F}$ $\sigma_{zul} = 204\ MPa$

3.2.3.2 Allowable Stress of S355 in the Area of Base Material

Input parameters		Allowable stress
$R_{eh} = 355\ MPa$ $\gamma_M = 1{,}15$ $\gamma_F = 1{,}00$	*(Yield strength)* *(Material safety factor)* *(Design load safety factor)*	$\sigma_{zul} = \frac{R_{eh}}{\gamma_M \cdot \gamma_F}$ $\sigma_{zul} = 308\ MPa$

3.2.3.3 Allowable Stress of X5CrNi 18-10 in the Area of Base Material (for bending)

Input parameters			Allowable stress
$R_{eh} = 190\ MPa$ $\gamma_M = 1{,}15$ $\gamma_F = 1{,}00$ $*K_{P,b} = 1{,}27$	*(Yield strength)* *(Material safety factor)* *(Design load safety factor)* *(Plastic shape coefficient)*	 *[N4]	$\sigma_{zul} = \frac{R_{eh} \cdot K_{P,b}}{\gamma_M \cdot \gamma_F}$ $\sigma_{zul} = 209\ MPa$

3.2.4 Allowable Stress of S235 in Area of non-proofed Welds

Input parameters		Allowable stress
$R_{eh} = 235\ MPa$ $\gamma_M = 1{,}15$ $SF_W = 0{,}8$	*(Yield strength)* *(Material safety factor)* *(Seam factor)*	$\sigma_{zul} = \frac{R_{eh}}{\gamma_M \cdot \gamma_F} \cdot SF_W$ $\sigma_{zul} = 163\ MPa$

3.2.5 Allowable Stress of S355 in Area of non-proofed Welds

Input parameters		Allowable stress
$R_{eh} = 355\ MPa$ $\gamma_M = 1{,}15$ $SF_W = 0{,}8$	*(Yield strength)* *(Material safety factor)* *(Seam factor)*	$\sigma_{zul} = \frac{R_{eh}}{\gamma_M \cdot \gamma_F} \cdot SF_W$ $\sigma_{zul} = 246\ MPa$

Section 4: Finite-Element-Model

4.1 General

Overall, a FE-model was used for the calculations.

4.2 Geometric Tolerances

Geometrical tolerances due to material or machining tolerances were not taken into account in the FE-model. The profiles were modeled with their nominal wall thicknesses.

4.3 Temperature

The simulation is performed with linear-elastic material parameters at room temperature.

4.4 Software

The strength verification is carried out using FE programs, which are listed in Table 8.

Description	Name	Version	Software provider
FE-Preprocessor	HyperMesh	14.0	Altair
FE-Solver	OptiStruct	14.0	Altair
FE-Postprocessor	HyperView	14.0	Altair

Table 8: Used FE-software

4.5 Element Types

The meshing of the structure with finite elements was largely done with 4-noded shell elements. The use of triangular elements with 3 nodes was avoided if possible. Basic element size approx. 10mm and 5mm.

Element-type	Description	Quantity
QUAD4	Shell element	34830
TRIA3	Shell element	143
CBEAM	Beam element	321
CONM2	Concentrated mass	1
RBE2	Rigid element	9
RBE3	Interpolation element	1

Table 9: FE-elements

4.6 Boundary Conditions

Figure 5 illustrates the boundary conditions. The boundary condition for the force introduction is according to [N5] F = 2222 N.

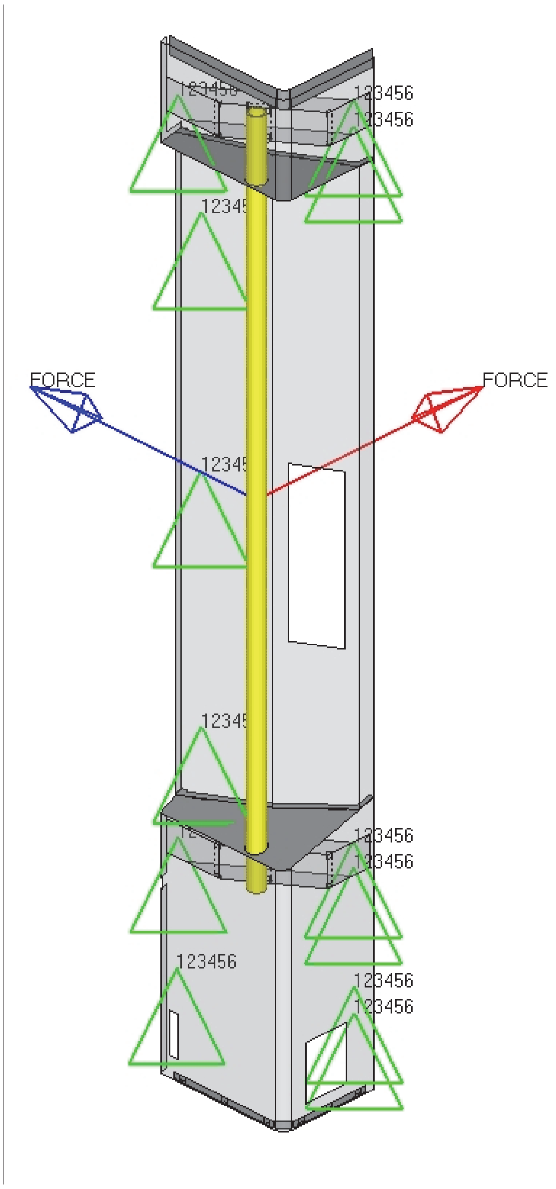

Figure 5: Boundary conditions

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4.7 Element Thicknesses

The thicknesses of the red shells in Figure 6 are t = 3mm and the blue shells t = 2mm.

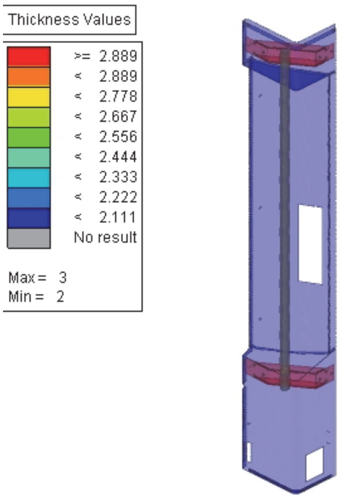

Figure 6: Shell thicknesses

4.8 Other Elements

The handhold has been modeled using beam elements. The shape as well as the dimensions are shown in Figure 7.

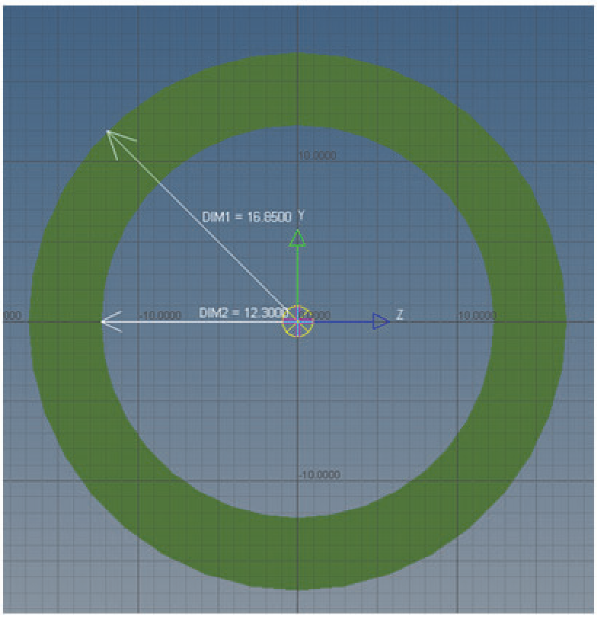

Figure 7: Model of the handhold

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Section 5: Load Cases

5.1 General

According to [N5] 2 static load cases (S1 und S2) are investigated.

5.2 Static Load Cases

		Force		Mass acceleration
Load case number	**Description**	**F_x [N]**	**F_y [N]**	**a_z^* [m/s²]**
S1	Load longitudinal + acceleration vertical	2222		-10
S2	Load lateral + acceleration vertical		2222	-10

$^*a_z$ – acceleration in Z-direction

Table 10: Static load cases acc. to [N5]

Section 6: Results

6.1 Static Load Cases

6.1.1 Base Material

6.1.1.1 Results for Sheets (S235 and S355)

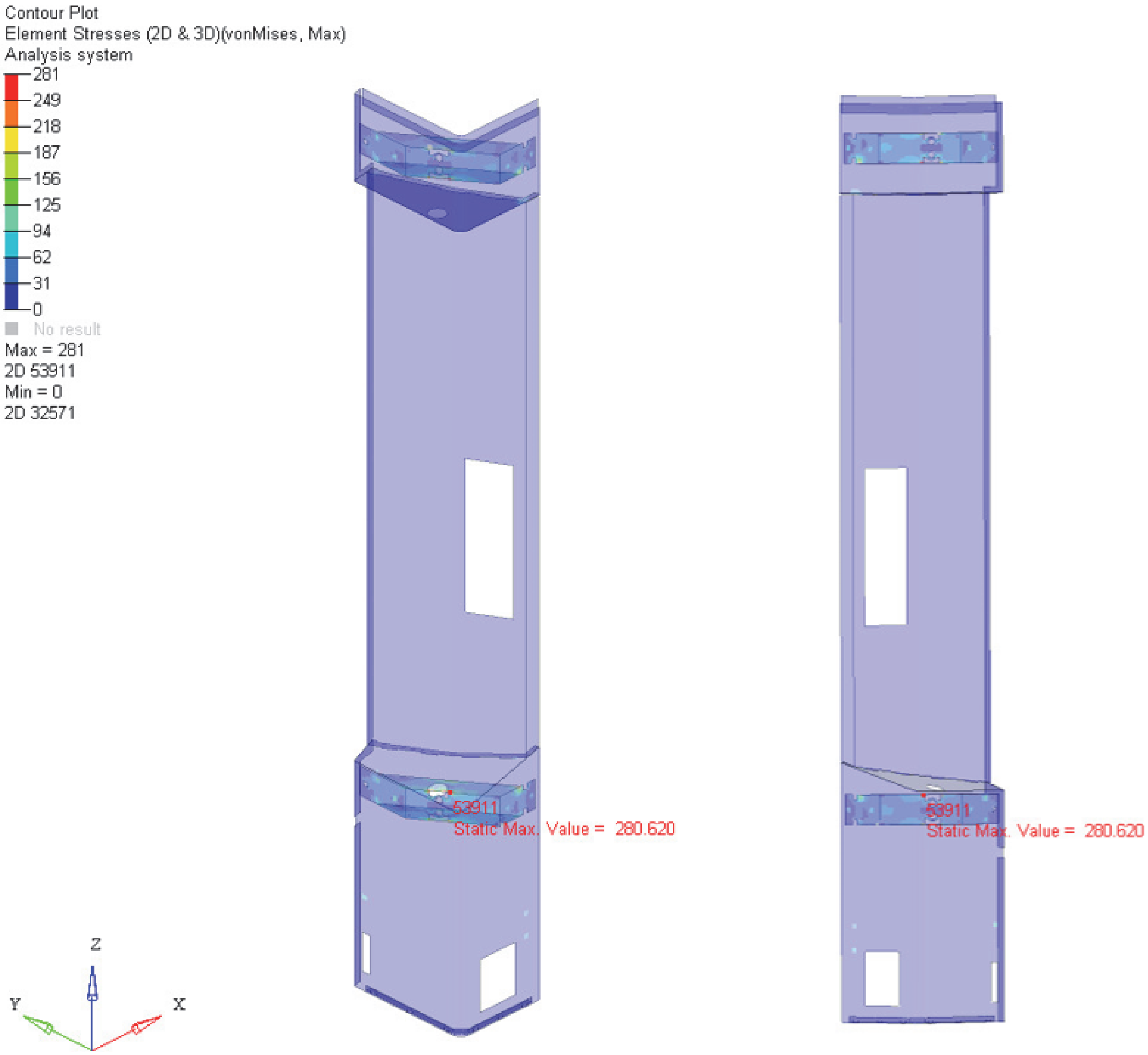

Figure 8: Envelope (S1 and S2) base material, sheet S235 and S355,

von Mises stress plot, max. stress 281 MPa

6.1.1.2 Results for Sheet S235

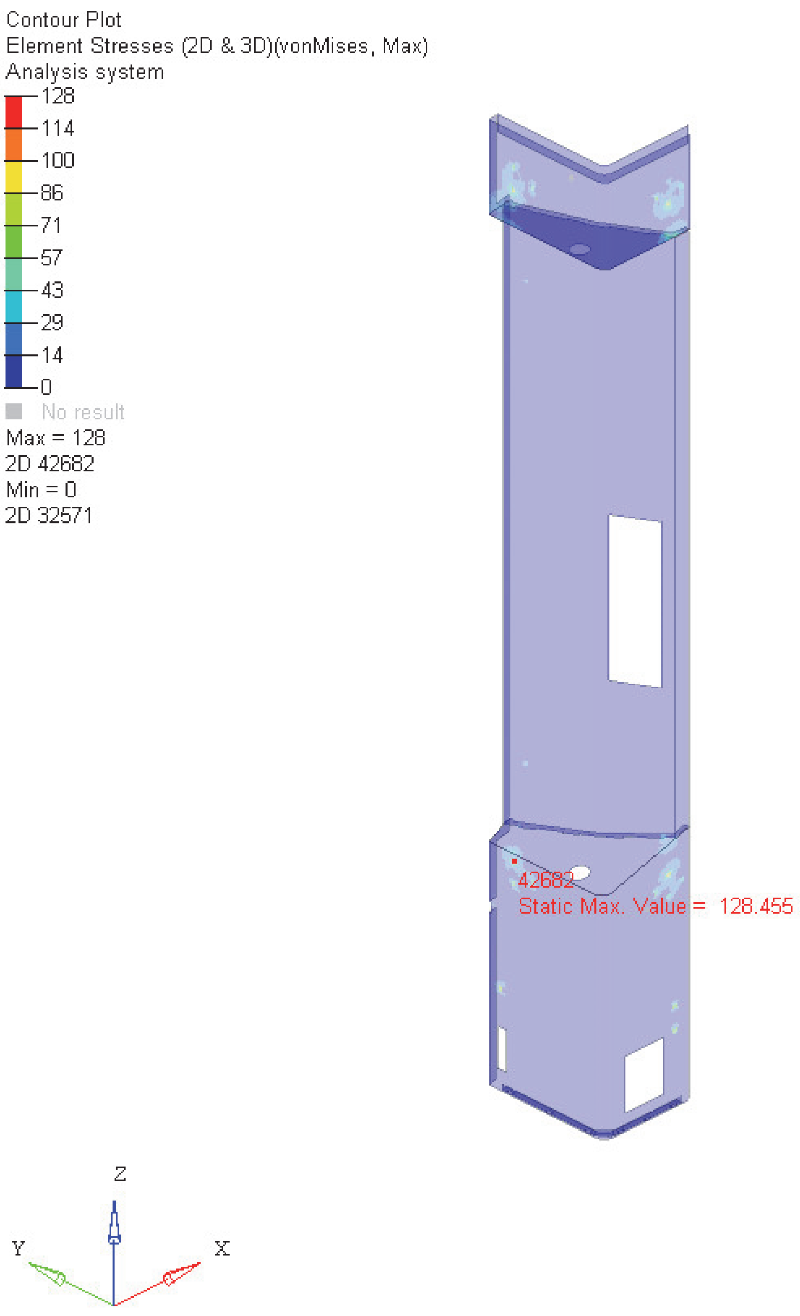

Figure 9: Envelope (S1 and S2) base material, sheet S235,

von Mises stress plot, local stress 128 MPa (allowed 204 MPa)

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6.1.1.3 Results for Sheet S355

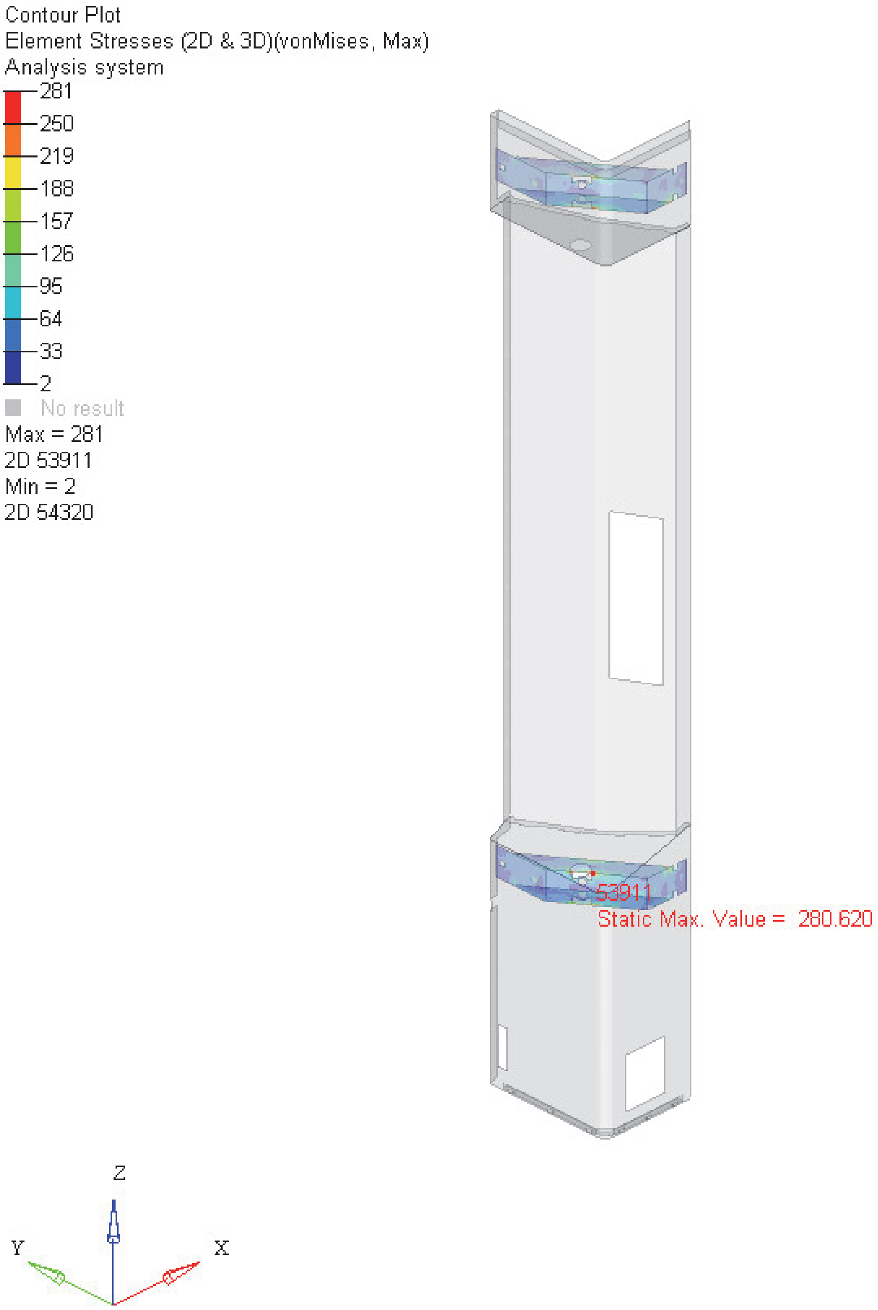

Figure 10: Envelope (S1 and S2) base material, sheet S355,

von Mises stress plot, local stress 281 MPa (allowed 308 MPa)

6.1.1.4 Results Attachment Console Sheet S355

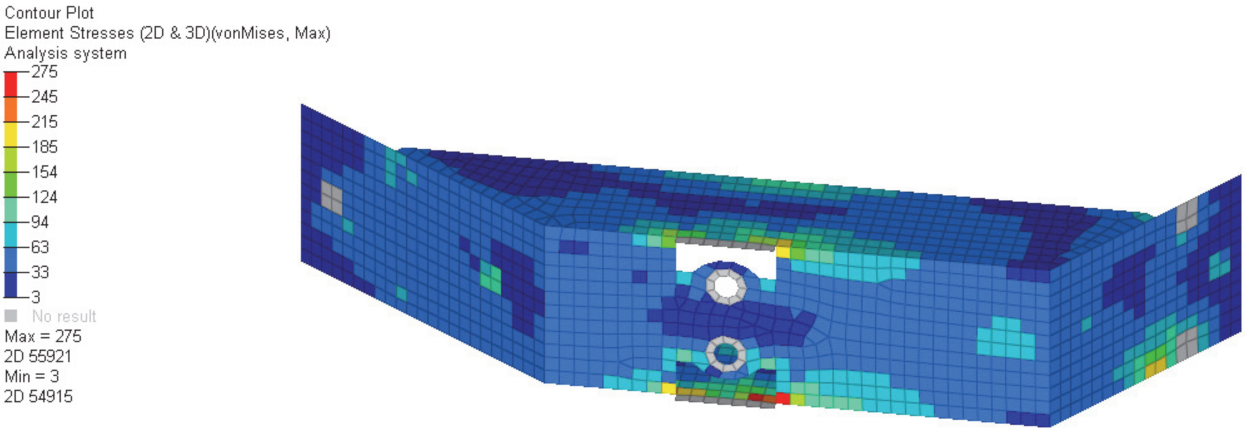

Figure 11: Upper console, Envelope (S1 and S2) base material, sheet S355,

von Mises stress plot, local stress 275 MPa (allowed 308 MPa)

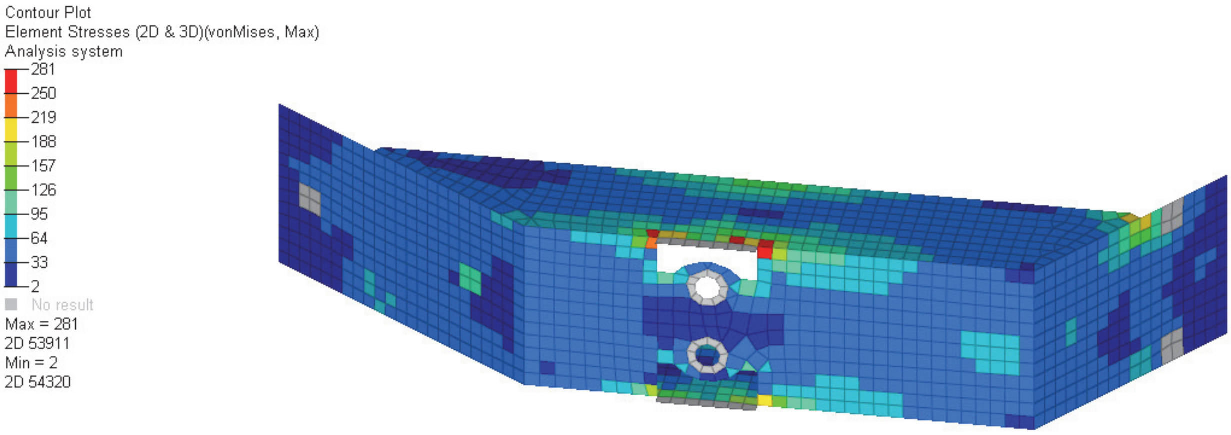

Figure 12: Lower console, Envelope (S1 and S2) base material, sheet S355,

von Mises stress plot, local stress 281 MPa (allowed 308 MPa)

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6.1.1.5 Results Handhold Sheet X5CrNi 18-10

The maximum stress in the handhold is 170 MPa.

The maximum deflection in the middle of the handhold is 4.8 mm.

6.1.1.6 Evaluation of the Results

Max. local stress at S355 is 281 MPa (allowed 308 MPa).

Max. local stress at S235 is 128 MPa (allowed 204 MPa).

Max. local stress at X5CrNi 18-10 is 170 MPa (allowed 209 MPa).

All global stresses are well below the relevant limit.

The maximum deflection of the handhold at the point of attack is 4.8 mm. This corresponds to 0.4% deflection with respect to the total length and is thus smaller than the permitted upper limit of 2% according to [N5].

6.1.2 Welding Seams

6.1.2.1 Results for Sheet S235

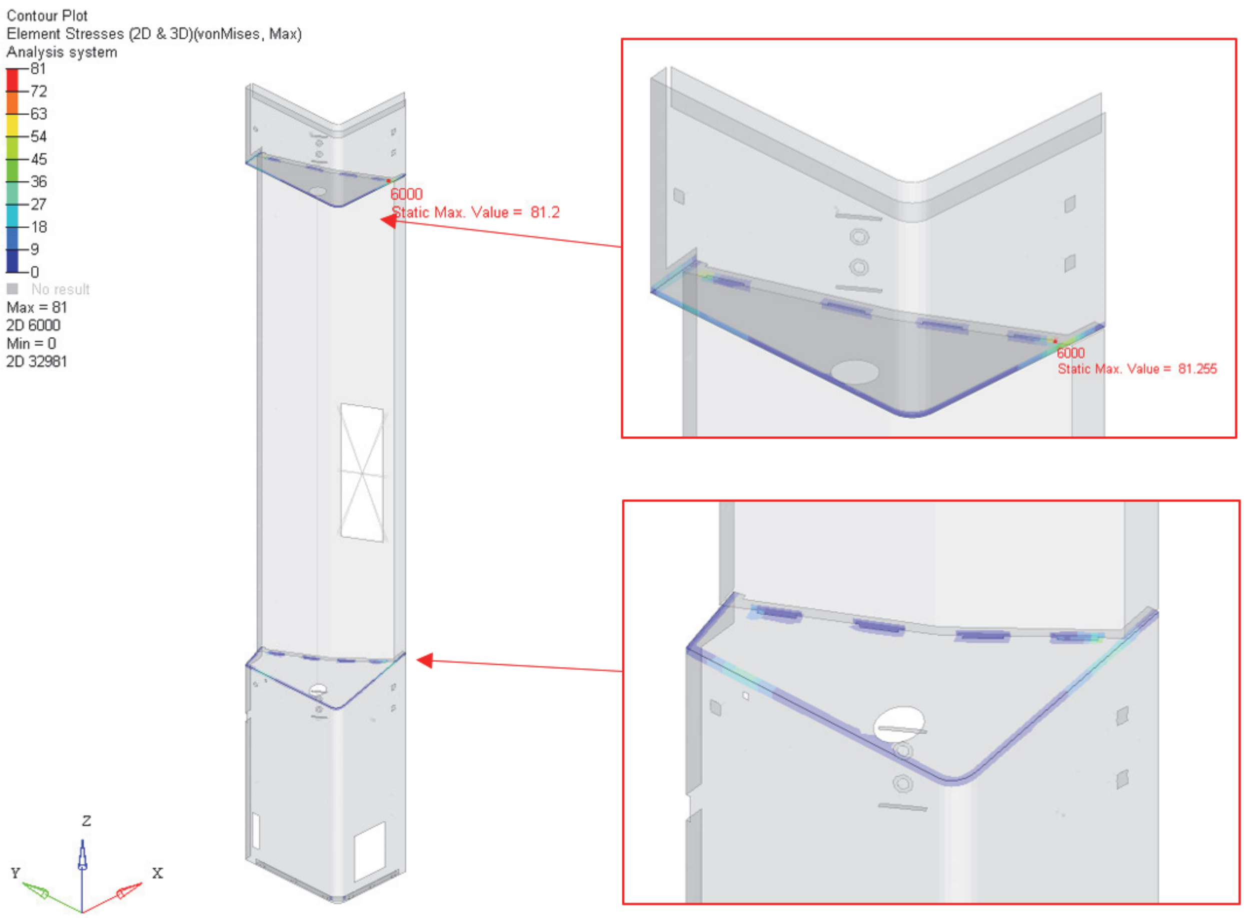

Figure 13: Envelope (S1 and S2) welding seem, sheet S235,

von Mises stress plot, local stress 81 MPa (allowed 163 MPa)

6.1.2.2 Results for Sheet S355

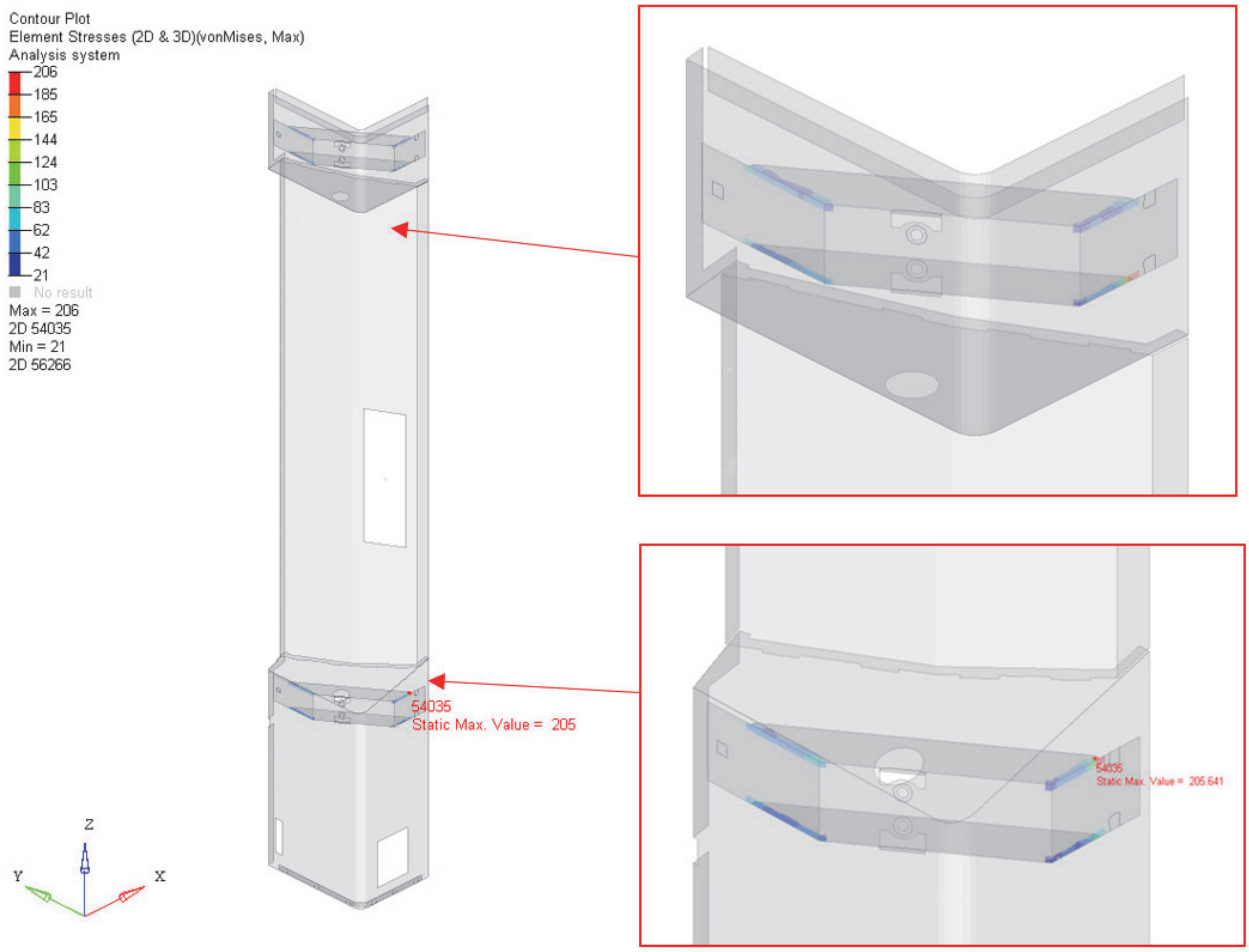

Figure 14: Envelope (S1 and S2) welding seem, sheet S355,

von Mises stress plot, local stress 206 MPa (allowed 246 MPa)

6.1.2.3 Evaluation of the Results

Max. local stress at S235 is 81 MPa (allowed 163 MPa).

Max. local stress at S355 is 206 MPa (allowed 246 MPa).

All global stresses are well below the relevant limit.

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Section 8: Conclusion

The structural requirements correspond to [N5]. In total, 2 static load cases were investigated.

The stress level is generally relatively low. The local stress peaks at the extreme loads are within the permissible range.

The construction of the panel as well as the construction of the handhold are fully suitable for the required applications.

Section 9: Attachment

ANNAX A: List of Stress Peaks

Load case	Acceleration			Shell side	Stress
	F_x [N]	F_y [N]	a_z [m/s²]		v. Mises [MPa]
S1	2222		-10	Z1	281
				Z2	259
S2		2222	-10	Z1	257
				Z2	243

Table 11: List of all stress peaks – base material

Load case	Acceleration			Shell side	Stress
	F_x [N]	F_y [N]	a_z [m/s²]		v. Mises [MPa]
S1	2222		-10	Z1	206
				Z2	168
S2		2222	-10	Z1	82
				Z2	85

Table 12: List of all stress peaks – welding seems

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ANNEX B: List of Tables

ANNEX C: List of Figures

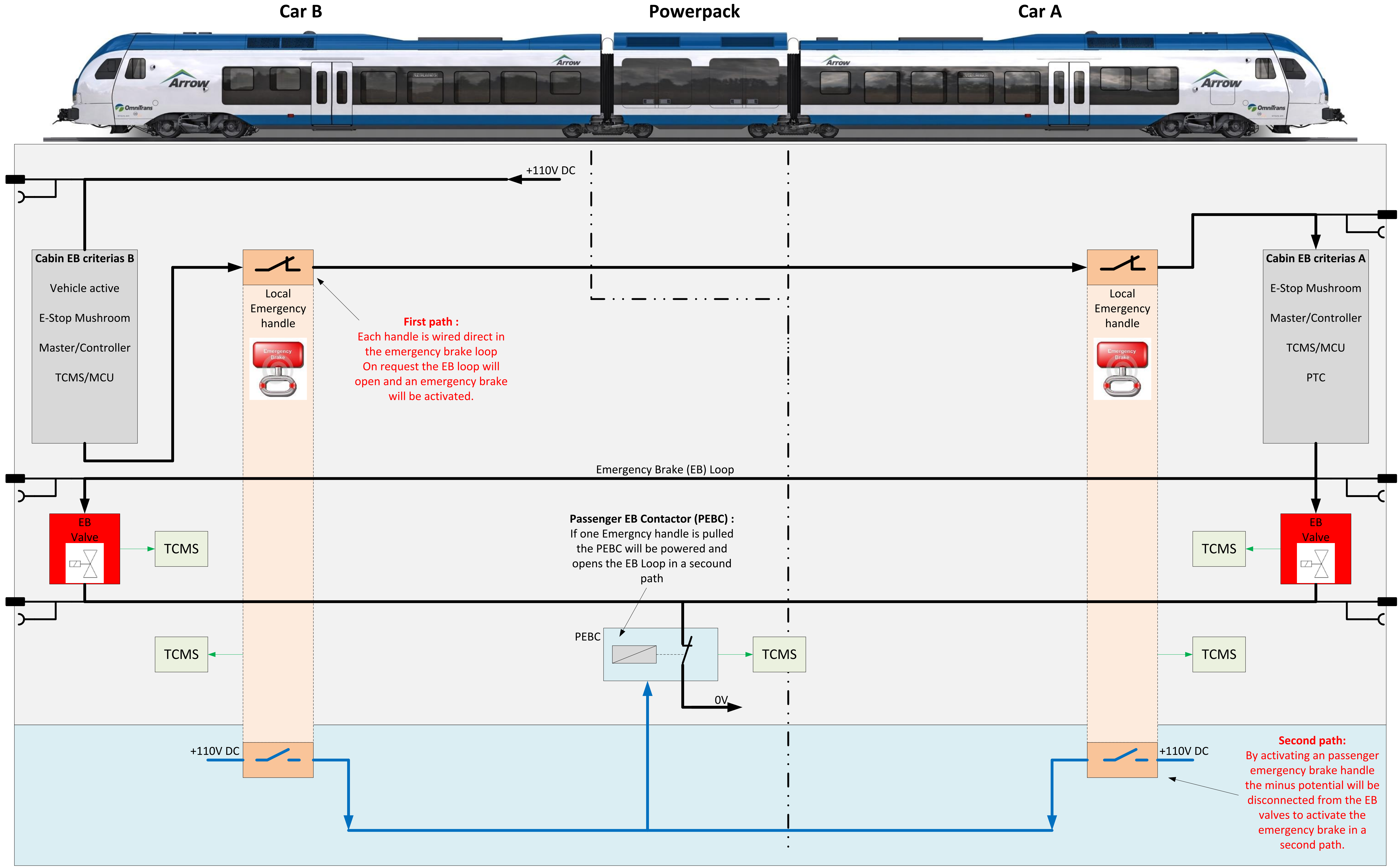
Appendix D: SCRRA Stadler FLIRT 3 Emergency Brake Circuit

Flirt 3 SBCTA

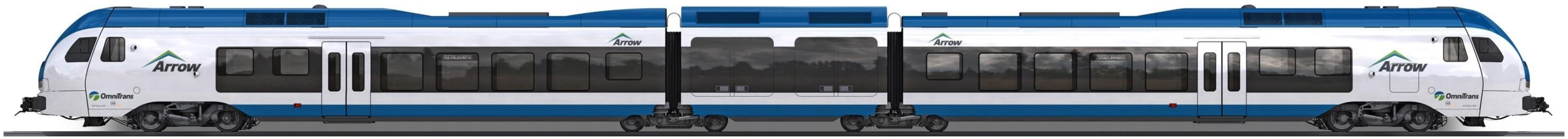
Trainline Overview
L-4410

Revision	Changes	written by	reviewed by	approved by	Date
-	first issue	Jens Steger	Sandro Stüdli	Jens Steger	2018/01/03
-	-	-	-	-	-
-	-	-	-	-	-

Passenger alarm



Car B | Powerpack | Car A



EMERGENCY BRAKE

FRENO DE EMERGENCIA

Pull handle to stop train

Tirar del asidero para parar el tren

SBCTA DMU Emergency brake decal