



Qualification of Terminal Boxes

Ramon Gasull Anguera – Business Development Manager Nuclear Power Plants

International Meeting – Equipment Qualification in Nuclear Installations

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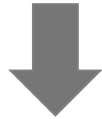
Outline

- Nuclear Equipment Qualification at Weidmüller
- Terminal Boxes
- Qualification Strategy
- Qualification of Terminal Blocks
- Qualification of Enclosures
- NPP Mochovce 3&4

Nuclear Equipment Qualification at Weidmüller

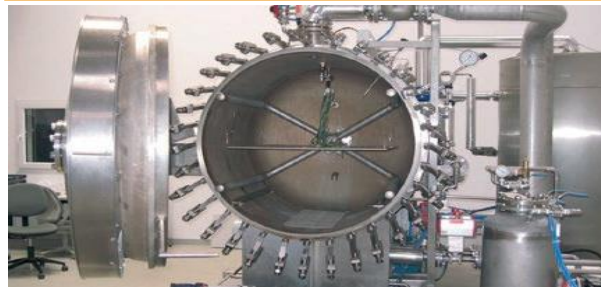
Nuclear Equipment Qualification

Management System



Process Suitability

Product Design

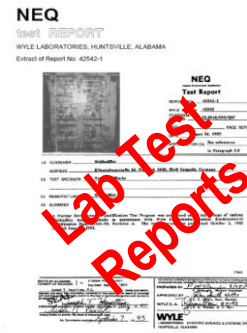


Product Suitability

Manufacturing QA/QC



Production Suitability



Weidmüller		FUD - SAM KN		ID: 018208000		REV: 01		PAGE: 3 / 17	
		Customer Contract Number:		PC: 8600478830					
		Order No. SAP (WV):		21212627					
Order No.	Item description	Quantity	Unit	Examination		Confirmation performed by		Comments	Record No.
				Order date	Order date	Order date	Order date		
24	Procurement of our material (D) SAM 0207-01 (2018-08-08) Item: #11377000	25	PCB	2018-08-08	2018-08-08	2018-08-08	2018-08-08		2.1 Certificate no. 416.0016
25	Procurement of our material (D) SAM 0207-01 (2018-08-08) Item: #11377000	25	PCB	2018-08-08	2018-08-08	2018-08-08	2018-08-08		Inspection no. 2.13.566.7 (01/07/2008)

Terminal Box

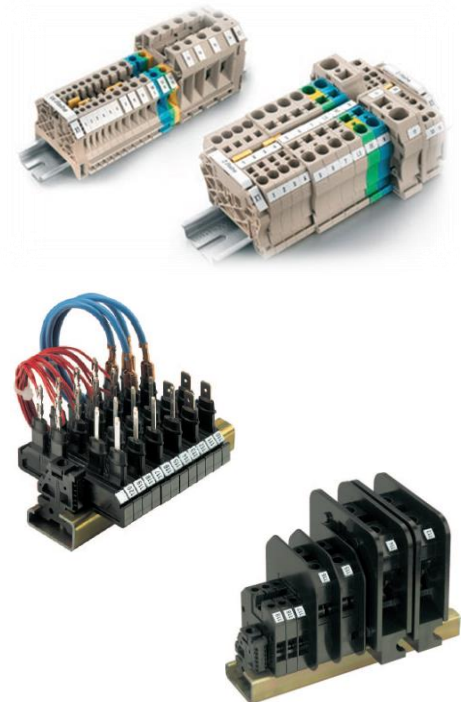
Enclosure



Cable Gland

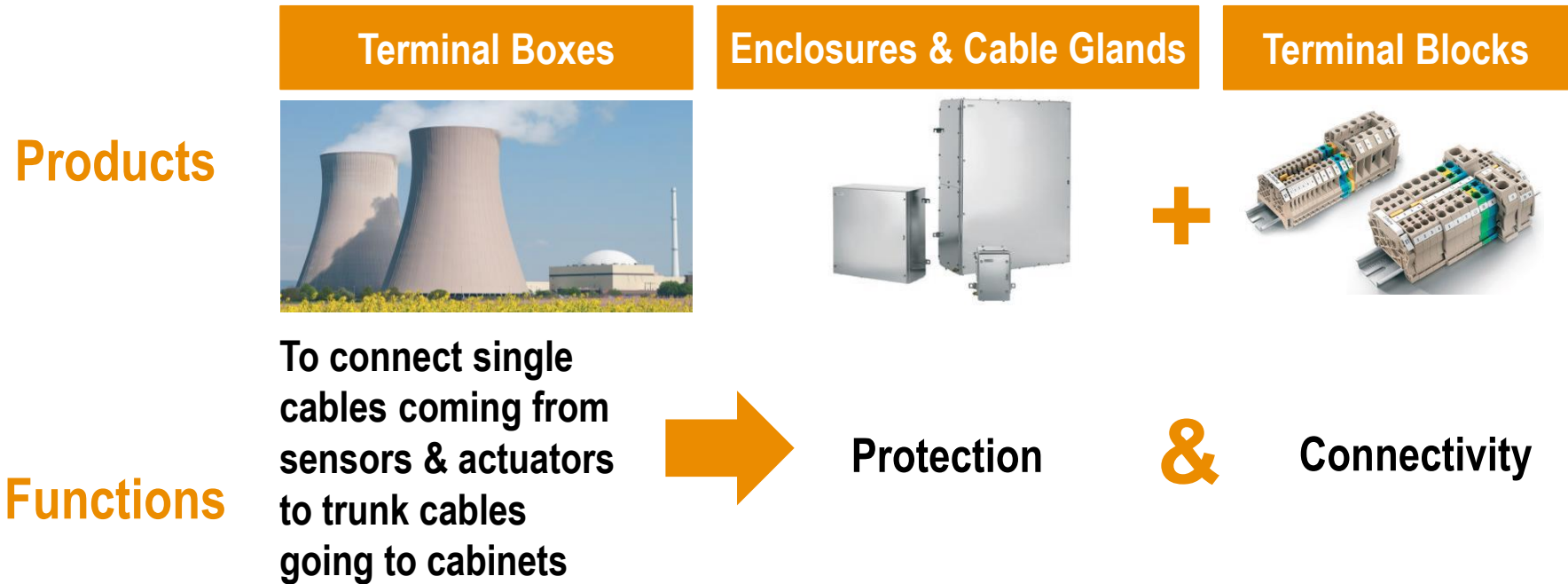


Terminal Block



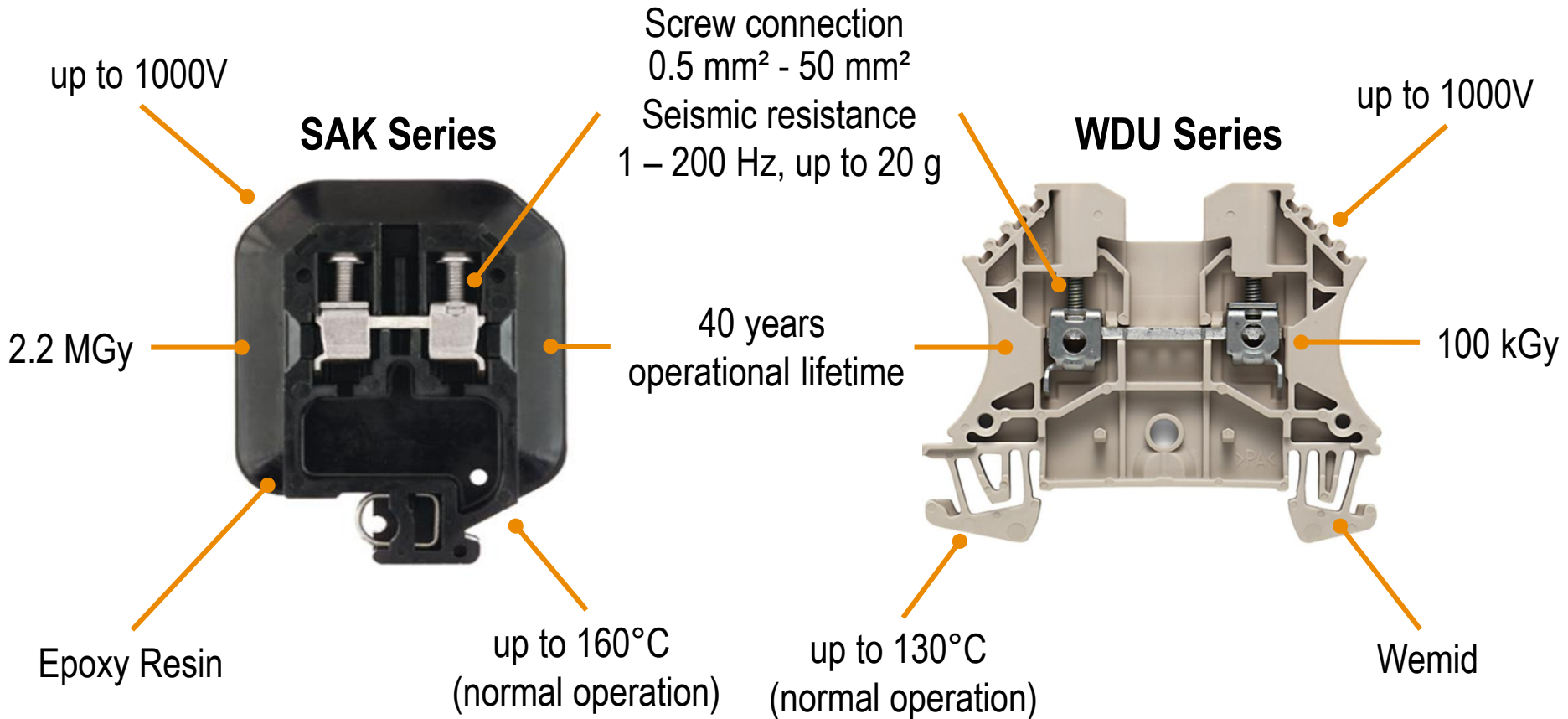
It is not feasible (costs, time schedule, capacity) to test all terminal boxes that will be installed in a nuclear power plant

Qualification Strategy



- Challenges**
1. Representative test specimens to cover the scope of supply
 2. Flexibility during project execution in case of design changes

Qualification of Terminal Blocks (1)



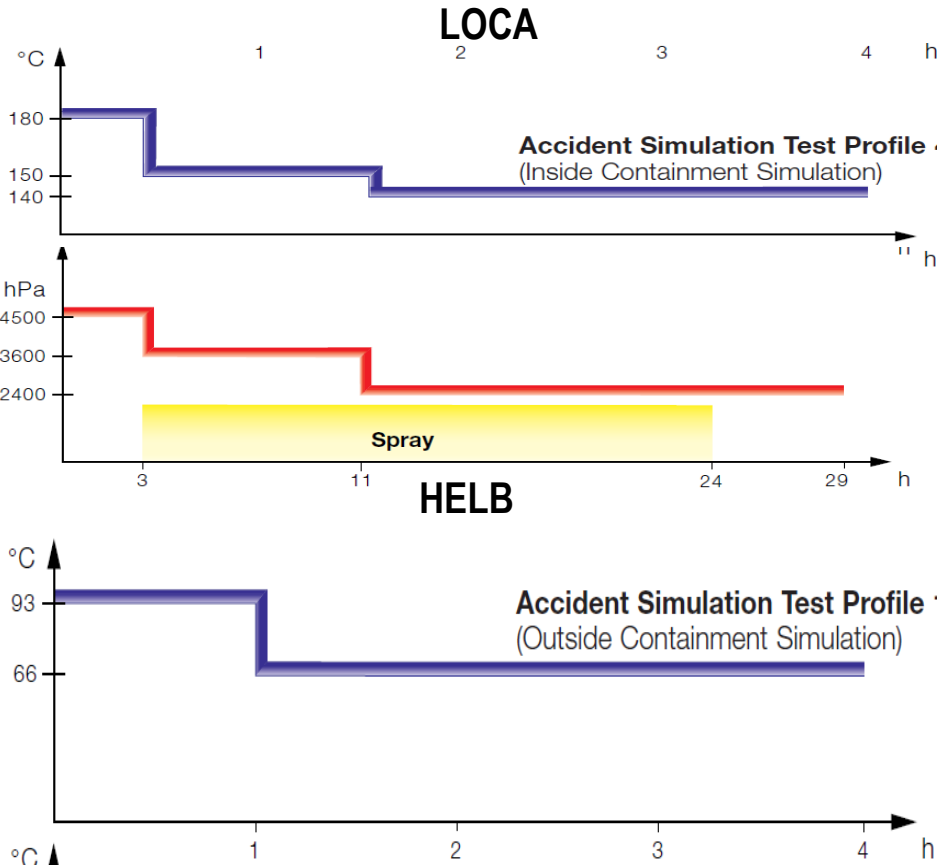
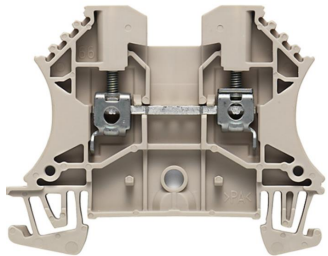
Qualification program in accordance with IEEE 323 & 344

Qualification of Terminal Blocks (2)

SAK Series



WDU Series



Weidmüller terminal blocks are able to fulfil their function in NPP environments even without the protection of enclosures

Qualification of Enclosures



silicone gaskets

Tightness: IP 66
(dust & water jet)

Klippon TB & STB

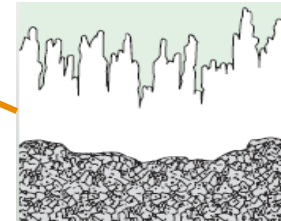
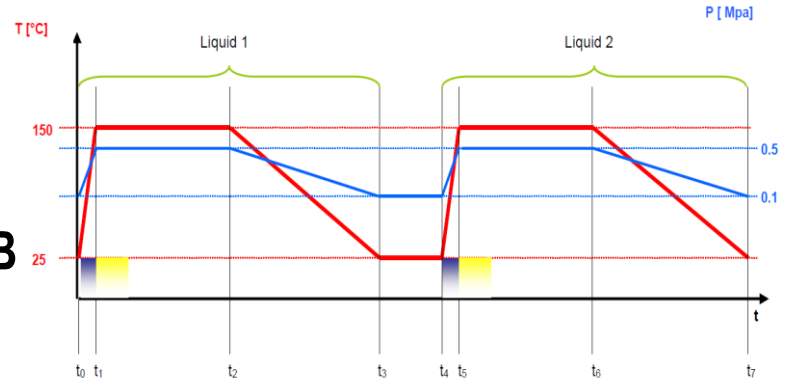


up to 135°C
(normal operation)

high-quality welding



stainless steel 316L / 1.4404

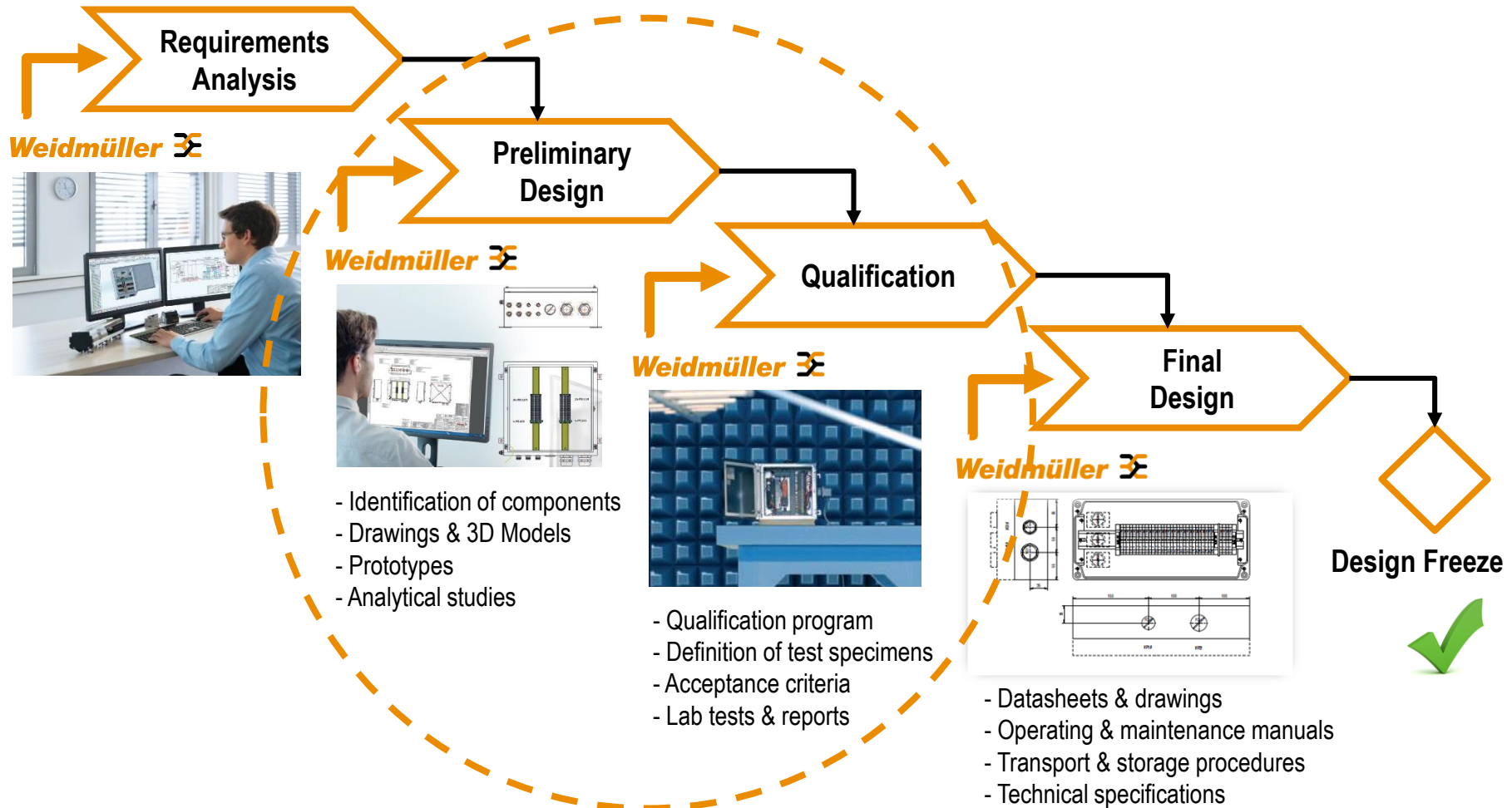


electropolished surface



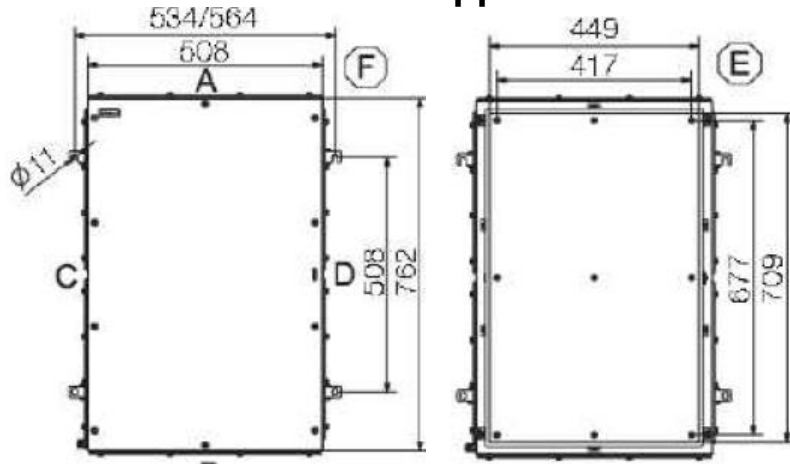
LOCA (up to 5 bar) & seismic resistant enclosures

NPP Mochovce 3&4: Qualification of Terminal Boxes



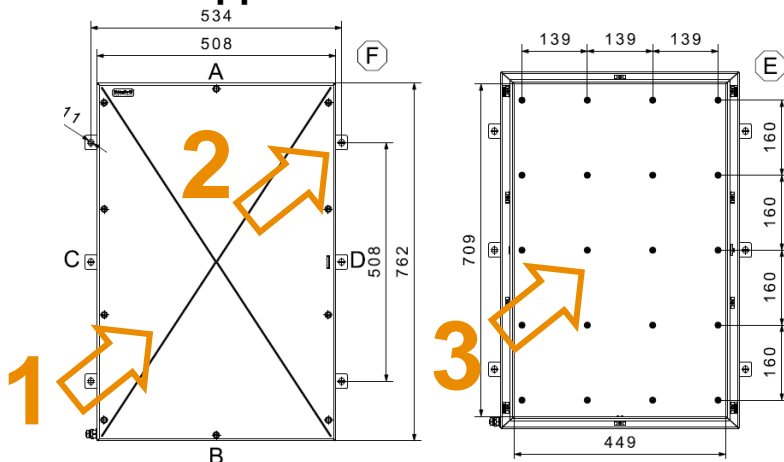
NPP Mochovce 3&4: Improvement of Seismic Resistance

Standard Klippon TB



Reinforcement of the lid

Klippon TB for NPP Mochovce





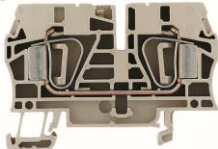






Closed eyelets & special lugs welding



Additional fastening sleeves for DIN rail mounting

NPP Mochovce 3&4: Test Specimens

Enclosures			
Stainless steel		Aluminum	
<p>Klippon TB</p> 	<p>Klippon STB</p> 	<p>Klippon K (Production Site 1)</p>	<p>Klippon K (Production Site 2)</p> 
Terminal blocks	W-Series	Z-Series	P-Series
			
Cable Glands			



The biggest variants of each enclosure type were considered the most critical and therefore selected as representatives test specimens of the complete scope of supply

NPP Mochovce 3&4: Qualification Program (1)

0. Determination of activation energies by thermogravimetry analysis (TGA)

- Sealing of the enclosures
- Sealing of cable glands
- Insulation material of terminal blocks

1. Initial Equipment Inspection & Functional Tests

- Visual inspection
- Tightness of the enclosure
- Insulation resistance
- Pass through resistance

2. Thermal Ageing

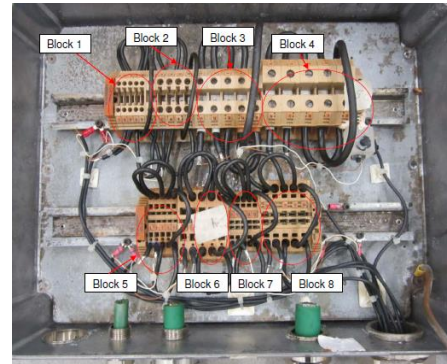
- 40°C during 40 years (ageing temperature: 120°C)

3. Radiation Ageing

- Dose: 100 kGy (1kGy/h)

4. Functional Tests after Thermal & Radiation Ageing

- Tightness of the enclosure:
- Insulation resistance
- Pass through resistance



NPP Mochovce 3&4: Qualification Program (1)

3. Vibration Ageing

- 1 to 200 Hz (5 up & down sine sweeps), up to 2 m/s².

4. Seismic Resistance

- Determination of resonance frequencies
- Five sine sweeps (2 Hz – 35 Hz – 2 Hz)
- Sine beat tests (2 Hz to 32 Hz), up to 5 g

5. Accident Event – HELB Test

- Max. Temperature: 100°C (see profile)

6. Final Equipment Inspection & Functional Tests

- Visual inspection
- Insulation resistance (1)
- Pass through resistance (2)
- Tightness of the enclosure (3)

Acceptance criteria

- 1) >125 kOhm within 5 terminals & between terminals & walls of enclosure
- 2) Change of voltage drop < 50% & no short circuit
- 3) IP 65 (dust and jet water)

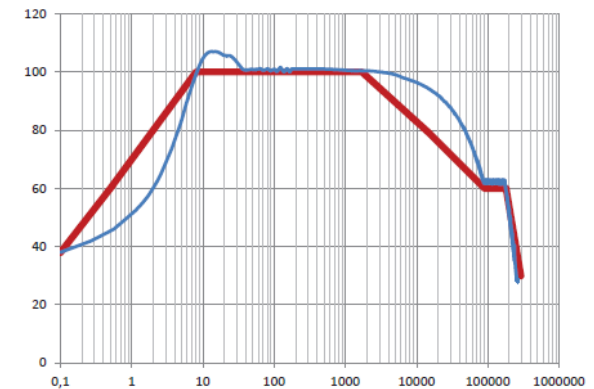
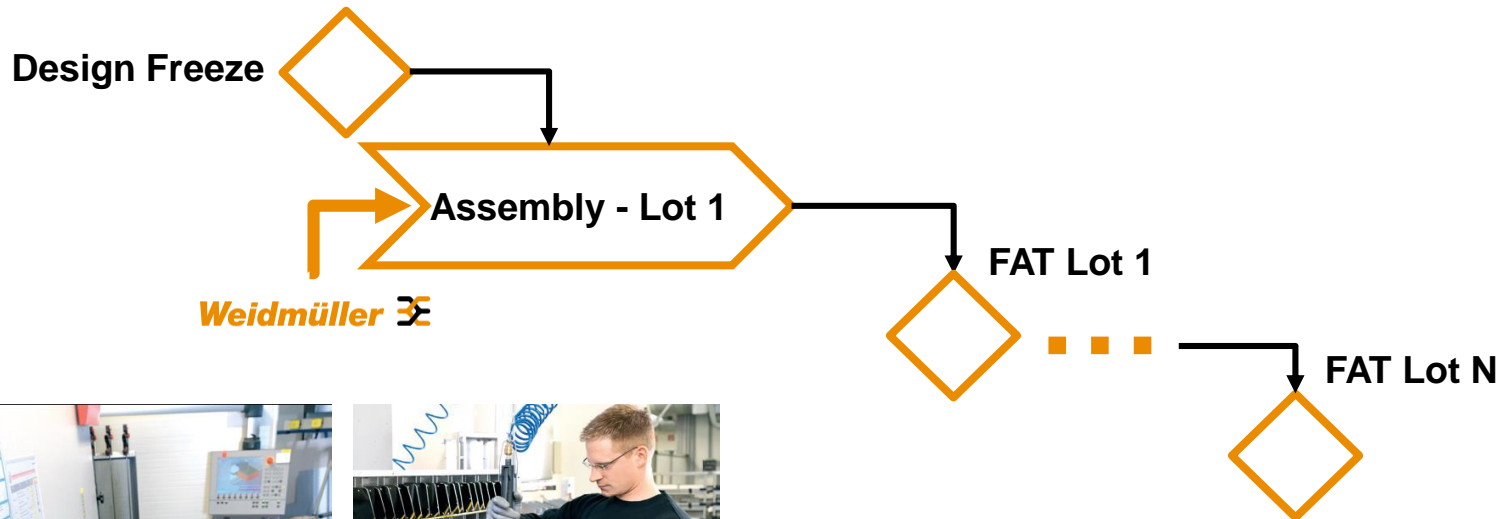





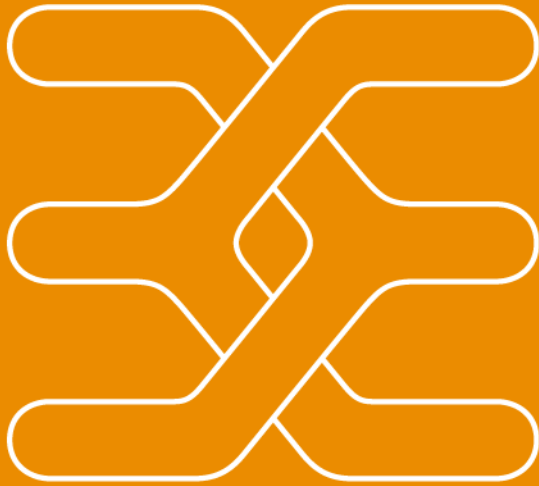
Fig. 1 Temperature profile

NPP Mochovce 3&4: Production & assembly of terminal boxes



- 
-  Serial production <--> specimens
 -  Product conformance to requirements

>1000 terminal boxes
> 5000 empty enclosures



Let's connect

Your Contact Person

Business Development Manager for Nuclear Power Plants

Weidmüller Interface GmbH & Co.KG

Ramon Gasull Anguera

Tel.: +49 5231 14-292894

Ramon.Gasull@weidmueller.com