DFH acceptance tests and QA Plan

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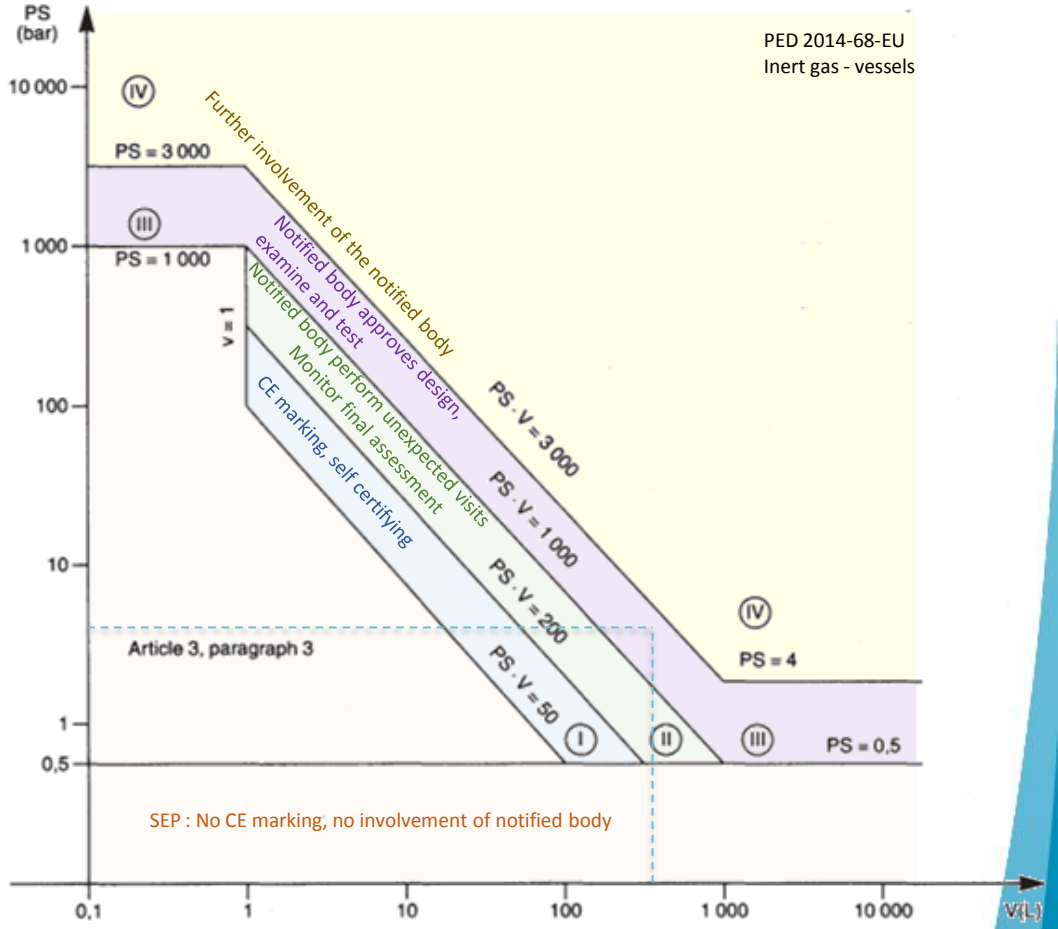
DDR DFH 16 June 2020

Prerequisites for DFH operation

- HSE requirements
  - Pressure Equipment Directive
    - for design, manufacturing, qualification and documentation
  - IEC 60364 Electrical Installation for buildings

- HL LHC QA requirements
  - Quality inspections
    - leak tightness, electrical, dimensions tests
  - Documentation
    - dwg, procedures, tests reports, risk assessment
  - Traceability
    - QA plan, MTF, assembly traveler
  - Archiving
    - EDMS, MTF, NC

- DFHx (and DFHm) will be in CAT III following the PED categorisation
  - ➔ Parts shall be delivered with the required documentation to fulfill the HSE final assessment



General QA approach

Design phase :

- 2D dwg, calculation reports, Technical specifications, QA plan, Overall MIP
- ➔ CERN approval for production

Manufacturing preparation phase :

- MIP, welding book, procedures (cleaning, inspection, pressure test, leak test)
- ➔ CERN documentation approval

Manufacturing & inspection :

- Raw material procurement, manufacturing, inspection, reporting, archiving
- ➔ CERN reports and documentation approval

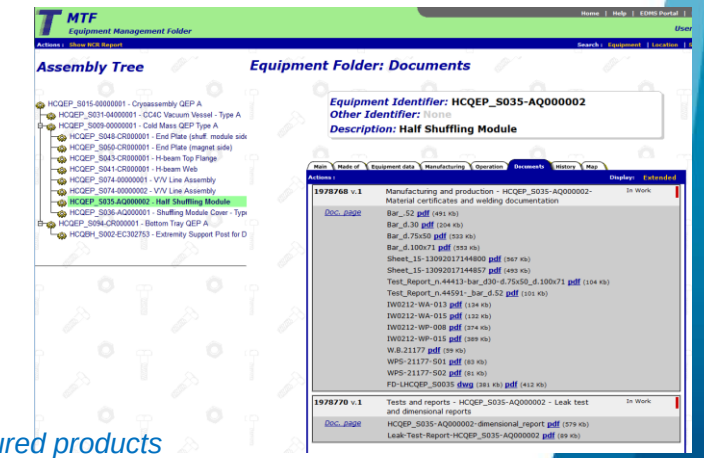
Delivery of qualified parts to CERN :

Assembly at CERN :

- Same requirements apply

QA follow-up (next talk)

- Items identification / Traceability
- Upload documentation to MTF
- Detailed installation and maintenance procedures

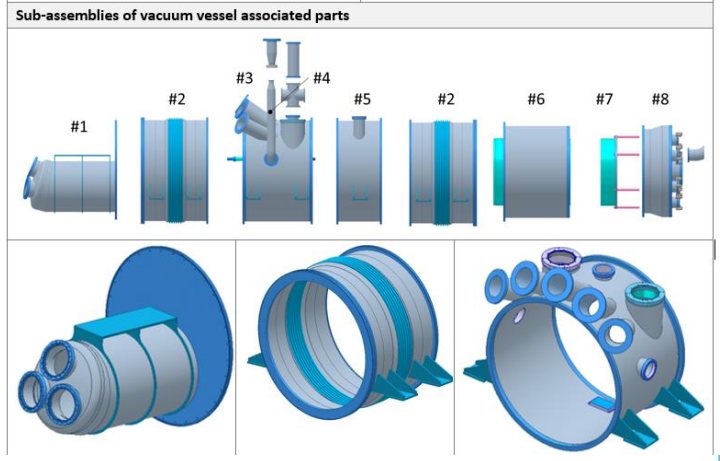


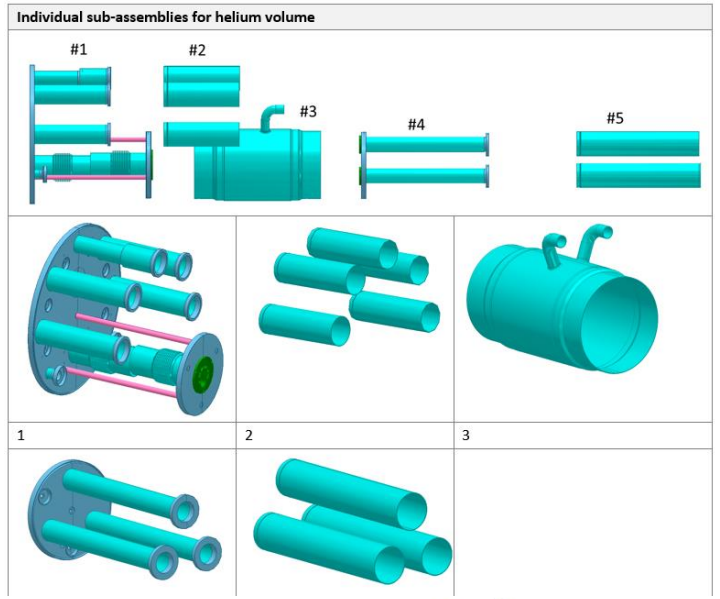
CERN database MTF for manufactured products

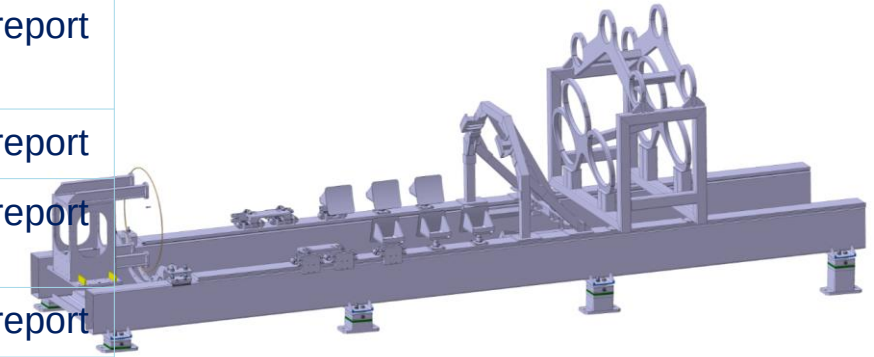
Acceptance tests for DFH structural parts delivery to CERN

- Objective : perform the acceptance tests in Sweden where welding is not required

	Objective Demonstrate :	**Proposed test**	**Acceptance criteria**	**Deliverable**
Vacuum Vessel parts	Assemblability Dimension	Blank assembly Measurement campaign	CERN dwg	Dimension control report
	Leak tightness	Leak test on blank assembly	leak rate $<10^{-8}$ mbar.l.s^{-1}	Leak test report (procedure & results)
Helium vessel parts	Dimension	Measurement campaign	CERN dwg	Dimension control report
Frame	Assemblability	Blank Assembly		Dimension control report
Structural parts	Dimension	Measurement campaign	CERN dwg	Dimension control report
MLI	Dimension	Measurement campaign	CERN 3D	Dimension control report







Documentation associated to DFH structural parts

- Each element shall be identified to allow the traceability of the documentation (see next talk for details)

- Non exhaustive list of documentation to be provided for the DFH parts

	Manufacturing Drawings	Calculation report	Material certificate	Cleaning procedure	Leak test procedure	Leak detector calibration	Welding & welder Qualification	Weld inspection Visual	Weld inspection Radio	NDT personnel qualification
Vacuum Vessel parts	ISO-GPS	EN13445-3*	EN10204 EN10088	ISO23208	ISO20485 EN1779	To be provided	Harmonised standard to PED	All : 100% ISO 17637* Criteria ISO5817-B	Leak tight : 25% ISO 17636* Criteria ISO5817-B	ISO 9712 NDT level 2
Helium vessel parts (pre-assembly)	ISO-GPS	EN13445-3*	EN10204 EN10028	ISO23208	ISO20485 EN1779 (@ Cern)	To be provided	Harmonised standard to PED	All : 100% ISO 17637* Criteria ISO5817-B	Leak tight : 25% ISO 17636* Criteria ISO5817-B	ISO 9712 NDT level 2
Frame	ISO-GPS	SEP	EN10204 EN10088	Good Practice	NA	NA	Applicable standard	All : 100% TBD	TBD	TBD
Structural parts	ISO-GPS	SEP	EN10204 EN10088	Good practice	NA	NA	NA	All : 100% TBD	TBD	TBD

*suggested harmonised standard to PED, other harmonised standard may be used

Assembly at CERN

- Same approach for manufacturing qualification and inspection criteria (welders, welds procedure, leak testing, cleaning, weld inspection)

- HSE acts as notified body for the helium vessels calculation report approval, Pressure test and final assessment

	Manufacturing Drawings	Calculation report	Material certificate	Cleaning procedure	Leak test procedure	Leak detector calibration	Welding & welder Qualification	Weld inspection Visual	Weld inspection Radio	NDT personnel qualification
Vacuum Vessel parts										
Helium vessel parts (pre-assembly)	ISO-GPS	EN13445-3*	EN10204 EN10028	ISO23208	ISO20485 EN1779 (@ Cern)	To be provided	Harmonised standard to PED	All : 100% ISO 17637* Criteria ISO5817-B	Leak tight : 25% ISO 17636* Criteria ISO5817-B	ISO 9712 NDT level 2
Frame										
Structural parts										

*suggested harmonised standard to PED, other harmonised standard may be used

Observations

- DFH parts shall comply with HSE & HL LHC QA requirements
- Each individual part shall be delivered with the relevant documentation allowing the final assessment of the SC Link + DFH + Current leads assembly
- Same approach for CERN assembly with HSE as notified body for final assessment

Spare slides

Non exhaustive list of QA requirements for illustration

	Procurement				Manufacturing & assembly											QA
							Welding		Weld inspection				Leak test		Cleaning	
	Manufacturing drawings	CE certif.	Calculations reports	Pressure test procedure	Material certificate	Dimensional report	Welder	Procedure	NDT personnel	Visual inspection	X-ray proc.	X-ray result	Procedure	Operator	Procedure	MTF archivi
Standard	ISO-GPS	PED	EN13445 EN14917+A1	EN13458-2	EN10028 HL-LHC_QA	NA	ISO 9606-1 ISO14732	EN ISO 15614-1	ISO 9712 NDT level2	ISO 17637	ISO 17636	ISO 5817 Quality B	EN1779A1 EN13185	ISO 9712 Level2	EN12300	
Qualification by notified body		if needed	If needed				X	X	X					X		
Components																
Vacuum vessel	X		X		X	X	X	X	X	X	X	X	X	X		X
Helium vessels	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Thermal shield	X			X	X	X	X	X	X	X	X	X	X	X		X
MLI	X				X	X										X
Structural supports	X				X	X										X