

# Comments to Manufacturing QA documentation



C. Parente (HL-LHC Technical Quality Officer)  
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# Requirements for Manufacturing Readiness

Due 1 month before start of manufacturing for CERN approval

#	Requirements
1	Niobium material samples according to Section 3.2
2	Material certificates and quality control of raw materials (including RRR measurements)
3	Material certificates of welding consumables (whenever applicable)
4	Functional and manufacturing drawings (with tolerances)
5	Design reports demonstrating that welds are designed to withstand the specified load cases (refer to Section 3.6.1)
6	<b>Welding plan</b> including: <ul style="list-style-type: none"><li>• Welding maps</li><li>• Welding and brazing procedure qualification record including CERN acceptance criteria in Section 4.2 (WPQR and BPQR)</li><li>• Welding and brazing procedure specification (WPS and BPS)</li><li>• Welders performance qualification (GTAW), Welding and Brazing Operators Performance Qualifications (electron-beam welding and vacuum brazing) – WPQ, WOPQ and BOPQ</li></ul>
7	Manufacturing procedures (whenever required in Annex 6.3)
8	Test procedures (whenever required in Annex 6.3)
9	EB welded and vacuum brazed samples according to the requirements specified in Section 3.8.4
10	NDT personnel qualifications
11	<b>Manufacturing and inspection plan (MIP) – list of all manufacturing and quality control operations.</b>

# Manufacturing and inspection plan (MIP)

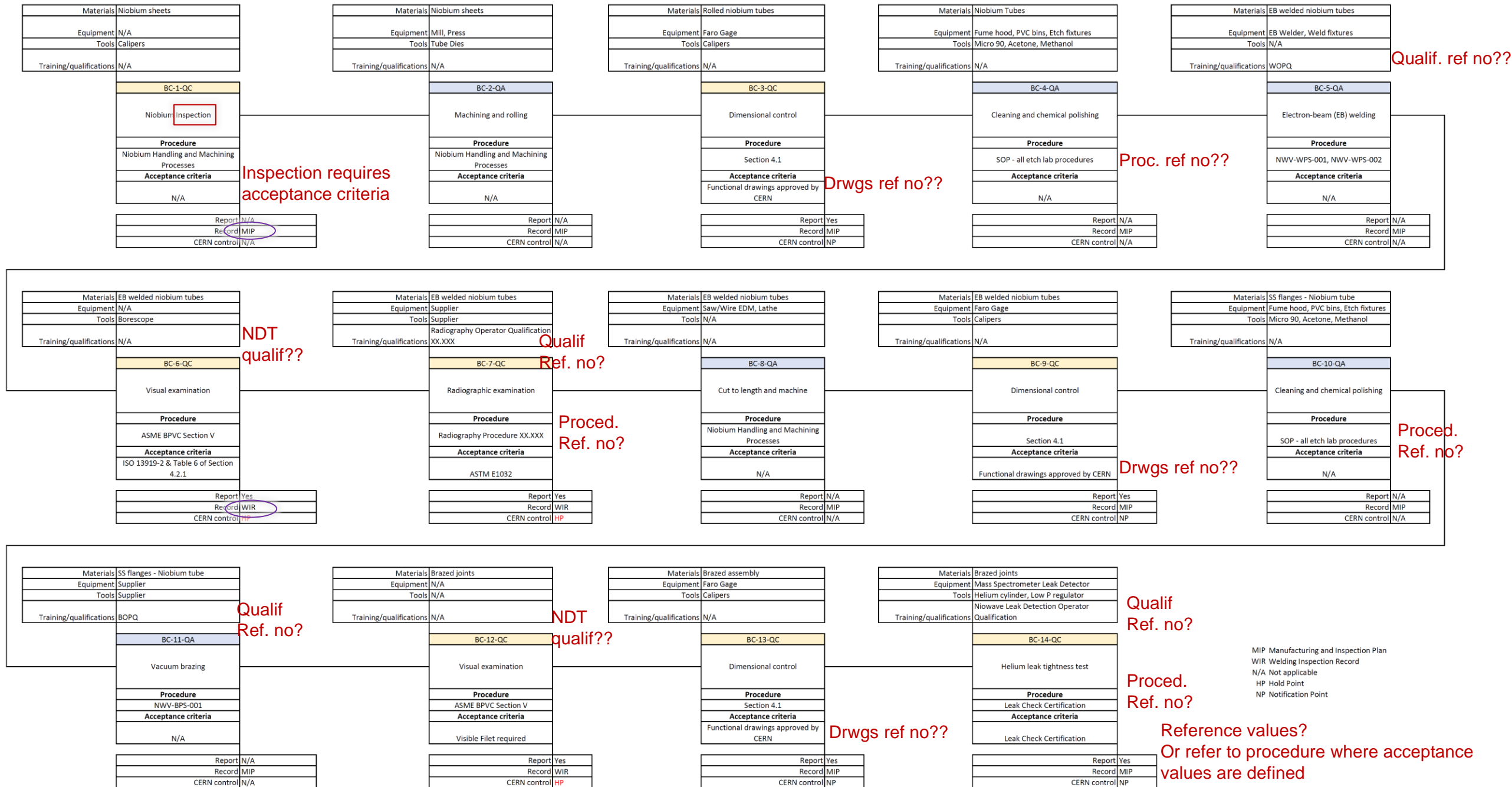
- Niowave can use its own QA plan template or, if not existing, it must be created containing the list of the manufacturing steps with the their corresponding QA information provided in the process diagram (see example in the next slide)

# MIP - Example

Step ID	Step name	Inputs			Outputs					Observations Comments	
		Procedure Ref.	Acceptance criteria Ref.	Training/Qualifications Ref.	Reports Ref.	Hiwave control	CERN control	Responsible	Date		Signature
	Shaping and machining	Section 3.8.2 & 3.8.3	N/A	Supplier			N/A				
	Dimensional control	Section 4.1 - to be defined by supplier	Functional drawings approved by CERN	Supplier			NP				
	Cleaning and chemical polishing	Section 3.8.5 (Annex 6.5 and 6.6) - to be defined by supplier	N/A	Supplier			N/A				
	Vacuum brazing	Section 3.8.6 & BPS (ASME BPVC Section IX, part QB)	N/A	ASME BPVC Section IX, part QB			N/A				
	Visual examination	ASME BPVC Section V	ASME BPVC Section VIII Div. 1	EN ISO 9712 or SNT-TC-1A (ASNT) - minimum level 2			HP				
	Dimensional control	Section 4.1 - to be defined by supplier	Functional drawings approved by CERN	Supplier			NP				
	Helium leak tightness test	EN 13185 or ASME BPVC Section V - to be defined by supplier	Section 4.4	EN ISO 9712 or SNT-TC-1A (ASNT) - minimum level 2			NP				
	Ultrasonic examination	ASTM E 1001	Section 4.2.2 Table 7	EN ISO 9712 or SNT-TC-1A (ASNT) - minimum level 2			HP				
	Chemical polishing	Section 3.8.5 (Annex 6.6) - to be defined by supplier	N/A	N/A			N/A				
	Electron-beam (EB) welding	Section 3.8.7 & WPS (ASME BPVC Section IX, part QW)	N/A	ASME BPVC Section IX, part QW			N/A				
	Visual examination	ASME BPVC Section V	ISO 13919-2 & Table 6 of Section 4.2.1	EN ISO 9712 or SNT-TC-1A (ASNT) - minimum level 2			HP				
	Radiographic examination	ASME BPVC Section V	ISO 13919-2 & Table 6 of Section 4.2.1	EN ISO 9712 or SNT-TC-1A (ASNT) - minimum level 2			HP				
	Dimensional control	Section 4.1 - to be defined by supplier	Functional drawings approved by CERN	Supplier			NP				
	Resonator frequency check & tuning	Section 4.3 - to be defined by supplier	Section 4.3	N/A			HP				
	Dimensional control	Section 4.1 - to be defined by supplier	Functional drawings approved by CERN	Supplier			NP				
	Helium leak tightness test	EN 13185 or ASME BPVC Section V	Section 4.4	EN ISO 9712 or SNT-TC-1A (ASNT) - minimum level 2			N/A				
	Packaging & shipping	Section 3.9 - To be defined by supplier	N/A	N/A			HP				
	Bulk chemical polishing	Section 3.8.5 (Annex 6.6) and Section 3.10 - to be defined by supplier	N/A	N/A			N/A				
	Heat treatment	Section 3.10.1 - to be defined by supplier	N/A	N/A			N/A				
	Light chemical polishing	Section 3.8.5 (Annex 6.6) and Section 3.10 - to be defined by supplier	N/A	N/A			N/A				
	High pressure water rinse	Section 3.10.2 - to be defined by the supplier	N/A	N/A			N/A				
	RF acceptance tests at cold temperature	To be defined by supplier	Section 4.5	Yes			HP				

# Manufacturing process diagram

Complementary document to the MIP, but not replacing it!



**General comment:** The MIP and WIR indicated in the process diagram as records are specific documents that must be created to register who/when performed the task and what are the results (they will also include the reference to the corresponding required reports, when applicable).

# Welding map & welding book - Examples

Welding plan (example provided during meeting 01-02/10/2014)

Technical drawing of a damper assembly. The drawing includes a side view (A-A), a top view, and three detailed views (DETAIL 2, 3, 5). Callouts include S05, S01, S03, S04, S02, S06, and S07. Dimensions include 719.4 ± 0.2, 569.4, 447 (445 + 2 RS), 32, 33.5, 1.3, 4, 2.5, 0.2 ± 0.1, 0.5 ± 0.4, 0.34, 50, 114.3, 8, 4.5, 2.5, 30°, 40°, 40°, 7, 8, 25, 37.1, and 141. A small photograph of the physical damper is also shown.

Technical specifications:  
 MASS = 13.6kg  
 Max allowed pressure : 110 bar  
 Test pressure : 157 bar  
 Fluid : CO2 liquid  
 Technical specifications : EDMS N°1246846  
 Plan fonctionnel : CMSTKCOX0001

**PLAN NUMEROTATION SOUDURE**

1	DAMPER NAMEPLATE	6	1.4404	CMSTKCOX0002	
2	FOR TRACKER CO2 PROJECT		[AISI 316L]	ST0468249	
3	ROUND BAR BSS	5	1.4428	BTS N°1000	44.57.19 313.6
4	ROUND BSS		[AISI 316L]	ST0478497	
5	ROUND TUBE Ø114.3 x 8.56 - S80	4	1.4435	KNOLLER : 4" x 80s - 316L SEAMLESS	
6	TUBE ROND Ø114.3x8.56 - S80		[AISI 316L]	ST0433005	
7	MALE NUT VCR - 1"	3	Stainless Steel	SWAGELOK : SS-16-VCR-4	
8	ECHOU MALE VCR - 1"		[AISI 316L]	ST0433008	
9	ISLAND VCR 1" - BUTT WELDED	2	Stainless Steel	SWAGELOK : 6LV-16-VCR-3-16TB7	
10	EMBOUT VCR 1" - SOUDE BOUT		[AISI 316L]	ST0433007	
11	DISHED END Ø114.3x8.56 S80	1	1.4435	KNOLLER : R-275-316L-4" x 80s	
12	FOND BOMBE Ø114.3x8.56 S80		[AISI 316L]	ST0450642	

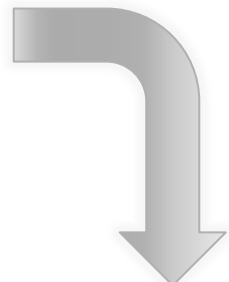
ISO 2768-mK ✓ N° 3.2 (✓) ISO 13715 -0.3 +0.3

Work shop tools

PLAN NUMEROTATION SOUDURE  
 DAMPER  
 PLAN CMSTKCOX0001  
 FOR TRACKER CO2 PROJECT

SCALE: 1:2  
 REVISIONS: 1:2  
 APPROVED: G. FAURE 2014-10-02  
 CAD Document Number: ST0433004\_03  
 REPLACES:

PROJECT ENGINEER FOR PRODUCTION: CRNHZMW\_1274 | 2



**Welding book**  
 (containing also welding inspection records, WIR)  
 Reference to the welding book should be made,  
 when applicable, to the Manufacturing & Inspection Plan  
 (MIP)

Weld ID	Drawing ref.	Process	PQR	WPS/BPS	Welder ID	Date	Non-destructive tests (NDT)											
							VT		RT		UT		LT		Other			
							Tester ID	Report ref.	Date	Tester ID	Report ref.	Date	Tester ID	Report ref.	Date	Tester ID	Report ref.	Date
W01																		
W02																		
W03																		
...																		
...																		
VT	Visual examination																	
RT	Radiographic test																	
UT	Ultrasonic test																	
LT	Leak tightness test																	