

Quality Assurance Plan

QUALITY ASSURANCE PLAN

Notation conventions

QA: QUALITY ASSURANCE- by Contractor

R: REVIEW

W: WITNESS,

VT - Dimensional & visual check

RT - Radiography (X-ray) /

WPQ - Welders qualification

PQR - Welding procedure qualification

HIS - Heat insulation space

MTC – Material test certificate from Government approved Laboratory in addition to mill test certificate

TPI - Third Party Inspection

ISRO - Customer

Sl.No	Description of test, checks	Kind of test/checks	Extent of test	Applicable code	Acceptance document	Inspection				
						Manufacturer		ISRO	TPI	
						Point type	Signature	Point type	Point type	Signature
1	2	3	4	5		6	7	8	9	10
1	I. Check of drawings									
1.1	Analysis of project detailed drawings			ASME sec..VIII.1	Design documents and drawings	QA		R&A	R&A	
2	II. Certification of welding processes and the personnel									
2.1	WPQ	Each welder	100%		WPQ certificate	QA		R	W	
2.2	PQR	Each procedure	100%		PQR certificate	QA		R	W	
2.3	Welding process alignment	Each procedure	100%	Technical process	Welding alignment report	QA		R	W	
3	III. Incoming inspection of materials quality									
3.1a	1. Austenitic steel plates (inner vessel – shells, heads, shell rings)	Visual inspection	100%		Product spec	QA		R	W	
3.1b		Chemical analysis	Each heat/		Mill test certificate, MTC	QA		R	W	

3.2		Mechanical properties		As per code	Mill test certificate MTC	QA		R	W	
3.3		Impact bending test at T=-196° C	Each heat	As per code	Manufacturer's check test report, MTC	QA		R	W	
3.4		Ultrasonic test of austenitic steel plates	Each plate (100%)	As per code	Mill test certificate	QA		R	R	
3.5	2. Austenitic steel bars.	Chemical analysis	Each heat	As per code	Mill test certificate, MTC	QA		R	W	
3.6		Mechanical properties			Mill test certificate, MTC	QA		R	W	
3.7		Impact bending test at T=-196° C	Each heat	As per code	Manufacturer's check test report, MTC	QA		R	W	
3.8		Ultrasonic test, visual inspec- tion/	Each bar (100%)	As per code	Mill test certificate	QA		R	R	
3.9		Chemical analysis/	Each heat	As per code	Mill test certificate, MTC	QA		R	W	
3.10	3. Austenitic steel forgings	Mechanical properties	Each heat	As per code	Mill test certificate, MTC	QA		R	W	
3.11		Impact bending test at T=-196° C	Each heat	As per code	Mill test certificate, MTC	QA		R	W	
3.12		Ultrasonic test, visual inspec- tion/	Each bar (100%)/	As per code	Mill test certificate	QA		R	R	
3.13		Visual check	100 %	As per code	Manufacturer's check test report	QA		R	R	
3.14	4. Austenitic steel seamless pipes	Dimentional check	One coupon of the lot	As per code	Manufacturer's internal inspection report	QA		R	R	
3.15		Chemical analysis/	Each heat	As per code/	Mill test certificate Manufacturer's internal inspection report, MTC	QA		R	W	

3.16		Mechanical properties (including impact bending test)	Each heat	As per code	Mill test certificate, MTC	QA		R	W
3.17		Hydraulic test	100%	As per code	Mill test certificate	QA		R	R
3.18		Flattening test	5% pipes of lot	As per code	Mill test certificate	QA		R	R
3.19		Intergranular corrosion test	Each heat	As per code	Mill test certificate	QA		R	R
3.20		Ultrasonic test	100%	As per code	Mill test certificate	QA		R	R
3.21		Micro & macro structure examination		As per code	Test report	QA		R	W
3.22		Low temperature impact test at 77K	One sample per heat	As per code	Test report	QA		R	W
3.23	5. Carbon steel plates (jacket - shells, heads, shell rings, partitions)	Chemical analysis,	Each heat	As per code	Mill test certificate Manufacturer's internal inspection report, MTC	R		R	W
3.24		Mechanical properties	Each heat	As per code	Mill test certificate Manufacturer's internal inspection report, MTC	R		R	W
3.25		Visual check/	100 %	As per code	Manufacturer's check test report,	R		R	R
3.26		Dimentional check	One coupon of the lot	As per code	Manufacturer's internal inspection report	R		R	R
3.27	5. Welding materials	Chemical analysis	100 %	As per code	Manufacturer's certificate	QA		R	R
4	IV. Manufacture of tank's parts and assembly units								
4.1	Tank's inner vessel	Dimentional check and visual check	100%		Manufacturer's check test report	QA		R	R
4.2	Each end plate of tank (inner vessel)	Solution annealing (austenite)	100%		End plate Manufacturer's check test report	QA		R	R
4.3	Jacket	Dimentional check and visual check	100%		Manufacturer's check test report	QA		R	R
5	V. Check of tank's welded joints								
5.1	Fit-up	Dimentional check and visual check	Each welded joint	Drawings	Manufacturer's check test report	QA		R	W

5.2	Welding flow sheet, welding procedure	Approval	Each procedure	As per procedure	Manufacturer's check test report	QA		R	R	
5.3	Welds testing (on coupons)	1. Static tensile test 2. Static bending test 3. Impact bending test at T=-196 deg.C	One test for shells, for each end plate, for each pipe lot	As per procedure	Manufacturer's check test report	QA		R	R	
5.4	Nondestructive test of all welds of inner vessel	a)RT UT (ultrasonic testing)/ b)Dye Penetrant test (DPT) to be done after root run and final run	a)100% b)100%		Manufacturer's check test report	QA		R	R	
5.5	Nondestructive test of all welds of outer jacket		a)25% b)100%		Manufacturer's check test report	QA		R	R	
6	VI. Cleaning, pickling, passivation & Oxygen Service standard cleaning as per ASTM G93/CGA G 4.1									
6.1	Tank's inner vessel	Defatting / Oxygen service standard cleaning	100%	ASTM G93/CGA G 4.1	Manufacturer's check test report Visual inspection / Luminescent testing; Mechanical particles determination / Internal surface oil contamination test	QA		R	R W	
7	VII. Pneumatic tests									
7.1	Pneumatic tests of inner vessel	Pneumatic test for strength and leak	100%	As per code	Manufacturer's check test report	QA		R	W	
7.2	Pneumatic tests of outer vessel	Pneumatic test for strength and leak	100%	As per code	Manufacturer's check test report	QA		R	W	
8	VIII. Final dimensional & visual check									
8.1	Final dimensional & visual check of inner vessel	Final dimensional & visual check	Basic overall dimensions and dimensions of all welds		Manufacturer's check test report	QA		R	W	
8.2	Final dimensional & visual check of outer jacket					QA		R	W	

8.3	Support structure fabrication	Dimensional and DP test			Inspection report	QA		R	R	
9	IX. Vacuum tests									
9.1	Leak tests of inner vessel (design pressure)	Leak test by helium blowing-off	All welds	Leak should be less than 1×10^{-9} Pa-m ³ /s	Manufacturer's check test report	QA		R	R	
9.2	Leak tests of the inner vessel-and-jacket assembly	1. Leak test of jacket by helium blowing-off	All welds of jacket	Leak should be less than 1×10^{-9} Pa-m ³ /s	Manufacturer's check test report	QA		R	R	
9.3		2. Leak test of inner vessel with vacuum chamber method	100%	Leak should be less than 1×10^{-9} Pa-m ³ /s	Manufacturer's check test report	QA		R	W	
9.4	Ensure Leak tightness across the inner vessel as well as outer vessel	MSLD in vacuum mode, helium charged inside inner vessel, outer vessel shrouded by synthetic bags and charged with helium.	100%	Leak should be less than 1×10^{-9} Pa-m ³ /s	Manufacturer's check test report	QA		R	W	
9.5	Vacuum stability tests of HIS	Vacuum Stabilization Test	Each HIS	Vacuum rise measurement	Manufacturer's check test report	QA		R	W	
9.6	Check of residual pressure in HIS	Instrumental inspection	100%		Manufacturer's check test report	QA		R	W	
10	X. Final operations.									
10.1	Preservation	Inner vessel preservation with dry nitrogen, P=0.5 kgf/cm ² .	100%		Manufacturer's check test report	QA		W	W	
10.2	Check of documentation completeness	Check	100%		Manufacturer's check test report	QA		W	W	
In addition, include the following										
11.1	Material Identification w.r.t MTC /			Approved Drawings	Material Identification Report	QA		W	R	
11.2	All Bought out items	Visual Inspection			Product Spec.	QA		R	R	
11.3		Instruction Manual		Instruction Manual	Instruction Manual	QA		R	R	
11.4		Test Reports/Calibration Test Certificates		Documents	Documents/Standards	QA		R	R	
11.5		Performance Testing		Instruction	Performance Test re-	QA		R	R	

				Manual	port/standards					
Ports Opening and Nozzle welding with Shell & dished ends										
11.6	Flange and Pipe welding	a) Dimensional b) RT/UT c) DP test	CTII 2082-1222	Drawing	Inspection Report DP/ X-Ray	QA		R	R	
11.7	Marking and opening of ports and weld setup	Dimensional		Drawing	Inspection Report	QA		W	R	
11.8	Welding of all ports with vessel	DP test shall be carried out after root run and after final		ASME SEC VII DIV.I & ASME SEC.V CTO 00220368-024	Inspection Report	QA		R	R	
Vessel Fabrication										
11.9	Shell Rolling	Dimensional		Drawing	Inspection Report	QA		R	R	
11.10	Formation of Dished ends	a) Dimensional b) RT/UT			Inspection Report	QA		W	R	
11.11	Performance Test	LN2 filled to 75% of gross volume and evaporation loss measured				QA		W	W	