



## MINISTRY OF DEFENCE (DGQA)

### STANDARD QUALITY ASSURANCE PLAN FOR END FITTINGS

STANDARD QAP NO. DGQA/DQA(WP)/END FITTINGS/28/2021/REV 0

Total Nos. of Pages: 15  
ISSUING AUTHORITY

DIRECTORATE OF QUALITY ASSURANCE (WARSHIP PROJECT)  
MINISTRY OF DEFENCE (DGQA)  
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MINISTRY OF DEFENCE (DGQA)			
DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011		SQAP OF END FITTINGS	PAGE
		STANDARD QAP NO. DGQA/DQA(WP)/END FITTINGS/28/2021/REV 0	REV NO
		DATE	26 Jul 21

RECORD OF AMENDMENTS

<u>Sl. No.</u>	<u>Date of Amendment</u>	<u>Amendments</u>	<u>Authority</u>	<u>Remarks</u>

	MINISTRY OF DEFENCE (DGQA)	SQAP OF END FITTINGS	PAGE	03
DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/END FITTINGS/28/2021/REV 0	REV NO	00	

**MINISTRY OF DEFENCE (DGQA)**  
**STANDARD QUALITY ASSURANCE PLAN**  
**FOR END FITTINGS**

**STANDARD QAP NO.**

**DGQA/DQA(WP)/END FITTINGS**

**/28/2021/REV 0 DATED 26 JUL 2021**

  
 (A. George)  
 Rear Admiral  
 ADGQA (WP)

Promulgated by:-

DIRECTORATE OF QUALITY ASSURANCE (WARSHIP PROJECT)  
 MINISTRY OF DEFENCE (DGQA)  
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 <b>MINISTRY OF DEFENCE (DGQA)</b>	<b>SQAP OF END FITTINGS</b>	<b>PAGE</b>	04
	<b>STANDARD QAP NO.</b> <b>DGQADQA(WP)/END</b> <b>FITTINGS/28/2021/REV 0</b>	<b>REV NO</b>	00
<b>DIRECTORATE OF QUALITY</b> <b>ASSURANCE (WP)</b> <b>NEW DELHI - 110 011</b>		<b>DATE</b>	26 Jul 21

### CONDITION OF RELEASE

1. This standard QAP has been prepared for use of the Indian Navy and of its contractors to follow the specified Quality Assurance procedure during the execution of the contracts. No alteration is to be made to this Standard QAP except by the issue of authorised amendment by DQA (WP).
2. It is to be applied as required in the Quality Assurance procedures covering manufacture of End Fittings for IN Ships and Submarines.
3. The website <http://www.dgqadefence.gov.in> may also be referred for other QA requirements.
4. The Standard QAP has been prepared on the basis of decisions made in consultations with leading manufacturers of End Fittings, representatives of Professional Directorates and Inspection Agencies. Any user of this Standard QAP either within DGQA / Indian Navy or in industry may propose an amendment to it with valid justification. Proposals not applicable to particular contract can be sent directly to DQA (WP), New Delhi, and those directly applicable to a particular contract are to be dealt with using contract procedures.
5. DQA (WP) reserves the right to amend or modify the contents of this Standard QAP without consulting or informing any holder of this document.
6. When this Standard QAP is incorporated into contracts, users are responsible for their correct application and for complying with contractual and other statutory requirements. Compliance with Standard QAP does not of itself confer immunity from legal obligations.
7. Enquiries in connection to these requirements may be made from:

**DIRECTORATE OF QUALITY ASSURANCE (WARSHIP PROJECT)**  
**MINISTRY OF DEFENCE (DGQA)**  
**'H' BLOCK, NIRMAN BHAWAN PO**  
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 <b>MINISTRY OF DEFENCE (DGQA)</b> <b>DIRECTORATE OF QUALITY</b> <b>ASSURANCE (WP)</b> <b>NEW DELHI - 110 011</b>	<b>SQAP OF END FITTINGS</b>	<b>PAGE</b>	<b>05</b>
	<b>STANDARD QAP NO.</b> <b>DGQA/DQA(WP)/END</b> <b>FITTINGS/28/2021/REV 0</b>	<b>REV NO</b>	<b>00</b>
		<b>DATE</b>	<b>26 Jul 21</b>

## CONTENTS

<u>S.No.</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
1.	Standards Invoked	06
2.	Specific Requirements	07
3.	Abbreviations	08
4.	Scope	09
5.	System Description	10
6.	Part-I: General Information	12
7.	Part-II : Technical Inspection/Trials	13
APP 'A'	Standard QAP of End Fittings	14-16

	MINISTRY OF DEFFENCE (DGQA)	SQAP OF END FITTINGS	PAGE	06
	DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/END FITTINGS/28/2021/REV 0	REV NO	00
			DATE	26 Jul 21

## STANDARDS INVOKED

<u>S. No.</u>	<u>Specification No.</u>	<u>Description</u>
1	ASTM : E45-13	Standard test methods for determining the inclusion content of steel.
2	ASTM : E112	Standard test methods for determining average grain sizes.
3	ASTM : A403/ A403M	Standard specification for wrought austenitic stainless steel piping fittings
4	ASTM : E407-07el	Standard practice for micro etching metals and alloys
5	ASTM : A262 Practice 'E'	Standard practice for detecting susceptibility to inter granular corrosion attack in austenitic steel.
6	ASTM : A959	Standard guide for specifying harmonized standard grade compositions for wrought stainless steels.
7	ASTM : F1387-99, A9	Standard specification for performance of piping and tubing mechanically attached fittings
8	ANSI – B16.9	Factory made wrought butt welding fittings
9	ASME Boiler & Pressure Vessel Code Sec II, Div I, Sub Sec NB, ,Article NB 5330	Acceptance standard for ultrasound test.
10	ASME Boiler & Pressure Vessel Code Sec II, Div I, Sub Sec NB, ,Article NB 5350	Acceptance standard for liquid penetration test.
11	ASME Boiler & Pressure Vessel Code Sec II, Div I, Sub Sec NB, ,Article NB 5510	Qualification & certification of personnel for NDT – General requirement.

	MINISTRY OF DEFENCE (DGQA)	SQAP OF END FITTINGS	PAGE	07
DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/END FITTINGS/28/2021/REV 0	REV NO	00	

### **SPECIFIC REQUIREMENTS**

1. Testing of physical and chemical properties has to be done by NABL accredited lab.
2. If casting is being poured without integral test bar, then the pouring is to be witnessed by Inspector.
3. Radiography is to be carried out for critical regions marked in the approved drawing. Class of casting is to be mentioned in the drawing.
4. Non Destructive Testing is to be carried out by ISNT/ ASNT level II or III qualified technicians. NDT Procedure to be certified by ISNT/ ASNT level III qualified personnel.
5. Make of the outsourced items should be as per approved PLL/Bill of Material (BoM) or Naval approved sources
6. In case of bought out items, physical verification / function of item may be undertaken during assembly of the equipment to avoid repetition.
7. Imported items will be accepted against following import documents:
  - (a) Copy of one among Bill of Lading/Shipping Bill/ Airway Bill.
  - (b) Invoice by OEM or Country of Origin certificate of the equipment with packing list.
  - (c) Bill of Entry for Warehousing
  - (d) The certificate of Conformity (CoC) indicating governing specifications and values to which the items are tested along with Original Equipment Manufacturer (OEM) test certificates/ test reports/ Catalogue/ Data sheet.
  - (e) Guarantee/ Warrantee certificate from the supplier/ OEM as per supply order.
8. If Type Testing, has already been done in earlier projects on identical units, it will not be done again & the original reports of earlier tested units will have to be provided for review of Inspection Agency.

 <b>MINISTRY OF DEFENCE (DGQA)</b>	<b>SQAP OF END FITTINGS</b>	<b>PAGE</b>	08
	<b>STANDARD QAP NO.</b> <b>DGQA/DQA(WP)/END</b> <b>FITTINGS/28/2021/REV 0</b>	<b>REV NO</b>	00
<b>DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011</b>		<b>DATE</b>	26 Jul 21

## ABBREVIATIONS

VI	Visual Inspection
DI	Dimensional Inspection
LTC	Lab Test Certificate
STC	Supplier Test Certificate
CC	Conformance/Compliance Certificate
CHP	Customer Hold Point
IR	Inspection Report
NABL	National Accreditation Board For Testing And Calibration of Laboratories
P	Perform
R	Review
W	Witness
TC	Test Certificate
OEM	Original Equipment Manufacturer
DPT	Dye Penetrant Test
MPT	Magnetic Particle Test
SBN	Structure Borne Noise
ABN	Air Borne Noise
FATs	Factory Acceptance Trials
PQR	Procedure Qualification Record
WPS	Welding Procedure Specification
WPQR	Welder Performance Qualification Record
ETT	Environmental Type Test
ASNT	American Society of Non destructive Testing
ISNT	Indian Society of Non destructive Testing

 <b>MINISTRY OF DEFENCE (DGQA)</b>	<b>SQAP OF END FITTINGS</b>	<b>PAGE</b>	09
	<b>STANDARD QAP NO.</b>	<b>REV NO</b>	00
<b>DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011</b>	<b>DGQA/DQA(WP)/END FITTINGS/28/2021/REV 0</b>	<b>DATE</b>	26 Jul 21

## SCOPE

**Scope of Quality Assurance:** This SQAP is meant for QA coverage of End Fittings used in IN Ships and Submarines. The scope of Quality Assurance will cover witness and review of all manufacturing activities during all stages viz. raw material stage inspection including, bought out items, in-process stage inspection and final inspection stage. The scope also covers the review and witness of Type Test of equipment, wherever applicable.

This Standard Quality Assurance Plan contains comprehensive list of inspections and/or trials that is to be applicable for quality assurance of the equipment. In addition, quality assurance of equipment will also be governed by specific conditions laid down in SOTRs and 'Approved Drawings'. The inspections/ trials must be contemporary to latest technology/ techniques available in the industry at the time of placement of orders

The following quality assurance activities will be carried out during the quality assurance of equipment:

- (a) Visual Inspection.
- (b) Dimensional Inspection.
- (c) Review of Lab Test Certificates.
- (d) Witness of in-house Lab Testing, if applicable.
- (e) Witness of Non-destructive testing viz. UT, RT, DPT & MPT
- (f) Review of draft documentation and witness/ stamping of final documentation, as applicable.
- (g) Issue of CHP clearance.
- (h) Issue of I-Note/ Form-IV or Dispatch Clearance as applicable.

	MINISTRY OF DEFENCE (DGQA)	SQAP OF END FITTINGS	PAGE	10
	DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/END FITTINGS/28/2021/REV 0	REV NO	00
			DATE	26 Jul 21

## SYSTEM DESCRIPTION

End Fittings or On Line Fittings are means of connectivity between given system pipes of similar or dissimilar dimensions and connectivity between system pipes and system components. These End Fittings are used for providing connectivity between system pipes and other equipment in the system which could be valves, reducers, pressure/ temperature sensors, cooling pumps, compressors etc. The fittings offer easy dismantling of system components and disconnections of system pipes to facilitate removal/ installation of other equipment.

### Identification of End Fittings:

Each fitting is identified by a part No and its description. The item description, describes the basic shape, diameter and the pressure rating of the fitting eg part No 522-35-1243-01, having description "T-piece Dy-15, PY-400" means, this fitting is used for joining three pipes of ID 15 mm and working pressure of 400 Kg/ cm<sup>2</sup>. The End Fittings are categorized in following groups:-

- (a) T/ Three Way Piece - (21 sizes)
- (b) Cross/ Four Way Plate – (08 sizes)
- (c) Conical Pipe Adapter – (09 sizes)
- (d) Branch Unions – (20 sizes)
- (e) Intermediate Unions – (06 sizes)
- (f) Adapters/ Adapter Couplings - (14 sizes)
- (g) Reducers – (04 sizes)
- (h) Additional Union Butt – (28 sizes)
- (i) Screw in Coupling – (05 sizes)
- (k) Miscellaneous Fittings, include L-piece/ Elbow , Collar/ Flange - (08 Types)

	MINISTRY OF DEFENCE (DGQA)	SQAP OF END FITTINGS	PAGE	11
	DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/END FITTINGS/28/2021/REV 0	REV NO	00
			DATE	26 Jul 21

## STANDARD QUALITY ASSURANCE PLAN

### Part - I: General Information

1. The following generic information must generally be indicated on each QAP as its identity:-

- (a) Equipment Name
- (b) Equipment Technical Details (as applicable)
- (c) Purchase Order Reference
- (d) Sub/Sub-Sub Orders reference (as applicable)
- (e) Name of Main Indenter/ Ordering Authority
- (f) Name of end user
- (g) Name of Firm / Manufacturer
- (h) SOTRs Reference
- (i) Yard No./ Name of Ship where to be fitted (if available)/End User
- (k) References of relevant Drawings
- (l) QAP No. & Date (as indicated by the firm)
- (m) Contractual Delivery Date
- (n) Inspection Authority
- (p) Inspection Agency
- (q) Quantity (as applicable)

	MINISTRY OF DEFENCE (DGQA)	SQAP OF END FITTINGS	PAGE	12
DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/END FITTINGS/28/2021/REV 0	REV NO	00	

## STANDARD QUALITY ASSURANCE PLAN

### Part - II:

Standard QAP of End Fittings

Appendix "A"

## STANDARD QUALITY ASSURANCE PLAN FOR END FITTINGS

SL. NO	MATERIAL/ COMPONENT/ DRG.NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	AGENCIES		REMARKS		
							FIRM	QAE			
<b>1.00 DRAWINGS/DOCUMENTS OF ASSEMBLY/ SUB ASSEMBLIES</b>											
1.01	Drawings & Documents	Approved Drawings & Documents	100%	PO, TSP, SOTR, TNC Minutes, Approved Drawings	PO, TSP, SOTR, TNC Minutes and Approved "Drawings"	PO, TSP, SOTR, TNC Minutes	P	R	As per the Quality Assurance document – "QAD-01" uploaded in DGQA website "dgqadefence.gov.in".		
1.02	Type Test Report	Availability and Verification	One/ Size/Type	PO	Type Test Plan/ SOTR	Type Test Report	P	R	(a) Type Test is to be undertaken only if specified in the PO.  (b) In case the item has not been Type Tested in the past/ reports of Type Test is not held, then Type Test would need to be undertaken as per approved Type Test Plan/ SOTR only whenever PO specifies the same.		
<b>2.00 RAW MATERIALS INSPECTION/ IDENTIFICATION</b>											
2.01	Input Raw Materials (Rolled/ Extruded/ Forged Bars)	Raw Material Identification	100%	Approved Drawings, Specification and SOTR	Approved Drawings, Specification and SOTR	IR	-	W	CHP UT to be performed by ASNT/ ISNT level II/III personnel.		
		Chemical & Mechanical	01/ size/ heat			MTC/STC/TC	P	R			
		UT	100%			IR	P	W			
2.02	* End Fittings (before machining)	Flow Lines for forgings	01/ size /type/heat			NABL TC	P	R	Review of forging process if End Fittings are made by forging. Firm to submit forging process details for QA review.		
		Heat Treatment (HT) and Stress relieving (if applicable/ required)	100%			IR			Samples to be identified and sealed by QA Reps. Samples for mechanical tests to be drawn after heat treatment (wherever applicable).		
		Chemical, Mechanical tests	01 per size/type /heat			NABL TC			HT chart (wherever applicable) to be submitted.		
		Micro Test (Grain Size, Inclusion Rating)	01/ heat				CHP		Micro Test and IGC are applicable if requirement is specified in relevant material specification/ standard/ approved drawing/ SOTR.		
		Inter Granular Corrosion (IGC) Test									

SL.	COMPONENT/ DR.G.NO/	MATERIAL	CHARACTERISTIC/	TYPE OF CHECK	QUANTITY	REFERENCE	DOCUMENTS	ACCEPTANCE FORMATS	AGENCIES	FIRM	QAE	REMARKS
3.00	STAGE INSPECTION/ IN-PROCESS INSPECTION		UT/ RT	100%				IR/TC		P	W	UT to be undertaken by ISNT/ASNT level II/III. RT is applicable when UT cannot be performed for some reason. UT/RT procedure is to be certified by ISNT/ASNT Level III.
3.01	PRE REQUISITE TO FINAL INSPECTION		Visual Inspection	As per Approved	Approved	Surface Drawing/ Drawings, and outer)	Dimensions/ Drawings, SOTR	SOTR	STC	P	R	Compliance Matrix/ Certificate along with End Fitings (After Machining)
4.00	FINAL INSPECTION		Type Test	Cyclic Test (6000 cycles) at working pressure	One/	Purchase order	Type Test Plan/ Size/Type	Type Test Report	P	W		(a) Type Test is to be undertaken only if specified in the PO. (b) In case the item has not been Type Tested in the past reports of Type Test is not held, then Type Test would need to be undertaken as per Approved Type Test Plan/ SOTR only whenever PO is not held, then Type Test would need to be undertaken as per Approved Type Test Plan/ SOTR only whenever PO specifies the same.
4.01			Type Test	Cyclic Test (6000 cycles) at working pressure	One/	Purchase order	Type Test Plan/ Size/Type	Type Test Report	P	W		
5.00	FINAL INSPECTION		Visual Inspection	100%								
5.01	Inspection of finished fittings		CHP	LPT/MPi to be done post Pressure Test								
			Test Pressure as per approved drawings or 1.5 times working pressure (if test pressure not mentioned in the approved drawings). Pressure test duration 05 minutes or as mentioned in drawings.	IS : 2500								
			Surface Finish (inner & outer)	Dimensions/ Check								
			LPT/MPi	100%								
			Pressure Test	100%								
			IR									
			Approved Drawings/ SOTR and PO									
			Where in									
			Where in									
			TS : Observed Tensile Strength									
			D : Outside Diameter									
			T : Wall Thickness									
			Chemical Test	01/size/type/lot								
			Weight	10%								
			Chemical testing from finished End fittings at the discretion of QAE.									

## STANDARD QUALITY ASSURANCE PLAN FOR END FITTINGS

SL. NO	MATERIAL/ COMPONENT/ DRG.NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	AGENCIES	REMARKS	
								FIRM	QAE
		Marking	100%						All End Fittings to be marked with name of Mfg, Part No and working pressure, material grade etc on visible part of End Fittings / attach identification tally/ label to each fitting .
		Packing	100%						
		Preservation	100%						

**Note \*:-**

- (a) Test(s) may vary depending upon the raw material and manufacturing process of End Fittings e.g. flow lines determination is applicable for end fittings made by forging or for End Fittings machined from forged bars.
- (b) UT/RT (Para 2.02) are not applicable to End Fittings machined straight from extruded/ forged input bars and End Fittings not subjected to any heat treatment. RT is to be performed only when UT cannot be performed for any reason.
- (c) Micro Test and Inter Granular Corrosion (IGC) are applicable, if requirement is specified in relevant material specification/ standard/ approved drawing / SOTR.
- (d) If forged End Fittings dimensions are inadequate for mechanical tests (tensile and impact tests) then samples for the same tests should be made from separately forged test piece(S). In such cases, test piece(S) should be forged to a diameter not less than the largest diameter in each size of finished end fitting (sample for each size of end fitting is required). The forged test pieces should be heat treated along with the forged end fittings before machining.
- (e) All NDTs are to be performed as per the NDT procedure certified by ISNT/ASNT level III personnel.

**General Instructions:**

1. End Fittings may vary from design to design therefore only applicable components details to be incorporated in the drawings.
2. Original documents to be presented for verification during inspection.

**Legends:**

P-Performed, R-Review, V-Verification, W-Witness, CHP-Customer Hold Point, STC- Supplier Test Certificate , IR-Inspection Report, TC-Test-Certificate

