



MINISTRY OF DEFENCE (DGQA)

STANDARD QUALITY ASSURANCE PLAN

FORGED BAR FOR RUDDER AT TRAILING EDGE AND ASSOCIATED FORGED PIECES

Standard Quality Assurance Plan covers the technical requirements for providing Quality Assurance cover to Forged Bar for Rudder at Trailing Edge and Associated Forged Pieces.

**STANDARD QAP NO. DGQA/DQA (WP)/FORGED BAR/13/2018/REV-0
01 AUG 2018**

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ISSUING AUTHORITY

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RECORD OF AMENDMENTS

Sl. No.	Date of Amendment	Amendments	Authority	Remarks

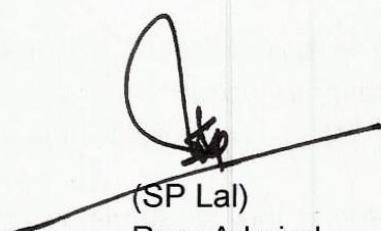
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**STANDARD QAP NO.
DGQA/DQA(WP)/FORGED BAR/13/2018/REV-0
01 AUG 2018**



(SP Lal)
Rear Admiral
ADGQA (WP)

Promulgated by:-

**DIRECTORATE OF QUALITY ASSURANCE (WARSHIP PROJECT)
MINISTRY OF DEFENCE (DGQA)
'H' BLOCK, NIRMAN BHAWAN PO
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CONDITIONS OF RELEASE

1. This Standard Quality Assurance Plan (SQAP) has been formulated for reference of the Order Placement Agencies, Inspection Authority, Inspection Agencies and the Industry. No alteration is to be made to this SQAP except by the issue of authorised amendment by DQA (WP).
2. It is to be applied, as required, for Quality Assurance during various stages of manufacture of Forged Bar for Rudder at trailing edge and Associated Pieces for *IN* Ships.
3. The website <http://www.dgqa defence.gov.in> may also be referred for other QA requirements.
4. The SQAP has been prepared with reference to earlier approved QAPs, QA requirements specified in the latest SOTR of Rudder Forgings and decisions made during the collegiate meeting held at DQA(WP) with OEM and representatives of the concerned Production Directorate of the *IN*. Any user of this SQAP 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. The specifications and standards laid out in the SQAP are indicative only. The specifications / parameters and standards given in the Technical Specifications (TSP) / MoM of TNC / Approved drawings will be final and binding.
7. When this SQAP 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 in itself confer immunity from legal obligations.
8. 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
NEW DELHI - 110 011**

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STANDARDS INVOKED

<u>SI. No.</u>	<u>Specification No.</u>	<u>Description</u>
1	OCT5.9125-84	Russian Shipbuilding Standard
2	NES 729	NDT
3	NES 736 Part 2	Requirement of Quality Steel-Forging
4	ISO 6892-1:2009	Tensile Testing
5	EN ISO 148-1:2010	Impact Testing at -40°C
6	EN ISO 6506-1:2005	Hardness testing
7	BS 6072	Surface Inspection
8	BS 6443	Surface Inspection
9	ASTM E 350-2	Spectrometric Chemical analysis
10	ASTM E 112-13	Macro Analysis
11	ASTM 8216	Heat Treatment
12	NCD1435 Issue2	Painting

Note:- The Standards given are indicative only. The specifications / parameters given in the Technical Specifications (TSP) / MoM of TNC / Approved drawings will be final and binding

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SPECIFIC REQUIREMENTS

1. All QA requirements including approval of Drawings and QAP is to be in conformance with the conditions stipulated in DQA(WP) document QAD-01 R01 available at DGQA website <http://www.dgqadefence.gov.in> .
2. Testing of physical and chemical properties has to be done by NABL accredited lab. (Including firm's NABL accredited lab).
- 3 Non-Destructive Testing is to be carried out by ISNT/ ASNT Level II or III qualified technician.
4. All forgings are to undergo UT for soundness and integrity checks.
5. Imported items will be accepted against following import documents:-
 - (a) Bill of Lading / Shipping Bill / Airway Bill.
 - (b) Invoice by OEM or Country of Origin Certificate with Packing List.
 - (c) Bill for entry to warehousing.
 - (d) OEM Confirmation Certificate.
 - (e) Firm's Guarantee certificate as per SOs.

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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
V	Verification
W	Witness
TC	Test Certificate
OEM	Original Equipment Manufacturer
DPT	Dye Penetrant Test
MPT	Magnetic Particle Test
MTC	Material Test Certificate
UT	Ultrasonic Test
RT	Radiography Test
PQR	Procedure Qualification Record
WPS	Welding Procedure Specification
WPQ	Welder Performance Qualification
ASNT	American Society of Non-Destructive Testing
ISNT	Indian Society of Non-Destructive Testing

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SCOPE

1. **Scope of Quality Assurance.** The scope of Quality Assurance will cover witness and review of all manufacturing activities during all stages viz. Raw Material Stage, In-process Stage and Final Stage.
2. The 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
3. 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 / Supplier Test Certificates / Compliance Certificates/Import documents.
 - (d) Witness of in-house Lab Testing, if applicable.
 - (e) Witness of Non-destructive Testing viz. UT, DPT & MPT.
 - (f) Review of Heat Treatment Charts.
 - (g) Review of Draft documentation and witness / stamping of final documentation, as applicable.
 - (h) Issue of CHP clearance.
 - (j) Issue of Dispatch Clearance or Issue of Form-IV, as applicable.

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ITEM DESCRIPTION

Forged Bar for Rudder at Trailing Edge and Associated Pieces

1. The Forged Bar for Rudder at Trailing Edge and Associated Forged Pieces are together called as 'Set of Rudder forgings'. One set of rudder forgings mainly consist of the following:-

- (a) Two (2) forged bar for rudder at trailing edge per ship.
- (b) Two (2) forged pieces above root cord in hull appendage per ship.
- (c) Two (2) forged pieces at tip cord in forward end per ship.

2. The material used for the forgings is Steel of Grade 08 GDNF of SC40. The chemical composition of the material is appended below.

Fraction of Total Mass of Elements %								
Not More Than					Range			
C	Si	Cr	S	P	Mn	Ni	Cu	V
0.1	0.15 - 0.4	0.3	0.02	0.02	0.8 - 1.2	1.15 - 1.55	0.8 - 1.2	0.08 - 0.12

3. Generally, 0.8 to 1.0 kg of Aluminium per Ton of molten metal is added into the above material

4. The mechanical properties of the set of Rudder forgings should comply to below mentioned values.

Sl. No	Property	Min Value / Range
1.	Yield Point	392 MPa
2.	Ultimate Strength	490 MPa
3.	Elongation	20%
4.	Reduction of Area	45%
5.	Impact Strength at - 40°C	40 J/cm ²
6.	Surface Hardness	1558 0 1882 MPa
7.	Imprint Diameter for Hardness Test	4.7 to 4.3 mm

Note:- The details given are indicative only. The specifications / parameters given in the Technical Specifications (TSP) / MoM of TNC / Approved drawings will be final and binding.

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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 per PO)

Part - II. Technical Inspection / Trials

Standard QAP of Forged Bar for Rudder at Trailing Edge and Associated Pieces	Appendix "A"
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STANDARD QUALITY ASSURANCE PLAN FOR FORGED BAR FOR RUDDER AT TRAILING EDGE & ASSOCIATED PIECES

SL. NO.	MATERIAL / COMPONENT / DRG.NO / QUALITY ACTIVITY	QTY AS PER P.O.	CHARACTERISTICS / TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
1.0.0	DRAWINGS / DOCUMENTS VERIFICATION								
1.1.0	Drawings and Documents		(i) Check for availability of approved drawings	100%	PO, SOTR / TSP & TNC Minutes	All approved drawings along with DBM are available	List of approved drawings	CHP for R	
			(ii) Verification of manufacturing drawings	100%		Manufacturing drawings bear complete data; The data is sufficient for production and stage inspections	List of approved drawings	CHP for R	
2.0.0	MATERIAL INSPECTION								
2.1.0	Patterns / Templates, as applicable as per SOTR/TSP & TNC Minutes		Visual Inspection and Dimensional Inspection	100%	SOTR / TSP, TNC Minutes, Approved Drawings, Manufacturing drawings	Patterns meet the requirement of approved manufacturing drawings	IR	W	Final approval for manufacture will be given by QAE
2.2.0	Raw Material / Ingot		(i) Material Identification (Heat No) and stamping	100%		Raw material confirm to given specifications	IR	W	Testing to be done at NABL Accredited Lab
			(ii) Chemical analysis (Prior to forging)	One sample per heat / lot		Chemical properties meet the laid down specifications	LTC	CHP for W	
3.0.0	IN -PROCESS INSPECTION								
3.1.0	Set of Rudder Forgings		Forging Witness	100%	SOTR / TSP, TNC Minutes, Approved Drawings, Manufacturing drawings	Compliance to specifications	IR	W	
3.2.0	Set of Rudder Forgings		(i) Visual Inspection using magnification optics as per SOTR / TSP / TNC Minutes	100%		No surface flaws like overlap, shrinkage, blow holes, cold shuts, surface dross, slag etc.	IR	W	

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SL. NO.	MATERIAL / COMPONENT / DRG.NO / QUALITY ACTIVITY	QTY AS PER P.O.	CHARACTERISTICS / TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
			(ii) Dimensional Inspection	100%		Dimensions as per approved manufacturing drawings	IR	R	
			(iii) Heat Treatment	100%		Mode of heat treatment established by manufacturer to achieve required properties, chemical composition & dimensions.	IR	R	
			(iv) Identification & stamping of integral test pieces	100%		Raw material confirm to given specifications	IR	W	Sample to be taken after heat treatment
			(v) Chemical analysis	One sample per forging		Chemical properties of forgings meet the laid down specifications	LTC	CHP for W	Testing to be done at NABL Accredited Lab
			(vi) Mechanical Property Testing • Yield point • Ultimate strength • Elongation • Reduction of Area • Impact strength at temperature - 40 °C • Surface Hardness (Brinell) • Imprint diameter of hardness test	One sample per forging		Mechanical properties confirm to given specifications	LTC	CHP for W	Testing to be done at NABL Accredited Lab
			(vi) Micro & Macro examination	One test strip per	SOTR / TSP, TNC Minutes,	Compliance to specifications	LTC / Metallogr	CHP for W	Testing to be done at NABL

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SL. NO.	MATERIAL / COMPONENT / DRG.NO / QUALITY ACTIVITY	QTY AS PER P.O.	CHARACTERISTICS / TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
				forging	Approved Drawings, Manufacturing drawings		aphs		Accredited Lab
			(vii) Ultrasonic Testing after proof machining	100%		No defects	NDE Report	CHP for W	Testing to be done by ISNT / ASNT Level II or III technician
4.0.0 FINAL INSPECTION									
4.1.0	Set of Rudder Forgings		(i) Visual Inspection and Dimensional Inspection post machining	100%	SOTR / TSP, TNC Minutes, Approved Drawings, Manufacturing drawings	Compliance to specifications	IR	W	
			(ii) Surface finish	100%		No flakes, scaling, cracking, forging together, scabs, sand marks and other defects	IR	W	
			(iii) DP Test	100%		No surface defects (cracks, crack type defects, linear, linear type defects arising from inclusions greater than 3mm in length, pores etc)	NDE Report	CHP for W	Testing to be done by ISNT / ASNT Level II or III technician
			(iv) MPT	100%		No surface / sub surface defects	NDE Report	CHP for W	
4.2.0	Weight Measurement & COG		Weight	100%		Measured weight within tolerance limit	Weight Certificate	W	
4.3.0	Painting		Visual Inspection	100%		Compliance to specifications	IR	W	

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SL. NO.	MATERIAL / COMPONENT / DRG.NO / QUALITY ACTIVITY	QTY AS PER P.O.	CHARACTERISTICS / TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
5.0.0 PRE-REQUISITE FOR ISSUE OF FORM - IV									
5.1.0	Submission of as Built Drawing (If applicable)		Verification	100%	Approved drawings	As built drawings are approved by IHQ MoD(N)	--	R	Drawings are to be stamped by QAE
5.2.0	Identification marking, Packing & Preservation		Visual Inspection	100%	SOTR / TSP, TNC Minutes, Approved Drawings, Manufacturing drawings	Compliance to specifications	IR	W	
5.3.0	Compliance to SOTR		Verification	100%	SOTR	Manufacturing should meet SOTR / TSP, TNC requirements	Compliance Matrix	R	
5.4.0	Guarantee / Warrantee Certificate		Verification	100%	PO, SOTR, TNC Minutes	Compliance to PO, SOTR, TNC Minutes	Certificate	R	
5.5.0	Submission of FORM 4 (I & T Certificate)		Correctness	100%	PO, SOTR, TNC Minutes	Compliance to PO, SOTR, TNC Minutes	FORM-4	P	

NOTE:-

1. Equipment & accessories to be supplied should conform to specifications.
2. Material Testing to be done at NABL accredited Laboratories.
3. NDT procedure to be approved by ASNT / ISNT Level III qualified person based on standards and acceptance criteria specified in SOTR / TSP and performed by ASNT / ISNT Level II / Level III qualified person.
4. The QAP does not apply to items not in the scope of supply of the firm.
5. Inspection of assemblies / sub-assemblies and other items which have not been included in the SQAP but form an important part of the system will also be undertaken.
6. The column 'Quantity as per P.O has been left blank which has to be filled by the firm as per P.O while submitting QAP for approval.