



## **MINISTRY OF DEFENCE (DGQA)**

### **STANDARD QUALITY ASSURANCE PLAN**

### **FOR DC MOTOR**

MOTORS ARE AN INTEGRAL PART OF MODERN WARSHIPS. THEY PROVIDE REQUIRED MOTIVE POWER FOR PROPULSION AND WORKING OF VARIOUS EQUIPMENT FITTED ON BOARD SHIPS AND SUBMARINE. THERE ARE TWO TYPES OF MOTORS VIZ. AC & DC MOTORS OVER A WIDE RANGE OF RATINGS AND FRAME SIZES USED ONBOARD IN SHIPS AND SUBMARINES. THIS SQAP IS FOR ALL DC MOTORS TO BE USED IN THE INDIAN NAVY.


STANDARD QAP NO DGQA/DQA (WP)/DC MOTOR/24/2020/REV 0  
DEC 2020

Total Nos. of Pages: 18

#### **ISSUING AUTHORITY**

DIRECTORATE OF QUALITY ASSURANCE (WARSHIP PROJECT)  
MINISTRY OF DEFENCE (DGQA)  
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## **MINISTRY OF DEFENCE (DGQA)**


### **STANDARD QUALITY ASSURANCE PLAN** **FOR DC MOTOR**

**STANDARD QAP NO  
DGQA/DQA (WP)/DC MOTOR/24/2020/REV 0  
DEC 2020**

  
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ADGQA (WP)/(AOL)

Promulgated by:-

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### **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 Motor (DC Motor) for IN Ships/Submarine .
3. The website <http://www.dggadefence.gov.in> may also be referred for other QA requirements.
4. The Standard QAP has been prepared on the basis of decisions made in Collegiate meeting held at DQA (WP) with leading manufacturers of **DC Motor** and representatives of professional directorate /DEE and **DOI**. 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 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)**  
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**NEW DELHI - 110 011**






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### STANDARDS INVOKED

Standards as mentioned in the EED-57-09, SOTR and approved drawings.


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### **SPECIFIC REQUIREMENTS**

1. Testing of physical and chemical properties has to be done by NABL accredited lab. (Including firm's NABL accredited lab)
2. Make of the Items should be as per approved PIL/Bill of Material (BoM) or Naval approved sources
3. In case of bought out items, physical verification / function of item may be undertaken during assembly of the equipment to avoid repetition.
4. Imported items will be accepted against following import documents:-
  - (a) Bill of Lading.
  - (b) Country of Origin.
  - (c) Shipping Bill/ Air way bill.
  - (d) Bill of Entry.
  - (e) OEM Test Certificate/Quality Assurance Guarantee Certificate.
  - (f) OEM's certificate confirming that spares are tested for fitment on main equipment for which spares are ordered i.e. PAC firm's confirmation certificate.
  - (g) Firm's Guarantee Certificate as per SO. Functional test may be undertaken ,if required, in addition.
5. Ingress protection testing will be as per applicable IP rating.
6. EMI/EMC test and ETT will be done at accredited Government/PSU test centers or NABL accredited labs.
7. If Type Testing, EMI/EMC and ETT have already been done in earlier projects on identical units, it will not be done again & the reports of earlier tested units will have to be provided for review of Inspection Agency.

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### **ABBREVIATIONS**

VI	Visual Inspection
DI	Dimensional Inspection
LTC	Lab Test Certificate
STC	Supplier Test 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
FATs	Factory Acceptance Trials
ETT	Environmental Type Test
EMI	Electro Magnetic Interference
EMC	Electro Magnetic Compatibility
ASNT	American Society of Non destructive Testing





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## SCOPE


**Scope of Quality Assurance:** The scope of Quality Assurance will cover witness and review of all manufacturing activities during various stages of manufacturing. Raw Material, Stage inspections including bought- out items, In-process inspection and final assembly, trials & tests, packing & preservation . The scope also covers the review and witness of Type test of equipment, wherever applicable. Witness and review could also be undertaken from remote locations subject to adequate and required facilities for recording, witnessing from Remote etc. being available with firm and mutually agreed between firm and Inspection Authority/Agency.

The Standard Quality Assurance Plan contains comprehensive list of inspections and/or trials that are 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 and dimensional checks.
- (b) Review of Lab Test Certificates.
- (c) Witness of in-house Lab Testing, if applicable.
- (d) Witness of Non-destructive Testing, as applicable
- (e) Review of ETT, EMI/EMC and ESS reports, in addition to pre ETT inspection and post ETT inspection of Unit, Performance Trials as applicable.
- (f) Review of Draft documentation and witness/Stamping of final documentation, as applicable.
- (g) Issue of CHP clearance.
- (h) Painting, Packing & Preservation.
- (j) Issue of Dispatch Clearance or Issue of Form-IV, as applicable.




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### **SYSTEM DESCRIPTION**

1. The term 'DC Motor' is used to refer to any rotatory electrical machine that converts Direct Current electrical energy into mechanical energy. In normal motoring mode, most electric motors operate through the interaction between an electric motor's magnetic field and winding currents to generate force within the motor. In certain applications, such as in the transportation industry with traction motors, electric motors can operate in both motoring and generating or braking modes to also produce electrical energy from mechanical energy.
2. The DC motors are mainly used for main motors of submarines the auxiliaries onboard Submarines and other under water vessels. The primary advantage of the DC Motor is that it can develop constant torque over a wide speed application. In future the DC Motor may also be used in Electric propelled ships.

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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
  - (j) 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)

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## STANDARD QUALITY ASSURANCE PLAN

### Part – II:

Technical Inspection & Trials in the form of QAP

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# **STANDARD QUALITY ASSURANCE PLAN FOR DC MOTORS**

(Part-II)

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SL. NO	MATERIAL/COMPONENT/ DRG.NO/ QUALITY ACTIVITY	QTY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
1.	<b>DRAWINGS</b>								
1.01	Drawings & documents		GA drawings and detailed bill of material (DBOM)	100%	PO, SOTR, TNC Minutes and EED-57-09 (Which ever is relevant)	Same as reference document	List of approved binding drawings	CHP for R	Binding drawing & Binding data, duly approved by Design authority, Professional & Inspection Authority (or by Command for MO orders) to be verified
2.	<b>MATERIAL INSPECTION</b>								
2.01	(a) SS Shaft (b) Structural Steel for Plate		Physical & Chemical Properties	Sample	(a) BS EN10088-3 2014 (b) IS 2062	Material Grade std. as Per Approved drawings	LTC (NABL Lab)	CHP for R	Sample to be drawn in presence of QA rep
2.02	(a) SS Shaft (b) Structural Steel for Plate		UT	100%	-do-	-do-	Certified by ASNT level -II Personnel	R	
2.03	(a) Stamping (b) Copper Wire		(a) Visual Inspection (b) Verification of dimension, Mechanical, Chemical, Thermal and Electrical properties.	100%	(a) IS 648:2006 (b) IS 13730	-do-	STC	R	

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SL. NO	MATERIAL/COMPONENT/ DRG.NO/ QUALITY ACTIVITY	QTY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
2.04	Carbon Brushes		(a) Dimensional Checks (b) Material Certificates	100%	As per PO/Approved drawings	As per PO/Approved drawings	STC	R	
2.05	Commutator		(a) Dimensional Checks (b) Material Certificates (c) Spin Tests	100%	As per PO/Approved drawings	As per PO/Approved drawings	STC	R	
2.06	Key For (a) Motor Rotor (b) Commutator (c) Fan		(a) Visual Inspection (b) Verification of dimension	100%	As per PO /Approved drawings	As per PO/Approved drawings	STC	R	
2.7	(a) Bearing Make/Type (b) Shaft Seal (c) Misc Items viz. Cable Gland, Cooling Fan and Fan Hub, etc.		(a) Visual Inspection (b) Verification of dimension,	100%	As per PO / Approved drawings	-do-	STC	R	

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# STANDARD QUALITY ASSURANCE PLAN FOR DC MOTOR

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SL. NO	MATERIAL/COMPONENT/ DRG.NO/ QUALITY ACTIVITY	QTY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
3.	STAGE INSPECTION								
3.01	Rotor & Stator		(a) Visual Inspection/ Dimensional Inspection (b) Calculation Of Air GAP	100%	Approved Drawings	Approved Drawings	Inspection Report/STC	W	If the Motor manufacturers have automatically data logging machine for rotor balancing then reports are to be as "Review" otherwise rotor balancing is to be as "Witness" by QAE rep at Firm's.
3.02	Motor BOM		Visual Inspection/ Dimensional Inspection						
3.03	Rotor		Balancing						
4.	TEST & TRIALS								
4.01	Type Tests		(a) Insulation Resistance (ambient & hot) (b) Winding Resistance (Hot & Cold) (c) Temperature rise (85°C) (Sr. 06 of foot note for insulation Class 'H') (d) Load Test at 100%, 75% and 50% , Determine efficiency((at all loads including 125% load) (e) Starting Torque(>1.5 times of full load torque) (f) Enclosure Protection Tests for motor and terminal Box- As per (g) Over Speed at 115% for 15 minutes (h) Momentary Over-Load Test at 110% for 15 Sec. (i) Thermister Resistance (Ambient, Cold & Hot) (k) IP( As applicable) (l) Direction of Rotation (m) Speed Range Test( at voltage 175V,220V and 320V) (n) Earth Bonding	One Motor of each Frame size per Lot	Approved Drawings	EED-57-09 and Approved Drawing	Type Test Report	W	-Starting Torque and Locked Rotor test are to be done for motor rating less than 50 KW. 50 KW and above, these two tests are to be carried out during IFAT.

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# STANDARD QUALITY ASSURANCE PLAN FOR DC MOTOR

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SL. NO	MATERIAL/COMPONENT/ DRG.NO/ QUALITY ACTIVITY	QTY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
4.02	Routine Tests		(a) Winding Resistance (Hot & Cold) (b) Thermistor resistance test (ambient, Cold, & Hot) (c) No Load Test (d) Over Speed Test At 115 % for 15 minutes (e) locked Rotor Test (>1.5 times of full load Torque (f) Starting Torque(>1.5 times of full load torque) (g) Space Heater (Where Ever Applicable) (h) Direction of Rotation (i) Bearing check/-SPM	All Balance Motors	Approved Drawings	EED-57-09 and Approved Drawing	Routine Test Report	W	-EED-57-09 and its subsequent revision is to be compiled. -Starting Torque and Locked Rotor test are to be done for motor rating less than 50 KW. 50 KW and above, these two tests are to be carried out during IFAT
4.03	General For All Motors		(a) Insulation Resistance (ambient & hot) (b) High voltage test (c) Bearing check/-SPM (d) Dimensional check (e) Weight checks (f) Terminal / name plate check (g) Earth bonding. (h) Space heater (wherever applicable) (i) Air Gap Calculation	All Motors	Approved Drawings	EED-57-09 and Approved Drawing	Routine Test Report	W	

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# STANDARD QUALITY ASSURANCE PLAN FOR DC MOTOR

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SL. NO	MATERIAL/COMPONENT/ DRG.NO/ QUALITY ACTIVITY	QTY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
4.04	Integration Trial		(a) Protection Mechanism to be checked	One Motor of each Type with Starter/Control Panel	IHQ Mod(N)/DEE Policy EE/01/1-67/Power-18 dt 15 Jul 10	IHQ Mod(N)/DEE Policy EE/01/1-67/Power-18 dt 15 Jul 10	IR	W	Starter motor integration trials to be conducted at motor manufacturer place as per IHQ policy EE/01/1-67/Power-18 dt 15 Jul 10.
									<u>Only for new construction ships.</u>
4.05	Environmental Type Test & EMI/EMC reports		Availability & Verification	Prototype sample	PO & SOTR/TNC Minutes/JSS 55555 /and Approved drawings used during type test for similar Motor	PO & SOTR/TNC Minutes/JSS 55555 /and	Type test /ETT/EMI/ EMC reports	CHP for R	-EMI/EMC Acceptance Test Plan duly vetted by NEC Mumbai.  -Reports be reviewed if Frame Size is already tested for ETT & EMI/EMC.
5	<b>DOCUMENTATION</b>								
5.01	Documents for Operation, Maintenance and Repair		Availability & Verification	100%	PO	PO	-	CHP for R	-All Documentation are to be made as per JSS-0251.  -Documents are to be stored in CD/DVD as IETM format as per EED-P-23



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SL. NO	MATERIAL/COMPONENT/ DRG.NO/ QUALITY ACTIVITY	QTY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
<b>6. PAINTING, PACKING &amp; PRESERVATION</b>									
6.01	Painting,		Visual Inspection & DFT	100%	Approved Drawing, SOTR, Paint Plan/DGS 251	Approved Drawing, SOTR/PO	IR	CHP for W	
6.02	Packing		Visual Inspection	100%	Approved Drawing, SOTR/PO	Approved Drawing, SOTR/PO	IR		
6.03	Preservation and Marking		Visual Inspection	100%	Approved Drawing, SOTR/PO	Approved Drawing, SOTR/PO	IR		

NOTE:-

1. Type Test, EMI/EMC and Environmental test in accordance with EED-57-09 are to be carried out after QA agencies, clearance and sealing of equipment. Post ET and EMI/EMC, checks will also be conducted by QA agencies. If Type Testing, EMI/EMC and ETT have already been done in earlier projects on identical units, it will not be done again & the reports of earlier tested units will be provided for review of Inspection Agency. In case of any difficulty/discrepancy in carrying out the above, matter be referred to IHQ Mod(N)/DEE within 10 days of receipt of approved QAP under intimation to HQ DQA(WP).
2. EMI/EMC and ETT test will be done at NABL Lab. In case of non-availability of NABL lab QAE rep should witness.
3. Equipment & Accessories to be supplied should conform to specifications.
4. Starter cum Control Panel is to be procured /manufactured only from Naval approved vendor as mentioned in IHQ Mod(N)/DEE Compendium of Vendors 2015 No. EE-50-30(REV-2) dated 29 Jun 2015.
5. Starting torque (Sl. No 4.01 (e) & 4.02 (f) & locked rotor test (Sl No 4.02(e)) of the SQAP are to be performed for motor rating with less than 50 KW, as part of Type test and Routine tests. For motor rating above 50 KW, these two tests are to be carried out during IFAT as per IHQ Mod(N)/DEE Approved ATP.
6. Endurance, Temperature rise test ( for Insulation Class 'H'), Noise and Vibration test (over all & 1.3 Octave Band levels) are to be performed during IFAT as per IHQ Mod(N)/DEE Approved ATP.

## Legends

CHP	Customer Hold Point-a point beyond which the vendor will not proceed without a written authority from QAO. The process / activity will be inspected by QAO.
R	Review of certificate and records by QAO-a point at which client will review documentation records at an agreed time after completion of activity.
P	Performed By
OEM	Original Equipment Manufacturer
V	Verification
W	Witnessed By
MTC	Material Test Certificate
LTC	Lab Test Certificate
DFT	Dry Film Thickness
	IR
	UT
	ATP
	SOTR
	TNC
	STC
	Supplier's Test Certificate
	Inspection Report
	Ultrasonic Test
	Approved Test Plan
	Statement of Technical Requirement
	Technical Negotiation Committee