MINISTRY OF DEFENCE (DGQA)

STANDARD QUALITY ASSURANCE PLAN

INTEGRATED PLATFORM MANAGEMENT SYSTEM (IPMS)

BY M/s L3 COMMUNICATIONS INDIA PVT.LTD.

STANDARD QAP NO. DGQA/DQA(WP)/IPMS/03/2022/REV 01
DATED 28 JUL 2022

Total Nos. of Pages: 88

ISSUING AUTHORITY

DIRECTORATE OF QUALITY ASSURANCE (WARSHIP PROJECT)
MINISTRY OF DEFENCE (DGQA)
6TH FLOOR 'B' BLOCK, DEFENCE OFFICES COMPLEX
AFRICA AVENUE, SAROJINI NAGAR PO
NEW DELHI - 110 023

RECORD OF AMENDMENTS

Sl. No.	Date of Amendment	Amendments	Authority	Remarks

MINISTRY OF DEFENCE (DGQA)

STANDARD QUALITY ASSURANCE PLAN INTEGRATED PLATEFORM MANAGEMENT SYSTEM (IPMS)

BY M/S L3 COMMUNICATIONS INDIA PVT.LTD.

SQAP NO. DGQA/DQA (WP)/IPMS/03/2022/REV 1 DATED 28 JUL 22

(SN Alamanda)
Rear Admiral
ADGQA (WP)
28 Jul 22

Promulgated by

DIRECTORATE OF QUALITY ASSURANCE (WARSHIP PROJECT)
MINISTRY OF DEFENCE (DGQA)
6TH FLOOR 'B' BLOCK, DEFENCE OFFICES COMPLEX
AFRICA AVENUE, SAROJINI NAGAR PO
NEW DELHI - 110 023

CONDITION 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 IPMS for *IN* Ships.

3. The website ***htpps://www.dgqadefence.gov.in*** may also be referred for other Quality Assurance related inputs.

4. The SQAP has been prepared in consultation with Professional Directorates and Production Directorates of the *IN* and M/s L3 Communications India Pvt. Ltd. Any user of this SQAP within DGQA/ *IN* 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. The specifications and standards laid out in the SQAP are indicative only. The specifications/ parameters and standards given in the Statement of Technical Requirement (SOTR)/ Technical Specifications (TSP)/ MoM of TNC / Approved drawings will be final and binding.

6. DQA(WP) reserves the right to amend or modify the contents of this SQAP without consulting or informing any holder of this document.

7. In case the SQAP is incorporated into contracts, users are responsible for their correct application while complying with contractual and other statutory requirements. Compliance with SQAP does not of itself confer immunity from legal obligations.

8. Enquiries in connection to these requirements may be made from:

DTE OF QUALITY ASSURANCE (WARSHIP PROJECT)
MINISTRY OF DEFENCE (DGQA)
'B' BLOCK, 6TH FLOOR,
DEFENCE OFFICES COMPLEX
AFRICA AVENUE, SAROJINI NAGAR PO
NEW DELHI-110023

CONTENTS

STANDARDS INVOKED

Sl No.	Specification	Description
1	BS 6121/EN 624440-2013	Cable Glands specification
2	DGS 251	Painting specification
3	DME 452	Preparation of the hard copies of documents (manuals & drawings).
4	DEF STAN 61-5	Electrical Power Supply Systems
5	DEF STAN 02-603	Requirements for the policy, design and installation of Fire Detection Systems in ships
6	DOD-STD-2168	Software development standard
7	EED-50-23&NB/0695/ AFDS dated 19 Jan 18	Addressable Fire Detection Systems (*IN* Policy).
8	EE-50-25(R1)&NB/0695/ FWS dated 01 Oct 15	Addressable Flood Alarm System (*IN* Policy)
9	BR 3021	*IN* Shock Manual
10	NSS Gr- I/ II	Requirements for High Impact Shock Tests Based on *IN* Shock Policy, Shipboard Machinery Equipment and systems.
11	ISO 12063, 1987	Classification of degree of protection provided by enclosures of electrical equipment
12	ISO 12207	Software development process
13	IEEE 802.3-2008	Gigabit Ethernet
14	JSS 55555	Environmental test methods for electronic & electrical equipment
15	JSS 0251-01& EED-S-048	Preparation of documents and drawings
16	MIL- STD-461F	EMI/EMC requirement
17	MIL-STD-1474D	Design criteria standard, noise Limits
18	MIL-M-7298C	Documentation for COTS equipment
19	MIL-STD-810G	Environmental engineering consideration and lab tests
20	MIL-S-901D	Shock Tests, H.I. (High Impact); shipboard machinery
21	MIL-HDBK-2036	Preparation of electronic equipment specifications
22	MIL-STD-2036A	General requirements for electronic equipment specifications
23	MIL-HDBK-217F	Reliability prediction for electronic equipment
24	MIL-STD-1472G	Human engineering design criteria for military systems, equipment and facilities
25	MIL-STD-167/1	Mechanical vibration of shipboard equipment
26	MIL-STD-740-2	Structure borne noise measurements and acceptance criteria of shipboard equipment
27	NES 507/737/ 1005	Painting
28	NES-723	Tally & Diagram plates
29	MIL-STD-1474D	Airborne Noise limits

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

ABBREVIATIONS

ABN	Air Borne Noise
AFAS	Automatic Flood Alarm System
AFDS	Addressable Fire Detection System
ASNT	American Society of Non-destructive Testing
ATP	Acceptance Test Plan
BDTS	Battle Damage Control System
CDR	Critical Design Review
CHP	Customer Hold Point
CoC	Certificate of Conformance
COTS	Commercially of the Shelf
CPRO	Controller Procurement
DBOM	Detailed Bill of Material
DE	Diesel Engine
DELCS	Diesel Engine Local Control Station
DI	Dimensional Inspection
DME	Directorate of Marine Engineering
DPRO	Directorate of Procurement
DPT	Dye Penetrant Test
DQA(N)	Directorate of Quality Assurance (Naval)
DQA(WP)	Directorate of Quality Assurance (Warship Project)
EHM	Equipment Health Monitoring
EMC	Electro Magnetic Compatibility
EMI	Electro Magnetic Interference
EOT	Engine Order Telegraph
ESS	Environment Stress Screening
ET	Environmental Testing
FATs	Factory Acceptance Trials
GA	General Arrangement
GT	Gas Turbine
GTLCS	Gas Turbine Local Control Station
HT	Heat Treatment
HW	Hardware
IETM	Interactive Electronic Technical Manual
IFATs	Integrated Factory Acceptance Trials
IIBMS	Interactive Incident Board Management System
IP	Ingress Protection
IPMS	Integrated Platform Management System
IR	Inspection Report
ISNT	Indian Society of Non-destructive Testing
JB	Junction Box
JSG	Joint Services Guide
LOP	Local Operating Panel
LSD	Large Screen Display
LTC	Lab Test Certificate

ABBREVIATIONS

MPT	Magnetic Particle Test
MTC	Material Test Certificate
MCA	Melt Control Analysis
NABL	National Accreditation Board for Testing and Calibration Laboratories
NDT	Non-destructive Testing
OBS	On Board Spare
OEM	Original Equipment Manufacturer
OPA	Order Placing Authority
P	Performed
PAC	Proprietary Article Certificate
PCB	Printed Circuit Board
PCL	Propulsion Control Lever
PDR	Primary Design Review
PIL	Part Identification List
PO	Purchase Order
PQR	Procedure Qualification Record
QA	Quality Assurance
QAE	Quality Assurance Establishment
QAO	Quality Assurance Officer
QAP	Quality Assurance Plan
QAD	Quality Assurance Document
R	Review
RT	Radiography Test
RTU	Remote Terminal Unit
SBN	Structure Borne Noise
SMC	Standard Marine Console
SOTR	Statement of Technical Requirement
STC	Supplier Test Certificate
TB	Terminal Block
TC	Test Certificate
TNC	Technical Negotiation Committee
TSP	Technical Specifications
TT	Type Test
TTR	Type Test Report
UPS	Uninterruptable Power Supply
UT	Ultrasonic Testing
V	Verification
VI	Visual Inspection
W	Witness
WESEE	Weapons & Electronics System Engineering Establishment
WPQ	Welder Performance Qualification
WPS	Welding Procedure Specification

SPECIFIC REQUIREMENTS

1. Testing of physical and chemical properties has to be done by NABL accredited laboratory only (including firm's NABL accredited laboratory). Samples are to be drawn by QAE reps. Three test specimens per batch/ lot/ heat shall be made. Retest to be carried out on two, in case of failure of initial specimen.

2. Testing of 100% sample of sheets to be carried out if OEM marked heat nos./ batch nos. are not available on the raw material sheets. Three test specimens per batch/lot shall be made. Retest to be carried out on two further specimens in the event of failure of initial specimen.

3. Castings are to be poured from ingots and scrap. Only manufacturer's own scrap is permitted. No other scrap is permitted. The ingots for non-ferrous castings are to be poured from virgin metals. All ingots are to be stamped/ embossed/ labeled by the manufacturer with unique cast number. Each batch/ lot of ingot is to be accompanied with results of melt control analysis. Randomly selected samples from ingots shall be forwarded to lab for analysis.

4. The *class* of casting is to be invariably mentioned in the drawing/ DBOM. All castings are to be subjected to RT and/ or UT, as applicable, to qualify the same in accordance with the approved *class* of casting, unless otherwise specified in P.O. & SOTR/ TSP. The extent of RT will be as per the approved drawing. Repairs on castings, if necessary, are to be undertaken only post inspection of the casting defects and clearance of the QA Agency.

5. All forgings are to undergo UT for soundness and integrity checks.

6. Shooting sketch indicating Critical Test Regions and Test Regions are to be submitted prior to testing.

7. The following guidelines are to be followed for inspection of welds:-

   (a) The dimensions of the weld are to be as per established standards, which is to be indicated in the Approved Drawings and QAP.

   (b) The firm is to submit **Weld Procedure Specification** (WPS) and **Process Qualification Record** (PQR) to the Inspection Agencies for approval as per the applicable standards.

   (c) The Inspection agencies should ask for the PQR certificate prior commencement of welding.

   (d) Whenever, welding is to be carried out for critical equipment, the firm shall tack weld the structure/ component and call the Inspecting Agency for inspection. The Inspecting Agency is to ascertain that the preparation has been done in accordance with the specifications and only then approve complete welding.

8. **Qualification of NDT Personnel**.

(a) All NDT procedures are to be performed and/ or sentenced by NDT personnel who have acquired the desired minimum qualification (Level II/ III) through Central Certification Programs conducted by the Certification Bodies like ISNT, ASNT and BINDT. The certification of these personnel should be in-date and verifiable through the websites of the Certification Bodies. Certification of personnel through Employer Based Programs is not to be treated at par with Central Certification Programs.

(b) **Radiography (RT) and Ultrasonic Testing (UT)**.

(i) RT and UT procedures/ technique sheets are to be approved by ISNT Level-III or ASNT Level-III or PCN Level-III or other equivalent Level-III NDT personnel, certified through Central Certification Programs.

(ii) RT and UT are to be performed by ISNT Level-II/ III or ASNT Level II/ III or PCN Level-II/ III or other equivalent Level-II/ III NDT personnel, certified through Central Certification Programs.

(iii) Interpretation/ sentencing of RT and UT reports are to be done by ISNT Level-III or ASNT Level-III or PCN Level-III or other equivalent Level-III NDT personnel, certified through Central Certification Programs.

(c) **Magnetic Particle Testing (MPT) and Dye Penetrant Testing (DPT)**.

(i) MPT and DPT procedures/ technique sheets are to be approved by ISNT Level-III or ASNT Level-III or PCN Level-III or other equivalent Level-III NDT personnel, certified through Central Certification Programs.

(ii) MPT and DPT are to be performed by ISNT Level-II/ III or ASNT Level-II/ III or ASNT (SNT-TC-1A) Level-II/ III or PCN Level-II/ III or other equivalent Level-II/ III certified NDT personnel.

(ii) Interpretation/ sentencing of MPT and DPT reports are to be carried out by ISNT Level-III or ASNT Level-III or PCN Level-III or or other equivalent Level-III NDT personnel, certified through Central Certification Programs, only if there is any ambiguity/ difference of opinion between QA Agency and the supplier.

9. Make of the items should be as per approved PIL/ Detailed Bill of Material (DBOM) or *IN* approved sources.

10. Items/ components classified as imported/ bought-out/ COTS in the SQAP is indicative only. In this regard, the approved GA drawing and DBOM shall be final binding.

11. Bought-out items will be subjected to normal QA inspections as per QAP.

12. 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 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 OEM Test Certificates/ Test Reports/ Catalogue/ Data Sheet.
(e) Guarantee/ Warrantee certificate from the supplier/ OEM as per supply order.
(f) Non-inclusion of Malicious Code Certificate by OEM.

Note:- In case of new induction equipment which are imported in nature, the CoC must indicate the governing standards for Qualification Test and values to which items have been tested.

13. The ESS Test shall be conducted to 100% electronic components/ units/ assemblies as a part of manufacturing process as per DQA(N) policy vide letters 66301/Policy-07/DQA(N)/QA-07 dated 09 Aug 16.

14. Conformal coating of PCBs is to be undertaken as per DQA(N) policy letter DQA(N) letter 580930/DQA/EL dated 17 Feb 14.

15. Burn-in Test is to be undertaken as per DQA(N) policy letter 66301/Policy-10/DQA(N)/QA-10 dated 14 Jun 13.

16. MTC is to be issued by the original manufacturer of the item. Certificate of Conformity (CoC) may be issued by the equipment manufacturer or integrator who has sourced the item for use in the equipment. CoC/ MTC must indicate governing specifications and values to which the item has been tested. The certificate must include copies of test reports.

17. In case of shipyard orders, TTs shall be undertaken if equipment is not Type Tested OR reports are not held. For DPRO/ CPRO orders, TT shall be applicable, only if indicated in PO. TT will be done at Govt/ PSU/ NABL accredited labs. In case suitable Govt/ PSU/ NABL accredited labs are not available, TT are to be done at non-Govt/ non-NABL accredited lab and the tests are to be witnessed by QA reps. Policy on Type Test has been promulgated vide DQA(WP) letter 12575/POLICY/DGQA/WP-TC dated 17 Mar 21 and DQA(N) letter DQAN/SG/1001/Type Test dated 18 Jan 22. Further, policy on issuance of Type Approval Certificate has been promulgated vide DQA(WP) letter 12575/Policy/DGQA/WP-TC dated 11 Oct 21 .

18. If TTs 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.

19. EMI/ EMC plan submitted by the firm is to be vetted by NEC, Mumbai and approved by IHQ MoD(N).

20. Packing material should not contain environmentally hazardous material prohibited by law/ regulation.

21. Post promulgation of this SQAP, separate QAP approval for IPMS is not required. The manufacturer shall be required to submit confirmation to concerned QA Agency and/ or OPA, towards acceptance of SQAP either in totality or with some design specific inclusions and/or exclusions w.r.t. SQAP, if any. The SQAP along with proposed inclusions/ exclusions approved by DQA(WP) shall be deemed as the approved QAP for the particular PO.

SCOPE

The scope of QA includes witness/ review at all stages of manufacturing viz., raw material stage, in-process stage and final stage. The scope also covers witness / review of Type Testing, wherever applicable.

The SQAP contains comprehensive list of inspections and/ or trials that are applicable for QA of the equipment. In addition, QA of the equipment will also be governed by specific conditions laid down in SOTRs and 'Approved Drawings'. The inspections/ tests / trials must be contemporary to latest technology/ techniques available in the industry in India at the time of placement of purchase order.

The QA inspections of IPMS would broadly include following:-

(a) Visual Inspection.
(b) Dimensional Inspection.
(c) Witness of pouring in absence of integral test bar.
(d) Review of Lab Test Certificates.
(e) Witness of in-house Lab Testing, if applicable.
(f) Witness of Non-destructive Testing viz. UT, DPT & MPT.
(g) Review of RT films and reports.
(h) Review of Heat Treatment Charts.
(j) Review of Shock Test and SBN & ABN reports for qualification of Type Test, as applicable.
(k) Verification of ESS Test reports of electronic components/ units/ assemblies.
(l) Burn-in Tests.
(m) Review of software quality checks.
(n) All functional & safety parameter checks.
(p) Issue of CHP clearance.
(r) Review of draft documentation and witness/ stamping of final documentation, as applicable.
(s) Issue of Dispatch Clearance or Issue of I-Note.

SYSTEM DESCRIPTION

1. Integrated Platform Management System (IPMS) is a complex computer based control and monitoring system. It constitutes of electronic hardware connected up by dual redundant ethernet network and control software, designed to provide integrated control and monitoring of various shipboard equipment/ systems. The IPMS would typically comprise of following sub-systems:-

(a) Integrated Machinery Control System – IMCS.

(b) Battle Damage Control System – BDCS.

(c) Automated Fire Detection System – AFDS.

(d) Automated Flood Alarm System – AFAS.

(e) Automated Power Management System – APMS.

(f) Onboard Training System – OBTS.

(g) Propulsion Control System – PCS.

(h) Tank Level Indication System – TLIS.

(j) CCTV System

STANDARD QUALITY ASSURANCE PLAN

Part - I. General Information

The following generic information must generally be provided on each SQAP 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)

Part – II. Technical Inspection/ Trials

Standard QAP Integrated Platform Management System	Appendix "A"

SQAP FOR INTEGRATED PLATFORM MANAGEMENT SYSTEM (IPMS) BY M/s L3 COMMUNICATIONS INDIA PVT LTD

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
1.0.0	**SECTION I: DRAWINGS AND DOCUMENT INSPECTION**							
1.1.0	Approved GA drawing, DBOM, Manufacturing drawing, Minutes of PDR and CDR.	Verification of drawings/ documents	100%	PO, SOTR/ TSP, TNC MoM, PDR MoM & CDR MoM	Availability of approved drawings	List of approved drawings	R	Manufacturing drawing will be liked & vetted with reference to approved GA drawings & DBOM at OEM premises
1.2.0	Type Test/ ET/ EMI/ EMC/ IP test/ ship motion test reports for Consoles, RTUs, WMC, UPS etc. as per PO/SOTR	Availability & Verification	One of each type	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Completion of all Type Tests as per specifications	NABL Lab test reports	R	Refer para 17, Specific Requirements
2.0.0	**SECTION II: RAW MATERIAL INSPECTION (As per approved drawing, including but not limiting to following)**							
2.1.0	**CONSOLE STRUCTURE (SMCs) - MULTI FUNCTION PROPULSION CONTROL CONSOLE, MULTI FUNCTION EOOW CONSOLE, MULTIFUNCTION DA CONSOLE, MULTI FUNCTION ACS CONSOLE, MULTI FUNCTION BDCS CONSOLE, MULTI FUNCTION WALL MOUNT CONSOLE, EHM ENCLOSURE FOR DE & GB, MULTIFUNCTION BRIDGE CONSOLE**							
2.1.1	**Casted Components.** Including but not limited to the following:- Base Plate, Rear Cover, Bull Nose and End Caps	(i) Chemical Analysis of Ingot	100%	TSP/ SOTR, Approved Drawings & DBOM,TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Mill TC/ NABL TC	R	
		(ii) Pouring with integral test bar	100%		Conformity to specifications	IR	R/ W	W if casting is without integral test bar
		(iii) Casting identification & stamping	100%		Conformity to specifications	IR	W	Moulds to be opened in presence of QAE reps
		(iv) Heat Treatment (If applicable)	100%		Conformity to specifications	HT Chart/ Report	R	
		(v) Chemical Composition & Mechanical properties	1 sample per batch/ lot/ heat		Conformity to specifications	NABL TC	R	Refer para1 - Specific Requirements
		(vi) DPT	100%		Conformity to specifications	NDT Report	W	Refer para 8 - Specific Requirements
		(vii) RT/ UT (As applicable)	100% on critical areas/ critical regions		Conformity to specifications	RT Report	CHP for R/ W	W for UT only Refer para 8 - Specific Requirements
2.1.2	**Fabricated Components.** Including but not limited to the following:- Sheets for Panels, Enclosure	(i) Material Identification & Stamping	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM &	Conformity to specifications	IR	W	Refer para 1 - Specific Requirements
		(ii) Chemical Composition & Mechanical Properties	1 sample per batch/lot/heat			NABL TC	CHP for R	

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	& Frames			CDR MoM				
2.2.0	**REMOTE TERMINAL UNIT, BDCS HW FIRE & SALVAGE PUMP CONTROL PANELS, CRITICAL SIGNAL SPLITTER BOXES, INTERACTIVE INCIDENT BOARD MANAGEMENT SYSTEM (IIBMS), WALL MOUNTED HARDWIRED LOCAL CONTROL STATION GT, WALL MOUNTED HARDWIRED LOCAL CONTROL STATION DE, LARGE SCREEN DISPLAY, UNINTERUPTABLE POWER SUPPLY DC, SEALED MAINTAENANCE FREE VRLA BATTERY, UNINTERRUPTABLE POWER SUPPLY 230 V OUT PUT SINGLE PHASE, SEALED MAINTENANCE FREE VRLA BATTERIES, EQUIPMENT HEALTH MONITORING (EHM) & VIBRATION MONITORING SYSTEM, PLEXIGLASS INCIDENT BOARD, ENCLOSURE FOR TANK LEVEL INDICATION (TLI) SYSTEM & ADRESSABLE FLOOD ALARM SYSTEM (AFAS), CCTV SERVER CABINET FOR DIGITAL IR CAMERA**							
2.2.1	Sheets (for Enclosure, Doors, Mounting plate, Frame etc)	(i) Material Identification & Stamping	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	IR	W	Refer para 1 - Specific Requirements
		(ii) Chemical Composition & Mechanical Properties	1 sample per batch/lot/heat			NABL TC	CHP for R	
2.3.0	**MULTI-FUNCTION PROPULSION CONTROL CONSOLE**							
2.3.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) 4 pole relay + Base	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) 2 pole relay							
	(iii) Double deck TB							
	(iv) 4 Cond thru TB							
	(v) Fuse TB							
	(vi) Ground Modular TB							
	(vii) TB 2 diode							
	(viii) Schottky diode							
	(ix) 2 Cond TB 6 - 10 sqmm							
	(x) MCB 2 pole, 10 A							
	(xi) Glass Fuse 3.15 A							
	(xii) Push Button							
	(xiii) Push Button, Alternate							
	(xiv) Guard							
	(xv) 2 Pos Selector							
	(xvi) 3 Pos Selector Mom							
	(xvii) 18 mm round IND + Lens							
	(xviii) Lamp 24 VAC/DC, Single LED White diffuse							
	(xix) 3 cond thru TB							
	(xx) Fan with guard							
	(xxi) Blade Fuse 1 A							
	(xxii) Blade Fuse 5 A							
	(xxiii) Blade Fuse 3 A							
	(xxiv) Blade Fuse 10 A							
	(xxv) MCB 2 pole, 20 A							

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	(xxvi) Fuse TB							
	(xxvii) JANTX diode							
	(xxviii) Eyebolt							
	(xxix) DC to DC Convertor 24VDC							
	(xxx) Din Rails							
	(xxxi) End stop							
	(xxxii) EMI Gasket							
	(xxxiii)Audio Amplifier							
	(xxxiv) Misc Installation Material (Glands, Fasteners etc)							
2.3.2	**BOUGHT-OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Engine speed gauge	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) Lube oil pressure gauge							
	(iii) Fuel admission gauge							
	(iv) Fresh water temperature gauge							
	(v) Main oil pressure gauge							
	(vi) Pitch response gauge							
	(vii) Shaft speed gauge							
	(viii) GT speed gauge							
	(viii) PT speed gauge							
	(ix) GT LO pressure gauge							
	(x) Exhaust temp gauge							
	(xi) GT TIC gauge							
	(xii) EMI Filter							
2.3.3	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Speaker	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) Isolation Shock Mounts							
	(iii) Rugged Computer							
	(iv) Rugged Monitor							
	(v) Keyboard Trackball							
	(vi) EOT Lever SCC							
2.4.0	**MULTI-FUNCTION EOOW CONSOLE**							
2.4.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) 4 pole relay + Base	VI, Verification of documents, Functional	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC	Conformity to specifications	STC/CoC & Calibration	R	Functional checks are to be conducted post

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	(ii) End stop	checks, if applicable as per approved ATP		MoM, Manufacturing Drawings, PDR MoM & CDR MoM		Certificate, if applicable		integration to system
	(iii) Ground Modular TB							
	(iv) Push Button 1NO+1NC, Alternate							
	(v) 3 cond thru TB							
	(vi) Fan with guard							
	(vii) Blade Fuse 1 A							
	(viii) Blade Fuse 5 A							
	(ix) Blade Fuse 3 A							
	(x) Blade Fuse 10 A							
	(xi) MCB 2 pole, 20 A							
	(xii) Fuse TB							
	(xiii) Guard							
	(xiv) JANTX diode							
	(xv) Eyebolt							
	(xvi) DC to DC Convertor 24VDC							
	(xvii) DC to DC Convertor 48VDC							
	(xviii) Misc installation Material (Glands, Fasteners etc.)							
	(ixx) Ethernet Switch							
	(xx) Fiber Optic Module							
	(xxi) Din Rails							
	(xxii) EMI Gasket							
	(xxiii) Audio Amplifier							
2.4.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) EMI Filter	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
2.4.3	**IMPORTED ITEMS**							
	(i) Speaker	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) Rugged Computer							
	(iii) Rugged Monitor							
	(iv) Keyboard Trackball							
	(v) Isolator Shock Mounts							
	(vi) POE Switch							

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
2.5.0	**MULTI-FUNCTION DA CONSOLE**							
2.5.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) 4 pole relay + Base	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) 2 pole relay							
	(iii) Double deck TB							
	(iv) 4 Cond thru TB							
	(v) Fuse TB							
	(vi) Ground Modular TB							
	(vii) TB 2 diode							
	(viii) MCB 2 pole, 10 A							
	(ix) Glass Fuse 3.15 A							
	(x) Push Button							
	(xi) Push Button, Alternate							
	(xii) Guard							
	(xiii) Buzzer							
	(xiv) 2 Pos Selector							
	(xv) 18 mm round IND + Lens							
	(xvi) Lamp 24 VAC/DC, Single LED White diffuse							
	(xvii) 3 cond thru TB							
	(xviii) Fan with guard							
	(xix) Blade Fuse 1 A							
	(xx) Blade Fuse 5 A							
	(xxi) Blade Fuse 3 A							
	(xxii) Blade Fuse 10 A							
	(xxiii) MCB 2 pole, 20 A							
	(xxiv) Fuse TB							
	(xxv) End Stop							
	(xxvi) JANTX diode							
	(xxvii) EMI Gasket							
	(xxviii) Eyebolt							
	(xxix) DC to DC Convertor 24VDC							
	(xxx) DC to DC Convertor 48VDC							
	(xxxi) Misc Installation Material (Glands, Fasteners etc)							
	(xxxii) Din Rails							
	(xxxiii) Audio Amplifier							
	(xxxiv) Ethernet Switch							

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	(xxxv) Fiber Optic Module							
2.5.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) EMI Filter	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) Engine speed gauge							
	(iii) Lube oil pressure gauge							
	(iv) Fresh water temperature gauge							
2.5.3	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Speaker	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) Isolation Shock Mounts							
	(iii) Rugged Computer							
	(iv) Rugged Monitor							
	(v) Keyboard Trackball							
	(vi) POE Switch							
2.6.0	**MULTI-FUNCTION ACS CONSOLE**							
2.6.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) 4 pole relay + Base	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) End stop							
	(iii) Ground Modular TB							
	(iv) Push Button 1NO+1NC, Alternate							
	(v) 3 cond thru TB							
	(vi) Fan with guard							
	(vii) Blade Fuse 1 A							
	(viii) Blade Fuse 5 A							
	(ix) Blade Fuse 3 A							
	(x) Blade Fuse 10 A							
	(xi) MCB 2 pole, 20 A							
	(xii) Fuse TB							
	(xiii) Guard							
	(xiv) JANTX diode							
	(xv) Eyebolt							
	(xvi) DC to DC Convertor 24VDC							
	(xvii) Misc installation Material (Glands, Fasteners etc.)							
	(xviii) Din Rails							
	(ixx) EMI Gasket							
	(xx) Audio Amplifier							

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	(xxi) Ethernet Switch							
	(xxii) Fiber Optic Module							
2.6.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) EMI Filter	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
2.6.3	**IMPORTED ITEMS(As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Speaker (ii) Rugged Computer (iii) Rugged Monitor (iv) Keyboard Trackball (v) Isolator Shock Mounts	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	SOTR/ TNC MoM, TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
2.7.0	**MULTI FUNCTION BDCS CONSOLE**							
2.7.1	**COTS ITEMS(As per approved drawing & DBOM, including but not limiting to following)**							
	(i) 4 pole relay + Base (ii) 2 pole relay (iii) Double deck TB (iv) 4 Cond thru TB (v) Fuse TB (vi) Signal Splitter (vii)Ground Modular TB (viii) TB 2 diode (ix) Schottky Diode (x) 2 cond TB 6 - 10 sqmm (xi) MCB 2 pole, 10 A (xii) Glass Fuse 3.15 A (xiii) Glass Fuse 0.5 A (xiv) Push Button (xv) Push Button, Alternate (xvi) Guard (xvii) 2 Pos Selector (xviii) 3 Pos Selector (xix) 18 mm round IND + Lens (xx) Lamp 24 VAC/DC, Single LED White diffuse (xxi) 3 cond thru TB (xxii) Fan with guard	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC& Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	(xxiii) Blade Fuse 1 A							
	(xxiv) Blade Fuse 5 A							
	(xxv) Blade Fuse 3 A							
	(xxvi) Blade Fuse 10 A							
	(xxvii) MCB 2 pole, 20 A							
	(xxviii) Fuse TB							
	(xxix) Guard							
	(xxx) JANTX diode							
	(xxxi) Eyebolt							
	(xxxii) EMI Gasket							
	(xxxiii) DC to DC Convertor 24VDC							
	(xxxiv) Misc Installation Material (Glands, Fasteners etc)							
	(xxxv) Din Rails							
	(xxxvi) Audio Amplifier							
2.7.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) EMI Filter	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC& Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) Firemain Pressure Gauge							
	(iii) Salvage Pressure Gauge							
2.7.3	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Speaker	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) Rugged Computer							
	(iii) Rugged Monitor							
	(iv) Keyboard Trackball							
	(v) Isolation Shock Mounts							
2.8.0	**MULTI FUNCTION WALL MOUNT CONSOLE**							
2.8.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) 4 pole relay + Base	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) Fuse TB							
	(iii) Ground Modular TB							
	(iv) 3 cond thru TB							
	(v) Fan with guard							
	(vi) Blade Fuse 1 A							
	(vii) Blade Fuse 5 A							
	(viii) Blade Fuse 3 A							
	(ix) Blade Fuse 10 A							

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	(x) MCB 2 pole, 20 A							
	(xi) End Stop							
	(xii) Eye Bolt							
	(xiii) EMI Gasket							
	(xiv) DC to DC Convertor 24VDC							
	(xv) POE Switch							
	(xvi) DC to DC Convertor 48VDC							
	(xvii) Misc installation Material (Glands, Fasteners etc.)							
	(xviii) Din Rails							
	(xix) Audio Amplifier							
2.8.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) EMI Filter	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
2.8.3	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Speaker	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) Ethernet Switch							
	(iii) Fiber Optic Module							
	(ii) Rugged Computer							
	(iii) Rugged Monitor							
	(iv) Keyboard Trackball							
	(v) Isolator Shock Mounts							
2.9.0	**EHM ENCLOSURE FOR DE & GB**							
2.9.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Eyebolt	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
	(ii) Misc. installation Material (Glands, Fasteners etc).							
2.9.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) EMI Filter	VI, Verification of documents, Functional checks, if applicable as	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing	Conformity to specifications	STC/CoC & Calibration Certificate,	R	Functional checks are to be conducted post integration to system
	(ii) EMI Gasket							

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	(iii) Audio Amplifier	per approved ATP		Drawings, PDR MoM& CDR MoM		if applicable		
2.9.3	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Speaker (ii) Rugged Computer (iii) Rugged Monitor (iv) Keyboard Trackball (v) Isolator Shock Mounts	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
2.10.0	**MULTI FUNCTION BRIDGE CONSOLE**							
2.10.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) 4 pole relay + Base (ii) End stop (iii) DC to DC Convertor 24VDC (iv) Ground Modular TB (v) Push Button Alternate (vi) 3 cond thru TB (vii) Fan with guard (viii) Blade Fuse 1 A (ix) Blade Fuse 5 A (x) Blade Fuse 3 A (xi) Blade Fuse 10 A (xii) MCB 2 pole, 20 A (xiii) Fuse TB (xiv) Guard (xv) JANTX diode (xvi) Eyebolt (xvii) Misc installation Material (Glands, Fasteners etcs) (xviii) Din Rails (xix) EMI Gasket	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
2.10.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) EMI Filter	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
2.10.3	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Speaker	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) Rugged Computer							
	(iii) Rugged Monitor							
	(iv) Keyboard Trackball							
	(v) Isolator Shock Mounts							
2.11.0	**REMOTE TERMINAL UNIT (RTU)**							
2.11.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Terminal Blocks, Din Rail MDL (50F) VAI	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) Terminal Blocks, Din Rail MDL (50M) (VDOP & VDI)							
	(iii) Terminal Blocks, Din Rail MDL (37M) (VAO, COMM)							
	(iv) Circuit Breaker, 20A 2 Poles							
	(v) Diode, Rectifier, Power, Ultrafast, CR1							
	(vi)Fuse Terminal Block							
	(vii) Terminal Block, 3-Cond Thru							
	(viii) Terminal Block, Ground							
	(ix) Din Rail Capacitor Module							
	(x) Diode							
	(xi) EMI Gasket							
	(xii) Signal Splitter							
	(xiii) Relay Module, 24VAC-DC Input, Dpdt							
	(xiv) Eyebolt							
	(xv) Misc Installation Material (Glands, Fasteners etc)							
	(xvi) Din Rails							
2.11.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Cable Assembly, for VDOP(J1), VDI(J1,J2)	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) Cable Assembly, VDOP Power							
	(iii) Cable Assembly, VAI (J1,J2)							
	(iv) Cable Assembly, VAO							

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	(v) Cable Assembly Serial Link USB Cable							
	(vi) Power Filter, EMI, 20A, 50							
	(vii) Fan Assembly 19IN Rack Mount							
	(viii) 16 Slot Chassis							
	(ix) Serial Link Adapter							
	(x) Cable Assembly							
2.11.3	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) VDMC CARD	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) CCA VDOP-24							
	(iii) CCA VDI-48							
	(iv) CCA VAI-48							
	(v) CCA VAO-8							
	(vi) Slot Bypass Board							
	(vii) Ethernet Switch							
	(viii) Fiber Optic Module (Sfp Module)							
	(ix) Isolator Shock Mount							
	(x) 2*8 Slots VME Chassis							
2.12.0	**BDCS HW FIRE & SALVAGE PUMP CONTROL PANELS**							
2.12.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) 4 pole relay + Base	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) 2 Pole Relay							
	(iii) Double deck TB							
	(iv) 4 cond thru TB							
	(v) Fuse TB							
	(vi) Signal Splitter							
	(vii) Ground Moduler TB							
	(viii) TB 2 diode							
	(ix) Schottky Diode							
	(x) 2 cond TB 6 – 10 sqmm							
	(xi) MCB 2 pole, 10 A							
	(xii) Glass Fuse 3 A							
	(xiii) Glass Fuse 0.5 A							
	(xiv) Push Button							
	(xv) 2 Pos Selector							
	(xvi) 3 Pos Selector							
	(xvii) 18 mm round IND + Lens							
	(xviii) End stop							

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	(xix) Lamp 24 VAC/DC, Single LED White diffuse							
	(xx) Eyebolt							
	(xxi) EMI Gasket							
	(xxii) Misc installation material (Glands, Fasteners etc)							
	(xxiii) Din Rails							
2.12.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Firemain pressure gauge	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) Salvage pressure gauge							
2.12.3	**IMPORTED ITEMS(As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Isolator Shock Mounts	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
2.13.0	**CRITICAL SIGNAL SPLITTER BOXES**							
2.13.1	**COTS ITEMS(As per approved drawing & DBOM, including but not limiting to following)**							
	(i) 2 pole relay	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) End stop							
	(iii) Double deck TB							
	(iv) End cover double deck TB							
	(v) Partition plate double deck TB							
	(v) Ground Modular TB							
	(vii) Ground Modular TB end plate							
	(viii) Eyebolt							
	(ix) EMI gasket							
	(x) Misc installation Material (Glands, Fasteners ect)							
	(xi) Din Rails							
2.13.2	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Isolator Shock Mounts	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM &	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
				CDR MoM				to be conducted post integration to system
2.14.0	**INTERACTIVE INCIDENT BOARD MANAGEMENT SYSTEM (IIBMS)**							
2.14.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Eyebolt	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
2.14.2	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) 55 inch large Screen Touch Monitor	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) 21 inch Touch screen Monitor							
	(iii) Computer for IIBMS							
	(iv) Isolator Shock mount							
2.15.0	**WALL MOUNTED HARDWIRED LOCAL CONTROL STATION GT**							
2.15.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) 4 pole relay + Base	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) 2 Pole Relay							
	(iii) Double deck TB							
	(iv) 4 cond thru TB							
	(v) Fuse TB							
	(vi) Signal Splitter							
	(vii) Ground Moduler TB							
	(viii) TB 2 diode							
	(ix) Schottky Diode							
	(x) 2 cond TB 6 - 10 sq mm							
	(xi) MCB 2 pole, 10 A							
	(xii) Glass Fuse 3.15 A							
	(xiii) Glass Fuse 0.5 A							
	(xiv) Push Button							
	(xv) 2 Pos Selector							
	(xvi) 3 Pos Selector							
	(xvii) 18 mm round IND + Lens							
	(xviii) Lamp 24 VAC/DC, Single LED White diffuse							
	(ixx) End stop							

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	(xx) Eyebolt							
	(xxi) EMI Gasket							
	(xxii) Misc installation Material (Glands, Fasteners etcs)							
	(xxiii) Din Rails							
	(xxiv) Guard 51-925							
	(xxv) Push Button Alternator							
2.15.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) GT Speed (72 X 72)	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) PT Speed (72 X 72)							
	(iii) GT LO Pressure Gauge (48 X 48)							
	(iv) Exhaust Temp Gauge (48 X 48)							
2.15.3	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Engine Room Repeater	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements
	(ii) Horn and Strobe							
	(iii) Isolator Shock Mounts							
2.16.0	**WALL MOUNTED HARDWIRED LOCAL CONTROL STATION DE**							
2.16.1	**COTS ITEMS**							
	(i) 4 pole relay + Base	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) 2 Pole Relay							
	(iii) Double deck TB							
	(iv) 4 cond thru TB							
	(v) Fuse TB							
	(vi) Signal Splitter							
	(vii) Ground Moduler TB							
	(viii) TB 2 diode							
	(ix) Schottky Diode							
	(x) 2 cond TB 6 - 10 sqmm							
	(xi) MCB 2 pole, 10 A							
	(xii) Glass Fuse 3.15 A							
	(xiii) Glass Fuse 0.5 A							
	(xiv) Push Button							
	(xv) 2 Pos Selector							
	(xvi) 3 Pos Selector							

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	(xvii) 18 mm round IND + Lens							
	(xviii) Lamp 24 VAC/DC, Single LED White diffuse							
	(ixx) End stop							
	(xx) Eyebolt							
	(xxi) EMI Gasket							
	(xxii) Misc installation material (glands, fasteners etc)							
	(xxiii) Din Rails							
	(xxiv) Guard 51-925							
	(xxv) Push Button Alternator							
2.16.2	**BOUGHT OUT ITEMS**							
	(i) Engine Speed Gauge (72 X 72)	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) Lube Oil Pressure Gauge (48 X 48)							
	(iii) Fuel Admission Gauge (48 X 48)							
	(iv) Fresh Water Temp Gauge (48 X 48)							
	(v) Main Oil Pressure Gauge (48 X 48)							
	(vi) Pitch response Gauge (72 x 72)							
	(vii) Shaft speed Gauge (72 x 72)							
2.16.3	**IMPORTED ITEMS**							
	(i) Engine Room Repeater	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) Horn and Strobe							
	(iii) Isolator Shock Mounts							
2.17.0	**LARGE SCREEN DISPLAY**							
2.17.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Eye Bolt	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM& CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
2.17.2	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) 55" Large Screen Touch Monitor	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM& CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) Isolator Shock Mount							
2.18.0	**LARGE SCREEN DISPLAY WITH CPU**							
2.18.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Large Screen Display	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
	(ii) CPU							
	(iii) Keyboard							
	(iv) Mouse							
	(v) Isolator Shock Mounts							
2.19.0	**UNINTERUPTABLE POWER SUPPLY DC**							
2.19.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Input Power Connector	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) Input Power Mating Connectors							
	(iii) Remote Signal Connector							
	(iv) Remote Signal Mating Connectors							
	(v) Output Power Connectors							
	(vi) Output Power Mating Connectors							
	(vii) Battery Connectors							
	(viii) Battery Mating Connectors & Eyebolt							
2.19.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) UPS Power Unit	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
	(ii) Junction Box							
2.19.3	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Shock & Vibration Isolator	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM &	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
				CDR MoM				integration to system
2.20.0	**SEALED, MAINTENANCE FREE VRLA BATTERY**							
2.20.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Eyebolt (ii) Battery (iii) Output Connector (iv) Output Mating Connectors	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
2.20.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) UPS Battery Unit	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
2.20.3	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Shock & Vibration Isolator	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
2.21.0	**UNINTERRUPTABLE POWER SUPPLY 230 V OUT PUT, SINGLE PHASE**							
2.21.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Input Power Connectors (ii) Input Power Mating Connectors (iii) Remote Signal Connector (iv) Remote Signal Mating Connectors (v) Output Power Connectors (vi) Output Power Mating Connectors (vii) Battery Connectors (viii) Battery Mating Connector (ix) Eye Bolt	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
2.21.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) UPS Power Unit	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM &	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
				CDR MoM				
2.21.3	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Shock & Vibration Isolator	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
2.22.0	**SEALED MAINTENANCE FREE VRLA BATTERIES**							
2.22.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Eye Bolt	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
	(ii) Battery							
	(iii) Output Connectors							
	(iv) Output Mating Connectors							
2.22.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) UPS Power Unit	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
2.22.3	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Shock & Vibration Isolator	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
2.23.0	**EQUIPMENT HEALTH MONITORING & VIBRATION MONITORING SYSTEM**							
2.23.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) EHM Server	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) Tri Axial Accelerometer							
	(iii) Single Axial Accelerometer							
	(iv) Calibrator							
	(v) Portable Data Collector Unit							
	(vi) Portable Accelerometer with Cable							
	(vii) Magnetic Base							

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
2.23.2	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Isolation Shock Mount	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
2.24.0	**SENSORS FOR DOORS AND HATCH**							
2.24.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Proximity Switch/ Sensor (ii) Junction Box (iii) Connecting Cable with Socket (iv) Mounting Bracket	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
2.25.0	**FLEXIGLASS INCIDENT BOARD WITH SHEETS**							
2.25.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Plexiglass Board in one frame	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
2.26.0	**IPMS TANK LEVEL INDICATING SYSTEM**							
2.26.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Ball Valve (ii) Local Display Unit (iii) Dual Power Supply Module (iv) DC Axial Fan (v) J Strap Shock Mounts	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
2.26.2	**BOUGHT OUT ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Enclosure for TLI	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
2.26.3	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Fuel Storage Tank Sensors (ii) Fuel Service Tank for GT/ DE Sensor	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	(iii) Sludge Tank Sensor							
	(iv) DA Oil Tank Sensor							
	(v) GT Dirty Oil Tank Sensor							
	(vi) Bilge Water Holding Tank Sensor							
	(vii) DE/RG - Drain Tank Sensor							
	(viii) DE/ RG LO Storage Tank Sensor							
	(ix) Fuel Stripping Tank Sensor							
	(x) RG LO Circulating Tank Sensor							
	(xi) AVCAT Tank Sensor							
	(xii) AVCAT Drain Tank Sensor							
	(xiii) FW Tank Sensor							
	(xiv) Ballast Tank Sensor							
	(xv) DE/ DA Fuel RU Tank							
	(xvi) Distilled Feed Water Tank Sensor							
	(xvii) AVCAT Service Tank Sensor							
	(xviii) AVCAT Recovery Tank Sensor							
	(xix) Stabilizer LO Storage Tank Sensor							
	(xx) CPP Oil Storage tank Sensor							
	(xxi) Header Tank for GT Sensor							
	(xxiii) Level Switch							
2.27.0	**INCLINOMETER WITH LOCAL DISPLAY**							
2.27.1	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) 1 X NT1000 EPR Display Unit	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) 1 X NT1000 Sensor Unit							
	(iii) 1X2 entry Junction Box							

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
2.28.0	**EOT/ PLC SYSTEM**							
2.28.1	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Bridge Station Lever type EOT	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) OPS Room Station Lever type EOT							
	(iii) MCR Station Lever type EOT							
	(iv) FWD Engine Room Repeater							
	(v) AFT Engine Room Repeater							
	(vi) Control Station cabinet							
2.29.0	**ADDRESSABLE FIRE DETECTION SYSTEM**							
2.29.1	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Main Control Panels	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) Repeater Panels							
	(iii) Optical Smoke & Heat Combination Detector - IS							
	(iv) Optical smoke Detector							
	(v) Rate of Rise Heat Detector							
	(vi) Rate of Rise Heat Detector - Intrinsically Safe							
	(vii) Fixed Temperature Detector							
	(viii) UV-IR Combined Flame Detector							
	(ix) UV-IR Combined Flame Detector - Intrinsically Safe							
	(x) Manual Call Point							
	(xi) Bell							
	(xii) Fire Detection Central Unit D							
	(xiii) Optical smoke &Heat combination detector							
	(xiv) Hooter							
2.30.0	**ADDRESSABLE FLOOD ALARAM SYSTEM**							
2.30.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Sounder & Beacon	VI, Verification of	100%	TSP/ SOTR, Approved	Conformity to	STC/CoC &	R	Functional checks are

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	(ii) JB for Sensor Interface	documents, Functional checks, if applicable as per approved ATP		Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	specifications	& Calibration Certificate, if applicable		to be conducted post integration to system
	(iii) ZenerBarrier (Analog)							
	(iv) ZenerBarrier (Digital)							
	(v) Ethernet Switch							
	(vi) UPS &Battery Charger							
	(vii) Installation accessories 'U' clamp & 'L' brackets							
2.30.2	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Main Control Panels	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) Repeater Panels							
	(iii) DQA Controller Module							
	(iv) DQA DI Module							
	(v) DQA AI Module							
	(vi) Magnetic Floating Type Sensor (IS)							
	(vii) Dual Level Sensor (IS)							
	(viii) Pressure Sensors							
	(ix) Pressure Sensors (Non IS)							
2.31.0	**SPECIAL TEST EQUIPMENT**							
2.31.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Mini OTDR (MM 850/1300nm) with Adapter	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC & Calibration Certificate, if applicable	R	Functional checks are to be conducted post integration to system
	(ii) Mini Optical Lost Test Set (OLTS)							
	(iii) Optical Leak Detector							
	(iv) Termination Kit with LC Type Connector							
2.32.0	**OFF EQUIPMENT PRESSURE SENSORS**							
2.32.1	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Fuel Transfer Pump Suction Pressure Transmitter	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) AVCAT Fuel Transfer Pump Suction Pressure Transmitter							
	(iii) Fuel Oil Filling and Transfer System Line Pressure Transmitter							
	(iv) Fuel Oil Stripping System Suction Pressure Transmitter							

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	(v) Chilled water pump suction pressure transmitter							
2.33.0	**OFF EQUIPMENT CITADEL PRESSURE SENSORS**							
2.33.1	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) CITADEL Pressure Transmitter Pressure Transmitter	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
2.34.0	**OFF EQUIPMENT TEMPERATURE SENSORS**							
2.34.1	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Chilled Water System Line Temperature Transmitter	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
2.35.0	**DIGITAL IR CAMERA**							
2.35.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Server (Mounted inside Cabinet)	VI, Verification of documents, Functional checks, if applicable as per checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
2.35.2	**IMPORTED ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Isolation Shock Mount	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Import Documents	R	Refer para 12 - Specific Requirements Functional checks are to be conducted post integration to system
	(ii) IR Camera							
2.36.0	**A3 COLOR PRINTERS**							
	(i) A3 Color Printers	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
2.37.0	**A4 HIGH RESOLUTION PRINTER**							
	(i) A4 High Resolution Black & White Laser Printer	VI, Verification of documents, Functional	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
		checks, if applicable as per approved ATP		MoM, Manufacturing Drawings, PDR MoM & CDR MoM				integration to system
2.38.0	**DATABUS CONNECTION PORTS**							
2.38.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) POU Point	VI, Verification of documents, Functional checks, if applicable asper approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
2.39.0	**IPMS RUGGED PORTABLE OPERATOR UNITS**							
2.39.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Rugged POU with Power Adaptor	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
2.40.0	**IPMS RUGGED PORTABLE DIAGNOSTIC UNITS**							
2.40.1	**COTS ITEMS (As per approved drawing & DBOM, including but not limiting to following)**							
	(i) Rugged PDU with Power Adaptor	VI, Verification of documents, Functional checks, if applicable as per approved ATP	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	STC/CoC	R	Functional checks are to be conducted post integration to system
3.0.0	**SECTION III: IN-PROCESS INSPECTION**							
3.1.0	**CONSOLE STRUCTURE (SMCs) - MULTI FUNCTION PROPULSION CONTROL CONSOLE, MULTI FUNCTION EOOW CONSOLE, MULTIFUNCTION DA CONSOLE, MULTI FUNCTION ACS CONSOLE, MULTI FUNCTION BDCS CONSOLE, MULTI FUNCTION WALL MOUNT CONSOLE, EHM ENCLOSURE FOR DE & GB, MULTIFUNCTION BRIDGE CONSOLE**							
3.1.1	**Casted components** (i) Base Plate, Rear Cover, Bull Nose and End Caps	VI & DI	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications.	IR	R	
	(ii) Painting	VI	100%			IR	R	
3.2.0	**SHEETS FOR ENCLOSURES AND DOORS AFTER FABRICATION**							
3.2.1	Painting	VI and DFT	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	IR	R	

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
3.3.0	**REMOTE TERMINAL UNIT, BDCS HW FIRE & SALVAGE PUMP CONTROL PANELS,CRITICAL SIGNAL SPLITTER BOXES, INTERACTIVE INCIDENT BOARD MANAGEMENT SYSTEM (IIBMS), WALL MOUNTED HARDWIRED LOCAL CONTROL STATION GT, WALL MOUNTED HARDWIRED LOCAL CONTROL STATION DE, LARGE SCREEN DISPLAY, UNINTERUPTABLE POWER SUPPLY DC, SEALED MAINTAENANCE FREE VRLA BATTERY, UNINTERRUPTABLE POWER SUPPLY 230 V OUT PUT SINGLE PHASE, SEALED MAINTENANCE FREE VRLA BATTERIES, EQUIPMENT HEALTH MONITORING (EHM) & VIBRATION MONITORING SYSTEM, PLEXIGLASS INCIDENT BOARD, ENCLOSURE FOR TANK LEVEL INDICATION (TLI) SYSTEM & ADRESSABLE FLOOD ALARM SYSTEM (AFAS), CCTV SERVER CABINET FOR DIGITAL IR CAMERA**							
3.3.1	**SHEETS FOR ENCLOSURES AND DOORS AFTER FABRICATION**							
3.3.2	Painting	VI and DFT	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM Drawing	Conformity to specifications	IR	R	
4.0.0	**SECTION IV: ASSEMBLIES**							
4.1.0	**CONSOLE STRUCTURE (SMCs) - MULTI FUNCTION PROPULSION CONTROL CONSOLE, MULTI FUNCTION EOOW CONSOLE, MULTIFUNCTION DA CONSOLE, MULTI FUNCTION ACS CONSOLE, MULTI FUNCTION BDCS CONSOLE, MULTI FUNCTION WALL MOUNT CONSOLE, EHM ENCLOSURE FOR DE & GB,MULTIFUNCTION BRIDGE CONSOLE**							
4.1.1	Assembly	(i) ESS of electronic components/ units/ assemblies	100 %	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM, CDR MoM& ESS Plan approved by DQA (WP)	Conformity to specifications	Test Reports/ CoC	R	Refer para 13 - Specific Requirements CoC is applicable for imported items supplied by the manufacturer in as it is condition with no additions/ alterations
		(ii) Conformal coating of PCBs	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM& CDR MoM	Conformity to specifications	IR	W	Refer para 14 - Specific Requirements
		(iii) Verification of completeness	100%			IR	W	
		(iv) Internal Unit wiring checks	100%			IR	W	
		(v) Visual & Dimension Inspection	100%			IR	W	Stand-alone ATP to be approved by Professional Directorate.
		(vi) Standalone Functional Trials	100%			IR	W	
4.2.0	**REMOTE TERMINAL UNIT, BDCS HW FIRE & SALVAGE PUMP CONTROL PANELS FWD & AFT, CRITICAL SIGNAL SPLITTER BOXES, INTERACTIVE INCIDENT BOARD MANAGEMENT SYSTEM (IIBMS), WALL MOUNTED HARDWIRED LOCAL CONTROL STATION GT (LCS GT), WALL MOUNTED HARDWIRED LOCAL CONTROL STATION DE (LCS DE), LARGE SCREEN DISPLAY (LSD), LARGE SCREEN DISPLAY WITH CPU,UNINTERUPTABLE POWER SUPPLY DC, SEALED MAINTAENANCE FREE VRLA BATTERY,UNINTERRUPTABLE POWER SUPPLY 230 V OUT PUT SINGLE PHASE,SEALED MAINTENANCE FREE VRLA BATTERIES, DIGITAL IR CAMERA,A3 COLOR PRINTERS, A4 HIGH RESOLUTION PRINTER, DATABUS CONNECTION PORTS, RUGGED PORTABLE OPERATOR UNITS, RUGGED PORTABLE DIAGNOSTIC UNITS, EQUIPMENT HEALTH MONITORING (EHM) & VIBRATION MONITORING SYSTEM,SENSORS FOR DOORS AND HATCH, PLEXIGLASS INCIDENT BOARD, TANK LEVEL INDICATION (TLI) SYSTEM, INCLINOMETER**							

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
	WITH LOCAL DISPLAY, EOT/PLC SYSTEM, ADDRESSABLE FIRE DETECTION SYSTEM, ADDRESSABLE FLOOD ALARAM SYSTEM, SPECIAL TEST EQUIPMENT, OFF EQUIPMENT PRESSURE SENSORS, OFF EQUIPMENT CITADEL PRESSURE SENSORS, OFF EQUIPMENT TEMPERATURE SENSORS,							
4.2.1	Assembly	(i) ESS of electronic components/ units/ assemblies	100 %	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM, CDR MoM & ESS Plan approved by DQA (WP)	Conformity to specifications	Test Reports/ CoC	R	Refer para 13 - Specific Requirements CoC is applicable for imported items supplied by the manufacturer in as it is condition with no additions/ alterations
		(ii) Conformal coating of PCBs	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing	Conformity to specifications	IR	W	Refer para 14 - Specific Requirements
		(iii) Verification of completeness	100%	Drawings, PDR MoM& CDR MoM	Conformity to specifications	IR	W	
		(iv) Internal Unit wiring checks	100%			IR	W	
		(v) VI & DI	100%			IR	W	Stand-alone ATP to be approved by Professional Directorate.
		(vi) Standalone Functional Trials	100%			IR	W	
4.3.0	**REMOTE CONTROLLED VALVE**							
4.3.1	Remote Controlled Valve	**Inspection to be carried out as per SQAP No. DGQA/DQA (WP)/VALVES/09/2022 REV-1 Dated 15 Feb 22.**						
4.4.0	**IPMS BI-DIRECTIONAL FLOWMETER**							
4.4.1	Flow Meter	**Inspection to be carried out as per SQAP No. DGQA/DQA (WP)/FLOWMETER/14/2018/REV 0 Dated 23 Aug 18.**						
4.5.0	**CABLES**							
4.5.1	Fire Detection Loop Cable	**Inspection to be carried out as per MQAP No. DQAN/L/611118/MQAP-CABLES(VERSION 03) – Feb 08 & EE-50-13 (REV -1)**						
5.0.0	**SECTION V: TYPE TESTING**							
	Consoles SMCs& Wall Mount Console, RTU, BDCS FWD & AFT, DE LCS & GT LCS, Critical Signal Splitter box Port & Starboard, AFAS	(i) Vibration (MIL-STD-167/ Test No. 28 JSS – 55555)	One of each type	PO/ SOTR, TNC MoM/ Approved drawings/ PDR & CDR MoM/ JSS 55555/ MIL-**STD**-461 F/ Approved ATP	Conformity to specifications	Type Test Reports	R	**CHP**.
		(ii) High Temperature (MIL-STD-810/ Test No.17, JSS – 55555)						
		(iii) Damp Heat Test No.10, JSS 55555						
		(iv) Low Temperature (MIL-STD-810)/ Test No 20, JSS 55555)						

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
		(v) Drip Proof (Test No.11, JSS 55555)						
		(vi) Tropical Exposure (Condition A , 7 cycles , Test No 27, JSS 55555)						
		(vii) Mould Growth (Test No 21, JSS 55555)						
		(viii) Corrosion (Salt) (Test No. 9, JSS 55555)						
		(ix) Bump Test (Test No.5, JSS 55555)						
		(x) Shock (NSS Gr.I or Gr. II shocks as per face) Test No 24, JSS 55555/ MIL-STD-901D						
		(xi) Ingress Protection As per SOTR/ Approved Drawing						
		(xii) Ship Motion (+/- 30 Deg. 10 Sec)						
		(xiii) Pitch (7 Fore & AFT, 6 Sec)						
		(xiv) Tilt (20 Deg Either side)						
		(xv) Airborne Noise (MIL-STD-1474 D)						
		(xvi) Structure borne Noise (MIL-STD-740-2)						
		(xvii) EMI/EMC Test (MIL-STD-461 F)						
6.0.0	**SECTION VI: MISCELLANEOUS REQUIREMENTS**							
6.1.0	Submission of draft documentation including manuals (Hardware &Software)	As per SOTR	100%	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Documentation	R	To be sent to IHQ MoD (N)/ DND/ DME for vetting/approvals.
6.2.0	Software Quality Assurance	Software Quality Checks	100%	Software QAP approved by IHQ/DME	Completion of checks as per approved QAP	IR	R	Software QAP & audit / validation to be approved by IHQ MoD(N)/ DME

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
6.3.0	Inspection of the test bed setup & Integrated System	As per IFAT documents	100 %	TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Suitable for IFAT	IR	R	
7.0.0	**SECTION VII: FINAL INSPECTION – INTEGRATED FACTORY ACCEPTANCE TRIALS**							
7.1.0	Integrated Functional Trials on OEM Test Bed/ Stand	All Functional & Safety parameters to be checked	100 %	TSP/ SOTR/ Approved Drawings/ DBOM/ Manufacturing Drawings/ TNC MoM/ PDR MoM/ CDR MoM/ Approved IFATs Protocol	Conformity to specifications	IFAT Report	W	**CHP** IFAT to be witnessed by by IFAT Team & report is to be approved by IHQ/ DME
7.2.0	Endurance Test/ Burn-in Test (168 Hrs at Room temp or +55°C for 48 Hrs.)	All Functional & Safety parameters to be checked	100 %	TSP/ SOTR/ Approved Drawings/ DBOM/ Manufacturing Drawings/ TNC MoM/ PDR MoM/ CDR MoM/ Approved IFATs Protocol	Conformity to specifications	IFAT Report	W	**CHP**
8.0.0	**SECTION VIII: PRE-REQUISITE FOR ISSUE OF I-NOTE**							
8.1.0	B&D, OBS, special tools etc as per Purchase Order	(i) Product Identification	100 %	PO, TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	IR	W	
		(ii)VI/DI	100%		Conformity to specifications	IR	W	
8.2.0	Submission of manuals, documents, as-made drawings etc for stamping	Verification & Stamping	100 %	PO, TSP/ SOTR, TNC MoM, PDR MoM & CDR MoM	Conformity to specifications	Documentation	R	**CHP**
8.3.0	Liquidation of observations during IFAT (if any)	Liquidation of remarks/observations	100 %	TSP/ SOTR/ Approved Drawings/ DBOM/ Manufacturing Drawings/ TNC MoM/ PDR MoM/ CDR MoM/ Approved IFATs Protocol	Approved IFAT Documents	IR	W	
8.4.0	Weight Recording	Weight	100 %	PO, TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	Weight Certificate	W	**CHP**
8.5.0	Painting, Marking & Preservation	VI	100 %	PO, TSP/ SOTR, Approved Drawings & DBOM, TNC MoM,	Conformity to specifications	IR	R	

Sl No	MATERIAL/COMPONENT/ DRG NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	ACTION BY QAE	REMARKS
				Manufacturing Drawings, PDR MoM, CDR MoM & DGS 251				
8.6.0	Pre Dispatch Inspection & Packing	VI	100 %	PO, TSP/ SOTR, Approved Drawings & DBOM, TNC MoM, Manufacturing Drawings, PDR MoM & CDR MoM	Conformity to specifications	IR	W	

Annexure - 1

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भारत सरकार
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No.: 66301/Policy-07/DQA(N)/QA-07 09 Aug 16

All the Establishments under DQA (N)

GUIDELINES FOR ENVIROMENTAL STRESS SCREENING (ESS) OF NAVAL ELECTRICAL/ELECTRONIC EQUIPMENT

Background

1. Refer to this Directorate letter of even number dated 14 Jun 13.

2. This Directorate, vide letter ibid, have brought out the requirement of carrying out Environmental Stress Screening (ESS) on Electronic items and emphasized about the methodology to be adopted for conduct of ESS. ESS is a product specific programme and therefore, specific screen strength needs to be defined for type of product. Stress screening is a part of manufacturing process in which the simulated environmental stresses are used to screen out those failures that would otherwise occur in the field. The stress should be closely tailored to the equipment's design capability to provide an effective screen without damaging good components.

3. Difficulties in formulating ESS plan has, however, been reported by few manufacturers as per the letter ibid. Most of the manufacturers resorted to use of sample screen strengths of ESS indicated in the letter ibid (for the purpose of guidance), for their ESS programs which were observed to be difficult for implementation on their products.

Aim

4. The aim of this letter is to lay down guidelines for formuation of effective ESS programme and methodology for conduct of ESS on Electronic Components/Units/ PCBs/Modules. The guidelines also provide directions to manufacturing agencies to incorporate tests at the design and manufacturing stage to weed out such deficiencies, which can manifest at a later stage causing avoidable down time of the equipment and expensive corrective action thereupon.

Applicability of ESS

5. **Indigenous Manufacturing.** The ESS is to be applied to 100% electronic components/units/assemblies as part of manufacturing process for indigenously manufactured electronics. Hardware incorporating purely mechanical system/elements including wire wrapped backplanes and fragile electronic items viz. LCD panels, Hard Disk Drives etc. may be exempted from ESS.

6. The present guidelines will be applicable for the new POs placed after promulgation of this policy. For all previous POs, ESS plan as per approved QAP may be followed. For new orders pertaining to spares of Systems/Equipment supplied earlier, ESS scheme as per guidelines in vogue/as conducted at the time of delivery of the system would be applicable.

7. **Applicability for Imported/COTS Items.** In case of imported and COTS items, following guidelines will apply:-

(a) During the course of production, a variety of imported/COTS items (components/PCBs/modules) may be used by the manufacturer of main system. ESS on such items is to be carried out at the next higher indenture level. The severities are to be decided based on designed parameter of weakest component as per data sheets of components in order to ensure that there is no damage to the used part whilst conduct of ESS.

(b) However, in case the Imported items are being supplied by the manufacturer in 'As It Is' condition with no addition/alternations, such items are to be accepted based on CoCs clearly endorsing the standards to which the items comply and physical values of test conditions the items have been subjected to ESS.

(c) Use of fully finished COTS items needs to be specifically approved by IHQ MoD(N)/(Professional Dtes)/OPA and are to be accepted against CoCs as in case of 'As It Is' imported items.

ESS Programme

8. It is necessary to conduct ESS at the earliest possible stages where it is possible to reveal latent defects and initiate necessary corrective actions. Following needs consideration while devising effective ESS programme:-

(a) A viable ESS program must be dynamic wherein the screen parameters must be actively managed and tailored to the particular characteristics of the equipment being screened.

(b) Effective ESS program generally involve more than one type of screen.

(c) Thermal cycling and random vibration are considered the first and second most effective screens respectively in identifying latent defects.

(d) While severity of the applied stress screen must be strong enough to effectively reveal the latent defects, care must also be taken not to over-stress the item which could either cause damage or reduction in residual life. At the same time, non-precipitation of latent defects is indication of weak stress level. The stress must conform to stringent level within designed parameters of the weakest component. Design parameters are generally much higher than the operating parameters.

(e) ESS is applied to 100% of the units manufactured including spares and repaired units.

ESS Process Sequence

9. The electronic hardware is recommended to be screened as per the following sequence:-

Stage-1 : Perform thermal cycling screening at PCB level

Stage-2 : Perform random vibration at PCB level or higher indenture

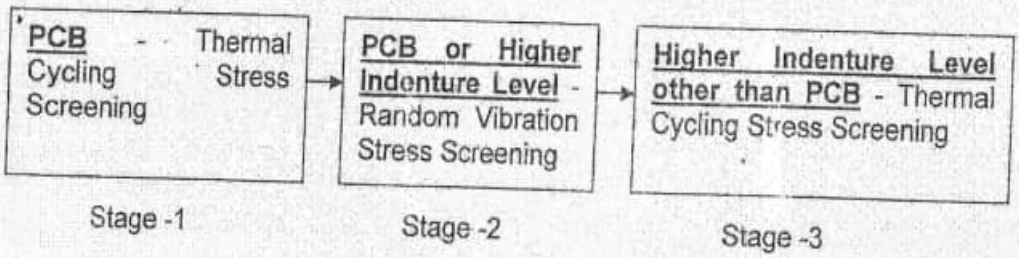
Stage-3 : Repeat thermal cycling screening at an indenture higher than PCB level

10. The conduct of thermal cycling prior to random vibration pre-stresses potential defects which can then be surfaced more effectively by random vibration. Random vibration also conditions some defects to the point of failure which are detected by a subsequent thermal cycling with performance monitoring. All ESS requirements must be accomplished at the lowest feasible level of assembly. The following three indenture levels have been identified for conduct of ESS: -

(a) PCB level

(b) Module/ sub-unit level

(c) Unit/Cabinet level



ESS Flow Diagram

11. **Screens for Conduct of ESS**. A tailored screen requires that specific parameters of equipment being screened, be reviewed such that defects are detected and removed without incurring undue damage to the equipment. The screening levels should not exceed design limits, but they must be of sufficient strength to precipitate failures due to weak parts and manufacturing defects at the earliest time such that corrections are most cost effective. Two screens each for Thermal Cycling Stress Screening (TCSS) and Random Vibration Stress Screening (RVSS) have been defined at **Encl 1 & 2** respectively. **In case a screen with severity below the above two screens is proposed for any item, approval of *Professional Directorate* is to be sought for use of such items with suitable justification. The screen for such cases would then be worked out based on the limitations imposed by the specifications of the items approved to be used.** Accordingly, the applicable screen severities can be categorized as follows: -

(a) **Screen-A (Severe)**. This would be the default screen with most stringent severity based on design parameters of weakest component for effective precipitation of latent defect.

(b) **Screen-B (Moderate)**. To be selected based on parameters of the items necessitating use of screen severity below the above Screen 'A' category. Prior approval for use of such items has to be obtained by the firm from Professional Directorate. The tailored screen would accordingly be specified in the QAP with suitable justifications. Reason for application of this screen for the item instead of Screen 'A' is to be justified in the QAP and list to be attached with QAP.

12. Based on the above process sequence and categorisation of screens, it is proposed to denote the stress severity of products as per the notation "Product (XXX)", where the first "X" represents thermal screen severity for Stage-1, the second "X" represents screen severity for random vibration at Stage-2 and third "X" represents thermal screen severity for Stage-3. For example "Item (ABB)" would indicate that the item is to be subjected to thermal stress as per screen 'A' in Stage-1, random vibration as per screen B in Stage-2 and thermal stress as per screen B in Stage-3. A proposed format for ESS plan is placed at Encl. 3.

13. **Thermal Cycling Stress Screening (TCSS)**. The following aspects are to be considered whilst conducting TCSS:-

(a) The temperature range for thermal cycling should be established by considering the component characteristics and the equipment specifications for maximum and minimum designed values under operating and storage conditions. The temperature range should be as large as component characteristics will permit regardless of the products intended operational limits.

(b) The rate of change of temperature between the extremes must be as rapid as possible to create the optimum level of thermal stress. The minimum acceptable rate of change is 5° C per minute.

(c) The number of cycles is more closely related to the temperature range and rate of change than to the equipment complexity or number of parts. Tailoring of this parameter is generally done based on the analysis of failures observed with the incremental number of cycles.

(d) Dwell time at maximum and minimum operating and storage temperatures should be only enough to achieve thermal stability.

14. **Random Vibration Stress Screening (RVSS)**. The following aspects are to be considered whilst conducting RVSS:-

(a) Random Vibration Stress Screening may be performed preferably at lower indenture level.

(b) The attitude or orientation of item for RVSS shall be decided based on the plane which provides maximum shear force to the soldered joints and components during random vibration. The RVSS is to be conducted preferably in all three axes.

(c) For a module level testing, the fixture shall be structurally rigid without causing resonance and further amplification to the Unit Under Test (UUT).

(d) EUT shall be subjected to sinusoidal sweep between 20-2000 Hz to identify the existence resonance prior to conduct of RVSS. If the equipment resonance frequencies fall within the input frequency range, excessive energy could be seen by the equipment and damage could occur. One of the following two measures may be taken in such cases: -

(i) Modify the equipment design to achieve a more rugged item to obtain a resonance falling outside the input frequency range.

(ii) Make a notch on the input profile eliminating frequency band of 5 Hz before and after the resonating frequency.

15. **Approval of ESS Programme**. The manufacturer is solely responsible for drawing up the ESS programme as the design parameters of the components are known to them. Once the ESS screen is finalized as per Encl.-1&2, the same is to be submitted to DQA(N) through respective field units for approval. Such ESS plan will be annexed to the QAP.

16. In view of the foregoing, following guidelines be adhered to regarding formulation and conduct of ESS: -

(a) Based on category of items viz. indigenously manufactured, Imported, COTS and applicability of ESS thereon, a draft ESS plan is to be submitted by the vendor to the Field Inspection agency as part of draft QAP and forwarded to DQA(N) for approval.

(b) The draft plan must conform to Screen Strength 'A' and 'B' of Encl. 1&2 and ESS severity plan as per Encl.3.

(c) Approval of IHQ MoD(N)(Professional Directorates) will be mandatory for use of item/component imposing restriction on default ESS screen 'A'.

(d) The draft ESS plan will be submitted alongwith draft QAP as an annexure for approval.

17. This letter supersedes all previous letters on ESS.

(Amit Rastogi)
Commodore
Deputy Director General
Quality Assurance (Naval)

Enclosure: As above

Copy to:-

The Addl DGQA (WP)
Directorate of Quality Assurance (WP)
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The Chief of the Naval Staff
{for ACOM(IT&S)/PDSP/PDWE/PDEE/PDSR/PDSMAQ}
IHQ MoD(N)
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The Chief of the Naval Staff
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The Director General
{for DDG (M&M)}
Coast Guard Headquarters
National Stadium Complex
New Delhi- 110001

Enclosure-1 to DQA(N) letter No.:
66301/Policy-07/DQA(N)/QA-07
dated 09 Aug 16

THERMAL CYCLING STRESS SCREENING (TCSS)

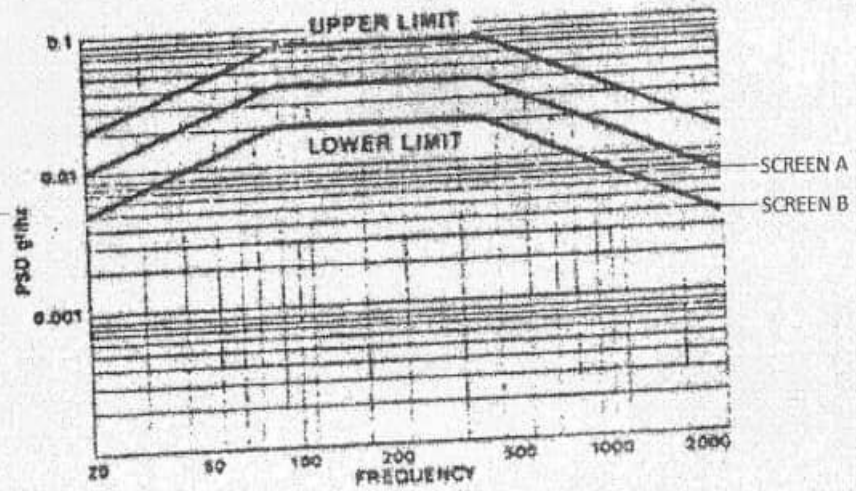
Sl. No.	Level	Screen	Test Details	Remarks
1	PCB Level	A	-40 °C to +70 °C, 10 Cycles (Ramp 10° C/min) or 20 Cycles (Ramp 5° C/min) Dwell: 10 min	Power OFF condition
		B	-20 °C to +55 °C, 10 Cycles (Ramp 10° C/min) or 20 Cycles (Ramp 5° C/min) Dwell: 10 min	
2	Sub Unit / Equipment	A	-30 °C to +55 °C, 6 Cycles (Ramp 10° C/min) or 12 Cycles (Ramp 5° C/min) Dwell: 10 min	Power ON condition
		B	-10 °C to +50 °C, 6 Cycles (Ramp 10° C/min) or 12 Cycles (Ramp 5° C/min) Dwell: 10 min	

Enclosure-2 to DQA(N) letter No.: 66301/Policy-07/DQA(N)/QA-07 dated 09 Aug 16

RANDOM VIBRATION STRESS SCREENING (RVSS)

Sl. No.	Level	Screen	Test Details	Remarks
1	PCB Level / Sub Unit / Equipment	A	20-80 Hz, +3db Octave 80-350 Hz, PSD 0.04 g^2/Hz 350-2000 Hz, -3db Octave 10 min per axis, G rms = 6.06 (Profile given below)	1. On all three axes. 2. Power ON condition
		B	20-80 Hz, +3db Octave 80-350 Hz, PSD 0.02 g^2/Hz 350-2000 Hz, -3db Octave 10 min per axis, G rms = 4.284 (Profile given below)	

Random Vibration Profile



Enclosure-3 to DQA(N) letter No.:
66301/Policy-07/DQA(N)/QA-07
dated 09 Aug 16

ESS: STRESS SEVERITY PLAN

Sl. No.	PCB Level/Sub Unit/ Equipment	Screen Parameters	Remarks
1	**SUB UNIT-1**		
	Nomenclature Part No.	XAA	
	PCB LEVEL		
(A)	PCB Assy – A (MIL) Part No.	AXX	
(B)	PCB Assy B(NON MIL) Part No.	BXX	
2	**SUB UNIT -2**		
	Nomenclature Part No.	XBB	
(A)	**PCB LEVEL**		
	PCB Assy – A (MIL) Part No.	AXX	
(B)	PCB Assy – B (NON MIL) Part No.	BXX	
3	**CABINET/EQUIVALENT LEVEL**		
(A)	Nomenclature – (MIL) Part No.	AAA	
(B)	Nomenclature – (NON MIL) Part No.	BBB	

Annexure - 2

E-

रक्षा मंत्रालय/ रु.आ.म.नि
गुणता आश्वासन निदेशालय (यु० परि०)
'एच' ब्लाक, निर्माण भवन पोस्ट
नई दिल्ली - 110011
दूरभाष- 011-23015012-4002
फैक्स: 011-23014619
ई-मेल: dqawp@navy.gov.in

Ministry of Defence/ DGQA
Dte of Quality Assurance (WP)
'H'- Block, Nirman Bhawan Post
New Delhi - 110011
Tel:011-23015012-4002
Fax: 011-23014619
e-mail: dqawp@navy.gov.in

12575/POLICY/DGQA/WP-TC

17 Mar 21

As per Distribuition List

TYPE TESTING OF NAVAL ENGINEERING, HULL AND NBCD EQUIPMENT

1. **Introduction**. Equipment/ systems installed onboard warships/ submarines are required to endure the severities of marine environment and perform the intended role under extreme conditions of vibration, shock, heat, corrosive environment, EMI/EMC etc. Prototypes/ first piece of new induction equipment/ systems are subjected to a series of tests to ensure that the desired levels of reliability and ruggedness are embedded to withstand and operate in adverse conditions.

2. **Type Tests**. Type Tests refer to a set of tests carried out on equipment/ systems to validate the design, gauge the capability to deliver desired performance under severe marine environmental conditions and qualify them for installation/ exploitation onboard ships and submarines. The tests are conducted under simulated conditions in the laboratory/ testbeds. Some of the tests may accelerate the severity of environmental conditions with commensurate reduction in exposure time of the equipment to such conditions. Type Tests are specific to each equipment/ system based on the material specifications, performance characteristics, operating environment and installation plan onboard ships/ submarines. The scope and sequence of tests is guided by the SOTR and standards viz., Defstan/ NES, MIL Std, EEDQ, JSS 55555, NCD etc., applicable for the equipment/ systems. These may include Endurance Test, Tilt Test, Environmental Test, EMI/ EMC Test, Air/ Structure Borne Noise Test, Vibration Test, Shock Test etc. In a system configuration comprising of multiple independent functional units, each independent functional unit is Type Tested.

3. **Applicability of Type Tests**. All types of hull, engineering, electrical and NBCD equipment/ systems (other than imported and COTS items) are to be subjected to Type Tests prior to induction. This also includes equipment/ systems ordered by shipyards for new construction ships. The type tests will be applicable on following: -

(a) On prototype or first piece/ set of equipment/ system manufactured by an OEM.

(b) On previously inducted equipment/ systems if they have not been Type Tested during induction or have undergone changes/ additions and alterations wrt design, architecture, material specification, duty point, dimensions, manufacturing process and governing standards/ specifications (view obsolescence or technical upgrade) irrespective of the quantum of change or there are changes in environmental conditions to which the equipment/ system was earlier Type Tested. The decision of the Professional Directorate regarding requirement of Type Test of such equipment/ system shall be final and binding.

(c) On previously inducted equipment/ systems, if the OEM is not able to produce previously conducted Type Test reports during Quality Assurance inspections by the Inspections Agencies.

4. **Scope of Type Tests**. The scope of Type Tests will vary for different equipment/ systems and are generally specified in the applicable standards as indicated in SOTR, PO, QAP etc. These tests are to be conducted as per the Acceptance Test Procedure (ATP) promulgated by the concerned Professional Directorate. Some of the generic tests which are undertaken as part of Type Tests are enumerated below: -

(a) **Endurance Test**. Endurance Test involves continuous running of equipment/system for a prolonged duration on the test bed. During the test the operating parameters and performance characteristics of the equipment are monitored by the Inspection Agency. Duration of endurance test is to be as specified in the approved ATP.

(b) **Tilt Test**. The equipment/ systems onboard ships are required to sustain the roll/ pitch of the ship and give the desired performance. To simulate the shipboard conditions, the equipment/ systems are tilted on the test bed and run for a predefined period of time. The operating parameters and performance characteristics of the equipment shall be monitored by the Inspection agency during Tilt Test for the duration as specified in the approved ATP.

(c) **Airborne Noise (ABN) Test**. The ABN test is generally conducted as per MIL-STD-740-1(SH) to ensure that the equipment/ systems comply to the acceptable airborne sound level criteria. The weighted sound pressure levels and octave band sound pressure levels are measured at designated locations and the values obtained are compared with the limits specified in the SOTR to ascertain the acceptability of the equipment/ systems.

(d) **Structure Borne (SBN) Test**. The SBN test is critical, to ensure that the noise transmitted by the equipment to the ship's hull is within the limits prescribed in the approved SOTR. MIL-STD-740-2 is one such guiding documents for undertaking SBN measurements of shipboard equipment.

(e) **Vibration Test**. Vibration Test of equipment encompasses following types of tests: -

(i) **Environmental Vibration Test.** During Environmental Vibration Tests, the equipment is subjected to simulated environment vibration, as may be encountered when installed onboard ships/ submarines, to prove the physical and functional integrity when subjected to the vibration environment.

(ii) **Internally Excited Vibration Test.** In case of Internally Excited Vibration Test, record of overall vibrations and narrow-band analysis are also undertaken on test beds so as ensure that the amplitudes recorded are within the stipulated limits. Abnormal / high vibration levels at the fundamental and harmonic/ sub-harmonic frequencies indicate inherent/ incipient defects in the equipment/ systems. The values recorded on the test bed are also used for benchmarking/ comparison during the service life of the equipment/ systems. ISO 10816 and MIL-STD-167-1A/2 are some of the standards which are referred for undertaking vibration tests.

(f) **Shock Tests**. The shock testing of critical naval equipment is undertaken as a part of Type Test. The tests are guided by BR 3021 and MIL-STD-901(D). As a general convention light (up to 600 kg) and medium (600 - 2500 kg) are shock tested and heavy (more than 2500 kg) are not subjected to shock testing. The tests are done either physically or through mathematical simulation. Guidelines on shock standards have also been issued vide IHQ MoD(N)/DME letters EG/5522/POLICY dated 11 May 07 and EG/Policy/TSV/13/2016 dated 13 Dec 16.

(g) **Environmental Tests (ET)**. These tests cater for the natural (climatic) as well as induced environmental conditions. The following are the standards depending on the origin of equipment: -

(i) **Indigenous Equipment**. JSS 55555:2012 (Rev 03), issued by the Directorate of Standardisation has been promulgated as the guideline for conduct of Environmental Tests on electronic and electrical equipment inducted in service. The list of environmental tests applicable for naval equipment is contained at Table 3.5, 3.6 and 3.7 corresponding to ship-borne equipment protected (Class N1), exposed (Class N2) and submersible (Class N3) respectively.

(ii) **Imported Equipment**. MIL-STD-810G is normally specified as the applicable standards for ET in respect of all equipment being imported from western countries. However, a number of countries, especially Russia, France and Germany, follow their own ET standards viz. GOST, STANAG, VG etc.

(h) **EMI/ EMC Tests**. To ensure functionality of equipment/ systems without any performance degradation during operation in Electromagnetic environment, EMI/EMC Tests as per MIL-STD-461E/F has been specified for all electronic and electrical systems installed onboard in ships. Guidelines for determination of

applicable tests and methodology for EMI/EMC acceptance are contained in DQA(N) letter 66301/Policy-09/DQA (N)/QA-09 dated 14 Jun13.

(j) **Ingress Protection (IP) Tests**. Ingress protection test is carried out to classify and rate the enclosure of control panels / devices as per its degree of protection against ingress of solid particles and liquids. IP rating does not substitute the drip proof test or driving rain test as the former is the rating of the protective enclosure whereas the latter two tests are to check the effect of such environmental condition on electronics.

5. **Yellow Banding**. Equipment/ systems subjected to Type Tests render it unfit for onboard use. Such equipment/ systems are "Yellow Banded" and used for training and display purposes. The requirement of Yellow Banding of equipment is to be adequately covered in the SOTR/ RFP/ PO. The decision regarding the use of yellow-banded prototype for any unavoidable requirement shall be that of the Professional Directorates.

6. **Conduct of Type Tests**. Type Tests are to be conducted in the manufacturer's premises or laboratory depending upon the test procedure. All lab tests are to be conducted at Govt. labs/ private labs accredited by NABL and may not be witnessed by QA agencies. Lab reports are to be reviewed by QA agency for qualifying the product. The consolidated Type Test reports are to be forwarded by the Inspection Agency to the concerned Professional Directorate at IHQ MoD(N) through DQA(WP) for scrutiny and approval.

7. **Type Tests for Imported Items**. In case of items of import nature, Type Tests qualification of the item would be accepted by reviewing the Certificate of Conformity (CoC) submitted by the vendor. The CoC must indicate the governing standards for Qualification Tests and values to which the items have been tested. These may include OEM test certificates/ test reports/ data sheet and compliance matrix vis-à-vis the standards specified in the Purchase Order (PO).

8. **Type Test for New Induction Orders.** The newly inducted equipment/ systems are to mandatorily undergo Type Test. This would also be applicable for all equipment/ systems which are being indigenized by the *IN*. The Naval Order Placing Agencies/ Indigenising Agencies are to specify the requirement of Type Test in the SOTR, RFP and Purchase Orders.

9. **Type Test for Replenishment Orders**. In so far as equipment which are already inducted to the *IN* without Type Testing are concerned, Type Tests will be conducted only if the same is mandated vide the PO issued by any of the Naval Order Placing Agencies.

10. **Type Test for Shipyard Orders**. In case of equipment ordered by the shipyards for the shipbuilding projects, Type Testing will be conducted mandatorily, if the equipment is not Type Tested in the past. In case of any ambiguity, the issue is to be taken up with the concerned Professional Directorate at IHQ MoD(N) for decision. The requirement of Type Testing is to be adequately covered in the SOTR, RFP and Purchase Orders.

11. **Repetition of Type Test**. Equipment/ systems which have already qualified Type Test, need not be subjected to repeat Type Test unless demanded iaw para 3 (b) and (c) above. In case of multiple independent functional units in a given system, repeat Type Test will be applicable for only those independent functional units, which have undergone changes.

12. **Inclusion of Type Test Requirements in SOTR / TSPs and Purchase Orders**. Type Tests of equipment/ systems have cost and time implications. It is therefore essential that Type Test requirements are clearly spelt out as part of equipment specification (SOTRs/ TSPs), RFPs and POs issued by the Naval Procurement Agencies and the shipyards. The Type Test Plan must form part of Quality Assurance Plan for the equipment/ systems.

13. **Type Approval Certificate**. On satisfactory completion of Type Tests, a Type Approval Certificate in respect of the equipment/ systems is to be issued by DQA(WP) based on the test reports. The Type Approval Certificate is to indicate the equipment details and the unique Type Approval Number.

14. **Validity of Type Test**. The Type Approval Certificate will be valid till the time the equipment has not undergone any change or there are changes in environmental conditions to which the equipment/ system was earlier Type Tested.

15. **Type Testing by Third Party Inspection Agency**. The Type Tests can be conducted by Third Party Inspection Agencies (TPIA). In such cases the Type Test Report is to approved by the concerned Professional Directorate at IHQ MoD(N). For conduct of Type Test by TPIA, the schedule for Type Test or the Acceptance Test Plan (ATP) is to be approved by the Professional Directorates. The laboratory tests are to be conducted either at Govt. laboratories or NABL accredited laboratories.

16. **Grant of Green Channel Status or Self Certification Status**. Equipment/ systems which are not Type Tested will not be considered for grant of Green Channel or Self Certification Status. However, completion of Type Testing shall not be prerequisite for award of Green Channel/ Self-certification status for spares.

17. The above guidelines are applicable for RFPs which are issued post promulgation of this letter. This letter supersedes all previous letters on this subject.

Marwaha

(S Marwaha)
Commodore
Commodore QA (WP)
For ADG QA (WP)

Annexure - 3

दूरभाष: ०११-२३०१५०१२-४०१०
Tel: 011-23015012-4010
फैक्स: ०११-२३०१४६१९
Fax: 011- 23014619
ई-मेल: dqawp@navy.gov.in
e-mail: dqawp@navy.gov.in

भारत सरकार / रक्षा मंत्रालय
Govt. of India/ Ministry of Defence
गुणता आश्वासन निदेशालय (यु. परि)
Dte. of Quality Assurance (WP)
'एच' ब्लॉक, नई दिल्ली - 110 011
'H' Block, New Delhi - 110 011

12575/POLICY/DGQA/WP-TC

11 Oct 21

All Field Units of DQA(WP)

ISSUE OF TYPE APPROVAL CERTIFICATES WITH UNIQUE TYPE APPROVAL NUMBER TO FIRMS/ OEMS

1. Refer to DQA(WP) letter 12575/POLICY/DGQA/WP-TC dated 17 Mar 21.

2. Para 13 of letter at para 1 ibid stipulates that DQA(WP) shall issue Type Approval Certificate (TAC) for all Engineering, Hull, NBCD and Electrical systems/ equipment and their associated starters, panels and control system, which fall under the ambit of DQA(WP). The objective of this letter is to lay down the procedure for issuing TACs with a unique Type Approval Number on successful completion of Type Tests.

3. The pre-requisites for processing the case for issue of TACs are as follows:-

(a) Completion of all Type Tests as listed in the approved ATP and QAP/ SQAP.

(b) Approval of Test Reports, as necessary, by the concerned Professional Directorates.

4. The workflow process for issue of TACs is enumerated below and the flow diagram is placed at **Enclosure-I**:-

(a) **Receipt of Type Test Reports from Firms/ OEMs**. Post completion of Type Tests and receipt of approval of the vibration, SBN, ABN and Shock Test/ Analysis reports etc, as necessary, from the Professional Directorates, the Field Unit (CQAE/ QAE) is to make a formal communication to the firm/ OEM to submit four copies of all Type Test reports. The reports are to be submitted in a consolidated form. The format for submitting the Type Test reports is enumerated at **Enclosure- II**.

(b) **Forwarding of Type Test Report to DQA(WP)**. The Field Units are to forward the consolidated Type Test Reports to DQA(WP) with a covering letter by registered post, duly confirming that '**Type Tests of the equipment have been completed i.a.w the approved QAP/ SQAP and ATP**'. This is to be completed within four working days of receipt of the Type Test Reports from the firms/ OEMs.

(c) **Approval by Professional Directorate**. On receipt of the Type Test reports, DQA(WP) is to forward the same on file (along with copy of approved QAP and ATP, if available/ applicable) to the concerned Professional Directorates for concurrence to issue TAC.

(d) **Approval of Draft TAC by ADG QA (WP)**. After concurrence of the Professional Directorates is received, the concerned Tech Group is to put up the Type Test reports along with the draft TAC (as per format placed at **Enclosure-III**) in quadruplicate for approval of ADG QA(WP).

(e) **Issuance of TAC**. The TAC with unique Type Approval Number is be issued after approval of ADG QA (WP) is obtained.

(f) **Distribution of TAC**. Completed TAC and the Type Test Reports are to be forwarded by DQA(WP) as per the below mentioned distribution list by registered post:-

(i) Copy No. 1 - Professional Directorate.

(ii) Copy No. 2 - Firm/ OEM

(iii) Copy No. 3 - CQAE/QAE

(iv) Copy No. 4 - Office copy at DQA(WP)

5. Since issuance of TACs involves multiple stakeholders, completion of the entire workflow may involve time. Therefore, **issuance of I-Notes to firms/ OEMs by Field Units is to be de-linked from the issuance of Type Approval Certificates, in case all parameters observed during Type Tests are within the limits specified in the SOTR/ TSP/ SQAP/ approved QAP/ approved ATP, as applicable**.

6. It is requested that the above mentioned procedure be followed for all current and future procurement orders where DQA(WP) is the nominated Inspection Authority.

(प्रदीप बिस्वास / Pradeep Biswas)
केपटेन/ Captain
केपटेन क्यू.ए (टेक)/ Captain QA (Tech)
कृते अ.म.नि.गु.आ (युपो.प.)/ for ADGQA (WP)

Enclosures:- As above

Copy to:-

The Principal Director IHQ MoD(N)/ DME Room No. 124 A Wing, Sena Bhawan New Delhi -110 011	The Principal Director IHQ MoD(N)/ DNA Room No. 419, D-II Wing, Sena Bhawan, New Delhi - 110 011

The Principal Director IHQ MoD(N)/ DOI 5th Floor, Chanakya Bhawan Chanakyapuri, New Delhi -110 021	The Principal Director IHQ MoD(N)/ DNBCD Room No. 15, A Block Hutments Dalhousie Road, New Delhi - 110 011
The Principal Director IHQ MoD(N)/ DND (SSG) A-33, Kailash Colony New Delhi - 110 048	The Principal Director IHQ MoD(N)/ DEE 4th Floor, D-II Wing, Sena Bhawan, New Delhi - 110 011
The Principal Director IHQ MoD(N)/ DPRO C Wing, Sena Bhawan New Delhi -110 011	The Principal Director IHQ MoD(N)/ DLS 6th Floor, Yashwant Place, Chanakyapuri New Delhi -110 021
The Principal Director IHQ MoD(N)/ DSP 9th Floor, Chanakya Bhawan Chanakyapuri, New Delhi -110 021	The Flag Officer Commanding-in-Chief (for CSO (TECH)) Headquarters, Western Naval Command Tiger Gate SBS Marg, Mumbai - 400 001
The Flag Officer Commanding-in-Chief (for CSO (TECH)) Headquarters, Eastern Naval Command Naval Base P.O Visakhapatnam - 530 014	The Flag Officer Commanding-in-Chief (for CSO (TECH)) Headquarters, Southern Naval Command Naval Base Kochi - 682 004
The Commander-in-Chief Andaman & Nicobar Command (for CSO (Tech)) Headquarters, Andaman & Nicobar Command Naval Base, Port Blair - 744 102	The Material Superintendent Material Organisation LBS Marg, Ghatkopar (West) Mumbai - 400 086
The Material Superintendent Material Organisation Kancherapalem Post Visakhapatnam - 530 008	The Material Superintendent Material Organisation PO Box No. 621, Haddo Post Port Blair- 744 102
The Material Superintendent Material Organisation Southern Naval Command Kochi - 682 004	The Material Superintendent Material Organisation C/o Naval Base Karwar - 581 308

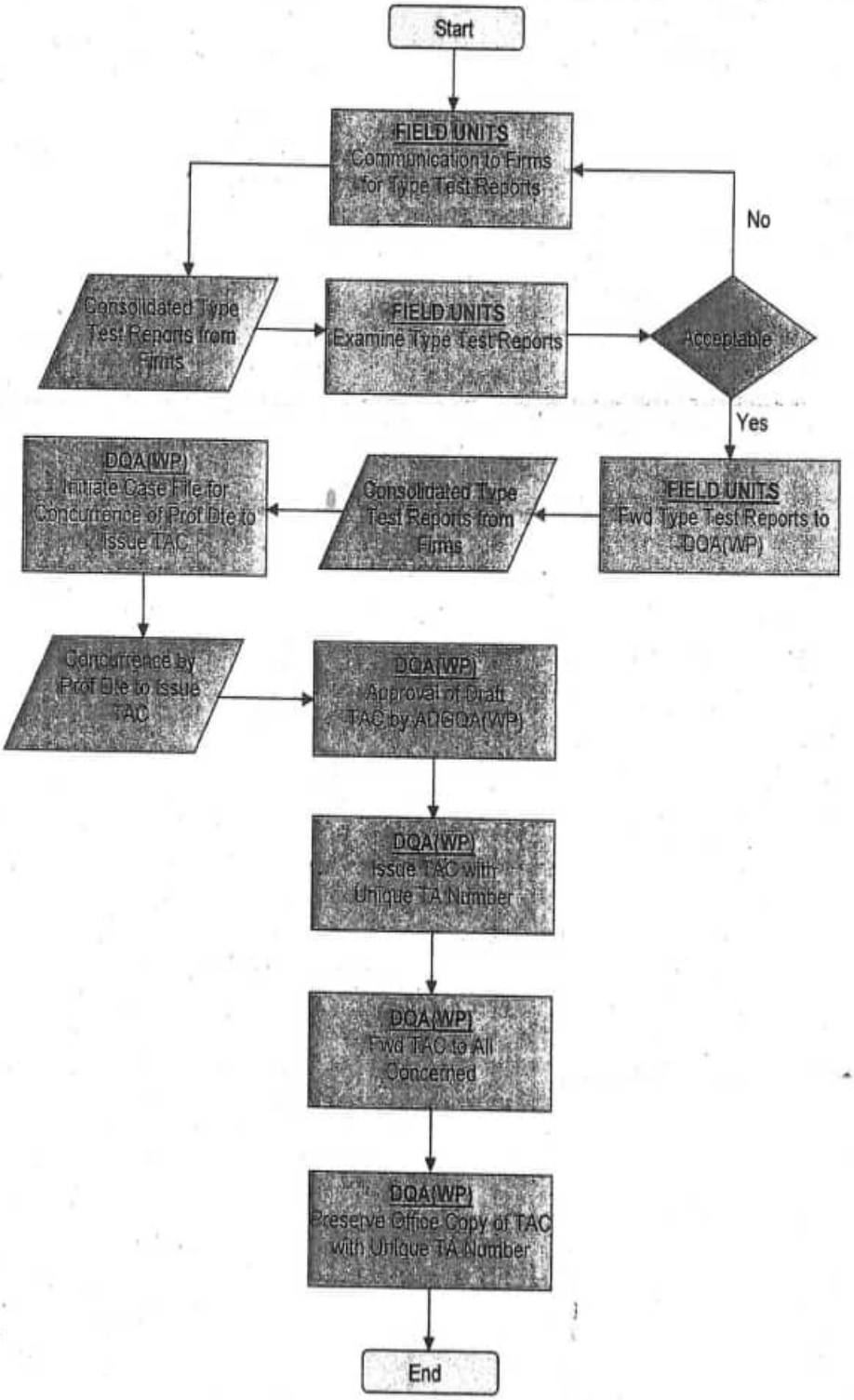
Distribution List:-

The Chief Quality Assurance Officer Chief Quality Assurance Establishment (MS) 7th Floor NMRL DGQA Complex, Tiger Gate Naval Dockyard Mumbai - 400 001	The Chief Quality Assurance Officer Chief Quality Assurance Establishment (WE/WP/EFS) DGQA Complex, LBS Marg, Vikroli (West) Mumbai - 400 083

The Chief Quality Assurance Officer Chief Quality Assurance Establishment (EFS) National Highway No 5 Visakhapatnam - 530 018	The Chief Quality Assurance Officer Quality Assurance Establishment (WE) Annexe N-8A, 'H' Block, DHQ P.O. New Delhi - 110 011
The Quality Assurance Officer Quality Assurance Establishment (WE/FPC) Jalhali Camp Road, Yeshwantpur P.O. Bangalore - 560 022	The Quality Assurance Officer Quality Assurance Establishment (WE) Block-1 Annexe (West Wing) BHEL, Bhopal - 462 022
The Quality Assurance Officer Quality Assurance Establishment (WE/EFS) DGQA Complex, Palavanthangal Post Chennai - 600 114	The Quality Assurance Officer Quality Assurance Establishment (WE) Besides Don Bosco High School Makarpura Road, B/H Shell Petrol Pump ONGC-PO, Vadodara - 390 009
The Quality Assurance Officer Quality Assurance Establishment (WE/WP) Commissariat Road, Hastings Kolkata - 700 022	The Quality Assurance Officer Quality Assurance Establishment (EFS) Commissariat Road, Hastings Kolkata - 700 022
The Quality Assurance Officer Quality Assurance Establishment (WE) Bldg No 375, CQAE (EE) Complex, Aundh Camp Pune - 411 027	The Quality Assurance Officer Quality Assurance Establishment (WE) Building, T-24, Adj. Kendriya Vidyalaya-IV S&T Road Jalandhar Cantt - 144 005

Enclosure-I to DQA(WP) letter 12575/ POLICY/DGQA/WP-TC dated Oct 21

WORKFLOW DIAGRAM FOR ISSUE OF TYPE APPROVAL CERTIFICATES WITH UNIQUE TYPE APPROVAL NUMBER



FORMAT FOR SUBMISSION OF TYPE TEST REPORTS

1. The Type Test Report of an equipment is to be submitted in a consolidated manner in form of a booklet.

2. The booklet should have a page indicating the 'Content' with 'page numbers'.

3. The Type Test Report of each sub-assembly should be segregated by a 'separator sheet' for ease of identification.

For example:- In case of a pump, all Type Test reports of pump and motor should be combined and put together into a single booklet. The reports of the pump and motor should be separated by a 'separator sheet'.

4. The separator sheet should contain following particulars of the sub-assembly:-

(a) Name of the sub-assembly.
(b) Manufacturer's Name
(c) Model No.
(d) Approved GA Drawing Nos.
(e) Applicable SQAP/ Approved QAP No.

Enclosure-III to DQA(WP) letter 12575/
POLICY/DGQA/WP-TC dated Oct 21

STANDARD FORMAT OF TYPE APPROVAL CERTIFICATE

DIRECTORATE OF QUALITY ASSURANCE (WARSHIP PROJECT)
H-BLOCK, NIRMAN BHAWAN POST, DHQ ZONE
NEW DELHI - 110011

Ref: Date:

TYPE APPROVAL CERTIFICATE

It is certified that the system/ equipment as described below is Type Approved and considered suitable for installation onboard ships of Indian Navy.

1.	**Type Approval No**	
2.	**Nomenclature of Main System/ Equipment (Particulars of all sub-assemblies of the system/ equipment are to be mentioned)**	Name - Diesel Alternator Make - M/s GRSE-DEP Model - Approved GA Drawing No -
3.	**Particulars of Sub-assemblies of Main System/ Equipment**	(a) Name - Diesel Engine Make - M/s MTU, Germany Model - Approved GA Drawing No - (b) Name - Alternator Make - M/s Elmot Alternators Model - Approved GA Drawing No - (c) Name - Excitation Panel Make - M/s Elmot Alternators Model - Approved GA Drawing No -

3.	**Particulars of Sub-assemblies of Main System/ Equipment**	(d) Name - Coupling Make -M/s Elmot Alternators Model - Approved GA Drawing No - (e) Name - Local Control Panel Make - M/s Power Control Engineering Model - Approved GA Drawing No - (f) Name - Fire Fighting Panel Make - M/s Agni Controls Model - Approved GA Drawing No - (g) Name - Acoustic Enclosure Make - M/s BBM Acoustics Model - Approved GA Drawing No - (h) Name - Battery Charger Make - M/s Electronic Control Group Model - Approved GA Drawing No - (j) Name - Base Frame Make - M/s Matchwell Engineering Model - Approved GA Drawing No -
2.	**Manufacturer (Name & Address)**	M/s GRSE-DEP Plant Plaza Road Dhurva, Ranchi - 834 004
3.	**Intended Service**	Power generation onboard ships of Indian Navy
4.	**Purchase Order Against Which Type Test Undertaken**	
5.	**SQAP/ Approved QAP Particulars**	
6.	**Conditions of Approval and Validity**	See **Annexure-I**

Seal

(Signature block of authorised signatory)

Annexure - I
(to Type Approval Certificate with Type Approval No _____)

1. The approval is subject to following:-

(a) The basic configuration of the system/ equipment as specified in the approved GA drawings mentioned in the certificate is not changed.

(b) There are no changes in the system/ equipment or it's sub-assemblies w.r.t design, architecture, material specification, duty point, dimensions, manufacturing process and governing standards/ specifications (view obsolescence or technical upgrade).

(c) There are no changes in environmental conditions to which the equipment/ system was earlier Type Tested.

2. The Type Approval Certificate will remain valid till the time the conditions specified at para 1 above are fulfilled.

3. Any changes incorporated in the system/ equipment which renders the same non-compliant to the conditions specified at para 1 above are to be brought to the notice of the concerned Professional Directorate at IHQ MoD (Navy) and DQA(WP). Complete or partial Type Testing shall be undertaken for issue of Type Approval Certificate afresh. The decision of the Professional Directorates at IHQ MoD (Navy) and DQA(WP) regarding requirement of repeat Type Test shall be final and binding.

Annexure - 4

Tele : 011-26193307
Fax : 011-26192870
E-mail : naval-dgqa@nic.in
Website : www.dgqadefence.gov.in

भारत सरकार
Government of India
रक्षा मंत्रालय (गु.आ.म.नि.)
Ministry of Defence (DGQA)
गुणता आश्वासन निदेशालय (नौ सेना)
Dte of Quality Assurance (Naval)
पश्चिमी खंड - 5, आर.के. पुरम
West Block – 5, RK Puram
नई दिल्ली - 110 066
New Delhi - 110066

No.: DQAN/SG/1001/Type Test

18 Jan 22

As per Distribution List

TYPE TESTING OF NAVAL ELECTRICAL/ELECTRONIC EQUIPMENT

1. **Background**. Ship/submarine borne equipment/systems are likely to encounter stringent environmental conditions during their operational/storage life cycle. These are categorised as climatic environmental conditions (high/low temperature, humidity, tropical exposure etc.) and induced environmental conditions viz. shock & vibration, EMI/EMC etc. It is essential that the equipment, if exposed to such environments, continue to work satisfactorily and therefore, there is a need to design/ ruggedize these equipment and validate their capability to operate in most stringent environment conditions prior installation/exploitation.

2. **Type Tests**. In order to gain confidence that the equipment would perform its designed role in the intended environment, during its expected operational and storage life, the equipment is subjected to standard tests under simulated environmental conditions in laboratory. These tests are designed to accelerate severity of environmental conditions with commensurate reduction in exposure time of the equipment to such conditions. In addition, the electrical/electronic equipment is also required to be subjected to electrical qualification tests under specified conditions to assess its capability for reliable performance. Such tests are called Type Tests or Qualification Tests.

3. **Conduct of Type Tests**. Type Tests are conducted on prototype equipment or early production model to qualify the equipment for their operation/exploitation onboard ships/submarines as per the standards specified in the Purchase Order. It is essential that the Type Tests are tailor made on the basis of equipment specifications, operational characteristics and installation region onboard ship. In a system configuration of multiple independent functional units/panels, each independent functional unit/panel will be subjected to Type Tests. The sequence of Type Tests is followed as indicated in JSS 55555 for effective validation of design.

4. **Sampling Plan for Type Test**. Following would be the norm for selection of sample for conduct of Type Test:-

(a) One sample each for every type of electrical/electronic equipment should go through Type Testing to prove its capability to withstand environmental conditions.

(b) In a situation like multiple units of same specifications, one specific unit (preferably prototype or first production model in the absence of prototype) is subjected to all tests as per defined sequence in JSS 55555.

(c) Distributed tests over various units (with same specifications) are neither permitted nor does it serve any purpose.

(d) If there is a range of items of same category, but, of different ratings, the type testing needs to be undertaken on one sample of each rating.

(e) Two different types/sizes of panels having same components, materials and ratings are to be type tested individually due to difference in heat distribution profile and also different shock and vibration withstanding capability.

5. **Occasion of Type Test**. All Electrical/Electronic items for Naval application (excluding COTS), unless and otherwise specifically stated, are required to undergo Type Tests before induction into service. Various occasions for conduct of Type tests are as follows:-

(a) First of its type item being introduced in the Navy for use onboard ships/submarines.

(b) For similar items, changes in internal configuration or design.

(c) When changes in manufacturing process, raw material or components take place due to obsolescence or technological upgrade or any other reason.

(d) When specified in RFP/PO by the Order Placing Authority.

6. **Categories of Type Tests**. The Type Tests can be broadly categorised into following: -

(a) **Environmental Tests**. These tests cater for the natural (climatic) as well as induced environmental conditions.

(b) **Dynamic Tests**. These tests deal with the shock and vibration likely to be encountered by the equipment during transportation, storage and operation.

(c) **EMI / EMC Tests**. To ensure functionality of the equipment without any performance degradation during operation in intended Electromagnetic environment.

(d) **Ingress Protection (IP) Tests**. Ingress Protection test is carried out to classify and rate the enclosure of electrical/electronic devices as per its degree of protection against physical object, accidental contact, dust and water. IP rating does not substitute the drip proof test or driving rain test as the former is the rating of the protective enclosure whereas the latter two tests are to check the effect of such environmental condition on electronics. IP rating table is placed at **Appendix 'A'**.

(e) **Generic Electrical Type Tests**. Electrical equipment is required to undergo few generic Electrical Type Tests to qualify them for their general electrical performance and suitability to operate onboard ships. The SOTRs of respective electrical equipment indicate such equipment specific Type Tests also with test severities and test methodologies. An indicative list of equipment Generic Electrical Type Tests is placed at **Appendix 'B'**. Applicability of such Type tests is equipment specific and therefore, are to be selected as per equipment specifications and design.

7. **Guiding Standards.** Following standards / standards specified in the RFP/PO is to be followed for Type Test.

Environmental Tests

(a) Environmental Tests - JSS 55555: 2012 (Rev 3)

(b) IP Rating - EN 60529

EMI/EMC

(c) Mil Std. 461 F/G

Shock Standards

(d) BR 3021(1)/BR 3021(2)

8. **Severity Levels**. The **maximum severity levels,** as indicated in above standards would, become applicable unless specified otherwise. Similarly, the EMI/EMC qualification of the equipment must follow the "Naval EMI/EMC Acceptance Plan" duly vetted by NEC(Mbi) and approved by IHQ MoD(N). In case of imported items, the severity as well as range and scope of ETs, Shock/Vibration and EMI/EMC requirements must compare to those indicated at para 7 above. While such requirements depend upon the type of platform and location of the equipment onboard, a generic table indicating various types of Environmental Tests (but not limited to) with respective severity level for Naval equipment is placed at **Appendix 'C'**. The Type Test plan including EMI/EMC Acceptance plan must form part of QAP.

9. **Yellow Banding**. Equipment subjected to complete range of ETs render it unfit for onboard use as the test conditions limit the performance of the equipment over intended period of service life. Such equipment is "Yellow Banded" and is used as reference system for training and display purposes. **However, the equipment if not subjected to Mould Growth and Corrosion (salt) tests, is not required to be**

Yellow Banded. In the cases, where no prototype is catered, mould growth and salt corrosion tests may be carried out on representative samples to obviate Yellow Banding of equipment. The representative sample, in such cases, will contain PCBs, electronic components, connectors, card cage elements, guiderail etc., forming part of equipment. Further, In case of shock test, yellow banding is generally not required for electronic equipment unless specifically recommended by design authorities. However, in case of mechanical/electromechanical equipment, yellow banding would necessarily be done if permanent misalignment or displacement takes place during shock test.

10. **Rationalisation of Type Tests**. While it is essential to subject new induction equipment to complete range and scope of Type Test/ETs, there may be a need to rationalise the same due to non availability of test facility or the test chamber of required size. Some equipment e.g. large cabinet of Radar/Sonar, antenna etc. due to their size/weight constraint, may undergo design verification such as Finite Element Module (FEM) analysis by NABL accredited /Govt. body in place of physical tests for shock and vibration. Such verification of design calculation is to be considered as conformance to specified Shock/Vibration provided specific directives by OPA/IHQMoD(Navy) is obtained by the vendor.

11. **Conduct of Type Tests**. As far as possible, Type tests are to be conducted at Govt / NABL accredited Lab and may not be witnessed by QA agencies. In such case, Lab reports are to be reviewed by QA agency for qualifying the product. In case, the tests are undertaken at own Lab or any private Lab, not accredited by NABL, tests will be witnessed by QA agencies for qualification. Following Sequence will be followed during Qualification Testing:

(a) **Visual Inspection:** For physical damage and workmanship

(b) **Functional Test:** To check operational features of system against requirements as per IHQ approved ATP.

(c) **Electrical Tests:** To check all technical measurable parameters (specifications) of the system including safety tests as per given test procedures (**TPs**).

(d) **Identification of Parameters and conduct of Environmental Tests** Environmental tests are carried out as per JSS/Mil std as per specifications of the eqpt. Before and after every environmental/ Dynamic test the equipment is examined physically and performance is checked for operation and critical measurable parameters. These parameters will be identified and performance of the eqpt will be checked against these parameters as per approved ATP by IHQ/ MoD (N).

(e) **Final Functional test:** Post environmental tests the equipment will be tested again for normal operation of the equipment as per IHQ approved ATP.

12. **Type Tests for Imported Items**. In case of items of import nature, Type Tests qualification of the item would be accepted by reviewing the Certificate of Conformity (CoC) submitted by the vendor. The CoC must indicate the governing Standards for Qualification Tests and values to which the items have been tested, Original Equipment Manufacturer test certificates/test reports/data sheet and compliance matrix vis-à-vis the standards specified in the Purchase Order (PO). Approval for equivalent/ alternative international standard used by the OEM of foreign origin must be obtained from IHQ/ MoD (N). A typical CoC format is placed at Appendix 'D'.

13. **Repeat Type Test**. Equipment, already qualified Type approval tests, need not be subjected to repeat Type test unless demanded IAW Para 5 (a) to (c) above. The repeat type test is applicable for only those independent functional units, which have undergone changes. Changes in design/process/components in any indenture contained in the bigger independent functional unit, would call for repeat Type tests of the bigger independent functional unit. However, in case such changes do not affect equipment specifications, an "Abridged Type Test" protocol can be proposed, giving due justification, by the OEM, in consultation with Design Authority, for approval by QA authority/DQA (N).

14. **Type Test Requirements as part of Specifications**. Type Testing of one equipment has time and cost implication. It is, therefore, essential that the requirement of Type Tests is spelt out upfront as part of equipment specification (SOTRs/TSPs) and RFP/TE as part of essential requirements equipment specifications. The Type Testing plan must form part of Quality Assurance Plan generated for the equipment.

15. **Type Approval Certificate**. Upon qualification of Type tests, a Type approval certificate in respect of the type approved item will be issued by HQ DQA (N) on recommendations of concerned field unit. The Type approval certificate issued by any other defence authority will be acceptable provided the range and scope of the Type tests meet the Purchase Order requirements. The Type approval certificate will indicate the equipment details and the unique Type approval number. Type Testing Compendium will be maintained at HQ, DQA (N) in Soft/ Hard copy. Following details will be required by HQ DQA (N) for issue of Type approval certificate:-

(a) Test reports of all Type tests.

(b) Drawing of the equipment.

(c) Relevant Bill of Material.

(d) Details of major manufacturing processes.

16. Validity of Type Test. The Type approval certificate will remain valid subject to conditions outlined at Para 5 above.

17. **Type Testing at NABL accredited Lab:** Testing at external NABL accredited laboratory is permitted if test facilities are either not available in DGQA laboratory or delay is anticipated due to non availability of time slot. Following procedure will be followed:-

(a) Supplier will ensure that proposed external lab has the given test in its scope of NABL accreditation and provide the copy of the same to QA agency.

(b) Eqpt/ Samples will be sealed by the QA agency after preliminary QA checks on Eqpt as per the IHQ/ MoD (N) approved Qualification Test Procedure (QTP).

(c) Supplier will arrange for submitting Eqpt/ samples to NABL lab and bear all logistical/financial expenses incurred in testing.

(d) Applicable standard will be indicated in the requisition for the test and IHQ/ MoD (N) approved QTP (Acceptance criteria) will be provided to the testing Laboratory for measuring performance of equipment during Type testing.

(e) Confidential test reports will be submitted by the NABL laboratory to the QA agency.

18. This letter supersedes all previous letters on this subject.

(VK Lekhi)
Commodore
DDG Quality Assurance (N)

Encl:-

Appendix A - IP Rating Table.
B - Generic Electrical Type Tests.
C - Environmental Test Specifications.
D - CoC Format.

Copy to:-

ACOM (IT&S) ACOL ACOM(D&R) ACNS(SR) ACNS(SM) ADGQA(WP)

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(for DLS / DND / DPRO / DSP / DNA / DWE / DEE / DSR / DME/DNS/DSMAQ)

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The Material Superintendent
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The Material Superintendent
(for CPRO)
Material Organisation
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PortBlair-7441

All Establishments under DQA (N)

Appendix A
Refer Para 6 (d)

IP RATING TABLE

The first numerical indicates protection of person against access to hazardous parts, and protection of equipment against ingress of solid foreign object.		The second numerical indicates protection of equipment against harmful ingress of water.	
IP RATING FIRST DIGIT	**PROTECTION**	**IP RATING SECOND DIGIT**	**PROTECTION**
X	Protection unspecified(Untested)	X	Protection unspecified(Untested)
0	Non Protected	0	Non Protected
1	Protection of the back of the hand against accidental access to hazardous parts, and protection of equipment against objects larger than 50 mm.	1	Protection against drops of water falling vertically.
2	Protection of fingers against access to hazardous parts and protection of equipment against objects larger than 102.5mm.	2	Protection against drops of water falling vertically when the object is tilted up to 15ft from its normal position.(In any direction)
3	Protection of persons holding tools or wires (larger than 2.5mm diameter) and protection of equipment against object larger than 2.5mm.	3	Protection against spraying water at up to 60 ft from the vertical.
4	Protection of persons holding small tools or wires(larger than 1 mm diameter) and protection of equipment against objects larger than 1 mm.	4	Protection against splashing and spraying water from all practicable direction.
5	Protection against entry of dust in sufficient quantity to interface with satisfactory operation of equipment.	5	Protection against low pressure jets of water from all practicable direction.
6	Complete protection against entry of dust.	6	Protection against heavy seas or strong jet of water from all practicable direction.
-	-	7	Protection against temporary immersion.
-	-	8	Protection against continuous submersion.

*** In IP rating IP AB; A (first digit) denotes human safety and protection of enclosure against solid object. B(second) digit denotes protection of enclosure against water ingress.**

Appendix B
Refer Para 6 (e)

GENERIC ELECTRICAL TYPE TESTS

S. No.	Test Description	Reference	Remarks
01.	Mili Volt Drop	NES 511	Superseded by **DEFSTAN 02-511/ 1:2000**
02	Short Circuit	NES 511	-Do –
03	Temperature Rise	NES 511	-Do –
04	Through Fault	NES 511	-Do –
05	Withstand Voltage (HV)	NES 511	-Do –
06	Insulation Resistance	NES 511	-Do –
07	Operation of Protection Devices	NES 511	-Do -
08	Tilt Test	NES 1004	-Do –
09	Load Test	NES 511	-Do –
10	Intrinsic Safety Test	NES 511 (For equipment in magazine area)	-Do -
11	Flame Proof Test	NES 511 (For equipment in magazine area)	-Do -

Appendix C
Refer Para 8

ENVIRONMENTAL TEST SPECIFICATIONS (IN ACCORDANCE WITH JSS 55555:2012)

Sl. No.	Test	Test No.	Specifications		Remarks
1.	Vibration	28	(a) **Equipment Installed in Major Warships**		(a) The equipment should be in switched 'ON' condition during the test. (b) The equipment would be mounted on the vibration table by its normal means of attachment on ship.
			(i) Mast head region		
			Frequency range	Amplitude	
			5 to 14 Hz	±1.25 mm constant displacement	
			14 to 23 Hz	±0.45 mm constant displacement	
			23 to 33 Hz	±0.125 mm constant displacement	
			(ii) After region		
			5 to 23 Hz	±0.45 mm constant displacement	
			23 to 33 Hz	±0.125 mm constant displacement	
			(iii) Main region		
			5 to 33 Hz	±0.125 mm constant displacement	
			(b) **Equipment Installed in Minor Warships**		
			(i) After region		
			7 to 300 Hz	± 0.4 mm constant displacement or ± 60 mm/s constant velocity (whichever is the lesser)	
			(ii) Main region		
			7 to 300 Hz	± 0.2 mm constant displacement or ± 30 mm/s constant velocity (whichever is the lesser	

			(c) **Equipment Installed in Submarines**	
			5 to 33 Hz | ± 0.125 mm constant displacement	
2.	High Temp	17	Procedure 6. Test Condition K (for protected & submersible): (a) Operation : +55°C (b) Storage : +70°C Procedure 6. Test Condition M (for exposed): (a) Operation : +55°C (b) Storage : +85°C Duration: 16 hrs	Performance check during last hour
3.	Damp Heat	10	Operating Temp : 40°C RH : 95% Duration Unpacked and switched-'OFF' : 15h30 Mins Unpacked and switched-'ON' : 30 Mins Total : 16 Hrs duration	
4.	Low Temp	20	Procedure 4, Test Condition 'H' Temperature : -10°C Duration : 16 hrs	Performance check during last 30 mins.
5.	Drip Proof	11	Duration : 15 min	For protected items. Equipment should be operated during the test.
6.	Driving Rain	12	Test Condition C Static pressure : 200kPa	For exposed items
7.	Immersion	19		Equipment should be in its 'unpacked' and switched-'OFF' condition.
8.	Tropical Exposure	27	Test condition A : 7 cycles (for Protected & Submersible) Test condition C : 28 cycles (for Exposed) Temp : 20°C to 35°C RH : 95% Duration : 24 hrs (one cycle)	
9.	Mould Growth	21	Temperature : 30°C, RH : > 90% Duration : 28 days	To be conducted on representative samples for N1 class

				'and on complete eqpt or scale down model for N2 and N3 class eqpt/items. COTS items (or part of it) approved by IHQ/ MoD (N) and Pre-qualified cables not to be selected for Mould Growth test.
10.	Corrosion Salt	9	Procedure 1 (for Exposed & Submersible) Procedure 2 (for Protected) Temp : 35° C, RH : 90 to 95 %	To be conducted on representative samples for N1 class and on complete eqpt or scale down model for N2 and N3 class eqpt/ items. COTS items (or part of it) approved by IHQ/ MoD (N) not to be selected for Salt Corrosion test. Equipment should be in its 'unpacked' and switched-'OFF' condition.
11	Shock Test		The equipment should be able to withstand following shock severities:- (i) **NSS Grade I** (for equipment fitted below waterline) – 120g, 8ms (vertical) and 70g, 8ms (lateral). (ii) **NSS Grade II** (for equipment fitted above waterline) – 50g, 11ms (vertical) and 22g, 11ms (lateral).	
12	Ship Motion Test		NES-1004	As per SOTR/ RFP
13	Any other tests applicable as per specification of eqpt.			

Appendix D
Refer Para 12

CERTIFICATE OF CONFORMANCE (CoC)

1. **Item Details**

S. No.	Description & Part No. of Item	Serial No. of Item, in case, specified in the PO	PO Reference
(a)			
(b)			
(c)			

2. **Qualification Tests**

(a) **Environmental Tests - Compliance Matrix**

S. No	Details of ET as per PO			Standard to Which Tested	Test Severity to Which Tested	Test Report Ref	Remarks	
	Test No.	Test condition	Procedure				Complied	Non complied

(b) **EMI/EMC Compliances**

(c) **Any Test(s) other than ET and EMI/EMC tests**

3. This is to certify that the above mentioned item(s) being supplied conform to the above mentioned standards.

Date:
Seal/Stamp

Signature :
Name :
Designation:

Annexure - 5

Tele : 011-26193307
Fax No. : 011-26192870
E-mail : naval-dgqa@nic.in
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भारत सरकार
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Ministry of Defence (DGQA)
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No.: 66301/Policy/DQA(N)/SG

14 Nov 17

As per distribution list

REVISION OF ACCEPTANCE CRITERIA FOR IMPORTED EQUIPMENT/ ITEMS: IMPORT DOCUMENTS

1. Imported stores are, presently, accepted on the basis of validation of following seven import related documents in accordance with Para 17 of Section-V, Chapter 05 and Para 29 of Chapter 13 of DGQA Standing Orders and DQA(N) letter No. 66301/Policy/DQA(N)/SG dated 31 Jul 15:-

(a) Bill of Lading.
(b) Shipping Bill.
(c) Bill of entry to Ware House.
(d) Country of Origin.
(e) Original manufacturers certificate conforming that spares are tested for fitment on main equipment for which spares are ordered i.e. PAC firm's confirmation certificate.
(f) Original manufacturers certificate / Quality Assurance Guarantee certificates
(g) Firm's guarantee certificate as per Supply Orders (SOs).

It has been observed that all of the above documents may not necessarily be needed to assure quality and at times non availability of one or more import related documents has caused undue delay in acceptance of stores. Accordingly, the issue has been examined in detail and it has been decided to rationalise the documents for acceptance of imported stores for ease of doing business yet retaining following essential QA requirements:-

(a) Establishing the traceability of the item i.e the item is supplied by OEM.
(b) Confirmation of items to the specification through certification by supplier / OEM.
(c) Guarantee / Warrantee certificate from OEM.

3. In view of the above, the following import documents will be validated fc acceptance of imported stores hence forth: -

(a) Copy of one among Bill of Lading / Shipping Bill / Airway Bill (A document issued by the transporter of the equipment which clearly indicates the description, quantity, port of collection and port of discharge).

(b) Invoice by OEM or Country of Origin certificate of the equipment with packing list.

(c) Bill of Entry into warehouse.

(d) The Certificate of Conformity (CoC) indicating governing specifications and values to which the items are tested alongwith Original Equipment Manufacturer (OEM) test certificates/test reports/ Catalogue/Data Sheet.

(e) Guarantee / Warrantee certificate from the supplier/OEM as per Supply Order.

4. DGQA standing order has been amended accordingly.

5. In view of the above OPAs are requested to include list of documents as at Para 3 above in the Supply Orders pertaining to imported stores.

(Amit Rastogi)
Commodore
Offg Addl. Director General
Quality Assurance (Naval)

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Annexure - 6

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No.: 66301/Policy-10/DQA (N)/QA-10 14 Jun 2013

BURN IN TESTING OF NAVAL ELECTRICAL/ELECTRONIC EQUIPMENT

1. Refer to DQA (N) letter 66301/Policy-17/DQAN/QA-11 dated 15 Mar 12 (not addressed to all).

2. **Introduction**. Burn-in test is a technique used to assess the capability of equipment to perform reliably by operating it continuously for prolonged duration under normal or accelerated environmental conditions. Burn-in testing is normally conducted at OEM's premises immediately after satisfactory completion of FATS but prior to delivery of the equipment. Essentially, burn-in testing is a form of Environmental Stress Screening (ESS) which was initially devised for systems using vacuum tube technology, with the aim to ascertain impact of 'component drift' on the overall performance characteristics of the system. The concept was subsequently extended to equipment utilizing transistor/IC based component technology despite the fact that it offered relatively higher stability/reliability. It was considered that for these products, high temperature burn-in was the best stimuli for precipitating latent defects. Over the years, burn-in testing has been further extended to new generation equipment and systems and the present policy is governed by DQA (N) letter ibid.

3. **Study Undertaken on Burn-in Testing.** A detailed study on the burn-in testing as a concept was undertaken at this Headquarters keeping in view the advancement in technology and other related issues and the outcome/conclusions arrived at are contained in succeeding paragraphs.

4. **Component/Assembly Technology.** Over the years the electronics industry has matured and component technology/assembly techniques have improved profoundly. Components procured from renowned manufacturers guarantee reliable, pre-screened and ESS compliant products. Similarly, manufacturing technology for PCBs/sub-assemblies has also improved over the years. These changes, as studies reveal, have resulted in significant changes in product fault spectrum. Experimental data gathered during last several years on this subject indicates that the screening stimuli, through traditional burn-in testing, is no longer an effective method for precipitation of latent defects. For this reason, many modern electronic system manufacturers have abandoned constant temperature burn-in as a defect precipitation screen.

Cont. 2/-

5. **Infrastructure Requirement.** For burn-in testing to be effective, it is essential that the equipment under test be continuously operated for prolonged duration in *fully integrated mode,* in non-ac conditions or under higher temperatures for proportionately lesser duration. Also, for optimal results, 'interactions' with the system should also be performed to simulate the actual operating scenario. Considering that the current guidelines specify 168 hrs (7 days) of continuous operation, the infrastructure and manpower requirements are generally substantial.

6. **Undesirable Effects of Burn-in Testing.** It is a fact that there are a number of components, especially high power microwave components, which are 'life-limited' and every hour of operation of such components, reduces their overall operational life. Though this is obviated during burn-in testing by switching on such devices for limited duration only (and not to 168 hrs), the overall life of equipment does get affected.

7. **Feedback on Burn-in Testing.** As per the policy in vogue, all electronic and weapons systems undergo burn-in testing prior to delivery from OEMs premises. Failures observed during the process have been compiled and it is evident that most defects observed are attributable to workmanship, utilization of components from non-qualified vendors/spurious sources and inadequacies in internal quality control and not consequent to burn-in testing as such. In fact, majority of such defects would surface if the ESS is conducted meticulously. Further, difficulties during conduct of Burn-in testing for 168 hrs such as monitoring/checking of parameters for extended duration, manpower constraint, availability of continuous power, requirement of additional infrastructure (in case of large quantity of equipment) have also been brought out by the field agencies/manufacturers in the past.

8. **Procedures in Vogue**. In accordance with this Headquarters letter ibid, burn- in testing is required to be carried out on **all** systems/equipment by continuous operation for a period of 168 hrs prior shipment. The guidelines also cater for switching on of microwave power devices for limited duration only.

9. **Conduct & Applicability of Burn-in Testing**. In light of above, it would be more prudent to carry out Burn-in test with the aim to ascertain the ability of the equipment to perform satisfactorily for prolonged duration by operating it continuously for 'sufficiently long duration' rather than as a test to weed out infant mortality defects. However, it may also not be appropriate to do away with this method of testing for all manufacturers/types of equipment altogether.

10. **Revised Guidelines fo Burn-in Testing.** Following are the revised guidelines to be adhered to for the purpose of conduct of burn-in testing of equipment/systems:-

Cont. 3/-

(a) In case of major equipment such as weapons, sensors, CMS, AISDN etc., the first-of-type system is to be subjected to Burn-in testing. The conduct of the test on the subsequent systems is to be reviewed by the QA agency, in consultation with DQA (N) HQ, depending on the performance of the first system. In taking a decision on this aspect, the capability of the OEM to implement effective ESS processes would be an important criterion. Further, if the first-of-type system has undergone Burn-in testing successfully, the additional systems to be supplied under repeat orders are also to be exempted from Burn-in testing.

(b) In case of electrical/electronic equipment ordered in bulk quantities (greater than 10), burn-in test is to be conducted on the first 10 % of the systems being supplied. Thereafter, depending upon the performance/defects observed, conduct of burn-in test on the subsequent systems to be reviewed. If one batch of supplies have undergone Burn-in testing successfully, the additional batch/systems to be supplied under repeat orders are also to be exempted from Burn-in testing.

(c) **Duration Of Burn-In Testing**. The duration of the 'Burn In' test is to be decided considering the duration of continuous operation envisaged during operational exploitation. The following criteria may be followed:-

(i) **Systems Requiring Continuous Operation for Prolonged Duration**. In case of equipment requiring continuous operation for prolonged periods (24 X 7 operation like CMS, EW, AISDN, Communication systems etc.) , the burn-in test is to be conducted for 168 hrs at room temperature or 48 hrs at + 55 deg C elevated temperature. Battery operated equipment such as portable WT sets should also be subjected to endurance test of 168 hrs by providing alternate supply arrangement. Transmitting equipment (except SONAR) having life limited elements such as Magnetrons, TWTs, Laser elements should be subjected to 24 hours of endurance test with active elements powered up for 2 hours at a time totaling to 8 hours and equipment in passive/stand-by mode for balance time.

(ii) **Systems Operated Intermittently.** In case of equipment which is operated intermittently, the duration of the burn-in is to be examined on case-to-case basis and finalized in consultation with the OEM. This duration should however be not less than 8 hrs. The duration should be adequate to provide a degree of confidence of system capability to operate continuously for the requisite period. The burn-in test for this category could also be conducted at room temperatures or elevated temperatures as deemed appropriate.

(d) **Performance Monitoring**. System performance should be monitored and health checks to be conducted at regular intervals.

Cont. 4/-

11. In view of the above, following is requested:-

(a) Guidelines at Para 10 above be referred for conduct of burn-in testing of all naval electrical/electronic equipment being inspected.

(b) Comments, if any, which warrant amendment/modifications to these policy directives/guidelines be forwarded to this directorate by 31 Jul 13 for further necessary action.

(अजय सिंह बिसेन)
कप्तान, भा.नौ.
उप महानिदेशक, गु.आ.नि.(नौसेना)
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Annexure - 7

Tel: 011-26193307

580930/DQAN/EL

17 Feb 14

रक्षा मंत्रालय/गु.आ.म.नि
MINISTRY OF DEFENCE (DGQA)
गुणता आश्वासन निदेशालय/नौ सेना
Directorate of Quality Assurance (Naval)

CONFORMAL COATING ON PCBs – ELECTRICAL/ELECTRONIC EQUIPMENT

1. Conformal coating is applied on PCBs in order to protect them against humidity, dust, moisture, air borne contaminants, abrasion/damage for longer life and better reliability. The JSG 0283 specifies the requirement of conformal coating for all PCBs for military applications. In addition, conformal coating has also been recommended in the JSG for non-military applications where the equipment is to operate in marine and humid environment. Therefore, the application of conformal coating on PCBs for Naval equipment is considered essential considering the humid conditions experienced onboard ship/submarines.

2. **Policy Directives**. The requirement of conformal coating was included in the ESS guidelines promulgated in Jul 05. However, whilst revising these guidelines in Mar 12/Jun 13, the aspects pertaining to conformal coating were deleted as the same did not pertain to the ESS specifications. It is pertinent to mention that the ESS guidelines promulgated by this directorate in 2003 also did not include conformal coating. No policy directives/guidelines on conformal coating have also been issued by IHQ, MoD(N). Therefore, as on date no explicit guidelines on conformal coating of electrical/electronic equipment being procured for IN applications is available.

3. Considering the criticality of conformal coating for Naval equipment, all QA agencies are making efforts to ensure that all electrical/electronic equipment are supplied with conformal coating. However, in the absence of explicit guidelines, the following difficulties are being experienced by the field agencies:-

(a) **Imported Equipment**. The majority of indigenous manufacturers are carrying out conformal coating on the PCBs. However, in the case of imported equipment, a large no. of manufacturers do not comply to conformal coating requirements. The justification provided is that, such procedures of conformal coating are not being followed in the respective countries. Further, it is claimed that the equipment being supplied by them for various other marine applications has been performing satisfactorily in the field for a number of years and no problem encountered. Thus, in the absence of a clear cut policy on conformal coating, ambiguity arises with respect to acceptance of the PCBs of imported equipment which do not have conformal coating.

(b) **COTS/Ruggedised COTS**. A large no. of equipment being supplied by the indigenous manufacturers is in the form of ruggedized COTS. As per the existing policy, the ruggedized COTS

equipment with respect to the environmental and EMI/EMC specifications. However, at times the OEMs have shown apprehensions in carrying out conformal coating on the COTS PCBs which are being put into ruggedized enclosures. An example in this regard is the satellite modem for NEWN, where M/s Aayur, Bangalore supplied the in-house productionised PCBs without conformal coating. The requirement of conformal coating could not be insisted as the same were not included in the contract.

(c) **Ambiguous Specifications**. The contract/specifications of a large no. of systems include requirement of conformal coating for "non-COTS PCBs". This leaves ambiguity with respect to conformal coating on COTS PCBs being used in the system. In this regard, an example is of SDN 71. The contract includes conformal coating for "non-COTS PCBs". However, the QAP received from BEL, Bangalore indicates **conformal coating on 100 % indigenously manufactured PCBs and all pluggable COTS PCBs**. Relevant extract of the QAPs are placed at enclosure for reference. It may be seen that the firm has specified the conformal coating in the QAP as per their own interpretation. This needs to be avoided and clear cut policy directives on applicability of conformal coating need to be formulated.

4. It is appreciated that there is a need to evolve a policy on the use of conformal coating on PCBs of electrical/electronic systems being procured. Following issues need to be considered whilst formalizing the policy:-

(a) Conformal coating on PCBs of indigenous/imported and COTS/Ruggedised COTS systems as mentioned at Para 3 above.

(b) Type (Acrylic, Epoxy, Silicone etc.) and thickness of coating.

(c) Repair methodology of PCBs with coating and re-application of coating post repairs.

5. In view of the above, it is requested that issues brought out at Para 1 to 4 above be examined and policy directives with respect to requirement of conformal coating on Naval equipment may be issued.

(Ajay Singh Bisen)
Captain
Deputy Director General
Quality Assurance(Naval)

Encl : As above

IHQ,MoD(N)/PDEE

Copy to:-

IHQ, MoD(N)/ACOM(IT&S)