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QUALITY ASSURANCE PLAN

FOR

POWER SUPPLY

(GBE SDN-P15B)

(M/s MDL Purchase Order No 3300000002, 3300000003, 3300000004,
3300000005 Date 21.11.2014)

M/s BEL PO NO. : BEPO/S20/4900225268 DATED 21.12.2015

MANUFACTURER:



Larsen & Toubro Limited
EAIC-MARINE BUSINESS
6A, North side, Rabale-MIDC,
Rabale, Navi Mumbai.



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QAP

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CN NO.

SH NO.
2

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PREPD.
DINESH WANI , L&T

DATE

08.11.2016


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RECORDS OF AMEDEMMENTS


S. No.	SUBJECT	AMENDMENT		AMENDED BY	DATE OF INSERTION	INITIALS	REMARKS
		NO.	DATE				
1	QAP Rev	0	08.11.16	DPW/VGM	08.11.16	DPW	Initial rev

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CHAPTER – I
(General Requirements)

1.1 List of Abbreviations

ACOS	Auto Change Over Switch
ADP	Auxiliary Distribution Panel
ASTN	American Society of Non Destructive Testing
ATP	Approved Test Plan
CB	Circuit Breaker
CHP	Customer Hold Point
DI	Dimensional Inspection
EMI/EMC	Electromagnetic Interference/ Electromagnetic Compatibility
FAT / I-FATs	Factory Acceptance Trials / Integrated FATs
IR	Inspection Report
LFH	Limited Fire Hazard
MCB	Miniature Circuit Breaker
MCCB	Moulded Case Circuit Breaker
MDP	Main Distribution Panel
NABL	National Accreditation Board for Testing and Calibration of Laboratories
OEM	Original Equipment Manufacturer
P	Perform
R	Review
SDN	Ships Data Network
STC/LTC/TC	Supplier Test Certificate/ Lab Test Certificate / Test Certificate
TS	Technical Specifications
UPS	Uninterrupted Power Supply
VI	Visual Inspection
W	Witness

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1.2 TERMINOLOGY AND DEFINITIONS: The terms used and their definition in QAP will be as follows:

1.2.1. Quality Assurance Plan (QAP). QAP is a comprehensive document which enables the Inspecting Officer to conduct smooth & effective acceptance/testing of the item(s) specified in the order. The QAP will lay down the complete and detailed requirements of QA activities and the methodology for acceptance of item/equipment against the particular order.

1.2.2. Inspection Criteria. List of complete **checks** carried out on the equipment from raw material stage to the finished item and could include verification / measurement of physical, electrical, mechanical and chemical parameters.

1.2.3. Acceptance Norms. Defines the various means of verifying the inspection criteria and could include visual tests, functional measurements, testing of parameters, measurement of dimensions, environmental testing, environmental stress screening, EM interference compatibility and endurance. The QAP shall define norm for acceptance of the item either through review of documents (R) or Witness (W) of the test.

1.2.4. Review. The term “Review (R)” shall mean verification of tests/checks reports, undertaken on the item/sample as per inspection criteria conducted at NABL accredited Lab/Govt. Lab.


1.2.5. Witness. The term “Witness (W)” shall mean physical measurement/testing of items/sample as per approved document in the presence of QA inspector.

1.2.6. Sampling Plan. Sampling Plan is applicable for the lot or batch of the items where it would not be possible for 100% checks. The sampling plan shall clearly specify/mention the Acceptance Quality Level (AQL) wrt to applicable specification.

1.2.7. Customer Hold Point (CHP). The term Customer Hold Points (CHPs) denotes critical stages of the manufacturing implying that the next stage of manufacturing cannot commence unless clearance of the previous stage is accorded by the inspection agency. The CHP stages shall be decided by the respective QA agency in consultation with the firm.

1.2.8. QA Process. All processes involved from receipt of Purchase Order to issue of I-Note as brought out in Para 3.2.

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1.2.9. Input Material. The input material shall mean the material that the OEM procures from its approved supplier in its raw form. The list of such input materials is vast and varied. However, discrete electronic components , ICs (active and passive devices) , displays , fans , pipes, plates, sheet, forging, casting, & bought out items /modules/assemblies etc are few part of input materials.


1.2.10. COTS. The term Commercial off the Shelf (COTS) refers to commercially available items suitable for naval applications and is bought from the civilian market. Such items are in the regular production range of the manufacturer and follow their own qualification. However, these items must meet the requirements stated in NSQRs/SOTRs/POTS/PO in its existing form or at higher indenture level when used as a components or LRU.

1.2.11. Manufactured Items. Items manufactured either in OEM premises or subcontracted/outsourced as per the specification given by the OEM and are used as input material such as casting, forging, PCBs, LRUs etc. form the manufactured items.

1.2.12. Environmental Stress Screening (ESS). ESS is the tailored application for electrical and electronics items to identify and eliminate defective, abnormal or marginal parts and manufacturing defects. ESS is to be carried out on 100% electronics as per the severities mentioned in DQA (N) guidelines promulgated vide letter No. 66301/Policy-17/DQA(N)/QA-07 dated 09 Aug16 and 66301/Policy-17/DQA(N)/QA-10 dated 14 Jun 13. Backplane wired bare cabinets will also be subjected to ESS. However, if backplane is subjected to ESS separately or CoC in case of imported backplane, then backplane wired bare cabinets need not be subjected to ESS.

1.2.13. Type Test. The purpose of this test is to check the vulnerability of the equipment to failure due to prolonged environmental effects (climatic and induced) under which the Unit under Test (UUT) is likely to operated or stored. The UUT is thus exposed to simulated environment at accelerated scale for shorter duration. The guidelines for conducting ETs for electrical and electronic items/equipments have been promulgated vide JSS 55555 - 2012 (Rev 3) (or) MIL STD 810G. The detailed ET plan for the system indicating the device being subjected, test parameters, severities and venue for conduct of the test is to be included in the QAP.

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1.2.14. EMI/EMC Tests. The EMI/EMC tests will be carried out as per the approved Naval EMI/EMC Plan (N-EMAP). The N-EMAP is to be vetted by NEC (MB) and approved by IHQ MoD(N). The approved N-EMAP would form the addendum of QAP. List of EMI/EMC tests would be as per MIL STD 461E/F.


1.2.15. Certificate of Conformance (CoC). Certificate of Conformity (CoC) is the certificate issued by the OEM/authorized distributor stating that the supplied items shall meet the specified requirements indicated by the purchaser. The certificate shall be in accordance with agreed CoC format.

1.2.16. Imported Stores. Items/components of imported nature forming part of any assembly will undergo complete Type Tests as part of the assembly. However, fully finished products/stores of imported nature shall be accepted against validation of following import documents as per DGQA guidelines:-

- (i) Bill of Lading
- (ii) Country of origin
- (iii) Shipping Bill
- (iv) Bill for entry for warehouse
- (v) Certificate of Conformance (COC).
- (vi) Firm's certificates confirming that spares can be used for fitment on main equipment for which spares are ordered.
- (vii) Firm's guarantee certificate as per Supply Order.

1.2.17. Factory Acceptance Tests (FATs) FATs is to be undertaken on the integrated system in accordance with IHQ MoD (N) approved FATs documented by an agency nominated by the order placing Authority (OPA)/IHQ MoD (N).

1.2.18. Preservation & Packing. Preservation & Packing of the equipment, spares/goods contracted so as to ensure safety against damage in the conditions of land, sea and air transportation, transshipment, storage and against weather hazards during transportation. The sellers shall ensure that the stores are packed in containers which are made sufficiently strong and with seasoned wood.

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1.3 Technical Description of the Centralised UPS and Power Distribution System for GBE SDN P-15B.

The Power Supply Solution for GBE SDN P-15B being developed by L&T provides Centralised UPS and Power Distribution System for the entire SDN System on Project P-15B. The Power supply solution is designed to provide 230V Line to Line from Ships supply of 380V/50Hz/3 Wire from normal and alternate source. The system caters for incoming supply with following characteristics:

The main constituents of the system are as follows:

- UPS
- Transformer
- Auto Change Over Switch
- Distribution Panels (Main and Auxiliary)
- Circuit Breakers (CBs – MCBs/ MCCBs)
- Battery Rack

1.4 System Specifications of the Centralised UPS and Power Distribution System for GBE SDN P-15B

(a) **Centralised UPS with Output Transformer.** The centralized UPS are modular based on Decentralized Parallel architecture. The UPS consists of 3 No's of 10 KVA modular online double conversion type units in a single rack. Each of these modules contains all the hardware required for full system operation. Three single phase output transformers (Rating 12KVA Pri. 192V, 58A & Sec. 253V, 44A Single Phase) for 230V, 1 Ph, 50 Hz feed the MDP which is mounted inside the UPS.


- **Dimensional Details:** 1200 X 1600 X800mm (L X H X D)
- **Weight:** 980Kg +/-5%
- **Output Power Rating:** 30KVA, 1 Ph. 230V AC 50Hz

(b) **Transformers (Trafo).**The Transformers conform to IEC 60076/BS 3399:1961. These indoor type transformers are provided with Drip- proof, Air cooled, Suitable for marine use and F class insulation. The rating of the transformers is suitable for 30 KVA load. The input side transformer is 58KVA, 380/167V, 3 Ph, 50Hz, Star / Star –Delta configuration.

- **Dimensional Details:** 1150 X 900 X850 mm (L X H X D)
- **Weight:** 440Kg +/-5%
- **Power Rating:** 58KVA, Primary 380V AC 3Ph. 50Hz. Secondary 167V Delta Star (Star to Delta-Star Transformer)

(c) **Auto Change over Switch.** Auto change over switch (ACOS) conform to standard EED-Q-64. The function of the ACOS is to provide 380 V AC from normal and

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alternate supply to the CB1 panel. It provides automatic changeover between the supplies. Priority is provided to normal supply. When this supply goes unhealthy, the unit switches over to alternate supply.

- **Dimensional Details:** 650 X 650 X 315mm (L X H X D)
- **Weight:** 83Kg +/-5%
- **Output Power Rating:** 100A ACOS, 3 Ph. 380V AC 50Hz (2 Input 1 output)


(d) **Distribution Panels (Main and Auxiliary Distribution Panels).** Mains distribution panel is used to distribute the 1 phase output from the UPS supply to individual Auxiliary Distribution panel at each compartment. The Mains distribution panel consist of Molded Case Circuit Breakers (MCCB) and number of miniature circuit breakers (MCB). Auxiliary distribution panel is used at each compartment to distribute power to individual equipment. The ADP contains Circuit Breakers of various rating. There are three types ADP Type-A, Type-B and Type-C. ADP are provided with suitable EIPG Type cable glands for all Input and Output cables.

SL	BOARD DESCRIPTION	DIMENSIONS IN mm (L X H X D)	WEIGHT IN KG (+5%)	INPUT POWER	OUTPUT POWER
1	Main Distribution Panel	500 X 550 X185	46	1Ph. 230VAC,100A	
2	Auxiliary Distribution Panels ADP-A	500 X 450 X175	34	1Ph. 230VAC, 58A	
3	Auxiliary Distribution Panels ADP-B	500 X 400 X175	33	1Ph. 230VAC, 48A	
4	Auxiliary Distribution Panels ADP-C	500 X 350 X175	24	1Ph. 230VAC, 20A	

(e) **Circuit Breaker Box (CB1 and CB 2).** The Main purpose of Circuit breaker box is to provide protection to electrical equipment against the short circuit and overload. The Circuit Breaker Box –Output provides the Circuit Breakers at output of UPS and at output of UPS Output transformer. The output of the ACOS is connected to CB1. From the CB1 the 380 V AC is connected to transformer. The transformer steps down the voltage to 167 V AC. The same is fed back through CB1 to UPS unit. Basically CB1 is used to connect the transformer to system. CB2 is connected at the output of UPS. CB2 provides linking between UPS and main distribution panel.

CB1

- **Dimensional Details:** 500 X 550 X 260mm (L X H X D)
- **Weight:** 39Kg +/-5%
- **Output Power Rating:** 125A, 3 Ph. 380V AC 50Hz

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CB2

- **Dimensional Details:** 250 X 400 X 260mm (L X H X D)
- **Weight:** 15Kg +/-5%
- **Output Power Rating:** 160A, 1 Ph. 230V AC 50Hz

(f) **Battery Rack.** The Battery rack houses batteries (Type - maintenance free, lead acid approved for marine service) required for 30 Min Battery Backup. Rack is designed to support the easy replacement of Individual Batteries and space is provided to keep additional 8 nos. batteries (4 Nos in each compartment) with refer to Drawing No. SYGB005-01 to 08.

- **Dimensional Details:** 1400 X 1500 X 800mm (L X H X D)
- **Weight:** 953Kg +/-5%
- **Power Rating:** 12V DC, 65Ah 28 Batteries in Series (336V DC Approx.)

1.5 Block diagram of Centralised UPS and Power Distribution System For GBE SDN P15-B

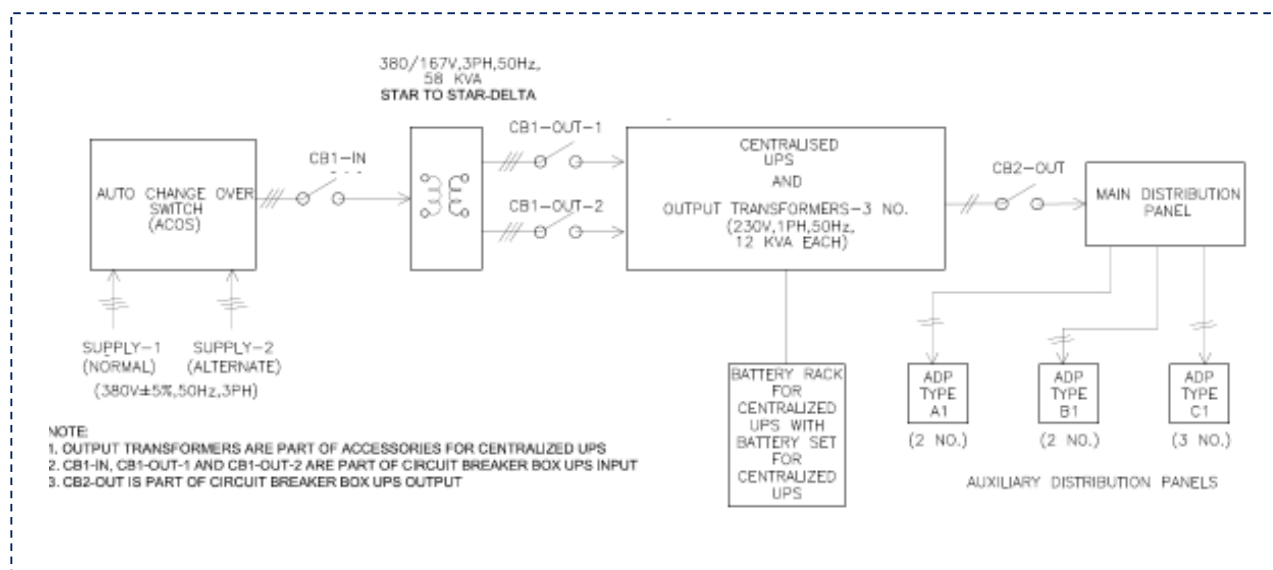




Figure 1

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1.6 List of Deliverables


SL	ITEM DESCRIPTION	PART NUMBER	QTY	UOM
I	MAIN EQUIPMENTS : Consists of Main equipment deliverables items			
1	Centralized UPS	112184988287	2	No's
2	Battery Rack for centralized UPS	112184988384	2	No's
3	Battery Set for centralized UPS	112184988481	2	No's
4	Accessories for centralized UPS	112184988578	2	No's
4.1	Transformer-UPS Input	112185862451	1	No's
4.2	Auxiliary Dist Panel –Type-A1	112185862645	2	No's
4.3	Auxiliary Dist Panel –Type-B1	112185862742	2	No's
4.4	Auxiliary Dist Panel –Type-C1	112185862839	3	No's
4.5	Auto Change Over Switch (ACOS)	112185863033	1	No's
4.6	Circuit Breaker Box UPS Input	112185862936	1	No's
4.7	Circuit Breaker Box UPS Output	112187901876	1	No's
5	Main Power Distribution Panel	112184835997	2	No's
II	INSTALLATION MATERIALS: Installation Material include Shock mounts, Mating Connectors / Lugs, Fasteners and other accessories as required to install items listed at Main Equipment.			
1	Inst Matl for Centralized UPS	112185525764	2	No's
2	Inst Matl Main Power Distribution Panel	112185525861	2	No's
3	Inst Matl Accessories for centralized UPS	112185525958	2	No's
4	Inst Matl for Centralized Battery Rack	112185526055	2	No's

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1.7 List of OB & T&T Spares

	OB SPARES: “OBS for UPS & Accessories, BEL part no: 112185526928” is part of “Misc Spares-OB, BEL part no: 1121 855 262 49”			
SL	ITEM DESCRIPTION	PART NUMBER	QTY	UOM
1	OBS for UPS & accessories	112185526928	1	Set
	OB Spares for Centralized UPS	-		
	OB Spares for Circuit Breakers –UPS input	-		
	OB Spares for Circuit Breakers –UPS Output	-		
	OB Spares for Main power distribution panel	-		
	OB Spares for Auxiliary distribution panel	-		
	OB Spares for Auto change over switch	-		


	T&T SPARES: “T&T Spares for UPS and Accessories , BEL Part No. 112188066388” is part of “Misc Spares T&T , BEL Part No. 1121 855 264 43 ”			
SL	ITEM DESCRIPTION	PART NUMBER	QTY	UOM
1	Misc. Spares T&T	112185526443	1	Set
	T&T Spares for Centralized UPS	-		
	T&T Spares for Circuit Breakers UPS -Input	-		
	T&T Spares for Circuit Breakers UPS Output	-		
	T&T Spares for Main power distribution panel	-		
	T&T Spares for Auxiliary distribution panel	-		

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CHAPTER – II
(Applicable Standards)

2.1 List of Governing Specifications and Applicable Standards

<u>S.No.</u>	<u>Specification No.</u>	<u>Description</u>
1	AISI -303/303 Se/304/grade	Stainless Steel
2	A4-70 / AISI-316 Marine Grade	Fasteners
3	IS 13947-1993 Part-II, NES 511 & NES 530	MCCB
4	IS 8828 -1996	MCB
5	IS 1248-1983,IS 7222-1980, IS 13010	Meters (Voltmeters, Ammeters, Frequency meters, KWH Meters, Transducers etc)
6	IS 11149-1984	Neoprene Gasket / conductive gasket / EMI shielding as applicable
7	IS 1901	Miscellaneous Electrical items (Bulbs, Lamp Holder, Resistors, PB, Actuators, Diodes, Bridge Rectifiers, Switch)
8	IEC 60076 / BS 3399:196	Transformer
9	DGS/EED/IV/1535/R6, NES 512	Cable Glands
10	EED-Q-071(R4)	Specifications for AC Motors and Starters / Control Gears
11	EED-Q-64	ACOS
12.	TS 1121 100 200 91	Paint
13	JSG-0457-01:1986 Part I/II/III & 1997 Part IV	Painting Scheme (External surfaces)
14	NES 518 / 526	LFH Cables
15	NES 532	Electrical Supplies and Distribution System
16	NES 723	Cable Tallies
17	NES 784	Safety Markings

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2.3 Quality / Workmanship/ Process Standards : The standards followed in L&T are tabulated below:

SL. NO.	QUALITY STANDARDS	TITLE
1	F:MQAQC:0005	Suppliers System Audit
2	F:MQAQC:0004	Receipt Inspection – Fabrication work
3	MQS – 001 to 019	Receipt Inspection - System Material
4	F:MQAQC:0010/11	In-Process Inspection - Switchboards/ Control Panels

SL. NO.	L&T WORKMASHIP / PROCESS STANDARDS	TITLE
1	MQS 001 to 019, QC 001	Workmanship Standards – Component level
2	GA/ ELD	Component Mounting

2.3 EMI/EMC Standards: MIL-STD-461E

2.4 Environmental Testing (ET) Standards JSS 55555: 2012 (Rev3) Class N1


2.5 Environmental Stress Screening (ESS) Standards:
No.66301/Policy-07/DQA (N)/QA-07 dated 09 Aug 2016

2.6 Burn-in / Endurance: 168 Hrs at room temperature “No. 66301/Policy-10/ DQA (N) / QA-10” dated 14 Jun 2013

2.7 Technical Documentation Standards

- JSS-0251-01 (for L&T System)
- OEM Document (For OEM supplied Equipment)

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2.8 SOFTWARE DOCUMENTATION STANDARDS. Not Applicable

2.9 PACKING AND PRESERVATION STANDARDS. As per BEL PO requirements

2.10 Classification of sub-systems based on location onboard N1/ N2/N3 for

Qualification : N1

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CHAPTER –III

(QA Core Activities)


- 3.1 General Quality Assurance Plan.** The detailed Inspection Criteria for Components / Assemblies/System/ are provided as below. This plan is generic hence please refer actual List of Components / Assemblies with Inspection Criteria mentioned in Table 3.6.

Table 3.1

General Quality Assurance Plan


Sl. No	QA Stage	QA Characteristics	Quantum of checks	Ref.doc	QA Criteria/ Acceptance Norms	Remarks
1	Input Material					
(a)	<u>Electrical /Electronic Items</u>					
1(a)	(i) Discrete electronics Items/components	Visual, Electrical tests	100% Or Sampling plan as per IS 10673 (as per practice of the firm)	As per OEM's specification Catalogue, with CoC	Review of Report Test Certificates	For applicable components only (List of items are mentioned in Table 3.6)
	(ii)COTS Items	Visual, Electrical	100%	As per OEM's specification Catalogue, with CoC	Review of Report/ Test Certificates	Refer List of items are mentioned in Table 3.6

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Sl. No	QA Stage	QA Characteristics	Quantum of checks	Ref.doc	QA Criteria/ Acceptance Norms	Remarks
(b)	<u>Mechanical items</u>					
1(b)	(i) Bar, Plate, pipe, sheets	Visual, Chemical Physical, Inclusion Rating, Bend Test, Coupling Test and other applicable test as per relevant specification/Drg.	One sample per batch	Approved drawings , IS/ BS & other OEM Stds	Review of Test certificates (To be decided by QA agency)	For applicable parts only (Like M.S. Sheet)
	(ii) Casting	Pouring of castings, Visual, Chemical, Physical, Non Destructive test (NDT)	One sample per batch	Approved drawings , Process, IS/BS or any other OEM Stds	Review Test Certificates	N.A.
	(iii) Forgings	Visual, Chemical Physical, NDT, Micro, Macro, UT and Forging Flow lines	One sample per batch	Approved drawings , Process, IS/BS or any other OEM Stds	Review Test Certificates	N.A.

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SI no	QA Stage	QA Characteristics	Quantum of checks	Ref.doc	QA Criteria/ Acceptance Norms	Remarks
1(b)	(iv) Standard articles (bolt, nut, washer, seal, chain, bearings, etc)	Visual, Dimension, Chemical, Physical, Hardness, coating thickness,	Sampling plan as per IS 2500 Part-I	OEM Catalogue. Approved drawings IS/BS & other equivalent specs.	Review Test Certificates	N.A.
	(v) Spring	Visual, Dimension, Chemical, Physical, Load test/spring rating	Sampling plan as per IS 2500 Part-I	OEM Catalogue. Approved drawings IS/BS & other equivalent specs.	Review Test Certificates	N.A.
	(vi) Seal/molded rubber components	Visual, Dimension, Chemical, Physical, shore hardness polymer identification / Shelf life.	Sampling plan as per IS 2500 Part-I	OEM Catalogue. Approved drawings IS/BS & other equivalent specs.	Review Test Certificates	N.A.

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SI no	QA Stage	QA Characteristics	Quantum of checks	Ref.doc	QA Criteria/ Acceptance Norms	Remarks
1(b)	(vii)Adhesives	Shelf life	100%	OEM Catalogue	Certificate of Conformance	Data sheets to be provided for each batch.
	(viii) Bearings	Visual, Dimension, Chemical, Physical, Axial, radial play	100%	OEM Catalogue, Approved drawings IS/BS and other equivalent specs.	Review Test Certificates	N.A.

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Sl no	QA Stage	QA Characteristics	Quantum of checks	Ref.doc	QA Criteria/ Acceptance Norms	Remarks
1(b)	(ix) Hoses	Visual, Dimension, material, pressure test	100%	OEM Catalogue, Approved drawings IS/BS & other equivalent specs.	Review Test Certificates/ Witness	N.A. Sl. No. (ix) And (x) both option namely witness and review of certificate would be applicable. The discretion to witness for the particular item would rest with the inspection agency N.A.
	(x) Valves, gear box, Hyd. cylinders, actuators, all types of pressure gauges and misc instrumentation	Visual, pressure test, functional test and verification of calibration certificate as applicable	100%	OEM Catalogue, Approved drawings/ ATPs/ IS/BS & other equivalent specs.	Review Test Certificates/ Witness	

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				1121 849 892 57		
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Sl no	QA Stage	QA Characteristics	Quantum of checks	Ref.doc	QA Criteria/ Acceptance Norms	Remarks
2	<u>In Process</u>					
2 (a)	(a) <u>PCBs(In-House manufactured/ sub-contracted)</u>	Visual	100%	Approved GA/ schematic	Review/ Witness	Approval from IHQ MoD(N) is required for use of Non- Mil grade. ATPs should be approved by IHQ MOD (N) During FAT PCBs will be tested with Board.
		Component lay out & wiring, configuration /Version)	100%	Approved GA/ schematic /wiring chart	Review/ Witness	
		Functional tests	100%	ATP	Witness	
2 (b)	(b) <u>Cables</u>	(i) Visual (ii) Raw material (iii) dimension (iv) functional test	100% As per TPs	Approved TPs/ drawings	Review/ Witness	Since Cable Supply is not in L&T Scope. N.A.

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SI no	QA Stage	QA Characteristics	Quantum of checks	Ref.doc	QA Criteria/ Acceptance Norms	Remarks
2 (c)	<u>(c) Cabinets</u>	(i) Visual (ii) Dimension (iii) Functional Test	100%	Approved drawing/ Approved ATP	Witness	(Conformance to the drawing wrt ventilation, lifting arrangement, handle, shock mount fitment, components layout, grounding arrangement, internal wiring etc.) CHP All the equipment will checks during FAT in individual / integrated format as per Approved ATP.

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Sl no	QA Stage	QA Characteristics	Quantum of checks	Ref.doc	QA Criteria/ Acceptance Norms	Remarks
3	<u>ESS</u> (PCB and Modules)	As per approved ESS Plan/DQAN guideline	100%	DQAN Guideline dated 14 Jun 13 /MIL HDBK 2164A/MIL HDBK 344A or other equivalent specs.	Review/ witness	(a) CHP (b) OEM should draw the ESS plan for the equipment being supplied as per DQAN guideline for the parameters/ checks mentioned therein. To be undertaken at NABL accredited Lab/ Govt. Lab. Witness will be done by QA agency In case test is being conducted at firm's premises. CoC to be provided in the format attached as Annexure-I of the QAP

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SI no	QA Stage	QA Characteristics	Quantum of checks	Ref.doc	QA Criteria/ Acceptance Norms	Remarks
4	<u>Ets</u> (at Equipment level)	As per Table 3.4.1	On prototype or first of production model	JSS 55555 – 2012 (Rev -3) or other equivalent specification	Review/ witness	Witness for indigenous manufactured items. Review of CoC for imported items. The CoC should contain the achieved and specified values as per the specification tested.

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Sl no	QA Stage	QA Characteristics	Quantum of checks	Ref.doc	QA Criteria/ Acceptance Norms	Remarks
5	<u>Final Product</u>					
5 a)	Final Assembly	Completeness checks Dimension & Weight	100%	Approved drawing/ Specification.	Witness	QA agency is to physically confirm that all LRUs assembled in the system have QA stamp for clearance CHP
5 b)	EMI/EMC test	As per Table 3.5	Prototype or first of production model	Approved EMI/EMC- Acceptance Plan (EMC-AP)	Review	OEM to formulate EMC-AP and forward to IHQ MoD(N) through NEC(MB). The plan shall be as per SOTRs/POTS

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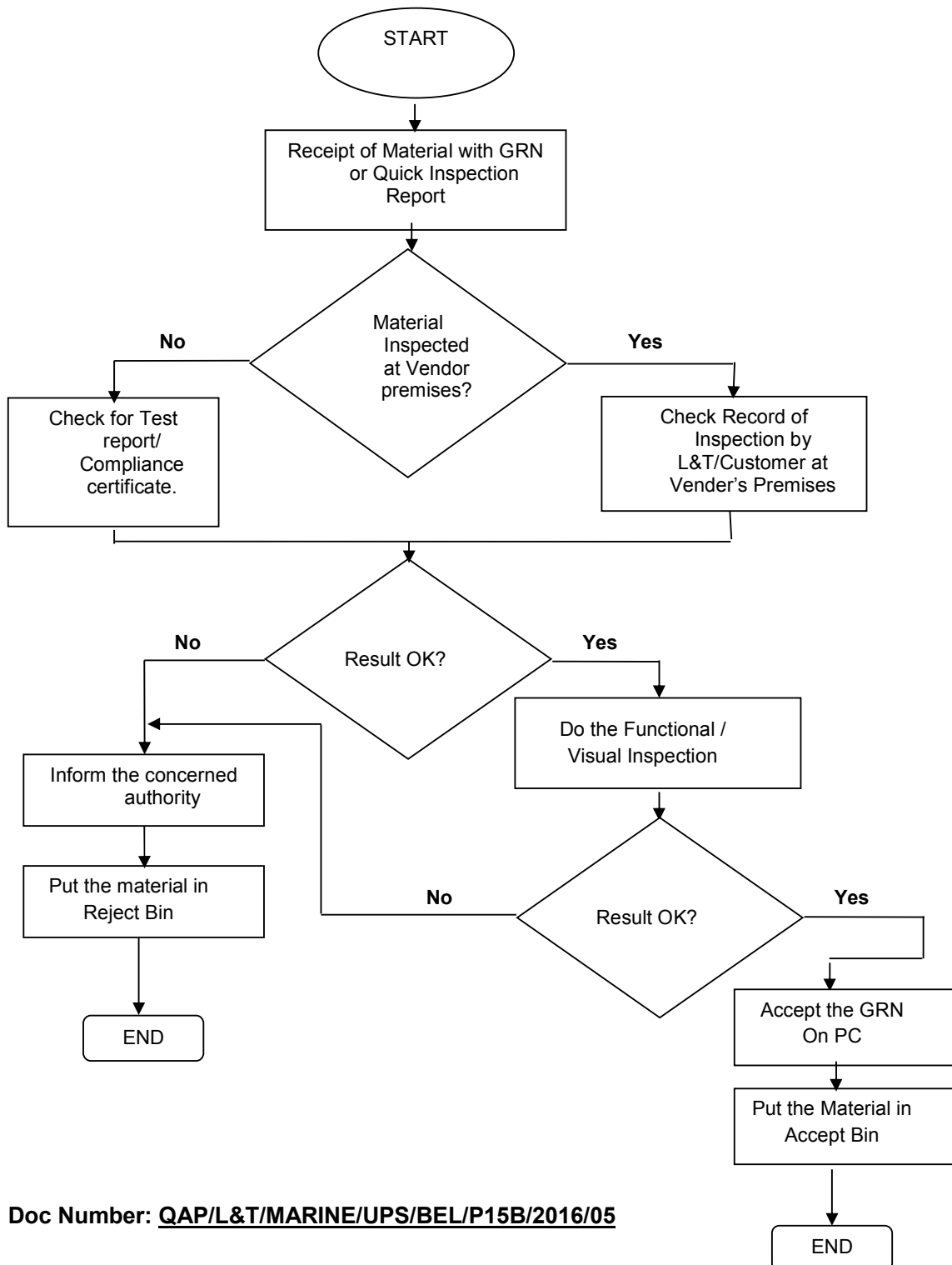
SI no	QA Stage	QA Characteristics	Quantum of checks	Ref.doc	QA Criteria/ Acceptance Norms	Remarks
5 c)	Functional test	Endurance Test	"On the first System"	Approved Plan by IHQ MOD(N)	Witness	Testing to be carried out as per approved ATP by IHQ/MOD(N) CHP
		Factory Acceptance Test (FATs)	100%	Approved FATs /ATP Document by IHQ MoD(N)		
5 d)	Painting	Color scheme Dry Film Thickness (DFT) measurement	100%	Approved color scheme by IHQ MoD(N)	Witness/ Review	
5 e)	Preservation & Packing	Visual	100%	Approved Packing & Preservation.	Witness/ Review	

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3.2 QA Process Involved. Flow chart of QA process involved is placed at

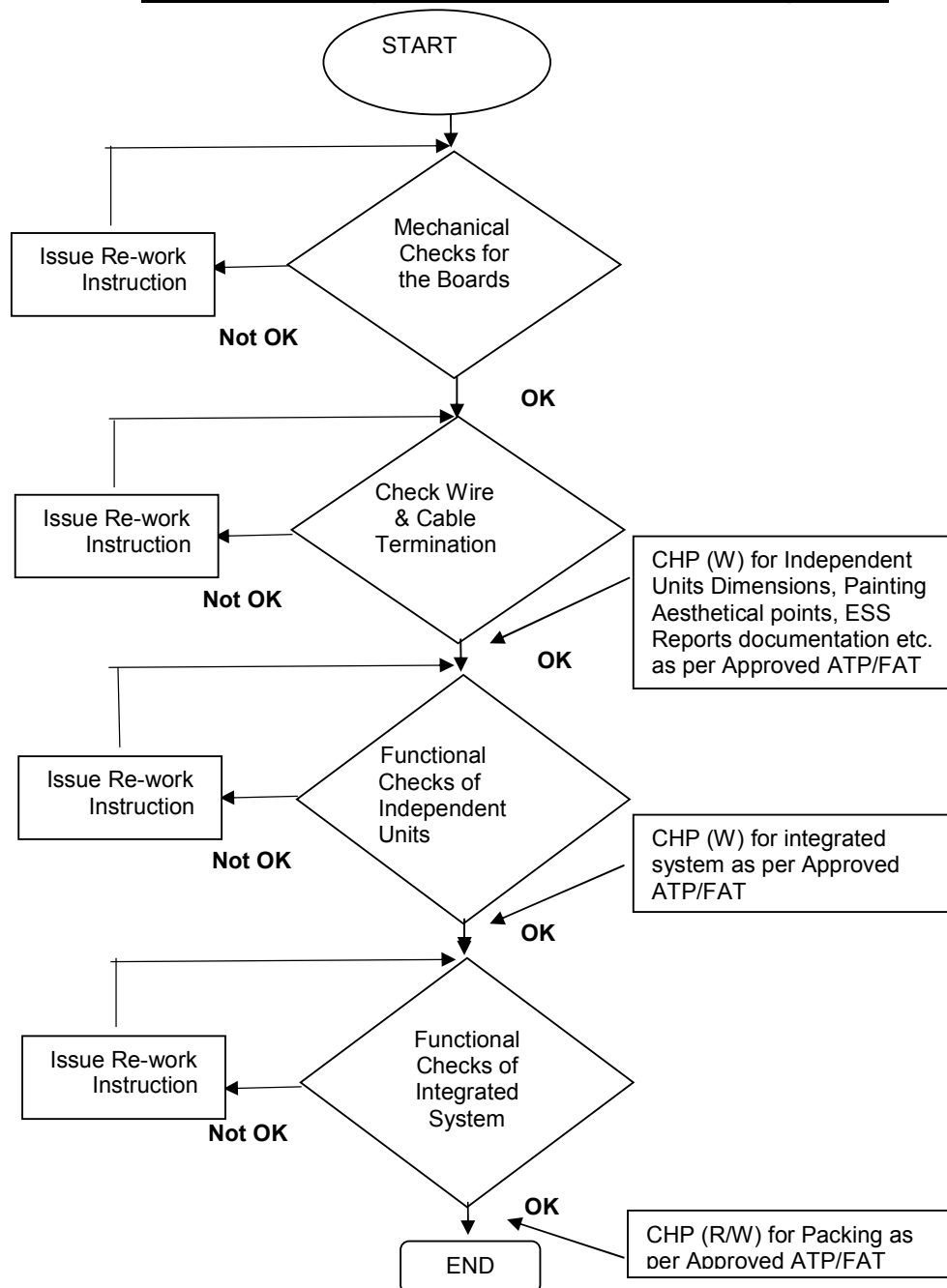
3.2.1 Flow chart for Input Material Checks




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3.2.2 Flowchart for In-process and Final Product inspection



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3.3 Details of Environmental Stress Screening (ESS). ESS is the tailored application of electrical and environmental stresses for electronics parts, modules and units to identify and eliminate defective, abnormal or marginal parts and manufacturing defects. It is a production screen normally conducted on 100% of the manufactured items. The intent of ESS is to simulate infant mortality failures via accelerated aging without causing damage or inducing wear out to the product under development / manufacture.

The Environmental Stress Screening (ESS) Plan is detailed as below:

Table-3.3(a)
ESS Test Sequence

SI No.	ESS Stage	Test	Applicability	SEVERITY
1	Stage-1	Thermal Cycling (PCB level)	Indigenous PCBs	As per: DQA(N) letter 66301 /Policy- 07 / DQA(N) / QA-07 dated 09 AUG 2016
2	Stage-2	Random Vibration (PCB level or higher	Indigenous manufactured units/PCB	
3	Stage-3	Thermal Cycling (indenture higher than PCB level)	Indigenous manufactured units	
Conformal Coating				
1	Conformal coating		100% on non- COTS PCBs	


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Table 3.3 (b)

Random Vibration Stress Screening (RVSS) Severity Specification

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	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	



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Table 3.3 (c)
Thermal Cycling Stress Screening (TCSS) Severity Specification

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	

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(a) ESS Plan for Indigenous PCBs/Modules/Units:

Table 3.3 (d)

ESS: STRESS SEVERITY PLAN for PCBs/Modules/Units

SI No	PCB Level/Sub Unit/Equipment	Screen Parameters	Remarks
1.	<u>PCB LEVEL</u>		
A)	Inverter Control card (Non MIL) Part No. : IPMS106CM3C01-icc	BBX	When PCB is part of Main Equipment or Spares
B)	Rectifier Control Card (Non MIL) Part No. : IPMS106CM3C01-rcc	BBX	When PCB is part of Main Equipment or Spares
C)	Signal conditioner Card (Non MIL) Part No. : IPMS106CM3C01-sccr	BBX	When PCB is part of Main Equipment or Spares
D)	Rectifier Driver Card (Non MIL) Part No. : IPMS106CM3C01-rdc	BBX	When PCB is part of Main Equipment or Spares
E)	Display Control Card (Non MIL) Part No. : IPMS106CM3C01-dcc	BBX	When PCB is part of Main Equipment or Spares
2.	<u>EQUIPMENT/ UNIT LEVEL</u> Automatic Changeover Switch Module (ACOS) (Non MIL) Part No. : 1121 858 630 33	XBB	Here we ACOS is a complete assembled sealed unit/Electronic module. And hence Random Vibration & Thermal Cycling will be carried out.

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Table-3.3(e)
List of Item Exempted from ESS:

SI	Item Description	Part Number	Category	Remarks
Units Exempted from ESS				
1	Centralized UPS	112184988287	IND	All the PCBs used in UPS, ESS testing will be carried out as mentioned in ESS chapter 3.3
2	Battery Rack for centralized UPS	112184988384	IND	All these items are not involving any Electronic PCBs.
3	Battery Set for centralized UPS	112184988481	IND	
4	Accessories for centralized UPS	112184988578	IND	
4.1	Transformer-UPS Input	112185862451	IND	
4.2	Auxiliary Dist Panel –Type-A1	112185862645	IND	
4.3	Auxiliary Dist Panel –Type-B1	112185862742	IND	
4.4	Auxiliary Dist Panel –Type-C1	112185862839	IND	
4.6	Circuit Breaker Box UPS Input	112185862936	IND	
4.7	Circuit Breaker Box UPS Output	112187901876	IND	
5	Main Power Distribution Panel	112184835997	IND	
PCB/Module Exempted from ESS				
1	Card mounted on Thyristor/IGBT stack Like RC Snubber cards	N.A.	IND	These cards are mounted on IGBT & Thyristor stack & proven and supplied by OEM (M/s Semikron) directly.
2	IGBT driver card.	N.A.	IND	
3	Aux./Power Contactor, Fuses, Lamps, Push Buttons, Control/Selector Switches, Relays, MCBs, MCCBs, Transformers, Fan With Filters , Thermostats, Space Heaters, Terminals, Cable Lugs, Cable Glands, Shock Mounts, Thyristor Stack, IGBT Stack, Capacitors, Chokes and Inductors, SMPS, Hall Effect Sensors, Current Transducers, Capacitors, Batteries.	N.A.	IND	All these items are not involving any Electronic PCBs.


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3.4 ENVIRONMENTAL TESTS (ET)

Table-3.4.1
Details of environmental test Plan

SI No	Test	Severity	Applicable Standard	Venue	Remarks
1	Vibration	Test No.: 28, Freq range: 5 to 33Hz, Amplitude \pm 0.125mm, Constant Displacement, No. of axes: X, Y, Z, Duration: 1hour in each axis, Tests carried out with shock mounts.	JSS 55555: 2012 Rev.3-N1	Govt / NABL accredited lab	The equipment should be in switched ON condition. Visual inspection and functional check after the test. CHP (W)
2	High Temp	a) Test No.: 17 Procedure 6. Test condition K: Operation at $55^{\circ}\text{C} \pm 3^{\circ}$ for a period of 16 hours. Functional check during last ½ hr. b) Storage at $70^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for a period of 16 hours. Functional check at room temp after completion of the test.	JSS 55555: 2012 Rev.3-N1	Govt / NABL accredited lab	a) The equipment should be in switched on condition during the test. Functional check in the last ½ hr. b) The equipment should be in switched off condition during the test. CHP (W)

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3	Damp Heat	Test No.: 10 The temp and relative humidity +40°C±2°C at 95%RH. Test duration 16 hours. Functional check during last ½ hr.	JSS 55555: 2012 Rev.3-N1	Govt / NABL accredited lab	The equipment should be in switched off condition during the test and switched on for functional check during last ½ hr. CHP (W)
4	Low Temp	Test No: 20 Procedure 4. Test condition H: -10°C ± 3° for a period of 16 hours. Functional check during last ½ hr.	JSS 55555: 2012 Rev.3-N1	Govt / NABL accredited lab	The equipment should be in switched off condition during the test and switched on for functional checks during last ½ hr. CHP (W)
5	Drip Proof	Test No: 11 Duration 15 Minutes	JSS 55555: 2012 Rev.3-N1	Govt / NABL accredited lab	The equipment should be in switched ON condition during test. CHP (W)
6	Mould Growth	Test No.: 21 (To determine the resistance of electronic and electrical equipment against mould growth) As per JSS 55555: N1 Rev 3	JSS 55555: 2012 Rev.3-N1	Govt / NABL accredited lab	Enclosure material sample will be tested Sample To be Identified by CQAE(WE) / Inspection Agency nominated by DQA(N)

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7	Corrosion Test(Salt)	<p>Test No: 9</p> <p>Procedure 2 for inner deck items (To determine the suitability of electronic and electrical equipment ‘; for use and/or storage in salt laden atmosphere)</p> <p>Salt spray operating for 2 hrs. One cycle: Stored at temperature +35°C±2°C at 90 to 95%RH for 22 hrs.</p> <p>No. of cycles: 3</p>	JSS 55555: 2012 Rev.3-N1	Govt / NABL accredited lab	<p>Enclosure material sample will be tested</p> <p>Sample To be Identified by CQAE(WE) / Inspection Agency nominated by DQA(N)</p>
8	Shock Test Or Impact Test	<p>Test No: 24</p> <p>NSS Grade II(above water line): Shocks/ face (3 Shocks per face Total = 18 Shocks)</p> <p>(i)50 g,11 m-sec(vertical)</p> <p>(ii)22 g,11 m-sec(lateral)</p>	JSS 55555: 2012 Rev.3-N1	Govt. / NABL accredited lab	<p>The equipment should be in switched off condition.</p> <p>Visual inspection and functional check after the test. CHP (W)</p>

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9	BUMP Test	Test No. 5 Peak Acceleration 100m/s ² , Pulse duration 16msec, no. of bumps 4000+/- 10, general ruggedness test	JSS 55555: 2012 Rev.3-N1	Govt. / NABL accredited lab	The equipment should be in switched off condition. Visual inspection and functional check after the test. CHP (W)
10	Tropical Exposure	Test No. 27 Test Condition A-7 Cycles	JSS 55555: 2012 Rev.3-N1	Govt. / NABL accredited lab	The equipment should be in unpacked and switched-off condition. Visual Examination, Electrical and Mechanical Checks after Test CHP (W)

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Table 3.4.2
List of Items to be undergone Environmental Tests:

Sl.	Item Description	Part No.	Test	Severity	Applicable Standards	Remarks
1	Centralized UPS	112184988287	Test No. and Severity as per Table 3.4.1		JSS 55555:2012 Rev.3-N1	See Note
2	Battery Rack for centralized UPS	112184988384	Test No. and Severity as per Table 3.4.1		JSS 55555:2012 Rev.3-N1	
3	Battery Set for centralized UPS	112184988481	Test No. and Severity as per Table 3.4.1		JSS 55555:2012 Rev.3-N1	
4	Accessories for centralized UPS	112184988578	Test No. and Severity as per Table 3.4.1		JSS 55555:2012 Rev.3-N1	
4.1	Transformer-UPS Input	112185862451	Test No. and Severity as per Table 3.4.1		JSS 55555:2012 Rev.3-N1	
4.2	Auxiliary Dist Panel – Type-A1	112185862645	Test No. and Severity as per Table 3.4.1		JSS 55555:2012 Rev.3-N1	
4.3	Auxiliary Dist Panel – Type-B1	112185862742	Test No. and Severity as per Table 3.4.1		JSS 55555:2012 Rev.3-N1	

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Sl.	Item Description	Part No.	Test	Severity	Applicable Standards	Remarks
4.4	Auxiliary Dist Panel – Type-C1	112185862839	Test No. and Severity as per Table 3.4.1		JSS 55555:2012 Rev.3-N1	See Note
4.5	Auto Change Over Switch (ACOS)	112185863033	Test No. and Severity as per Table 3.4.1		JSS 55555:2012 Rev.3-N1	
4.6	Circuit Breaker Box UPS Input	112185862936	Test No. and Severity as per Table 3.4.1		JSS 55555:2012 Rev.3-N1	
4.7	Circuit Breaker Box UPS Output	112187901876	Test No. and Severity as per Table 3.4.1		JSS 55555:2012 Rev.3-N1	
5	Main Power Distribution Panel	112184835997	Test No. and Severity as per Table 3.4.1		JSS 55555:2012 Rev.3-N1	

Note: As Per BEL P.O., Batteries will not be supplied along with the equipment dispatch. Batteries will be supplied at the time of STW (Setting to Work). For Type Testing, equivalent dummy weight will be used in Battery Rack.

FE analysis will be undertaken for Centralized UPS and Battery Rack for Vibration, Shock & Bump Tests. Actual testing will not be undertaken due to weight and size constraints at available Test facilities at CQAE (WE) Bangalore, CQA (L) Bangalore & M/s BEL, Bangalore. FE analysis reports will be submitted to nominated QA agency.

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3.5 Details of EMI/EMC Test: The EMI/EMC tests will be conducted as per the NEC (MB) vetted test plan and the approved test plan will be appended to the document.

Sl. No	Test No	Ref Doc	Description
1	CE 101	MIL-STD-461E	Conducted Emission on Power Leads 30 Hz to 10 KHz
2	CE102	MIL-STD-461E	Conducted Emission on Power Leads 10 KHz to 10 MHz
3	RE101	MIL-STD-461E	Radiated Emission Magnetic Fields 30 KHz to 100 KHz
4	RE102	MIL-STD-461E	Radiated Emission Electric Fields 10 KHz to 1GHz
5	CS101	MIL-STD-461E	Conducted Susceptibility on power Leads 30 Hz to 150 KHz
6	CS114	MIL-STD-461E	Conducted Susceptibility, Bulk cable injection, 10Khz 200MHz
7	CS115	MIL-STD-461E	Conducted Susceptibility, I(max) 5 Amps Peak pulse
8	CS116	MIL-STD-461E	Conducted Susceptibility, Damped Sinusoidal Transients, Cables & Power leads, 10KHz to 100MHz
9	RS101	MIL-STD-461E	Radiated Susceptibility Magnetic Fields 30 KHz to 100 KHz
10	RS103	MIL-STD-461E	Radiated Susceptibility Electric Fields 2 MHz to 18 GHz

List of Items to undergo EMI/EMC Tests:

The EMI/EMC tests will be conducted as per the NEC (MB) vetted test plan and the approved test plan will be appended to the document after approval.



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Table 3.5
List of Items to undergo EMI/EMC Tests

Sl.	Item Description	Part No.	Test	Applicable Standards	Test Lab	Remarks
1	Auto Change Over Switch (ACOS)	112185863033	Tests Details are as per Para 3.5 & subject to NEC (MB) Vetted EMI/EMC Plan	MIL-STD-461E	NABL Accredited Lab	
2	Circuit Breaker Box UPS Input	112185862936	Tests Details are as per Para 3.5 & subject to NEC (MB) Vetted EMI/EMC Plan	MIL-STD-461E	NABL Accredited Lab	
3	Transformer-UPS Input	112185862451	Tests Details are as per Para 3.5 & subject to NEC (MB) Vetted EMI/EMC Plan	MIL-STD-461E	NABL Accredited Lab	
4	Centralized UPS	112184988287	Tests Details are as per Para 3.5 & subject to NEC (MB) Vetted EMI/EMC Plan	MIL-STD-461E	NABL Accredited Lab	

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3.6 List of Components / Assemblies with Inspection Criteria:

Table 3.6

List of Components / Assemblies with Inspection Criteria


Sl no	Item Description	Part No	Supplier/ Supplier Code reference	Characteristics	Class	Type of Check	Sample	Acceptance Norms	Format of Record	Agency	C H P	Grade
1	INCOMIONG / RAW MATERIAL INSPECTION											
1.1	Sheet for fabrication	–		Material Mechanical & Chemical properties	Major	By Test	Sampling	Al 64430/ 52000 grade & A4-70/ AISI-316 / Approved drawings	NABL accredited Lab Report	P	R	
2	BOUGHT OUT ITEMS											
2.1	Transformers, Chokes/ Inductors.		M/s Trans power	As per Approved drawings	Major	Visual	100%	Approved drawing	STC/IR	P	R	
2.2	Batteries	EP 65-12	Exide (India)	As per Approved drawings	Major	Visual	100%	Approved drawings	STC/IR	P	R	
2.3	ACOS	-	L&T	Make / Type No., Current Rating, Voltage Rating	Major	Visual	100%	Approved drawings	STC/IR	P	R	
				Functional Tests		As per approved Specifications						
2.4	UPS	-	L&T	As per Approved drawings	Major	Visual	100%	Approved drawings	STC/IR	P	R	

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			SH NO. 44	PREPD. DINESH WANI , L&T	DATE
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SI no	Item Description	Part No	Supplier/ Supplier Code reference	Characteristics	Class	Type of Check	Sample	Acceptance Norms	Format of Record	Agency	C H P	Grade
2.5	MCB/ MCCB	BB206* */DN0** (as per rating)	L&T	Make / Type No., Current Rating, Voltage Rating, Aux. contacts etc	Major	Visual	100%	Approved Drawing	IR	P	R	
				Continuity	Major	Continuity tester						
2.6	Relays	-	Phoenix (Germany)	Make / Type No., Current Rating, Voltage Rating, Aux. contacts etc	Major	Visual	100%	Approved Drawing	STC/IR	P	R	
				Continuity	Major	Continuity tester						
2.7	Cable -Power & Control	-		Voltage, Grade, Colour	Major	Visual	Sampling	Approved Drawing	STC/IR	P	R	
				Thickness of Insulation, IR Value, Conductor Resistance		By Test				P	R	
2.8	Lamps	EILG24 0A	L&T	Make / Type No., Voltage Rating	Minor	Visual	100%	Approved Drawing	STC/IR	P	R	
				Functional Checks		Test				P	R	
2.9	Space Heater		Vileco	Make/Type/Wattage	Minor	Visual	Sampling	Approved Drawing	STC/IR	P	R	

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	00	ORIGINAL	NO.OF SH 65	APPRD. RAJENDRA DIXIT , L&T	DATE 08.11.2016
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Sl no	Item Description	Part No	Supplier/ Supplier Code reference	Characteristics	Class	Type of Check	Sample	Acceptance Norms	Format of Record	Agency	C H P	Grade
2.10	Terminals	CTS /CMT	Connectwell /Wago	Make/Type No. , Voltage and current Rating		Visual	Sampling	Approved Drawing	STC/IR	P	R	
2.11	Cable Glands	EIPG	Electromac	As per Approved drawings	Minor	Visual	Sampling	Approved Drawing	STC/IR	P	R	
2.12	Thermostat	-	APT Controls	Make/Type		Visual	Sampling	Approved Drawing	STC/IR	P	R	
2.13	Cable Lugs	-	Dowell	As per Approved drawings	Minor	Visual	Sampling	Approved Drawing	STC/IR	P	R	
2.14	Push button	HD15 C3+H C61B 2	L&T	Make/Type No.		Visual	Sampling	Approved Drawing	STC/IR	P	R	
2.15	Selector & Control Switch	KT206 2	L&T	Make/Type No. , Voltage and current Rating	Minor	Visual	100%	Approved Drawing	STC/IR	P	R	
2.16	Fuse	HF + HC	L&T	Make/Type No. , Voltage and current Rating	Minor	Visual	Sampling	Approved Drawing	STC/IR	P	R	
				Continuity		Continuity tester						

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Sl no	Item Description	Part No	Supplier/ Supplier Code reference	Characteristics	Class	Type of Check	Sample	Acceptance Norms	Format of Record	Agency	C H P	Grade
2.17	Power & Auxiliary Contactor	MOO/ MXO/ MNO/ MX	L&T	Make/Type No. , Voltage and current Rating, Aux contacts etc	Minor	Visual	100%	Approved Drawing	STC/IR	P	R	
				Continuity		Continuity tester						
2.18	Shock Mounts	AKCC	IRMRA / Resistoflex	As per Approved drawings Reports Review	Minor	Visual	Sampling	Approved Drawing	STC/IR	P	R	

3.7 **List of Imported Items:** Nil

3.8 **List of Indigenous Items procured through Sub-Contractors**
List included in Para 3.16 of QAP

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3.9 List of Applicable Drawings

Table 3.9
List of Applicable Drawings

Sr. No.	Description of Drawing	Drawing No.	Rev. No
1	Block Diagram for power supply solution for GBE SDN-P-15B	SCG1701	3
MAIN DISTRIBUTION PANEL			
1	General arrangement diagram for Main Distribution Panel	SYGB003-01 to 08	3
2	Master Bill of Material for Main Distribution Panel	SCG1676	2
3	Scheme diagram for Main Distribution Panel	SWG1514	3
AUXILIARY DISTRIBUTION PANEL TYPE A			
1	General arrangement diagram for Auxiliary Distribution Panel Type A	SYGB007-01 to 16	3
2	Master Bill of Material for Auxiliary Distribution Panel Type A	SCG1677	1
3	Scheme diagram for Auxiliary Distribution Panel Type A	SWG1515	2
AUXILIARY DISTRIBUTION PANEL TYPE B			
1	General arrangement diagram for Auxiliary Distribution Panel Type B	SYGB008-01 to 16	3
2	Master Bill of Material for Auxiliary Distribution Panel Type B	SCG1678	1
3	Scheme diagram for Auxiliary Distribution Panel Type B	SWG1516	2
AUXILIARY DISTRIBUTION PANEL TYPE C			
1	General arrangement diagram for Auxiliary Distribution Panel Type C	SYGB009-01 to 24	3
2	Master Bill of Material for Auxiliary Distribution Panel Type C	SCG1679	1
3	Scheme diagram for Auxiliary Distribution Panel Type C	SWG1517	2
100A ACOS PANEL			
1	General arrangement diagram for 100A ACOS Panel	SYGB011-01 to 08	3
2	Master Bill of Material for 100A ACOS Panel	SCG1680	2
3	Scheme diagram for 100A ACOS Panel	SWG1518	2
CIRCUIT BREAKER PANEL - 1			
1	General arrangement diagram for CIRCUIT BREAKER PANEL - 1	SYGB006-01 to 08	2
2	Master Bill of Material for CIRCUIT BREAKER PANEL - 1	SCG1789	1
3	Scheme diagram for 100A CIRCUIT BREAKER PANEL - 1	SWG1611	1
CIRCUIT BREAKER PANEL - 2			
1	General arrangement diagram for CIRCUIT BREAKER PANEL – 2	SYGB012-01 to 08	3
2	Master Bill of Material for CIRCUIT BREAKER PANEL – 2	SCG1681	3
3	Scheme diagram for 100A CIRCUIT BREAKER PANEL - 2	SWG1519	2

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Sr. No.	Description of Drawing	Drawing No.	Rev. No
INPUT TRANSFORMER			
1	General Arrangement diagram Input Transformer	SYGB010-01 TO 08	3
CENTRALISED UPS			
1	Diagram for Centralised UPS with Output Transformer	SYGB004-01 to 08	3
2	Master Bill of Material for Centralised UPS	SCG1698	3
BATTERY RACK FOR CENTRALISED UPS			
1	Diagram for Battery Rack	SYGB005-01 to 08	4
2	Master Bill of Material for Battery Rack	SCG1699	4


3.10 List of approved ATPs/ PTPs.

Table 3.10
List of approved ATPs/ PTPs

Sl no	ATP Description	Part No	Version	Date	Remarks
1	Acceptance Test Procedure For Main Distribution Panel	QSFAT905	0	22 July 2016	
2	Acceptance Test Procedure For Auxiliary Distribution Panel (Type A)	QSFAT906	0	22 July 2016	
3	Acceptance Test Procedure For Auxiliary Distribution Panel (Type B)	QSFAT907	0	22 July 2016	
4	Acceptance Test Procedure For Auxiliary Distribution Panel (Type C)	QSFAT908	0	22 July 2016	
5	Acceptance Test Procedures For 100A ACOS Panel	QSFAT909	0	22 July 2016	
6	Acceptance Test Procedure For Circuit Breaker Panel-1	QSFAT910	0	22 July 2016	
7	Acceptance Test Procedure For Circuit Breaker Panel-2	QSFAT959	0	22 July 2016	
8	Acceptance Test Procedure For 58 KVA Transformer	QSFAT1036	0	22 July 2016	
9	Acceptance Test Procedures For Centralised UPS And Battery Rack	QSFAT1034	0	26 July 2016	
10	Integrated Acceptance Test Procedures For BEL SDN Project	QSFAT1037	0	28 July 2016	
11	Acceptance Test Procedure For 100A ACOS (For Type Testing)	QSFAT1038	0	21 Mar 2016	
12	Acceptance Test Procedures For Centralised UPS (For Type Testing)	QSFAT1017	0	28 July 2016	


Note: ATPs are in under Approval Process

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3.11 List of PCBs with Jumper: Nil

SL. No.	Item Description	Part No.	Category	No. of Jumpers	Applicable Standards	Remarks


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3.12 List of Non MIL Components:

Table 3.12
List of Non MIL Components


SI no	Item Description	Part No/ TYPE NO.	Class/ EQUIPMENT SPECIFICATION	Supplier Reference / MAKE	Grade (IND/COM)	REMARK
1	AUX CONTACTOR	MO0	COIL VOLTAGE:415V AC 50HZ BASIC CONTACT: 3NO+2NC /BASIC CONTACT: 2NO+3NC	LARSEN & TOUBRO	IND	
2	FUSE	HF + HC	RATINGS:2A	LARSEN & TOUBRO	IND	
3	LAMP	EILG415A	LAMP TYPE:LED COLOUR:GREEN VOLTAGE:415V AC 50/60Hz	LARSEN & TOUBRO (ESBEE)	IND	
4			LAMP TYPE:LED COLOUR:RED VOLTAGE:415V AC 50/60Hz			
5		EILR240A	LAMP TYPE:LED COLOUR:RED VOLTAGE:240V AC 50/60Hz			

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			SH NO. 51	PREPD. DINESH WANI , L&T	DATE
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SI no	Item Description	Part No/ TYPE NO.	Class/ EQUIPMENT SPECIFICATION	Supplier Reference / MAKE	Grade (IND/COM)	REMARK
6			LAMP TYPE:LED COLOUR:GREEN SUPPLY:AC FREQUENCY:50/60 Hz VOLTAGE:240V			
7	PUSH BUTTON	HD15C3+ HC61B2	COLOUR:BLACK HEAD TYPE:FLUSH HEAD LEGEND 1:TEST NC CONTACTS:1 RATINGS:6A SIZE:22.5MM	LARSEN & TOUBRO (ESBEE)	IND	
8	POWER CONTACTOR	MNX110	ADD ON :2NO 2NC FREQUENCY:50HZ COIL VOLTAGE:415VAC POLES:3	LARSEN & TOUBRO	IND	
9	RELAYS	SPE01011 88704	INPUT VOLTAGE: 415V AC 50HZ SYSTEM:3PH RELAY CONTACTS: 6NO EQUIPMENT:AUTO CHANGE OVER RELAY	LARSEN & TOUBRO	IND	

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SI no	Item Description	Part No/ TYPE NO.	Class/ EQUIPMENT SPECIFICATION	Supplier Reference / MAKE	Grade (IND/COM)	REMARK
10	SELECTOR SWITCH	STAYPUT	POSITIONS:4 POLES:6 RATINGS:16A MOUNTING:DOOR SIZE:48 X 48 SWITCH TYPE:SELECTOR SWITCH Technical description 1:OFF Technical description 2:AUTO Technical description 3:NORMAL Technical description 4:ALTERNATE	LARSEN & TOUBRO (SALZAR)	IND	
11	SELECTOR SWITCH	STAYPUT	POSITIONS:2 POLES:4 RATINGS:16A MOUNTING:DOOR KEY LOCK:NOT REQUIRED SIZE:48 X 48 SWITCH TYPE:SELECTOR SWITCH Technical description 1:LOCAL Technical description 2:REMOTE	LARSEN & TOUBRO (SALZAR)	IND	
12	CONTROL SWITCH	KT2062	RATINGS:10A SWITCH TYPE:TOGGLE SWITCH POLES:2P	LARSEN & TOUBRO (KAYCEE)	IND	
13	MCB (Curve C, 2 Pole)	BB20040C	RATINGS:4A	LARSEN & TOUBRO (EXORA)	IND	
14		BB20060C	RATINGS:6A			

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**QUALITY ASSURANCE
PLAN****DOC
CODE
QAP**

PART NUMBER

1121 849 892 57**POWER SUPPLY
SOLUTION GBE
SDN – P15B**SH NO.
53PREPD.
DINESH WANI , L&T

DATE

08.11.2016

00

ORIGINAL

NO.OF SH
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RAJENDRA DIXIT , L&T

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SI no	Item Description	Part No/ TYPE NO.	Class/ EQUIPMENT SPECIFICATION	Supplier Reference / MAKE	Grade (IND/COM)	REMARK
15		BB20100C	RATINGS:10A			
16		BB20630C	RATINGS:63A			
17		BB20200C	RATINGS:20A			
18	MCCB	DN0-100D	RATINGS:100A RELEASE TYPE:THERMAL MAGNETIC THERMAL SETTING:80-100 MAGNETIC SETTINGS:900 POLES:3	LARSEN & TOUBRO	IND	
19		DN2-250N	RATINGS:125A RELEASE TYPE:THERMAL MAGNETIC THERMAL SETTING:100-125 MAGNETIC SETTINGS:750-1250 POLES:3			
20		DN2-250N	RATINGS:160A RELEASE TYPE:THERMAL MAGNETIC THERMAL SETTING:128-160 MAGNETIC SETTINGS:960-1600 POLES:3			

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SI no	Item Description	Part No/ TYPE NO.	Class/ EQUIPMENT SPECIFICATION	Supplier Reference / MAKE	Grade (IND/COM)	REMARK
21	CONVERTOR GRADE TRANSFORMER	SPE01011 89344	PRIMARY: STAR 380V SECONDARY: STAR 167V SECONDARY: DELTA 167V COOLING: DRY TYPE AIR COOLED INSULATION: CLASS F EFFICIENCY AT 100%: >95% EFFICIENCY AT 50%: >95% IMPEDANCE: < 5% REGULATION AT UPF: < 5% REGULATION AT 0.8 PF: < 5%	STATIC TRANSFORMER/ ANY REPUTED MAKE	IND	
22	FAN WITH FILTER	3240.6	INPUT SUPPLY 230V AC, 50Hz	RITTAL/ FINDER/ ANY REPUTED MAKE	N.A.	
23	OUTLET FILTER	3240.06	EMC OUTLET FILTER	RITTAL/ FINDER/ ANY REPUTED MAKE	N.A.	
24	CONTROL TRANSFORMER	SPE01011 84620	PRIMARY VOLTAGE: 415V AC, 50Hz SECONDARY VOLTAGE: 230V AC, 50Hz VA BURDEN: 100VA INSULATION: CLASS F	PRECISE/DEEPAK/ERICON/A NY REPUTED MAKE	IND	
25	THERMOSTAT	SPE01011 81970	SUPPLY:240V AC FREQUENCY:50HZ TEMPERATURE RANGE:25-60 °C WATT:60	APT CONTROLS/ ANY REPUTED MAKE	IND	

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SI no	Item Description	Part No/ TYPE NO.	Class/ EQUIPMENT SPECIFICATION	Supplier Reference / MAKE	Grade (IND/COM)	REMARK
26	SPACE HEATER	SH07057	SUPPLY:240V AC FREQUENCY:50HZ RATINGS:60W	VILECO / ANY REPUTED MAKE	IND	
27	Control & Power TERMINALS (COLOR:GREY)	CTS4UN	SUITABLE FOR WIRE:0.5 - 4SQMM	CONNECTWELL	IND	
28		CTS25UN	SUITABLE FOR WIRE: 4 - 35SQMM			
29		CTS2.5UN	SUITABLE FOR WIRE:0.5 -2.5SQMM			
30		CTS35U	SUITABLE FOR WIRE:10SQMM - 35SQMM			
31		CMT4	SUITABLE FOR WIRE: 0.5 - 2.5SQMM			
32	Thyristor Stack	2x MD B6C 165/222.75 - 120F	Three phase Thyristor based rectifier I/P AC Voltage:- 165 Volt O/P DC Voltage:- 222.2 Volt O/P DC Current:- 120 Amp Ambient Temp:- 55 Deg Type of Cooling:- Force SCR/Diode :- SCR 2-Q/4-Q:- 2 Q Duty Class:- Class I	Semikron	IND	

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SI no	Item Description	Part No/ TYPE NO.	Class/ EQUIPMENT SPECIFICATION	Supplier Reference / MAKE	Grade (IND/COM)	REMARK
33	IGBT Stack	MD B2CI 400/192- 58F	Single phase IGBT based Inverter DC Voltage:- 400 Volt O/P AC Voltage:- 192 Volt O/P AC Current 58 Amp Switching Frequency 12.5 kHz Fundamental Frequency 50 Hz Type of Cooling:- Forced Ambient Temp:- 55 Deg Duty Class:- Class I	Semikron	IND	
34	DC link Capacitor	IPMS106C O3G01	4700 uF/450v DC , Electrolytic, PG grade	Alcon	IND	
35	DC Choke	IPMS106S 33P01	2.5mH, 120A	Deepak Instruments	IND	
36	Fan with Filter	3322.107	Exhaust fan and filter	Rittal	IND	
37	Printed Circuit Board	IPMS106CM3 C01-rcc	Rectifier Control Card	NAPT	IND	
38	Printed Circuit Board	IPMS106CM3 C01-dcc	Display Card	NAPT	IND	
39	Printed Circuit Board	IPMS106CM3 C01-icc	Inverter Control Card	NAPT	IND	
40	Printed Circuit Board	IPMS106CM3 C01-sccr	Signal conditioner Card	NAPT	IND	

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SI no	Item Description	Part No/ TYPE NO.	Class/ EQUIPMENT SPECIFICATION	Supplier Reference / MAKE	Grade (IND/COM)	REMARK
41	Printed Circuit Board	IPMS106CM3 C01-rcc	Rectifier Driver card	NAPT	IND	
42	Printed Circuit Board	IPMS106CM3 C01-vcc	Voltage Divider Card	NAPT	IND	
43	SMPS	LRS-100	24V DC output	Mean well	IND	
44	Push Button	SPE01011 00050	PUSH BUTTON,ESBEE,RED,SHROUDED	LARSEN & TOUBRO (ESBEE)	IND	
45	Push Button	HD15C2	22.5DIA,SHRUDED PB,GREEN,ESBEE	LARSEN & TOUBRO (ESBEE)	IND	
46	Push Button	SPE01011 86167	PUSH BUTTON (YELLOW),ESBEE	LARSEN & TOUBRO (ESBEE)	IND	
47	Hall Effect sensor	LEM-HAS 50S	I _{pn} =50A, I _{pm} =150A	LEM	IND	
48	Output Sensing Transformer	IPMS1065 33R01	270V, 9V, 1 phase, 10VA	Deepak Instruments	IND	
49	Current Transducer	IPMS1065 33S01	100A/0.2A, 50 Hz, 1 Phase	Deepak Instruments	IND	

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SI no	Item Description	Part No/ TYPE NO.	Class/ EQUIPMENT SPECIFICATION	Supplier Reference / MAKE	Grade (IND/COM)	REMARK
50	Output Capacitor	IPMS106CO3 D01	4.7uF, 440V AC, MPP, Ic= 4 Amp ALUMINIUM CAN WITH TAG TERMINALS Type: AP4	Advance Components	IND	
51	Output choke	IPMS106574 O01	1 Phase 170uH, 62A Peak, 44A RMS, Bm=1.2, cross coupled	Deepak Instruments	IND	
52	Capacitor	IPMS106CO3 E01	10uF, 440V AC, MPP ALUMINIUM CAN WITH TAG TERMINALS Type: AP4	Advance Components	IND	
53	Inductor	IPMS106573J 01	3 phase 8.37mH, 15A Peak , 8A RMS	Deepak Instruments	IND	
54	Inductor	IPMS106573 K01	3 Phase Inductor 6mH 12A Peak, 7A RMS	Deepak Instruments	IND	
55	Harmonic Filter Capacitor	IPMS106CO3 F01	2.2 uF, 440V AC, MPP ALUMINIUM CAN WITH TAG TERMINALS Type: AP4	Advance Components	IND	
56	Input choke	IPMS106573 H01	3- phase, 200uH, 86A	Deepak Instruments	IND	
57	Terminal	281-101	SUITABLE FOR WIRE: 0.08 - 4SQMM COLOUR:GREY	Wago	IND	
58		CTS10U	SUITABLE FOR WIRE: 0.5 - 10SQMM COLOUR:GREY	Connectwell		
59	Filter	3238.200	Outlet filter	Rittal	N.A.	

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SI no	Item Description	Part No/ TYPE NO.	Class/ EQUIPMENT SPECIFICATION	Supplier Reference / MAKE	Grade (IND/COM)	REMARK
60	Input Sensing Transformer		Primary: 167V,10VA, Delta Secondary: 9-0-9 V, 3 phase Star Dimensions : H-100 D-130 W-80	Deepak Instruments	IND	
61	Contactor	MNX-70	MNX 70 Contactor,230V AC	LARSEN & TOUBRO	IND	
62	Output transformer	IPMS1065 34J01	Type: Inverter grade KVA Rating: 12KVA Primary: 192 VAC, 1 phase, 58 A Secondary: 253 VAC @ NL,44 A, 1 Phase, 50Hz Impedance: 8 -10% NL Current < 2.5 A Cooling: Dry type Air cooled Insulation: Class F Efficiency: >95%	STATIC TRANSFORMER/ ANY REPUTED MAKE	IND	
63	Battery	EP 65-12	12 VDC, Type: 65AH	Exide	IND	
64	CABLE LUGS	--	SUITABLE FOR CUSTOMER CABLE SIZE	DOWELL	IND	
65	CABLE GLANDS	EIPG 9 - R10	SUITABLE CABLE OD: 07 - 10MM	ELECTROMAC/ ANY REPUTED MAKE	IND	
66		EIPG11- R13	SUITABLE CABLE OD: 10 - 13MM			
67		EIPG 13.5 - R15	SUITABLE CABLE OD: 13 - 15MM			


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SI no	Item Description	Part No/ TYPE NO.	Class/ EQUIPMENT SPECIFICATION	Supplier Reference / MAKE	Grade (IND/COM)	REMARK
68		EIPG 29 - R28	SUITABLE CABLE OD: 25 - 28MM			
69		EIPG42- R46	SUITABLE CABLE OD: 43 - 46MM			
SI no	Item Description	Part No/ TYPE NO.	Class/ EQUIPMENT SPECIFICATION	Supplier Reference / MAKE	Grade (IND/COM)	REMARK
70	SHOCK MOUNT	AKCC-10	MASS RANGE: 10KG	IRMRA/ RESISTOFLEX	NA	
71		AKCC-15	MASS RANGE: 15KG			
72		AKCC-25	MASS RANGE: 25KG			
73		AKCC-120	MASS RANGE: 120KG			
74		AKCC-160	MASS RANGE: 160KG			

3.13 Sampling Plan Included in para 3.6

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CHAPTER IV

(Final Acceptance)


4.1 Factory Acceptance Tests (FATs)

FATs is to be undertaken on the integrated system (Individually for Power Supply Solution) in accordance with the IHQ MoD(N)approved FATs document by an agency nominated by the Order Placing Authority(OPA)/IHQ MoD(N) on completion of all QA activities.

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CHAPTER V
(Marking, Deliveries & Packing / Preservation)

- 5.1 **Packing.** Material would be supplied in suitable cartons to avoid transit damages. Packing list would be made available with each consignment for the loose items, if any. Box no and items details would be mentioned in the check list for ease of identification. Standard Packing Methodology performed for all Naval Projects will be practiced and followed.
- 5.2 **Marking.** Each packing will be marked the details such as contract no. , date, consignee, gross weight.
- 5.3 **Preservation.** Preservation instruction along with shelf life for each equipment will be specified in Technical document and System Hand Book.

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Annexure

Certificate of Conformance (COC format)

 POWER SUPPLY SOLUTION GBE SDN – P15B	QUALITY ASSURANCE PLAN		DOC CODE QAP	PART NUMBER 1121 849 892 57	
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DATE:

CERTIFICATE OF CONFORMANCE (CoC)

OEM Address :

OEM reference with date :

BEL Unit's name and address :

BEL SO/Contract Ref :

Delivery date :

This is to certify that following items being supplied comply with specifications given below.


Sl.No	OEM Part No	BEL Part No	Description of item	Year of Manufacture	Qty Supplied	Item SI No

Specifications

a) Environmental.

Sl. No	Tests Carried Out	Standard	Compliance Parameters
1	High Temperature		
2	Low Temperature		
3	Humidity/Damp Heat		
4	Fungus/Mould growth		
5	Salt corrosion		
6	vibration		
7	shock		
8	Vibration		
9	Rain/Drip Proof(as applicable)		
10	Solar Radiation(as applicable)		
11	Immersion(as applicable)		

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b) Environmental Stress Screening (ESS)

Sl. No	Tests Carried Out	Standard	Compliance Parameters
1	Thermal cycling		
2	Random vibration		

c) EMI/EMC Compliance :

Date:

Seal/Stamp:

Signature:

Name:

Designation:

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