QUALITY ASSURANCE PLAN

FOR

POWER SUPPLY

(GBE SDN-P15B)

(Purchase Order No 3300000002, 3300000003, 3300000004, 3300000005 Date 21.11.2014)

MANUFACTURER:

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

Doc Ref: QAP/L&T/MARINE/UPS/BEL/P15B/2016/05

INDEX

LIST OF TABLES

LIST OF Annexures

LIST OF AMENDEMENTS

S. No.	SUBJECT	AMENDMENT		AMENDED BY	DATE OF INSERTION	INITIALS	REMARKS
		NO.	DATE				
1	QAP Rev	0	06.08.16	DPW/KVS	06.08.16	DPW	Initial rev

Doc Ref: QAP/L&T/MARINE/UPS/BEL/P15B/2016/05

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

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.

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 14 Jun13 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.

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.

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

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.

- **Dimensional Details:** 500 X 550 X185mm (L X H X D)
- **Weight:** 46Kg +/-5%
- **Output Power Rating:** 100A, 1 Ph. 230V AC 50Hz

(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

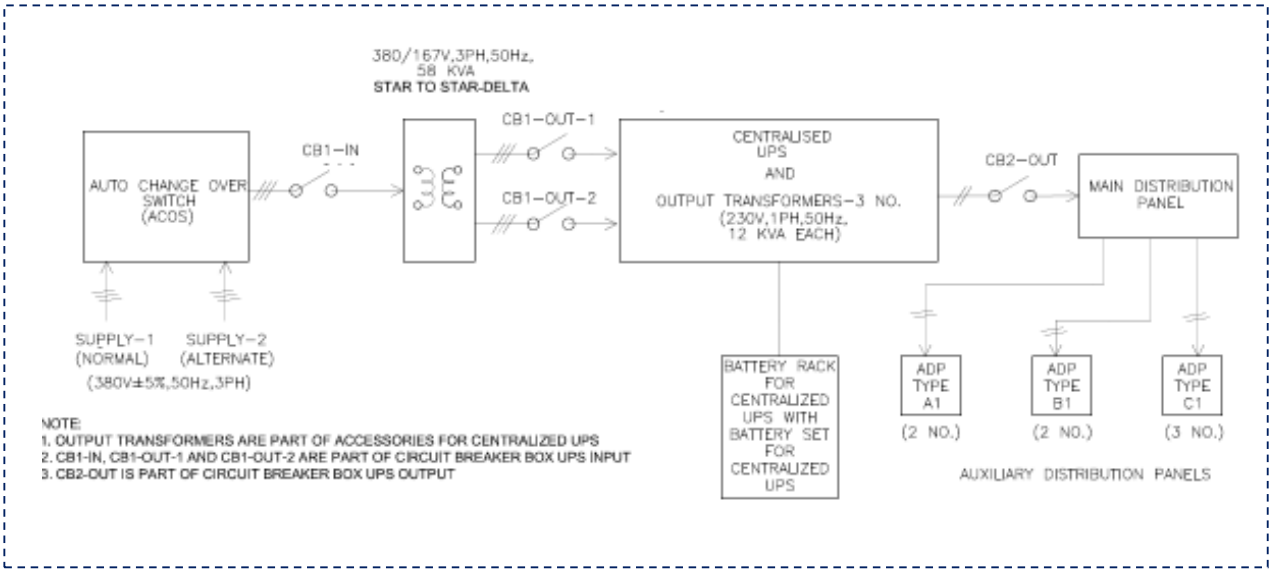
CB2

- **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 GBW SDN P15-B



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
5	Main Power Distribution Panel	112184835997	2	No's
6	Transformer-UPS Input	112185862451	1	No's
7	Auxiliary Dist Panel –Type-A1	112185862645	2	No's
8	Auxiliary Dist Panel –Type-B1	112185862742	2	No's
9	Auxiliary Dist Panel –Type-C1	112185862839	3	No's
10	Auto Change Over Switch (ACOS)	112185863033	1	No's
11	Circuit Breaker Box UPS Input	112185862936	1	No's
12	Circuit Breaker Box UPS Output	112187901876	1	No's
II	**INSTALLATION MATERIALS:** Installation Material should 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

1.7 List of OB & T& T Spares

	OB SPARES: Spares based on 2 year's requirement with a maximum mission type of 90 days.			
SL	**ITEM DESCRIPTION**	**PART NUMBER**	**QTY**	**UOM**
1	OBS for UPS & accessories	112185526928	1	Set
	OB Spares for Centralized UPS	-	As Required.	
	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: Spares required during Installation and STW of the System.			
SL	**ITEM DESCRIPTION**	**PART NUMBER**	**QTY**	**UOM**
1	Misc. Spares T&T	112185526443	1	Set
	T&T Spares for Centralized UPS	-	As Required.	
	T&T Spares for Circuit Breakers UPS -Input	-		
	T&T Spares for Circuit Breakers UPS Output	-		
	T&T Spares for Main power distribution			
	T&T Spares for Auxiliary distribution panel			

CHAPTER – II
(Applicable Standards)

2.1 List of Governing Specifications and Applicable Standards

S.No.	Specification No.	Description
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

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

Qualification : N1

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

2.4 EMI/EMC Standards: 461E

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

2.6 Environmental Stress Screening (ESS) Standards:
No.66301/Policy-07/DQA (N)/QA-07 dated 14 Jun 2013

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

2.8 Technical Documentation Standards

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

2.9 SOFTWARE DOCUMENTATION STANDARDS. Not Applicable

2.10 PACKING AND PRESERVATION STANDARDS. As per BEL PO requirements

CHAPTER –III

(QA Core Activities)

3.1 General Quality Assurance Plan. The detailed Inspection Criteria for Components / Assemblies/System/ are provided as below.

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	AI 64430/ 52000 grade & A4-70/ AISI-316 / Approved drawings	NABL accredited Lab Report	P	R	
2	**BOUGHT OUT ITEMS**											
2.1	Transformers		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	

Doc Ref: QAP/L&T/MARINE/UPS/BEL/P15B/2016/05

	QUALITY ASSURANCE PLAN		DOC CODE QAP	PART NUMBER 1121 849 892 57	
POWER SUPPLY SOLUTION GBE SDN – P15B			SH NO. 17	PREPD. DINESH WANI , L&T	DATE 21.07.2016
	00	ORIGINAL	NO.OF SH 34	APPRD. RAJENDRA DIXIT , L&T	DATE 21.07.2016
	ISSUE NO.	CN NO.			

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
2.5	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	EILG240A	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	

Doc Ref: QAP/L&T/MARINE/UPS/BEL/P15B/2016/05

	QUALITY ASSURANCE PLAN		DOC CODE QAP	PART NUMBER 1121 849 892 57	
POWER SUPPLY SOLUTION GBE SDN – P15B			SH NO. 18	PREPD. DINESH WANI , L&T	DATE 21.07.2016
	00 ISSUE NO.	ORIGINAL CN NO.	NO.OF SH 34	APPRD. RAJENDRA DIXIT , L&T	DATE 21.07.2016

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						

Doc Ref: QAP/L&T/MARINE/UPS/BEL/P15B/2016/05

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	**IN-PROCESS INSPECTION**											
3.1	Panel Fabrication for :-	-		Dimensions, Gasket, Locking arrangement, Cable entry termination, Color shade	Major	Visual	100%	Approved Drawing	IR / FAT	P	R	
	a. ACOS											
	b. Circuit Breakers											
	c. UPS											
	d. Distribution Panels											

Doc Ref: QAP/L&T/MARINE/UPS/BEL/P15B/2016/05

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
3.2	Assembly 1.Acos 2.Circuit breaker 3.UPS 4.Distribution panel	-		i. Layout & Component arrangement, earthing ii. Dimension iii. Gland plate assembly Base plate assembly	Major	Visual	100%	Approved Drawing	IR / FAT	P	R	
3.3	ESS test for (i)ACOS Modules (ii) Control PCB for UPS	-		Thermal Cyclic Test & Vibration Test by test	Major	By test	100%	As per ESS Guideline "No.66301/Policy-07/DQA (N)/QA-07" Dated 14.Jun 2013 As per ESS Plan	Lab Report	P	R	
3.4	Wiring (Power & Control)	-		As per Approved drawings	Major	Visual	100%	Approved Drawing	IR / FAT	P	R	

Doc Ref: QAP/L&T/MARINE/UPS/BEL/P15B/2016/05

	QUALITY ASSURANCE PLAN		DOC CODE QAP	PART NUMBER 1121 849 892 57	
POWER SUPPLY SOLUTION GBE SDN – P15B			SH NO. 21	PREPD. DINESH WANI , L&T	DATE 21.07.2016
	00	ORIGINAL	NO.OF SH 34	APPRD. RAJENDRA DIXIT , L&T	DATE 21.07.2016
	ISSUE NO.	CN NO.			

Sl no	Item Description	Part No	Supplier/ Supplier Code reference	Characteristics	Class	Type of Check	Sample	Acceptance Norms	Format of Record	Agency	CHP	Grade
4	**Final Inspection**											
4.1	Visual Inspection	-		Measurement of overall dimension Mounting arrangement of components Wiring arrangement and ferruling, gasket fixing, cable gland & Talley plate details		Visual	100%	Approved Drawing	FAT	P	W	
4.2	Functional Check	-		As per FATs document	Major	Electrical	100%	Approved Drawing /FAT Document	FAT	P	W	
5	**Type Testing**											
5.1	Type testing	-	As per JSS 55555/MIL 461E standard		By Test	1 number	As per Approved TT plan	As per Approved TT plan	Lab Reports	P	R	
6	**Dispatch clearance**											
6.1	Preservation & packing and dispatch	-	Preservation & Packing		Visual	100%	Approved drawing / PO		Packing List	P	R	

Doc Ref: QAP/L&T/MARINE/UPS/BEL/P15B/2016/05

	QUALITY ASSURANCE PLAN		DOC CODE QAP	PART NUMBER 1121 849 892 57	
POWER SUPPLY SOLUTION GBE SDN – P15B			SH NO. 22	PREPD. DINESH WANI , L&T	DATE 21.07.2016
	00	ORIGINAL	NO.OF SH 34	APPRD. RAJENDRA DIXIT , L&T	DATE 21.07.2016
	ISSUE NO.	CN NO.			

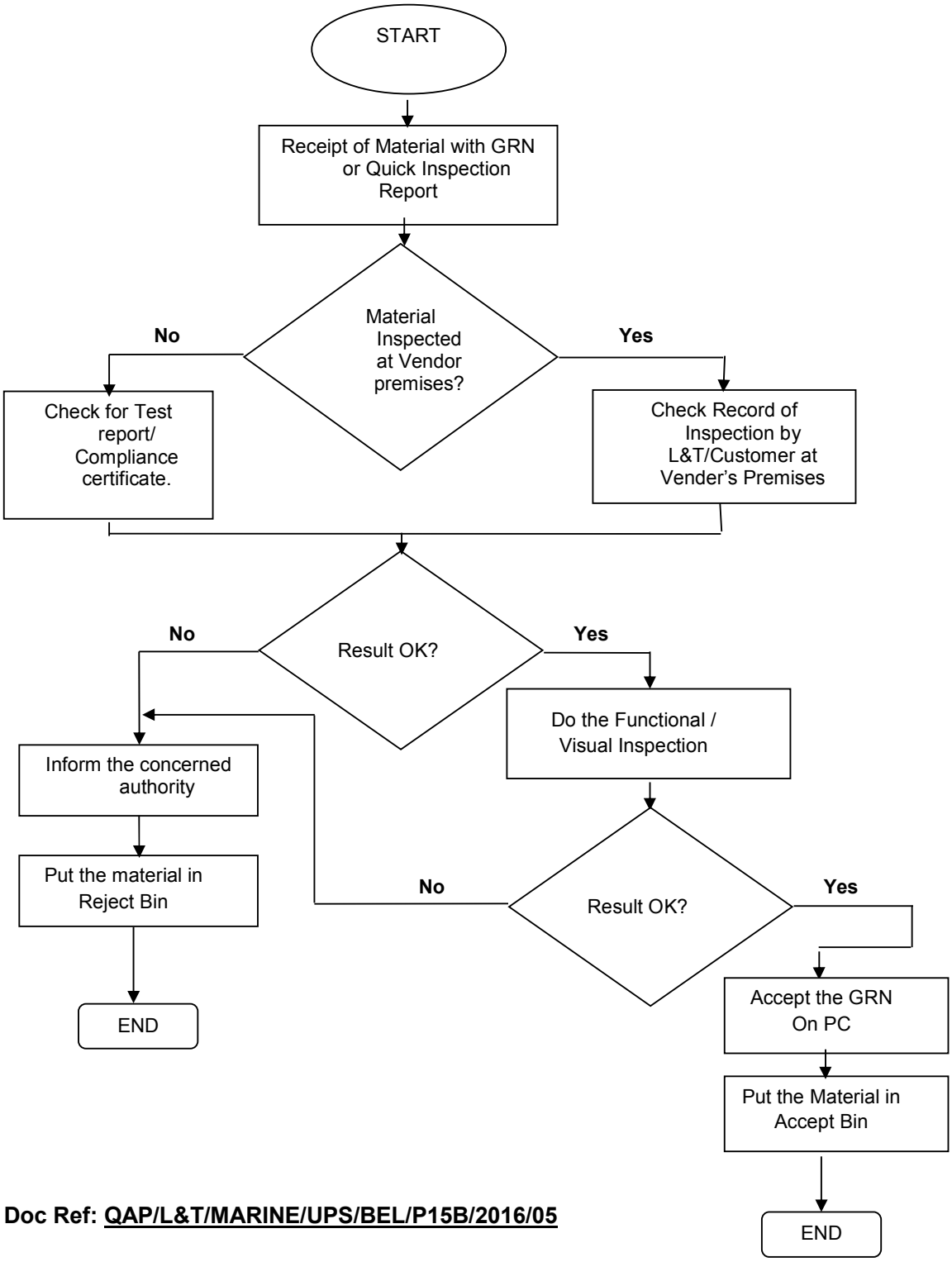
Abbreviations:

STC - Supplier Test Certificated
IR - Inspection Report
FAT - Factory Acceptance Test
P-Perform
R-Review
W-Witness

Doc Ref: QAP/L&T/MARINE/UPS/BEL/P15B/2016/05

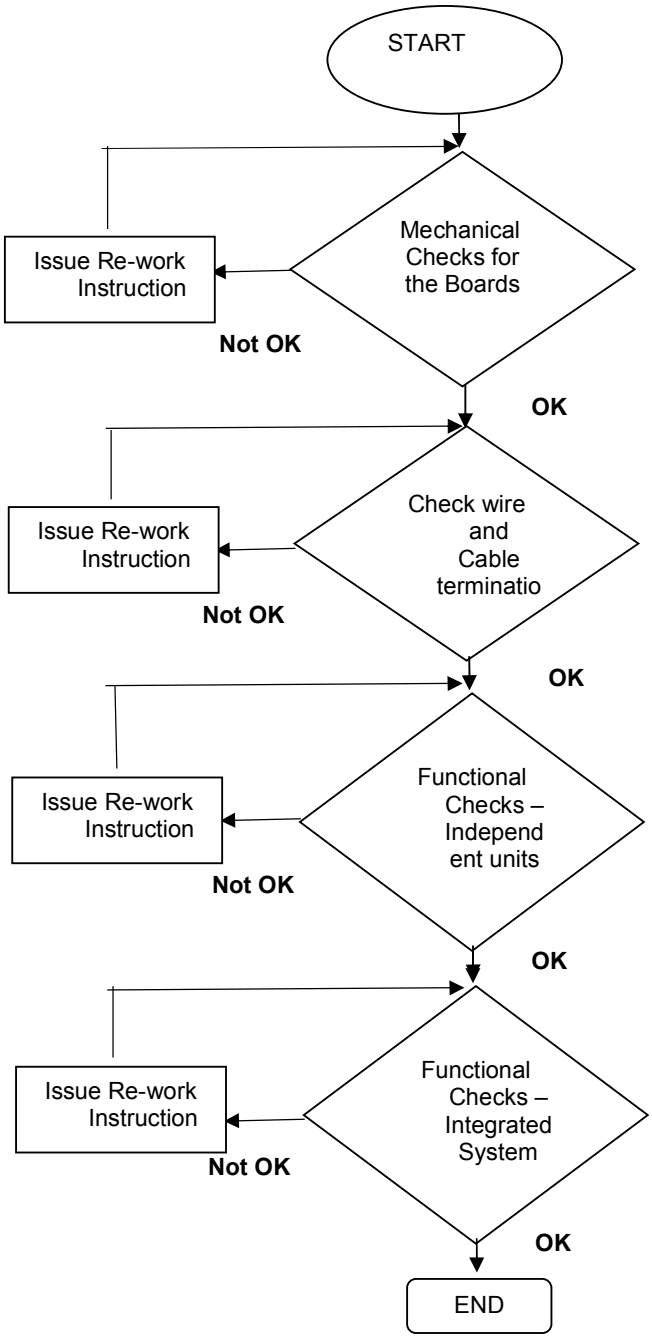
3.2 **QA Process Involved**. Flow chart of QA process involved is placed at

3.2.1 Flow chart for Input Material Checks



Doc Ref: QAP/L&T/MARINE/UPS/BEL/P15B/2016/05

3.2.2 Flowchart for In-process and Final Product inspection



Doc Ref: QAP/L&T/MARINE/UPS/BEL/P15B/2016/05

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 production flow chart indicates the tests to be carried out on different levels, agencies involved and stages of testing to be carried out.

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

3.4 ESS Test Sequence:

Table-3.1

Sl No	TEST	APPLICABILITY	SEVERITY
1	Thermal Cycling (PCB/Unit level)	Indigenous manufactured PCBs /Units	As per: DQA (N) letter 66301 /Policy-07 / DQA (N) / QA-07 dated 14 Jun 2013 (Table-1 for Thermal Cycling test.)
2	Random Vibration (PCB/Unit level)	Indigenous manufactured PCBs /Units	
3	Thermal Cycling (PCB/Unit level)	Indigenous manufactured PCBs /Units	

3.5 List of Item Exempted from ESS:

Table-3.2

Sl No.	Item Description	Part No	Category (Manufactured/Purchased Parts Imported/Cots)	Remarks
1	Card mounted on Thyristor/IGBT stack Like RC Snubber cards	**N.A.**	Purchased From M/s Semikron	Ref. Note mentioned in same table
2	IGBT driver card.	**N.A.**	Purchased From M/s Semikron	
Note: These cards are mounted on IGBT & Thyristor stack & proven and supplied by OEM (M/s Semikron) directly.				

3.6 List of Considered Units/Modules to undergo ESS:

Table-3.3

Sl No.	Item Description	Part No	Category (Manufactured/Purchased Parts Imported/Cots)	Remarks
1	Automatic Changeover Switch Module (ACOS)	N.A.	L&T	

3.7 List of Considered PCBs to undergo ESS:

Table-3.4

Sl No.	Item Description	Part No	Category (Manufactured/Purchased Parts Imported/Cots)	Remarks
1	Inverter Control card		L&T	
2	Rectifier Control Card		L&T	
3	Power Supply Card		L&T	
4	Thyristor Driver Card		L&T	
5	Display Card		L&T	
6	Zero Crossing Detector (ZCD) Card		L&T	

3.8 Details of Thermal Cyclic Test:

Table 3.5

Thermal Cycling Stress Screen Parameters	PCB/ Unit level
Temperature Range (Minimum)	From -40°C TO 70°C
Temperature Rate of Change (Minimum)	5°C/Minute
Temperature Dwell Duration	05 Minutes
Temperature Cycles	15
Power ON/OFF	For PCB Power ON not required and for Module/Unit level Power ON Required
Equipment Monitoring	Supply ON/ Power ON LED Lamp monitoring only for Module / Unit Level.

Note: As per requirement the test is to be carried out at 10°C/Minute. However due to test facility restriction at ERTL/NABL approved LAB the test is being conducted at 5°C/Minute.

3.9 Details of Random Vibration Test:

Table 3.6

Random Vibration Screen Parameters	PCB / Unit level
Acceleration Level	6Grms
Frequency Limit	20-2000Hz
No of Axes	3
Power Spectral Density	0.04G^2 /Hz(with-3db per octave from 350 to 2000Hz)
Duration of Vibration	10 Minutes each Axis (All 3 axis).
Power ON/OFF	For PCB Power ON not required and for Module/Unit level Power ON Required.
Equipment Monitoring	Supply ON/ Power ON LED Lamp monitoring only for Module / Unit Level.

3.10 Details of Environmental Test (ET) Environmental Tests Standards are as per JSS: 55555: 2012(Rev.3) Class –N1

Table 3.7

Sl. No	Environmental Tests	Test No., Procedure No., Condition & Description	Remarks
1	Vibration	Test No.: 28, Freq. range: 5 to 33Hz, Amplitude +/- 0.125mm, Constant Displacement, No. of axes: X, Y, Z, Duration: 1hour in each axis, Tests carried out with shock mounts.	The equipment should be in switched ON condition. Visual inspection and functional check after the test.
2	High Temp	Test No.:17 Procedure 6.Test Condition "K". Operation at 55DegC +/-3DegC for a period of 16 hours. Functional check during last ½ hr. Storage at 70DegC +/-3DegC for a period of 16 hours. Functional check at room temp after completion of the test.	The equipment should be in switched on condition during the test. Functional check in the last ½ hr. The equipment should be in switched off condition during the test.
3	Damp Heat	Test No.: 10; The temp and relative humidity +40DegC +/-2DegC at 95%RH.Test duration 16 hours. Functional check during last ½ hr.	The equipment should be in switched off condition during the test and switched on for functional check during last ½ hr
4	Low Temp	Test No: 20; Procedure 4. Test condition H: -10DegC, +/- 3Deg C for a period of 16 hours. Functional check during last ½ hr.	The equipment should be in switched off condition during the test and switched on for functional checks during last ½ hr.
5	Drip Proof	Test No: 11 Duration 15 Minutes	The equipment should be in switched ON condition during the test.
6	Mould Growth	Test No.: 21 (To determine the resistance of electronic and electrical eqpt against Mould growth)	Enclosure material sample will be tested.
7	Corrosion Test(Salt)	Test No: 9 Procedure 1 for upper deck items Procedure 2 for inner deck items (To determine the suitability of electronic and electrical eqpt for use and/or storage in salt laden atmosphere)	Enclosure material sample will be tested.
8	Shock Test	Test No: 24 NSS Grade II (above water line):Shocks/face	The equipment should be in switched off condition.
9.	Tropical Exposure Test	Test No:27 Test Condition A-7 cycles	The equipment should be in switched off condition.

Note: As Per BEL P.O. Batteries will be supplied at the time of STW (Set to Work). Hence For the purpose of Type Testing Instead of actual Batteries dummy weight will be used in Battery Rack.

3.11 List of Items to be undergone Environmental Tests:

Table 3.8

Sl.	Item Description As per M/S BEL PO	BEL Part No.	Item Description As per M/S L&T Drawing	L&T Board No.	Qty
1	Auto Change Over Switch (ACOS)	112185863033	100A Auto Changeover Panel	SYGB011-01	1
2	Circuit Breaker Box UPS Input	112185862936	Circuit Breaker Panel-1	SYGB006-01	1
3	Circuit Breaker Box UPS Output	112187901876	Circuit Breaker Panel-2	SYGB012-01	1
4	Main Power Distribution Panel-	112184835997	Main Distribution Panel	SYGB003-01	1
5	Transformer-UPS Input	112185862451	Input Transformer (58KVA Star-Delta)	SYGB010-01	1
6	Auxiliary Dist Panel –Type-A1	112185862645	Auxiliary Dist. Panel –Type-A	SYGB007-01	1
7	Auxiliary Dist. Panel –Type-B1	112185862742	Auxiliary Dist. Panel –Type-B	SYGB008-01	1
8	Auxiliary Dist. Panel –Type-C1	112185862839	Auxiliary Dist. Panel –Type-C	SYGB009-01	1
9	Centralized UPS	112184988287	Centralised UPS	SYGB004-01	1
10	Battery Rack for centralized UPS	112184988384	Battery Rack	SYGB005-01	1

3.12 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

3.12 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.

Table 3.9

Sl. No.	Item Description	Part No.	Test	Applicable Standard	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		MIL-STD-461E	NABL Accredited Lab	
3	Transformer-UPS Input	112185862451		MIL-STD-461E	NABL Accredited Lab	
4	Centralized UPS	112184988287		MIL-STD-461E	NABL Accredited Lab	

3.13 List of Components / Assemblies with Inspection Criteria:

As mentioned in Incoming /Raw Material & Bought out Items of QAP Appendix 'A'.

3.14 List of Imported Items: Nil

3.15 List of Indigenous Items procured through Sub-Contractors

List included in QAP Appendix 'A'.

3.16 List of Mil Components: All the items are indicated in QAP are type tested.

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

3.17 Sampling Plan Included in the QAP.

3.18 List of PCBs with Jumper: Nil

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

.

3.19 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	2
	MAIN DISTRIBUTION PANEL		
1	General arrangement diagram for Main Distribution Panel	SYGB003-01 to 08	2
2	Master Bill of Material for Main Distribution Panel	SCG1676	1
3	Scheme diagram for Main Distribution Panel	SWG1514	2
	AUXILIARY DISTRIBUTION PANEL TYPE A		
1	General arrangement diagram for Auxiliary Distribution Panel Type A	SYGB007-01 to 16	2
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	2
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	2
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	2
2	Master Bill of Material for 100A ACOS Panel	SCG1680	1
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	1
2	Master Bill of Material for CIRCUIT BREAKER PANEL - 1	SCG1789	0
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	2
2	Master Bill of Material for CIRCUIT BREAKER PANEL – 2	SCG1681	2
3	Scheme diagram for 100A CIRCUIT BREAKER PANEL - 2	SWG1519	2

INPUT TRANSFORMER			
1	General Arrangement diagram Input Transformer	SYGB010-01 TO 08	1
CENTRALISED UPS			
1	Diagram for Centralised UPS with Output Transformer	SYGB004-01 to 08	1
2	Master Bill of Material for Centralised UPS	SCG1698	1
BATTERY RACK FOR CENTRALISED UPS			
1	Diagram for Battery Rack	SYGB005-01 to 08	1
2	Master Bill of Material for Battery Rack	SCG1699	1

3.20 **<u>List of approved ATPs/ PTPs</u>**. As per approved Functional Checks indicated in QAP.

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	

CHAPTER IV

(Final Acceptance)

Factory Acceptance Tests (FATs)

FATs is to be undertaken on the integrated system 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.

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.