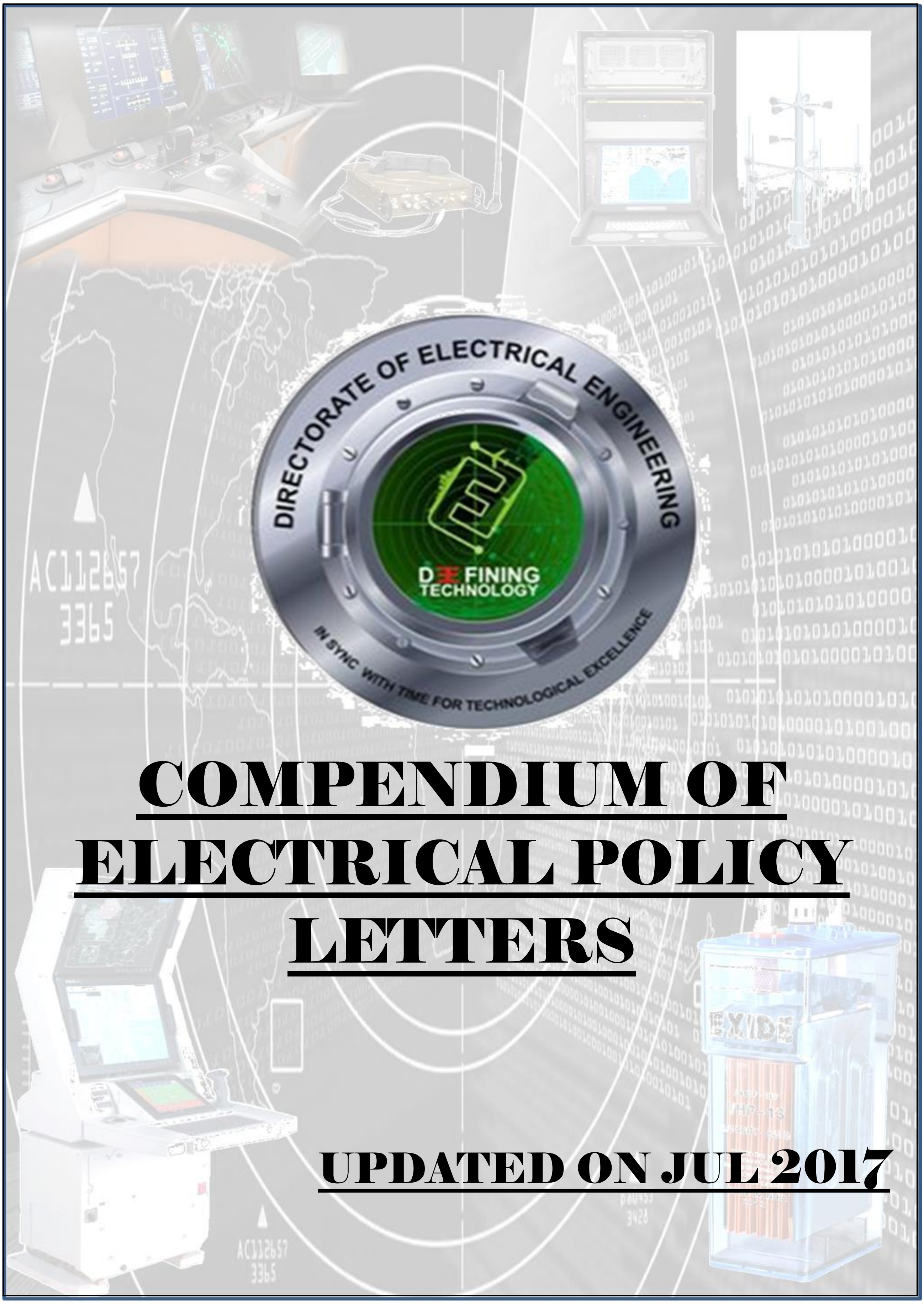

COMPENDIUM OF ELECTRICAL POLICY LETTERS

UPDATED ON JUL 2017

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Tel: 23011668

Integrated Headquarters
Ministry of Defence (Navy)
New Delhi -110011

EE/Policy/L-73/Power-20

16 Dec 10

The Flag Officer Commanding –in-Chief
(for CLO)
Headquarters, Eastern Naval Command
Visakhapatnam-530014

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters Western Naval Command
SBS Road,
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The Flag Officer Commanding –in-Chief
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Headquarters, Southern Naval Command
Kochi-682004

The Commander-in-Chief
{for CTO (Marine)}
Headquarters Andaman & Nicobar
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POLICY GUIDELINES ON FEASIBILITY STUDY BOARDS AND PREPARATION OF DRAFT WLDs

1. During the course of Ship's life cycle, a large number of equipment/ systems are replaced onboard to cater for improvement in operational performance, design upgrades, induction of technological upgrades, non-supportability and replacement of obsolete equipment etc. These changes, which entail fitment of new equipment/ modification to the existing equipment or its configuration, removal of redundant equipment, etc., are processed as Additions and Alterations (As & As), as per guidelines and procedures laid down vide NO 55/03.

2. The first step towards implementation of the changes in the Ship's equipment is convening of a feasibility board and generation of comprehensive Board Proceedings (BPs) addressing all aspects of the desired changes. These BPs are

required to be examined at Command Headquarters and approved locally for minor As & As, whilst for major As & As these are forwarded to IHQ MoD(N), alongwith their recommendations for approval. The scope of activities, required to be carried out by each of the stake holder for implementing any As & As along with timelines for completion of various activities vis-à-vis the Ship's refit schedule has been clearly elucidated in the NO 55/03.

3. Of late it has been observed that the BPs and the draft Working Level Drawings (WLDs) are not comprehensive and do not address all the requirement specified in the Navy Order. Deficiencies in the BPs and WLDs necessitate their referral back to Boards/ refitting authority for re-examination and clarifications leading to avoidable delays in processing/ approval at IHQ MoD(N). In few instances, BPs have been received at IHQ MoD(N) without recommendations from Command HQ.

4. In order to ensure that the Board Proceedings and WLDs are speedily processed and approved at IHQ MoD(N), a comprehensive list of guidelines have been formulated and are placed at **Encl-1 and 2**. Majority of these requirement for BPs are specified in NO 55/03, however these have been elaborated further for clarity and to include some additional requirement. This would obviate possibility of critical/ essential issues being overlooked during formulation of BPs/ preparation of WLDs.

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

(a) Guidelines placed at Enclosure be included in the Terms of Reference for the Feasibility Boards Examining every As & As.

(b) BPs/ WLDs be examined for completeness at Command Headquarters and are forwarded to IHQ MoD(N) along with specific recommendations for approval.

(Amit Rastogi)
Captain
Director Electrical Engineering

Encl: - 1. Guidelines for Feasibility and As & As Boards.

2. Guidelines on preparations of system WLDs.

Enclosure 1 to IHQ MoD(N)/DEE letter EE/Policy/L-73/Power-20 dated 16 Dec 10

GUIDELINES FOR FEASIBILITY STUDY BOARDS

1. The feasibility study/ As & As Boards over and above the Terms and References specified by the Board Convening Authority should examine each of the undermentioned requirements and incorporated findings in BPs in a structured manner: -

System Requirements

(a) Brief Description of System. A brief technical description of each unit of system be mentioned.

(b) System Configuration/ Layout Diagram. A schematic diagram of complete system configuration/ layout and location details of each unit with compartment layout be depicted.

(c) Foundation/ Mounting Details. Whether foundations of existing unit/ system are suitable or new foundations will have to be welded for installation of system. Requirement of degutting/ re-gutting and modifications if any proposed to the compartment be specified in the BPs.

(d) Power Supply Requirement. Details of various power supplies required for system along with identification number and location of DBs, Fuse panels & breakers be specified. Further, additional MCCB/ transformers/ isolation switches if any required should be mentioned along with system power supply arrangement diagram.

(e) Interface Requirement. List of equipment to be interfaced with compatibility for interfacing, requirement of data conversions, details of interface protocols along with interface wiring diagram should be appended in the BPs.

(f) Cable Schedule. A detailed cable schedule separately for system intra connections, interfacing with other system and power supply cables be prepared as per specified format.

S. NO	CABLE CODE	TYPE & DESC	PART/ PATT NO.	UNIT FROM	UNIT TO	APPROX LENGTH	SUPPLIED BY	REMARKS

(g) Cable Route. A detailed cable route for each cable including interfacing cables be prepared and location details of every compartment sequentially passed through by cable be mentioned. Further, while finalizing cable route, cable hygiene aspects viz. avoidance to sharp turns, requirement of conduit, securing space etc. be also examined.

(h) Cable Glands. Details of existing (both deck/ bulkhead) glands to be pierced and new glands required to be welded for laying the cables be annexed with BPs.

(j) EMI/ EMC Analysis. The Board should co-opt a member from NEC (MB)/ seek EMC analysis report from NEC (MB) and the same be annexed with the BPs.

(k) Bill of Material. A comprehensive Bill of Material required for installation of system be prepared giving description, part/ patt no. if applicable, quantity of each item and agency responsible to provision.

(l) Manufacturers PIL/ CPIL. The details to include: -

(i) Name of Units/ Sub Units

(ii) Type/ Model

(iii) Manufacturers Part number or ILMS Part number

(iv) Qty of each unit.

(m) Documentation. A list of documents required to be supplied with the system be specified by the Board.

(n) Spare Tools. List of OB spares required along with special tools/ instruments necessary for system maintenance be specified with all relevant details.

(p) OEM Details. Addresses of the system OEMs including their telephone number, E mail ID and Web site details be mentioned.

(q) Training. Level and scope of special training required if any, for yard personnel/ ships staff at OEMs premises be also specified by the Board.

(r) Scope of Work. The Board should work out a detailed scope of work for each activity required to be undertaken for installation of system and recommend agencies responsible. Further, estimated time and cost for implementation of As & As be also specified.

(s) Shipping/ Unshipping. Details of shipping/ un-shipping routes of new equipment as envisaged by the Board be clearly indicated. Further, requirement for system maintenance envelope be also examined and addressed in the BPs.

(t) Disposal of Existing System including OBS. The Board should give recommendation on disposal of existing system i.e., re-appropriation to other ships, survey as serviceable to MOs or survey as unserviceable.

(u) Size and Weight of Equipment. Dimensional details and weight of equipment being removed and proposed to be installed shall be indicated in the BPs.

(v) Waveguide Route. Layout of wave guide routes clearly indicating length, number and types of bends (E&H) with a preliminary analysis of VSWR be appended.

(w) Citadel Integrity. Effects on citadel boundaries on installation of equipment/ implementation of proposed modification be assessed and Board to confirm that the citadel integrity is not disturbed.

(x) Additional Bench Marks. Board to indicate requirement of additional Bench marks if any.

(y) Water Tight & Gas Tight Integrity. Affect on water/ gas tight integrity of the ship and methods to restore the ship's water/ gas tight integrity be specified.

Miscellaneous Requirements

(z) Stability Consideration. A preliminary stability evaluation of the ship consequently to the modification/ installation proposed may be tabulated and compliance to criteria as specified in NES 109 be examined.

(aa) Heat Load Implication. Details of heat load in respect of equipment being removed and added in compartment be calculated and specified. Additional requirement of Air conditioning if any, be supported with heat load data and Power supply details/ arrangement.

(ab) Fire Fighting System. The Board shall recommend on augmentation/ additional requirements of Fire Fighting System/ Fire Sensors.

(ac) Lighting and Internal Communication. Requirement of additional lighting and internal communication if any, be examined by the Board and necessary details be mentioned in the BPs.

(ad) Index of Annexure. All drawings, documents and schedules annexed with BPs be listed with reference to relevant para number of Proceedings.

(ae) Terms of Reference. This shall include list of all relevant orders in vogue, Navy orders, Technical manuals NES etc. and other specific requirements mentioned by the Board Convening Authority.

2. Recommendations. The board should make unambiguous recommendations on implementation of BPs and feasibility to execute the proposed As & As. In addition issues specific to a ship/ class of ship should be brought out explicitly. Further, in case implementation of As & As / installation of equipment is not feasible

technically or otherwise, the board should recommend accordingly duly supporting with relevant documents.

Enclosure 2 to IHQ MoD(N)/DEE letter EE/Policy/L-73/Power-20 dated 16 Dec 10

GUIDELINES ON PREPARATION OF SYSTEM WLDs

1. System WLDs are prepared by refitting authority based on the system specifications contained in the approved Board Proceedings. However, major deviations to approved Board Proceedings have been observed in the draft WLDs without obtaining necessary approval from IHQ MoD (N). This leads to infructuous correspondence between IHQ and Commands Headquarters which invariably delay approval of WLDs. Therefore, to ensure time bound approval of system WLDs, it is imperative that refitting authorities mention all deviations with respect to approved BPs duly supported by approval of respective Command HQs.

2. In addition, refitting authorities are to ensure that under mentioned requirements are suitably incorporated in the system WLDs prior forwarding to IHQ MoD(N) for approval: -

(a) Cable Schedule. WLDs should contain complete cable schedule as per format given below: -

S.No.	Cable code	Cable Type & Desc	Cable Part/ Patt No.	Unit from	Locn of Unit	Approx. length in Mtrs	Detailed Cable route	Supplied by	Remarks

(b) Deck head/ Bulkhead Glands. Details of existing and new glands be included in the WLDs as per given format: -

S.No.	Type & Description of glands	Location of Gland	Size of glands	Cable code passing through each glands	Remarks

(c) Reference to Fittings. Details of sub units/ assemblies be included in WLDs as per under mentioned format: -

S.No.	Item Code	Desc of unit/ sub-unit and brief tech. parameters	Type/ Model	Part/ Patt No.	Qty.	Wt	Dimensions	Locn of Unit	Frame No. Deck No.	Supplied by	Remarks

(d) Deck wise plan of cable run to be shown and Deck head/ Bulkhead glands be indicated.

(e) All the existing units/ system that are required to be interfaced with the new system to be shown in dotted lines and also be mentioned in Reference to fittings and Cable schedule.

(f) Data cables and Power cables be shown using different colour or distinct lines for easy identification on the drawings.

(g) Installation details are to be prepared in 1:5, 1:10 scale.

(h) Layout be prepared in 1:10, 1:20 or 1:25 scale.

(j) The proposed and existing structure and equipment be indicated in 'Red' and 'Black' colour respectively.

(k) The details of scale (1:5, 1:10 etc) utilized in the individual drawing be appended on respective drawings.

(l) Installation details should be drawn in Plan, Elevation and Side Elevation along with dimensional details of each sub-unit separately.

(m) Details of connectors used be included in Reference to Fittings and shown in the drawings.

3. AFDs (As Fitted Drawings) are to be prepared on system installation and HAT/ SAT completion. Any deviations in the system installation post approval of WLDs are to be clearly incorporated in the AFDs. Refitting authority/ Ship Staff to render returns in accordance with NO 55/03 post installation of equipment.

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Tel: 23011668

Integrated Headquarters
Ministry of Defence (Navy)
New Delhi -110011

EE/Policy/L-77/Power-22

15 Apr 11

The Flag Officer Commanding –in-Chief
(for CLO)
Headquarters, Eastern Naval Command
Visakhapatnam-530014

The Flag Officer Commanding-in-Chief
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Headquarters Western Naval Command
SBS Road,
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The Flag Officer Commanding –in-Chief
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Headquarters, Southern Naval Command
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The Commander-in-Chief
{for CTO (Marine)}
Headquarters Andaman & Nicobar
Port Blair- 744 102

REVISED PROCEDURES FOR VETTING/ APPROVAL OF EQUIPMENT MANUFACTURING DRAWINGS

1. **Introduction**. There are various organisations responsible for procurement of equipment for use onboard ships/ submarines viz. IHQ MoD(N) for first induction equipment, Shipyards for new construction ships and MOs for ABER/ MLU replacement. Manufacturing drawings for new induction equipment is approved by procuring directorate at IHQ after obtaining comments from professional directorate and DQA(N/WP). The procedure expeditious and efficient as the agencies involved in scrutiny/ approval of drawings are co-located at IHQ and have direct coordination.

2. However, in case of Shipyards and MOs procurement, due to involvement of many agencies, the equipment drawing approval procedure is very length, cumbersome and leads to inordinate delay. This is firstly because of the agencies involved in preparation, examination and approval of drawings do not interact directly with each other and secondly due to complete centralization in approval of drawings. These inherent drawbacks in drawing approval procedures lead to inordinate delays

which adversely affect the timely availability of equipment for onboard installation during ships construction phase/ scheduled refits of the ships.

3. Hence, a need has been felt to streamline and de-centralise the drawing approval procedures for expeditious approval of drawings. Towards this, the procedures being followed hitherto have been reviewed at IHQ MoD(N) with all stake holders. Recommendations of all Command Headquarters have been received/ examined and addressed in the revised drawings approval procedures enumerated in the succeeding paragraphs.

4. **Shipyard Orders**. Firms should forward the drawings to the Production Directorates, i.e., DND/ DSP who would then coordinate the approval of drawings through Professional Directorates and DQA(N/WP). Production Directorates/ agencies to promulgate timelines for approving he drawings by respective agency. DND/ DSP should then forward the drawings to Professional Directorates for approval with respect to compliance to SOTRs and to DQA(N/WP) for approval on quality issues. In the process of approval of drawings, the issues requiring clarifications from OEM needs to be addressed independently by Professional Directorates/DQA(N/ WP), as required and the drawings are to be stamped as follows: -

(a) "Approved for compliance to SOTRs" by Professional Directorates.

(b) "Approved for compliance to Quality issues" by DQA(N/ WP).

(c) "Approved for compliance to Installation issues" by DND/ DSP (Production Directorates).

(d) Production Directorates to forward one copy of final approved drawings to OEM/ Shipyards/ MOs/ AHSP/QA agency on receipt of approval from Processional Directorates and QA organisation.

(e) For urgent requirement where the delivery time of the equipment needs to be hastened, collegiate vetting of drawings may be undertaken and coordinated by the Production Directorate.

5. **MOs Orders**. Most of the procurements undertaken by MOs pertain to existing equipment for which drawings are already held or local substitutes for which the drawings are required to be approved. Further, Command are well acquainted with the time line for various equipment to be fitted onboard ships/ submarines and hence drawings pertaining to MO Purchase Orders are to be vetted and approved by respective Commands. Assistance can be sought from organisations like ETMA/ MTU/ HITU, Dockyards/ NSRY and local QA agencies for approval of drawings. Ordering actions by DPRO undertaken through NLC-I/ II are also to be treated akin to MO orders and would be approved by the concerned Command of the ship on which equipment is to be fitted.

6. **Other Agency Orders**. The procedure for approval of drawings for Orders placed by IHQ (Professional Directorates/ DOI), Dockyards, DGNP etc. would be as

follows: -

(a) Firms to forward the drawings to order placing authority.

(b) "Approved for compliance to SOTRs" by Professional Directorates/ Dockyards/ DGNP.

(c) "Approved for compliance to Quality issues" by DQA(N/WP) / Dockyards/ DGNP.

(d) "Approved for compliance to Installation issues" by Order placing authority.

(e) Order placing authority to approve the drawings post obtaining comments of all stake holders and forward one each copy of final approved drawings to OEM/ MOs/ AHSP/ QA agency as applicable.

7. In view of the above, following are requested: -

(a) The drawings approval procedures mentioned above be communicated to all order placing agencies for further dissemination to vendors for compliance.

(b) Comments/ feedback if any be forwarded to Integrated Headquarters, Ministry of Defence (Navy)/ DEE by 15 May 11.

(Amit Rastogi)
Captain
Director Electrical Engineering

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Tel: 23011668

Integrated Headquarters
Ministry of Defence (Navy)
New Delhi -110011

EE/Policy/L-65/Power(l-65(i)

27 Jan 10

The Flag Officer Commanding –in-Chief
(for CLO)
Headquarters, Eastern Naval Command
Visakhapatnam-530014

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters Western Naval Command
SBS Road,
Mumbai – 400023

The Flag Officer Commanding –in-Chief
(for CLO)
Headquarters, Southern Naval Command
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The Commander-in-Chief
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SAFETY PRECAUTION AGAINST ELECTRIC SHOCK

1. Refer to IHQ MoD(N) letter EE/Policy/L-01/Power-01 dated 24 Jan 05 and NO 27/06.

2. Accidents due to electrocution onboard *IN* ship and establishments is a cause of concern. Whilst these incidents have been resulted in an unfortunate loss of human life in the past, it has brought out the need for personnel to strictly adhere to safety norms and procedures during maintenance and operation of electrical equipment.

3. The procedures and measures indicated in the Navy Order and IHQ policy letter quoted above needs to be strictly adhered to towards maintaining adequate safety precautions onboard. These safety procedures and measures needs to be suitably reiterated by the Commands to the lower formations so that such lapses on the safety front are always avoided.

4. A set of safeguards which need to be ensured by units and forwarded vide IHQ/DEE letter ibid is placed at Encl-1 for ready reference. It is requested that the above be disseminated to lower formations. Further, the same be suitably incorporated if not already existing, in the relevant Standing Orders of ships/ units. Adherence to these needs to be monitored and checked during annual inspection/ staff checks by Commands.

5. There is also a requirement to undertake inhouse electrical safety audits of both ships and establishments and recorded of the same maintained. Terms of reference for the safety audit is placed at Encl-2. Further, ETMA/ ETMUs may be entrusted by Commands to undertake surprise Electrical Safety Audit onboard ships so as to ensure safety norms are being followed by the ships.

6. The domestic (230V) supply is the major source of low insulation and risk of electrocution onboard ships. Feasibility of suitable Insulation Monitoring System (IMS) and ELCBs for protection against electrical shock from domestic and galley equipment is being considered. Post successful trials this will be inducted as an additional protective device.

7. Commanding Officer INS Valsura, by a copy of this letter is requested to duly emphasise on the electrical safety aspects and safeguards during basic training.

(Amit Rastogi)
Captain
Director Electrical Engineering

Enclosure 1 to IHQ MoD(N)/DEE letter EE/Policy/L-65 dated 27 Jan 10

SAFETY PRECAUTIONS WHILE WORKING ON ELECTRICAL EQUIPMENT

1. All electrical equipment are earthed properly and are connected to power source through specified connectors.

2. Rubber gloves suitable for working upto 450V be worn by all electrical sailors while working on live equipment.

3. Feeder Breaker of the particular equipment is to be switched OFF while connecting/ disconnecting supply of that equipment and a tally "Men at work, do not switch on supply" is to be positioned.

4. While connecting/ disconnecting supply to electrical equipment, it is to be ensured doubly with the help of tester/ multi-meter that the line is completely dead and safe to work upon.

5. Rubber mats are placed as per guidelines contained in BR 2000 (52).

6. Lead lamps and test equipment to be used correctly as brought out in NO Str 02/03.

7. A senior electrical sailor should supervise the whole work closely. Where not feasible, a second person should be available for providing any assistance/ safety cover.

Enclosure 2 to IHQ MoD(N)/DEE letter EE/Policy/L-65/Power dated 27 Jan 10

SAFETY AUDIT OF DOMESTIC CONSUMERS/ GALLEY EQUIPMENT FOR PREVENTION AGAINST ELECTRIC SHOCK

1. **Checks to be undertaken**

(a) Check for earth integrity of all plugs and sockets.

(b) Check for fitment of double pole switch sockets.

(c) Check if sufficient number of protection material like Rubber mats, gloves etc are available onboard the Ships.

(d) Check for satisfactory earthing of all electrical equipment.

(e) Check for water accumulation around galley equipment.

(f) Check for condition and use of proper rating of cables connected to domestic consumers/ galley equipment.

(g) Check for overloading of sockets.

(h) Check lightening arresters installation, continuity and termination into earthpits provided (only for shore establishments).

(j) Check usage of standard tools for operation and maintenance of fitted equipment.

(k) Any other electrical safety hazard.

2. **Awareness Programmes**.

(a) Ships should have regular lectures through departmental DOP on precautions to be observed while working on live electrical equipment.

(b) Personnel to be familarised with procedures of recording minor modifications and A's and A's in E-MAPS/ Kalamazoo and also on tallies/ documents of the equipment.

3. **Recommended Reference Documents for Preparation of Standing Orders**.

S. No.	**Reference Document**	**Relevant Article/ Para**
(a)	Indian Electricity Rules, 1956 (As amended on 25 Nov 2000)-GOI,	Para 36 – Chapter IV

	Ministry of Power, Central Electricity Board.	
(b)	Electrical Power Distribution and Utilisation, BR 2000 (52)	Chapter-1 (Safety)
(c)	Marine Engineering Manual, BR 3000	Art 0623, 0624, 0630
(d)	Marine Engineering Manual, BR 3001	Art 0607, 0608, 2226, 2227, 2231, 2232, 2406
(e)	Ships NBCD Manual, BR 2170	Chapter 6, 21 Annexure 21 E.

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Integrated Headquarters
Ministry of Defence (Navy)
New Delhi -110011

EE/03/9711

30 Dec 10

The Material Superintendent
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The Material Superintendent
Material Organisation
c/o Fleet Mail Office
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The Material Superintendent
Material Organisation
c/o Fleet Mail Office
Kochi

The Material Superintendent
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c/o Navy Office
Karwar- 581308

INDUCTION OF HIGH VOLTAGE INSULATED SYNTHETIC MATS FOR SHIP BASED APPLICATION

1. Hitherto, *IN* Shipshave been supplied with black serrated anti skid insulated rubber mats for electrical applications conforming to IS-5424-1969 specifications. However, these specifications have already been withdrawn vide Govt. of India Gazette number DL(N)04/0007/2003-05 dated 28 Jul 07. Further, new specifications IS-15652-2006 on insulating mats for electrical applications have been introduced.

2. The high voltage mats conforming to IS-15652-2006specifications are made of PVC material which is fire retardant and water/moisture proof. The mats have high tensile strength and safe against electric shock for voltage up to 33 KV AC and 240V DC. These mats are available in 2.0 mm(classA) 2.5 mm (classB) , 3.0 mm(class C) and 3.5 mm(classD) thickness which are suitable for 3.3 KV , 11 KV ,33 KV and 66 KV based electrical applications respectively .

3. In view of the above, it is requested that all the future procurement for high voltage insulted synthetic mats for electrical applications onboard *IN* ships include a requirement to conform to IS-15652-2006 specifications.

(Amit Bose)
Captain
Principal Director Electrical
Engineering

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Integrated Headquarters
Ministry of Defence (Navy)
New Delhi -110011

EE/03/9715 30Jun 15

The Flag Officer Commanding –in-Chief
(for CLO)
Headquarters, Eastern Naval Command
Visakhapatnam-530014

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters Western Naval Command
SBS Road,
Mumbai – 400023

The Flag Officer Commanding –in-Chief
(for CLO)
Headquarters, Southern Naval Command
Kochi-682004

The Commander-in-Chief
{for CTO (Marine)}
Headquarters Andaman & Nicobar
Port Blair- 744 102

COMPENDIUM OF VENDORS - 2015

1. **Background**. The power equipment for new construction ships as well as the ships in commission are presently procured from IHQ approved vendors as per the existing vendor compendium promulgated by DEE in Dec 2011. It has been the endeavor of DEE to update the vendor base for induction of quality equipment related to Power Generation and Distribution (PGD) in consonance with contemporary technologyonboard *IN* ships and submarines.

2. **Vendor Inclusion/ Deletion**. Equipment and stores utilised by the Indian Navy are subjected to exploitation under varying operational and climatic conditions. The Indian Navy has special and critical requirements of storage, transportation, maintenance/repair and ever changing personnel who operate and maintain the equipment. It is, therefore, obvious that quality, reliability and delivery of products depend on the technical competence and capability of the Vendors. Due to the stringent requirements of the Indian Navy, the task of capacity and capability assessment of the vendors is more demanding than for common industrial or civil application. To ensure the competence of the vendors for supplying quality products

to defence forces, the responsibility capacity and capability assessment of vendors for the *Electrical Equipment* in the *IN* has been assigned to DEE since Jan 11.

3. In order to increase the vendor base within the country, DEE interacts with a number of prospective OEMs, as per procedure given below, prior inclusion in the IHQ approved list :-

(a) Capacity assessment.

(b) Manufacture of Prototype in conformance to EED/SOTRs.

(c) Type/ ESS tests of prototype.

(d) Field Evaluation Trial (FET) by ETMA.

(e) Submission of certificates.

4. The vendors whose product is not at par with the standards desired by the Navy or those who are unable to meet the requirements/ specifications in SOTRs are removed from the existing list.

5. **Revised Vendor List**. Based on the inputs received from ships/ Commands/ shipyards on the IHQ approved vendors for power equipment in terms of their performance, supportability, spare availability and successful completion of FET, a revised compendium has been prepared and is placed at Enclosure.

6. In view of the above, it is requested that the vendor compendium be disseminated to all procurement agencies/ Yards for necessary action. Procurement of specified equipment is to be done based on Vendor Compendium-15. This compendium would be applicable from the date of promulgation. It is further requested that recommendations/ feedback on the compendium, if any, be forwarded to this office by 31 Aug 15.

(C Raghuram)
Captain
Principal Director
Directorate of Electrical Engineering

Encl: - As above.

Enclosure to IHQ MoD(N)/DEE letter EE/03/9715 dated 30 Jun 15

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Section I

Categorisation of Electrical Equipment

Sl	Category	Remarks
(a)	Cat 'A'	The equipment nominated on single vendor basis for which SOTRs would be provided by IHQ MoD (N)/DEE.
(b)	Cat 'B'	The equipment are to be procured from IHQ MoD(N) approved vendors on LTE basis. The equipment are required to conform to IHQ MoD (N)/DEE published EED/SOTRs.
(c)	Cat 'C'	These are COTS equipment and can be procured through any reputed vendor. Only basic technical specifications of the equipment will be provided by ***IN***.
(d)	Cat 'C*'	The equipment listed as Cat 'C*' are 'general PGD equipment'. However, the equipment are to conform to IHQ MOD(N)/DEE promulgated EED/SOTRs.

Section II

CAT 'A' EQUIPMENT

Sl No	Equipment/ System	Name of the Firm/Vendor
1.	Ship Installed Radiac System (SIRS) -4012 -4012A	M/s Electronic Corporation of India Limited Instrument & Systems Division

Section III
CAT ‘B’ Equipment

Sl No	Equipment/ System	*IN* Specs	Name of the Firm/Vendor
1	Alternator	EED-Q-242 (R2)	M/s Kirloskar Electric Co Ltd. Bangalore
			M/s Elmot Alternators Pvt Ltd, Hyderabad
			M/s BHEL, Bhopal
			M/s Cummins Generator Technology Kothrud, Pune
2	Main Switchboards, C&C and Weapon Switchboard, EDCs	EED-Q-264/ *IN* promulgated SOTRs	M/s L&T, Mumbai
			M/s GEII, Bangalore
			M/s Siemens Ltd., New Delhi
			M/s Marine Electricals, Mumbai
3	Automated Power Management System(APMS)	EED-Q-264/ *IN* promulgated SOTRs	M/s L&T, Mumbai
			M/s GEII, Bangalore
			M/s Marine Electricals, Mumbai
4	Air Circuit Breaker/MCCBs/ MCBs	EED-Q-264	M/s L& T Ltd, Mumbai
			M/s GE India Industrial Pvt Ltd, Bangalore
			M/s Marine Electricals, Mumbai
			M/s Siemens Ltd., New Delhi
			M/s Schneider Electrical, New Delhi
5	Motors	EED-Q-071 (R4)	M/s Narhari Engg Works, Palghar
			M/s Poly Phase Motors, Vadodara
			M/s Ketaki Engg Pvt Ltd, Chennai
			M/s Elmot Alternators Pvt Ltd, Hyderabad
			M/s Bharat Bijlee Ltd, Mumbai/ Delhi
			M/s Laxmi Hydraulics Pvt Ltd, Solapur
6	Starters /Control Panels and Soft Starters	EED-Q-071 (R4)	M/s L&T, Mumbai
			M/s GEII, Bangalore
			M/s Marine Electricals, Mumbai
			M/s Siemens Ltd., New Delhi
			M/s Symtronics Automation,

Sl No	Equipment/ System	*IN* Specs	Name of the Firm/Vendor
			Pune
			M/s Erhad+ Leimer India Pvt Ltd. Gujarat
7	Rotary Converters	EED-Q-267	M/s Elmot Alternators Pvt Ltd, Hyderabad
			M/s Kirloskar Electric Co Ltd. Bangalore
			M/s Kerala Electric & Allied Engineering Co Ltd, Cochin
8	Auto Change Over Switch	EED-Q-264	M/s Precision Power Products, Aurangabad
			M/s L&T, Mumbai
			M/s Marine Electricals, Mumbai
			M/s GEII, Mumbai
9	Helo Starting Rectifiers	EED-Q-267	M/s Auto Electronic Control, Mumbai
			M/s Static Transformers, Indore
			M/s L &T Ltd, Mumbai
10	Cables (EBXL)	EED-50-12(R2) & EED-50-13 (R1)	M/s Radiant Cables, Hyderabad
			M/s NICCO Corporation Ltd, New Delhi
			M/s Siechem Technologies Pvt Ltd, Chennai
11	Light Fittings	EED - Q - 261	M/s Manish Industries, Kolkata
			M/s Issac Engineering Works, Kolkata
			M/s Arvin Industries, Mumbai
			M/s Ray Enterprises, Ambala Cantt.
12	Conventional Auto Emergency Lantern (AEL)	EED-Q-265	M/S Ray Enterprises, Ambala Cantt.
	LED Based AEL	EE-50-28	M/s Mcgeoth Marine, Mumbai
	LED Based Light Fixtures	EED-50-33	M/s Mcgeoth Marine, Mumbai M/S Ray Enterprises, Ambala Cantt.
13	Addressable Fire Detection System (AFDS)	EE-50-23	M/s Marine Electricals, Mumbai in association with Martec, Italy
			M/s Consilium India in Association with M/s Consilium, Sweden.
			M/s L&T, Mumbai
			M/s Navicom Technology,

Sl No	Equipment/ System	*IN* Specs	Name of the Firm/Vendor
			Mumbai
			M/s Elcome Integrated Systems Pvt. Ltd;
14	Addressable Flood Alarm System (AFAS)	EE-50-25 (R1)	M/s M/s Navicom Technology, Mumbai
			M/s L&T, Mumbai
			M/s Elcome Integrated Systems Pvt. Ltd; M/s Oriole Technical Solution Pvt Ltd, Mumbai
15	Sound Power Telephone (SPT)	EE-50-08 (R2)	M/s Elcome Integrated Systems Pvt. Ltd;
			M/s Marine Electricals, Mumbai in association with M/s SCM Sistemas, Spain
			M/s Linia Engineering Services, Mumbai
16	Compact Florescent Lamp	DEE/01/04	M/s Halonix Ltd, Noida
			Indo Asian Fusegear, Noida
17	Cables(LFH)	DEF STAN 02-525, DEF STAN 02-526 AND DEF STAN 02-527	All DGQA Registered Vendors. www.dgqadefence.gov.in

Section IV

CAT 'C' Equipment

Sno.	Equipment
1	Batteries (Only standard rating Batteries) (Except Submarine Batteries)
2	Dimmer
3	Bell, Buzzer, Hooter, Loud Hailer
4	Switch/sockets (ruggedized for marine application) (Class/Type approved, viz. ABS, DNB, IRS,etc. equivalent)
5	Fans (Domestic)
6	Reflectors
7	24 V Lead Lamps
8	Incandescent Lamps (ISI approved)
9	Geyser
10	Uninterrupted Power Supply (UPS) (Class/Type approved, viz. ABS, DNB, IRS,etc. equivalent)
11	Electrical Siren
12	MCT Glands (Class/Type approved, viz. ABS, DNB, IRS,etc. equivalent)

Section V

CAT 'C*' Equipment

Sl	Equipment	*IN* Specs
1	Transformers (*including Isolation Transformers)	EE-50-16 (4- Wire) Defstan-02-535 (3-Wire)
2	Navigational Lights Control Panel(NLCP)	EED - Q – 262 (R1)
3	15" Signaling Projector and Searchlight	EE-50-26
4	Window Wipers	EE-50-14
5	High Voltage Insulated Synthetic Mats	IS-15652:2006
6	Distribution Board Junction Box /Power Panel	EE-50-18
7	Trans - Rectifiers	EE-50-34
8	Manual/ Hand Change Over Switch	EED-Q–264
9	Battery Charger	EE-50-35
10	Non standard Batteries	As per SOTRs provided by Order Placing Authority

Section VI

ADDRESS DETAILS: IHQ MoD (DEE) NOMINATED VENDORS

Sl	Name of The Firm/Vendor with Complete Address	Telephone/Fax Numbers
1	M/s Electronic Corporation of India Limited (SIRS) Instruments & Systems Division; ECIL P.O, Hyderabad – 500 062 Mr. K Narsaiah, Sr. DGM (Defence Project) Tel: 040-27186690 headig@ecil.go.in Mr. GR Koteswar Rao **Local Add.** B-7, DDA Local Shopping Centre, A Block, Ring Road Naraina, ND-28 Mr. Rajiv Mathur , Sr. DGM(Instrument & System Division)	Fax: 040-27121611 Tele Fax: 040-27140061 Tel : 040-27122734 Tel : 011-25774342 Fax :011-25771929 Mob: 9654100555
2	M/s Kirloskar Electric Co Ltd. Post Box No 5555, Malleswaram West, Bangalore-560055 Mr. K Jagannath, Sr. General Manager 9845072171 kjg@vrkec.com www.kirloskar-electric.com **Local Add.** Kundan House, Nehru Place, New Delhi 110010 UCO Bank Bldg. Parliament Street, New Delhi Mr VS Kulkarni, Sr Engineering, Marketing 9818557302 vivekk@koel.co.in	Tele:080-23372488/2337/4865 Fax :080-23377706 Tele: 011-26233788 Fax: 011-26233791 Tel: 23711786, 23718544 Fax: 23710159
3	M/s Elmot Alternators Pvt Ltd L -1, Elmot Estate, Industrial Development Area Nacharam, Hyderabad 500 076 Mr. Akash Rao elmotalternators@yahoo.co.in	Tele: 40 -27155058 Fax :40-27155054 Mob: 09849634220

Sl	Name of The Firm/Vendor with Complete Address	Telephone/Fax Numbers
4	M/s Cummins India Ltd Dhanukar Colony Kothrud, Pune 411038 Contact person: Mr. Girish Uttam Chandani,DGM Marketting, Mob : 9922956359 Ganendra Sharma Vice President Mob: 9822306434 Mr. Mahendran, SM Mkts.(Marine) Mob: 9881245641 Mr. Nitesh Jain Mob:9763709490 Mr. Nagesh Wagle, Mob : 9922967247 Web: www.cumminsindia.com M/s Cummins Generator Technology India Ltd. Godrej Eternia-CB Wing, 5th Floor, Wakdewadi Mumbai Pune Road, Shivajinagar, Pune-411005	Tele: 020-30233745 020-25380240 Fax: 020-25381591 020-25380753 Fax: 020-25380125 Mob: 09689910835 Fax: 0020-66025331
5	M/s Larsen &Toubro Ltd. R-672,T.T.C Industrial Area M.I.D.C. Rabale Navi Mumbai-400701 www.Intebg.com Cdr (Retd) Alok Bhagwat, Sr. DY. Gen. Mgr. Mob: 9820253195 R S Mahajan, General Manager Mob: 9820552701 **Local Add.** M/s Larsen & Toubro Ltd Ambadeep Building (9th Floor) 14, Kasturba Gandhi Marg New Delhi – 110001 Cdr.(Retd) A K Sinha, Sr. Dy. General Manager Mob: 783859002	Tele:022-27649502 67051726 Fax : 022-27649301 Tel: 011-41509981 Fax:011-41509979
6	M/s Tyco Fire & Security India Pvt Ltd	Tel: 0120-4014300

Sl	Name of The Firm/Vendor with Complete Address	Telephone/Fax Numbers
	A-26, Sector-63, Noida, UP-201307 Contact person Mr. Niraj Sinha, National Sales Manager Mob: 9810103455 Email: nsinha@tycoint.com www.tycoasia.com M/s Tyco Fire & Security India Pvt Ltd D-601, Campus D, 8th Floor RMZ, Centennial Kundalahalli Main road Bangalore-560048 Contact person: Mr. Dinesh Babbar, General Mgr. Email : dbabbar@tycoint.com Mr. Malliga Sairam, Sales Cordinator Email: msairam@tycoint.com	Fax: 0120-4014333 Tel: 080-41990990 ext- 0828 Fax: 080-41163329
7	M/s GEII, Bangalore 6th Floor, RMZ Millenia, Tower B, Plot No.1& 2 Murphy Road, Ulsoor, Bangalore 560 008 Mr. A Bhardwaj **Local Rep** Mr Prakash Kumar,	Tele: 080 – 41434034 Fax: 080 41434100 Mob: 9811402588
8	M/s Siemens Ltd. 6th Floor, R&D Building Kalwa Works, Thane Belapur Road Airoli, Navi Mumbai-400601 Kind Attn: Mr. Manav Gandhi ,Manager Marketing Mob: 9930177887 manavgandhi@siemens.com www.siemens.co.in	Ph-022-3326 5604 Fax-022-3326 5505
9	M/s Marine Electricals(I) Pvt. Ltd. B-1, Udyog Sadan-3 MIDC, Marol Industrial Area, Andheri (East), Mumbai 400 093 marine@bom4.vsnl.net.in web: marineelectricals.com Cdr (Retd) Rajeev Malhotra 9323109545	Tele:022-28349132 022-28346076 Fax :022-28364045

Sl	Name of The Firm/Vendor with Complete Address	Telephone/Fax Numbers
10	M/s Schneider Electrical A-29, Mohan Co-operative Indl.Estate, Mathura Road, New Delhi-110044 Mr. Vishal Basotra, Business Development Manager 9818084461 vishal.basotra@in.schneider-electric.com www.schneider-electric.co.in Mr. Vishal Gupta, Associate Manager	Tele: 011-39404000/41590000 Fax: 011-41678012/41678010/41678011 9958111413
11	M/s Narhari Engineering Works 443,Laxmi Plaza, Laxmi Industrial Estate New Link Road, Andheri(W), Mumbai-400053 contact@narhariengg.com newpms@vsnl.com Mr. Kiran N Shah	Tel : 022-56920933/26322411 Fax :022-56920934 Mob: 9821111201
12	M/s Poly Phase Motors 702, GIDC,Makar pura, Vadodara-390010 mail@polyphasemotors.com Mr Bharat V Shah, Proprietor	Tele:0265-2645076, 6580776 Fax :0265 – 2638176
13	M/s Ketaki Engg Pvt Ltd (motors) Plot A-8, 1st Main Road Industrial Estate Ambattur,Chennai-600058 Mr. A Gilbert, Executive Director ketakiengg@vsnl.net	Mob: 9444042255
14	M/s Bharat Bijlee Limited 4th Floor, Milap Niketan, 8-A, Bahadur Shah Zafar Marg, New Delhi – 110002 Mr. Praveen Ahuja, Sr Manager (Motor) 9818121132 bbldelhi@bharatbijlee.com web: www.bharatbijlee.com	Tel: 011-23319694, 23711434 Fax: 23319413, 455-375290
15	M/s Laxmi Hydraulics Pvt Ltd (Motors) B-11, MIDC, Chincholi, Solapur - 413255 Mr. Sharadkrishna Thakre. ,MD lhpindia@lhpmotor.com web: www.lhp.co.in	Tel: 0217-2357001 Fax: 0217-2357006
16	M/s Symtronics Automation Pvt. Ltd.	Tel: 020-66114556/57

Sl	Name of The Firm/Vendor with Complete Address	Telephone/Fax Numbers
	Industrial and Defence Electronic Control System S-1, T Block, MIDC Bhosari Pune – 411026 , India **Contact person:** Mr. Mohan Wani Executive, Mob: 9766598050 Email: mohan.wani@symtronicsindia.com mohanwani@gmail.com **Local Office:** Cdr(Retd) Abhay Sharma DGM (Marine System) Mob: 09958225925 Email: ab_sh66@yahoo.com	Fax: 020-27120931
17	M/s Kerala Electric & Allied Engineering Co Ltd, 7th Floor, Housing Board Office Complex Panampilly Nagar, Cochin – 682036 kelindia@vsnl.com website: kelindia.com Mr. S Harikumar Manager (Marketing) Mob: 09447854055 Kelharikumar@gmail.com	Tel: 0484 – 2310012/13/14 Fax: 0484 – 2310015
18	M/s Precision Power Products C-144, NIDCWaluj Industrial Area, Aurangabad-431136 santoshkumar@pppgroup.co.in Powerpanel@pppgroup.co.in Web: Precisionpowerproducts.com Mr Vikas Bhamburdekar, MD	Tele: 0240-2554336, 2554028, 2556590 Fax : 0240-2564916
19	M/s GE India Industrial Pvt. Ltd. 361, Solitaire Corporate Park M.Vasanji Road, Chakala, Andheri (E) Mumbai – 400093, Mr.Chetan Shrotri, Regional Manager e-mail: chetan.shrotri@ge.com	Tel : 022-40101602 Fax: 022-40101611 Mob: 09819295485
20	M/s Automatic Electronic Controls Mfg. Co.	Tel : 022-32979741 Fax : 022-26870065

Sl	Name of The Firm/Vendor with Complete Address	Telephone/Fax Numbers
	Gali No. B-28/29, Giriraj Industrial Estate, Mahakali Cave Road, Andheri (East) Mumbai 400 093 aec@marineelectricals.com aecmfg@gmail.com Mr. VK Mishra (GM), Mob: 09820038417 Tele:022-32979741, Fax :022-25655124,	Tele:022-32979741 Fax :022-25655124,
21	M/s Static Transformers Pvt Ltd G-4 A/D, Industrial Estate Polo Ground Road, Indore – 452015 mail@statictransformer.com Mr. SA Joshi, Managing Director Nihil Gokhale static@sancharnet.in	Tele: Ph. 0731-2420859; 2102839 Fax 0731-2420793,2423815
22	M/s Radiant Cables Ltd B-12,4 & 6 sanath Nagar; Hyderabad – 500 018 Contact person Anupam Nathaniel (Vice President) cables@radiantcorpn.com Mr. C Venkateswarlu, Manager (Sales) B-1, I.E. Sanathnagar, Hyderabad-500018 09347525966 sales@radiantcorpn.com	Tele: 040-23704470 -73 Fax : 040-23703421 Fax : 040-23703421
23	M/s NICCO Corporation Ltd D- 138, Defence Colony, New Delhi 110024 M8-11A, Hemkunt Chamber, 89, Nehru Place, New Delhi - 110019 Rajesh Garg, Vice President (North) 9811110209 Delhi.sales@niccocable.com www.niccogroup.com Nicco House, 2, Hare Street, Kolkata – 700001 sbhattacharya@niccocable.com	Tele:011-4601612 Fax : 011-4601614 Tel: 011- 41717208-09 Fax: 011- 41717210 Tel: 033-22420569, 22485102 Fax: 033-22209443 Fax: 033-2581-2940

Sl	Name of The Firm/Vendor with Complete Address	Telephone/Fax Numbers
	Mr Sanjoy Bhattacharya, Director (Cable operation) Mr. Sibu Chakrabarti (9831628648) sibu@niccocable.com	
24	M/s Siechem Technologies Pvt Ltd (Cables) 26/27, Errabalu Chetty Street, Chennai – 600001 sales@siechem.com web: www.siechem.com	Tel: 044-25226141, 25220859 Fax: 044-25222871
25	Manish Industries 133, Beliaghata Road Kolkatta 700 015 manishindustries@hotmail.com	Tele:033 -22515426/1455 Fax: 033-24866156 Mob: 9051266795
26	M/s ISSAC Engineering Works 27/1/6, Dr SC Banerjee Road, Kolkata 700 010	Tel: 033-23501803 Fax: 033-23531058
27	M/s Arvin Industries Gala No-6, Pant Nagar, Ghatkopar(E), Mumbai Mr Arvind B Sanghvi – 09869120313 arvinindustries@gmail.com	Tele: 022-25019302/25513797/ 25512440 Fax : 022-21028160/25579718
28	M/s Ray Enterprises, 18, Industrial Estate, Jagadhari Road Ambala Cantt 133 001 Mr Dinesh Chowdhry, CEO Mob: 09416069399 info@rayen.in rayen123@rediffmail.com rayen@dataone.in www.rayen.in	Tele:0171-3291400/2699399/ 2698351 Fax : 0171-2699420 0171-2698390
29	M/s McGeoch Marine Electricals Pvt Ltd A-16, Anand Mangal Industrial Estate Opp-IPOL Industries, Waliv Phata, Vasai(E), Thane-401 208 Web site: www.mcgeoch-marine.com Email: sales@mcgeoch-marine.com Contact person Cdr(retd) Rajeev Malhotra- Mob: 09323109545 Mr. Deepaak Sawant, Mob:	Tel: 0250-6450633 Fax: 022-28364045 /39167193

Sl	Name of The Firm/Vendor with Complete Address	Telephone/Fax Numbers
	09225901816	
30	M/s Consilium Marine India Pvt Ltd 210, Raheja Arcade Sector-11, CBD Belapur, Navi Mumbai – 400614 KK Manoharan, GM 9930330162 www.consilium.ae manoharan@consilum.ae	Tel: 022-67935150/52/53 Fax: 022-67937921
31	M/s Navicom Technology International Pvt Ltd The Great Easern Sumit, B'Wing, 11th Floor, Sec-15, CBD Belapur, Navi Mumbai – 400614 Mr. AM Agnihotri, GM agnihotri@navicom-tech.com www.navicom-tech.com www.navicom.in navindiasales@navicom.in Cdr (Retd) Vikesh Jain	Tel: 022-27563119/3145/ 5175 / 5176 Fax: 022-27563121 Mob: 096190 05697 - Mumbai 98710 58064 - Delhi
32	M/s Elcome Integrated Systems Pvt. Ltd; Great Eastern Summit A 11th Floor, Plot No. 56 Sector-15, CBD Belapur Navi Mumbai – 400 614 **Contact person**: Mr. Rakesh Tandon, Director E Mail: rakesh@elcomeindia.com **Local Add**: M/s Elcome Integrated Systems Pvt. Ltd; 501, 5th Floor Madam Bhikaji Bhawan Bhikaji Cama Place, New Delhi – 110066 **Contact person**: Capt. (Retd) SK Singh Vice President (Defence) Email: shyam@elcomeindia.com	Ph: 022-67618105 EPABX : 022-67618000 Fax : 022-67124694 Ph: 011-26170662 EPABX: 011-26171274/0661 Fax: 011-26171316

Sl	Name of The Firm/Vendor with Complete Address	Telephone/Fax Numbers
33	M/s Kantilal & Chunilal & Sons Appl. Pvt. Ltd. 80/82, Vitthalwadi,Kalbadevi Road Mumbai - 400 002 info@spherehotkcsa.com web: www.spherehotcsa.com Mr. NP Doshi, Director (Tech)	Tele:022-22400200/2420 Fax :022-56336518
34	M/s Krist Engg & Manufacturing Corporation, E-210, Kavinagar Industrial Area Ghaziabad-201002	Tele:120-2702591/2115129 Fax: 120-2702591
35	M/s Kirloskar Oil Engines Limited (KOEL) Laxmanrao Kirloskar Road, Khadki, Pune- 411003 SM Hiwase Tel: 020-66054042 smh@koel.co.in www.kirloskar.com SM Majumdar, Manager Marketing 98814 76160 smmn@koel.co.in	Tel: 020- 25810341 Fax: 020-25813208/ 0209
36	M/s Eon Electric Ltd. B-88, Sector 83, Phase – II, Noida-201305 (UP)	Tel 0120-3096700 0120-3096701 Fax : 0120-3096800
37	M/s Halonix Ltd B-31 Phase-II Noida, Gautam Budh Nagar Uttar Pradesh Mr. Mukesh Chaturvedi Mobile :09999758010	Tel : 0120-4756165 Fax : 0120-4756101
38	M/s Erhardt+Leimer India Pvt Ltd, Nr. Arvee Denim, Opp-Gallops Indl Park, Sarkhej Bavla Highway, Vill-Sari, Taluka-Sanand, Dist-Ahmedabad-382220, Gujarat Contact person Mr. Paras Choksi, Sr Manager (C&A)Mob: 09727725038, 09727725083 Email: indo-in@erhardt-leimer.com pcchoksi@erhardt-leimer.com website: www.erhardt-leimer.in	Tel: 2717-398457/60 Telefax: 2717-398452
39	M/s Oriole Technical Solution Pvt Ltd 10, Sahakar Bhawan, Narayan Nagar,	Tel: 022-25159141, 25154201

Sl	Name of The Firm/Vendor with Complete Address	Telephone/Fax Numbers
	Ghatkopar (W), Mumbai – 400086 Web: www.otspl.com Contact Person Mr Shaminder Singh Pujji, MD Mob: 9821120687	Fax: 022-25154201
40	M/s Linia Engineering Services, 505, Sai Sangam, 5th Floor, Sector-15, CBD Belapur, Navi Mumbai-400614 Email: liniaengg@gmail.com Contact Person Mr. Radhakrishnan Lt Cdr(Retd) Arun Varghese Mob: 09757169379	Telefax: 022-27577743/ 2757/ 8081

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Tel: 23010138

Integrated Headquarters
Ministry of Defence (Navy)
New Delhi -110011

EE/POLICY/L-80/POWER-23 *13* Dec 11

The Flag Officer Commanding-in-Chief
(for CLO)
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SBS Road,
Mumbai – 400023

The Flag Officer Commanding –in-Chief
(for CLO)
Headquarters, Eastern Naval Command
Visakhapatnam-530014

The Flag Officer Commanding –in-Chief
(for CLO)
Headquarters, Southern Naval Command
Kochi-682004

The Commander-in-Chief
{for CTO (Marine)}
Headquarters Andaman & Nicobar
Port Blair- 744 102

POLICY GUIDELINES ON SAFE HANDLING, STOWAGE, TRANSPORTATION AND ACCEPTANCE PROCEDURES OF ELECTRIC CABLES EX-STOCKS

1. **Introduction**. Material Organisations/WEDs maintain certain quantity of complete cable inventory as buffer stock to meet operational requirements of ships/submarines. Similarly shipyards and defence PSUs, involved in naval ship building and supply of shipborne equipment, respectively have to stock various types of inter and intra-system cables until these cables are laid onboard. The commonly used cables are LFH type and EBXL type which have sufficiently long shelf life and need to be stowed carefully for extended duration. Hence, it is imperative that due care need to be taken whilst handling, stowage and transportation of cables to ensure that no damage/deterioration take place during these evolutions and obviate requirement of requalification of cables prior actually putting them to use.

2. The requirement of addressing this issue in a comprehensive manner has been under active consideration at this Headquarters. The broad guidelines for

proper packing and labeling of cables by cable manufactures, safe handling, stowage and transportation by stocking organisations and acceptance criteria for cables ex-stocks by QA organisations, are mentioned in succeeding paragraphs.

3. **Packing and Labeling of Cables.** Proper packing and labeling of cables by cable manufacturers is important for safe and prolonged stowage of cables at MOs/Yards. The acceptance authority should verify compliance to under mentioned requirements at the pre-dispatch inspection stage from the OEM premises:-

(a) Cable ends should be effectively sealed against ingress of moisture and the ends must be fixed on the drum surface (flange) to avoid becoming free during handling, stowage and transport.

(b) The cables be supplied on suitably sized Wooden/ Steel Drums based on size and weight of standard length of cable. Cables procured for stocking for period more than five years generally be supplied on steel drums.

(c) Cables of 15 mm or less overall diameter and exceeding a mass of 25 Kgs may be supplied on plywood reels complying with the requirements of BS 1142 part 2. The barrel diameter is not to be less than 20 times the maximum specified diameter of the cable.

(d) A suitable weather proof protective wrapping is to be put around the cable after winding on reels with sufficient overlap to retard ingress of moisture.

(e) A weatherproof label is to be attached to the reel permanently and clearly indicating the following details:-

(i) Tare weight in Kg.

(ii) Length of cable in metres.

(iii) Year of cable sheath manufacture.

(iv) Name of cable manufacturer

(v) Nominal cross sectional area of the conductor.

(vi) Number of cores.

(vii) Direction of rotation of drum (by means of arrow).

(viii) Limits for stowage temperature and humidity.

4. **Precautions whilst Cable Handling and Transportation**. Cable drums must be handled with care during stowage, transportation and unreeling evolution. Improper handling procedures or handling equipment can lead to broken drums or

visible or invisible damage to the cable itself. The proper procedures for handling of cables on drums are illustrated as follows:-

(a) Cable drums are designed to be handled in upright position as indicated in Fig. 1. When kept upright, the cable layers will not get entangled. This would obviate problems during laying. All screws holding the flanges must be checked and tightened before moving the drums. Cable Drums should always be moved in an upright position.

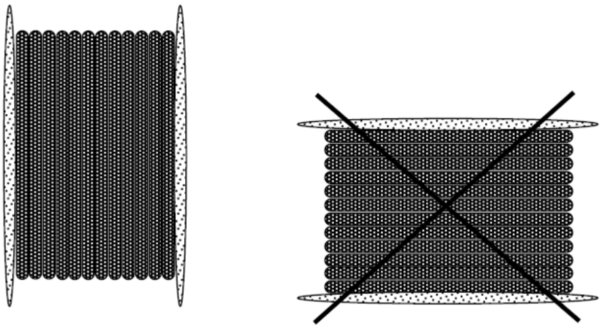

Fig. 1 Correct Upright position of Cable drums

(b) When the drum must be rolled for some reason, always roll the drum in the direction of arrow as depicted in Fig 2. This way, the cable will not unwind or loosen on the drum. However, this does not mean that the drum can be rolled freely for any distance. Typically, the rolling distance must be limited to five metres. If the drum is rolled beyond this limit, the cable winding will become too tight and cut off the rope holding the cable end. This may deform the cable and make it unfit for use. Once placed in position, proper stoppers should be used to prevent the drum from rolling.

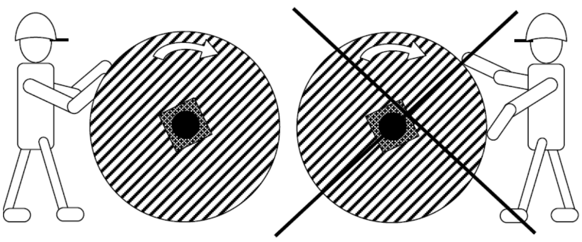

Fig. 2 Correct rolling direction of Cable drums

(c) Lift Drums using following methods: -

(i) In case of crane or boom type lifting equipment; insert shaft (heavy rod or pipe) through Drum hubs and lift with slings on shaft using spreader or yoke to reduce/avoid sling pressure against Drums flange, as illustrated in Fig.3

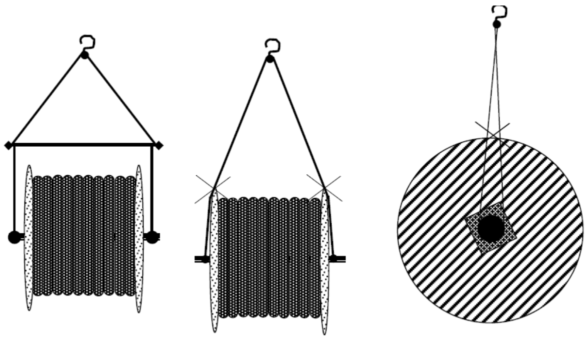

Fig. 3 Lifting of Cable drums using correct slings

(ii) Fork lift type of equipment may be used to move smaller, narrower width Drums. Fork tines should be placed so that lift pressure is on Drums flange and not on cable, and must reach all the way across drums so that lift is against both drum flanges, as shown in Fig. 4 below.

Fig. 4 Correct use of Fork lift for cable handling

(d) Suitable devices must be used for loading and unloading in order to avoid damage to the cable and the drum during transportation. Drums should never be dropped from a truck, ramp or container. Cable drums should only be transported with suitable vehicles and must be secured to the vehicle so that they cannot shift during transportation as shown in Fig. 5. The same applies in case cables are transported in a container.

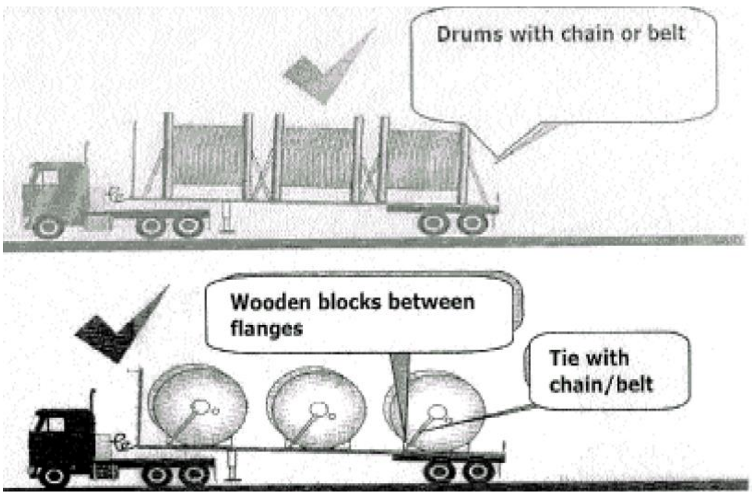

Fig. 5 Transportation of cables

(e) Avoid punching nails in cable drums. In case a cable drum is damaged, cable should be rewound on to another drum. The barrel diameter of the new drum should not be less than that of the original drum. Further, while rewinding, cable should not be dragged against drum flanges or sharp edges. In addition, original drum number should be noted, otherwise backtracking of cable manufacturer will become impossible.

5. **Safe Stowage of Cables**. Modern technological developments in the field of cable sheathing/insulation ensure that cables have long shelf life and if stocked properly, there should not be any deterioration on cable sheath/electrical design parameters. The under mentioned stowage conditions/procedures need to be followed for proper stowage of cables:-

(a) Cables for ship based applications should be stored indoor to the extent feasible. The permissible humidity and temperature ranges for storage, as defined in cable data sheet should be maintained.

(b) Power cable for shore applications can be stored outside on a raised concrete platform, covered with tarpaulins to protect against rain water, UV and IR rays of sun.

(c) The site chosen for storage of cable drums should be level and dry. It should have a firm, preferably concrete surface. This will avoid sinking of the Drums/flange, rotting and difficulty in subsequent shifting. All drums should be stored in such a manner as to leave sufficient space between adjacent drums for air circulation.

(d) During extended storage, the drum should be rolled by an angle of 90º once every three months. Also, tie bolts shall be checked and tightened at regular intervals. Always turn a cable drum using “Turn table”. In case turntable is not available two well-greased plates could be used.

(e) Always store and move the drum in an upright position. In no case, the drums be stored 'on the flat' that is with flange horizontal.

(f) The round shaped cable drum must be provided with stoppers as demonstrated in Fig. 6 to prevent accidental rolling during storage. Further, Drums must be labelled to allow easy and quick identification of the cable.

Fig. 6 Proper Stowage of cable drums

(g) The cables should not be stored in close proximity to oils, acids or chemicals.

(h) Cable drums should not be stacked during stowage as shown in Fig. 7.

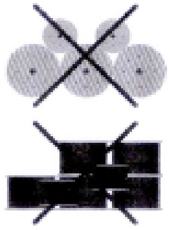

Fig. 7 Incorrect stowage of cables

6. **Acceptance Criteria for Cables ex-Stock**. With due precautions and adoption of procedures for cable stowage mentioned above, cables can be stocked for prolonged duration without significant change in their physical or electrical design data. However, prior clearance of cables ex-stock for laying onboard ships, it needs to be ascertained that cables are in good condition and no damage/deterioration has taken place physically/ or in designed electrical parameters. Therefore, following procedures be adopted to accept cables ex-stock:-

(a) **Cables Stocked for Less than Five Years**. Cables stocked for less than 5 years shall be subjected to following visual checks. On visual inspection of cables, if any of the under mentioned symptom is observed, sample piece of each cable be subjected to Bend Test and Ageing Test in accordance with respective Master QAP for LFH and EBXL cables mentioned in EE-50-12(Rev-1) and EE-50-13 and test results should be at least 90% of the original test values for Tensile strength and Elongation:-

(i) Physical cut/cracks on sheath/insulation.

(ii) Check of water ingress from both ends.

(iii) Deterioration /peeling of sheath/insulation.

(iv) Discolouration /sulphor formation on conductors.

(v) Legibility of core identification /cable marking

(vi) Corrosion/physical damage to cable screen.

(b) **Cables Stocked for Five to Ten Years**. In addition to the visual checks mentioned at para 6(a) above, the following additional electrical tests are to be conducted on such cables ex-stock and tests results should be equal to the original test values:-

(i) Insulation tests for inter-cores and overall.

(ii) Conductor Resistance.
(iii) HV Test.

(iv) Capacitance test for Co-axial cables.

(v) Spark test on collectively screened cables.

(c) Re-Qualification of Cables ex-Stock. Sample piece of each cable stocked for more than 10 years should be subjected to complete qualification tests as per original Master Qualification Test Plan for each type of cable. The tests results so obtained should not be less than 90% of original test values.

7. It is requested that information contained in this letter be disseminated to all concerned units and comments/feedback, if any, be forwarded to Integrated Headquarters, Ministry of Defence (Navy)/DEE by 31 Jan 12.

(I Dasgupta)
Captain
Director Electrical Engineering

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Integrated Headquarters
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Sena Bhavan,
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EE/Policy/L-57/NS/06 18 Apr 16

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The Commander-in-Chief
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Port Blair - 744102

M/s Bharat Electronics Limited
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Mr Kalghatgi, Dir(R&D))
Corporate Office, Outer Ring Road
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COMPREHENSIVE MAINTENANCE GUIDELINES FOR BEL ORIGIN EQUIPMENT

1. Refer to this Office letter of even number dated 14 Jul 14.

2. **Background**. BEL equipment have proliferated over the years and have been inducted onboard various ships, submarines and establishments in large numbers. In order to provide effective maintenance support for these equipment, numerous initiatives including repair facilities, augmentation/creation of water front facilities and conclusion of AMC/RRC have been resorted to. While these initiatives have yielded considerable dividends at major Naval stations, maintenance support at far flung Naval units have further scope for improvement. In addition, availability of ATEs

along with test software for BEL equipment at Naval Dockyards necessitates a relook into the maintenance philosophy. The availability of requisite expertise in BEL Water Front Support (WFS) Facilities was reviewed during the XIII WESMMC in Jun 14. Since WFS facility requires commitment in terms of financial and manpower resources, there exists a requirement to clearly demarcate equipment into those which *IN* would maintain and those which will be maintained by BEL under maintenance contracts. This will enable both BEL and *IN* to invest resources to ensure optimal maintenance facilities are setup.

3. Accordingly, the guidelines for Comprehensive Maintenance of BEL Equipment were promulgated vide IHQ MoD(N) letter ibid. Following the revision of financial powers by way of DFPDS-2015, the maintenance policy of certain equipment are being revised by this letter to enable Commands to conclude AMCs within their enhanced delegated powers.

Maintenance Policy for BEL Equipment

4. Based on discussions during XIII WESMMC, deliberations with Command Headquarters and at IHQ MoD(Navy) on the "Way Ahead" for handling maintenance of BEL origin equipment, the maintenance of BEL equipment are envisaged through following:-

(a) **Repair Facility**. Setup repair facility with trained manpower and reference systems at yards for equipment, which are mission critical in nature (viz. FCS, Sonars, Radars etc.) to be maintained by *IN*. Units/ Modules which cannot be repaired by Dockyards will be covered by Rate Repair Contract (RRC), to be concluded with BEL by respective Administrative Authorities.

(b) **Maintenance Contracts**. Comprehensive AMCs (CAMC) are concluded by either IHQ MoD(N) or Commands or FMUs for various equipment which are primarily large in numbers and COTS by nature(viz. CMS, MDB, Link-II systems, ELK 7036, VCS MkII and Mk III, DEX etc.).

5. **Support by WFS Facility**. The AMCs and RRCs are executed by WFS located at Mumbai, Vishakhapatnam, Kolkata Kochi, Port Blair and being set up in Karwar. Wherever WFS is located, the charter of the WFS would include the following:-

(a) Maintenance activities during contract execution period and warranty period.

(b) Repair support at Naval Dockyards and NSRYs till repair facilities are set up.

(c) Maintenance support at places where no repair facilities are envisaged and maintenance will be done through AMC for all categories of equipment.

6. Though, based on the guidelines indicated at Paras 4 and 5 above, equipment can be maintained either through Yards or WFS, location of ship also

influences the option. For example, repair facilities for Sanket Mk-II and ELK 7036 have been established in Mumbai and Vizag. However, these equipment will be maintained through CAMC at Port Blair, as they are fewer in number and repair facilities are not cost effective. BEL Origin Equipment existing/planned for induction in *IN* inventory have been categorised in respect of the maintenance philosophy to be adopted for each and elucidated at Enclosure. The details are enumerated in succeeding paragraphs.

7. **Maintenance Through *IN* Repair Facility**. These are equipment which will be maintained by Dockyards. The units/sub-units which cannot be repaired by Yards is to be covered by an RRC which needs to be concluded with BEL Units by the respective Yards/Commands for undertaking repairs.

8. **Maintenance Through WFS**. These are equipment which will be maintained by BEL, under AMC, through Water Front Support till repair infrastructure in *IN* is setup. The **AMC agreements** for respective equipment are to be concluded by respective Commands.

9. **Eqpt to be Maintained Under Maintenance Contracts by BEL WFS**. These are equipment which are to be maintained under maintenance contract to be signed between IHQ MoD(N)/ Commands and BEL.

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

(a) **Administrative Authorities**

(i) Conclude RRC/AMC for equipment indicated in Para 7,8 and 9 above. Cases beyond delegated Financial Powers be referred to IHQ.

(ii) Repair Infrastructure cases already sanctioned to be monitored and issues (if any) to be taken up with BEL during WESMMC Sub-Committee/WLM.

(b) **BEL**

(i) WFS facilities to be enhanced in terms of facilities and trained manpower and progress to be intimated to IN during WESMMC Sub-Committee/WLMs.

(ii) Forward proposal to IHQ MoD(N)/Commands for RRC/AMC/ Comprehensive Maintenance Contracts as indicated above.

(iii) Accord priority for Reference System and Dockyard Infrastructure contracts already concluded and progress be intimated to *IN* during WESMMC Sub-Committee/WLM.

(iv) Progress development of Test Programs for PCBs of various BEL systems on the ATE supplied to ND(Mbi) and ND(V).

(Amit Bose)
Rear Admiral
ACOM(IT&S)

Encl. As Above

Enclosure to IHQMoD(N) letter
EE/Policy/L-57/NS/06 dated 18 Apr 16

MAINTENANCE OF BEL EQUIPMENT

SNO	Equipment	Supplied By	Located At	Maintenance Philosophy
Radars				
(a)	RAWL-02 Mk-II	BE(B)	Mumbai	*IN* Repair Facility/RRC
			Vizag	By yard using generic repair facility/ RRC
(b)	RAWL-02 Mk-III	BE(B)	Mumbai	*IN* Repair Facility/RRC
(c)	Revathi	BE(B)	Vizag	*IN* Repair Facility post Warranty. Support by WFS till DSP is established through AMC
(d)	Rani/Rashmi	BE(B)	Mumbai	By yard using generic repair facility/ RRC
			Vizag	*IN* Repair Facility / RRC
(e)	Aparna	BE(B)	Mumbai	*IN* Repair Facility / RRC
			Vizag	*IN* Repair Facility / RRC
(f)	Star 2000	BE(G)	Goa, Kochi Vizag, Port Blair	CAMC by IHQ MoD(N)/Commands
(g)	IFF Mk-XI	BE(G)	Mumbai	*IN* Repair Facility/ RRC
			Vizag	*IN* Repair Facility/ RRC
(h)	CTDs	BE(B)	Mumbai	*IN* Repair Facility/ RRC
			Vizag	*IN* Repair Facility/ RRC
			Kochi	*IN* Repair Facility/RRC

SNO	Equipment	Supplied By	Located At	Maintenance Philosophy
Electronic Warfare (EW) Systems				
(j)	Ellora	BE(H)	Mumbai	*IN* Repair Facility / RRC
			Vizag	By yard using generic repair facility/ RRC
(k)	ELK 7036	BE(H)	Mumbai	*IN* Repair Facility/RRC
			Vizag	*IN* Repair Facility/RRC
			Kochi	*IN* Repair Facility/RRC
			Port Blair	AMC by Command/RRC
(l)	Sanket (Mk-II, Mk-III and S)	BE(H)	Mumbai	*IN* Repair Facility (Mk-II)/RRC AMC by Command (Mk-III and S)
			Vizag	AMC by Command/RRC
			Port Blair	AMC by Command/RRC
(m)	Ajanta Mk-II	BE(H)	Vizag	*IN* Repair Facility/ Repairs by BEL on case to case basis through Command/ RRC
			Kochi	*IN* Repair Facility/ Repairs by BEL on case to case basis through Command/ RRC
(n)	Drishti	BE(H)	All Locations (08)	CAMC by IHQ MoD(N)
(p)	Porpoise	BE(B)	Mumbai	AMC by Command
			Vizag	AMC by Command
Communication Systems				

SNO	Equipment	Supplied By	Located At	Maintenance Philosophy
(q)	VCS Mk-I	BE(B)	Mumbai	*IN* Repair Facility/RRC
(r)	VCS MK II	BE(B)	Vizag	AMC by Command
(s)	VCS MK III	BE(B)	Mumbai	AMC by Command
			Vizag	AMC by Command
(t)	CCS Mk-II	BE(B)	Mumbai	*IN* Repair Facility/RRC
			Vizag	*IN* Repair Facility/RRC
			Port Blair	AMC by Command
(u)	CCS Mk-III (Non ATM Segment)	BE(B)	Mumbai	*IN* Repair Facility/RRC
			Vizag	*IN* Repair Facility/RRC
(v)	EK-896	BE(B)	All Locations	*IN* Repair Facility/RRC
(w)	Link-II/S	BE(B)	All Locations	CAMC by IHQ MoD(N)
(x)	Link II Mod III	BE(B)	Mumbai	CAMC post warranty by Command
			Vizag	CAMC post warranty by Command
(y)	SACU/SMART-F	BE(Kotdwara)	All Locations	AMC by Commands
(z)	MSS Briefcase Terminal	BE(G)	All Locations	CAMC by IHQ MoD(N)/Commands
(aa)	Rukmani	BE(G)	All Locations	CAMC by IHQ MoD(N)/Commands
(aa)	Digital Exchange (DEX)	BE(B)	Mumbai	AMC by Command
			Vizag	
<u>Combat Management Systems (CMS)/ Ships Data Network (SDN)</u>				
(ab)	EMCCA	BE(G)	Mumbai	CAMC by IHQ MoD(N)/Command
(ac)	MDB	BE(B)	Mumbai	AMC by Command
(ad)	CMS-SNF	BE(G)	Vizag	CAMC by IHQ MoD(N)/Command
(ae)	CMS (17, 28, 15A,	BE(G)	Mumbai	CAMC post warranty by IHQ MoD(N)/Command

SNO	Equipment	Supplied By	Located At	Maintenance Philosophy
	16A, 15, 71) and MOD CMS for Rajput Class		Vizag	CAMC post warranty by IHQ MoD(N)/Command
(af)	AISDN and ATM switches	BE(B)	Mumbai	CAMC by Command
			Vizag	CAMC by Command
Underwater (UW) Systems				
(ag)	HUMSA	BE(B)	Mumbai	*IN* Repair Facility/RRC
			Vizag	*IN* Repair Facility/RRC
(ah)	Ushus	BE(B)	Mumbai	*IN* Repair Facility/ RRC
			Vizag	*IN* Repair Facility/ RRC
(ai)	Indigenous ASW Computer	BE(B)	Vizag	By yard using generic repair facility/ RRC
Fire Control Systems (FCS)				
(aj)	Shikari	BE(B)	Mumbai	*IN* Repair Facility
			Vizag	By yard using generic repair facility/ RRC
(ak)	Lynx/ Lynx U1/ Lynx U1(Mod)/ Lynx U2	BE(B)	Mumbai	By yard using generic repair facility/ RRC
			Vizag	*IN* Repair Facility
(al)	EON-51	BE(B)	Mumbai	By yard using generic repair facility/RRC
(am)		BE(B)	Vizag	By yard using generic repair facility/RRC
(an)		BE(B)	Karwar	By yard using generic repair facility/RRC
(ao)	Stabilised Optronics Pedestal	BE(Chennai)	Karwar	AMC by Command
			Kochi	AMC by Command
			Port Blair	AMC by Command

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EE/Policy/L-40/NS/01

18 Apr 16

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Visakhapatnam– 530 014

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Mumbai– 400 023

WEAPONS, ELECTRONICS AND SENSORS MAINTENANCE MANAGEMENT COMMITTEE (WESMMC)

1. Refer to IHQ MoD(N) letter EE/Policy/L-40/NS/01 dated 13 Sep 06 regarding WESMMC.

Background

2. **W**eapons, **E**lectronics and **S**ensors **M**aintenance **M**anagement **C**ommittee (WESMMC) had been constituted, vide IHQ MoD(N) letter ibid, with the aim of providing a forum for periodic interaction with BEL at IHQ MoD(N) and Command Headquarters level so as to ensure quality and timely life cycle support for BEL supplied equipment.

3. Over the last decade, WESMMC has evolved as an effective forum which has enabled focussing on critical issues faced by the *IN* with regard to support of BEL origin equipment. The process of conduct of WESMMC has matured and this letter aims to bring out the current procedure to be followed for conduct of WESMMC.

Purpose of WESMMC

4. WESMMC will be the nodal forum to address the following life cycle product support issues both at IHQ MoD(N) and Command levels:-

(a) Obsolescence of components/ devices.

(b) Configuration Control Management.

(c) Periodic review and analysis of system performance and recommendation of corrective action.
(d) Analysis of defects to identify adequacy/ inadequacy of maintenance, spares, built-in test equipment (BITE), training, repair infrastructure and documentation.

(e) Analysis of BEL response to quotes for spares and services.

(f) Institutionalised approach for recommending phasing out of equipment/ systems and identifying a suitable upgrade/ replacement equipment/ system.

Review Mechanism

5. **Apex Review**. At the Apex level, WESMMC will be headed by the Chief of Material. The reviews would be conducted at a nominated BEL Unit as mutually suitable to *IN* and BEL.

6. **Working Level Review**. The Working Level Review will be chaired by ACOM(IT&S) and would be conducted prior to the Apex Review.

7. **Sub-Committee Review**. The Command level sub-committee reviews will be headed by the CSO(Tech) of WNC and ENC at the respective Commands. Issues pertaining to SNC and ANC are to be coordinated at sub-committee level by WNC and ENC respectively and suitable reps of SNC and ANC may be co-opted as required.

8. **Periodicity**. The Apex Review and Working Level Review will be conducted once in six months and the sub-committee level meetings are to be held at WNC and ENC these reviews.

9. **Composition**. The detailed composition of the Apex/WLM committee and sub-committees is placed at Enclosure 1.

10. **Charter of WESMMC**. The broad charter of the Apex committee and sub-committees is placed Enclosure 2.

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

    (a) The constitution of WESMMC be intimated to concerned units.

    (b) The sub-committee level meeting be conducted at Commands.

(C Raghuram)
Commodore
PDEE

Encl: As above

Enclosure 1 to IHQ MoD(N) letter
EE/Policy/L-40/NS/01 dated 18 Apr 16

COMPOSITION OF WEAPONS, ELECTRONICS AND SENSORS MAINTENANCE MANAGEMENT COMMITTEE (WESMMC)

1. **Apex Level**

IHQ MoD (N)			**BEL**
COM	-	Chairman	CMD
ACOM (IT & S)	-	Member	Director (R&D)
ACOL	-	Member	Director (BC)
DG WESEE	-	Member	Director (OU)
PDWE	-	Member	Director (Marketing)
PDEE	-	Member	Concerned GMs
PDND	-	Member	Divisional heads
PDPRO	-	Member	Heads of Regional Offices
PDLS	-	Member	
PDSR	-	Member	
PDNS	-	Member	
PDSMAQ	-	Member	
ADG WESEE	-	Member	
PDNRD	-	Member	
PDSP	-	Member	
Director, HQ NTG	-	Member	
Rep DEE	-	Member Secretary	

Commands			**QA Agencies**
CSO(Tech)/HQWNC	-	Member	ADGQA (N) - Member
CSO(Tech)/HQENC	-	Member	CQAE(WE), Blr - Member
CSO(Tech)/HQSNC	-	Member	
CLO/HQWNC	-	Member	
CLO/HQENC	-	Member	
CLO/HQSNC	-	Member	
CTO(Marine 'L')	-	Member	
CSMTO/HQENC	-	Member	
Director INSMA	-	Member	
WATT(MB)	-	Member	
WATT(V)	-	Member	

Co-opted members as nominated by IHQ MoD(N)/DEE

Co-opted Members from Design Agencies	**Co-opted Members from Production Units**
(Concerned DRDO Labs, CDoT, etc)	(ECIL, HAL (Hyd), Keltron, etc)

2. **Working Level**

IHQ MoD (N)			**BEL**
ACOM (IT & S)	-	Chairman	Director (R&D)
PDWE	-	Member	Director (BC)
PDEE	-	Member	Concerned GMs
PDPRO	-	Member	Divisional GMs
PDLS	-	Member	Heads of Regional Offices
PDSR	-	Member	
PDNS	-	Member	
PDSMAQ	-	Member	
ADG WESEE	-	Member	
PDNRD	-	Member	
PDSP	-	Member	
PDND	-	Member	
DDGQA(N)	-	Member	
Rep DEE	-	Member Secretary	

Commands			**QA Agency**
CLO/HQWNC	-	Member	CQAE(WE), Blr - Member
CLO/HQENC	-	Member	
CLO/HQSNC	-	Member	
CTO(Marine 'L')	-	Member	
Director INSMA	-	Member	
WATT(MB)	-	Member	
WATT(V)	-	Member	
Director, HQ NTG	-	Member	

Co-opted Members from Design Agencies	**Co-opted Members from Production Units**
(Concerned DRDO Labs, CDoT, etc)	(ECIL, HAL (Hyd), Keltron, etc)

3. **Sub Committee Level**

IN			**BEL**
CSO (Tech)	-	Chairman	Executive Director
CLO	-	Member	Director (R&D)
Cd Logo	-	Member	GMs of BEL Units
CGO	-	Member	AGM (Commercial)
CCO	-	Member	AGM (Reginal Office)
COMCOS	-	Member	Group Heads
Director ETMA	-	Member	
CMP	-	Member	
Director INSMA	-	Member	
DGM (W), ND (MB/V)	-	Member	
Oi/c WED	-	Member	
Oi/c WATT	-	Member	
Rep NSRYs	-	Member	
Rep FTTT	-	Member	
Oi/c NTG	-	Member	
Local rep of DQA (N)	-	Member	
SLO	-	Member Secretary	

Co-opted members as nominated by respective Commands

Enclosure 2 to IHQ MoD(N) letter
EE/Policy/L-40/NS/01 dated 18 Apr 16

BROAD CHARTER OF THE APEX COMMITTEE AND SUB-COMMITTEE (WESMMC)

1. **Broad Charter of the Apex Committee**

(a) Examine System wise maintenance management issues for laying down policy guidelines.

(b) Review technology and spares obsolescence for each category of system and recommend system upgradation (modification/modernization).

(c) Review of system performance and direct and defect analysis for each system for implementing design changes/incorporation of modernization, review of maintenance philosophy (including review of ranging and scaling aspects), yard repair infrastructure augmentation etc.

(d) Review of functioning of water front support organisation.

(e) Examine technological advancement in the respective fields and initiate suitable projects will design agencies.

(f) Review of Configuration Control Management issues for each system.

(g) Examine and recommend capacity/ infrastructure augmentation at BEL.

2. **Broad Charter of the Sub Committee**

(a) Periodic analysis of system performance ship wise and recommend design changes of modifications/upgradation at sub system level to enhance system performance.

(b) Recommendation for review of HATS/SATS schedules.

(c) Carry out defect analysis for all BEL origin/ supplied systems and recommend changes in the maintenance philosophy, ranging and scaling, onboard and yard personnel training, up gradation of documents and repair infrastructure augmentation.

(d) Analysis of BEL responses for various quotes (equipment/spares, services) in a comprehensive manner and field related activities.

(e) Address any interface related issues in system/platform and recommend way ahead.

(f) Examine the efficacy of water front support/AMC periodically and recommend augmentation requirements.

(g) Recommend evolving of repair policy for equipment.

(h) Reviews of old spares orders and recommend short closing on a case-to-case basis.

(j) Review pending payments.

(k) Review causes for delay in defect rectification/trials.

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Integrated Headquarters
Ministry of Defence (Navy)
New Delhi-110011

EE/Policy/L-62/NS/07

11 Jun 09

The Naval Station Commander,
SK Garden, 1st Main,
Benson Town Post
Bangalore - 560046

The Director,
Headquarters Naval Technical Group
NTG/NLC Complex,
Vimanapura post,
Bangalore – 560017

The Officer-in-Charge
Naval Liaison Cell
NTG/NLC Complex,
Vimanapura post,
Bangalore – 560017

ADMINISTRATIVE ARRANGEMENTS FOR CONDUCT OF WESMMC APEX AND WORKING LEVEL MEETINGS AT M/S BEL (BG)

1. Refer to WESMMC Policy letter EE/Policy/L-40/NS/01 dated 13 Sep 06 (Copy enclosed)

2. The WESMMC forum was established in 2006 and the charter for the meeting was formulated vide above mentioned policy letter. The Apex review chaired by COM is held on a six monthly basis at BEL (Bg). A Working Level Meeting chaired by ACOM (IT&S) is held one day prior to the Apex Review. Till date four review meetings have been conducted.

3. In view of a large number of Senior Naval Officer attending the review meeting, and based on the experience of conducting four WESMMC Apex Review a requirement exists to stream line the administrative activates for the smooth conduct of the meeting at BEL (Bg).

4. The tasks to be coordinated by Naval Units positioned in Bangalore is enumerated below:-

(a) Coordinated with BEL (Bg) to prepare venue for the meeting including preparation of requisite number of folders for delegates and seating plan.

Action. HQNTG

(b) Arrangement of accommodation and transportation for delegates in coordination with BEL (Bg).

Action.NLC (Bg)

(c) Nomination of liaison Officers for Flag Officers attending the review meetings.

Action. Naval Station Commander

5. The finalized dates and agenda points for the meetings will be intimated by IHQ,MoD(N)/DEE to all agencies by fax/ email.

(Amit Bose)
Captain
DEE

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Integrated Headquarters
Directorate of Electrical Engineering
Ministry of Defence (Navy)
Sena Bhawan
New Delhi 110011

EE/POLICY/L-95/M&C

07 Aug 14

The Flag Officer Commanding-in-Chief
(for CSO(Tech)
Headquarters Western Naval Command
Mumbai - 400 023

The Flag Officer Commanding-in-Chief
(for CSO(Tech)
Headquarters Eastern Naval Command
Visakhapatnam - 530 014

The Flag Officer Commanding-in-Chief
(for CSO(Tech)
Headquarters Southern Naval Command
Kochi - 400 023

The Commander – in – Chief
(for CSO(Tech)
HQ, Andaman and Nicobar Command
Port Blair - 744 101

MAINTENANCE OF EMBEDDED SYSTEM SOFTWARE

1. Refer to VCNS Memo No VCNS/102/Gen/98 dated 17 Feb 98.

2. **Introduction**

(a) The proliferation of Embedded System Software (ESS) in modern weapons, sensors and control systems fitted onboard *IN* ships and submarines has seen a quantum increase over the last decade. The systems/ sub-systems employing software code to perform specific function(s) are termed as Embedded Systems (ES).

(b) Further, the systems having application specific ESS at their core performing mission critical functions are classified as Software Intensive

Embedded Systems (SIES). SIES include Fire Control System (FCS), Controls and Data Processors of Radars and Sensors, Combat Management System (CMS), Automated Power Management System (APMS), Integrated Platform Management System (IPMS), Machinery Controls, NBCD & FF System etc.

3. **Challenges in ESS Maintenance**. Considering that systems on ships and submarines are increasingly being designed with task-specific customised software and miniaturised hardware, the issues related to maintenance and support for ESS, which include management, archiving and defect rectification has become increasingly complex. Owing to lack of adequate knowledge-base and expertise in dealing with ESS, maintenance of ES including their Life Cycle Support is an area of concern that needs to be addressed expeditiously. Analysis of defects/ maintenance issues with regard to ES reveals following major challenges towards effective management of ESS:-

(a) **Software Version Control**. Variations in versions of ESS have often been observed in identical equipment fitted on-board same class-of-ships/ submarines. As a result, the system fitted Memory Media Device (MMD) provided by the OEM for an equipment cannot be readily used for cross-platform fitment. Further, majority of critical ES fitted on-board existing platforms do not have an OEM provided, verifiable ESS version stamp that can be authenticated. Non-availability of such information from system OEM severely restricts the software cataloguing and authentication capability.

(b) **Software Back up**. Presently, the OEMs provide ESS as a preloaded & preconfigured application on a system-installed MMD of that equipment. Further, in order to aid maintenance, the OEM may at best provide preloaded ESS on a spare MMD. The ESS is not provided as a comprehensive installable baseline package. This restricts the capability to catalogue, restore, repair and document a software based defect in a structured manner. Consequently, in the event of failure of an OEM provided pre-configured spare MMD, capability to restore a defective ES to an operational state is severely restricted as it solely depends upon the availability of the equipment's ESS image back up with the repair agencies or SEG.

(c) **Master Archiving**. In addition to the above, ESS image of such systems with variations cannot be used as master archive for class-of-ships/ submarines fitted with similar system as they lack standardisation. Therefore, it necessitates extraction and maintenance of MMD images from each individual ship/ submarine despite being fitted with identical systems. The main reason for such incompatibility and software variation are ad-hoc and unplanned upgrades by respective system OEMs and lack of adherence to Life Cycle processes for Software Development.

(d) **OBS/ B&D Spares**. It has been observed that majority of OBS/ B&D spares are either not loaded with the ESS or are loaded with an outdated version of the ESS. This renders the respective OBS/ B&D spare incompatible for exploitation until re-loaded with the current version of ESS. This issue is further compounded by the non-availability of a central archival to facilitate in re-loading the OBS/ B&D modules with the latest version of the ESS.

(e) **ESS Feedback/ Return**. Over the years, the repair yards have evolved a database of ESS resident on EPROM based ES. Similarly, SEG (Mbi) too has archived ESS on MMDs of many systems. However, presently there is no verifiable ship wise database for installed ESS with details regarding software version, modifications, availability of ESS back-up and ESS compatibility with similar equipment/ platforms. There is also a requirement to put in place a feedback mechanism to maintain and update the ESS data-base to facilitate version control and undertake ESS back up-post software modification so as to obviate random and interim changes by the OEM

4. **Aim.** The aim of this policy letter is to lay down the maintenance, archival and defect rectification guidelines pertaining to ESS installed onboard ships and submarines by addressing the following issues:-

(a) Nodal agency for ESS configuration management.

(b) ESS maintenance and archival methodology.

(c) ESS Feedback/ Returns methodology.

(d) Infrastructure requirement for ESS archival and maintenance.

(e) Roles and Responsibilities.

Nodal Agency for ESS Configuration Management.

5. SEG (Mbi) will be the nodal agency in the *IN* for archival, maintenance and configuration management of ESS. The formal aligning of the primary charter and duties of SEG (Mbi) to address various challenges wrt the overall management of ESS in the *IN* is being dealt with separately and would be subsequently promulgated as a separate Navy Order. In the absence of similar agency in Visakhapatnam, ND(V)/WECORS was nominated by HQENC as a representative of SEG(Mbi) and will cover the requirements of ANC based ships also. The broad contours of responsibilities of SEG (Mbi) for ensuring overall configuration control of ESS pan Navy are as elucidated below:-

(a) **ESS Image Management**. SEG (Mbi) (for WNC and SNC based Units) and ND(V) (for ENC and ANC based Units), in consultation with the respective Command and Op authorities, are to undertake extraction and archiving of ESS resident on various ES of ships and submarines. Towards this, ships and submarines are to land memory media devices (MMDs) as and when required. A fully functional plug and play system image is to be maintained by the nodal agency so as to act as a ready reference when required by ships, submarines and/ or other repair agencies.

(b) **ESS Version Management**. Based on the report/ feedback forwarded by the ships and submarines, SEG (Mbi) is to undertake cataloguing of ESS according to the version details. The pertinent ships and submarines are to ensure that any updated MMD is landed with SEG (Mbi) for updating the ESS archive whenever systems are upgraded/ modified by the equipment OEM (or any other agency). SEG (Mbi) is to also evolve a compatibility matrix for common equipment on board same class-of-ships and clearly bring out the similarities and dissimilarities of ESS, for which the requisite data is to be provided by the respective ops authority of that class-of-ships. SEG(Mbi) will be the authority for ESS version management and is to interact with ND(V)/WECORS for exchange of backups archival by them. SEG(Mbi) is to ensure that copies of ESS maintained by both the libraries are same at all times.

(c) **Repair Support**. SEG (Mbi)/ ND(V) will be responsible for repair support for ESS and would assist ships, submarines and repair yards to undertake repair and restoration of ESS. All defects are to be raised with DART numbers in the format placed at **Encl 1**.

(d) **Training Support**. In order to adequately enable the officers and sailors involved in maintenance of ES, training and exposure to the issues related to ES needs to be an integral part of various courses undergone by officers and sailors. Towards this, regular review of ab-initio, specialisation and PCT courses addressing the maintenance issues of ESS by the system maintainers is mandatory. On the basis of the review, SEG (Mbi) is to render advice to the Training Establishments, viz., the INA, Valsura and Shivaji with an aim to provide specific inputs on ES during various structured training courses.

ESS Maintenance and Archival Methodology

6. **Present Methodology**. Presently, Weapons Departments in the yards have been extracting and archiving EPROM based ESS, and, SEG (Mbi) has been carrying out the ESS extraction/ archival for other MMDs, viz., Hard Disk Drives (HDDs), Solid State Drives (SSDs), Compact Flash (CF), Disk-on-Modules (DoMs), Disk-on-Chips (DoCs) etc. However, such activities have been undertaken on as-required basis whenever ships and submarines have landed MMDs containing ESS of critical systems for repairs. There exists no mechanism to undertake ESS backup in a structured and well defined manner. As a result, the current mechanism to ensure maintenance support of ES during an equipment’s life time has avoidable gaps. Hence, there is a need to evolve a mechanism to ensure cataloguing and archiving of the ESS residing on all types of MMDs.

7. **Generation of Master Catalogue**. A mechanism to streamline the ESS

configuration management and control issues needs to be adopted. This entails generation of a ship-wise master catalogue/ software Configuration Control Document (CCD) at the first instance by all ships/ submarines and subsequent archiving of ESS residing on the identified equipment by SEG (Mbi). The said activity is critical to liquidate cataloguing deficiencies and to draw out an accurate and comprehensive ship-wise Master Catalogue based on ESS resident on system MMDs.

(a) **Generation of Master Catalogue (New Construction Ships)**. The methodology for generation of the Master Catalogue for new construction ships is as follows:-

(i) **Indigenous Construction**.

(aa) Before a system is presented for 'Acceptance Trials' (or FATs), the concerned OEM is required to prepare the CCD in consultation with the concerned NTG. After due vetting, the CCD is verified as part of the 'Acceptance Trials'. On successful completion of Acceptance Trials, the CCD is promulgated to all concerned (WEDs, Naval Dockyards, SEG and Ship' staff) by HQNTG. The CCD in the first instance of its issue, shall have Revision number as '0' and Version number as '0'.

(ab) NTG will finalise the CCD after two years of Commissioning of the Ship and forward the same to all stakeholders. After two years post commissioning of the ship, the responsibility of management and updation of the CCD will rest with SEG(Mbi) for the further life of the equipment.

(ii) Considering the above, activities of configuration control of ESS is to be coordinated by NTG/nominated agency under supervision of NTG upto two years post commissioning of the ship. These activities include the following:-

(aa) Keeping track and documenting changes being effected to ESS.

(ab) Coordinating archival of copies of corresponding firmware/software at SEG(Mbi).

(ac) Coordination of effecting changes through Yard/OEM to the corresponding LRUs housing the ESS in OBS and B&D with the help of SS and MOs / WEDs as required.

(ad) Draft the amendment to the Configuration Control Document of the system as well as Configuration sheets for each set of 'Similar LRUs.

(ae) Promulgation of amendments by HQNTG after due vetting process, which may involve a collegiate meeting with all the stake holders.

(b) **Professional Directorates / Procurement Agencies**. The requirement from OEMs indicated above are required to be incorporated in the SOTRs / RFPs and ensured in the final contracts as to ensure support of the OEM towards management of the ES.

(c) **Generation of Master Catalogue (Existing Ships . Foreign Origin Ships)**. In order to undertake archival and configuration management of ESS, a ship-wise list of systems that have ESS needs to be generated. In this regard formulation of Master Catalogue of ESS is to be coordinated by respective Commands in consultation with SEG(Mbi) and undertaken by ships/ submarines of the Command. The information required to be captured wrt each ES is to be as per format placed at **Encl 2**.(d) The feasibility of construing boards for each class-of-ship at the respective Commands may be explored in this regard.

8. **Updation and Archival**.

(a) **Updation and Archival of Ship Based ES**. During the process of STW, HATs followed by SATs, there could be configuration changes to certain LRUs being undertaken by the OEM. Therefore, Ships and submarines are directed to land MMDs for software extraction to facilitate archival of ES by SEG(Mbi)/ND(V) post completion of SATs / Acceptance Trials. Ships and submarines are also to ensure that the OBS held onboard is ported with the latest version of the software.

(b) **Updation of B&D Spares**.

(i) NTG is required to issue directives to respective Storage Depots [MOs / WEDs] under intimation to Commands and ensure that the B&D spares already supplied by the OEM are updated with latest version of the software. The storage depots on directives of NTG are required to facilitate the same by handing over the associated MMDs to the OEMs to enable updation of the software. Post undertaking of the updation, OEM is required to forward a certificate to NTG indicating serial number of the associated MMDs whose software has been updated. NTG inturn is required to forward the same to SEG(Mbi) and all ships/submarines provisioned with the equipment [Para 7(a)(ii) ibid relevant].

(ii) Ship’s staff whilst using of a MMD ex-MO/WED is required to avail the services of SEG/ND/OEM to ensure that the MMD is ported with the correct version of the software prior using the same onboard the ship.

9. **Archival Plan**.

(a) On completion of cataloguing as mentioned above, Commands are to evolve the ESS archival plan with inputs from SEG(Mbi)/ND(V). On the basis of the plan thus evolved, ships and submarines are to be directed to land MMDs for software extraction. Additionally, any OEM provided back-up ESS available on the platforms are also to be provided to SEG (Mbi) for archival.

(b) For systems with ESS resident on EPROMs, SEG(Mbi) is to de-conflict the archival tasks between those which require SEG's integral resources and those for which facilities are already available at the Weapons Departments of the respective yards. Accordingly, the landing plan for system EPROMs containing ESS is to be worked out in consultation with ND/ WECORS (being the repository agency for ESS residing on EPROMs).

ESS Feedback/ Returns Methodology

10. Master Cataloguing is a onetime activity to be undertaken by all the ships and submarines. However, the catalogue once drawn would require subsequent updates (additions, alterations or deletions) during the life time of ships of each class. Upon completion of master cataloguing, generation of a central database and subsequent archiving of the ESS by SEG (Mbi), it is essential to centrally monitor and manage the activities related to management of ESS within the Navy. For this purpose, the overall **controller** and **coordinator** for management of ESS are as follows:-

(a) **NTG**. For the first two years post commissioning of the ships constructed indigenously. Ship's staff are required to forward their returns to NTG for the first two years with a copy to SEG(Mbi).

(b) **SEG(Mbi)**. After two years from the date of commissioning for ships constructed indigenously and from date of commissioning for ships of foreign origin. Ship's staff are required to forward their returns to SEG(Mbi) accordingly.

11. To facilitate updates to the master database held by the following reports are to be rendered by the Ship's staff wef **31 Dec 14** to the Controller and Coordinator indicated above as per format placed at **Encl 2**:-

(a) **Interim Embedded Systems Configuration Report (I-ESCR)**. Ships and submarines are to render an I-ESCR immediately upon completion of a hardware and/ or software modification or upgrade by system OEM/ Specialist. The I-ESCR shall also indicate the timelines for ship staff to initiate and conclude archiving process in consultation with SEG (Mbi).

(b) **Half Yearly ESCR (HY-ESCR)**. Further, ships and submarines shall undertake comprehensive review of Master Catalogue and render a Half Yearly ESCR(HY-ESCR) report to SEG (Mbi) on 31 Dec 14 and 30 Jun 14, duly indicating only the systems which have undergone hardware/ software modification/ up gradation, else a “NIL HY-ESCR” report shall be rendered in case of no changes whatsoever. The review should also include the status of the OBS.

Infrastructure Requirement.

12. As has been brought out earlier, extraction of ESS and maintenance of a ready- to-use verifiable ESS archival is the responsibility of SEG (Mbi). To undertake this activity, the necessary infrastructure augmentation with regards to repair, test and archival facilities, IT infrastructure and other support infrastructure is required to be undertaken. SEG (Mbi) is to identify the ESS repair and test facilities required to render support to both in-service and also new induction ESS, and suitably keep augmenting the infrastructure to meet the present and future requirements. SEG (Mbi) is to also identify competent civilian firms that may provide assistance in extraction, archival, restoration and maintenance of ESS.

13. SEG(Mbi) is to forward specific cases where creation of an archive is not feasible due to limitations of technical expertise / infrastructure to the Parent Directorate of the Equipment as well as DEE in order to ascertain the way ahead.

Roles and Responsibilities

14. **Software Engineering Group (SEG).** SEG(Mbi) will be the nodal agency in the IN for archival, maintenance and configuration management of ESS and will be the repository of all master copies of the firmware/software embedded in systems onboard different ships. These copies of firmware/software, held at SEG, are indexed on the Pattern Number / name of the LRU, the name of the system in which the RLU is fitted, and the name of the ship on which the system is fitted. The following is additionally required to be undertaken:-

(a) As and when there is a modification/configuration-change to the firmware/software, copies of such modified firmware/software are to be obtained and the Master Catalogue updated.

(b) Provide updates of the firmware/software, to the Yards when required.

15. **Naval Dockyards/ Repair Centres**. Any modification to LRU of an equipment, by way of firmware/software or hardware, may be undertaken by Repair Centres of Naval Dockyards by obtaining a copy of embedded firmware/software, from SEG/ND(V)(WECORS). Any modifications, as a result of repair at Naval Dockyard, is to be intimated to the Ship’s staff by the repair centre to enable reflection of the same in the I-ESCR.

16. **Weapon Equipment Depots (WEDs) / Material Organisations (MOs)**. The WEDs / MOs are to maintain record of ‘Config Ids’ of the corresponding Configuration Sheets in the ledger-folios of respective LRUs and also in the WLMS based on the Configuration Sheets (for the LRUs) promulgated by HQNTG prior

commissioning / from OEM for subsequent procurements.

17. **Naval Technical Groups (NTGs)**.

(a) Formulate and finalise the CCD two years post commissioning of a ship incorporating all changes that had been undertaken. The final CCD at the completion of two years post commissioning of the ship is required to be issued by HQNTG.

(b) Coordinate with SEG(Mbi) to enable archiving of software for new construction ships.

18. **Professional Directorates / Procurement Agencies**. Requirement for copies of the firmware / software embedded in systems along with other requirement from OEM pertaining to updation of OBS and B&D is to be projected in RFPs/SOTRs are ensured in the final contracts.

Way Ahead

19. Formulation of Master Catalogue by SEG (Mbi) and archival of ESS of all ships and submarines is the first activity that needs to be undertaken. Thereafter, the feedback mechanism on ESS needs to commence. In view of the above, the following is requested:-

(a) Ships/ submarines under respective Commands are to evolve the platform specific ESS Master Catalogue iaw the format placed at **Encl 2**. The same is to be completed by **28 Feb 15** and forwarded incrementally to SEG (Mbi). SEG (Mbi) is to forward monthly progress of the cataloguing activity to IHQ MoD(N) / DEE wef **01 Oct 14**.

(b) Commands in consultation with Op Authorities and SEG (Mbi) are to formulate the plan for extraction and archiving of ESS and also for verification / validation of OBS.

(c) Yards are to ensure that the Master Catalogue thus evolved also includes the ESS available with them.

(d) Returns for ESS to SEG (Mbi) is to be commenced wef **31 Dec 14** as per **Encl 2**.

(SR Sarma)
Rear Admiral
ACOM(IT&S)

Encl:- As above

Enclosure 1 to DEE letter
EE/POLICY/L-95/M&C dated 07 Aug 14

SHIPS/SUBMARINES

SIGNAL FORMAT

FROM : <SHIP/ SUBMARINE>

TO : FMU (MB)

INFO : FOCINC WEST ASD(MB) <OP AUTHORITY> INSMA

NMU/ NML/ NMW/ NMR _______ (.) RA FOR ESS DEFECT(.) DART REF _______

(A) EQUIPMENT / SUB-EQUIPMENT

(B) DESCRIPTION OF SOFTWARE DEFECT/ERROR MESSAGE OBSERVED

(C) APPLICATION/SYSTEM SOFTWARE (NODE/SUB EQUIPMENT REFERENCE)

(D) TYPE OF SOFTWARE STORAGE MEDIA

(E) LAST KNOWN OCCURRENCE OF SIMILAR DEFECT, IF ANY

(F) PROBABLE CAUSE OF FAILURE, IF KNOWN

(G) ANY OTHER RELEVANT INFORMATION

2(.) FMU(MB) FOR SEG(MB)

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Enclosure2 to DEE letter EE/POLICY/L-95/M&C dated 07 Aug 14

FORMAT FOR EMBEDDED SYSTEM SOFTWARE MEMORY MEDIA DEVICES CATALOGUE

Class-of-Ship :ABC **Ship/ Project Name :** INS XYZ/ P 1111.2 **Catalogue Version No. :**B'class 1.10 **Date :**DD MMM YY

Catalogue Type **:** Pre-Commissioning (First-of-Class)/ Post-Commissioning / Modification/ Upgradation(**Mater/ I-ESCR/HY-ESCR**)

Sl. No.(A)	Ship(B)	Department(C)	Equipment, Origin & OEM(D)	Device(E)	Unit(F)	Sub-Unit(G)	Module(H)	Slot/ Position Label(J)	Memory Media Type & Archiving Agency (K)	Memory Media Interface Type (L)	Size/ Capacity(M)	OEM Details(N)	Cross Platform Compatibility (P)	Operating System & its Version Details(Q)	End Application & its Version Details (R)	Any additional Information (S)
01	Viraat	Electrical	CTD UK KH	Processor	MP card	Not Applicable	Not Applicable	Not Applicable	EPROM WECORS	Removable	Not Available	Hitachi	Compatible	SI 5.1	Not Available	Check Sum Value xxxxx, Individual Node Image
02	Sindhuvijay	Electrical	PALLADI Russian Sevmash	PD-41	Not Applicable	Not Applicable	MPR	Not Applicable	CF ESSEG / Agency	Removable	2 GB	SanDisk	Compatible	QNX 4.25	Not Available	Single Node Proprietary Application
03	Deepak	Engineering	IPMS Italy GE Fanuc	RIO	RIO-1	CPU	Processor Board	Not Applicable	PLC NF	Fixed	20 GB	Seagate	Not Compatible **List Reasons**	Win XPe	Proficy Machine Edition	Multiple node-Node Master Image

SAMPLE ENTRY: The data indicated above is for depiction of an entry and is not correct in content or context.

1. In case there is a need, additional column be inserted to include/ indicate sub-sub unit or module, where applicable. System/ Item Part no. will not suffice the requirement, specific

2. **Column (B) to (P)** – These columns are mandatory and must be filled up by the ESCB. Columns those are not relevant for an equipment such as Sub-unit or Module or Slot as the case may be shall indicate 'Not Applicable'. Post Upgrade/ Modification I-ESCR forwarded by SS shall also be forwarded in the same format including reference of Master Catalogue by ESCB in Column S.

3. **Column J**- In case there are multiple Memory Media Devices on a single card (eg. HDD), the slot/ Position label printed on the PCB shall be indicated to clearly identify media device.

4. **Column K**- The column indicates media type in use such as EPROM, Hard Disk Drive, Solid State Drive, Compact Flash, Disk-on-Module, Disk-on-Chip etc. and also indicates the agency responsible for extraction and archival. NF (no facility) shall be indicated for systems/ media types such as PLC for which there exists no in-house extraction & archival facility.

5. **Column (Q) to (S)** – Information, if available shall be furnished for these attributes; else 'Not available' shall be indicated against relevant column.

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EE/02/1800 12 Nov 15

The Flag Officer Commanding-in-Chief
[for CSO (Tech)]
Headquarters, Eastern Naval Command
Visakhapatnam – 530014

MAINTENANCE PHILOSOPHY FOR ELECTRICAL EQUIPMENT : IAC-1

1. **Background**. IAC-1, post commissioning is scheduled is to be based in Visakhapatnam. Accordingly, the maintenance aspects of the Electrical equipment, including creation of special purpose test stands/ repair facilities and dockyard maintenance facilities at ND (Vzg) have been reviewed towards ensuring continued support to the ship.

2. **Aim**. The aim of this letter is to amplify the policy for repairs/maintenance of Electrical equipment. This letter is also to be utilized by ND(Vzg) for ascertaining the yard augmentation requirements and initiate requisite actions.

3. **Range of Equipment**. This policy covers all Electrical equipment installed onboard IAC-1.

Maintenance Philosophy

4. **Present Status**. Most of the electrical equipment being installed onboard IAC-1 have already been inducted in service. However, certain equipment are first time induction and maintenance support would need to be augmented for these. Towards this, the list of electrical equipment being installed onboard IAC-1 along with requirement of creation of repair facilities and repair/ maintenance methodology of these equipment has been examined and the equipment are broadly grouped into

following three categories :-

(a) **Category-I**. Already installed onboard various *IN* platforms, for which expertise is available and which are envisaged to be maintained by Yards.

(b) **Category-II**. To be maintained through AMC/ RRC.

(c) **Category-III**. Repair facilities being set up at various Yards.

5. The list of equipment falling under Category-I, II and III are placed at Enclosure to this letter.

6. **Maintenance Support**. The maintenance philosophy primarily aims to address the requirement of onboard and shore based repair. Following is to be undertaken in case of Onboard/ Shore based repair:-

(a) **Onboard Repair**

(i) Ship staff is to undertake initial DI / DR by replacement of defective units utilising OBS, documentation and STE available onboard.

(ii) Further repairs of Category-I equipment to be undertaken by the Yards.

(iii) Category-II equipmentto be maintained through AMC / RRC to be concluded by Commands.

(b) **Shore based Repair**. The 2nd/ 3rd/ 4th level repairs of equipment to be undertaken as follows: -

(i) Dedicated repair facility at yards along with reference systems being set up for Category-III.

(ii) Comprehensive AMC / RRC through Water Front Support of OEMs.

7. **Way Ahead**. In view of the above, HQENC is requested for the following: -

(a) **Category-I**. Ascertain existing facilities at ND(Vzg) to cater for additional repair activities and undertake augmentation, if any, w.r.t Category-I.

(b) **Category-II**. Conclude AMC/RRC for Category-II equipment.

(C Raghuram)
Commodore
Principal Director

Encl. As above.

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Enclosure to DEE letter
EE/02/1800 dated 12 Nov 15

MAINTENANCE PHILOSOPHY FOR ELECTRICAL EQUIPMENT : IAC-1

Sl.	Equipment	OEM	Category	Repair / maintenance
1	Ring Laser Gyro Sigma 40	M/s Sagem, France	Cat-I	Test facility at Vzg & Mbi
2	EM LOG Ver II	M/s KELTRON, Trivandrum	Cat-I	Repair facility with ND(Vzg)
3	ECHO SOUNDER Ver II	M/s KELTRON, Trivandrum	Cat-I	Repair facility with ND(Vzg)
4	Auto Plotter	M/s MSI Defence Systems, UK	Cat-V	**Case for repair facility being progressed by DEE**
5	Integrated Bridge System	M/s Navicom, Mumbai	Cat-II	Through AMC
6	NLCP and Navigator Lights		Cat-I	Repair facility with ND(Vzg)
7	Repeaters for RLG		Cat-I	Test facility at Vzg & Mbi
8	V/UHF search receiver with DF ELK7036	M/s BEL, Hyderabad	Cat-II	Through AMC
9	VCS Mk-II	M/s BEL, Bangalore	Cat-II	Through AMC
10	MB & SRE	M/s Phil Audiocom, Pune	Cat-II	Through RRC
11	V / UHF Aircraft HomerTACAN	M/s Moog Inc, USA	Cat-II	Through AMC
12	Anti Missile Chaff System (Kavach Mod-II)	MPF, Ambernath	Cat-V	**Case for repair facility being progressed by DEE**
13	EW System Shakti	M/s BEL, Hyderabad	Cat-V	**Case for repair facility being progressed by DEE**
14	Advanced CCS	M/s BEL, Bangalore	Cat-II	Through AMC
15	Transrectifiers, 24V DC rectifiers	M/s Precision Power Products	Cat-I	Repair facility with ND(Vzg)
16	Rotary Converters	M/s Elmot Alternators, Hyderabad	Cat-I	Repair facility with ND(Vzg)

Sl.	Equipment	OEM	Category	Repair / maintenance
17	Emergency Supply	M/s Ray Enterprises, Ambala	Cat-I	Repair facility with ND(Vzg)
18	C&C Switch Board	M/s GE India, Bangalore	Cat-I	Repair facility with ND(Vzg)
19	Main Switch Board / Breakers / ACOS	M/s L&T, Mumbai	Cat-I	Repair facility with ND(Vzg)
20	Energy Distribution Stations	M/s L&T, Mumbai	Cat-I	Repair facility with ND(Vzg)
21	Shore Connection Boxes	M/s L&T, Mumbai	Cat-I	Repair facility with ND(Vzg)
22	Power and Lighting Cables	M/s Radiant Cables M/s Siechem Technologies Pvt. Ltd M/s Nicco Corporation	Cat-I	--
23	AELs	M/s Ray Enterprises, Ambala	Cat- I / II	Repair through replacement
24	Light Fittings LED based	M/s McGeoch Marine Electricals	Cat- I / II	Repair through replacement
25	Conventional Light Fittings	M/s Ray Enterprises, Ambala	Cat- I	--
26	Multi Cable Transit Sealing System (MCT)	M/s Roxtec, Sweden	Cat- I	Repair facility with ND(Vzg)
27	APMS (as part of IPMS)	M/s BHEL / Avio (Italy)	Cat- V	**Reference system being part of original PO and is being supplied (by DME)**
28	Addressable Fire Fighting / Detection System(as part of IPMS)	M/s BHEL / Avio (Italy)	Cat- V	**Reference system being part of original PO and is being supplied (by DME)**
29	SIRS 4012	M/s ECIL, Hyderabad	Cat- I	Repair facility with ND(Vzg)
30	SPT System	M/s Elcome Marine	Cat- I	Repair facility with ND(Vzg)
31	Auto Telephone Exchange	M/s BPL / M/s Elcome / M/s Marine Electricals	Cat- II	Through AMC
32	3D Band Radar / RAN 40L	M/s Selex, Italy	Cat- V	**To be setup**
33	Ship Data Network SDN 71	M/s BEL, Bangalore	Cat- II	Through AMC
34	Combat Management System CMS 71	M/s TPSED, Mumbai	Cat- II	Through AMC

Sl.	Equipment	OEM	Category	Repair / maintenance
35	LRSAM / MF STAR	M/s IAI ELTA, Israel	Cat- V	**D-level repair facility being progressed by DWE**
36	COTS Radar	M/s Sperry Marine	Cat- II	Through AMC
37	Precision Approach Radar (Rezistor-E)	ZAO NIIIT-RK, Russia	Cat-III	**Included in ARF for Vikramaditya**
38	ILMEN	Elecktropribor, Russia	Cat-III	**Included in ARF for 1135.6 ships**
39	MTK 201E	NII Telvedenoya, Russia	Cat-IV	**Through post guarantee support by RS**
40	LUNA	Elecktropribor, Russia		
41	SATURN	Aerosvet, Russia		
42	KTSOD	JSC ROE, Russia		
43	IOLIT	PJSC RPKB, Russia		
44	IFF Mk-XII	M/s BEL, Ghaziabad	Cat-I	Through AMC
45	Magnetic Compass	M/s John Lilley & Gilley, UK	Cat-I	Through AMC
46	Link II Mod III	M/s BEL, Bangalore	Cat-I	Through AMC
47	Flight Deck Communication System (FDCS)	M/s 3G Communications / M/s BEL, Bangalore	Cat-I	Through AMC

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EE/Policy/L-44/Power-17

23 Mar 09

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RATIONALISATION OF EMI/ EMC COMPLIANCE AND TESTING OF PGD EQUIPMENT

1. **Introduction**. Electro-Magnetic Compatibility is an essential pre-requisite for any electrical equipment being fitted on Naval platforms. The modern warships are densely populated with electronic/ electrical equipment which are susceptible to mutual Electromagnetic Interference (EMI), due to intended as well as un-intended emissions over a wide range of EM spectrum from co located equipment.

2. The sustained efforts to achieve indigenisation and induction of contemporary technologies have resulted in a wide range of equipment being introduced in the Navy. Processor based PGD equipment and Thyristor based switching circuits have become a standard nom. Adequate measures, to restrict un-intended conducted and radiated emissions are therefore, necessary to achieve and optimum level of EMC at the time of design and installation of these equipment onboard Naval ships.

3. **Governing Specifications**. Presently, SOTRs/EED-Q of equipment promulgated, indicate requirement of EMI/ EMC compliance as per MIL-STD-461E

standard. This standard has the inherent advantage of specified limits for different types of platforms along with their test procedures for military equipment. The standard also specifies the EMI/ EMC compliance checks require to be carried out under actual operating conditions (i.e., full rated load) of the equipment. Adequate facilities exist in the country to carry out the EM compliance check as per MIL-STD-461E. The list of accredited labs/ facilities geared up for these checks is placed at **Encl-1**.

4. **Applicability of Tests**. Though relevant standard for EMI/EMC compliance is indicated in the SOTR, there is some ambiguity with respect to equipment wise applicability of the tests indicated in the standards and there is a need to indicate the exact tests covered by this standard for different class of equipment. In order to provide greater clarity with respect to the applicability of test, the whole range of PGD equipment have been classified in to four categories and their applicable tests as per MIL STD 461E are tabulated at **Encl-2**.

5. In view of the above, following be noted for compliance: -

(a) Relevant MIL STD 461E tests as per table placed at Encl-2 be specified for all PGD equipment and the same be incorporated in SOTRs/ RFP/ Tender Document.

(b) The EMI/ EMC testing needs to be carried out at rated full load. In case of non availability of shielded chamber/ constraints of size, the test may be carried out at OEM premises with recording of ambient radiation levels.

(c) In case of COTS equipment, test reports of EMI/EMC tests as per COTS standard, carried out at accredited labs may be accepted post verification of the adequacy of the tests undertaken.

6. It is requested that above guidelines for EMI/ EMC testing on PGD equipment be disseminated to all procurement agencies/ yards for compliance.

(Amit Rastogi)
Captain
Director Electrical Engineering

Encl: - 1. List of accrediated labs/ facilities
2. Tests applicable as per MIL-STD-461-E

Encl-1 to EE/Policy/L-44/Power-17
dated 23 Mar 09

LIST OF ACCREDITED EMI/ EMC LABS

S. No.	Name of Laboratory	Complete Address	Facilities Available as MIL STD
1.	LRDE	Electronics and Radar Development Establishment Bangalore-080-25241873	MIL STD 461 C/D/E
2.	Bharat Electronics	EMC Centre, QA Division Bharat Electronics Ltd, Bangalore	MIL STD 461 C/D/E
3.	RCI	RCI, Hyderabad Tel: 040-4306087	MIL STD 461 C/E
4.	SAMEER, Chennai	Sameer Centre for Electromagnetics 2nd Cross Road, CIT Campus, Taramani, Chennai-600113	MIL STD 461 C/E
5.	SAMEER, Mumbai	Sameer Centre for Electromagnetics, IIT Campus, Hill Side, Powai, Mumbai-400076	MIL STD 461 C/E
6.	NEC Mumbai	Naval EMC Centre C/o Fleet Mail Office, Mumbai-400001 Tel:26664334	MIL STD 461 C (Limited)

Encl-2 to EE/Policy/L-44/Power-17
dated 23 Mar 09

TEST APPLICABLE FOR PGD EQUIPMENT

Cat	**Description of Equipment**	**Applicable tests as per MIL Std 461/E (for Ship borne Eqpt)**	**Applicable tests as per MIL Std 461/E (for Submarine Eqpt)**	**Remarks**
A	Motors	CE 101, 102 RE 101, RE 102	CE 101, 102 RE 101, RE 102	Equipment without electronics.
B	Alternators/ Generators, Rotary Converters	CE 101, 102 RS 101 RE 101, 102	CE 101, 102 RE 101, RE102 RS 101	Equipments with circuitry for control and monitoring of voltage/ frequency/ temperature etc.
C	(a) Switchboard (b) Switchgears (ACBs and MCCBs) (c) ACOS (d) Control Panels (e) ICCP (f) Starters & Controllers (g) NLCP (h) GPI (j) UPS (k) SFC (l) Rectifiers (including HSRs, GT starting, Control and Battery Charging) (m) AELs (n) SPT (p) LED Lights (q) Any other eqpt with electronics	CE 101, 102 CS101, CS 114 CS115 RE101, RE102 RS101, RS103	CE 101, 102 CS101, CS 114 CS115 RE101, RE102 RS101, RS103	Eqpt with Electronics

D	Transformers	RE 101, RE102	RE 101, RE102	
E	CFL/ Tube Lights	RE 101, RE102 CE101, CE102	RE 101, RE102 CE101, CE102	
F	Emergency Socket, Plugs and Socket, ECOS and HCOS	Nil	Nil	

Note: CE 101 though not recommended for Ships as per MIL-STD-461E (recommended as per MIL-STD-461D) has again been recommended as per MIL-STD-461F. This being the case the same has been added in the purview of ship's also.

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EE/03/9707 27 Jan 10

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RETRO-FITMENT OF STARTERS ONBOARD EXISTING SHIPS

1. Refer to EED-Q-071(R3) regarding selection of starters for different rating of motors.

2. EED-Q-071(R3) specifies selection of a type of starter based on rating of the motor. The motors below 5KW use DOL starters, rating of 5 to 15 KW use Star Delta starter and for motors above 15 KW soft starters are to be used.

3. It has now been brought to the notice of this Directorate that ships undertaking ABER replacement of existing Star Delta/DOL starters with soft starters for motors of rating above 15 KW have expressed inability to adhere to EED-Q-071 (R3) specifications, due to higher space requirement of starters vis-à-vis star delta and DOL starters. This causes undue delay in delivery of equipment and prolonged correspondence to resolve the issue.

4. In view of the above, it is requested that if the Soft Starter is of higher dimension and cannot be installed either by relocation or removal of redundant units on the bulkhead then the DOL/ Star Delta Starter may be considered in-lieu and procurement undertaken.

5. It is requested that information contained in this letter be disseminated to all units.

(Amit Rastogi)
Captain
DEE

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EE/Policy/L-66/Power-17 22 Apr 10

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POWER QUALITY AUDIT – DURING SHIPS LIFE CYCLE

1. **Introduction**. Indian Naval Ships are increasingly being fitted with new generation equipment, weapons and sensors which are highly sensitive to power supply variations. In the recent past, failures of a number of sensitive electronic components/ sub-systems have been attributed to sub-optimal quality of onboard power supplies. There is a requirement therefore, to establish the quality of power suppliers available to critical and sensitive systems onboard, vis-à-vis applicable Military and Defence standards and implement corrective actions for deviations, if any.

2. **Power Quality**. Power Quality may be defined as “Power supply which is devoid of deficiency or deviation in voltage, current and frequency that may cause breakdown, failure or malfunctioning of user equipment”. The need to ensure power supply quality onboard IN platforms is extremely important as correct functioning of all equipment can only be assured if the power supply parameters are within acceptable limits. Any disturbance in the power supply either at the source end or the consumer end results in overall deterioration of quality of the power supply onboard.

3. **Applicable Standards**. The relevant military standards being followed by IN are as under: -

(a) Performance parameters of the Generators' Def Stan 08-142.

(b) Permissible tolerance for voltage, waveform and frequency at user equipment terminals; Def Stan 61-5, Part 4 "Quality of Power Supply onboard Ships".

(c) Required engineering practices and policy guidelines for design of supply and distribution system onboard ships and submarines: Def Stan 08-109 (NES 532 revised).

4. **Factors Responsible for Power Quality**. Some of the important factors which would ensure required quality of power suitable for correct and efficient operation of sensitive electronic equipment are: -

(a) **Selection of Alternator Alongwith Governor and AVR**. The ability of the alternator to absorb/ withstand, the collective disturbances initiated by all consumers in the network is envisaged to be the most important factor contributing to the quality of power supply onboard. Therefore, correct selection of Alternator, its excitation and speed governing system (AVR and Governor) needs to be ensured during the procurement process.

(b) **Compliance to Performance Standards**. Ensuring stringent performance checks of the generators, high capacity motors/ induction loads and distribution system during induction and post major repairs/ overhaul in accordance with laid down specifications (as per Para 3 above) is also important in ensuring acceptable quality of power supply onboard.

(c) **Adherence to Standard Engineering Practices**. A few examples of non adherence to standard engineering practices leading to degradation of quality of power supply onboard are: -

(i) Provisioning of non-designed converted supplies for COTS equipment in an ad-hoc manner.

(ii) Inappropriate/ uneven load distribution while providing supply to new equipment.

(iii) Operation of equipment at low insulation value.

(iv) Unchecked and unauthorized As & As/ modifications.

Power Quality Audit (PQA) – During Ships Life Cycle.

5. With a view to address issues related to power supply quality as brought out at Para 3 & 4 above, there exists a need to carry out power quality audits at various

stages of ships construction and exploitation. While these issues get addressed to some extent during the ships design and construction stage, however Power Quality Checks (PQC) during the ships operational phase gets restricted to Generator load trials. The quality of power supply once established at construction stage, would need to be reviewed periodically during the ship's lifecycle for deterioration, if any, especially post implementation of Additions and Alterations or post major repairs/ overhauls of generation equipment and major load (motors/ MG sets/ conversion equipment). Therefore, there is a need to undertake Power Quality checks/ audit especially at the load end during the ship's operational phase.

6. **Occasions for Power Quality Checks**. The occasion for power quality checks during ships life cycle would be as follows: -

(a) **Generator Trials**. Generator trials are undertaken by ETMA/ ETMUs in accordance with promulgated GRAQ with a view to check the quality of power being generated. The occasion of generator load trials are specified in BR 6500 (201) Cat 4.

(b) **PQC- Load End**. PQC are not being undertaken currently at the load end unless warranted due to any specific defect analysis. However, these are also required to be undertaken to ascertain disturbances to the power supply due interaction with other heavy loads within the supply network or sub optimal performance of distribution system. The PQC is required to be undertaken by SS for all critical electronic equipment and for high capacity motor loads post refits and at least once a year. The format for recording PQC for respective equipment is placed at Appendix A. Details with regards to the parameter measurement points is placed at Appendix B. Guidelines procedure for carrying out PQC is placed at Appendix C.

(c) Occasions for PQC at load end would be as under: -

(i) Post major Additions and Alterations (As & As).

(ii) Post ABER/ BER replacement of major electrical and electronic systems and sensors.

(iii) On case to case basis as required for DI/ DR.

(iv) As an annual routine for critical electronics equipment and high capacity motor loads (>20 KW) for Capital ships.

7. **Surveillance Audit**. The surveillance audit is required to be undertaken for verifying correctness of power quality measurements and the records maintained by the ships staff. Whilst carrying out surveillance audit, the audit agency may undertake few sample checks of power quality as considered necessary. Surveillance audit be instituted as follows: -

(a) **Periodicity**. Annually or as ordered by AA.

(b) **Class of Ship**. All capital ships. (Details placed at Appendix D).

(c) **Agency**. ETMA/ ETMU. Personnel, if required may be co-opted for undertaking such activity.

(d) **Audit Program**. The program for conduct of the surveillance audit be promulgated by AA in Jan and Jun on a six monthly basis keeping IHQ/ DEE informed.

(e) **Scope**. The scope of the audit includes checking of records of generator trials, records of PQC maintained by SS and conduct of random checks and its correlation with ship's record.

(f) **Report**. The audit report is to be forwarded to IHQ MoD(N) on a bi-annually basis in the format placed at Appendix-E.

8. **Test Equipment for PQC**. It is imperative that the PQC are conducted using a highly accurate and reliable test equipment to obviate any possibility of incorrect measurements. Towards this, one *'Fluke' make Power Quality Analyser model 435* for all capital ships and two numbers for Electrical Trial agencies and Repair Yards have been allocated in the INCRETE under revision.

9. **Major A's & A's**. Induction of new equipment drawing heavy current needs to be planned such that least deviations are there on the power quality at the load end within the same supply network. Comments of ETMA w.r.t. effect on power quality due to fitment of new equipment should be obtained on all Feasibility Board Proceedings (Both ABER and A's and A's proposal) akin to NEC comments w.r.t. EMI/ EMC prior forwarding to IHQ MoD(N) for approval.

10. In view of the issues highlighted in preceding paragraphs, following needs to be undertaken: -

(a) Comments of ETMA wrt effect on power quality due to fitment of new equipment be obtained on all Feasibility Studies/ Board Proceedings (both ABER and A's and A's proposal) akin to NEC comments w.r.t EMI/ EMC prior forwarding to IHQ MoD(N) for approval.

(b) Maintenance schedule be suitably amended to incorporate power quality, checks as indicated at Para 6 above, to be undertaken by SS periodically.

(c) Surveillance Audit be undertaken by ETMA/ ETMU for all operational ships once a year or as ordered by the AA. Audit report to be forwarded to IHQ/DEE bi-annually in the format placed at Appendix 'E'.

(d) Surprise audits as ordered by AA be undertaken by ETMA/ ETMU.

(e) Sensitise personnel towards use of correct engineering practices and importance/ significance of power quality and appropriate selection of commercial equipment (COTS) for use onboard.

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

(a) Information contained in this letter be disseminated to all units.

(b) Comments/ feedback if any be forwarded to IHQ MoD(N)/ DEE by mid May 10.

(Amit Rastogi)
Captain
Director Electrical Engineering
Directorate of Electrical Engineering

Appendices: -	A	Details of Parameters to be checked at Load End
	B	Parameter Measurement Points.
	C	Guidelines procedure for undertaking sample PQC during surveillance audit.
	D	Class of ships required to undergo power surveillance audit
	E	Format for surveillance audit report

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Appendix-A
(Refer to Para 6 (b))

DETAILS OF PARAMETERS TO BE CHECKED AT LOAD END

Parameters	**Acceptable Value**	**Last Recorded Value**	**Present Value**
Voltage			
Nominal User Voltage	440V/ 415V/ 380V		
User Voltage Tolerances (a) Average of three line-to-line voltages (1) Refer Note (i) (b) Any one line-to-line voltage including (a) above and line voltage unbalance tolerance	 ± 5% ± 7%		
Voltage Modulation (2)	2%		
Line Voltage Unbalance Tolerance (3)	2%		
Voltage Transient Tolerance Refer Note (ii)	± 16%		
Voltage Transient Recovery Time	2 seconds		
Voltage Spike (peak value)	2.5 kV		
Waveform			
Total Harmonic Distortion Tolerance	5%		
Total Harmonic Distortion Transient Recovery Time	15%		
Total Harmonic Distortion Transient Tolerance	0.2 seconds		
Individual Harmonic	3%		
Deviation Factor	5%		
Frequency			
Nominal Frequency	60/50 Hz		
Frequency Tolerance (4) Refer Note (iii)	± 3%		
Frequency Modulation (5) Refer Note (iii)	0.5%		
Frequency Transient Tolerance (6) Refer Note (iii)	± 4%		
Frequency Transient Recovery Time	2 seconds		

Note

(i) Except under transient or fault conditions the maximum departure from nominal user voltage, due to the combined effects of (1), (2), (3) will not exceed ±

6% for average of three line-to-line voltages and ± 8% for any one line to line voltage.

(ii) Except under fault conditions the maximum excursion due to the combined effects of transients and (1), (2), (3) above will not exceed ± 20% for the average of three line-to-line voltages; ± 22% for any one line-to-line voltage. Excursions of this order will only occur infrequently, which means not more than 10 times in a period of 24 hours.

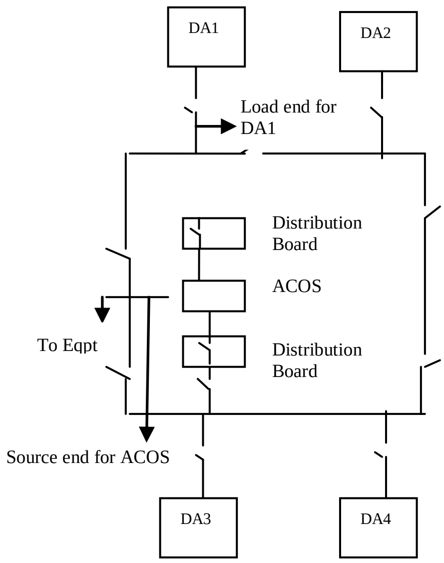
(iii) Except under fault conditions the maximum departure from 60/ 50 Hz resulting from (4), (5) and (6) above will not exceed 5.5%.

Appendix-B
(Refer to Para 6 (b))

PARAMETER MEASUREMENT POINTS

1. **Source End**. Parameters as per Appendix A are required to be checked at the switchboard, individually for all the generators by isolating the generator.

2. **Load End**. Load and parameters are to be measured at the output point of all ACOS and the System UPS fitted onboard ship.



Appendix-C
(Refer to Para 6 (b))

GUIDELINES PROCEDURE FOR UNDERTAKING SAMPLE PQC DURING SURVEILLANCE AUDIT

1. Start DA 1/ GTG 1 and take it in load.

2. Isolate the switchboard section (S1) being fed by DA 1/ GTG 1 by opening the 'Section/ Bus bar Interconnecting Breaker'.

3. Select the highest capacity motor (M1) being fed from the selected section (S1). Connect the power quality analyser at the input of motor M1 starter, Switch-on the motor and measure power parameters by Power Quality Analyser as per details given at Appendix-A.

4. Switch off motor M1.

5. Select one of the sensitive weapon equipment (W1) being fed by S1. Connect the power quality analyser at the 'outgoing end' of the ACOS/ DB feeding the selected weapon equipment.

6. Switch on weapon W1. Measure power parameters by power quality analyser as per details given at Appendix A.

7. Switch on weapon W1. Do not disconnect the power quality analyser.

8. Switch on motor M1 and measure any deviation in the power parameters due to switching on of motor M1 at the outgoing end of ACOS/ DB feeding weapon W1. Measure the power parameters.

9. Repeat the procedure for all sections of the switchboard.

Appendix-D
(Refer to Para 7 (e))

CLASS OF SHIPS REQUIRED TO UNDERGO POWER SURVEILLANCE AUDIT

1. Aircraft Carrier
2. Delhi Class
3. SNFs
4. Talwar Class
5. B'Putra Class
6. G Class
7. Khukri and Kora Class
8. P-17 post commissioning

Note: - The above list needs to be revised to include new commissioned platforms.

Appendix-E
(Refer to Para 10)

FORMAT OF SURVEILLANCE AUDIT

Surveillance Audit Report Command: - ________________				
Sl	Ship	Date	Anomalies	Corrective Actions Taken

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EE/ POLICY/ L-104/ POWER 12 Sep 16

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SAFETY PRECAUTIONS AND MAINTENANCE GUIDELINES LEAD ACID BATTERIES ONBOARD SHIPS

1. **Introduction**. Lead acid batteries have widespread applications onboard ships. A large number of LP batteries of 6V 4Ah, 12V 55Ah and 12V 180 Ah are used onboard ships for AELs, C&C switchboards, emergency supply, boats, Helo starting, GTG starting etc. In addition, modern day UPS provided with various electronic equipment onboard ships, comprise battery banks which are of “sealed maintenance-free/ VRLA” lead acid type. Therefore, maintenance of various types of lead acid batteries assumes importance as it directly affects the operational availability of vital services onboard ships.

2. **Types of Lead Acid Batteries**. There is a big leap in the technology of manufacturing of lead acid batteries. The following types of lead acid batteries are commercially available: -

(a) **Conventional Batteries**. A large number of batteries presently installed onboard *IN* ships are of conventional flooded lead-acid variety which suffer from drawbacks such as high internal resistance, rapid discharge due to local action, continuous gassing (requiring well ventilated compartments), extensive maintenance effort in terms of topping up of electrolyte, regular monitoring of specific gravity and regular cleaning of terminals for effective contact, high charging time and low shelf life/ useful life.

(b) **Maintenance Free Batteries**. Following two types of maintenance free batteries are in service: -

(i) **Sealed Lead Acid Batteries**. These batteries, by virtue of reduced maintenance, are finding increased use in the onboard applications and are progressively replacing conventional batteries. Sealed lead acid batteries are manufactured with pure materials so as to reduce gassing rates. They gradually lose liquid through gassing and cannot be replaced. These batteries require comparatively less maintenance but do not offer much advantage in terms of shelf life and service life.

(ii) **Valve Regulated Lead Acid (VRLA) Batteries**.The VRLA batteries essentially have the same lead-acid chemistry as the conventional batteries. A VRLA battery utilises a one-way, pressure relief valve system to achieve a “recombinant” technology. This means that the oxygen normally produced on the positive plate is absorbed by the negative plate. This suppresses the production of hydrogen at the negative plate and Water (H2O) is produced instead, retaining the moisture within the battery. It never needs watering. There are two types of VRLA batteries, Absorbent Glass Mat (AGM) and Gel cell. A comparison of the Conventional flooded Lead Acid battery with AGM and Gel based VRLA batteries is placed at **Enclosure-II**. VRLA batteries can be substituted in virtually any flooded lead-acid battery application. These batteries are also termed maintenance free, however, this is a misnomer as these batteries also require maintenance in respect of cleaning and regular functional testing. These batteries have purer materials so as to reduce gassing rates. By virtue of reduced maintenance, these batteries are already having increased use and are replacing the conventional batteries in onboard applications.

3. **Risk/ Hazards**. The lead acid batteries both conventional, maintenance-free and VRLA batteries present certain risks/ hazards which are summarised as under: -

(a) Conventional lead acid batteries onboard ships are to be handled with utmost care as they contain Sulphuric acid which could cause severe skin and eye burns in case of a leak.

(b) During overcharging excessive evolution of Hydrogen gas can result in fire-hazard/ explosion.

(c) A VRLA battery should never be opened as this would expose the battery to excess oxygen from the air. In addition to damaging the battery, warranty will also be rendered void.

4. **Precautions During Handling & Utilisation**. Due to the risks involved, the precautions that are to be adhered to, while handling/ utilisation of batteries onboard ship are placed at **Enclosure I**.

5. **Onboard Maintenance**. Service life of the battery essentially depends on the proper treatment and accurate execution of charging cycle. Knowledge and experience are necessary preconditions to avoid malfunctions, breakdowns and accidents. BR 4500 (701) provides generic guidelines for maintenance of lead acid batteries. Any failure to adhere to laid down maintenance instructions affects the performance and life of battery. The following important points should be kept in mind for keeping the battery in good condition: -

(a) **Deep Discharge**. Battery manufacturers often quote battery Ah capacities based on End of Discharge Voltages (EODV). For Lead acid batteries, the selection of an EODV is largely based on the limit that prevents damage of the cell through over-discharge (from overexpansion of the cell plates). Typically, 1.75 V to 1.80 V per cell is used when discharging over longer than 1 hour. Situations of deep discharge should be avoided by constant monitoring of cell voltages and ensuring correct functioning of trickle charging circuits. A lead acid battery, once deep discharged, will not hold charge even after re-charging and is normally un-usable.

(b) **Monitoring of Electrolyte**. The level of electrolyte should always be 10 to 15 mm above the top of the plates, which must not be left exposed to air. Adding distilled water occasionally should make up for evaporation of electrolyte. In case of sealed maintenance free batteries, this requirement does not exist.

(c) **Addition of Acid**. Addition of sulphuric acid onboard is to be avoided. If unavoidable, the same is to be undertaken with utmost care and under supervision of a senior sailor.

(d) **Cleaning of Batteries**. The acid and formation of Copper Sulphate on the battery top should be cleaned regularly with cloth moisturised with soda solution of Ammonia water.

(e) **Battery Terminals**. The battery terminals and metal supports should be periodically cleaned down to bare metal and covered with Vaseline or petroleum jelly.

(f) **Battery Charging Bay**. Battery charging rooms and battery compartments are to be painted during refits with special acid resistant rubberised paint to prevent any corrosion. Further, battery charger specifications are to be in accordance with EED 50-35.

(g) **High Temperature/ Overheating**. One of the most detrimental conditions for a battery is high temperature, particularly above 55°C. The rates of corrosion, solubility of metal components, and self-discharge increase with increase in temperature. Typically the battery life reduces to 50% for every 10°C increase in temperature. High operating temperature (e.g. batteries in engine room) during cycle service requires higher charge input to restore discharge capacity and local action (self-discharge) losses.

6. **Capacity Test**. The batteries are to be capacity tested every two years or if not holding the charge or getting discharged very fast. The capacity tests are to be undertaken preferably as per the rating of the batteries. Capacity testing as per the rated load (if less than the rating of the batteries) may be considered in case of batteries not clearing the capacity tests as per their rating and immediate replacements being not available provided the battery during capacity test achieves more than 80% of the rated capacity. Capacity testing as per the rated load is to be undertaken only during Biennial checks provided no problems are being experienced wrt holding of charge. The capacity test is to be undertaken with a “Battery Capacity Tester” provided as part of CRETE to ships in accordance with the NO 15/13 and IHQ MoD (N)/ DEE policy letter EE/ POLICY/ L-85/ 2338 dated 15 Sep 15.

7. **Replacement of Conventional Batteries** . With the advancements in the technology, zero maintenance batteries (maintenance free batteries) including VRLA batteries are now being offered by vendors. ***The existing conventional batteries are to be replaced on progressive bases with maintenance free batteries of the same voltage and Ah capacities***. Due care is required to be taken during replacement of the conventional batteries with maintenance free batteries especially in respect of matching overall dimensions and installation. If the batteries are not single and size of the battery banks are such that it entails degutting and re-gutting, then the replacement is to be taken up as minor As and As activity by the ship, in accordance with NO 55/ 03.

8. **Submarine Main Batteries**. The above guidelines do not cover the submarine main batteries, even though the maintenance approach and guidelines would be largely the same. For submarine main batteries, maintenance philosophy is promulgated by Submarine Headquarters through various Submarine General Memorandums (SGMs) and Submarine Temporary Memorandums (STMs) from time to time, in addition to the procedures given in the technical manuals.

9. In view of the foregoing following are requested: -

(a) Information contained in this letter be disseminated to all units.

(b) Comments/ feedback, if any, be forwarded to Integrated Headquarters, Ministry of Defence (Navy)/ DEE by end Dec 16.

(C Raghuram)
Commodore
PDEE

Encl: As above

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Enclosure I to IHQ MoD (N) letter No.
EE/POLICY/L-06/POWER 06 dated12 Sep 16

SAFETY REGULATIONS – HANDLING OF LEAD ACID BATTERIES

1. **General**.

(a) Entrance to the battery room shall be restricted to authorised persons only.

(b) Personnel entering the Battery room shall wear protective clothing (Cotton overall and not synthetic) and are not to carry any loose objects in the pockets.

(c) Only insulated tools are to be used and the same are to be removed after working. Tools are not to be left in the compartment as they may fall on battery terminals and cause short circuit, leading to fire/ explosion.

(d) Neighbouring cell connectors are not to be touched simultaneously.

(e) Smoking is to be strictly prohibited in the vicinity of battery pool.

(f) The doors/ hatches leading to the battery room should be kept shut except for movement of personnel. The exhaust/ ventilation system of the compartment must be kept running.

(g) Extra objects of any kind are not to be stored inside the battery room. The compartment should have adequate supply of fresh water and suitable wash basin and drainage arrangement. Requisite First Aid kit and medicines should be kept well stocked.

2. **Precautions During Battery Charging**.

(a) All battery charging routines must be carried out with full ventilation arrangement operating.

(b) Warning Notices – 'Battery charging in progress, no smoking or naked lights' be displayed.

(c) Where fitted, vent plugs must be out.

(d) Manufacturer's guidelines be consulted for the correct charging rate.

(e) Requisite Fire fighting equipment are to be at hand.

(f) Battery temperature, is to be carefully monitored whilst charging. If the temperature exceeds 46^0C (115^0 F) in temperate climates or 52^0C (126^0 F) in the tropics, then charging current must be reduced or suspended until the battery cools down.

3. **Mixing of Electrolyte**. Mixing of electrolyte onboard ship is to be undertaken only when essential and is to be avoided whilst the ship is at sea, especially in heavy sea conditions. In any case, this activity is to be undertaken with utmost care and under the supervision of a senior sailor. The following precautions are to be taken while mixing electrolyte: -

(a) Equipment used with acid must be kept apart at all times from the equipment used with alkali as the contamination of a lead acid battery with alkali damages it permanently.

(b) The special acid resistant electrolyte buckets are to be used. Stirring rods of either glass or thin wood are to be used.

(c) When mixing acid and water, acid is to be added to water and not vice versa. Explosive boiling could otherwise occur. The solution should be allowed to cool to room temperature before adding to a battery.

4. **Wearing of Protective Clothing**. Protective clothing is to be worn by all personnel engaged in battery charging or the mixing of electrolyte. The following protective clothing are to be worn while working on batteries: -

(a) Overalls with sleeves rolled down.

(b) Boots Knee, rubber.

(c) Gloves rubber.

(d) Goggles rubber complete with clear window.

5. **Chemical Burns**. The following precautions are to be taken in case of chemical burns: -

(a) In case of acid getting into eyes, they should be washed immediately with large amount of water, repeating this operation several times to make certain that all traces of acid have been removed.

(b) Clothing that have been splattered with acid should be washed with excess of water. Washing soda bicarbonate pastes or solutions should thereafter be applied and washed away.

(c) Medical attention be sought without delay.

**Enclosure II to IHQ MoD (N) letter No.
EE/POLICY/L-06/POWER 06 dated 12 Sep 16**

TECHNICAL FEATURES OF MAINTENANCE FREE BATTERIES INCLUDING VRLA BATTERIES

1. **Technology**. Maintenance free and Valve Regulated Lead Acid (VRLA) batteries essentially have the same lead-acid chemistry as the conventional batteries. There are two types of VRLA batteries, Absorbent Glass Mat (AGM) and Gel cell. VRLA batteries can be substituted in virtually any flooded lead-acid battery application. These batteries are also termed maintenance free, however, this is a misnomer as these batteries also require maintenance in respect of cleaning and regular functional testing. These batteries have purer materials so as to reduce gassing rates. By virtue of reduced maintenance, these batteries are already having increased use and are replacing the conventional batteries in onboard applications. The batteries facilitate oxygen recombination cycle which results in nominal gassing and loss of water from the electrolyte. The electrolyte is immobilised by absorbing within an absorbent separator between the plates. However, due to liquid content likely to be lost through gassing and the same not being replaceable, these batteries necessitate constant monitoring of its health.

2. The main features of these batteries are as follows:

(a) **Technology**. The new generation batteries incorporate technology that use high purity/ quality lead cells providing larger active surface area and a very low internal resistance. Thus, the battery can provide much higher currents compared to the conventional one and without an appreciable drop in voltage.

(b) **Use of Recombination Technology**. Such batteries have the ability to convert the hydrogen and oxygen gases generated during the charging into water. Thus no gases are evolved during the charging operation. This also precludes ‘topping up’ with water periodically.

(c) **Higher Shelf Life**. These Batteries have very low self-discharge rate with shelf life more than a year subject to its storage undertaken in ambient conditions specified by the respective OEMs of the batteries.

(d) **Faster Recharging**. The Batteries can be fully charged from a discharged state within 3 to 4 Hrs.

(e) **Mounting Orientation**. The Batteries can be mounted in any position (even upside down) and there is no spillage of its electrolyte.

(f) **Light Weight**. The Batteries are much lighter in weight than their conventional counterparts for the same Ah capacity.

3. **Maintenance of VRLA Batteries**. The maintenance procedures are more or less similar to that of the conventional batteries brought out at **Enclosure I** except in aspects pertaining to electrolyte part and state of health. The best way to monitor state of health of VRLA batteries is to use "Battery Capacity Tester" provided as part of CRETE to ships in accordance with the NO 15/2013 and IHQ MoD (N)/ DEE policy letter EE/ POLICY/ L-85/ 2338 dated 15 Sep 15. The battery capacity tester provides inputs on the health of each battery even when in circuit based on impedance measurement techniques. The maintainers should be aware of the internal resistance values of each cell in order to obtain the health of the batteries as "Healthy"/ "Warning Zone"/ "To be Replaced". This facilitates replacement of only those cells which are identified as "To be Replaced" and therefore contributes to cost savings by avoiding replacement of the entire battery bank. Further, for "Warning Zone" cells, appropriate actions could be initiated for ensuring availability of replacements at hand.

4. A comparison of the Conventional Flooded Lead Acid (FLA) battery with AGM and Gel based VRLA batteries is tabulated below: -

S No	**Feature**	**VRLA (AGM)**	**VRLA (GEL)**	**FLA**
(a)	Gassing/ fuming	No gassing/fuming, can be installed anywhere. Can happen when overcharged which should be avoided as it could lead to cracking of sealed battery		High gassing/fuming, separate battery room with exhaust system essential
(b)	Topping up of electrolyte	No topping up required		Topping up required frequently
(c)	Charging current level	High	Lower	Lowest
(d)	Space requirement	Small size, low space requirement		Large Cell size, large space required
(e)	Transportation in charged condition	Possible, Easy		Not Possible.
(f)	Self discharge during storage at an average temperature of 35 deg	50% self discharge in 06 months.	50% self discharge in 12 months.	Self discharge is very high. Long duration storage not recommended.
(g)	Stratification	Negligible, no boost charging required		Prominent, requires frequent boost charging for prevention.
(h)	Deep discharge recovery	Average, after 4 to 5 charge/ discharge cycles		Poor, hard sulphation prevents recovery.
(j)	Charge efficiency	Excellent, 6 to 8 hours for 90% recovery.	Average, 8 to 10 hours for 90% recovery	Poor, 12 to 14 hours for 90% recovery.

S No	Feature	VRLA (AGM)	VRLA (GEL)	FLA
(k)	Charging requirement	Constant voltage charging by SMPS Power plants		Periodical boost charging at 2.7V/ cell essential
(l)	Risk of internal short circuiting	Remote		High, due to active material shedding.

5. **Disadvantages of VRLA Batteries**. VRLA batteries have following disadvantages/ limitations : -

(a) They are less tolerant to overcharging, which could lead to pre-mature failures.

(b) Thermal run-away could happen during incorrect charging.

(c) They have shorter life than well-maintained Flooded lead acid battery, while having higher initial cost, especially for deep-cycle requirements.

(d) Inability to test electrolyte by hydrometer could result in improper/ inadequate charging, which could also reduce battery life due to “memory” effect.

(e) They are not amenable to higher discharging rates.

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Integrated Headquarters
Ministry of Defence (Navy)
New Delhi -110011

EE/03/5124/L-71/Policy/P-20/Power 26 Aug 10

The Flag Officer Commanding –in-Chief
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Headquarters, Eastern Naval Command
Visakhapatnam-530014

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The Flag Officer Commanding –in-Chief
(for CLO)
Headquarters, Southern Naval Command
Kochi-682004

The Commander-in-Chief
{for CTO (Marine)}
Headquarters Andaman & Nicobar
Port Blair- 744 102

FITMENT OF MAINTENANCE FREE BEARINGS IN MOTORS

1. **Introduction**. The motors fitted onboard IN ships and submarines use different types of bearings viz. plain, Z (single Z) and ZZ (double Z) bearings. The plain and Z bearings require periodic greasing while ZZ bearings are metal shielded on both sides and are maintenance free. The selection of a particular bearing by the motor manufacturer is based on a number of factors like motor rating, r.p.m, intended use, running duty cycle, location, likely exposure to dust/ water etc. EED-Q-071 (R3) stipulates that motors up to frame sizes 160 should be provided with ZZ bearings. However, it is observed that number of motors smaller than frame size 160 are fitted with plain and Z bearings.

2. **Defect Analysis of Motors**. A defect analysis study carried out at ND (MB) has brought out that in 90% of motors removed for overhauling, the high SPM readings were attributable to lack of lubrication of bearings. The lack of greasing is primarily due to inaccessibility (like ventilation motors mounted in trunkings), non-availability of greasing nipples/ drain plugs and inadequate PPM routines.

3. **Way Ahead**. For most of commonly used plain and Z bearings, equivalent maintenance free ZZ bearings have been developed and are commercially available. Details of open/ maintenance free bearings where equivalent maintenance free

bearings are available is placed at Enclosure. The use of ZZ bearings, wherever feasible will reduce the maintenance requirements and rule out failure of motors due to non greasing of bearings. Therefore, while undertaking repair/ overhauling of motors upto frame size 160 and power rating 15 KW, open/ non maintenance free bearings are to be replaced with equivalent maintenance free bearings. However, certain specific high speed motors, may still need to use plain/ Z bearings due to non-availability of suitable equivalent maintenance free bearing. Also, certain higher rating motors fitted in remote locations are preferred to be fitted with ZZ bearings.

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

(a) All motors upto frame size 160 and power rating 15 KW are to use ZZ maintenance free bearings. EED-Q-071 (R3) is being amended accordingly. However, motors of capacity higher than 15 KW and frame size bigger than 160 may also use ZZ bearings based on end use and on specific approval by Administrative Authority.

(b) HQWNC is to initiate action for inclusion of maintenance free bearings listed at enclosure in the ILMS inventory by raising Item Introduction Forms (IIFs) and indicate probable vendors for supply to rule out single vendor situation.

(c) On inclusion of maintenance free bearings in the ILMS inventory, Material Organisations are to undertake procurement of equivalent maintenance free bearings in lieu of the existing bearings as listed at enclosure. MOs are to supply the existing bearings till stock lasts and then change over to supply of maintenance free bearings. However, procurement of plain/ Z bearing may be resorted to in specific cases as per end use, where specifically demanded.

(d) Dockyards/ Repair yards are to replace open/ non maintenance free bearings listed at enclosure with equivalent maintenance free bearings only while undertaking repair/ overhauling of motors upto frame size 160 and power rating 15 KW.

(Amit Rastogi)
Captain
Director Electrical Engineering

Enclosure to DEE Letter EE/03/5124/L-71/Policy/P-20/Power dated 26 Aug 10

S.No.	Open/ Non Maintenance Free Bearings Presently Being Used		Equivalent Maintenance Free Bearing
	Bearing No. (SKF)	Patt No.	
1.	608	N3110-000078	608 ZZ
2.	629	N3110-000080	629 ZZ
3.	3212A	N0269-8097719	3212A ZZ
4.	6000	N3110-000084	6000 ZZ
5.	6003	N0269-9233900	6003 ZZ
6.	6004	N0269-8166368	6004 ZZ
7.	6007	N0269-8099710	6007 ZZ
8.	6009	N0269-9501509	6009 ZZ
9.	6200	N3110-000082	6200 ZZ
10.	6201	N3110-000087	6201 ZZ
11.	6202	N3110-000091	6202 ZZ
12.	6203	N3110-000922	6203 ZZ
13.	6204	N3110-000104	6204 ZZ
14.	6205	N3110-000111	6205 ZZ
15.	6206	N3110-000119	6206 ZZ
16.	6207	N3110-000121	6207 ZZ
17.	6208	N3110-000127	6208 ZZ
18.	6209	N3110-000130	6209 ZZ
19.	6210	N3110-000133	6210 ZZ
20.	6211	N3110-000137	6211 ZZ
21.	6212	N3110-000141	6212 ZZ
22.	6213	N3110-000143	6213 ZZ
23.	6214	N0269-9500063	6214 ZZ
24.	6215	N0269-9500064	6215 ZZ
25.	6216	N0269-9500065	6216 ZZ
26.	6217	N0269-9500066	6217 ZZ
27.	6218	N0269-0000388	6218 ZZ
28.	6219	N0269-9500068	6219 ZZ
29.	6300	N3110-000085	6300 ZZ
30.	6301	N0269-9501326	6301 ZZ
31.	6302	N3110-000096	6302 ZZ
32.	6303	N3110-000239	6303 ZZ
33.	6304	N3110-000107	6304 ZZ
34.	6305	N3110-000116	6305 ZZ
35.	6306	N3110-000120	6306 ZZ
36.	6307	N3110-000123	6307 ZZ

37.	6308	N3110-000128	6308 ZZ
38.	6309	N3110-000132	6309 ZZ
39.	6310	N3110-000135	6310 ZZ
40.	6311	N3110-000139	6311 ZZ
41.	6312	N3110-000142	6312 ZZ
42.	6313	N3110-000144	6313 ZZ
43.	6314	N3110-000146	6314 ZZ
44.	6315	N3110-000374	6315 ZZ
45.	6316	N3110-000380	6316 ZZ
46.	6317	N3110-000387	6317 ZZ
47.	6318	N0269-9500090	6318 ZZ
48.	6319	N3110-000394	6319 ZZ
49.	6320	N3110-000397	6320 ZZ
50.	RLS4	N3110-000009	RLS4 ZZ
51.	RLS5	N3110-000013	RLS5 ZZ
52.	RLS6	N3110-00001	RLS6 ZZ
53.	RLS7	N3110-000020	RLS7 ZZ
54.	RLS8	N3110-000024	RLS8 ZZ
55.	RLS9	N3110-000027	RLS9 ZZ
56.	RLS10	N3110-000030	RLS10 ZZ

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New Delhi -110011

EE/03/9711(LED) 10 Jun 14

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The Flag Officer Commanding –in-Chief
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Headquarters, Southern Naval Command
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The Commander-in-Chief
{for CTO (Marine)}
Headquarters Andaman & Nicobar
Port Blair- 744 102

INDUCTION OF LED BASED LUMINAIRE ONBOARD IN SHIPS

1. **Introduction**. *IN* Ships are presently fitted with conventional light fittings with CFL and incandescent lamps. These light fittings have inherent drawback of high failure rate, low luminosity and low luminaire efficacy.

2. **Background**. Major advancements in the field of general and special purpose light system have taken place during the last decade. LED clusters for lighting are gaining wider applications in the domestic and industrial world. To harness this technology for ship based applications, extensive technical trials and evaluations of LED lights from various vendors were undertaken by IHQ. Post successful trials, LED based Lighting systems have been nominated for IAC (P-71) for Weather Deck, Pendant and Cabin Lighting applications. The design of these luminaires was customised and prospective vendors capable of manufacturing the luminaires conforming to IHQ promulgated specifications have been nominated. These luminaires have also been '**Type**' approved. Post satisfactory development of LED based luminaires for Weather Deck, Pendant and Cabin Lighting, presently user

trails of light fittings of Hangar and Machinery space applications onboard ***IN*** Ships is also in progress.

3. **Formulation of SOTRs**. As brought out above, the LED based luminaire are state of the art technology and offers superior operational features. To harness these advantages gainfully, design and technical details of LED based lightings of various make were studied and a comprehensive SOTR EED-50-33 for all types of LED based Luminaire (including explosion proof fittings) meeting all naval requirements have been formulated and placed at enclosure to this letter.

4. **Development of Vendor Base**. Presently IHQ MoD/DEE has nominated two vendors for supplying LED based luminare for P-71(IAC). Further, evaluation of additional vendors for supplying LED based lighting is also in progress. The details of the approved vendors for LED luminaire are as follows :-

(a) M/s McGeoch Marine Electricals Pvt Ltd
A-16, Anand Mangal Industrial Estate
Opp-IPOL Industries, Waliv Phata,
Vasai(E), Thane-401 208
Tel: 0250-6450633

(b) M/s Ray Enterprises,
18, Industrial Estate, Jagadhari Road
Ambala Cantt 133 001
Tele:0171-3291400/2699399/ 2698351

5. **Induction of LED Based Luminaire**. LED based luminaire are cleared for induction for ships in commission as well as on new ships under construction. Further, following way ahead has been decided for retro fitment :-

(a) Commands to undertake technical discussions with the IHQ nominated vendors to finalise the installation arrangements of LED luminaries with the existing mounting arrangements. Approved drawings of LED lighting fixtures of both the OEMs are enclosed for reference.

(b) Post finalisation of installation/mounting arrangements, Commands to undertake replacement of existing light fixtures with LED based luminaire and INCAT the light fittings.

(c) Commands to ensure that commonality of LED Light fittings are maintained across class of ships.

(d) LED based luminaire to conform to EED-50-33 for design and technical requirement.

(e) Details of additional vendors for LED based luminare will be forwarded separately on completion of type testing clearances.

(B Sivakumar)
Commodore
Principal Director
Directorate of Electrical Engineering

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EE/Policy/9711(LED)/L-98 18 Mar 15

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PROLIFERATION OF COTS LED LIGHT FITTINGS

1. Refer to IHQ MoD(N)/DEE letter EE/03/9711(LED) dated 10 Jun 14.

2. IHQ/DEE vide letter ibid had promulgated policy and specifications for installing Mil Grade LED based light fittings onboard ships. The policy letter also specifies the approved vendors for supplying Mil Grade LED light fittings. The LED luminaries supplied by these vendors have undergone extensive 'Type Testing', onboard trials and are as per the SOTR (EED-50-33) promulgated by IHQ/DEE vide letter ibid. It is pertinent to mention that the design of light fittings was developed and customised to withstand severe environmental conditions (shock/ vibration/ corrosion/ temperature/ ESS/ fire safety) as well as the EMI/EMC environment onboard.

3. Notwithstanding the above, it has lately come to light, that ships are procuring and installing COTS based LED light fittings onboard from local vendors. Since COTS based LED light fittings are not designed for Naval use, the installation of

these could result in the following:-

(a) Low reliability of light fittings due to use of sub-standard/non-certified electronics and the COTS design does not cater for ship borne shock/vibration/environmental conditions.

(b) Compromise on EMI/EMC compliance.

(c) Thermal management is one of the important aspects that are considered during design of LED light fittings. Improper thermal management will lead to excess heat generation and may compromise on fire safety onboard. Further, the life of the LED package inside light fitting also reduces drastically due to improper thermal management.

(d) Creation of non standard inventory due to induction of various types of COTS LED lights by every ship.

4. In view of the above, in order to prevent the proliferation of COTS based LED light fittings onboard, Commands are requested to undertake the following:-

(a) Only Mil Grade LED lightings are to be procured from IHQ/DEE approved vendors as per SOTR EED-50-33 promulgated by IHQ/DEE vide letter ibid.

(b) Existing COTS based LED lights fitted onboard *IN* are required to be removed.

(c) Proliferation of COTS based LED lights is to be monitored during OLSAT audits, Annual Inspections and OSTs.

(d) Commands to implement the way ahead recommended at Para 5 of IHQ/DEE letter ibid on progressive basis.

(B Sivakumar)
Commodore
Principal Director
Dte of Electrical Engineering

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Integrated Headquarters
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New Delhi -110011

EE/03/9700 31 Jul 13

The Director
Electrical Trials and Modification Authority
c/o Fleet Mail Office
Mumbai – 400001

DIESEL ALTERNATORS LOAD TRIALS

1. The design specifications and testing requirements for Diesel Alternators for ships are specified in following two documents: -

(a) DEF STAN 02-313 for Prime Movers.

(b) DEF STAN 08-142 Issue 3 for Alternators.

2. Hitherto, all trial agencies have tested the DAs for both new construction ships and ships in commission post major repairs/ overhaul of DAs as per requirements specified in these documents.

3. During the trials of the 1 MW DA for the P-15A ships under construction at MDL Mumbai, WOT (MBI) had sought clarifications on the requirements of testing the DAs for “maximum permissible load changes”(both “Throw-On” and “Throw-Off”) and associated peak percentage variation permissible for frequency and its corresponding recovery time. The issue has been examined at IHQ MoD(N) and the trial requirements are amplified as follows: -

4. **Non Turbocharged Engines with Mechanical Governor**

(a) Momentary change of speed is **not to exceed 10% of the nominal speed for 100% load decrease** i.e. full-load to no load {(Para J to 10.3 (b) of DEF STAN 02-313)}.

(b) Momentary change of speed is **not to exceed 10% of the nominal speed for 100% load increase** i.e. no-load to full load {(Para J to 10.3 (c) of DEF STAN 02-313)}.

(c) In **both the above two instances,** the **speed is to return to** and **remain within 1 percent of the final steady** state speed **in not more than 2 seconds** from the instant of the load change {(Para 4.5 (a) (8) of DEF STAN 08-142}.

5. **Turbocharged Engines with Mechanical Governor**

(a) Momentary change of speed is **not to exceed 10% of the nominal speed for 100% load decrease** i.e. full-load to no load {(Para J to 10.3 (b) of DEF STAN 02-313)}.

(b) Momentary change of speed is **not to exceed 10% of the nominal for a maximum** load **increase of 70% load** {(Para J to 10.3 (c) of DEF STAN 02-313)}.

6. **Non Turbocharged Engines with Electronic Governor**

(a) Momentary change of speed is **not to exceed 5% of** the nominalspeed for 100% load decrease **i.e. full-load to no load and the speed is to return to and remain within 0.2% of the final steady** state speed **in not more than two seconds** from the instant of load change {(Para J to 10.4 (d) of DEF STAN 02-313)}.

(b) Momentary change of **speed is not to exceed 5% of the nominal speed for 100% load increase** and the**speed is to return to and remain within 0.2% of the final steady state** speed **in not more than two seconds** from the instant of load change {(Para J to 10.4 (d) of DEF STAN 02-313)}.

7. **Turbocharged Engines with Electronic Governor**

(a) Momentary change of speed is not to **exceed 5% of the nominal speed for 100% load decrease** i.e. full-load to no load and the speed is to return to and remain within 0.2% of the final steady state speed **in not more** than two seconds from the instant of load change {(Para J to 10.4 (d) of DEF STAN 02-313)}.

(b) Momentary change of **speed is not to exceed 10% of the nominal** speed for a **maximum load increase of 70% and the speed is to return to** and remain **within 0.2%** of the final steady state speed in **not more than two seconds** from the instant of load change {(Para J to 10.4 (d) of DEF STAN 02-313)} and {(Para 4.5 (a) (8) of DEF STAN 08-142)}

8. The electrical trials for other performance parameters of DAs will be carried out as hitherto as per the requirements specified in DEF STAN 08-142.

9. In view of the above, it is clarified that all trials will conform to requirements at para 2 above for the maximum permissible load “Throw-On”” / “Throw-Off”. It is

requested that these clarifications be also communicated to all other electrical trials agencies.

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EE/03/9711/Power Policy 11 May 16

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MODIFIED 230 VOLT DOMESTIC SUPPLY SCHEME

1. Refer to IHQ MoD(N)/DEE letter EE/03/9712 dated 30 Aug 06.

2. **Background**. The single phase 230V domestic supplies onboard ***IN*** ships are drawn from the primary 415V/380V/440V, 3 phase, 3 wire system with a floating neutral. The aim of the 3-wire system being to ensure the continued operation of systems/ equipment even under conditions of line-to-earth (hull) fault in one of its phases. This supply configuration, however, contradicts the requirement of safety in case of COTs and domestic equipment.

3. A study was undertaken by DEE to examine in detail the 230V domestic supply scheme in conjunction with the relevant Naval Engineering Standard NES 539 (Guide to the Design of Supply System for Portable Electrical Equipment) considering the safety aspects of domestic supply. Details of technical requirements for 230V, 4 wire transformer has already been enumerated in EED-50-16 and EED-50-17 promulgated by IHQ MoD(N)/DEE.

4. **Implementation**. The enhancement of safety aspects onboard ships with respect to the 230V, single phase domestic supplies to be carried out in following manner: -

For New Construction Ships

(a) All new construction platforms to be installed with 415/380/440V, 3 phase, 3 wire to 230V, 3 phase, 4 wire transformer and double pole MCBs iaw EED-50-16 and EED-50-17 respectively.

(b) As the domestic 230V supply systems are not mission critical, additional safety in the form of Earth Leakage Current Breakers (ELCBs) be also installed for domestic equipment. The ELCBs will ensure tripping of the supplies in case of detection of a leakage current.

Existing Platforms

(c) Replacement of single pole commercial switches with double pole MCB which may be implemented during AMPs/refits on progressive basis.

(d) As and As to install 415/380/440V, 3 phase, 3 wire to 230V, 3 phase, 4 wire transformer to cater for domestic supply circuits, i.a.w. EED-50-16 be implemented during refits. Fitment of ELCBs be also undertaken as part of As and As.

5. **Recommendations**. In view of the above, following is recommended:-

(a) Incorporation of a 4 wire 230V system on all platforms as per Para 3 above.

(b) Information contained in this letter be disseminated to all units and shipyards.

(c) IHQ MoD(N) letter at Para 1 above is superseded.

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EE/03/9707/Power Policy/III 01 Jul 16

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POLICY ON INDUCTION OF CABLE GLANDS FOR *IN* SHIPS

1. **Background**. Electrical cables form the lifeline towards ensuring the availability of ships equipment and services. During construction of the ship, the cables are laid across its length and breadth with due attention to aspects of battle damage survivability, redundancy, growth potential and maintenance of gas and water tight integrity. Towards this, the cables that run from one compartment to another are required to be passed through suitable cable glands.

2. **Cable Glands**. Presently, *IN* ships employ cable glands of varying geometrical shapes and dimensions to permit routing of a number of cables through openings. After routing of the bunch of cables, the gaps between the cables and sides of the opening are filled with chemical compounds to provide necessary sealing. However, such filling are prone to developing cracks in the vibration and shock prone environment of a ship. Further, for utilising an existing sealed cable gland, its sealing needs to be removed. This often physically damages the insulation of earlier cables, as the sealing compound does not lend itself for easy removal. Apart from this, the entire process is labour intensive necessitating a more modular

approach to design of the cable glands, which would permit removal of any existing cable and routing of a new cable with considerable ease.

3. **Multiple Cable Transit (MCT) Glands**. IHQ MoD(N)/DEE had carried out a market/technical survey of available products with a view to identifying suitable glands for their modularity, ease in installation, re-configurability etc. The MCT glands, which cater for standard set of cable penetrations, are provided with corresponding precisely manufactured modules of two types viz, cable holding and filling modules. These modules are inserted in the gland to either hold the cable routed through them or to blank an opening left unused. In fact no chemical compounds are used to seal the MCT glands.

4. **Features of MCT Glands**. The salient features of the MCT Glands are as follows: -

(a) MCT glands are available in different frame sizes depending on the number of cables and the diameters of cables, it is required to house.

(b) The frames are normally made of ST37 graded steel and are also available in aluminum, stainless, high strength, or non-magnetic steel. Different types of frames are manufactured to suit different installation conditions such as confined spaces, reduced access and high mechanical strain areas.

(c) The frames are supplied with modules for both cable holding and filling purposes.

(d) The above modules are made of halogen free material. Modules are flexible and cavities can be obviated with application of pressure by insertion of additional modules having screw facility to render gas tightness to 0.3 bar and water tightness up to 4 bar.

(e) The modules also ensure an optimal EMI/ EMC shielding within a large frequency band. Any Electromagnetic Interference that occurs on the cable sheath is prevented from passing through the packing system.

(f) The modules packing the MCT frames can be easily reconfigured for passing additional cables by replacing the filling modules with cable holding modules. This process can be easily completed in a short time.

5. It may be seen that MCT Glands offer modularity, high quality sealing, ease in installation and ship shape appearance as compared to conventional methods of sealing using sleeves and filling compound. A comparison of MCT features vis-à-vis those of conventional system is placed at **Enclosure-I**. In addition, photographs of standard frames and modules are placed at **Enclosure-II** for ready reference.

6. EMI/ EMC compliant block type MCT Glands/ conductive sealant compound are required to be used for CAT-A compartments.

7. However, at places where cables are to be laid for equipment located on the weather deck or exposed areas which require weather deck penetration, use of a

pipe gland is recommended. A diagrammatic representation of pipe gland is placed at **Enclosure-III**.

8. Usage of MCT glands or pipe glands is not always feasible, especially in constricted spaces like Engine Room, Boiler Room, Pump Rooms etc. In such cases, for new construction ships, shipyards are to approach respective WOTs for inspection of the area. Respective WOTs will inspect the constricted space and recommend alternative procedure like cable coaming with sealing compound/ cable coaming with re-usable transit material or any other suitable procedure depending on the requirement as deemed fit. A diagrammatic representation of usage of suitable filling compounds is placed at **Enclosure-IV**. During the commissioning of the ship, a record of usage of type of gland used at all the locations in the ship has to be made by the shipyard and made available to the ship staff. Any alteration to the document is to be duly recorded by the ship staff.

9. **List of Vendors**. The MCT glands have been categorised as Cat C item and therefore can be procured through any reputed vendor. However, following vendors can also be approached for procurement of MCT glands:-

(a) M/s Wallmax, India, R-77A, Greater Kailash, Part-I, New Delhi-110048

(b) M/s Elcome Integrated Pvt Ltd, Great Eastern Summit A, 11th Floor, Plot No. 56, Sector-15, CBD Belapur, Navi Mumbai-400614.

(c) M/s MCT Brathberg India Pvt Ltd, 40/56, CR Park, New Delhi-110019.

(d) M/s Roxtec India Ltd, D-65, Udyog Vihar, Phase VI, Gurgaon.

9. **Induction Policy**. In view of the advantages offered by MCT Gland systems, over conventional schemes, the following policy is promulgated for *IN* ships: -

(a) The induction of MCT glands is to be continued onboard new construction ships.

(b) MCT glands can be used on existing ships if new bulkhead/ deckhead penetration is required to meet the need for installing additional equipment or for re-cabling.

(c) However, for weather deck (deck to deck) penetrations, pipe glands may be used.

(d) In case of constricted/ congested space, following agencies will decide on type of cable glands to be used:-

(i) WOT for ships under construction.

(ii) MMT for ships under MR-MLU.

(iii) Board proceedings approval authority (As & As) for all other ships.

11. **Recommendation**.

(a) Information contained in this letter be disseminated to all units and shipyards.

(b) Comments/ feedback if any be forwarded to Integrated Headquarters, Ministry of Defence (Navy)/ DEE.

(c) This policy letter supercedes this Directorate letter EF/ POLICY/ L-35/ POWER-11 dated 14 Jul 05.

(d) DND and DSP are requested to disseminate the contents of this policy letter to shipyards.

(C Raghuram)
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Principal Director
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Encl: As above.

Enclosure-I to IHQ MoD(N)/DEE letter EE/03/9707/Power Policy/III dated 01 Jul 16

COMPARISON OF MCT, COMPOUND AND SLEEVES PACKING SYSTEM

1. A comparison of the MCT Glands, Sleeve and Compound packing systems is tabulated below: -

Features	**MCT**	**Sleeves**	**Filling Compound**
Depth of the Frame	Minimum frame depth is approx. 60 mm.	Longer frames of size approx 200 mm	Longer frames of size that will be more than 200 mm
Separation between the cables	Min distance is approx 4 mm	The thickness of the sleeves defines the distance	Distance is difficult to control and in most of the cases it is practically nil
Quality of sealing	Precisely manufactured modules ensure high reliability of the frames	Quality dependent on the thickness of sealing and the temperature at which it is prepared	Quality dependent on the mix of water and powder, and the temperature at which it is prepared.
Appearance	No left over and very clean installation	The putty spreads over the sleeves	The filling compound spreads over sleeve
Reconfigurability	Very easy and fast to open, only normal spanner is required.	Slightly difficult to open, tools required, takes more time.	Very difficult to reopen, heavy duty tools required, time consuming.
Efforts of installation	Single side assembly, no need of help from the other side.	Assembly from both sides of bulkhead	Assembly from both sides of bulkhead.
Time for completion of packing the gland	Ready for use after tightening of the sealing wedge	The *putty* needs couple of days to harden	The compound needs 2-3 days to harden.

Enclosure-II to IHQ MoD(N)/DEE letter EE/03/9707/Power Policy/III dated 01 Jul 16

MCT FRAMES AND MODULES

1. The MCT cable glands use frames of varying size depending on the number of cables, cable diameter, and place of installation. The frame is packed with modules of different sizes for holding the cables. The pictures of the frames and modules with brief description is given below: -

(a) **Standard Frame**. These frames (Fig 1) are recommended when there are large numbers of cables on the rack and the penetration is to be done in the bulkhead/ deck head that will face high mechanical strength.

Fig 1- Photographs of Standard Frames

(b) **Round Penetrations**. These frames (Fig 2) are recommended when there are small or midsized quantities of cable on the cable rack. This frame with ring shaped sealing elements allows a better adjustment to variations in cable outer diameter dimensions.

Fig 2- Photographs of Round Penetrations

(c) **Modules**. Cables are packed between suitable modules (Fig 3) wherein 2 pieces are needed for each cable. The empty space within the frame is filled with 'filling' modules. The modules are flexible that they seal all the cavities that might remain, when pressure is applied by the use of compression plate.

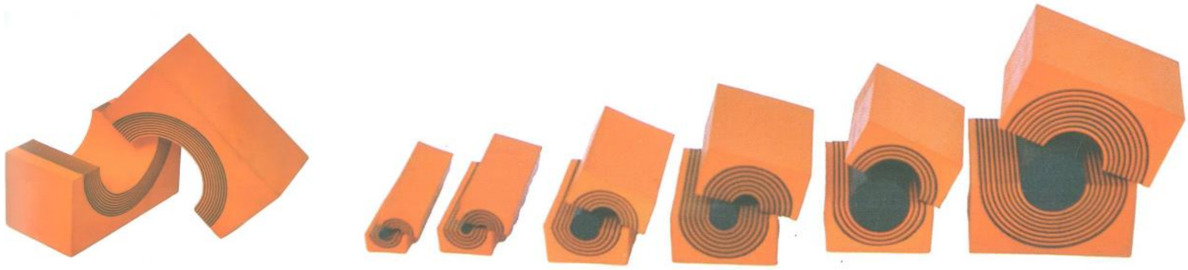


Fig 3- Photographs of modules

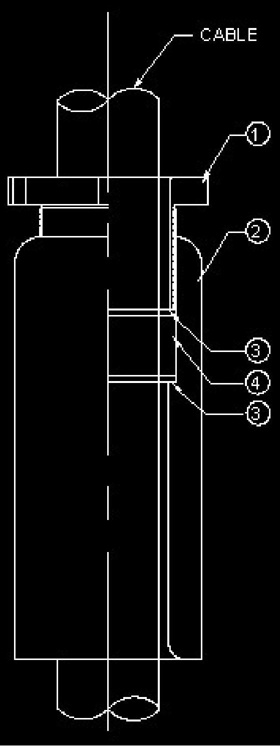
2. A typical implementation with MCD glands is shown in Figure 4.

Fig 4 Typical Implementation with MCD Glands

Enclosure-III to IHQ MoD(N)/DEE letter EE/03/9707/Power Policy/III dated 01Jul 16

1. The method of implementation of pipe with a gland is depicted in Figure 1.

FIGURE



NO.	NAME	QTY	MATERIAL	FINISH	REMARKS
1	GLAND	1	BRASS		ORDINARY GLAND TOP.
2	BODY	1	STEEL PIPE	GALVANIZED	IS-1239
3	WASHER	2	STEEL		
4	GASKET	1	NEOPRINE		

Enclosure-IVto IHQ MoD(N)/DEE letter EE/03/9707/Power Policy/III dated 01 Jul 16

1. **Cable Coaming with Re-usable Transit Material**. Cable transits in gas tight/ water tight/ fire resistant bulkheads/ decks/ constricted spaces where cables are expected to be laid in future are filled with re-usable transit material like RISE. These materials have to be class approved for gas tight/ water tight integrity and have to be fire retardant. Photographic depiction is given in Figure-1.

Fig 1 Implementation Re-usable Transit Material

2. **Cable Coaming with Sealing Compound**. Alternatively, cable coamings can also be filled with pourable material. Filling material has to be class approved sealing compound or putty so as to withstand fire and maintain gas tight /water tight integrity.

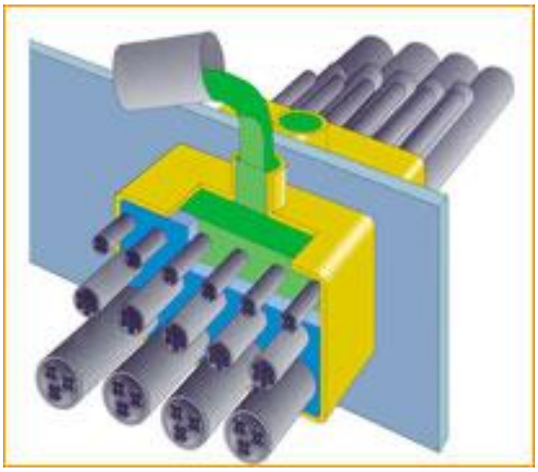


Fig 2- Implementation of Pourable sealing Compound

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PROCUREMENT OF MOTORS AND STARTERS

1. **Introduction**. Specifications for motors and starters to be installed onboard *IN* ships have been stipulated in IHQ MoD(N)/DEE promulgated EED Q 071 (R3). The said document lists out various protections which need to be incorporated in the starter/ control design so as to ensure safety of the motor. However, in the recent past, a number of motor failures onboard newly commissioned *IN* ships have occurred and their analysis has revealed that these failures could have been prevented if the protections s envisaged in EED Q 071 (R3) been implemented in totality.

2. **Procurement of Motors & Starters**. As per the practice in vogue, the procurement agency places composite order for an engineering system like AC plat, ref plant, firemain system etc on the system manufacturer. The system manufacturer in turn procures motors and starters independently from IHQ MoD(N) approved vendors and integrate them with the main system control circuitry. Therefore the

engineering system OEM, by deault becomes the system integrator including motor and starter. This invariably becomes and involved and complicated affair especially with soft starters where the starter needs to be calibrated and settings frozen.

3. **System Factory Acceptance Trials (FATs)**. The system FATs are required to be undertaken at system manufacturer premises after integrating system components including electrical control system with the motor and its starter. However, during FATs, integrated trials of motor and starter is a grey area as motor-starters trials do not form part of main system FATs. In case the said integrated motor-starter trial is not undertaken, the efficacy of all the motor protections incorporated in the starter can not be established. The problem is further compounded by the fact that the motors and starters are not procured through same supplier which leads to separate testing/ trials of motors thereby leaving the motor-starter integration a vacuum in the whole process.

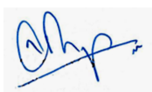
4. **Composite Motor Starter Procurement**. To obviate the problems highlighted at Para 3 above, it is imperative that the motor manufacturer takes the complete responsibility of integrating and calibrating the motor with the intended starter. Towards this end, the system manufacturers are required to procure motor and its starter through a single source, i.e., the motor manufacturer. The motor manufacturer in turn will procure required starter through IHQ MoD(N)/DEE approved vendor and will integrate the motor starter, as well as conduct its calibration and freeze its settings. Further, ensuring completion of starter motor integrated trials and implementation of all required protections will then be the responsibility of the motor manufacturer. In addition, during system FATs, the relevant documents with regards to conduct of starter motor integrated trials will also be required to be checked by the FATs team.

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

(a) For an engineering system like AC plant, ref plat, firemain etc, the system manufacturer be directed to procure motor along with the starters as specified at Para 4 above.

(b) For independent motor procurement along with the starter, composite order for procurement of motor and starter be placed on the motor manufacturer who in turn will procure the starter through IH MoD approved vendor.

(c) In case of independent motor or starter procurement as retrofit, the procurement agency to continue procurement of motor/starter through respective IHQ MOD(N) approved vendor as per the existing procedure.



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PROLIFERATION OF UPS BACK-UP SUPPLY ONBOARD SHIPS

1. **Background**. The requirement of providing UPS for various equipment/ systems onboard has been stipulated in various formats in International Standards. Besides provisioning of *normal and alternate* supplies for all critical systems onboard through ACOS/ HCOS, ships are also being fitted with Automated Power Management System (APMS) which provides high reliability in power management and distribution onboard ships and therefore the possibility of a '*Black Out'* onboard ships would be minimal. However, large number of *processor based systems, viz.* IPMS, IBS, CMS, SDN etc, comprising of embedded software, are sensitive to power fluctuations and therefore require Uninterrupted Power Supply (UPS) for optimal performance. In addition to these systems, all SOLAS equipment and critical navigational/ safety equipment also require UPS as per extant stipulations.

2. **Uninterrupted Power Supply (UPS)**. An UPS supplies energy stored in the batteries to the equipment during input power supply interruptions. The 'on-battery' runtime of UPS is relatively short (few minutes) but sufficient to start the standby

power source or properly shut down the protected equipment. The following three types of UPS are used onboard ships: -

(a) **24V DC Battery Backup**. This UPS arrangement is provisioned at an intermediate position of the power supply chain for equipment. Most of the equipment in modern day electronics work on '*Switch-Mode Power Supplies'* (SMPS) which convert the AC supply from the mains into 24V DC and have DC-DC converters for further energising the electronic circuits. The batteries are connected in parallel to the equipment in-built rectifier and are always in float/ trickle charging mode as long as the AC input supply from the mains is available. Batteries power the equipment only when there is no output from in-built rectifier owing to failure of AC supply from the mains or when a defect occurs in the in-built rectifier. The battery backup provides the advantage of avoiding an extra inverter circuit as found in the case of COTS Online/ Offline UPS. Battery backup arrangement has the best compliance to EMI/ EMC requirements as it does not entail any switching device and effects seamless change of power source from mains to batteries (connected in parallel to the output of in-built rectifier of the equipment). *The battery backup is therefore the most preferred UPS arrangement subject to the equipment design catering for the same.*

(b) **Online UPS**. This UPS arrangement accepts AC input, rectifies it and then inverts it to power-up the protected equipment. The batteries are always connected to the invertor, so no power transfer switches are necessary. It is used for powering-up equipment which is sensitive to power fluctuations and in an event of power interruption, prone to software corruption and where having DC battery backup is not technically feasible.

(c) **Off-line UPS**. In off-line UPS, the equipment is powered directly from the input power and back-up power circuitry is invoked only when the utility power fails. The Off-line UPS is to be used where having DC battery backup is not technically feasible or the equipment can tolerate 'brownout'

for a limited duration (usually in milli-sec) corresponding to time for switching in of the UPS as alternate source of supply to the equipment.

3. **Requirement of UPS**. The requirement of a UPS for a particular system is based on recommendations from the OEM, Design Feedback Reviews etc. However, in the recent past, it has been observed that, a large number of UPS are being installed onboard ships during their construction phase and in even post commissioning to meet the requirement of continuous availability of supplies to certain equipment onboard, primarily due to *operational* reasons or for providing *additional redundancy* to various equipment which range from critical to even non-

essential equipment. This has led to excessive proliferation of UPS onboard. Further, the various UPS fitted onboard are of different make, design, specification and dimension, thus making *maintenance, logistic support and monitoring* the performance of these UPS a daunting task for SS. Requirement of such large number of UPS onboard, therefore, merits re-assessment and strict implementation of suitable measures to contain their proliferation. Further, UPS is also a major source of EMI onboard ships. Hence, there is a need to holistically examine the requirement of UPS onboard *IN* ships.

4. **Proliferation of UPS**. The issue of proliferation of UPS onboard ships has been deliberated at length at IHQ MoD(N). Considering the requirement of uninterrupted power supply for systems critical for navigation and safety onboard all ships in commission as well as ships under construction, the usage of UPS under following conditions only is considered necessary:-

(a) Processor based systems which are sensitive to power supply fluctuations and require graceful shutdown.

(b) Where the UPS is mandated as part of the main equipment and supplied by the OEM.

(c) Critical equipment related to safe operation and safety of men/ material onboard ships, as per SOLAS recommendations.

5. Towards containing the proliferation of UPS back-up supply onboard *IN* ships and based on the requirement brought out at Para 3 and 4 above, following was deliberated by the directorate: -

(a) Comparative study on advantages/ disadvantages of **Centralised UPS** vis-à-vis **Distributed UPS**.

(b) Development of Ruggedised UPS for usage onboard *IN* ships.

6. **Comparative Study**. A comparative study on advantages/ disadvantages of Centralised UPS vis-à-vis Distributed UPS was undertaken based on system/ equipment layout, power supply distribution onboard and operation/ maintenance philosophy practiced onboard *IN* ships. Comparative table is placed at Encl 1 for detailed reference. Based on the study, it has emerged that **Distributed UPS configuration** has distinct advantages over **Centralised UPS architecture** and is therefore recommended for usage onboard IN Ships. The following aspects favour distributed UPS configuration:-

(a) Size

(b) Reparability

(c) Redundancy

(d) Voltage drop

(e) Responsibility onboard ships

(f) Feasibility of implementation onboard existing ships/ new construction ships

7. **Development of Ruggedised UPS**. Since, requirement of uninterrupted power supply for systems is considered critical and unavoidable, the subject policy envisages induction of Ruggedised UPS onboard ships. Accordingly, development of indigenous Ruggedised UPS has been taken up by IHQ/DEE with several competent firms. The trials of first indigenously developed, 2 KVA prototype UPS by M/s Keltron is scheduled in Feb 17. Further, in order to expand vendor base, M/s Marine Electrical and M/s PPP have also been tasked to develop Ruggedised UPS for ship based systems. The induction of Ruggedised UPS would be undertaken post completion of successful trials.

8. **Marinised UPS**. In the interim, for all future requirements (prior Ruggedised UPS is ready for induction), installation of marinised UPS is required to be undertaken onboard *IN* Ships in accordance with specifications laid down by *'International Association of Classification Societies' and 'IEC 62040-1:2008 (and subsequent revisions issued by IEC hereinafter).* A brief summary of the requirements of marinised UPS is placed at Encl 2. It is highlighted that the exploitation of existing UPS onboard *IN* Ships is to be continued as hitherto and replacement would be undertaken post completion of successful trials of indigenously developed Ruggedised UPS.

9. **List of Equipment with UPS**. Post deliberation with the user Directorates and Commands, classification of equipment based on their role w.r.t safety, navigation and operational scenarios was undertaken. The list of equipment which may therefore require UPS are listed below: -

Ser	Equipment	Type of UPS
(a)	Navigational lights and NLCP	Offline/ 24V DC battery backup
(b)	Telephone Exchange	
(c)	Main Broadcast	
(d)	Conning and Machinery Intercom	
(e)	Emergency lighting	
(f)	Two Communication Sets (Below 1KW)	
(g)	Flood and Fire Alarm Systems	

Ser	Equipment	Type of UPS
(h)	Gyro and DDU	Online/ 24V DC battery backup
(j)	GPS/ AIS/ VDR/ DAT Recorder/ ECDIS	
(k)	Machinery Control and Indication supplies	
(l)	MDA/ MSS Tx/ Rx	
(m)	GMDSS (MMB set)	
(n)	Steering Controls and Indications	
(p)	One Nav COTS Radar (with least blind arc)	
(q)	Echo Sounder and Log	
(r)	Rukmani/ INMARSAT/ ECL Beacon	
(s)	All other processor based networked/ standalone systems and weapon systems where UPS is supplied as part of main equipment (by the OEM).	Online/ Offline/ 24V DC battery backup (Rec of OEM)

10. Other than the above equipment, there are various other equipment onboard ships that are also provided with UPS such as LAN, PCs and certain processor based COTS equipment.

11. **Maintenance**. The following maintenance philosophy is to be followed in respect of UPS installed onboard ships: -

(a) Indigenous UPS. The maintenance will be undertaken through a Comprehensive AMC with the OEM. As part of the envisaged scope of the CAMC, the OEM will be responsible to stock the required spares to fulfil the service conditions of the CAMC. Towards this, respective Commands are required to conclude CAMC under delegated financial powers. At sea, SS will undertake maintenance routines as promulgated by the OEM.

(b) Foreign Origin UPS. In respect of UPS, for which CAMC is not possible, the maintenance routines advised by the OEM/as per maintops will be undertaken by the SS and DI/ DR will be undertaken with assistance of the Yard and also by means of offloading DR to local competent firm.

12. In view of the foregoing following are requested: -

(a) Information contained in this letter be disseminated to all units.

(b) Comments/ feedback, if any, be forwarded to Integrated Headquarters, Ministry of Defence (Navy)/ DEE by end Feb 17.

(C Raghuram)
Commodore
Principal Director
Directorate of Electrical Engineering

Copy to:-

The Admiral Superintendent
{for AGM (L)/DGM(MAT)}
Naval Dockyard
Mumbai

The Admiral Superintendent
{for DGM (L)/DGM(MAT)}
Naval Dockyard
Visakhapatnam

The Material Superintendent
Material Organisation (for CMP)
Ghatkopar
Mumbai

The Material Superintendent
Material Organisation (for CMP)
c/o Fleet Mail Office
Visakhapatnam

The Material Superintendent
Material Organisation (for CMP)
c/o Fleet Mail Office
Kochi

The Material Superintendent
Material Organisation (for CMP)
c/o Navy Office
Naval Base
Karwar- 581308

The Flag Officer Sea Training
(SO(L))
Headquarters FOST
c/o Fleet Mail Office
Kochi

The Admiral Superintendent
Naval Ship Repair Yard
Naval Base, Kochi 682004

The Commodore Superintendent

Naval Ship Repair Yard
Post Box No. 705, Haddo (Post)
Port Blair – 744102, A&N Islands

The Commodore Superintendent
Naval Ship Repair Yard
C/o Navy Office
Naval Base, Karwar-581308

The Director
NEC (Mbi)
c/o Fleet Mail Office
Mumbai – 400001

The Director ETMA (Mbi)
c/o Fleet Mail Office
Mumbai – 400001

Internal: -

PDSR **PDNS** **PDWE** **PDME** **PDIT** **PDND** **PDSP**

TA/ COM

ACOM(IT&S)

For information

Enclosure 1 to IHQ MoD(N) /DEE letter EE/03/9711 dated 24 Jan 17

ADVANTAGES OF DISTRIBUTED UPS OVER CENTRALISED UPS

Ser	**Description**	**Distributed UPS**	**Centralised UPS**
1.	Size	Small size based on equipment/system requirement	Larger UPS size necessitating dedicated compartment to house the UPS
2.	Repairability	The User equipment would be affected incase of DI/DR of UPS	Several ship's critical system would be affected during DI/DR
3.	Maintainability	Less maintenance since small in size	More maintenance since large in size
4.	Safety	Less fire hazards	Increase fire hazard risk due to more number of batteries
5.	Voltage Drop	Less/ minimal/ negligible voltage drop/ loss view adjacent/co-location of UPS and consumer	Voltage loss/ drop view increased cabling requirement for various consumers
6.	Redundancy	The ship's normal supply would be the reserve power supply.	Need to design an alternate/ redundant Central UPS incase of failure
7.	Heat Load	Less heat load	Large heat load
8.	Cabling	Reduced cabling	Increased cabling
9.	Gland piercing	Decreased/Nil gland piercing	Increased gland piercing. May affect WT integrity onboard
10.	Maintenance	Distributed maintenance load as the concerned system maintainer would repair/ maintain the UPS	Watch Keeping required akin to submarines.
11.	Responsibility		Single point responsibility. A separate team required for maintenance

Enclosure 2 to IHQ MoD(N) /DEE letter EE/03/9711 dated 24 Jan 17

REQUIREMENTS FOR UNINTERRUPTED POWER SUPPLY SYSTEM

Design and Construction

1. UPS units are to be constructed in accordance with IEC 62040-1:2008 *(and subsequent revisions issued by IEC hereinafter)*.

2. The type of UPS unit employed, whether off-line or on-line, is to be appropriate to the power supply requirements of the connected load equipment.

3. The UPS unit is to be monitored and audible and visual alarm is to be given in a normally attended location for the following: -

   (a) Power supply failure (voltage and frequency) to the connected load.

   (b) Earth fault.

   (c) Operation of battery protective device.

   (d) When the battery is being discharged.

   (e) When the bypass is in operation for on-line UPS units.

Testing

4. Appropriate testing is to be carried out to demonstrate that the UPS unit is suitable for its intended environment. This is expected to include as a minimum the following tests: -

   (a) Functionality, including operation of alarms.
   (b) Temperature rise.
   (c) Ventilation rate.
   (d) Battery capacity.

5. Where the supply is to be maintained without a break following a power input failure, this is to be verified after installation by practical test.

Performance

6. The output power is to be maintained for the duration required for the connected equipment.

7. No additional circuits are to be connected to the UPS unit without verification that the UPS unit has adequate capacity. The UPS battery capacity is, at all times, to be capable of supplying the designated loads for the time specified in the regulations.

8. On restoration of the input power, the rating of the charge unit shall be sufficient to recharge the batteries while maintaining the output supply to the load equipment.

Precaution

9. Storage batteries shall be so designed that they retain their rated capacity at inclinations of up to 22.5^0, and no electrolyte leaks at inclinations of up to 40^0. Cells without covers are not allowed.

10. The weight of the greatest transportable unit shall not exceed 100 kg.

11. Storage batteries shall be maintained and operated in accordance with the manufacturer's instructions.

12. Charging equipment shall be so rated that discharged storage batteries can be charged to 80% of their rated capacity within a period not greater than 10 hours without exceeding the maximum permissible charging currents.

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Dte of Electrical Engineering
New Delhi – 110011

EE/POLICY/L-10/NAV-02

05 May 16

The Flag officer Commanding-in-Chief
(for CLO)
Headquarters Eastern Naval Command
Visakhapatnam-530 014

The Flag officer Commanding-in-Chief
(for CLO)
Headquarters Western Naval Command
Mumbai-400 023

The Flag officer Commanding-in-Chief
(for CLO)
Headquarters Southern Naval Command
Kochi-682 004

The Commander-in-Chief
(for CTO (Marine))
HQ ANC
Port Blair-744 101

MAINTENANCE GUIDELINES FOR KELTRON MAKE: ECHO SOUNDER AND LOG

1. Refer to IHQ MoD(N) letter EE/POLICY/L-09/NAV-01 and EE/POLICY/L-10/NAV-01 both dated 16 Feb 05.

2. **Background**. This letter pertains to the maintenance guidelines for the indigenously developed M/s Keltron, Thiruvananthapuram make Echo Sounder (Single and Dual Channel) and Log which have been installed onboard various *IN* ships and submarines in large numbers. These are being installed on all new construction ships and are also being retrofitted onboard existing ships during their ongoing refits/MLUs.

3. **Repair Facility**. Repair/Reference setup of the systems have been installed at ND(MB), ND(V) and NSRY (PB) and are used for repairs of the Echo sounder and Log up to LRU level. Sufficient training and expertise have been developed by yard personnel on these equipment.

4. **Training**. Training Reference systems have been installed at INS Valsura and ND Scholl to facilitate periodic training of personnel.

5. **Documentation**. The documents of Echo Sounder and Log have been have been promulgated and issued under following INBR series:-

(a) Keltron Echo Sounder - 2651 Series

(b) Keltron Log - 2650 Series

6. **Onboard and B&D Spares**. The OB and B&D spares for the systems have been supplied along with the equipment. The equipment is INCATed and demands for spares can be raised as required by the units.

7. **MAINTOPS**. The periodic routine maintenance of Echo Sounder and Log is required to be undertaken by SS/Dyd in accordance with the MAINTOPS promulgated for each class of ship.

8. **Onboard Maintenance (Level I & II).** Level I/II, involving periodic checks, monitoring of critical parameters and DI/DR up to PCB/Module level is required to be undertaken by the SS. Available OBS and technical documentation are to be utilized for the purpose. Assistance of the yards is to be obtained for fine-tuning of parameters in case considered beyond the capabilities of the SS.

9. **Ashore Maintenance (Level III and IV)**. Defects requiring repairs to PCBs/Modules, back-plane wiring / connectors and major STW/tuning are to be projected to the repair yards. The repair yards are to utilize the reference sets for carrying out the necessary defect analysis and repairs.

10. **Repairs by OEM**. In the event that the repairs of the equipment cannot be undertaken using in-house facilities due to non-availability of specific expertise or component level spares, the same are to be offloaded to M/s Keltron in accordance with procedure in vogue. M/s Keltron also has their local offices at Mumbai and Visakhapatnam with suitable technical staff.

11. **Replacement Policy**. Presently, Keltron Echo sounder ver 1.0, ver 2.0 and Log ver 1.0 have been declared obsolete by M/s Keltron and production of the same have been discontinued. The next generation Echo sounder i.e Ver 3.1 and Log Ver 3.0 have cleared UET and are the replacement for the obsolete systems. Installation of these equipment onboard certain *IN* ships has also commenced.

12. It is requested that:-

(a) Information contained in this letter be disseminated to all units.

(b) Comments / feedback, if any, be forwarded to IHQ MoD(N)/DEE by end Jun 16.

13. IHQ MoD (N) letter at Para 1 above is hereby superseded.

(C Raghuram)
Commodore
PDEE

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Telephone: 23011130

Integrated Headquarters
Ministry of Defence (Navy)
New Delhi 110 011

EE/POLICY/L-12/NAV-04

05 May 16

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters Western Naval Command
Mumbai . 400 023

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters Eastern Naval Command
Visakhapatnam . 530 014

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters Southern Naval Command
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The Commander-in-Chief
(for CTO(Marine))
HQ ANC
Port Blair - 744 101

MAINTENANCE GUIDELINES: GYRO STD 20/22M AND RLG SIGMA 40

1. Refer to IHQ MoD (N) letter EE/POLICY/L-11/NAV-03 and EE/POLICY/L-12/NAV-04 both dated 16 Feb 05.

2. **Background**. This letter pertains to the maintenance guidelines for Gyro STD 20/22M and RLG Sigma 40 onboard *IN* ships. Gyro STD 20M manufactured by M/s Raytheon and RLG Sigma 40 manufactured by M/s Sagem France have been installed onboard various platforms across the Navy. STD 20/22M has been inducted as the main Gyro for ships that do not require vertical reference data and as secondary gyro onboard ships requiring vertical references such as Talwar class, Teg class etc. RLG Sigma 40 provides navigational as well as vertical reference data and has been installed onboard Viraat, B-Class, G-Class, R-Class etc as replacement of old Gyro system and onboard P-15A, P-17, P-28 etc as initial fitment. RLG Sigma 40 was being supplied as an integral part of the BARAK and Brahmos Systems on various platforms.

3. **Repair Facility**. Repair Facilities for STD 20/22M as well as RLG Sigma 40 have been setup at ND(Mbi) and ND(Vzg) in 2012 and 2014 respectively. Presently, IHQ MoD(N) is progressing a case for STD 22M repair facility at NSRY(Kochi) and NSRY(PB), which are likely to be set up by end 2017 and 2018 respectively.

Expertise for repair / maintenance of both Gyro systems is available at Naval Dockyards.

4. **Maintainers Training**. Reference systems for training for both Gyros have been installed at INS Valsura. Initial maintainer training course was conducted by the OEM for Naval Dockyard personnel on the reference systems. Training of naval personnel is also being undertaken periodically at INS Valsura.

5. **Documentation**. Necessary documentation for operations and onboard maintenance have been contracted along with the equipment and supplied to ships. Technical documentation for Dockyard has been supplied along with the installed repair facility.

6. **Onboard and B & D Spares**. The OB and B&D spares have been supplied along with the equipment.

7. **MAINTOPS**. The periodic routine maintenance of STD 20/22M and RLG Sigma 40 is required to be undertaken by SS/Dockyard in accordance with the promulgated MAINTOPS.

8. **Maintenance Guidelines**. The repair, upkeep and maintenance of STD 20/22M Gyro and RLG Sigma 40 will be undertaken based on the following guidelines:-

(a) **Level I/II**. Level I/II, involving periodic checks, monitoring of critical parameters and DI/DR up to Module level is required to be undertaken by the SS. Available OBS and technical documentation are to be utilized for the purpose. Assistance of the yards is to be obtained for fine-tuning of the system in case considered beyond the capabilities of the SS.

(b) **Level III/IV**. Defects requiring repairs to PCBs/Modules, back-plane wiring / connectors and major STW/tuning are to be projected to the repair yards. The repair yards are to utilize the repair facilities for carrying out the necessary defect analysis and repairs. Repairs to lowest repairable Units (LRUs) by replacement of smallest repairable units (SRUs) where the LRUs cannot be opened by ships staff or require a special environment/special tools.

(c) **Repairs by OEM**. In the event that the repairs of the equipment cannot be undertaken in-house due to non-availability of specific facilities or component level spares, the same are to be offloaded to the OEM i.e M/s Raytheon/Sagem, in accordance with procedure in vogue.

9. It is requested that:-

(a) Information contained in this letter be disseminated to all units.

(b) Comments/feedback, if any, be forwarded to IHQ MoD(N)/DEE by end Jun 16.

10. IHQ MoD(N) letter at Para 1 above is hereby superseded.

(C Raghuram)
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PDEE

BACK TO INDEX

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EE/ POLICY/L-101/NAV/DDU-RLG

13 Jul 16

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters, Western Naval Command
Mumbai

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters, Eastern Naval Command
Vishakhapatnam

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters, Southern Naval Command
Kochi

The Commander-in-Chief
(for CTO (Marine))
Headquarters, Andaman and Nicobar Command
Port Blair-744101

CONFIGURATION AND MAINTENANCE OF DATA DISTRIBUTION UNITS (DDUs)

1. **Aim**. The aim of this policy letter is to highlight the salient aspects towards induction and installation of Data Distribution Units, developed indigenously, for re-transmission of gyro data onboard *IN* platforms.

Background

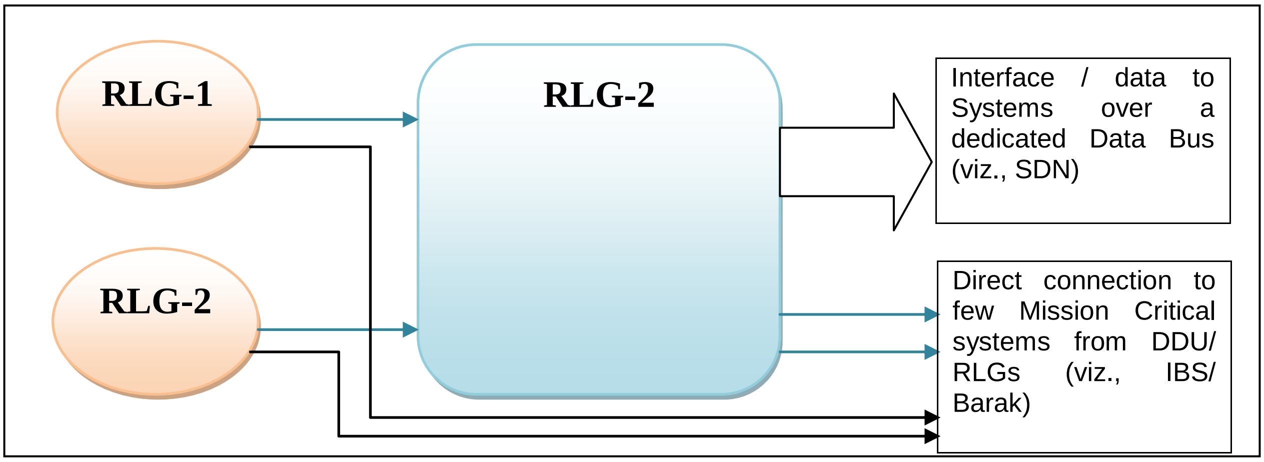
2. The conventional Gyros, based on mechanical rotating Gyrospheres, provided heading and stabilization data, typically, in the Synchro and Resolver formats. The output of the Gyro was thereafter fed to Re-Transmission Units (RTU) which transmitted the Ship's Course and stabilization information to various systems onboard. The RTUs were also capable of converting the Gyro heading data in different formats to meet requirement of various users onboard. Towards this, these servo-control based RTUs were provided with multiple voltages, viz., 24V DC, 115V/ 60 Hz as well as 115V/ 400Hz, so as to provide the azimuth data in the requisite format. Further, considering that majority of the *IN* platforms were equipped with two gyros, a '*Rotary Gyro Selection Switch (mechanical)*' was provided in the Gyro

compartment for manually selecting the input from either of the two gyro units thus providing redundancy in case of failure of any one gyro. Similar dedicated RTUs were also provided as part of the Vertical Gyro systems, Log and Wind Speed Data Systems, one for each of these systems.

3. With the induction of new generation Ring Laser based gyro systems like RLG Sigma-40 and INS-SA, both, Heading as well as Vertical Reference data, are available from a common Gyro. With majority of the new generation equipment fitted onboard *IN* platforms being based on digital electronics and combined with the installation of Ships Data Network (SDN) Systems onboard all platforms, the requirement of re-transmitting data from these advanced gyros was transformed to various Digital formats. Accordingly, this led to the replacement of the conventional analog RTUs with Data Distribution Unit (DDU). However, since some of the ships were equipped with legacy analog systems, there was a need for the new generation DDUs to transmit information in conventional Synchro Format as well, for which, suitable mechanisms for provisioning 115V / 400Hz supply needed to be factored in.

Design Aspects for New Generation Data Distribution Units

4. **Mission Critical and Non-Mission Critical Systems**. The DDU act as a point of interface between ships systems and RLGs. In order to meet the requirement of certain mission critical systems, requisite data is additionally provided directly from one/ two RLGs to such systems. For all other systems, the RLG data is provided from the RTU, either directly from the RTU or through the SDN system. A pictorial description of the basic configuration onboard *IN* ships is as depicted below:-



5. **Switching of Source**. The DDUs has an inbuilt switching mechanism to select the Gyro data from either of the two Gyros automatically as against the erstwhile manual mechanism. The automated switching ensures instantaneous changeover of source gyro in case of any failure thereby ensuring near seamless availability of Heading and stabilisation data for the various consumers.

6. **Power Supply for DDU**

(a) **Reference Supply**. The DDU requires 115V, 400Hz supply for transmission of data in analog (synchro) format. Non-availability of the 115V, 400 Hz supply may result in transmission of incorrect gyro data (synchro format) to the various end users. Towards obviating this, suitable audio/ visual alarm to the Gyro operator in the Gyro Compartment has been incorporated as a part of the DDU to indicate failure of the reference supply. However, re-transmission of gyro data in digital format will continue to be transmitted to the respective consumers without any interruption in such a scenario.

(b) **Internal Power Supply Modules**. Dual redundancy has also been built in terms of internal power supply arrangements to ensure no single point of failure. Further, towards ensuring seamless operation during changeover of main power supply, the power supply arrangement of the DDU also incorporates suitable UPS systems. The battery back-up of the UPS facilitates operation of the DDU for a duration of up to 30 minutes.

Redundancy in DDU Hardware

7. Considering the recent recommendations of FOST on the subject and the criticality of the gyro data, detailed analysis was undertaken regarding the requirement of fitting one/ two DDUs per ship. The two models which were assessed and the inherent advantages/ disadvantages are as enumerated below:-

(a) **Dual DDU Configuration**. A dual DDU configuration would necessitate fitment of an additional '*Intelligent Automatic Switching Unit*' at the output of the DDU for sensing the correct operation of both the units so as to facilitate switching the output from the defective DDU to the standby DDU for transmission of data to the SDN/ sink equipment. However, such a mechanism will in turn create a single point of failure at this '*Switching Unit'* thereby not effectively circumventing the purported issued of inadequate reliability of the DDU architecture.

(b) **Dual Distribution System for Individual Equipment**. Provisioning of inputs from two DDUs to each end user system would entail fitment of similar '*Intelligent Automatic Switching Unit'*on each of the sink systems resulting in hardware changes by respective hardware OEMs along with associated implementation issues. In addition, there would be an inescapable need to lay additional cables from the DDU/ SDN switches (as applicable) to each of the sink equipment, laid along physically separate routes (to obviate structural damages to ship sides) as well as multiple deck head/ bulkhead cable glands all along these routes. Further, failure of the Switching Unit will still result in non-availability of gyro data to the end equipment despite reliable operation of both, gyros and DDUs.

8. **Intra-DDU**. Based on the issues highlighted above, fitment of only a single DDU, per ship, is considered adequate onboard all *IN* platforms. However, to ensure that adequate redundancies are available within the DDUs, the internal hardware architecture has been re-designed so as to obviate any single point of failure. The

redundancy in design would address redundancy for both, the main processor module of the DDU itself as well as the line interface cards (on as required basis).

9. **Redundancy in Gyro Data Re-transmission**. ATM/ GbE based Ships Data Network has been installed on all new construction ships as well as on older platforms as part of the MR-MLU packages. The gyro data from DDU is connected to two different switches of the SDN system thereby ensuring high levels of redundancy in the re-transmission network. The usage of SDN system, with its highly redundant architecture, ensures reliable data even in the case of partial failure of the network due to any given reason.

Vendor Nomination

10. **Vendor Qualification**. Based on the high-level design of WESEE, DDUs have been productionised for various projects through the following vendors :-

(a) M/s Keltron
Special Product Group
Keltron Equipment Complex
Karakulam – 695664
Thiruvananthapuram, Kerala.
Fax: 0472 - 2888452

(b) M/s MEL Systems
Plot No 173, Developed Plots Estate for
Electrical, Electronics and Instrument Industries
Perungudi
Chennai – 600 096
Tamil Nadu
Fax: 044 - 24960488

(c) M/s Data Patterns
19, Arya Gowder Road,
West Mambalam,
Chennai – 600 003
Tamil Nadu
Fax: 044 – 24848703

Installation Plan for DDUs onboard *IN* Platform

11. While all new generation platforms are being fitted with a DDU as a *Buyer Nominated Equipment*,the existing ships/ projects on which the DDUs have been/ are being installed (along with their OEMs) is tabulated below:-

Ser	Installed Platforms	OEM
(a)	P-15A , P-28	M/s Data patterns
(b)	P-71	M/s MEL System
(c)	P-15, P-16A, Jalashwa, Ranvijay, Rajput,	M/s Keltron

Ranvir, Ranjit, Rana, Kirch, Karmuk, Kulish

Maintenance Philosophy

12. The maintenance of the DDUs is to be undertaken through AMC/ RRC under delegated financial powers at Command level. PAC certificates for the OEM are being processed at IHQ MoD(N).

Way Ahead

13. With an aim to standardise the equipment fit of DDUs onboard all platforms, following way ahead has emerged:-

(a) One DDU is required to be fitted on all platforms fitted/ planned to be fitted with RLG/ INS-SA systems.

(b) Considering that, the design of the DDU is based on the equipment fit onboard, the external interfaces will be based on the approved Interface Control Document (ICD), as promulgated by WESEE.

(c) Whilst an ICD for a platform undergoing MLU is already being promulgated by WESEE iaw extant policy, in case a DDU is planned for installation onboard a platform during any other type of refit, the ICD for DDU will be separately prepared by WESEE based on intimation by respective AAs.

(d) To maintain configuration control, procurement of DDUs for a particular class of ship is to be undertaken as a single order.

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

(a) **Administrative Authorities**

(i) Constitute Board of Officers for undertaking feasibility study, based on approved ICDs, towards fitment of DDUs onboard platforms nominated for fitment of RLG/ INS-SA.

(ii) Requirement of Life Cycle Support through AMC/ RRC is to be built in to the procurement contract.

(iii) Procurement of DDUs for a particular class of ship is to be preferably undertaken as a single order.

(b) **WESEE**. Forward ICDs and provide suitable assistance to AAs for progressing feasibility study for installation of DDUs onboard platforms and finalisation of DDU architecture.

(c) **WEDs**. Initiate procurement of DDUs from IHQ approved vendors indicated at Para 10 above, on as required basis.

(C Raghuram)
Commodore
PDEE

BACK TO INDEX

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Integrated Headquarters
Ministry of Defence (Navy)
Dte of Electrical Engineering
New Delhi – 110011

EE/ POLICY/L-101/NAV/DDU-RLG

27 Dec 16

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters, Western Naval Command
Mumbai

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters, Eastern Naval Command
Vishakhapatnam

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters, Southern Naval Command
Kochi

The Commander-in-Chief
(for CTO (Marine))
Headquarters, Andaman and Nicobar Command
Port Blair-744101

CONFIGURATION AND MAINTENANCE OF DATA DISTRIBUTION UNITS (DDUs) ONBOARD *IN* SHIPS

1. Refer to IHQ MoD(N)/DEE Policy letter EE/POLICY/L-101/NAV/DDU-RLG dated 13 Jul 16.

2. Based on the feedback / recommendations received from Command Headquarters, FOST and WESEE the policy letter on configuration / maintenance of DDUs has been reviewed. The revised policy is enunciated in the ensuing paragraphs.

3. **Aim** The aim of this policy letter is to highlight the salient aspects towards induction and installation of Data Distribution Units, developed indigenously, for re-transmission of gyro data onboard *IN* ships.

Background

4. The conventional Gyros, based on mechanical rotating Gyrospheres, provided heading and stabilization data, typically, in the Synchro and Resolver formats. The output of the Gyro was thereafter fed to Re-Transmission Units (RTU) which

transmitted the Ship’s Course and stabilization information to various systems onboard. The RTUs were also capable of converting the Gyro heading data in different formats to meet requirement of various users onboard. Towards this, these servo-control based RTUs were provided with multiple voltages, viz., 24V DC, 115V/ 60 Hz as well as 115V/ 400Hz, so as to provide the azimuth data in the requisite format. Further, considering that majority of the *IN* ships were equipped with two gyros, a ‘*Rotary Gyro Selection Switch (mechanical)*’ was provided in the Gyro compartment for manually selecting the input from either of the two gyro units thus providing redundancy in case of failure of any one gyro. Similar dedicated RTUs were also provided as part of the Vertical Gyro systems, Log and Wind Speed Data Systems, one for each of these systems.

5. With the induction of new generation Ring Laser based gyro systems like RLG Sigma-40 and INS-SA, both, Heading as well as Vertical Reference data, are available from a common Gyro. With majority of the new generation equipment fitted onboard *IN* ships being based on digital electronics and combined with the installation of Ships Data Network (SDN) Systems onboard all ships, the requirement of re-transmitting data from these advanced gyros was transformed to various Digital formats. Accordingly, this led to the replacement of the conventional analog RTUs with Data Distribution Unit (DDU). However, since some of the ships were equipped with legacy analog systems, there was a need for the new generation DDUs to transmit information in conventional Synchro Format as well, for which, suitable mechanisms for provisioning 115V / 400Hz supply needed to be factored in.

Design Aspects for New Generation Data Distribution Units

6. **Data Distribution**. The DDU acts as a point of interface between ships systems and RLGs. Safe to navigate and other mission critical systems are hardwired to DDU, in addition to being interfaced through the Ship Data Network (SDN) (wherever available).

7. **Switching of Source**. The DDUs has an inbuilt switching mechanism to select the Gyro data from either of the two Gyros automatically as against the erstwhile manual mechanism. The automated switching ensures instantaneous changeover of source gyro in case of any failure thereby ensuring near seamless availability of Heading and stabilisation data for the various consumers.

8. **Power Supply for DDU**

(a) **Reference Supply**. The DDU routes 115V, 400 Hz power supply from ship’s converter to RLG as reference supply for ‘Synchro Module’ inside RLG Sigma 40. In case of failure of 115V, 400 Hz supply the transmission of ‘synchro’ data from RLG stops. To alert the failure of 115V, 400 Hz supply audio/ visual alarm has been incorporated as part of DDU design.

(b) **UPS**. Towards ensuring seamless operation during changeover of main power supply, the power supply arrangement of the DDU also incorporates suitable UPS systems. The battery back-up of the UPS facilitates operation of the DDU for duration of up to 30 minutes.

Redundancy in DDU Hardware

9. Considering the recent recommendations of FOST on the subject and the criticality of the gyro data, detailed analysis was undertaken regarding the requirement of fitting one/ two DDUs per ship. The two models which were assessed and the inherent advantages/ disadvantages are as enumerated below:-

(a) **Dual DDU Configuration**. A dual DDU configuration would necessitate fitment of an additional '*Intelligent Automatic Switching Unit*' at the output of the DDU for sensing the correct operation of both the units so as to facilitate switching the output from the defective DDU to the standby DDU for transmission of data to the SDN/ sink equipment. However, such a mechanism will in turn create a single point of failure at this '*Switching Unit'* thereby not effectively circumventing the purported issued of inadequate reliability of the DDU architecture.

(b) **Dual Distribution System for Individual Equipment**. Provisioning of inputs from two DDUs to each end user system would entail fitment of similar '*Intelligent Automatic Switching Unit'* on each of the sink systems resulting in hardware changes by respective hardware OEMs along with associated implementation issues. In addition, there would be an inescapable need to lay additional cables from the DDU/ SDN switches (as applicable) to each of the sink equipment, laid along physically separate routes (to obviate structural damages to ship sides) as well as multiple deck head/ bulkhead cable glands all along these routes. Further, failure of the Switching Unit will still result in non-availability of gyro data to the end equipment despite reliable operation of both, gyros and DDUs.

10. **Redundancy in Gyro Data Re-transmission**. ATM/ GbE based Ships Data Network (SDN) has been installed on all new construction ships as well as on older *IN* ships as part of the MR-MLU packages. The gyro data from DDU is connected to two different switches of the SDN system thereby ensuring high levels of redundancy in the re-transmission network. The usage of SDN system, with its highly redundant architecture, ensures reliable data even in the case of partial failure of the network due to any given reason.

11. Based on the issues highlighted above, fitment of only a single DDU, per ship, is considered adequate onboard all *IN* ships.

Vendor Nomination

12. **Vendor Qualification**. Based on the high-level design of WESEE, DDUs have been productionised for various projects through the following vendors :-

(a) M/s Keltron
Special Product Group
Keltron Equipment Complex
Karakulam – 695664
Thiruvananthapuram, Kerala.
Fax: 0472 - 2888452

(b) M/s MEL Systems
Plot No 173, Developed Plots Estate for
Electrical, Electronics and Instrument Industries
Perungudi
Chennai – 600 096
Tamil Nadu
Fax: 044 - 24960488

(c) M/s Data Patterns
19, Arya Gowder Road,
West Mambalam,
Chennai – 600 003
Tamil Nadu
Fax: 044 – 24848703

Installation Plan for DDUs onboard *IN* Ships

13. While all new generation ships are being fitted with a DDU as a *Buyer Nominated Equipment*, the existing ships/ projects on which the DDUs have been/ are being installed (along with their OEMs) is tabulated below:-

Ser	Installed Ships	OEM
(a)	P-15A , P-28	M/s Data patterns
(b)	P-71	M/s MEL System
(c)	P-15, P-16A, Jalashwa, Ranvijay, Rajput, Ranvir, Ranjit, Rana, Kirch, Karmuk, Kulish	M/s Keltron

Maintenance Philosophy

14. The maintenance of the DDUs is to be undertaken through AMC/ RRC under delegated financial powers at Command level. PAC certificates for the OEM are being processed at IHQ MoD(N).

Way Ahead

15. With an aim to standardise the equipment fit of DDUs onboard all *IN* Ships, following way ahead has emerged:-

(a) One DDU is required to be fitted on all ships fitted/ planned to be fitted with RLG/ INS-SA systems.

(b) Considering that, the design of the DDU is based on the equipment fit onboard, the external interfaces will be based on the approved Interface Control Document (ICD), as promulgated by WESEE.

(c) Whilst an ICD for a ship undergoing MLU is already being promulgated by WESEE iaw extant policy, in case a DDU is planned for installation onboard a ship during any other type of refit, the ICD for DDU will be separately prepared by WESEE based on intimation by respective AAs.

(d) To maintain configuration control, procurement of DDUs for a particular class of ship is to be undertaken as a single order.

16. A separate policy letter will be issued to cover the life cycle support for DDU fitted onboard SSK submarines and NDIU fitted onboard EKM submarines.

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

(a) **Administrative Authorities**

(i) Constitute Board of Officers for undertaking feasibility study, based on approved ICDs, towards fitment of DDUs onboard ships nominated for fitment of RLG/ INS-SA.

(ii) Requirement of Life Cycle Support through AMC/ RRC is to be built in to the procurement contract.

(iii) Procurement of DDUs for a particular class of ship is to be preferably undertaken as a single order.

(b) **WESEE**. Forward ICDs and provide suitable assistance to AAs for progressing feasibility study for installation of DDUs onboard ships and finalisation of DDU architecture.

(c) **WEDs**. Initiate procurement of DDUs from IHQ approved vendors indicated at Para 10 above, on as required basis.

18. IHQ MoD (N) / DEE Policy letter at Para 1 above is hereby superseded.

(C Raghuram)
Commodore
PDEE

Copy to:

The Admiral Superintendent
Naval Ship Repair Yard
C/o Fleet Mail Office
Naval Base
Kochi-682004

The Admiral Superintendent
Naval Dockyard
Visakhapatnam - 530014

The Admiral Superintendent
Naval Dockyard
Mumbai – 400001

The Flag Officer Commanding
Western Fleet
C/o FMO
Mumbai - 400001

The Flag Officer Commanding
Eastern Fleet
C/o FMO
Visakhapatnam- 530014

The Flag Officer Sea Training
HQ FOST
Naval Base
C/o Fleet Mail Office
Kochi

The Director General
Weapon & Electronics System
Engineering Establishment (WESEE)
West Block-V, RK Puram,
New Delhi-110066

The Commodore Superintendent
Naval Ship Repair Yard
C/o Navy Office
Port Blair-744102

The Commodore Superintendent
Naval Ship Repair Yard
Naval Base
Karwar-581301

The Officer-in-Charge
Weapon Equipment Depot
Naval Dockyard
Shahid Bhagat Singh Road
Mumbai-400001

The Officer-in-Charge
Weapon Equipment Depot
Kancharapalem PO

Visakhapatnam-530008

The Officer-in-Charge
Weapon Equipment Depot
C/o Fleet Mail Office
Naval Base
Kochi-682004

INTERNAL. **DGND(SSG)** **ACOM(IT&S)** **ACNS(P&P)**

PDSR **PDWE**

Telephone: 23011668

Integrated Headquarters of
Ministry of Defence (Navy)
New Delhi – 110011

EE/POLICY/L-85/2338

15 Sep 15

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters, Western Naval Command
Mumbai – 400001

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters, Eastern Naval Command
Visakhapatnam - 530014

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters, Southern Naval Command
Kochi

The Commander-in Chief
[for CTO(Marine)]
Headquarters, Andaman and Nicobar Command
Port Blair- 744102

INCRETE LIST AND AUTHORISED HOLDINGS FOR SHIPS AND SUBMARINES

1. Refer to the following:-

(a) NO 15/2013 – Indian Naval Common Range Electrical Test Equipment (INCRETE) for Ships and Submarines.

(b) IHQ MoD (N)/ DEE letter of even no. dated 01 May 12.

2. **Background**.Test equipment are considered the lifeline of the maintainers onboard, and, their availability for carrying out DI / DR needs no emphasis. Theauthorisedlist of INCRETE was promulgated vide Appendix 'C' of the Navy Order ibid, which also specified the approved list of test equipment with make, model and list of vendors. However, with rapid changes in technology and obsolescence, many of these test equipment have been progressively upgraded with models/ new equipment which are superior in functionality and offer better user interface features.

3. **Revision of INCRETE**. Revision of test equipment holdings is undertaken with due diligence at IHQ MoD(N) after consultation with all stakeholders. Inputs received from the Test Equipment Working Group (TEWG) and recommendations from the Commands form the basis for IHQ to consider revision of INCRETE list. The

current revision aims to rationalise the INCRETE list so as to limit it to suffice the requirements of *'common range'* utilisation only. Accordingly, during the process of current revision, an analysis of STTE available on ships, procured along with various major weapons / sensors, viz., Sonars, Radars, EW systems, gunnery and missile systems, etc., has also been taken into consideration. Further, the parameter of *frequency of usage of test equipment* has been critically examined and as recommended by HQWNC and HQENC, test equipment which are rarely used onboard have been deleted from the list. All ships and submarines have been categorised into seven broad categories depending on the class, manpower and type of equipment fitted. The composite revised INCRETE list has been approved by the Chairman, Test Equipment Standing Committee (TESC), and, is placed at **Enclosure 1**.

4. **Methodology for Demanding / Procurement**. The INCRETE list placed at **Enclosure 1** would form the basis for INCRETE holdings on all existing ships/submarines as well as ships/submarines under construction. The methodology for demanding the INCRETE as per the revised list would be as follows:-

(a) All ships /submarines are to maintain the present stock of INCRETE till completion of its fair electronic life/ being declared BER and thereafter place demands on WEDs for new INCRETE as per authorisation in accordance with **Enclosure 1** to this letter.

(b) All excess INCRETE held with ships/submarines w.r.t INCRETE list at **Enclosure 1** are to be held onboard till completion of their serviceable electronic life and are to be surveyed on expiry of serviceable life/ rendered BER. **No demands are to be placed against such surveyed test equipment**.

(c) Ships/ submarines are to place demands on WEDs for all deficiencies w.r.t the INCRETE list along with a certificate as per format placed at **Enclosure 2**, duly approved by Command HQs. The deficiencies projected are to be strictly in consonance with the authorisation vide **Enclosure 1**. It is likely that most of the equipment in the INCRETE list are already held by ships / submarines and no additional demands may be required except for AC/DC tong testers (which would also serve the utility of multi-meters) and Optical Power Meters which have been included in the list. The procurement of INCRETE in accordance with this letter is only for those being undertaken for augmentation and for the remaining, procurement as per standard BER procedure is to be followed.

(d) **For WEDs**

(i) Procure the test equipment as per the technical specifications placed at **Enclosure 3**.

(ii) Procure/ issue the deficient test equipment to ships/ submarines only against firm demands and 'Certificate of INCRETE Deficiency' from the unit.

(iii) All pending indents/demands of test equipment not listed in the INCRETE list placed at **Enclosure 1** are to be cancelled and stocking of INCRETE is to be undertaken as per the list at **Enclosure 1**.

5. **Maintenance of Test Equipment**

(a) **Repair / Calibration of INCRETE**. For all test equipment, calibration of test equipment are to be undertaken as per OEM prescribed periodicity through Naval Dockyards / Repair Yards. Wherever, calibration facilities exist, calibration is to be undertaken by the respective yards. However, due to the pace of technology and its obsolescence there-of, setting up of specific repair and calibration facility for test equipment at Naval Dockyards / Repair Yards is not envisaged. Minor repairs like replacement of fuse, bulbs, panel knobs and switches which do not involve removal / opening of equipment and / or modules / assemblies are to be undertaken by ships and submarines and major repair are to be affected by Naval Dockyards / Repair Yards. Yards are authorised to demand modules, PCBs / components to undertake module / component level repairs. RRCs / RCs for repairs and calibration of test equipment may be concluded by the WEDs / yards wherever necessary. WEDs are to include RRCs / RCs, wherever feasible, at the test-equipment procurement stage itself. These are to include RCs for calibration too.

(b) **Repair / Calibration of High-end Test Equipment / STTE**. As no facility for repair / calibration of STTE/high-end test equipment is envisaged, WEDs are to conclude RRCs and RCs for calibration / repairs of these test equipment.

6. **Periodicity of Calibration**. The basic calibration period for all Common Range Electrical Test Equipment is to be the OEM prescribed periodicity. However, all ships and submarines are to endeavour to get their Common Range Electrical Test Equipment calibrated during the Normal refits, even if it means marginally advancing the due dates.

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

(a) The INCRETE list as per **Enclosure 1** to the letter be promulgated to all ships/ submarines under the respective commands.

(b) WEDs, ships and submarines be directed to undertake provisioning of INCRETE as per the methodology enumerated at Para 3 above.

(c) TEWG is to review the INCRETE list at least once a year and recommend updates to the list of test equipment so as to mitigate technology obsolescence issues.

(C Raghuram)
Commodore
PDEE

Encl. As above

Enlosure I to IHQ MoD(N)/DEE letter EE/POLICY/L-85/2338 dated15 Sep 15

REVISED INCRETE LIST

CATEGORY	CLASS OF SHIP / SUBMARINE
A	Aircraft Carriers
B	SNF, Delhi class, ‘B’ Class, Talwar class, P-17, 1135.6 follow-on, ‘G’ Class, P-15A, P-28, P-15B, P-17A
C	Tankers, Jalashwa, P-25 , P-25A, LPD
D	Submarines
E	Survey vessels, NOPVs, OPVs, LSTs, LCUs, 1241 RE, 1241 PE, Trg Ship, Sagardhwani, Nireekshak
F	Minesweepers, SDBs, Makar class, Gaj, Tarangini, WJFAC, XFAC
G	ISVs

S No	Test Equipment		CAT ‘A’	CAT ‘B’	CAT ‘C’	CAT ‘D’	CAT ‘E’	CAT ‘F’	CAT ‘G’
	Category	**Sub-Category**							
1.	AC/DC Clamp Meter		30	25	15	10	10	6	4
2.	Digital Insulation Tester		10	6	6	4	4	2	1
3.	Digital Oscilloscopes	Bench-Top	1	1	1	1	Nil	Nil	Nil
		Handheld	2	2	1	1	1	1	1
4	RF Power Meter		1	1	1	Nil	Nil	Nil	Nil
5	Power Supplies	0-32 V & 150W	4	3	2	2	2	1	Nil
6	Electric Motor		5	3	3	2	2	1	1

	Checker								
7	Shock Pulse Monitor		4	3	2	2	2	1	1
8	Soldering Station		4	3	3	1	2	2	Nil
9	Cable Fault Detector for Power Cables		1	1	1	Nil	Nil	Nil	Nil
10.	Battery Capacity Tester		1	1	1	1	1	1	Nil
11	Digital pH Meter		Nil	Nil	Nil	1	Nil	Nil	Nil
12	Portable Conductivity Meter		Nil	Nil	Nil	1	Nil	Nil	Nil
13	Power Quality Analyser		1	1	1	1	1	Nil	Nil
14	Optical Power Meter		1	1	Nil	Nil	Nil	Nil	Nil

Enclosure II to IHQ MoD(N)/DEE letter

EE/POLICY/L-85/2338 dated 15 Sep 15

CERTIFICATE OF INCRETE DEFICIENCY

SHIP						
Category for demand (A/B/C/D/E)						
S No.	Description of Test Equipment	S No. of the Test Equipment i.a.w. IHQ MoD(N)/DEE letter EE/POLICY/L-85/2338 dated Sep 15	Quantity Authorised i.a.w. IHQ MoD(N)/DEE letter EE/POLICY/L-85/2338 dated Sep 15 [A]	Qty held [B]	Deficiency [A-B]	Qty to be demanded

Sign :________________________
Name :________________________
Rank :________________________
P.No.:________________________
Date :________________________

APPROVED

INTENTIONALY LEFT BLANK

Enclosure III to IHQ MoD(N)/DEE letter
EE/POLICY/L-85/2338 dated 15 Sep 15

1. AC DC CLAMP METER WITH MULTI-METER FUNCTION

Sr No	Specification	Value
1	Jaw Opening	30 mm or more
	AC Current	
2	Current Range	0 - 600 A
3	Resolution	≤ 0.1 A
4	Accuracy	≤ 1.8% +/-5 digits
5	AC Response	True RMS
	DC Current	
6	Current Range	0- 600 A
7	Resolution	≤ 0.1 A
8	Accuracy	≤ 2% +/-5 digits
	AC Voltage	
9	Range	0 - 600V
10	Resolution	≤ 0.1V
11	Accuracy	≤ 1.5% +/-5 digits
	DC Voltage	
12	Range	0- 600V
13	Resolution	≤ 0.1V
14	Accuracy	≤ 1% +/-5 digits
	Resistance	
15	Range	0 - 400Ω
16	Resolution	≤ 0.1Ω
17	Accuracy	≤ 1% +/-5 digits
18	Continuity Beeper	≤ 0Ω
	Capacitance	
19	Capacitance Range	1nF to 100mF
20	Accuracy	≤ 1.5% +/-5digits
	Environmental Specifications	
21	Operating Temperature	-10^{0}C to +55^{0}C
22	Storage Temperature	-30^{0}C to +70^{0}C
23	Ingress Protection	IP 51 or better
	EMI/EMC Compliance	
24	EMI/EMC Standard	EN/IEC 61326
	Safety Compliance	
25	Safety Standard	EN/IEC 61010-1 CAT III

2. DIGITAL INSULATION TESTER

Sr No	Specification	Value
	Insulation Testing	
1	Normal Test Voltage Values	250 V, 500 V, 1000V
2	Measurement Range	10kΩ-1000MΩ on all ranges
3	Terminal Voltage on open Circuit (DC)	0% to 25% of rated voltage
4	Short Circuit Current	2mA +0% to 50%
5	Test Current on Load	>1 mA
6	Accuracy	≤ ±3% of reading to 10 MΩ ≤ ±5% of reading up to 100 MΩ ≤ ±30% of reading up to 1000 MΩ
	Continuity Testing	
7	Continuity Measurement at	≤ 200mA
8	Continuity Decision	≤ 0.01 Ohms
	Environmental Specifications	
9	Operation temperature	-10°C to +55° C
10	Storage temperature	-30°C to +70°C
	Ingress Protection	IP 51 or better
	EMI/EMC Compliance	
11	EMI/EMC Standard	EN/IEC 61326
	Safety Compliance	
12	Safety Standard	EN/IEC 61010-1 CAT III
	Other Features	
13	Auto-ranging Function	
14	Auto discharge Function	
15	Automatic Continuity test with Buzzer	

3. (A) DIGITAL OSCILLOSCOPE (BENCH TOP)

Sr No	Specifications	Value
	Vertical System	
1	Bandwidth (-3dB)	500 MHz
2	DC Vertical Gain Accuracy	≤ +/- 2% of full scale
3	Dual cursor accuracy	≤ +/- 2% of full scale
	Acquisition	
4	Maximum Sampling Rate 2 Channel Operation 4 Channel Operation	 ≥ 4 GSa/s interleave ≥ 2 GSa/S each channel
5	Maximum Recording Length 2 Channel Operation 4 Channel Operation	 ≥ 2 Mpts interleave ≥ 1 Mpts each channel
6	Peak Detection	>10ns
	Vertical System	
7	Analog Channels	4
8	Calculated rise time	≤ 700 ps

9	Vertical Resolution	≥ 8Bits
10	DC vertical accuracy	≤ +/- 0.25 % of full scale
11	Channel-to-channel isolation	> 100:1
12	Offset range	≤ +/- 2 V (1 mV/div to 200 mV/div) ≤ +/- 50 V (> 200 mV/div to 5 V/div)
	Horizontal System	
13	Range	2ns/div to 50s/div
14	Resolution	≤ 100ps
15	Time base accuracy	≥ 25ppm
16	Reference position	Left, centre, right
17	Delay Range(pre-trigger)	1 screen width or 120µs (whichever less)
18	Delay Range(post-trigger)	50ms to 500s
19	Delay Resolution	≤ 100ps
19	Modes	Main ,zoom, XY ,roll
20	Zoom	Dual window zoom
21	Minimum detectable pulse width	5ns
	Trigger System	
22	Sources	Channel1 - 4, External
23	Modes	Normal, Single, Auto, Force
24	Types	Edge (Rising, Falling or alternating)
25	Auto scale	Finds or Displays active channels ,sets the edge trigger type on the highest numbered channel, and sets the vertical sensitivity on the scope channel time base to display – 2 periods
26	Hold off time	40ns to 10s
27	Range	+/-6 div from centre of screen
28	Sensitivity	≥ 10mV/div:0.5 div <10mV/div: greater of 1 div or 5mV
29	Trigger Level Accuracy	≤ +/- 6 div from centre of screen
	External Trigger	
30	Input Impedance	1MΩ
31	Range	200 mVpp from DC to 100 MHz 350 mVpp from 100 MHz to 200 MHz
	Measurement	
32	Automatic Measurements	Delay, duty cycle, fall/rise time, frequency, period, phase shift, T-max, T-min, width, amplitude, average, base, crest, cycle mean, maximum, minimum, overshoot, peak-to-peak, pre shoot, standard deviation, top, V_{rms} ,(AC/DC)
33	Waveform match functions	CHA+CHB, CHA-CHB, CHB-CHA, CHA*CHB, CHA/CHB, CHB/CHA, d/dt(CHA), d/dt(CHB), FFT . ∫(CHA)dt, ∫(CHB)dt, FFT Enabled between any two channels

34	Cursors	DeltaV - Voltage difference between cursors Delta T- Time difference between Cursors
35	FFT Points	≥ 1024
36	FFT windows	Rectangular, Hamming, Hanning, Flattop
	Storage System	
37	Save/recall (non- volatile)	10 setups and waveforms can be saved and recalled internally
38	Storage Mode	USB Image formats-.bmp and .png Data format- .csv
	Environmental Specifications	
39	Operation temperature	-10°C to +55° C
40	Storage temperature	-30°C to +70°C
41	Ingress Protection	IP 51 or better
	EMI/EMC Compliance	
42	EMI/EMC Standard	EN/IEC 61326
	Safety Compliance	
43	Safety Standard	EN/IEC 61010-1 CAT III
	Other Features	
44	Auto-ranging Function	
45	Auto discharge Function	
46	Automatic Continuity test with Buzzer	

3. (B) DIGITAL OSCILLOSCOPE HANDHELD

Sr No	**Specification**	
	Vertical System	
1	Bandwidth (-3dB)	100MHz
2	DC Vertical Gain Accuracy	≥ +/- 4% of full scale
3	Dual cursor accuracy	≥ +/- 4.4% of full scale
	Acquisition	
4	Maximum Sampling Rate Single Channel Operation Dual Channel Operation	 ≥ 1 GSa/s interleave ≥ 500 MSa/s each channel
5	Maximum Recording Length Single Channel Operation Dual Channel Operation	 ≥ 120 Kpts interleave ≥ 60 Kpts each channel
6	Vertical Resolution	≥ 8 Bits
7	Peak Detection	> 10ns
	Filter	10 kHz and 20 MHz bandwidth limiters
	Vertical System	
8	Analog Channels	Channel 1 and Channel 2 Simultaneous acquisition
9	Calculated rise time	≥ 3.50ns typical

10	Vertical scale	2mV/div to 50V/div
11	Offset (position) range	+/- 4 div
12	Dynamic Range	+/- 8 div
13	Input impedance	1MΩ
14	Coupling	DC, AC
15	Bandwidth Limit	10kHz and 20MHz (selectable)
16	Probes	100:1passive probe
17	Probe Attenuation factor	100x
18	Probe Compensation output	$5V_{pp}$, 1KHz
19	Noise peak-to-peak	3% of full scale or $5mV_{pp}$, whichever is greater
	Horizontal System	
20	Range	5ns/div to 50s/div
21	Resolution	≥ 100ps for 5ns/div
22	Time base accuracy	≥ 25ppm
23	Reference position	Left, centre, right
24	Delay Range(pre-trigger)	1 screen width or 120µs (whichever less)
25	Delay Range(post-trigger)	50 ms to 500 s
26	Delay Resolution	100 ps for 5ns/div
27	Modes	Main ,zoom, XY ,roll
28	Zoom	Dual window zoom
	Trigger System	
29	Sources	Channel1,Channel2,External
30	Modes	Normal, Single, Auto
31	Types	Edge, Glitch, TV, Nth Edge, CAN, LIN
32	Auto scale	Finds or Displays active channels ,sets the edge trigger type on the highest numbered channel, and sets the vertical sensitivity on the scope channel time base to display – 2 periods
33	Hold off time	60 ns to 10s
34	Range	+/-6 div from centre of screen
35	Sensitivity	≥10mV/div
36	Trigger Level Accuracy	+/- 6 div from centre of screen
	External Trigger	
37	Input Impedance	1MΩ
38	Range	DC coupling to trigger level +/-5V
39	Bandwidth	100KHz
	Measurement	
40	Automatic Measurements	Delay, duty cycle, fall/rise time, frequency, period, phase shift, T-max, T-min, width, amplitude, average, base, crest, cycle mean, maximum, minimum, overshoot, peak-to-peak, pre shoot, standard deviation, top, V_{rms} ,(AC/DC)
41	Waveform match functions	CH1+CH2, CH1-CH2, CH2-CH1, CH1*CH2, CH1/CH2, CH2/CH1, d/dt(CH1), d/dt(CH2), FFT. ∫(CH1)dt, ∫(CH2)dt, FFT

42	Cursors	DeltaV - Voltage difference between cursors Delta T- Time difference between Cursors
43	FFT Points	≥ 1024
44	FFT windows	Rectangular, Hamming, Hanning, Flattop
	Environmental Specifications	
45	Operation temperature	-10°C to +55° C
46	Storage temperature	-30°C to +70°C
47	Ingress Protection	IP 51 or better
	EMI/EMC Compliance	
48	EMI/EMC Standard	EN/IEC 61326
	Safety Compliance	
48	Safety Standard	EN/IEC 61010-1 CAT III

4. RF POWER METER

Sr No	Specification	Value	
1	**Frequency range**	10 MHz to 18 GHz	
2	**Impedance matching (SWR)**	10 MHz to 2.4 GHz	<1.15
		2.4 GHz to 8.0 GHz	<1.25
		8.0 GHz to 12.4 GHz	<1.30
		12.4 GHz to 18.0 GHz	<1.40
3	**Power measurement range**	Continuous Average	20 nW to 15 W
		Burst Average	20 µW to 15 W
		Timeslot average	60 nW to 15 W
4	**Max. Power**	Average Power	More than 18 W
		Peak Envelope Power	More than 100 W for 10µSec
5	**Transition regions**	with automatic path selection	3
6	**Dynamic response**	Video Bandwidth	> 50 kHz
		Single-Shot Bandwidth	> 50 kHz
		Rise time 10 % to 90 %	< 8 µs
7	**Acquisition**	Sample rate (continuous)	More than 132 KHz
8	**Triggering**	**Internal**	
		Threshold Level Range	–19 dBm to +42 dBm
		External	
		Slope	Positive / Negative
10	**Zero offset**	< 130 µW	
11	**Zero drift**	< 40 µW	
12	**Measurement noise**	< 80 (40) µW	
	Environmental Specifications		
13	Operation temperature	-10°C to +55° C	
14	Storage temperature	-30°C to +70°C	
15	Ingress Protection	IP 51 or better	

	EMI/EMC Compliance		
16	EMI/EMC Standard	EN/IEC 61326	
	Safety Compliance		
17	Safety Standard	EN/IEC 61010-1 CAT III	

5. DC POWER SUPPLY

Sr No	Specifications		Value
1	DC Output Rating	Voltage	0 to 32 v
		Current	0 to 1.5 A
2	Maximum Power		150 W
3	Load Regulation	Voltage	<0.01% + 3mV
		Current	<0.01% + 3mA
4	Line Regulation	Voltage	<0.01% + 3mV
		Current	<0.1% + 3mA
5	Ripple and Noise	Voltage	<1mV rms <3mV p-p
		Current	<3mA rms
6	Setting Resolution	Voltage	≤ 1mV
		Current	≤ 1mA
7	Setting Accuracy	Voltage	≤ 0.03% + 20mV
		Current	≤ 0.1% + 5mA
8	Meter Resolution	Voltage	≤ 1mV
		Current	≤ 1mA
9	Meter Accuracy	Voltage	≥ 1mV
		Current	≥ 1mA
	Environmental Specifications		
10	Operation temperature	-10°C to +55° C	
11	Storage temperature	-30°C to +70°C	
12	Ingress Protection	IP 51 or better	
	EMI/EMC Compliance		
13	EMI/EMC Standard	EN/IEC 61326	
	Safety Compliance		
14	Safety Standard	EN/IEC 61010-1 CAT III	

6. ELECTRIC MOTOR CHECKER

Sr No	Features	Insulation Resistance Measurement
1		Identify open and short circuits/loose connections in a winding coil
2		Identify inter term shorts
3		Detect rotor bar problems without dismounting the rotor
4		Inductance of the winding with respect to different positions for rotor for detecting

		blow holes or cracks in the rotor bars
	Technical Specifications	
5	Insulation Resistance	0-20 Meg ohms at 500V DC Max. current 0.25 mA Accuracy - ± 5%
6	Resistance	0-60 ohms Accuracy - ± 2%
7	Inductance	0-300mH Accuracy - ± 2%
	Environmental Specifications	
8	Operation temperature	-10°C to +55° C
9	Storage temperature	-30°C to +70°C
10	Ingress Protection	IP 51 or better
	EMI/EMC Compliance	
11	EMI/EMC Standard	EN/IEC 61326
	Safety Compliance	
12	Safety Standard	EN/IEC 61010-1 CAT III

7.SHOCK PULSE MONITOR

Sr No	**Diagnostic Specifictaions**	
1	Machine Rotational Speed Range	200 rpm to 12000 rpm
	Electrical Specifications	
2	Ranging	Automatic
3	A/D Converter	4 Channel, 24 bit
4	Usable Bandwidth	2 Hz to 20 kHz
5	Sampling	≥ 51.2 Hz
6	Sampling Rate	2.5kHz to 50kHz
7	Dynamic Range	Better than 128 dB
8	Signal To Noise Ratio	Better than 100 dB
9	FFT Resolution	≥ 800 lines
	Sensor Specifications	
10	Sensor Type	Accelerometer
11	Sensitivity	≥ 100 mV/g
	EMI / EMC	
12	EMI / EMC Standard	EN 61326, EN 61010
	Environmental Specifications	
13	Operation temperature	-10°C to +55° C
14	Storage temperature	-30°C to +70°C
15	Ingress Protection	IP 51 or better
	EMI/EMC Compliance	
16	EMI/EMC Standard	EN/IEC 61326
	Safety Compliance	
17	Safety Standard	EN/IEC 61010-1 CAT III

8. SOLDERING STATION

Sr No	Specification	Value
1	Input Voltage	190V to 270V
2	Output Voltage	24V AC
3	Soldering Wattage	60 Watts
4	Temp range	180 - 480°C
5	Temp accuracy	≥ +/- 1° c
6	Tip to ground potential	< 2 mV
7	Tip to ground Leakage	< 2 mV
	Environmental Specifications	
8	Operation temperature	-10°C to +55° C
9	Storage temperature	-30°C to +70°C
10	Ingress Protection	IP 51 or better
	EMI/EMC Compliance	
11	EMI/EMC Standard	EN/IEC 61326
	Safety Compliance	
12	Safety Standard	EN/IEC 61010-1 CAT III

9. CABLE FAULT DETECTOR FOR POWER CABLES

S No.	Description	Specification
1	Fault Distance Range (In Meters)	50 m, 100 m, 200 m, 800 m, 1600 m, 3000 m & 6000 m
2	Measurement Mode	Auto or Manual
3	Fault Measurement Accuracy	≥ ±1% ±1 m
4	Resolution	≥ 20 cm
5	Measurement dead zone	Not more than 1 meter
6	Output Impedance	50 ~150 Ohms
7	Gain Range Control	1:10
8	Serial port for PC / Printer	USB
9	Timer	Automatic standby after 30 minutes of no activity on keys.
10	Alarm	It gives audible alarm when high voltage (>50V) appears on test leads, ensuring operator’s safety
	Environmental Specifications	
	Operation temperature	-10°C to +55° C
	Storage temperature	-30°C to +70°C
	Ingress Protection	IP 51 or better
	EMI/EMC Compliance	
	EMI/EMC Standard	EN/IEC 61326
	Safety Compliance	
	Safety Standard	EN/IEC 61010-1 CAT III

10. BATTERY CAPACITY TESTER

Sr No	Resistance Measurement			
	Range	**Resolution**	**Measurement Current**	**Accuracy**
1	40 mΩ	10 µΩ	37.5 mA	± (1% of L +8 digits)
2	400 mΩ	100 µΩ	3.75 mA	
3	4 Ω	1 mΩ	375 µA	
4	40 Ω	1 mΩ	37.5 µA	
	Voltage Measurement			
	Range	**Resolution**	**Accuracy**	
5	4 V	1 mV	± (0.1% of L +6 digits)	
6	40V	10 mV		
	Other Features			
7	Automatic standby after 30 minutes of no activity on keys			
8	Zero adjustment function to compensate for the voltage circuit displayed			
9	Maximum power consumed : 1 VA			
	Environmental Specifications			
10	Operation temperature	-10°C to +55° C		
11	Storage temperature	-30°C to +70°C		
12	Ingress Protection	IP 51 or better		
	EMI/EMC Compliance			
13	EMI/EMC Standard	EN/IEC 61326		
	Safety Compliance			
14	Safety Standard	EN/IEC 61010-1 CAT III		

11. DIGITAL pH METER

S No.	Description	Specification
1	pH	0.00 to 14.00 pH
2	Temperature	23 to 194°F (-5 to 90°C)
3	Resolution	0.01 pH, 0.1°
4	Accuracy	±0.01pH, ±1.8°F/±1°C
	Other Specifications	
5	Simultaneous display of pH and Temperature	
6	Indication on stabilization of reading	
7	Automatic Temperature Compensation	
8	Indication for replacement of electrode	

12. PORTABLE CONDUCTIVITY METER

S No.	Description	Specification
1	Conductivity	
2	Lowest Range	0-200 micro siemen/cm
3	Resolution	0.1 micro Siemen
4	Highest range	20-200 milli Siemen /cm
5	Resolution	0.1 milli Siemen

13. POWER QUALITY ANALYSER

Sr No	Input characteristics	
	Voltage inputs	
1	Number of inputs	4 (3 phase + neutral) dc-coupled
2	Maximum input voltage	1000 Vrms
3	Nominal voltage range	Selectable 1 V to 1000 V
4	Voltage Resolution	≥ 0.01 V
5	Accuracy	≥ ± 0.1%
6	Max.peak measurement voltage (Transient Mode)	≥ 6 kV
7	Input impedance	4 MΩ
8	Bandwidth	> 10 kHz
9	Scaling	1:1, 10:1, 100:1, 1,000:1 10,000:1 and variable
	Current inputs	
10	Number of inputs	4 (3 phase + neutral) dc- or ac-coupled
11	Type	Clamp or current transformer with mV output
12	Range	5 Arms to 6000 Arms
13	Current Resolution	≥ 0.1 A
14	Accuracy	≥ ± 0.5%
15	Bandwidth	> 10 kHz
16	Scaling	1:1, 10:1, 100:1, 1,000:1 10,000:1 and variable
	Environmental Specifications	
17	Operating temperature	0 °C to +50 °C
18	Storage temperature	-20 °C ~ +60 °C
19	EMI / EMC Standard	EN 61326
	Measurement Parameters	
20	Vrms, Arms	More than 10 cycle contineous non-overlapping intervals using more than 500 samples per cycle.
21	Vpeak, Apeak	Absolute highest sample value within more than 10 cycle interval with more than 40 µs sample resolution
22	V Crest Factor	Measures ratio between the Vpeak and Vrms
23	A Crest Factor	Measures ratio between the Apeak and Arms
24	Real Power	Full and fundamental real power display
25	Apparent Power	Full and fundamental apparent power display
26	Reactive Power	Fundamental reactive power display
27	VA Harmonics	Total disturbance power due to harmonics. Calculated for each phase and for total system based upon total apparent power andfundamental real

		power.
28	VA Unbalance	Unbalance power for total sytem. Calculated using symmetrical components method for fundamental apparent power and totalapparent power
29	Power factor	Calculated total watt/VA
30	Cos Ø	Cosine of angle between fundamental voltage and current
31	DPF	Calculated fundamental Watt/VA
32	Unbalance	The supply voltage unbalance is evaluated using the method of symmetrical components according to IEC61000-4-30
33	Transient capture	Captures waveform triggered on signal envelope. Additionally triggers on dips, swells, interruptions and Amps level
	Environmental Specifications	
34	Operation temperature	-10°C to +55° C
35	Storage temperature	-30°C to +70°C
36	Ingress Protection	IP 51 or better
	EMI/EMC Compliance	
37	EMI/EMC Standard	EN/IEC 61326
	Safety Compliance	
38	Safety Standard	EN/IEC 61010-1 CAT III

14. OPTICAL POWER METER

Sr No	Specification	Value
	Optical Sources	
1	Optical output connector	Fixed SC
2	Emitter type	850/1300: LED 1310/1550: FP Laser FindFiber: Laser
3	Emitter wavelengths (nm)	850, 1300, 1310, 1490, 1550, 1625
4	Power output	≥ -20 dBm
5	Power output stability (8 hours)	+/- 0.1 dB over 8 hours
6	Power measurement accuracy	+/-0.25 dB
7	Optical connector	Removable adapter
8	Detector type	InGaAs
9	Calibrated wavelengths	850, 1300, 1310, 1490, 1550, 1625
10	Power measurement range	850nm : 10 to -52 dBm 1300, 1310, 1490, 1550, 1625nm : 10 to -60 dBm

11	Resolution	Better than 0.01 dB
12	Battery life	>50 hours typical
	Serial communication physical interface	USB
	Enviornmental	
13	Certifications	CE, CSA, N10140, Class 1 laser-safe
	Environmental Specifications	
14	Operation temperature	-10°C to +55° C
15	Storage temperature	-30°C to +70°C
16	Ingress Protection	IP 51 or better
	EMI/EMC Compliance	
17	EMI/EMC Standard	EN/IEC 61326
	Safety Compliance	
18	Safety Standard	EN/IEC 61010-1 CAT III

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Directorate of Electrical Engineering
Integrated Headquarters of
Ministry of Defence (Navy)
New Delhi – 110 011

EE/POLICY/L-100/2185-H/RADAR

13 Jul 16

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters, Western Naval Command
Mumbai – 400001

CONDUCT OF ALIGNMENT OF REZISTOR-E COMPLEX – INS VIKRAMADITYA

1. Refer to the following (both not addressed to all):-

(a) Naval EMC Centre letter No 301/PA dated 16 Jan 15.

(b) HQWNC letter No EL/3440/11430 dated 22 Apr 16.

2. The procedure for conduct of alignment of Rezistor-E complex onboard INS Vikramaditya forwarded by HQWNC vide its letter ibid has been examined at IHQ MoD (N) in conjunction with the study of interference between radar Podberezovik and Radio Beacon (RB) of Rezistor-E conducted by NEC (Mbi) onboard Vikramaditya. The results of the study were forwarded by NEC (Mbi) vide their letter ibid.

3. The alignment of Rezistor-E along with its sub-complex is required to be undertaken every year in accordance with the proforma for trial directive placed at **Encl 1**. The Certification Team for the conduct of alignment checks is to be iaw **Encl 2**.

(C Raghuram)
Commodore
PDEE

Encl:- As above

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Encl.1 to IHQ MoD(N)/DEE Letter EE/09/2185/E dated 13 Jul 16

PROFORMA FOR TRIAL DIRECTIVE FOR CONDUCT OF ALIGNMENT OF SUB COMPLEX OF REZISTOR-E

1. **Introduction**. The co-alignment of the sub-complexes of Rezistor-E is required to be carried out every year by the ships staff. The alignment check is a mandatory requirement for conduct of safe flying operations onboard.

2. **Aim**. Aim of this process is to carry out alignment checks of RB, SR, MLS and ACS sub-complex and eliminate errors if any.

3. **Scope of Trials**. The scope and objectives of alignment are as follows:-

(a) To determine/ calculate the range, bearing and height errors of RB, SR, MLS and ACS.

(b) Incorporation of necessary correction to eliminate the errors and align different sub- complexes of Rezistor-E.

4. **References**. Following documents shall be referred for the conducting the trials:-

(a) Methodica provided by OEM.

(b) АКЕЯ. 461527.001ИЗ - OI Rezistor-E.

(c) АКЕЯ. 461525.001 ИЗ1 - OI LB.

(d) АКЕЯ. 461525.001 ИЗ2 - OI GB.

(e) АКЕЯ. 461527.001 ИЗ1 - OI DE.

(f) АКЕЯ. 461511.003 ИЗ1 - SR Console operation.

(g) АКЕЯ. 461523.008 ИЗ1 - ACS Console operation.

(h) АКЕЯ. 461523.008 ФО - Log Book ACS.

5. **Trial Team**. The following members will constitute the trial team:-

S No.	Name	Ship/Unit	Designation
(a)			
-----			

6. **Conduct**. The Team Leader of the alignment team will be responsible for the overall planning and conduct of alignment checks. He may co-opt any other aircrew/

technical personnel for the trials as required keeping the Headquarters informed. Members will be responsible to the Team Leader for smooth conduct of trials. The validity of alignment of sub-complexes of Rezistor-E will be one year.

7. **Aircraft**. INS Hansa is to nominate one/two MIG-29K/KUB with serviceable A-380 system or Flt Cdr Vikramaditya Kamov Flt is to nominate one/ two KA-31 with serviceable A-380. The ground crew is to be augmented as required by Vikramaditya to operate one/two MIG/KUB/KA-31 from the ship. A copy of certificate endorsing the serviceability of the A380 system used in the trials is to be enclosed with the trial report.

8. **LSO**. Commanding Officer INAS 300/303/Flt Cdr Vikramaditya Kamov Flt is to nominate suitable aircrew to carry out member/LSO duties for the duration of trials.

9. **Date and Venue.** The co-alignment checks are to be conducted off __________ from ____________ onwards. The aircraft and crew are to remain embarked until completion of trials.

10. **Weather**. The co-alignment checks are to be undertaken subject to suitability of weather and sea state as mentioned below:-

(a) Cloud Height - Not less than 1000 mtr.

(b) Wind Speed - Not exceeding 5 m/s.

(c) Visibility - Not less than 10 km.

(d) Sea state - Not exceeding 3.

11. **Phases.** The trials are to be conducted in the following phases:-

(a) **Phase I (Deck Alignment of Luna and MTK)**. Before conduct of alignment checks of Rezistor-E sub-complexes, deck alignment of Luna and MTK at harbour is mandatory.

(b) **Phase II (Deck Alignment of ACS by Corner Reflector)**. The Phase II checks are required to be undertaken, since ACS-1 and ACS-2 shall be the master reference whilst carrying out the alignment checks of various sub-complexes (RB, SR & MLS).

(c) **Phase III Co- Alignment of MTK-201E, Luna and ACS(landing aids) using Ka-31 at sea)**. Phase-III trials are to be undertaken post satisfactory completion of Phases II.

(d) **Phase IV (Alignment of sub-complexes of Rezistor-E)**. The Phase IV trials are to be undertaken post satisfactory completion of Phase III. Phase IV trials shall be further divided into three categories as mentioned below:-

(i) RB and SR alignment Run

(ii) LB alignment Run

(iii) GB alignment Run

(e) The detailed procedure for carrying out the Phase IV alignment run of each sub-complex is placed at **Appendix A**. Standard templates for entering data for alignment checks of RB/LB/GB are placed at **Appendix B.**

12. **Briefing**. Commanding Officer, INS Vikramaditya is to nominate a suitable officer to conduct comprehensive and detailed briefing for the Trial Team, Ground Crew, LSO and Ship's Command Team prior to commencement of trials.

13. **Flight Safety**. All aspects of Flight safety are to be adhered to. The overall responsibility of safe conduct of flying from the ship rests with the Commanding Officer, INS Vikramaditya. The decision to continue or abort the mission will rest with the Captain of the aircraft.

14. **Responsibility of the Ship**. The responsibilities of the ship staff are placed at **Appendix C.**

15. **Rendition of Report**. The Certification Team Leader will be responsible for submitting the alignment report within 10 days of completion of the trials to HQWNC/CAVO/CLO, FOCWF/FOO/FLO and with copies to IHQ MoD(N)/DEE/DNAS/DACP/ DAWFS/ DASE and HQNA/CSO(Air).

16. Since the trial presents an additional opportunity to undertake trials for check of interference between radar Podberezovik and RB of Rezistor-E; Electrical Officer, INS Vikramaditya is to render report to NEC (Mbi) with copies to HQWNC/CLO asper format placed at **Appendix D**. Naval EMC Centre letter No 301/PA dated 16 Jan 15 is relevant in this regard.

Encl. 2 to IHQ MoD(N)/DEE Letter EE/09/2185/E dated 13 Jul 16

COMPOSITION OF RESISTOR-E ALIGNMENT TEAM

Ser	Designation	Unit	Remarks
Team Composition			
1	Captain Air, Team Leader	Vikramaditya	Responsible for the overall planning and conduct of alignment checks. He may co-opt any other aircrew / technical personnel for the trials as required.
2	Electrical Officer	Vikramaditya	Responsible for ensuring full operability of Resistor-E Complex and ensuring that all shipborne equipment associated with Mig-29K/KUB/KA-31 operations are fully operational and calibrated.
3	Systems Analyst	FTTT(Mbi)	Responsible for making all measurements and checking the parameters of sub-complexes of Resistor-E. He may co-opt any other technical personnel for the trials as required.
4	Rep Yard	ND(Mbi)/WE CORS	Provide expertise for undertaking deck alignment and handling of alignment tools. He may co-opt members from ND(Mbi)/WECORS as per the requirement of trials.
5	Rep Yard	NSRY(Kar)	Associate with reps of ND (Mbi) and FTTT (Mbi) and gain experience and expertise for conduct of trials.
6	Ka-31/Mig 29K Squadron	Ka-31/Mig 29K Squadron	Conduct of Phase III & Phase IV Trials and verification of trial results.
7	HQNA	Flight Test Group	To accrue and build-up institutional knowledge for conduct of AFC trials of IAC-1.

Activity wise Responsibility of Agencies during Alignment

Ser	Activity / Phase	Responsibility
1	Parameter Checks	SS/FTTT (pre Alignment Checks)
2	Phase 1	SS/FTTT/NSRY(Kar)/ND(Mbi)
3	Phase 2	SS/FTTT/NSRY(Kar)/ND(Mbi)
4	Phase 3	SS/FTTT/Ka -31 Squadron
5	Phase 4	SS/FTTT/Mig 29K Squqdron

Appendix C
(Refers to para 14 of Encl 1)

RESPONSIBILITY OF THE SHIP

The following is to be ensured by the ship prior/ during/ post conduct of trials:-

(a) Ensure that all equipment associated with MIG-29K/ KUB/ KM-31 operations are fully operational and calibrated. Records of the same are to be provided to the trials team as and when sought.

(b) Ensure that all observations by the trial team are liquidated expeditiously if mandated and within ship's purview, and provide required documents called for by trial team.

(c) Provide deck crew and maintenance support to the aircraft while onboard. Maintenance crew maybe augmented by INS Hansa as required. Embarked technical crew is to carry out TRS/ AFS/ BFS onboard for the duration of trials. The ship is to ensure that availability and serviceability of all ASE/ GSE like chocks and lashing, fire fighting equipment, fuelling facility, starting supplies, etc.

(d) Provide still photo/ video cover as per requirements of the Trial team

(e) Ensure full operability of Rezistor –E complex within the bounds of limitations imposed due to the interference caused by radar Podberezovik on RB.

(f) Ensure standby supply is available for Rezistor-E Complex.

(g) Rezistor-E maintainer is to extract the data recorded from documenting equipment and calculate the error.

(h) If calculated error is beyond permissible limit,. Rezistor-E maintainer is to insert the required corrected value in "error correction window" of each sub-complex.

(j) Since the performance of A-380 fitted onboard aircraft is not consistent, it is important to identify hardware which is operates satisfactorily and consistently, to that end, prior conduct of trials a fully functional and certified A-380 module is to be used on the aircraft participating in the trials. Serial number of the A-380 system and aircraft frame identification on which it is installed is to be clearly indicated in the trial report. Copy of certificate certifying the serviceability of A-380 system is to be attached as an enclosure to the trial report.

(k) Only 28 frequencies as approved by the Russian side are to be used for conduct of trials.

Appendix D
(Refers to para 16 of Encl 1)

CHECKS FOR INTERFERENCE BETWEEN RADAR PODBEREZOVIK AND RADIO BEACON (RB) OF REZISTOR –E

Aim : To establish total extent of interference across the dynamic range of Rx of RB of Rezistor-E complex; interference (in terms of probability or percentage of correct data received by Rezistor-E) in each channel and during use of each of the 05 modes of Podberezovik is to be ascertained.

<table>
<tr><td colspan="3">Aircraft Type & Variant</td><td colspan="10"></td></tr>
<tr><td colspan="3">Aircraft Frame No</td><td colspan="10"></td></tr>
<tr><td colspan="3">Aircraft System</td><td colspan="10">A-380
Module Serial : Certified On:</td></tr>
<tr><td colspan="13"></td></tr>
<tr><td rowspan="2">Ch No.</td><td colspan="2">Podberezovik Off</td><td colspan="2">Combat_6R Mode</td><td colspan="2">Combat_12R Mode</td><td colspan="2">Rezistor-E Mode/ Cutting Short Pulse</td><td colspan="2">Aft Blank Mode</td><td colspan="2">Rez-E+ Aft Blank Mode</td></tr>
<tr><td>Fuel Data</td><td>Alt</td><td>Fuel Data</td><td>Alt</td><td>Fuel Data</td><td>Alt</td><td>Fuel Data</td><td>Alt</td><td>Fuel Data</td><td>Alt</td><td>Fuel Data</td><td>Alt</td></tr>
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Integrated Headquarters
Ministry of Defence (Navy)
Dte of Electrical Engineering
New Delhi – 110011

EE/ POLICY/L- 96/COMM -15

11 Sep 14

The Flag Officer Commanding–in-Chief
(For CLO/CCO)
Headquarters, Southern Naval Command
Kochi.

The Flag Officer Commanding–in-Chief
(For CLO/CCO)
Headquarters, Western Naval Command
Mumbai.

The Flag Officer Commanding–in-Chief
(For CLO/CCO)
Headquarters, Eastern Naval Command
Vishakhapatnam-

The Commander – in – Chief
For CTO (Marine)
HQ, Andaman and Nicobar Command
Port Blair-744101

MAINTENANCE GUIDELINES: PORTABLE V/UHF TRANSRECEIVER - LUP 329

1. **Background**. The letter pertains to the maintenance guidelines of portable V/UHF Transreceiver LUP 329 issued to every unit of *IN*.V/UHF LUP 329 has progressively replaced the V/UHF Manpack LUP-322 sets earlier issued to IN ships and establishments.The set has been indigenized by Bharat Electronics Limited, Bangalore (M/s BEL (Bg). This set is designed to be an upgraded version of the in-service LUP 322 V/UHF Tx/Rx.

2. **Brief Description**. The Portable V/UHF Transreceiver LUP 329, which operates on VHF band 108-155.975 MHz and UHF band 225-399.975 MHz has 40 preset channels with a channel spacing of 25 KHz in FF and 100 kHz in FH (100 hops/sec) and built-in-data modem up to 8 kbits/s. The standard operating modes are AM (min 60% modulation depth) and FM (deviation 5kHz $\pm$ 1.5 kHz) with both voice and data capabilities.The set supports COMSEC in full band for Voice/Data and also TRANSEC in UHF band for Voice/Data. The set also incorporates a Guard Receiver at 243.000 MHz in AM. The transmitter RF Power is 5W (CW). The operating temperature range for the set is -30 to +55˚C and is compliant with MIL STD 461E. The radio is compatible with the airborne radio.

3. **Procurement Case**. The equipment was procured under PAC Basis from M/s BEL (Bg) by IHQvide supply order No. 063DPR/095085/09DBLC003 dated 02 Nov 10. A total of 225 sets along with 113 packages of Fill Gun and Accessories, 35 packages of Key Management kits, 100 packages OBS and 04 packages of B&D spares and 04 packages of Test Jigs and Instruments have been procured.

4. **OEM Product Support and Reliability**. BEL (Bg) is manufacturing the sets in-house through ToT and is fully capable of rendering support for all defects, their analysis and repair of hardware. M/s BEL has committed product support of the equipment including spares required for upkeep of the equipment for a period of 10 years. The equipment is designed to provide an MTBF of 5000 hrs without any degradation of any performance governing parameters and MTTR of less than 20 minutes upto LRU level.

5. **Documentation**. The documentation (both User manuals and Maintenance manuals) have been approved and promulgated as INBR 4261 series. The documentation has been distributed to MOs at Mumbai, Vizag and Kochi on a pro-rata basis depending on the distribution of the sets. The technical documentation for level 3 and 4 repairs contain all drawings and details upto component level. However, this documentation along with the Test Jig manual together provides the procedures and checks upto module/ sub-module level.

6. **Onboard and B&D Spares**. A total 100 packages of OBS have been procured and have been distributed to MOs at Mumbai, Vizag and Kochi on a pro-rata basis depending on the distribution of the sets. A total of four packages of B&D spares have been procured and two each have been stacked at MOs at Mumbai and Vizag. The OEM has provided a detailed Part Identification List (PIL) containing module/ sub-module details (including few component level items also), along with the technical documentation. The complete PIL of 62 items has been INCATed and all items can be demanded from MOs.

7. **Test Equipment/ Tools/ Test Jigs**. A set of Test equipment / Tool kit has been procured for each set and is issued accordingly. These are to be utilized for level I and II repairs. The LUP 329 are very compact portable sets and very dense packaging of electronics and multilayer PCBs which are humisealed/ EMI/EMC shielded. Although the set is completely indigenized, it may not be feasible to undertake PCB repairs at component level at Yards due to presence of many hybrid components which need specialized equipment for DI/DR. The test jigs provided with the LUP 329 equipment are therefore designed to detect and indicate defects upto sub-module levels. Four packages of Test Jigs have also been procured for supporting level III and IV repairs at Yards. One each Test jig has been allotted to ND(Mbi), ND(V), NSRY(Koc) and NSRY(Pb) based on the population of the system vide DEE Fax EE/05/2054 dated 22 Jan 13.

8. **Operator and Maintainer Training**. As per terms of the Contract, the Operator and Maintainer level 1&2 course has been conducted at all the Commands and the maintenance course for level 3&4 was conducted at BEL(Bg) during induction of the sets. Further, training on test jigs has also been conducted at the time of commissioning of the test jigs at the Commands. The training for level 3 & 4

repairs imparted by the OEM at OEM premises has been upto module/ sub-module level.

Maintenance Philosophy

9. **1st and 2nd Level Maintenance**. The equipment is classified as portable and the first and second level of maintenance is to be undertaken by the ship's staff/FMU. This would include basic DI/DR and repair by replacement till module/unit level. Dedicated BITE facilities inbuilt in the system are to be utilised for ship level diagnosis at sea or harbor, Ship's staff /FMU staff are to undertake repairs utilizing OBS, document and generic test equipment.

10. **3rd and 4th Level Maintenance**.The 3rd and 4th level of maintenance is planned to be undertaken by the dockyard on modules/units landed for repairs by the ship's staff. The yards are to utilize the dedicated test jigs, as mentioned in Para 7 above, for 3rd and 4th level of repair and maintenance. The Yards are to undertake repairs upto sub-module levels and thereafter forward to OEM for component level repairs through RRC. The sets at Karwar are to be provided LRU level repairs at NSRY(Kar) using available spares and the collated defective cards are to be forwarded to ND(Mbi) for further repairs.

11. **Repair by OEM**. In the event that the repairs of the equipment (hardware or software) cannot be undertaken in-house due to non-availability of specific facilities or component level spares, the same are to be off-loaded to BEL (Bg), in accordance with procedures in vogue.

12. It is requested that: -

(a) Information contained in this letter be disseminated to all units.

(b) Comments/feedback if any be forwarded to integrated Headquarters, Ministry of Defence (Navy)/DEE by 30 Sep 2014.

(B Sivakumar)
Commodore
PDEE

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Dte of Electrical Engineering
New Delhi – 110011

EE/ POLICY/L-86/COMM- 13

18 Sep 12

The Flag Officer Commanding–in-Chief
(For CLO/CCO)
Headquarters, Southern Naval Command
Kochi.

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Headquarters, Western Naval Command
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(For CLO/CCO)
Headquarters, Eastern Naval Command
Vishakhapatnam

The Commander – in – Chief
For CTO (Marine)
HQ, Andaman and Nicobar Command
Port Blair-744101

MAINTENANCE AND UPKEEP POLICY – COMMUNICATION SYSTEMS

1. **Background**. In the past few years, the communication equipment fit onboard Naval Platforms have grown to cover the spectrum from VLF to Ku Band. Some new communication equipment (COTS nature) for Net Centric Operations (NCO) have been added to the suite enabling the Navy to undertake Blue Water operations optimally. All these equipment, being in operation almost 24X7 hrs need regular upkeep and maintenance. Substantial efforts have been put in by IHQ and all Commands to streamline the maintenance/ repair procedures and ensure stability in terms of both performance and maintenance support for this large spectrum of communication equipment.

2. **Aim**. The aim of this letter is to lay down the maintenance and upkeep procedures pertaining to the entire set of communication equipment presently in service onboard Warships.

3. **Range of Equipment**. This policy covers the range of equipment for normal Ship-board operations in VLF/MF/HF/ V/UHF range viz. CCS MK II, TR2400, ST1075, PAE3060, EK896 and PRC6020 as well as equipment used for NCO viz.

Rukmani, Link-II, SACU, SMART-F, SATCOM, NEWN and HSDM(High Speed Data Modem).

4. **On Board Spares (OBS)**. Adequate quantities of Onboard Spares (OBS) for each set have been catered for vide various IHQ supply orders. The OBS have been allocated to various platforms in accordance with the population of the various sets.

5. **Base and Depot (B&D) Spares**. Adequate sets of B&D spares for all the sets have been catered for vide various IHQ supply orders. In order to ensure effective utilization of these spares, they have been rationally reallocated from deposit stock to MO(Mb), MO(V) and MO(K) respectively in accordance with the population of the various sets. HSDM, being a non-ToT item**,** has been included in OBS as well as B&D. In addition, firm has also been asked to initiate action for storing adequate no. of HSDM as part of RU stock to cut down high turnaround time.

6. **Documentation**. One set of User and Technical manuals are supplied along with each communication set. These are to be utilized by the Ship staff for 1st and 2nd Level Maintenance.

7. **Test Jigs / Test Equipment**. Most of the current systems have an in-built BITE for onboard DI/DR. To cater for repair and maintenance at yards, adequate sets of test jigs have been installed at ND (MB), ND (V) and NSRY (K) for CCS MK II, TR2400, ST1075, PAE3060, EK896 and PRC6020. A test jig for TR2400 has been installed at NSRY(PB) also. The firms for the respective communication sets have imparted training to the yard personnel on the use and maintenance of the test jigs during the installation / commissioning activity. These test jigs need to be effectively utilised in order to reduce the repairs through RRC and further to reduce down time of sets.

8. **HATs Schedule and Maintops**. The HATs document and the Maintops of all the sets have been promulgated. In case of special test equipment requirements for certain serials, Commands have been directed to undertake procurement under delegated powers in case these test equipment is not available within local resources.

9. **Maintenance Philosophy**

(a) **1st and 2nd Level Maintenance**. The first and second level of maintenance is to be carried out by the ship's staff / FMU. This would include basic DI/DR and repair by replacement till module/unit level. Dedicated BITE facilities inbuilt in the systems are to be utilised for ship level diagnosis at sea or harbour. Since the equipment has been procured from varied sources, the maintenance philosophy is broadly sub-categorised as follows:-

(i) For Mil grade equipment (Sl. 1 to 7 of table at Enclosure) Ship's staff / FMU staff is to undertake repairs utilising OBS, documents and generic test equipment.

(ii) For COTS nature equipment (Sl. 8 to 10 of table at Enclosure), maintenance is to be undertaken by respective FMU/ NSRY through RRC. The ship staff is to report the defect to FMU/NSRY which should thereon get the equipment rectified and hand over to the ship.

(iii) The ship staff is not required to interact with the OEM for cases in Para 9(a)(i) and 9(a)(ii) above.

(iv) For defects in Link-II the ship staff is required to approach BEL, Waterfront Support to get the equipment rectified under AMC.

(v) NEWN problems are to be reported to respective COMNETCENs for repair under AMC.

(vi) Rukmani project related equipment are presently under warranty for 05 years. Subsequently, the equipment will be maintained by FMU/NSRY through AMC. Till commencement of AMC (date will be promulgated subsequently), Headqarters/CCOs are required to address warranty defects projected by ships to the OEM.

(b) **3rd and 4th Level Maintenance**. The 3rd and 4th level of maintenance for Mil grade equipment (Sl. 1 to 7 of table at Enclosure) is to be undertaken by the dockyards on modules / units landed for repairs by the ship's staff. The yards are to utilise the dedicated test jigs, as mentioned in Para 7 above, for 3rd and 4th level of repair and maintenance. In case the modules cannot be repaired by the yards the defective modules should be taken up for repairs through RRC concluded by respective MOs.

(c) Particular caution is to be exercised while dealing with OEMs/Firms/AMC reps on systems having embedded software and removable storage media like Hard disk/ Flash drives etc. to avoid leakage of any sensitive or classified data.

10. **Training**. User and Maintainer training is conducted on induction of every communication equipment. In addition, training is also conducted for dockyard personnel. The training to users and maintainers are also included in the training curriculums of relevant courses at respective training schools. Based on the feedback, repair/ training camps by various equipment OEMs have also been steered occasionally by IHQ/Commands at Commands/ OEM premises.

11. A table containing the consolidated maintenance support available for the various communication equipment is placed at Enclosure. It is requested that information contained in the letter be disseminated to all units. Comments, if any, on

the contents of the letter be forwarded to IHQ/DEE by end Dec 12.

(Amit Bose)
Commodore
PDEE

Encl: As above

Enclosure to IHQ MoD(N)/DEE Letter
EE/ POLICY/L-86/COMM-13 dated 18 Sep 12

MAINTENANCE AND UPKEEP POLICY – COMMUNICATION SYSTEMS

S NO	EQPT	ND(MB)	ND(V)	NSRY(K)	NSRY(PB)
1	CCS MK II	Yard support – Test Jig	Yard support – Test Jig	Yard support – Test Jig	-
2	TR 2400	Yard support – Test Jig	Yard support – Test Jig	Yard support – Test Jig	Yard support – Test Jig
3	PAE 3060	Yard support – Test Jig.	Yard support – Test Jig	Yard support – Test Jig	RRC is being undertaken for maintenance of onboard sets.
4	ST 1075	Yard support – Test Jig	Yard support – Test Jig	Yard support – Test Jig	
5	PRC 6020	Yard support – Test Jig	Yard support – Test Jig	Yard support – Test Jig	
6	EK 896	Yard support – Test Jig	Yard support – Test Jig	Yard support – Test Jig	
7	HSDM	Non TOT item : Survey/ Demand	Non TOT item : Survey/ Demand	Non TOT item : Survey/ Demand	Non TOT item : Survey/ Demand
8	SACU	RRC-FMU	RRC-FMU	RRC	RRC
9	SMART-F	RRC-FMU	RRC-FMU	RRC	-
10	SATCOM	AMC-FMU	AMC-FMU	AMC	-
11	Link-II	AMC-BEL WFS	AMC-BEL WFS	AMC-BEL WFS	AMC-BEL
12	NEWN	AMC-COMNETCEN	AMC-COMNETCEN	AMC-COMNETCEN	AMC-COMNETCEN
13	Rukmani	Warranty (05 YRS) Followed by AMC through FMU	Warranty (05 YRS) Followed by AMC through FMU	Warranty (05 YRS) Followed by AMC	Warranty (05 YRS) Followed by AMC

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Dte of Electrical Engineering
New Delhi – 110 011

EE/POLICY/L-92/COMM-14 10 Apr 13

The Flag Officer Commanding–in-Chief
(For CCO/CLO)
Headquarters, Western Naval Command
Mumbai – 400 023

The Flag Officer Commanding–in-Chief
(For CCO/CLO)
Headquarters, Eastern Naval Command
Visakhapatnam – 530 014

The Flag Officer Commanding–in-Chief
(For CCO/CLO)
Headquarters, Southern Naval Command
Kochi – 682 004

The Commander – in – Chief
(For CCO/CLO)
HQ, Andaman and Nicobar Command
Port Blair - 744 101

MAINTENANCE AND UPKEEP POLICY – AMSS SANCHAR ANTIVIRUS

1. **Aim**. The aim of this letter is to lay down the maintenance and upkeep procedures pertaining to the Antivirus suite for the AMSS-SANCHAR application on the NEW network.

2. **Background.** Sanchar AMSS software, based on NEWN, was supplied commissioned by M/s TATA Consultancy Services Pvt. Ltd. (M/s TCS) in 1999 for Indian Navy as per a WESEE Contract. The OEM, M/s TCS, had also been contracted for providing comprehensive AMC for the entire hardware and software, supplied as part of SANCHAR system. In addition to the above, a separate contract for supply, installation and support of an Anti-Virus solution for all the NEWN nodes, was also concluded separately by WESEE in 2004, for duration of 05 years, post completion of system warranty.

3. **Present Status.** The antivirus support was due to expire in Apr 12 and therefore to ensure continued service, a fresh case was initiated by IHQ

MoD(N)/DEE, and RFP issued to the firm in Jul 11. The AMC case had reached the contract conclusion stage by Dec 2011, when M/s TCS stated that in view of latest company policies, they were unable to progress with the contract unless some changes were made to certain standard clauses of contract. Inspite of multiple high level meetings at ACOM (IT&S) and ACOL level wherein it was explained to the firm, the firm decided to continue with their request of amendment to the contract terms. The antivirus support by the Firm was however extended till Apr 13 at no additional cost.

4. The case has been taken up with the MoD for resolution of way ahead on the impasses. However, MoD has expressed that the case is unlikely to be approved by the RM, since the issue pertains to standard clauses of contract. Considering the fact that the case may not be approved by the RM and based on deliberations at IHQ, the maintenance philosophy has been drawn out in the subsequent paragraph.

5. It is pertinent to mention that the Antivirus solution that was offered by M/s TCS during the comprehensive AMC (Para 2 above refers) was from M/s Trend Micro Systems which has been proved to be effective over more than eight years. The earlier Antivirus AMC contract was centrally concluded with M/s TC since the AMSS SANCHAR system was designed and developed by M/s TCS they had the complete understanding of the system. In the present situation however, a centralized contract for the Antivirus solution through a single alternate vendor was examined and it was observed to be not cost effective since the Firm's reps have to travel far and wide across different locations for execution of the AMC. Hence, it has been decided that respective Commands may conclude contracts with suitable local / geographically co-located Firms to provide the Antivirus solution for maintenance and upkeep of the AMSS SANCHAR system.

6. In view of the above, it is requested that local contracts may be concluded for Antivirus support for AMSS SANCHAR at Command levels. This contract can also be as an extension to the Anti-virus AMC contract already existing at every Command.

(Amit Bose)
Commodore
PDEE

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New Delhi – 110011

EE/ POLICY/L- 97/COMM -16

11 Sep 14

The Flag Officer Commanding–in-Chief
(For CLO/CCO)
Headquarters, Southern Naval Command
Kochi.

The Flag Officer Commanding–in-Chief
(For CLO/CCO)
Headquarters, Western Naval Command
Mumbai.

The Flag Officer Commanding–in-Chief
(For CLO/CCO)
Headquarters, Eastern Naval Command
Vishakhapatnam

The Commander – in – Chief
For CTO (Marine)
HQ, Andaman and Nicobar Command
Port Blair-744101

MAINTENANCE AND UPKEEP POLICY - V/UHF Tx/Rx PAE M7

1. **Background**. The letter pertains to the maintenance guidelines of V/UHF Tx/Rx PAE M7 procured by IHQ as replacement for the PAE 3060 sets fitted onboard a large number of *IN* Ships and establishments. The PAE 3060 Tx/Rx set had progressively replaced the Tx/Rx P 802G, Tx/Rx MUN 110/UN 410, P- 619, P-625 and VUC 203 sets earlier installed onboard IN ships and establishments. The directives for ABER replacement of PAE 3060 sets with PAE M7 has been issued vide IHQ MoD(N)/DNS policy letter CM/4860 dated 24 Dec 12.

2. **Brief Description**. The PAE M7 is a much advanced version of its predecessor. In place of microcontroller based design of the PAE 3060, the M7 incorporates microprocessor based design using FPGAs and DSPs. The PAE M7 is designed as a non-SCA compliant SDR and can adapt functionality based on the software and Wafeforms loaded. The M7 is capable of operating on the entire band from 100 to 399.975 MHz unlike the PAE 3060 which operates in VHF band 100-163 MHz and UHF band 225-900 MHz. The PAE M7 has selectable channel spacing of 25, 12.5 and 8.33 kHz as against a fixed 25 KHz in its predecessor. The standard operating modes are AM and FM with both voice and data capabilities and incorporates ECCM with FH of 500 hops/sec with TDMA unlike the 40 hops/sec

without TDMA capability of the PAE 3060. The RF power output is also enhanced with 50 W in AM and 100W in FM. The sets have a single amplifier module for the entire band and the construction is highly modular in nature. The system also incorporates a Built in Test (BIT) system to localise faults upto module level. It also provides for comprehensive monitoring of all important parameters of the equipment.

3. **Procurement Case**. The first lot of 97 nos. PAE 3060 V/UHF Tx/Rx sets were procured by IHQ vide supply order dated 08 Jan 1997. Post the fair electronic life of the PAE 3060 sets, IHQ identified the PAE M7 V/UHF Tx/Rx set as an ABER replacement and accordingly an order for 97 PAE M7 sets was placed on M/s ECIL (Hyd) in Apr 12 with a delivery period of 12 months. The Supply order includes 71 sets of Onboard Spares, 06 sets of Base & Depot spares, 04 sets of Test Jigs and Instruments and 97 sets of documentation.

4. **Product Support**. The PAE M7 set has been indigenised by Electronics Corporation of India Limited, Hyderabad (ECIL(Hyd)) under a ToT arrangement from M/s. Park Air, U.K. ECIL (Hyd) is presently fully capable of rendering support for all defects, their analysis and repair of hardware. As per terms of the contract, M/s ECIL (Hyd) has committed complete product support for a period of 15 years including two years of warranty.

5. **Documentation**. The documentation (both User manuals and Maintenance manuals) have been approved and promulgated as INBR 4556 series. The documentation has been distributed to MOs at Mumbai, Vizag and Kochi on a pro-rata basis depending on the distribution of the sets. The technical documentation for level 3 and 4 repairs contain all drawings and details upto component level. This documentation along with the Test Jig manual together provides the procedures and checks upto component level.

6. **HATs**. The HATs schedules ranging from EED-T/272/C to EED-T/276/C for PAE M7 has been promulgated vide NHQ letter EE/05/1974 B dated 12 Jun 13. The responsibility of offering HATs of the system (post NR/MR) would be that of SS/Dockyards.

7. **Onboard and B&D Spares**. A total 71 sets of OBS have been procured and have been distributed to MOs at Mumbai, Vizag and Kochi on a pro-rata basis depending on the distribution of the sets. A total of six sets of B&D spares have been procured and have been distributed to MOs at Mumbai, Vizag and Kochi on a pro-rata basis depending on the distribution of the sets. To cater for component level repairs, the OEM has provided a detailed Part Identification List (PIL) containing individual component details, along with the technical documentation. The complete PIL of 540 items (including proprietary items) has been INCATed and all components can be demanded from MOs.

8. **Test Equipment/ Tools/ Test Jigs**. A set of Test equipment / Tool kit has been procured for each set and is issued accordingly. These are to be utilized for level I and II repairs. Four packages of Test Jigs have also been procured for supporting level III and IV repairs at Yards. One each Test jig has been allotted to ND (MB), ND (V), NSRY (K) and FMU(Mbi) vide DEE Fax EE/05/2054 dated 10 Sep

13.The test jigs provided with the PAE M7 equipment can detect and indicate defects upto discreet component levels.

9. **Maintenance Training**. As per terms of the Contract, the Operator and Maintainer level 1&2 course has been conducted at the three Commands (Mumbai, Vizag and Kochi) and the maintenance course for level 3&4 (including Yard reps) has been conducted at ECIL(Hyd) in mid 2014. Further, training on test jigs has also been conducted at the time of commissioning of the test jigs at the Commands. The training for level 3 & 4 repairs imparted by the OEM at OEM premises has been at the component level.

Maintenance Philosophy

10. **Onboard Maintenance (Level I and II)**. Periodic checks by monitoring critical parameters for ascertaining the health of the equipment and DI/DR through replacement of faulty modules/PCBs will be undertaken by SS. Assistance of dockyard may be sought as necessary.

11. **Maintenance Ashore (Level III and IV)**. The personnel in dockyard/repairyard have been trained on use of the Test jigs. The yards are to undertake Level III and IV repair and maintenance of the PAE M7 sets. The post-repair performance of the sets landed in the yards, would be demonstrated at the shop floor using installed test jigs and test equipment. The sets at Port Blair and Karwar are to be provided LRU level repairs at the respective NSRYs using available spares and the collated defective cards are to be forwarded to the nearest Command for repairs through Yards/ RRC.

12. **Repairs by OEM**. In the event that the repairs of the equipment (hardware & software) cannot be undertaken in house due to non-availability of specific facilities or component level spares, the same are to be off-loaded to ECIL(Hyd), in accordance with procedures in vogue.

13. It is requested that:-

(a) Information contained in this letter be disseminated to all units.

(b) Comments/feedback if any be forwarded to Integrated Headquarters, Ministry of Defence (Navy)/DEE by 30 Sep 14.

(B Sivakumar)
Commodor
PDEE

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EE/ POLICY/L-86/COMM-13

15 Jan 15

The Flag Officer Commanding-in-Chief
(for CLO/CCO)
Headquarters, Southern Naval Command
Kochi

The Flag Officer Commanding-in-Chief
(for CLO/CCO)
Headquarters, Western Naval Command
Mumbai

The Flag Officer Commanding-in-Chief
(for CLO/CCO)
Headquarters, Eastern Naval Command
Vishakhapatnam

The Commander-in-Chief
(for CTO (Marine))
HQ, Andaman and Nicobar Command
Port Blair

MAINTENANCE AND UPKEEP POLICY – PROJECT RUKMANI EQUIPMENT

1. Refer to IHQ MoD(N)/DEE letter EE/POLICY/L-86/COMM-13 dated 18 Sep 12.

2. **Background**. Project Rukmani equipment consisting of C, Ku and UHF band as well as MSS were inducted as COTS equipment and have been installed onboard surface ships since 2010. Installation of the terminals onboard is likely to be completed shortly. The warranty of the various constituent systems (ship and ground based) will expire by Oct 2016. In view of the COTS nature of the hardware, the maintenance of the equipment including ground and ship based hardware is envisaged to be undertaken through comprehensive AMC with the OEM post warranty period. The submarine based terminals for Sindhughosh class submarines and INS Chakra are likely to be delivered and fitted in 2015 after which they will be under warranty. The maintenance philosophy of the terminals is envisaged to be same as that for ship based and ground based terminals post expiry of respective warranties.

3. **Aim**. Maintenance and upkeep procedures pertaining to the entire set of communication equipment including Rukmani, were laid down vide letter ibid. The

aim of this letter is to further amplify the maintenance and upkeep philosophy pertaining to the entire set of Project Rukmani equipment presently in service onboard warships as well as the associated shore segment at the Hubs.

4. **Range of Equipment**. This policy covers all the Rukmani Project equipment including C, Ku, UHF and MSS systems fitted onboard ships, submarines and ground based terminals.

5. **Maintenance Philosophy**. The maintenance philosophy for further levels of maintenance is elaborated in the succeeding paragraphs.

(a) **CAMC**. Post expiry of warranty, for both ship and submarine based systems, maintenance will be undertaken through a Comprehensive AMC (being pursued at IHQ MoD(N)) with the OEM. The CAMC will cover corrective as well as preventive maintenance of all the equipment as mentioned at Para 3 above and is envisaged to be executed with M/s BEL(Gad) as a single point of responsibility for the *IN*. Individual OEMs of hardware of the respective segments would provide the envisaged maintenance support through MoUs with BEL(Gad).

(b) **Coordination of Maintenance during CAMC (Ships/ Hubs and Shore terminals)**. The responsibility of coordination of timely preventive and corrective maintenance of the Afloat and Ashore segments of the equipment will be divided as follows:-

(i) **Ship/Submarine-borne Terminals**. Ship/Submarine-borne terminals will be maintained through the CAMC coordinated by Core teams based at the Fleet Maintenance Units (FMUs) at Mumbai and Vizag and NSRYs at Kochi, Port Blair and Karwar. The core team will be responsible for co-ordination of all preventive and corrective maintenance activities through the OEM. The division of responsibilities of the teams will be as follows:-

Sl.	**Core Team location**	**Area of Responsibility**
(aa)	FMU(Mbi)	Ships at Mumbai, Goa, Okha/ Porbandar
(ab)	FMU(Vzg)	Ships at Vizag, Chennai
(ac)	NSRY(Kochi)	SNC ships, L&M islands
(ad)	NSRY(Port Blair)	Ships at A & N islands
(ae)	NSRY(Karwar)	Ships at Karwar

(ii) Man-power for the constitution of the core teams is being re-appropriated from within Command resources. Each core team will comprise of the following personnel:-

(aa) FMU (Mbi) – 05 (01 EAP/EAR, 01 POELR/EMR, 03 Communication sailors) (ab) FMU (Vzg) – 04 (01 POELR/EMR, 03 Communication sailors)

(ac) NSRY (Koc) – 03 (01 EAP/EAR, 02 Communication sailors)

(ad) NSRY(Port Blair) – 02 (01 EAP/EAR, 01 Communication sailor)

(ae) NSRY (Karwar) – 02 (01 EAP/EAR, 01 Communication sailor)

(iii) **<u>Hubs and Shore terminals</u>**. All preventive and corrective maintenance activities related to the Shore terminals of the Command and Hubs will be undertaken by the Service Engineers of the OEM placed at the respective hubs. The service personnel integral to the hubs will form the core team for coordinating the CAMC for the hubs.

6. **<u>Spares</u>**. As part of the envisaged scope of the CAMC, the OEM will be responsible to stock the required spares to fulfil the service conditions of the CAMC. The MRLS will continue to be held by the various units. In certain critical cases, in order to meet the operational requirements, MRLS may be consumed for DI/DR by the OEM with an assurance of timely replenishment. Such consumption of MRLS would need to be reviewed by the respective Command Headquarters every quarter, so as to ensure that MRLS is not depleted at any time.

7. **<u>Documentation</u>**. Documentation as per the contract has been supplied to all units and the same is to be referred to for onboard operation and maintenance requirements.

8. **<u>Training</u>**. User and maintainer training has been carried out periodically for naval personnel. The aim of the training has been to impart requisite skills for operation as well as onboard troubleshooting based on BITE facility provided in the equipment. Refresher training capsules would need to be undertaken periodically to cater for the annual manpower turnover.

(B Sivakumar)
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New Delhi – 110011

EE/POLICY/L-106/COMM-18 30 Jan 17

The Flag Officer Commanding-in-Chief
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Headquarters, Southern Naval Command
Kochi

The Flag Officer Commanding-in-Chief
(for CLO/CCO)
Headquarters, Western Naval Command
Mumbai

The Flag Officer Commanding-in-Chief
(for CLO/CCO)
Headquarters, Eastern Naval Command
Vishakhapatnam

The Commander-in-Chief
(for CTO (Marine))
HQ, Andaman and Nicobar Command
Port Blair

MAINTENANCE GUIDELINES – PROJECT RUKMANI EQUIPMENT C AND KU BAND TERMINALS AND MSS

1. Refer to IHQ MoD (N)/DEE letter EE/POLICY/L-86/COMM-13 dated 15 Jan 15.

2. Maintenance and upkeep policy for project Rukmani equipment consisting of C, Ku and UHF band as well as MSS was issued vide IHQMoD(N)/DEE letter ibid.In view of the COTS nature of the hardware, the maintenance of the equipment including ground and ship based hardware was envisaged to be undertaken through comprehensive AMC (CAMC) with the OEM post warranty period. Comprehensive AMCs (CAMC) for C and Ku Band terminals and MSS terminals have been concluded at IHQ MoD(N) and AMC for UHF Satcom is under process. The aim of this letter is to streamline the maintenance/ upkeep and defect rectification procedures through division of responsibilities to various stake holders in order to ensure optimum utilization of the CAMC and availability of the Rukmani equipment for maximum operational exploitation.

3. **AMC Details**. CAMC for the C and Ku Band Rukmani terminals for a period of one year has been concluded with M/s BEL, Ghaziabad and is valid till 28 Dec 17. CAMC for the MSS terminals for a period of three years has been concluded with M/s Avantel, Hyderabad and is valid till 06 Nov 19. Post expiry of the CAMC, the same would be renewed. Soft copy of the Contract documents are being forwarded through mail over NUD. Case for conclusion of CAMC for the UHF Satcom terminals for a period of nine years is under process. The maintenance guidelines for further levels of maintenance and delegation of responsibilities is discussed in the succeeding paragraphs.

4. **Responsibility of Service Personnel on Ship/Shore (Users)**. The responsibilities of the Naval personnel on Ship/HUB are given below:-

(a) Maintenance of equipment logs books.

(b) On occurrence of any defect the user should carry out first level diagnostics as per BITE facility available with the equipment and restrict repair of the equipment to the extent of replacement of faulty subsystem only. Investigation/repairs at sub system level are not to be attempted.

(c) **Defect Reporting Procedure**. In case the ship staff is not able to rectify the defect, the same has to be reported to the Rukmani Core teams (discussed in succeeding paragraphs).The defect reporting procedure for C/Ku band Rukmani terminals and MSS Terminals is given below:-

(i) **C and Ku Band Terminals**. The defect is to be reported to the respective Core teams via Fax in the defect reporting format placed at Enclosure 1. The copy of the fax is to be marked to Control Centre at BEL, Ghaziabad.

(ii) **MSS Terminals**. The defect is to be reported to the respective Core teams via Fax in the defect reporting format placed at Enclosure 1.The copy of the fax is to be marked to the Control Centre at M/s Avantel, Hyderabad.

(d) It is to be ensured that a **complaint number is generatedby the AMC firm** and the same has to be obtained from the Core teamand recorded in the equipment log book.

(e) The Service engineers/POCs would provide assistance over telephone and try to resolve the issue online. In case the issue cannot be resolved online, resident engineer at the particular location will be deputed to resolve the defect with requisite spares.

(f) In case the defect is not resolved by the resident engineer, suitable specialist/ OEM rep would be deputed to resolve the defect.

(g) In extreme cases the AMC firms would need to utilize onboard spares for DI/DR. Any such usage has to be reported to the core team and it is to be ensured that the spares are replenished by the OEM within the stipulated time.

(h) Causative analysis of each defect is to be undertaken in association with the resident engineer and report submitted to Core team.

(j) The complaint has to be closed post defect rectification.

5. **Responsibility of Core Teams**. Directives for formation of Core teams consisting of Naval personnel at FMU(Mbi), FMU(Vzg), NSRY (Karwar), NSRY(Kochi) and NSRY (Port Blair) have been issued vide IHQ,MoD(N)/DEE policy letter ibid. The responsibility of the Core teams is coordination of timely preventive and corrective maintenance of the Afloat and Ashore segments of the Rukmani project equipment. The responsibility of the Core team and the actions to be taken by the Core team are given below:-

(a) The areas of responsibilities of the Core teams are as given below:-

Sl.	**Core Team location**	**Area of Responsibility**
(i)	FMU(Mbi)	Ships at Mumbai, Okha andPorbandar
(ii)	FMU(Vzg)	Ships at Vizag, Chennai, Paradip, Tuticorin and Kolkata
(iii)	NSRY(Kochi)	Ships at Kochi and L&M islands
(iv)	NSRY(Port Blair)	Ships at A & N islands
(v)	NSRY(Karwar)	Ships at Karwar and Goa
(vi)	Mumbai and Visakhapatnam Hub	Service personnel integral to the hubs will form the core team for the Hubs
Note:- Core teams at base port will be responsible for coordination of DI/DR for Ships at foreign ports		

(b) The Core team has to be fully conversant with the AMC contracts and the terms and conditions therein.

(c) On receipt of fax with defect reporting format / telephonic information from the ship, the Core team has to immediately report the defect to the AMC firms and register a complaint. The complaint number generated by the AMC firms is to be recorded and also intimated to the ship staff.

(d) The Core team will act as an interface between the ship and the AMC firms and will be responsible for ensuring resolution of the defects by the AMC firms. Towards this the core teams will have to interact with the AMC firms on a regular basis. Contact details of the AMC firms and associated POCs are placed at Enclosure 2 (for Rukmani C and Ku band terminals) and Enclosure 3(for MSS Terminals).

(e) In case the defect is not being attended to/ resolved by the AMC firm within the stipulated time period, the same has to be reported to the respective Command headquarters.

(f) The Core team has to maintain a record of complaint numbers, record of defects (with causative analysis) attended by the AMC firms and the time taken for resolution of the defects.

(g) Record of OBS / MRLS used by the AMC firms has to be maintained by the Core team and **it is to be ensured that the spares are replenished** within the stipulated time period as mentioned in the contract.

(h) Report on record of defects (with causative analysis) and the status of OBS/MRLS has to be forwarded to the Command headquarters on a monthly basis.

6. **Responsibility of Command Headquarters**. The responsibilities of Command Headquarters (CLO section) are given below:-

(a) Monitor functioning of the Core teams.

(b) Disseminate contact details of the Core team to all Ships and Shore stations (fitted with Rukmani equipment) and update the same on a regular basis as when there is a change in Core team members.

(c) Liase with AMC firms for unresolved defects/ replenishment ofspares reported by Core teams.

(d) Collate reports forwarded by Core teams and forward the same to IHQ,MoD(N)/DEE on a quarterly basis in format placed at Enclosure 4.

(e) Forward satisfactory performance certificate for the AMC firms in format placed at Enclosure 5.

(f) **Training**. The Command Headquarters are to ensure that M/s BEL,Ghaziabad conducts one training program (as per contractual obligation)for ship's staffon preventive maintenance of C and Ku band Rukmani terminals on quarterly basis at the supported ports (Mumbai, Vizag, Goa/Karwar, Kochi, Chennai and Port Blair).

(g) Escalate matters not within the control of Command Headquarters to IHQ,MoD(N)/DEE.

7. Soft copy of these guidelines are also being included as part of Compendium of Electrical Policy letters hosted on NUD.

8. It is requested that contents of this letter be disseminated to all ships and shore establishments fitted with Rukmani project equipment to ensure unhindered operational exploitation of the same.

(C Raghuram)
Commodore
PDEE

Copy to:-

The Admiral Superintendent
(DGM'W')
Naval Dockyard
Mumbai

The Admiral Superintendent
(DGM'W')
Naval Dockyard
Vishakhapatnam

The Flag Officer Commanding Western Fleet
C/o FMO,
Mumbai

The Flag Officer Commanding Eastern Fleet
C/o FMO,
Vishakhapatnam

The Flag Officer Commanding
Karnataka Naval Area
Naval Base
Karwar

The Flag Officer Commanding
Gujarat Naval Area
HQGD&D
Block No II, Wing C1
KarmyogiBhawan
Sec 10A, PO Box-28
Gandhinagar

The Admiral Superintendent
Naval Ship Repair Yard
Kochi

The Flag Officer Commanding
Maharashtra Area

C/o FMO, Mumbai

The Flag Officer Commanding
Goa Area
INS Gomantak
Vasco-da-Gama,
Goa

NOIC (TN)
INS Adyar
Chennai

NOIC (Kerela)
C/o INS Vendurthy
NavalBase
Kochi

NOIC (Kolkata)
C/o Navy Office
Hastings
Kolkata

NOIC (Port Blair)
C/o Navy Office
Port Blair

NOIC (Paradip)
Cuttack District
Paradip
Orrisa

NOIC (Lakshadweep)
Kavaratti Island
UT of Lakshadweep
HPO Kochi

The Material Superintendent
Material Organisation
Naval Stores Depot
Ghatkopar, Mumbai

The Material Superintendent
Material Organisation
C/o FMO, Visakhapatnam

Material Superintendent
Material Organisation
C/o FMO, Kochi

The Commodore Superintendent
Naval Ship Repair Yard
Karwar

The Material Superintendent
Material Organisation
Naval Base
Karwar

The Material Superintendent
Material Organisation
C/o Navy Office
Port Blair

The Officer-in-Charge
Fleet Maintenance Unit
C/o Fleet Mail Office
Mumbai

The Officer-in-Charge
Fleet Maintenance Unit
C/o Fleet Mail Office
Visakhapatnam

The Captain Superintendent
Naval Ship Repair Yard
Port Blair

Bharat Electronics Ltd
(forMrsRuchi Garg,General Manager-SBU Head)
Ministry of Defence
P.O. Bharat Nagar
Ghaziabad
UP-201010

Avantel Limited
(forMr P BalaBhaskar Rao , VP (Marketing))
Plot No 16,Sector –III,
HUDA Techno Enclave
Opp K. Raheja IT Park,
Madhapur
Hyderabad- 500 081

Internal: **ACNS(CSNCO)** **PDNSO**

Enclosure2 to IHQ/DEE letter EE/05/2010 dated 30 Jan 17

CONTACT DETAILS FOR C AND KU BAND RUKMANI TERMINALS

Sr No	Location	Area of Responsibility	Name	Designation	Contact Details
1.	Mumbai Hub	All Systems connected to Mumbai Hub	Control Cell	-	022-25540865 ,extn 150 (Telefax)
2.			Mohit Kumar	Engineer	+91-9987689283
3.			Anil K Sahu	Engineer	+91-9819902111
4.	Mumbai	All systems at Mumbai	Prashant	Engineer	9540322087
5.	Vizag Hub	All Systems connected to Vizag Hub	Control Cell	-	0891-2812193 (Telefax)
6.			Naveen Kumar	Engineer	+91-9990386830
7.			Biswajit K Das	Engineer	+91-8002419329
8.	Vizag	All systems at Vizag	Abhishek	Engineer	9313633244
9.	Kochi	All systems at Kochi	Deepak	Engineer	8077930066
10.	Port Blair	All systems at Port Blair	Rajan	Engineer	9532568505
11.	Karwar	All systems at Karwar	Details Awaited. In the in the interim Mr T P Kumar Singh, ManagerPS-SCCS at BEL (Gad) may be contacted on +91-9449088546 0120-2814133		
12.	Goa	All systems at Goa			
13.	Chennai	All systems at Chennai			

Sr No	**Location**	**Area of Responsibility**	**Name**	**Designation**	**Contact Details**
14.	BEL, Ghaziabad	All systems	Control Cell		0120-2770296
15.			Akshay Kaushal	Engineer	+91-9718917226
16.			Subhash Chand	Engineer	+91-9968788312
17.			T P Kumar Singh	Manager PS-SCCS	+91-9449088546 0120-2814133
18.		All systems	TribhuvanPrashad	DGM SCCS	+91-9871279040 0120-2813539
19.			Sunil KR	Sr. DGM - Project Head	+91-9871278166 0120-2814812
20.		All systems- To be contacted only by Command Headquarters in case the defect/issue is not resolved	Ruchi Garg	General Manager-SBU Head	0120-2814812 0120-2894573

Enclosure 3 to IHQ/DEE letter EE/05/2010 dated 30 Jan 17

CONTACT DETAILS FOR MSS TERMINALS

Sr No	Location	Area of Responsibility	Name	Designation	Contact Details
1.	Avantel, Hyderabad	All Systems	Control Cell	-	040-66305004 (Fax no)
2.			BalaBhaskar Rao	Vice President Marketing	+91-9866343684
3.			V Subhas	Manager	9908010099
4.	Mumbai	All systems in Mumbai	Umesh Pradhan	Regional Manager	+91-9224259612
5.	Visakhapatnam	All systems in Visakhapatnam	K Sreenivasa Reddy	Manager	+91-9989317472
6.	Kochi	All systems in Kochi	V SajeevKumar	Sr Engineer	+91-9020095951
7.	Port Blair	All systems in Port Blair	Narendra Prasad	Sr Engineer	9476005456
8.	Karwar	All systems in Karwar	A Rajashekhar	Sr Engineer	9535221130
9.	Kattaboman	All systems in Kattaboman	B Srinivasulu	Sr Engineer	9789985867
10.	Gurgaon	All systems in Delhi	Satyapal	Ast Manager	8800624292
11.			Ravi Shankar Jawa	Regional Manager	9810178006

Enclosure 1 to IHQ/DEE letter EE/05/2010 dated 30 Jan 17

DEFECT REPORTING PROFORMA – PROJECT RUKMANI EQUIPMENT

1. Unit - ____________________________

2. Equipment- ____________________________

3. Location - ____________________________

4. Defect Description - ____________________________

5. Defect Date & Time - ____________________________

6. Additional Data on Defect - ____________________________

    (a) Preliminary DI/DR (If available)

    (b) Prior History (if any)

7. Effect on system availability –

    (a) Partially ops

    (b) Totally ops

    (c) Non-ops

8. Reported by

    (a) Name & Rank

    (b) Tel / Mobile

    (c) Any other contact details

Round Stamp **(Ship Staff Signature)**

Enclosure 5 to IHQ/DEE letter EE/05/2010 dated 30 Jan 17

SATISFACTORY PERFORMANCE CERTIFICATE (DATE FROM-DATE TO) FOR RUKMANI C AND KU BAND TERMINALS

It is certified that M/s Bharat Electronics Limited, Ghaziabadhas provided services to the satisfaction of the user during the period from ______________ to _____________.

Date:- Signature

Round Stamp

SATISFACTORY PERFORMANCE CERTIFICATE (DATE FROM-DATE TO) FOR MSS TERMINALS

It is certified that M/sAvantel, Hyderabad has provided services to the satisfaction of the user during the period from ______________ to _____________.

Date:- Signature

Round Stamp

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Telephone: 2301 1668

Integrated Headquarters
Ministry of Defence (Navy)
Dte of Electrical Engineering
Sena Bhawan
New Delhi - 110 011

EE/POLICY/L-102/EW-13 30 Aug 16

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters, Western Naval Command
Mumbai - 400 023

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters, Eastern Naval Command
Visakhapatnam - 530 014

The Flag Officer Commanding-in-Chief
(for CLO)
Headquarters, Southern Naval Command
Kochi - 682 004

The Commander-in-Chief
(for CTO(Marine))
HQ ANC
Port Blair - 744 101

MAINTENANCE GUIDELINES: CHAFF SYSTEMS

1. **Introduction**. *IN* Ships are fitted with a wide range of Western, Russian and Indigenous origin chaff decoy systems. These systems are primarily intended to provide a soft-kill Anti-Missile Defence (AMD) option with a very short response time. Depending on the capability of specific systems, these maybe additionally exploited to confuse/distract the enemy radars by using longer range rockets. This letter aims to define the maintenance guidelines of chaff systems in the Navy.

2. **Generic Description of Modern Chaff Systems**. Chaff systems comprise of three building blocks viz. the Tactical Computer also referred to as the Fire Control System (FCS), Launchers and the Rockets. The tactical computer is the heart of the system which, depending on the direction of the incoming missile, wind direction and ship's course determines the launcher, type and number of rockets and the sequence of firing of the rockets with the aim to maximise effectiveness of chaff cloud. There are at least two launchers installed, which could either be fixed type as in the case of Super Barricade system on Godavari class, Kavach Mod I on LSTs or

trainable as in the case of PK -2M in case of Delhi class and Kavach Mod II onboard Kolkata and Kamorta class ships. Rockets contain a payload of aluminium foils, which on blooming create a 'chaff cloud' emulating a radar target.

Chaff Systems in *IN*

3. **Russian Origin**. The following chaff systems (PK series) of Russian origin are installed onboard *IN* ships:-

(a) **PK 2M**. Installed onboard Delhi class ships and INS Vikramaditya the system employs two, twin barrel trainable launchers, an electrical servo system and a fire control system SMETA-E.

(b) **PK 10**. Installed onboard Talwar, Teg and 1241 RE (Pralaya and Prabal) ships, the system has two fixed sets of ten tube launchers. The fire control panel provides the firing control supply for the selected chaff rockets.

(c) **PK 16**. Installed onboard 1241 RE/ PEs, Ranjit, Ranvir and Ranvijay, the system has two sets of sixteen tube launchers. The fire control panel provides the firing control supply for the selected chaff rockets.

4. **Western Origin**. Two major chaff systems, Super Barricade and Deseaver are installed onboard *IN* platforms. These are briefly described below:-

(a) **Super Barricade Chaff**.Three sets of the system were supplied by M/s ML Aviation (now M/s Wallop) UK and installed onboard Godavari class ships. The system employs twin fixed launchers controlled by a tactical computer. The system has been declared obsolescent vide IHQ MoD(N) letter WP/ 0377 dated 07 Jun 16. Since, Godavari has been decommissioned, Super Barricade chaff system declared obsolescent and IN Ships Ganga and Godavari are also at the end of their service life, the requirement to upgrade the chaff system has been held in abeyance. As the OEM has stopped manufacturing spares, the ex-Godavari chaff system and its OBS post merging in the B&D stock along with the existing B&D spares would be utilised to support the systems onboard IN Ships Ganga and Gomati till their decommissioning.

(b) **Deseaver Chaff**.Three sets of the system were supplied by M/s Elbit, Israel and installed onboard Brahmaputra class ships. The system employs twin fixed launchers controlled by a dedicated Fire Control System (FCS). The PAC for procurement of Deseaver chaff spares has been accorded vide IHQ MoD(N) letter DPR/MW/4006/PAC/39 dated 31 Mar 16.

6. **Indigenous Chaff System**.The design and development of indigenous chaff decoy system 'Kavach' was progressed by IHQ MoD(N) in association with Ordnance Factory Board (OFB). Kavach Mod-I (with fixed launchers) and Mod-II (with trainable launchers) variants have been developed and installed onboard *IN* platforms. A brief description of Kavach system is as follows:-

(a) **Kavach Mod-I**. The OEM of the system is Gun Carriage Factory (GCF), Jabalpur. The system consist of two Long Range cum Medium Range Launchers containing 16 tubes each (12 Medium Range and 04 Long Range) and two or four Short Range Launchers having 16 tube each. The system is installed onboard Shivalik class, NOPVs (Saryu class), LSTs (Shardul class), *IN* Ships Viraat, Rajput and Kora. The HATs/SATs of Kavach Mod I has been completed onboard Shivalik class ships, NOPV (Saryu class), LSTs (Shardul class), *IN* Ships Rajput and Kora. The system will be installed onboard remaining P25/25A ships on progressive basis during their scheduled refits.

(b) **Kavach Mod-II**. The OEM of the system is Machine Tool Prototype Factory (MTPF), Ambarnath. The system consist of two Long Range cum Medium Range Launchers containing 16 tubes each (12 Medium Range and 04 Long Range in centre) and two Short Range Launchers having sixteen tube each. The system is installed onboard Kolkata and Kamorta class ships and INS Deepak. The HATs/SATs of Kavach Mod II has been completed onboard INS Kamorta and HATs completed onboard *IN* Ships Kolkata and Kadmat.

6. **Documentation**. Requisite documentation for undertaking repairs and maintenance of the system are available onboard.

7. **Onboard and B&D Spares**.Onboard spares have been provided with the respective chaff systems. B&D spares have also been provisioned and stocked at WEDs (FCS spares) and NADs (Launcher spares).

8. **MAINTOPs**. MAINTOPs for existing chaff systems have been promulgated by INSMA for carrying out periodic maintenance routines.

9. **Maintenance Philosophy**

(a) **Onboard Maintenance (Level I and II)**. The routine maintenance of the chaff systems including the launchers is to be undertaken by SS. Repairs to FCS/Tactical Computer and elements of control chain be undertaken by replacement of defective parts. Due care of the launcher barrels to prevent corrosion are to be taken. Further, the firing circuits and associated devices are to be checked periodically as specified in the respective MAINTOPs.

(b) **Ashore Maintenance (Level III and IV)**. The Naval Dockyards shall be responsible for III/IV level maintenance of all elements of the systems including launchers up to the firing circuit stage. Repair facilities for Russian origin chaff launchers has been established in the yards. In addition the dockyards shall also carry out repairs to defective PCBs/ Modules landed by SS.

(c) **Maintenance by NAD (Level III and IV)**. NADs will be responsible for Series inspection routines (every two years) of launcher barrels and the chaff mountings.

10. **Training**. Onboard maintenance training for ship's crew on *IN* chaff systems

is being undertaken at INS Valsura. Further, Operator/ Maintainer training for the ship's crew is being provided as part of chaff system initial installation and trials. A Level III/ IV training of Kavach Mod-I and Mod-II chaff systems has been undertaken in Aug 16 for Yard personnel at GCF, Jabalpur and MTPF, Ambarnath respectively. The training covered aspects pertaining to Launcher servo mechanism and Fire Control System (FCS) software to enable Yard personnel to undertake level III/IV maintenance of all the elements of the Kavach systems including launchers up to the firing circuit stage.

11. **Dockyard Support Package (DSP)**. Repair facilities for Russian origin chaff launchers has been established in the yards. Kavach Mod-II DSP for Naval Dockyards Mumbai and Visakhapatnam is being procured as part of procurement of Kavach Mod-II chaff systems for P 17A ships. The AoN for the case is being progressed at IHQ MoD(N) and the DSP is expected to be delivered by 2019.

12. It is requested that:-

(c) Information contained in this letter be disseminated to all units.

(d) Comments/feedback if any be forwarded to Integrated Headquarters, Ministry of Defence (Navy)/DEE by 30 Sep 16.

(C Raghuram)
Commodore
Principal Director

BACK TO INDEX

Tele : 2301 1101

Intergrated Headquarters
Ministry of Defence(Navy)
New Delhi – 110 011

EE/POLICY/L-54/EW-05

11 Feb 09

The Flag Officer Commanding – in Chief
(for CLO)
Headquarters Western Naval Command
Mumbai – 400 001

The Flag Officer Commanding – in Chief
(for CLO)
Headquarters Eastern Naval Command
Visakhapatnam – 530 014

The Flag Officer Commanding – in Chief
(for CLO)
Headquarters Southern Naval Command
Kochi – 682 004

The Flag Officer Commanding – in Chief
(for CTO Marine)
Headquarters, ANC
Port Blair

GENERIC GUIDELINES FOR PROTECTION OF ELECTRONIC EQUIPMENT/TELEPHONE EXCHANGES AGAINST LIGHTNING

1. **Background**. In recent past number of incidents have been report from HQs/Ashore units regarding damages to the electronic equipment (especially telephone exchanges) due to lightning strikes. The aim of this letter is to familiarize all ashore units regarding lightning, its impacts and remedial measures to protect the sensitive electronic equipment installed indoors, as well as measures to be undertaken during procurement/contract stages.

2. **Introduction**. Lightning is an atmospheric discharge of electricity, which typically occurs during thunderstorms and sometimes even during volcanic eruptions or dust storms. During the short interval of a lightning flash, several discharges occur. The initial path for the discharge is established in about 50 microseconds. Intermediate return stoke currents of about 1 kA follow the initial return stroke and last for a few milliseconds. Subsequent strokes occur at intervals of 50 to 60 milliseconds The review stroke interval may include a continuing current of 100A or so which flows for several milliseconds or until the start of the next return stoke.

3. **Effects of lightning**. Various known effects of lightning are : -

(a) Mechanical and Thermal effects.

(b) Conductor Impedance effects.

(c) Induced Voltage effects.

(d) Capacitive Coupled Voltage.

(e) Electrical effects.

4. **Electrical Effects of Lightning**. The electrical effects of lightning are of main concern to electronic equipment especially indoor equipment like telephone exchanges, communication sets etc. The lightning discharges to or near the buildings and structures could potentially cause damage to electrical/electronic equipment therein. Melting or burning of conductors occurs at the point of interception of the stroke. The voltages developed by the fast rise time, high amplitude current pulse are often high enough to break down insulation, pose personnel hazards and cause component/device failures. Electronic equipment connected to exposed cables are of high risk needing specific attention.

5. **Protection**. Broadly speaking, lighting protection entails two areas. First, the protection of building infrastructure encompassing the lightning arrestor system (including Earth pits) and second, the protection of the electronic equipment housed therein encompassing all associated power supply/signal/data lines. In general these areas of concern are addressed and implemented through the OEMs instructions/guidelines for installation of electronics equipment/telephone exchanges. However, in absence of such instructions from OEMs, various types of protection measures that need to be implemented for buildings, power supply lines and Data /Signal lines of electronic equipment/telephone exchanges are discussed in detail in the EED-52-05 issued by IHQ/MoD(N) in Jan 09. Apart from the lightning protection measures for the building, the electronic equipment especially those connected to exposed cables needs to be adequately protected against radiated and conducted susceptibility. This has to be done by measure of hardening equipment, passing exposed cables through metallic conduits, installation of surge protectors etc, and this need to be in insisted while connecting these cables to the COTs equipment.

6. In view of the above, it is imperative that ll new electronic equipment/telephone exchanges being installed in shore stations are to follow the adequate protection measures. This aspects needs to be borne in mind during the procurement and contract stages. MES construction/Installations also require adhering to the guidelines as stipulated in the EED ibid. The existing systems also needs to, incorporate the same, if adequate precautions as indicated by OEM or EED are not incorporated in the installations, during their AMC/upgradation as deemed fit.

7. It is requested that : -

(a) Information contained in this letter be disseminated to all Establishment/ashore units.

(b) Equipment hardening and protection against radiation and conducted susceptibility should be catered for in TE/Contracts for COTs equipment.

(c) Comments/feedback if any be forwarded to IHQ/MoD(N) by 28 Mar 09.

(Amit Rastogi)
Captain
Director Elect. Engg.

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GENERIC GUIDELINES FOR PROTECTION OFELECTRONIC EQUIPMENT TELEPHONE EXCHANGES AGAINST LIGHTNING EED-52-05

Introduction

1. Lightning is an atmospheric discharge of electricity, which typically occurs during thunderstorms and sometimes even during volcanic eruption or dust storms. A strong, negatively charged region exists in the lower part of cloud with a counterbalancing positive charge region in the upper part of the cloud. In addition to these major charge centers, a smaller, positively charged region exists near the bottom of the cloud, the cloud appears to be negatively charged with respect to the earth, except in the immediate vicinity underneath the smaller positive charge concentration. Breakdown can occur between the charged regions within the cloud to produce intra- cloud lightning.

2. Cumulonimbus clouds associated with thunderstorms are huge turbulent air masses extending as high as 15-20 kilometers into the upper atmosphere. These charged regions develop electric field gradients of hundreds, or perhaps thousands, or millions of Volts between them. When the electr5ic field strength exceeds the breakdown potential of air (= 3X 10 6 Volts/meter), a lightning flash occurs and the charged areas are neutralized. Typical range values of various significant lightning parameters and frequency of transient occurrence are indicated below : -

Range of Values for Lightning Parameters (Extract from NEC-HDBK-120)

Parameter	Min	Typical	Max
Number of return strokes per flash	1	2 to 4	26
Duration of Flash (seconds)	0.03	0.2	2
Time between strokes (ms)	3	40 to 60	100
Peak current per return stroke(kA)	1	10 to 20	250
Charges per flash (coulombs)	1	15 to 20	400
Time to peak current (µs)	<0.5	1.5 to 2	30
Rate of rise(/kA/µs)	<1	20	210
Time to half –valve (µs)	10	40 to 50	250
Duration of continuing current (ms)	50	150	500
Peak continuing current (Amps)	30	150	1600
Charge in continuing current (Coulombs)	30	25	330

Freq. of Transient Occurrence-no of Lighning Surges in 10 Years at one Facility

High Incident Area	Low Incident Area
(100 Thunderstorm Days Per Year)	(10 Thunderstorm Days Year)
1750	175

Flash Parameters

3. During the short interval of a lightning flash, several discharges occur. The initial path for the discharge is established in 50 microseconds. Intermediate return stroke currents of about 2 kA follow the initial return stroke and last for a few milliseconds. Subsequent strokes occur at intervals of 50 to 60 milliseconds. The return stroke interval may include a continuing current of 100A or so which flows for several milliseconds or until the start of the next return stoke.

4. Lightning discharge involves the transfer of large amounts of electric charge between the cloud and the earth. A typical flash transfers 15 to 20 Coulombs (c) with some flashes involving as much as 400 Coulombs of charge. The energy per flash of lightning has been estimated to be as high as 10 8 watt- seconds.

5. **Effects of lightning.** These are various effects of lightning as listed below. Of these, the electrical effects of lightning are of concern to electronic equipment especially telephone exchanges.

(a) Mechanical and Thermal effects

(b) Electrical effects

(c) Conductor Impedance effects

(d) Induced Voltage effects

(e) Capacitively Coupled Voltage.

6. **Electrical Effects of Lightning**. Lightning discharges to or near the buildings and structures could potentially cause damage to electrical/electronic equipment therein. Melting or burning of conductors occurs at the point of interception of the stroke. The Voltages developed by the fast rise time, high amplitude current pulse are often high enough to break down insulation, pose personnel hazards and cause component and device failures. These voltages are produced due to varying contributions by the following and the lightning surges in power, signal, and circuits and generally the result of some combination of these: -

(a) IR drop (Current X Impedance) resulting from the lightning pulse traveling down power lines or signal lines, through structural members, along down conductors or overhead ground wires or though the resistance of the earth connection.

(b) Magnetic induction

(c) Capacitive coupling

Protection of Electronic Equipment Telephone Exchanges against Lightning

7. Broadly speaking, Lightning protection entails two primary areas. First, the protection of building infrastructure encompassing the lightning arrestor system

(including Earth pits) and second, the protection of the electronic equipment housed therein encompassing all associated power supply/signal/data lines. The various types of protection measures that need to be implemented for buildings, power supply lines and signal lines of electronic equipment/telephone exchanges are laid down in the following documents: -

(a) IS : 2309-1969

(b) IS : 3043-1987

(c) IS : 2309-1966

(d) IEC 62305 Standards

(e) IEC 61643 -21 and 61643 – 22 (or equivalent)

(f) NEC hand book NEC – HDBK – 120

(g) NEC standards NEC-STD – 1101

Guidelines-Lightning Protection Measures for Buildings

8. The fundamental principle for the protection of buildings against lightning is to provide an alternate low impedance conducting path between the atmosphere above the building and the general mass of earth. The ensures that lightning discharges enter the earth without producing dangerous potential differences in or near the building and also without passing through non-conducting parts of the buildings.

9. If adequately earthed metal parts of proper proportion are provided and spread proper on around the building, damage due to lightning could be largely prevented. The protective system should, however, be simple, mechanically strong and properly maintained. However, because lightning has such a wide range of characteristics, it is difficult to provide protection under all conditions although the degree of protection can be increased through optimal installation/maintenance philosophy. The purpose of lightning protection is to protect a building and other objects during lightning strokes.

10. Through simple logic/cost benefit analysis, it is evident that the comprehensiveness of the lightning protective system depends on various factors such as prevalence of lightning in the locality, frequency and extent of occupancy of the building, nature and value of its contents and the nature of the soil. Other things remaining the same, the more elaborate the protection system, the higher the level of protection against lightning. In determining how far to go in providing lightning. Protection for specification cases or whether or not is needed at all, it is necessary to take into account the following factors : -

(a) Usage of structure

(b) Type of construction

(c) Contents or consequential effects

(d) Degree of isolation

(e) Type of terrain

(f) Height of structure

(g) Lightning prevalence

11. The basic protection mechanism mandates proper installation of lightning arrestor conductors above the buildings and leading to ground (Earth pit). The recommended shape and minimum sizes of the lightning arrestor conductors for use above and below ground systems are enumerated in Table I & II placed at Appendix A&B respectively.

Guidelines – Lightning Protection Measures for Power Supply and signal Lines

12. **Introduction.** Control, Status, infra-facility power, and data/audio lines, other coaxial or twin-axial lines are most effectively protected through transient suppression designed as an integral part of the equipment, and specified transient suppression installed at wall penetration or exterior equipment termination.

13. **Suppression Design and Component Selection.** Transient suppression will effectively protect equipment only when proper components are selected so that the components operate in conjunction to provide the desired function. This is necessary so that the clamped output of the suppression components/circuit can provide optimum equipment protection. Actual suppression components are shown in Figures 'A' to 'C' below, as GT1 RV1 and RV2, and TS1 and their functionality described subsequently.

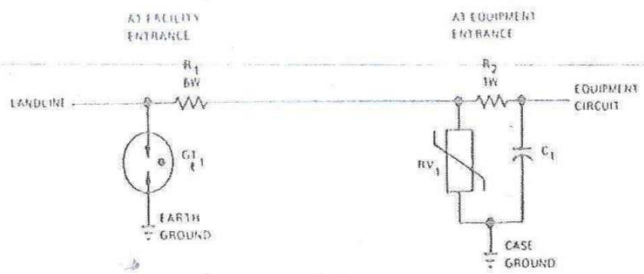


Fig-A

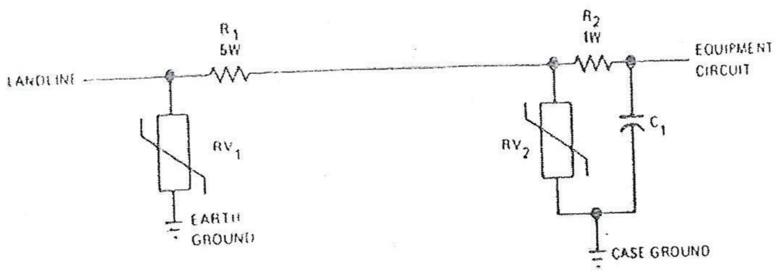


Fig-B

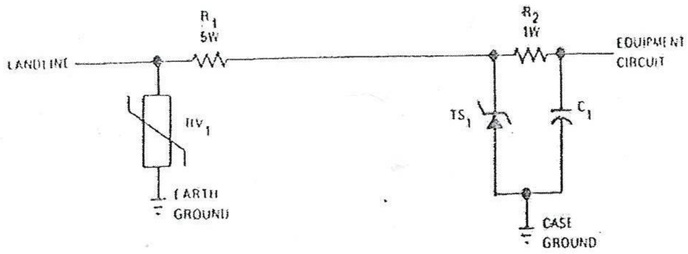


Fig-C

14. Suppression components are to be used both at the facility entrance and equipment entrance. However, care is to be taken to ensure that the suppression component at the equipment entrance should be chosen so that it has a lower turn on and clamping voltage than the suppression components at the facility entrance. Therefore, resister R1 must provide a voltage to turn on the suppression component at facility entrance and limit current flow through the suppressor at equipment entrance. Otherwise, the suppression component at the facility entrance may not turn on when a transient occurs. The component will not normally turn on when a transient of less than several hundred Volts peak amplitude occurs and the component is a gas-filled spark gap (GT1), also commonly known as Gas Discharge Tube (GDT). However, when a transient of greater amplitude occurs, the suppression component at the facility entrance must turn on. Otherwise, the suppression component at the equipment entrance will attempt to dissipate the entire transient to ground. As a result, the suppression component at the equipment entrance will attain a higher clamp voltage as it dissipates additional transient current. The higher clamp voltage gets reflected across protected which could be detrimental. In addition, the suppression component itself is likely to fail.

(a) **Gas-filled Spark Gap GTI**. A gas-filled spark gap is suitable for use as a transient suppressor at facility entrance in some cases. The device has a relatively high spark-over (turn-on) voltage and a relatively medium to slow turn on time when compared with a Metal Oxide Varistor (MOV) or Silicon Avalanche Diode Suppressor (SAS), which has been elaborated in subsequent paragraph. For typical lighting-induced transients on landlines, turn-on voltage is a nominal 500 Volts with an associated turn-on time of 1 microsecond. These characteristics are satisfactory as long as the value of resistor R1 is 10 ohms or more, and the peak pulse current rating for the suppression component at the equipment entrance is not exceeded. When R1 is ohms, a peak current of 50 Amperes is required to provide a voltage of 500 Volts across R1 which is the nominal turn-on Voltage for GTI. Since GTI turns on after a nominal 1 microsecond, the peak pulse current rating for most MOV and SAS devices will not be exceeded. After the spark gap turns on, arc Voltage across the device is as low as 20 Volts. This may nbe sufficiently below the normal line Voltage to create operational upset of the protected equipment. This upsetting in some cases, however, cannot be tolerated. If normal line voltage is greater than 20 volts, difficulty may be encountered in turning off the device, depending on available current. The arc mode of operation may be sustained by current greater than 1 Ampere for some devices. When the value of R1 is less than 10 Ohms, an MOV or other equivalent suppressor must be used at the facility entrance because a spark gap will not turn on before the suppressor at the equipment entrance is damaged by over current, particularly when the suppressor at equipment entrance is a SAS.

(b) **Metal Oxide Varistor (MOV)RV1, RV2**. As show in the Figures above, MOV can be used in various configurations to provide effective transient suppression. Turn-on time for the MOV is less than 10 nanoseconds, and turn-on voltage ranges from 22 to 1800 volts. Clamp voltage is not as low as for SAS devices and turn-on time is not as fast. The turn-on time for SAS devices is typically less than 5 nanoseconds, and less than 1 nanosecond in some configurations. The configuration show in Figure C, is especially effective for protecting highly susceptible equipment. The configurations shown by Figures A and B provide adequate protection when the protected equipment can safely withstand the rated clamping voltage for the MOV at the equipment entrance. An MOV with a 20 mm element diameter will normally provide required protection at facility entrance, and a 10 mm element diameter MOV will normally provide required protection at the equipment entrance. To enable desirable functioning, the turn-on voltage of the MOV suppressor at the facility entrance should exceed that of the MOV at the equipment entrance by approximately 10%. This is desirable to permit the MOV at the equipment entrance to turn on and dissipate low amplitude transients while reflecting a low clamp voltage to protected equipment. When a high-amplitude transient occurs, the voltage increase across R1 will cause the MOV at the facility entrance to turn on. When the MOV at the facility entrance turns on, it dissipates most of the remaining transient energy. Thus, the MOV at the equipment will conduct only a small amount of current and maintain a low clamp voltage that is reflected across the protected equipment. The MOV operating characteristics are similar to those for a pair of back-to-back zener diodes. Therefore, the device responds the same to a negative or positive transient voltage.

(c) **Silicon Avalanche Diode Suppressor (SAS) TS1**. The SAS device has the fasted turn-on time of any of the three suppressor devices shown in Figure above. Turn-on time is typically less than 10 nanoseconds and can be less than 1 nanoseconds in some configurations depending on lead length and the path to ground for the device. Turn-on voltage ranges from 3 Volts to 200 Volts. Devices may be connected in series to obtain higher turn-on voltages and to improve power handling capability. For example, two devices connected in series can dissipate approximately 1.8 times the power dissipated by a singe device. The clamping voltage for the device is also lower than for MOV devices. The maximum clamping voltage for the SAS devices is approximately 1.6 times the turn-on voltage at peak pulse current. Peak pulse current ranges from 139 Amperes for a 6.8 Volt device to 5.5 Amperes for a 200 Volt device over a period of 1 millisecond. Devices recommended for use at the equipment entrance have a peak pulse power dissipation ranging of 1500 watts over a period of 1 millisecond. Device are available in both unipolar and bipolar configurations. Operation of a unipolar device is very similar to that of zener diode, and operation of a bipolar device is very similar to that for a pair of back-to-back zener diodes. For most effective protection, unipolar devices should be used on lines that carry unipolar voltage provided the AC noise level on the applicable line is less than 0.5 volt. Use bipolar devices on lines that carry bipolar (AC) voltage and on lines with an AC noise level greater than 0.5 volt. Selection of SAS devices is based on the reverse standoff Voltage rating. The Reverse Standoff Voltage must be greater than maximum Line Operating Voltage, and should exceed normal line voltage by 20% when possible.

(d) **Resistor R2 and Capacitor C1**. Resistor R2 attenuates current flow to protected equipment resulting from clamp voltage of the transient suppressor at the equipment entrance. The resistor also speeds up, and in some cases, generates turn-on of the transient suppressor at the equipment entrance. In addition, the resistor limits current drain from protected equipment when a transient with polarity opposite that of the equipment power supply occurs. A power rating of 1 Watt is sufficient for the resistor. The resistance value should be as high as can be tolerated by applicable equipment, taking into consideration the value of resistor R1 and the impedance of the associated landline. The purpose of capacitor C1 is to filter out some high-frequency transient components, and the value of C1 should be selected accordingly. In some cases, equipment operating characteristics and line length may preclude the use of resistor R2 and Capacitor C1.

Grounding System

15. **Separation of Grounds for Suppression Components/ Circuits**.The high energy transient suppressor, shown at the facility entrance in Figure ‘D’, must have a path to earth ground that is separate from equipment ground or the ground for the low energy transient suppressor at the equipment entrance. In absence of this separate ground, large voltage spikes, causes by L d1/d1 effects when high-amplitude transient currents flow through the high-energy transient suppressor onto the ground may damage protected equipment or the low energy transient suppressor at the equipment entrance.

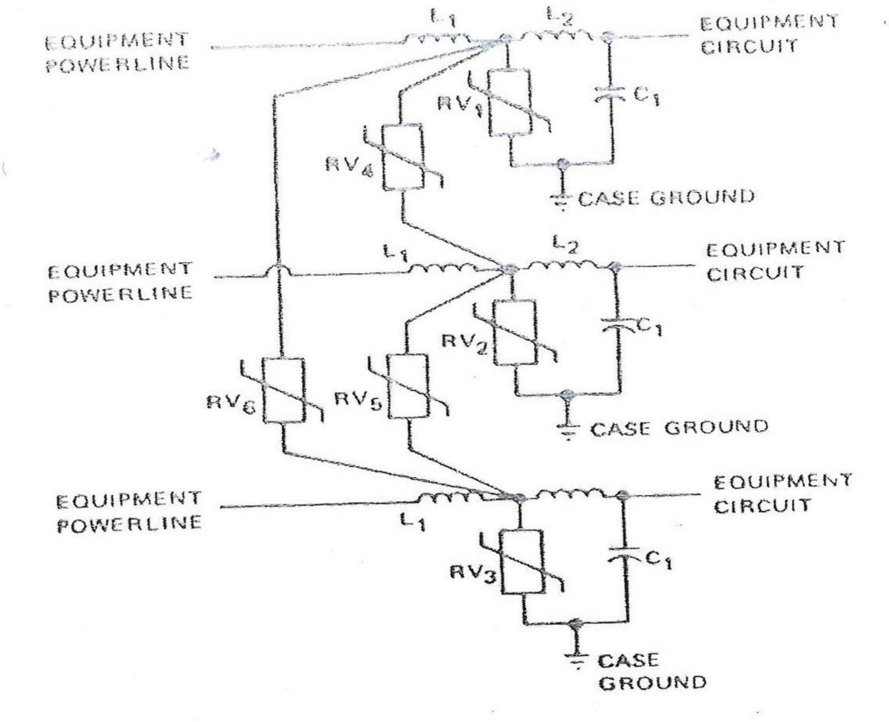


Fig-D

16. **Grounding of Transient Suppressor at Facility Entrance**. A schematic for the high-energy transient suppressor installed at the facility entrance is shown in figure "E" below. The power/ signal lines first be routed through a physical isolation device/manually operated switch and thereafter through the high-energy transient suppressor housed in a junction box where incoming lines are first terminated. The most effective ground for the suppressor can be provided by a ground bus bar located in, but electrically isolated from, the junction box. The ground bus bar should be connected as directly as possible to the Earth ground with an insulated 6 AWG (minimum) stranded copper wire.

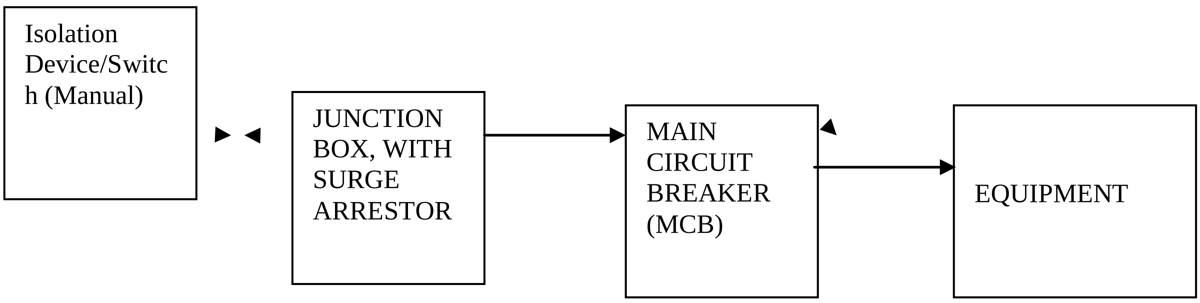


Fig – E

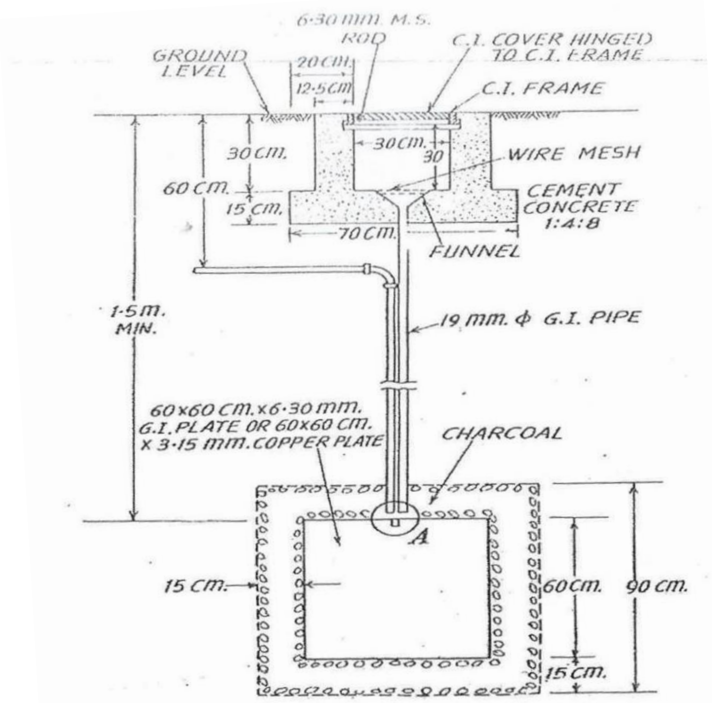
17. It is important that the ground wire has no sharp turns or bends, and is as short as feasible. The ground bus bar should be located to permit short, direct connection of suppressors between landline terminations and earth ground. In the event all transient suppression is included as an integral part of the equipment, an isolated ground must be provided for the high-energy transient suppressor.

18. **Groundling of Transient suppressor at Equipment Entrance**. The low-

energy transient suppressor at the equipment entrance should be directly bonded to the equipment case when possible. The ground side of the suppressor at the equipment entrance must be connected with a short, straight direct connection to equipment case to be effective. Connection of the suppressor to equipment case references both the suppressor and equipment circuits to the same ground potential, thus providing optimum equipment protection.

19. **Packaging Design**. Transient suppression component/circuits included as an integral part of equipment design should be enclosed in a shielded, compartmentalized section of the equipment. This is necessary to preclude cross-coupling of transient energy to other equipment circuits. The suppression components must be located so that transients are attenuated prior to entering an equipment components susceptible to damage, including EMI filters. Packaging design for transient suppression specified for installation at facility entrance is not critical. However, the design should provide for short, direct connection of transient suppressors between the line termination and ground.

20 Design of Earth Pits. Earth pits are to be designed/constructed appropriately for grounding of both lightning arrestor system and for system/equipment earthing These are to be in accordance with standards practices. Also, adequate separation between the earth pits for lightning arrestor system and for system/equipment earthing is to be maintained, to the extent feasible to avoid mutual return path. A schematic showing a typical Earth pit design is placed at fig-F



Typical installation of plate electrode

Fig-F Sample lay out diagram

IMPORTANT TIPS FOR SAFETY FROM LIGHTINING STROKES

1. **Out Door**

(a) Do not make a lightning rod of equipment subunit such as antennae etc, avoid projecting above the lightning arrestors/surrounding landscape.

(b) Do not stand under/near lightning conductor rods or strips, isolated trees, vehicle or machinery in wide open areas.

(c) Stay away from wire fences, over ground pipes rails and other metallic paths which could carry lightening currents from a stroke some distance away.

2. **Indoors**

(a) Avoid using telephones

(b) Stay away/out of contact with electrical wires, plugs switches, TV cabling or fixtures connected to house plumbing.

3. **Cone of Protection**

(a) It is achieved by use of air terminal or lightning rods, where a conducting structure will divert most flashes to itself and keep objects within radius equal to twice the height of this conductor from being struck.

(b) 1:1 zone of protection for important area and 1:2 is acceptable for less important area.

4. Two fundamental approaches for **protection of facilities**: -

(a) Lightening rods are used to neutralize a cloud sufficiently to a degree to prevent some stroke.

(b) Intercepting a lightening stroke and diverting it to the ground before it reaches a structure or an electrical circuitry by providing path of a least resistance to ground.

5. Two fundamental approaches for **Equipment protection** : -

(a) Use surge protectors on incoming power lines.

(b) Protect electronics against transient's levels by following methods: -

(i) Use of power line filter/isolation transformers to have common mode rejection.

(ii) Surge suppressor at equipment terminal.

6. **Equipment Earthing**. Proper grounding of all electrical appliances needs no emphasis. This is a primary requirement meant for the protection of men and equipment and needs to be ensured without fail at all times. Some salient aspects in this regard are enumerated below : -

(a) **Earthing of Electrical Machineries**. The frame of all electrical and electronic appliances that are regulating, supplying or consuming medium voltage energy are required to be earthed at two separate and distinct connections with the earth. The requirement is stipulated in the Indian Electricity Rules Chapter 6.

(b) **Connection with Earth**. The neutral conductor of a 3 phase 4 wire system and middle conductor of a 2 wire single phase three wire system are required to be adequately earthed as per the provision 6.1 of the Indian Electricity Act. Adequate number of earth provision needs to be provided such that the earth integrity is maintained throughout the establishment.

(c) **Earth to Neutral Integrity.** Earth to Neutral integrity is important towards ensuring safe operation of electronic equipment. This needs to be monitored regularly and should be as less as possible and at no times in excess of 2V on domestic 230V supply limes.

(d) **Checks for Grounding**. The integrity of ground as indicated in Para 4 above needs to be checked regularly. Earth Test meter may be used of this purpose and the earth resistance should not be in excess of 2 ohm.

Appendix-A
(Refer Para 11)

Table-1

Shapes and Minimum Sizes of Conductors for Use above Ground (Extract from IS : 2309-1969)

SL	Material and Shape	Minimum Size
a.	Round copper wire or copper-clad steel wire	6mm diameter
b.	Stranded copper wire	50mm2 (or 7/3.00 mm dia)
c.	Copper strip	20X3mm
d.	Round galvanized iron wire	8mmdiameter
e.	Galvanized iron strip	20X3 mm
f.	Round aluminum wire	9 mm diameter
g	Aluminum strip	25X3.15 mm

Appendix-B
(Refer Para 11)

Table-II

Shapes and Minimum Sizes of Conductors for Use BELOW Ground

SL	Material and Shape	Minimum Size
a.	Round copper wire or copper-clad steel wire	8mm diameter
b.	Copper strip	32x6 mm
c.	Round galvanized iron wire	10 mm diameter
d.	Galvanized iron strip	32X6 mm

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EE/06/L-29/EW-11

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COMPLIANCE TO EMI/EMC STANDARD – MIL-STD-461-E/F

1. Refer to IHQ/MoD(N) letter EE/06/1565 dated 26 Feb 2010 regarding standards to be followed for EMI/EMC test plan.

2. All electrical/ electronic equipment, except COTS/COTS based equipment, that are inducted into warships, are required to clear EMI/EMC trials in accordance with the relevant Military standards. Mil-STD-461-C, which was being specified as the relevant standard hitherto for this testing, has been revised to MIL-STD-461-E ON 10 Aug 1999 and subsequently to MIL-STD-461-F on Dec 2007. Unlike the older MIL-STD-461-C, where a detailed applicability matrix was provided for EMI/EMC testing for various type of equipment, MIL-STD-461E/F do not provide test applicability up to equipment/subsystem level. These standards gives only a broad platform specific applicability matrix, classifying the tests as **'A' (Applicable), 'L' (Limited) and 's' (to be specified).** While such a broad classification could lead to some amount of ambiguity on scope of EMI testing, the applicability of specific EMI tests needs to be clarified by the Navy at the SQR/ REP stages and contracted appropriately. This would ensure avoidable confusion during the finalisation of EMI/EMC test plan and preclude the need for the *IN* to compromise on some critical EMI tests during acceptance trials that are not contracted/ clarified to the OEM at the

RFP stage.

3. In order to streamline the test process and to ensure optimal EMC compliance of equipment being procured for the Indian Naval Ships and submarines, the following need to be strictly implemented:-

(a) All electrical electronic equipment, except COTS/COTS based equipment, that are inducted in *IN* for installation on Naval platforms, are to be tested in accordance with MIL-STD-461-E/F. In case system is to be tested as per MIL-STD-461-E, inclusion of CE-101 test must be ensured.

(b) All procurement/contracting agencies should clearly indicate in SQRs/RFP that the *"Equipment/system, except COTs/COTs based equipment, should comply with MIL-STD-461-E/F and OEM/firm would be required to formulate an EMI/EMC Acceptance Pan (EMI-AP) post placement of order for approval of IHQMoD(N), or a suitably nominated authority".*

(c) Equipment/systems, that have already been tested for EMI/EMC compliance as per the above specifications, need not be subjected again for these EMI tests against subsequent procurement orders.

(d) The draft EMI-AP, prepared by the OEM, would be vetted by NEC(Mbi) prior approval of IHQ/MoD(N).

(e) The approval EMI-AP would automatically become an addendum to the approved Quality Assurance Plan (QAP).

(f) EMI testing would be strictly undertaken as per approved EMI-AP, which would be equipment specific and the results of the EMI/EMC tests would be offered by the firm to the nominated QA agency.

(g) Specific clarification on technical issues regarding conduct of these EMI tests and interpretation of test results as per the approved EMI-AP, would be provided by NEC(Mbi) or IHQ MoD(N)/DEE, on as required basis.

(h) In the event of draughts/conflict on interpretation of the test results, the final clearance of equipment/system from EMC point of view will be given by IHQ MoD(N).

4. In case of COTS/COTS based equipment, EMI/EMC compliance certificate be sought from the OEM as per commercial standards prevalent in the OEM's country and equipment would be accepted against these Certificate of Compliance (COC) In this regard, IHQ MoD(N) policy directive issued vide letter EE/06/L-56/EW-07 dated 09 Feb 10 is also relevant.

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5. It is requested that the information contained herein be disseminated to all concerned.

(Amit Bose)
Captain
Principal Director

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EE/06/L-99/EW-12

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AMPLIFYING INSTRUCTIONS TO NAVY ORDER 01/13(LIFE CYCLE ELECTROMAGNETIC ENVIRONMENTAL EFFECT (E3) MANAGEMENT ONBOARD NAVAL PLATFORMS

1. Refer to NO 03/13. (Life cycle Electromagnetic Environmental Effect (E3) management onboard naval platforms).

2. As per Para 13 of the NO ibid, Pre/Post Refit EMI/EMC surveys are to be undertaken for refit cycles NR and above, only for 'Capital/Frontline' ships. The term Capital/Frontline was included in the NO to limit the requirement of refit EMI/EMC surveys to platforms fitted with large number of weapons and sensors and consequently having higher probability of EMI/RADHAZ.

3. In order to remove any ambiguities regarding the definition of 'Capital/Frontline' ships in specific context of this NO, list of platforms falling under the Category of 'Capital/Frontline' is hereby promulgated and is as tabulated below:-

S.No.	Class of Platform
(a)	1241 PE (Abhay Class)
(b)	1241 RE

(c) Jalashwa
(d) Brahmaputra
(e) Chakra
(f) Arihant
(g) Delhi
(h) Godavari
(j) Kamorta
(l) Kora
(m) Kolkata
(n) Prabal
(p) Rajput
(q) Shishumar (SSK)
(r) Shivalik
(s) Sindhughosh Class (EKM)
(t) Talwar
(u) Teg
(v) Air Carriers

4. Pre and Post Refit EMI/EMC surveys as mentioned in the NO 03/13 will be applicable only to the platforms as per above-mentioned list.

5. It is requested that the contents of this letter be disseminated to all concerned.

(C Raghuram)
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EE/Policy/L-57/NS/06 09 Apr 15

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MAINTENANCE POLICY FOR CMS SYSTEMS

Background

1. Combat Management Systems (CMS) provide seamless integration of weapons, sensors and other off board information sources to present a comprehensive tactical picture and equip the Command Teams with the decision-making tools to best address the evolving situation. The CMS is a Real-Time, Mission-Critical Decision Support System aiding the User to perform effective and efficient C4I operations.

2. CMS have been installed onboard capital ships such as Ranvir class, Shivalik class, INS Kolkata and INS Kamorta. These systems are also in the various stages of installation/procurement onboard Brahmaputra class, Delhi class, balance P-15A and P-28 ships, P-15B, P-71 etc. Modular CMS systems are planned to be installed onboard 23 other warships, which include RE, PE, Tankers, P-25 and P-25A class of ships amongst others. Eventually, all major platforms would have a flavor of CMS installed onboard.

3. Majority of the CMS systems have been procured from M/s BEL (DPSU). Post approval to procure CMS systems through the multi-vendor route, CMS-71 has been procured through M/s TPSED. Future procurement of CMS systems would be on Limited Tender basis.

4. **Aim**. The aim of this letter is to amplify the maintenance and upkeep philosophy pertaining to the CMS systems presently in service as well as the future CMS systems to be procured.

5. **Range of Equipment**. This policy covers all the CMS systems onboard ships as well as Reference and Training systems installed at shore establishments.

Maintenance Philosophy

6. The CMS system comprises three major components, viz., Hardware Segment, Application Software Modules and System Software modules. The systems post commissioning onboard are under warranty as per contract.

7. Comprehensive Maintenance Philosophy for M/s BEL make systems was promulgated in 2014 vide IHQ MoD(N) letter EE/Policy/L-57/NS/06 dated 14 Jul 14. In the philosophy, it was promulgated that CMS systems would be maintained through an CAMC by BEL through its Water Front Support (WFS) at Naval Dockyards. Accordingly, no 3rd or 4th line maintenance infrastructure has been setup for these CMS systems. In accordance with the subject maintenance philosophy, contracts for Comprehensive AMC of CMS systems onboard SNF and Brahmaputra class through WFS have been concluded with M/s BEL(Gad) to ensure continued maintenance and upkeep of these systems. In view of the COTS nature of the hardware and also the various variants of the CMS systems that would be deployed, the same policy would be applicable for non M/s BEL make CMS systems.

8. The maintenance philosophy is elaborated in the succeeding sub-paragraphs:-

(i) **CAMC**. Post expiry of warranty, for both ship and shore based systems, maintenance will be undertaken through a Comprehensive AMC with the OEM. The CAMC will cover corrective as well as preventive maintenance of the CMS systems. The CAMC is envisaged to be executed with M/s BEL(Gad) for the CMS systems for the systems that have been procured on Single Vendor basis through M/s BEL. For CMS systems procured on competitive basis, the CAMC would be undertaken by the CMS vendor on PAC basis. The CAMC vendor would be a single point of responsibility for the *IN* for all elements of the CMS systems, including the software developed by WESEE. The CAMC would be concluded either at IHQ MoD(N) or at respective Commands, depending on the financial implications.

(j) **Maintenance**.

(i) **Level 1 and Level 2 Repairs**. First two levels of maintenance are to be undertaken by ships staff and consist of periodic checks of all units in accordance with the relevant maintenance documents. The system is periodically checked with the help of diagnostic packages provided and malfunctioning PCBs/sub units identified and replaced from the onboard spares (OBS). The faulty PCBs are thereafter handed over to the CAMC reps by the ship staff for repairs.

(ii) **Level 3 and Level 4**. Level 3 and 4 maintenance consist of repair of the PCBs with the help of test set up/reference systems as well as resolution of any software related issue that has not been resolved by the ship's staff. These repairs are to be undertaken by the CAMC vendor through WFS and / or at OEM premises. Faults occurring because of failure of programmable devices/corruption of data in programmable devices would be handled by the CAMC reps. Periodic Maintenance which is beyond the purview of the ship's staff would also be undertaken by the CAMC reps.

(k) **Coordination of Maintenance during CAMC (Ships and Shore Establishments)**. The responsibility of coordination of timely preventive and corrective maintenance of the CMS systems will be undertaken by a suitable unit nominated by the Command (FTTT, WRSTG, ND, NSRY etc). In additional shore establishments, where systems such as the Reference Systems or Training systems are being installed, are to form a core team within the unit for coordinating the CAMC activities.

9. **Spares**. As part of the envisaged scope of the CAMC, the OEM will be responsible to stock the required spares to fulfil the service conditions of the CAMC. The OBS will continue to be held by the various units. In certain critical cases, in order to meet the operational requirements, OBS may be consumed for DI/DR by the OEM with an assurance of timely replenishment. Such consumption of OBS would need to be reviewed by the respective Command Headquarters every quarter, so as to ensure that OBS is not depleted at any time. Being a mission critical system, Base and Depot Spare procured for certain CMS systems are to replenish the onboard spares.

10. **Setting up of WFS Facility**. The vendor would be required to set up a WFS for which the CAMC of CMS is being executed. Appropriate office space is to be provided at the location by the Commands.

11. **Documentation**. Documentation as per the contract has been supplied to all units and the same is to be referred to for onboard operation and maintenance requirement.

12. **Training**. User and maintainer training would be conducted by the OEM reps on delivery of the systems. The aim of the training is to impart requisite skills for operation as well as onboard troubleshooting based on BITE facility provided in the equipment. Refresher training capsules would need to be undertaken periodically to cater for the annual manpower turnover. CMS systems would also being covered as part of the curriculum for trainees in INS Valsura and ND School. CMS Reference system has been positioned at INS Valsura and a CMS Training System has been procured for ND School to facilitate training of personnel. Other CMS Reference

systems being procured as part of the main CMS contract would be positioned at suitable locations by IHQ MoD(N).

13. **Security Aspects**. All CMS systems have a Tactical software component developed by WESEE. This component contains sensitive information about the weapons and sensors onboard the ship and the tactical algorithms in use by the CMS. The protection of the Tactical Software component through the lifecycle of the CMS system is of paramount importance. However, unlike the assurance when a DPSU is executing the CAMC, the prospect that the CAMC of a CMS system would be undertaken by a non-DPSU OEM requires additional safeguards to ensure protection of the Tactical software during the CAMC. An indicative list of safeguards is placed at Enclosure. The safety aspects may be augmented by the CAMC coordinating agency without compromising security or delaying the repair process.

(B Sivakumar)
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Encl. As Above

Enclosure to IHQ MoD(N)/DEE letter EE/Policy/L-57/NS/06 dated 09Apr 15

SECURITY SAFEGUARDS DURING CONDUCT OF CMS AMCs

Safeguards during Maintenance Phase. The measures that would be required to be in place to prevent misuse of the CMS hardware and software during the conduct of CAMC onboard are as follows:-

(a) **Non-Disclosure Agreement**. Signing of a Non-Disclosure Agreement with the CAMC vendor to bind them legally is mandatory. This will ensure that the CMS vendor will not share or utilize the IPR of IN with any third party.

(b) **Sharing of only Executables**. The source code will not be shared with the CAMC vendor. The CAMC vendor would be given access to only executables of the software. Source code is never to be shared or ported on any of the systems outside WESEE. In case of any unavoidable circumstances requiring the porting of the source code for debugging of any issue, explicit permission is to be sought by WESEE from IHQ MOD(N)/DEE to undertake the same. This is to be undertaken only by WESEE reps onboard. Post completion of the activity, WESEE is to forward a report indicating removal of the source code from the system and porting of the EXE.

(c) **Role & Right based Access**. Password Protection and setting up of appropriate user privileges for all the executable files is to be ensured during the CMS development. The access of CAMC reps to the software components should be controlled.

(d) **Secure Stowage of EXEs**. The CAMC vendor is to be responsible for secure stowage and handling of EXE's. The measures put in place by the vendor for secure stowage and handling of sensitive data would be audited by the local CMS CAMC controlling agency like FTTT/WRSTG/SEG.

(e) **Hardware Security**. Access to memory media through any port is to be disabled. Controlled access to enable execution of CAMC related functions only is to be ensured.

(f) **Physical Security**. Ensuring cabinet locking facilities are working and only required cabinets are accessed under supervision of SS by the CAMC reps.

(g) **Monitored Progress of Work Onboard**. SS to ensure that the CAMC reps are not working independently at any point of time. Strict monitoring of activities to be followed to foresee any attempted malpractice.

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LIFECYCLE SUPPORT OF INTERFACE UNITS DEVELOPED BY WESEE

1. WESEE is periodically tasked with the development of a number of interface solutions for system integration onboard *IN* platforms. While complex and industrially engineered units like Data Distribution Units (DDUs) of RLGs are supported under contractual provisions by the OEM, low-complexity interface units of generic nature,which are designed and engineered in-house by WESEE, have hitherto had no clear support procedure/ mechanism. This policy letter promulgates a mechanism for LifeCycle Support (LCS) of interface units designed, developed and implemented by WESEE.

2. **LCS Mechanism for Technically Complex Items with High Value (CAT A)**. These interface solutions are technically complex and have a service life of a decade or more. RLG Sigma 40 Data Distribution Unit (DDU) is a typical example of this

category. The production of all DDUs has been taken up through IHQ, MoD(N)/ DEE route. The maintenance and life cycle support of all such interface solutions is built within the individual contracts, with OEM being responsible for second and third level repairs. Further, requisite OBS and B & D spares have also been catered for in the contracts. This procedure is in consonance with the *IN* Maintenance Philosophy and is to be continued hitherto for all further new induction items falling under this category. The production of such new induction items would be the responsibility of concerned professional directorate at IHQ MoD(N). The items are to be stocked at WEDs. Requisite PAC for spares and services is to be issued to facilitate procurement and repairs by WEDs.

3. **<u>LCS Mechanism for Low Volume and Complex Design Items (CAT B)</u>**.Items developed by WESEE that are of low cost and are inducted in limited numbers are likely to be economically unviable for industry to support and also do not merit establishing a dedicated repair infrastructure. Therefore, WESEE would progress installation of these devices and also provide LCS for these items onboard field units. WESEE is to ensure adequate documentation and onboard spares are provided to the platforms for their sustenance during on board operations. Ship staff is to be trained for undertaking first level maintenance on board during the course of induction of such item. WESEE would provide field support to such items for repairs and replacement units, if necessary.

4. **<u>LCS Mechanism for High Volume and Standard Design Items (CAT C)</u>**.These items are often technologically less complex and are of low cost. However, they may require minor tuning/ adjustments onboard based on the specific purpose they are intended to be used for. These units are currently assembled by WESEE post procurement of components, connectors, chassis etc. The following guidelines are to be adhered to by all concerned agencies with regards to high volume and low cost items:-

(a) **<u>Induction, Production and Spares Management</u>**.

(i) **<u>Prototype Units</u>**. WESEE role as a design establishment will be limited to development of prototype solutions for urgent fleet support requirements and/or experimental/proof-of-concept purposes. Essential spares for upkeep of the prototype units, till their replacement with production version units, will also be delivered by WESEE along with the prototype unit.

(ii) **<u>Production Version Units</u>**. The high volume items are to be introduced in WEDs and a pattern number allocated. Initial stocking of units as a common item for all platforms is to be undertaken based on recommendation of WESEE. Bulk procurement of engineered versions of validated/ proven prototype interface units would be the responsibility of Commands, by offloading through WEDs, to suitable private firms identified by WESEE. These firms may be engaged by WESEE for a reasonable period of time through suitable MoUs. The firm so tasked for bulk production of WESEE designed interface units will also supply OBS and B&D spares as deliverables.

(iii) **Installation & Commissioning**. The responsibility of installation, commissioning and trials of the prototype version of the units will rest with WESEE. In case of production units, customisation and commissioning would also be undertaken by WESEE through field teams with the assistance of Ship Staff. Trials of such units may be undertaken and certified by ship's staff.

(iv) **Inventory Management**. The ranging and scaling of OBS and B&D spares will be undertaken by WESEE during induction, being the developer of the interface units. WEDs will undertake inventory management, including maintaining stock levels through fresh orders. WESEE is to indicate the MSL to be maintained by WED based on the population of interface units and life/MTBF.

(v) **Obsolescence Management**. In this case, LCS would be through adequate stocking of spares and components. Such units, if rendered non-repairable due to obsolescence/ non-availability of components, would be replaced as a whole by a freshly engineered alternate unit based on WESEE's design.

(b) **Repair and Survey Mechanism**. Repairs of these low cost items are not considered economically viable through trade and therefore following procedure is to be followed for in-house repairs and survey:-

(i) **Repairs / Replacement of Defective Items**. WESEE will provide repair/ replacement support for prototype units. For production units, field units are to land defective items/ units to WESEE field office (FIST) for DI/ DR. Repair facilities at Yards may also be utilized, as far as feasible, for repairs of interface units, using comprehensive documentation, PILs, software/ firmware etc. provided by WESEE. In case, repairs are not feasible, requisite BER certificate would be issued by Yards so as to enable the field unit to follow Survey and Demand procedure.

(ii) **Survey**. . BER items may be surveyed and disposed off as per extant procedure.

(c) **Configuration Control**.

(i) **Software/ Firmware**. Configuration control of the software/ firmware developed by WESEE will be undertaken by WESEE. The copies of firmware/ software will be forwarded by WESEE to SEG, which will maintain a repository of all such software, duly indexed system-wise and ship-wise. A repository of all such firmware / software, as required for respective Command, will also be maintained at WESEE field office (FIST) to provide requisite support to the field units. With every change/ modification to the software/ firmware, the copies of the modified/ changed software/ firmware will be forwarded by WESEE to SEG. Yards will undertake the necessary software/

firmware modifications of the interface units after obtaining the copy of the modified software/ firmware from SEG.

(ii) **Hardware**. For hardware configuration control, in order to maintain standardization in the pattern numbers (configuration identifiers) of WESEE designed units productionised by private firms, WED pattern numbers will be assigned based on WESEE or production agency's pattern numbers/ configuration identifiers.

5. Pattern numbers allocated by WED are to indicate the categories of the interface units. WESEE is also to promulgate a catalogue of all their products, along with their categories, on a half yearly basis.

6. It is requested that this policy letter be disseminated to units under command.

(C Raghuram)
Cmde
PDEE

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Integrated Headquarters
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New Delhi – 110011

EE/ POLICY/L-88/AFS

08 Oct 12

The Flag Officer Commanding–in-Chief
(For CLO/ CAVO)
Headquarters, Western Naval Command
Mumbai.

The Flag Officer Commanding–in-Chief
(For CLO/ CAVO)
Headquarters, Eastern Naval Command
Vishakhapatnam

The Flag Officer Commanding–in-Chief
(For CLO/CAVO)
Headquarters, Southern Naval Command
Kochi.

The Commander – in – Chief
For CTO (Marine)
HQ, Andaman and Nicobar Command
Port Blair-744101

MAINTENANCE AND UPKEEP POLICY – NAV AIDS AT NAVAL AIR STATIONS

1. **Background**. Naval Air Stations have numerous Nav-Aids operating 24x7 towards ensuring safe flying operations. These equipment have been procured for the respective Naval Air Stations on as required basis from various indigenous as well as foreign sources. Substantial efforts have been put in by IHQ and all Commands to streamline the maintenance / repair procedures and ensure stability in terms of both performance and maintenance support for these critical Air Field equipment.

2. **Aim**. The aim of this letter is to lay down the maintenance and upkeep procedures pertaining to the entire set of Nav-Aids installed at Naval Air Stations.

3. **Range of Equipment**. This policy covers the range of Nav-Aids for Naval Air Stations viz. ARSR, ASR, PAR, CADF, AFLS, NDB, DVOR, DME, ILS and MVLR/ DAT Recorder. Policy directives for new induction equipment like TACAN and ATMS would be issued post induction into the service. The detailed guidelines for each of these Nav-Aids are elaborated in the following paragraphs.

4. **Air Route Surveillance Radar (ARSR).** The ARSR is multi-functional phased array radar being procured to upgrade the air surveillance facility at the Naval Air Stations. Apart from undertaking surveillance this radar can also perform Air Defence functions for the Naval Air Stations. Three in no. radars (Make & Model – M/s ELTA, Israel, EL/M-2084) for NAS Hansa, Dega and Ukrosh are being procured vide contract 187/DEE/C/09-10/ARSR(03) dated 06 Nov 09 by DEE. The first system for Dega will be delivered in Nov 2012.

5. These ARSRs will be covered under a 17 month warranty for the first system and 15 months warranty for the 2nd and 3rd radars delivered, followed by a 12 month extended warranty on all systems. During the contract period, all requirements of Fuel, Oil and Consumables would have to be provided by the respective Commands. A list of Fuel, Oil and Consumables, to be provided by the Commands, is placed at **Enclosure 1**.

6. As part of the ARSR Contract 'O' & 'I' level maintenance spares and tools would be provided with each radar.A team of 08 *IN* personnel have been trained at OEM premises for undertaking 'O' & 'I' level maintenance. Commands are to ensure maximum dissemination of the expertise gained by these personnel in the maintenance of the ARSR radar.

7. As part of the product support, the OEM, M/s Elta systems Israel would be setting up a 'D' level repair facility at 13, BRD, Palam, New Delhi which would cater for the repair of all COTS components of the radar. Other patent components requiring D-level repairs would be repaired at the OEM premises.

8. **Airport Surveillance Radar (ASR)**. The Airport Surveillance Radar (ASR) is an approach control radar used to detect and display an aircraft's position to the Air Traffic Controller (ATC). These radar sets operate in S-Band, and are capable of reliably detecting and tracking aircraft at altitudes below 25,000 feet (7,620 meters) and within 40 to 80 nautical miles (75 to 150 km) of their airport. At present there are five (05) Airport Surveillance Radars in the *IN* inventory installed at Naval Air Stations Hansa, Dega, Utkrosh, Garuda and Rajali. The ASR Star 2000 radar of make M/s Thales, France and sourced through M/s BEL(Gad) has been installed at Naval Air Stations Hansa, Dega, Utkrosh and Garuda between the years 2001-2004. The ASR Watchman has been installed by Ms/ BEL(Gad) at Rajali in 2000.

9. The existing ASRs in the IN inventory have been declared obsolete and their replacement action has been initiated at IHQ under the Capital route along with the new ASR procurements for Naval Air Stations Campbell Bay, Shibpur, Rajali and Parundu. The replacements are likely to be effected by 2015, until which time these radars have to be maintained in an operational state. The existing ASRs are to be maintained through Comprehensive Maintenance Contract (CMC) through capable firms. Whilst the CMC for the ASR Star 2000 radars is being centrally progressed at IHQ, the CMC for the ASR Watchman is to be progressed by HQENC under the delegated financial powers of Command. In order to address the obsolescence issues of the ASR Star 2000 radars a case for limited refurbishment is being progressed at IHQ. NC-NC refurbishment of the ASR Star 2000 radar at Hansa has

been completed in May 12 with satisfactory results. On similar lines, the upgrade of all ASRs is being progressed at IHQ, for the following radar system modules:-

(a) Refurbishment of Transmitter – Receiver Cabinets (TR- 2000)

(b) Upgrade of the associated B&D spares

(c) Procurement of 02 sets of Antenna hardware.

10. **<u>Precision Approach Radar (PAR)</u>**. The Precision Approach Radar (PAR) is another type of radar that is used to control the approach of an aircraft to an airfield and is commercially known as a GCA. (Ground Controlled Approach) radar. The PAR radar fulfills two main criteria:-

(a) First, detect all aircraft flying within a range of thirty or forty miles.

(b) Secondly, accurately 'talk down' the targeted aircraft on to the correct runway.

11. Presently, there are two types of PAR radars in the *IN* inventory viz. the PAR 2080-C of make M/s Galileo Avionica, Italy and PAR-1M of make M/s ELDIS, Czechoslovakia. The PAR 1-M and 2080-C radars have been sourced through M/s HAL (Hyd) in 1997 and 2009 respectively.

(a) **<u>PAR 2080-C</u>**.The radar installed in Apr 2009 at Naval Air Station, Hansa was under a one year AMC, post installation till Apr 2010. The performance of the radar during the AMC period was satisfactory. The radar however faces a limitation in terms of spares availability. The radar had been procured without spares. The radar is TWT based and requires timely replacement of the TWT, which is a fixed life item. The OEM during the warranty period has replaced the TWT on two occasions. A onetime approval to procure spares under the delegated financial powers has been accorded by IHQ in 2010. The system is to be maintained by Hansa through a Comprehensive Maintenance Contract (CMC) with the OEM / trade. The CMC is required to be concluded under the delegated financial powers of HQWNC.

(b) **<u>PAR 1-M</u>**. The radar was installed in 1997 at Rajali and the display electronics were upgraded in 2007. The ABER proceedings for the radar forwarded by HQENC has been held in abeyance at IHQ post the 2007 refurbishment since the life of the radar has been extended till 2014. However, due to poor reliability and failure record of the radar, a case for replacement of the radar has been initiated at IHQ under the ‘Capital’ route. The replacement is likely by 2016 until which time the radar is to be maintained through a Comprehensive Maintenance Contract through the OEM / trade. The repair and CMC contract is being progressed at IHQ.

12. **<u>Commutated Aerial Direction Finder (CADF)</u>**. The Commutated Aerial Direction Finder (CADF) is used to find the direction of an aircraft with respect to true North. It is a receiver, which operates in a VHF/UHF frequency range. The VHF/UHF signal transmitted by the airborne aircraft is received by the commutated aerial.

Through comparison of the FSK modulated signals obtained from each antenna segment, differing in the path length, based on the relative closeness of each segment to the airborne aircraft, the direction of the aircraft is processed by the receiver cabinet.

13. 05 CADFs (M/s Moog Fernau, U.K. Model – HRDF 2030) for NAS Shikra, Dega, Rajali, Parandu and Utkrosh have been procured against IAF MAFI-II contract of 60 CADFs for all three services. 04 CADFs are also being procured, against an ‘Option Clause’ of the main IAF Contract, for NAS Hansa, Garuda, Campbell Bay and Shibpur of the same maek and model and would be installed by 2014. The installation of CADF procured under IAF MAFI-II contract is likely to be completed by end 2012 and would be under a three year AMC post one year warranty period. The warranty of all the CADFs would commence post completion of installation all 60 CADFs.

14. The repair philosophy of the CADFs is as follows:-

(a) **O-Level Repair**. Diagnosis and repair of minor faults / replacement of subassemblies /LRU’s to be undertaken by the Ship Staff.

(b) **I-Level Repair**. Diagnosis and repair of LRUs / replacement of SRUs within LRU. To be undertaken by the AMC firm.

(c) **D-Level Repair**. Repair and overhaul including stripping and rebuilding of equipment and discrete level repair of LRUs at IAF 9 - Base Repair Depot (BRD).

15. The OEM would be providing O-Level repair training during installation of the equipment at the respective Naval Air Station. The OEM has sub-contracted an Indian Vendor (M/s 3D Integrated Private Solutions, Gurgaon) for support during the warranty and AMC. The Helpdesk would be operational on all days, except 2nd and 4th Saturdays and Sundays/holidays between 0930 to 1730 hrs on the telephone number 0124-2210166 and FAX number 0124-2210164. All units are to directly lodge complaints with the Indian Vendor for system defects. Outstanding defects are to be monitored and taken up by the Commands and completed outstanding defects are to be forwarded to IHQ/DEE for taking up the with the IAF/OEM i.a.w. contractual provisions.

16. **Air Field Lighting System (AFLS)**. The Air Field Lighting System (AFLS) is a visual landing / take-off aid for aircraft during periods of reduced visibility and night conditions. The AFLS system typically constitutes the following components;-

(a) Runway – Elevated and Inset Lighting.

(b) Taxiway – Elevated Lighting.

(c) Approach Circuit - Elevated and Inset Lighting.

(d) Precision Approach Path Indicator (PAPI)

(e) 'H' – Indicator.

17. The AFLS is classified into various categories viz. Cat-I, Cat-II or Cat-III (A, B & C) based on the level of the Approach Lighting lights required. The higher the category of lighting, the closer the aircraft can approach the runway through visual aid of the AFLS. Cat-I / II lighting is considered sufficing all Naval Airfield requirements. However, in locations wherein the availability of sufficient land to install Cat-II lighting is a restriction, a modified Cat-I lighting may be adopted. The standards, specially for dual use air ports, operating both civil and military aircrafts, are guided by Annexure 14 to the International Civil Aviation Organization (ICAO) regulations and ICAO ADM Part 5 for Electrical Systems.

18. Whilst the installation and replacement of the complete AFLS systems at Naval Air Stations would be progressed at IHQ, the maintenance of AFLS, through AMC / CMC, is to be progressed under the delegated financial powers of the Command and cases for renewal of CMC taken up well before expiry of the existing Contract. It is recommended that the cases for replacement / repair / AMC of AFLS be taken up directly through trade and not through MES since they may have limited expertise on these systems.

19. **Non Directional Beacon (NDB).** The non-directional beacon is primarily a short distance navigational aid. The NDB radiates a signal in all directions around the transmitter. The aircraft receiver, when tuned to this signal, determines the direction from which the signal is being radiated. By following the direction indicated by the aircraft ADF instrument, the aircraft is guided towards the Naval Air Station.

20. There are presently 05 Naval Air Stations fitted with Non-directional Beacons viz. Hansa (M/s Northrop Grumman), Garuda (SA 400), Rajali & Parundu (GCEL 400W) whilst the NDB at Vishakapatnam (Dega) is with the Airport Authority of India (AAI). Procurement of 04 new 2KW NDBs of make M/s Hajin Electronic Industry Ltd., Korea (Model- KMW-2KS), sourced through M/s Electronic Labs, Mumbai is in progress for Shikra, Parundu, Utkrosh and Baaz by respective Commands. The replacement of the NDBs at Hansa, Garuda and Rajali are also to be progressed by the Commands with a similar NDB as ABER Category–II procurement. The equipment are recommended to be of similar make and model for all stations to enable better maintenance through commonality of spares. These systems, post warranty are to be maintained by the OEM / trade through Comprehensive Maintenance Contracts concluded by the respective Commands.

21. **Distance Measurement Equipment**. Distance Measuring Equipment (DME) is a transponder-based radio navigation technology that measures slant range distance by timing the propagation delay of VHF or UHF radio signals. Aircraft use DME to determine their distance from a land based transponder by sending and receiving pulse pairs - two pulses of fixed duration and separation. The ground stations are typically co-located with VHF Omni Range (VORs) equipment. A typical DME ground transponder system for en-route or terminal navigation will have a 1 KW peak pulse output on the assigned UHF channel. A low-power DME can also be co-located with an ILS glide slope antenna installation where it provides an accurate distance to touchdown function, similar to that otherwise provided by ILS Marker Beacons.

22. The Distance Measuring Equipment are fitted at Naval Air Stations Hansa, Dega, Utkrosh, Garuda and Rajali. Whilst the DME installed at Vishakhapatnam (Dega) and Port Blair (Utkrosh) are being maintained by the AAI, the DMEs at Hansa and Rajali are to be maintained through Annual Maintenance Contracts through trade by the respective Commands under delegated financial powers.

23. **Doppler VHF Omni Range (DVOR)**. VOR is an abbreviation for "VHF Omni-directional Radio Range", which implies that it operates in the VHF band. Adopted by ICAO in 1960s, VOR has been the main short-range (up to 200 Nm) navigational aid for several years. As opposed to the NDB, which transmits a non-directional signal, the signal transmitted by the VOR contains directional information. The Doppler VOR is the second generation VOR, providing improved signal quality and accuracy. The reference signal of the DVOR is amplitude modulated, while the VOR signal is frequency modulated. The frequency modulated signal is less prone to interference than the amplitude modulated signal and therefore the received signals provide a more accurate bearing determination.

24. The DVORs are fitted at Naval Air Stations Hansa, Dega, Utkrosh, Garuda and Rajali. Whilst the DVOR installed at Goa (Hansa), Vishakhapatnam (Dega) and Port Blair (Utkrosh) are being maintained by the AAI, the DME at Rajali is to be maintained through Annual Maintenance Contract through trade by HQENC under delegated financial powers.

25. **Instrument Landing System (ILS)**. An Instrument Landing System (ILS) is a ground-based instrument approach system that provides precision guidance to an aircraft approaching and landing on a runway, using a combination of radio signals and, in many cases, high-intensity lighting arrays to enable a safe landing during instrument meteorological conditions (IMC), such as low ceilings or reduced visibility due to fog, rain, or blowing snow. An ILS consists of two independent sub-systems, one providing lateral guidance (localizer), the other vertical guidance (glide slope or glide path) to aircraft approaching a runway. Aircraft guidance is provided by the ILS receivers in the aircraft by performing a modulation depth comparison.

26. The ILS are fitted at Naval Air Stations Hansa, Dega, Utkrosh and Rajali. Whilst the ILS installed at Vishakhapatnam (Dega) and Port Blair (Utkrosh) are being maintained by the AAI, the ILS at Hansa and Rajali are to be maintained through Annual Maintenance Contract through trade by respective Commands under the delegated financial powers.

27. **Multi Voice Logging Recorder (MVLR) / DAT Recorder**. The Multi-Voice Logging Recorders are multi-channel are used for recording all voice communications with the ATC tower. The MVLRs / DAT recorders are fitted at Naval Air Stations Hansa, Dega, Utkrosh, Garuda, Rajali, Shikra and Parundu. These recorders are to be maintained through Annual Maintenance Contract through trade by respective Commands under the delegated financial powers.

28. The cassette based voice recorders are to be replaced by 32/64 channel digital multi-channel recorders which are more reliable, easy to operate and

maintain. The procurements of new / replacement MVLRs / DAT recorders are to be progressed under the delegated financial powers of the Commands.

Miscellaneous Issues

29. **On Board Spares (OBS)**. Adequate quantities of Onboard Spares (OBS) for each Nav-aid has been catered for vide various IHQ supply orders. The OBS have been allocated to various Air Stations in accordance with the population of the various equipment / system.

30. **Base and Depot (B&D) Spares**. Adequate sets of B&D spares for all the Nav-aids have been catered for vide various IHQ supply orders. In order to ensure effective utilization of these spares, they have been rationally reallocated within MOs to meet urgent requirements of effected Naval Air Stations. The MOs would be responsible for stocking B&D spares for the Naval Air Stations under the respective Commands.

31. **Documentation**. One set of User and Technical manuals are supplied along with each Nav-aid. These are to be utilized by the NAS maintainers for the preventive and 1^{st} level maintenance.

32. **Maintops**. Maintops for all Nav-Aids have been promulgated vide IHQ Letter EE/10/2185 dated 07 Sep 12. In case of special test equipment requirements for certain serials, Commands have been directed to undertake procurement under delegated powers in case these test equipment are not available.

33. **Manpower**. General list Electrical Officers, with requisite experience and seniority should be positioned to man all the Naval Air Stations, so that the issues related to maintenance & upkeep of air field systems are adequately addressed. The complement of sailors should be augmented in a commensurate manner in view of the criticality of these systems vis-à-vis flying operations for military as well as civilian aircraft where applicable.

34. **Training**. User and Maintainer training is conducted on induction of every Nav-aid. The training to users and maintainers are also being imparted during the installation and OEM visits for maintenance to the respective Naval Air Stations. Repair/ training camps by the equipment OEMs will also need to be periodically co-ordinated and conducted by IHQ / Commands.

35. A table containing the consolidated maintenance support from trade available for various Nav-aids at Naval Air Station is placed at **Enclosure 2**.

36. It is requested that information contained in the letter be disseminated to all units. Comments or updates, on the contents of the letter be forwarded to IHQ/DEE by Jan 13.

(Amit Bose)
Commodore
PDEE

Encl: As above

Enclosure 1 to IHQ MoD(N) letter
EE/ POLICY/L-88/AFS dated 08 Oct 12

LIST OF FUEL AND CONSUMABLES

Sl	Sub System	Item P/N	Description	Qty per Year	Make	Reason for use	Frequency
1	Both Antennae	PX-7	Vaseline-nyco 65	3 Gal	Any	Protect metal parts from corrosion	1,3,12 months
2	Both Antennae	XG271	Grease	2 Gal	Any	Protect metal parts from corrosion	1,3,12 months
3	Both Antennae	BR2 PLUS	High performance Grease	2Gal	MOLYKOTE DOW CORNING	Protect metal parts from corrosion	1,3,12 months
4	All over	03174YVP-1	Wash primer, coating compound, base resin acid, per MIL-C-8514-partA	2Gal	HENTZEN	Paint applying-first stage-wash primer	On Damage
5	All over	03174YVP-1	Accelerator, acid component per MIL-C-8514-Part B	2Gal	HENTZEN	Paint applying-first stage-wash primer	On Damage
6	All over	04488WEP-4	Off-white epoxy primer as MIL-DTL-53022D Type 2 Part A	2Gal	HENTZEN	Paint applying-second stage-primer epoxy	On Damage
7	All over	04489CEH-4	Epoxy hardner as per MIL-DTL-53022D Type 2 Part B	2Gal	HENTZEN	Paint applying-second stage-primer epoxy	On Damage
8	All over	04489CEH-4	Thinner for paint epoxy MIL-T-81772 Type II	2Gal	HENTZEN	Paint applying-first/second stage	On Damage
9	All over	18691 AUZ-GD	36250 GREY ZENTHANE CARC AS PER MIL-DTL-53039C Type 1	2Gal	HENTZEN	Paint applying- Third stage carc coating	On Damage

10	All over	00053SST-1	Thinner Polyurethane Reducer for MIL-T-81772B Type 1	2Gal	HENTZEN	Paint applying- Third stage carc coating	On Damage
11	Both Antennas	NB52	Isoplex Topas – Grease	15 Gal	KLUBER	Internal Greasing of rotating parts	Monthly
12	LRCU	0731405957	AL-HOM-501 –premixed coolant(50%-50% ethylene-glycol/distilled water + inhibitors)	As required	GES	Antenna coolant	As required
13	RPS	ASTM No. 2-D	Diesel fuel	As required	Any	Engine fuel	As required
14	RPS	4962836	Premixed coolant	As required	Any	Engine coolant	As required
15	RPS	SAE 15W40	Lub Oil with API	As required	Any	Engine lubricating	As required

Enclosure 2 to IHQ MoD(N) letter EE/ POLICY/L-87/AFS dated Oct 12

MAINTENANCE SUPPORT FROM TRADE

SL	VENDOR	NAV-AIDS SUPPORTED
1.	M/s Bharat Electronics Limited Site-IV, Sahibabad Industrial Area, Bharat Nagar Post, Ghaziabad – 201010 Uttar Pradesh Mr. S.D. Pandit, Sr. DGM Fax. 0120-2770702	ASR (Star 2000 & Watchman)
2.	M/s AMA, Mumbai Canada Building, 224, DR. D.N. Road, Mumbai – 400 001 Maharashtra Tel: 022-2207571-2 / 66396571-2 Fax: 022-22078910 Email: ama@vsnl.com Website: www.amaindia.com	AFLS
3.	M/s Rewinder Techno-Electricals C-709 Vardhaman Apartments Mayur Vihar, Phase 1 New Delhi - 100091 Tel : + 91 11 22756605 Fax : + 91 11 2275 3680 rewindertechno@yahoo.com	AFLS
4.	M/s 3D Integrated Private Solutions, Gurgaon, Haryana Tel: 0124-2210166 Fax: 0124-2210164	CADF (Moog Fernau HRDF 2030)
5.	M/s MEANS Pvt. Ltd. H.O. 301,Gokul, 80-A Barda Street, Carnale Bandra(EAST) Mumbai - 400 009 Fax No. 022-23488484	DME, CADF, NDB, AFLS
6.	M/s 3D Integrated Systems Pvt. Ltd.	CADF
7.	M/s Integral Peripherals, Hyderabad	NDB
8.	M/s Three D Integrated Solutions Ltd. 609-611, JMD Pacific Square, Behind 32nd Milestone NH-8, Sector-15, Gurgaon - 122002 Fax No. 91-124-4054225	AFLS
9.	M/s Nexa House Plot No. 18, Sunrise Villa	AFLS

	Dabolim, Goa - 403 801 Fax No. 0832-2555042	
10.	M/s Indocen Electronics Systems Pvt. Ltd. Elcome House D-222/30, TTC Indl Area, MIDC, Nerul, Navi Mumbai – 400 706 Fax No. 022-27629154	AFLS, NDB
11.	M/s Taurus Aerospace Systems (P) Ltd. 123 HBR Layout, 2nd Cross 1st Stage, 1st Block, KN Post Bangalore - 560 043	MVLR
12.	M/s Nexa Murna-2, Mulavarickal Road Konduruthy Thevara, Kochi - 682013	NDB
13.	M/s JK Consultants Kubra Manzil Dabolim Vasco, Goa – 403 726	NDB
14.	M/s Marine Electronics and Navigation Systems Pvt. Ltd. 301, Gokul, 80 A, Baroda Street Mumbai – 400 009	NDB
15.	M/s JP & Companies, III 405B, HS Road, Koothattukulam Erankulam Dt. – 686662	NDB
16.	M/s Versatron Solutions, #2/1, Inbarajapuram 2nd Street, Choolaimedu, Chennai – 94, Tele & Fax. 044-455538454 www.versatron.in email: info@versatron.in	NDB
17.	M/s Omicron Power Engineers Pvt. Ltd. Plot no 331, V,I,E – sector CIDCO,Aurangabad - 431003	AFLS
18.	M/s Manish Electricals, Kalpana Nagar, CP Colony, Musar, Gwalior, MP-474006 Tele. 09425109887	
19.	M/s Youyang Airport Light Equipment India Pvt. Ltd. A-26/4, Mohan Cooperative Ind. Estate, Mathura road, New Delhi – 44 Tele. 011-40512487, 9971748697	

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20.	M/s Delite Electricals, B-Wing, ground Floor, No-34, Guru Gobind Singh Industrial Premises, Goregaon (East), Mumbai – 400063	

Note. This list will be updated periodically and is not to be construed as an official database of registered vendors.

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Integrated Headquarters
Ministry of Defence (Navy)
New Delhi 110011

EE/11/0621/POLICY/L-53/RADAR/SM 15 Jan 09

The Flag Officer Commanding in Chief (for CLO)
Headquarters Western Naval command
Mumbai 400023

The Flag Officer Commanding in Chief (for CLO)
Headquarters Eastern Naval command
Visakhapatnam 530014

FITMENT OF COTS RADAR-EKM SUBMARINES

1. Refer to IHQ MoD (N)/ DSMO letter SA/3026 dated 31 Oct 08 on the above subject (Not addressed to all).

2. An approval has been accorded for the replacement of Radar MRK-50 onboard Sindhughosh class submarines with appropriate COTS radar under the delegated financial powers of the Administrative Authority vide IHQ MoD (N) letter ibid.

3. The following is requested:-

(a) The replacement of the Radar MRK -50 be planned in a phased manner and the replacement plan and present status of platforms be intimated to IHQ MoD (N) by 15 Feb 09.

(b) Only complete units of COTS Radar may be procured through respective Material Organisations. The procured COTS radar is to be maintained under AMC.

(c) Existing units of Radar MRK-50 be declared BER (C) on replacement and stocked to undertake repair by cannibalisation till all the systems are replaced.

(d) No further demands be raised for the spares of Radar MRK-50.

(e) The complete COTS radar being installed/already installed onboard be INCATted through respective MOs.

(Sanjeev Kale)
Captain
DEE

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Ministry of Defence (Navy)
New Delhi 110011

EE/11/0621/POLICY/L60/Pirit & Palladi 01 May 09

The Flag Officer Commanding-in-Chief (for CLO)
Headquarters Western Naval Command
Mumbai

The Flag Officer Commanding-in-Chief (for CLO)
Headquarters Eastern Naval Command
Visakhapatnam 530014

MAINTENANCE OF PALLADI-E SYSTEM-877 EKM SUBMARINES

1. Refer to IHQ MoD (N)/DEE letter EE/11/0621/Pirit & Palladi dated 28 Jan 09 regarding Performance Evaluation of System Pirit-M, Palladi-M and KADK-INS Sindhuvijay.

Background

2. EKM class submarines are fitted with relay based platform control and monitoring system Palladi-E. While the system RTDs recommend renewal of Palladi-E only after 50,000 hrs of operation, the Russian side had intimated in 2005 that the system is obsolete and could no longer be supported. In lieu, they offered upgraded digital system, using processor based logic circuits for all future submarines. Accordingly, an evaluation of the upgraded systems, Palladi-M, was undertaken by an IN team in Jan 06 and a decision was taken to induct the upgraded system onboard Sindhuvijay and Sindhukirti during their MRs at Russia and HSL respectively.

3. In the interim, IN has identified indigenous firms capable to undertake repairs of defective modules/ sensors of the Palladi-E system. Also an analysis of equipment history indicated that the failure rate of modules has been quite low post repairs by indigenous firms. The sensors have been successfully indigenized by ND (V) through M/s SB Electro-Mechanical, Pune and M/s Linia Engineering, Mumbai. In addition, several modules of this system were successfully reconditioned/ repaired by ND (V) through M/s Pacific Semiconductors, Pune in 2004 for INS Sindhudhvaj and their performance has been satisfactory.

4. **Life Time Buy of Spares**. An RFP was floated for the Life Time Buy of Spares for System Palladi-E and Pirit-2E. The single reply to the RFP was received from M/s Zvyozdochka Shipyard and the firm has quoted exorbitant cost against estimated price based on the cost of systems supplied for INS Sindhuvijay in 2005. Therefore, the probability of this procurement is not likely.

5. **Sustenance of Old Systems**. As there are no proposals for up gradation of existing systems except for submarines undergoing/ coming up for MR, there is a requirement of sustaining the Palladi-E system fitted onboard remaining 07 EKM submarines, viz., Sindhuraj, Sindhukesari, Sindhuvir, Sindhuratna, Sindhushastra, Sindhughosh and Sindhudhvaj (excluding INS Sindhurakshak,where the system is likely to be upgraded during her forthcoming MR) over their balance life. In view of the difficulties/delays in procurement of LTB spares, it is considered that alternate indigenous avenues, for maintenance support for the existing system, as brought out at Para 3 above, need to be established.

6. In view of the foregoing, the following are requested:-

(a) The repairable inventory for Palladi-E system be repaired by offloading to trade, viz., M/s Pacific Semiconductors, Pune, M/s Linia Engg, Mumbai and M/s SBEM, Pune etc.

(b) Replacement of modules through indigenous manufacturers, conforming to form, fit and function compatibility, may also be considered.

(Amit Bose)
Captain
DEE

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Integrated Headquarters
Ministry of Defence (Navy)
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EE/11/0621/POLICY/L-75/SM 09 Mar 11

The Flag Officer Commanding in Chief (for CLO)
Headquarters Western Naval command
Mumbai

The Flag Officer Commanding in Chief (for CLO)
Headquarters Eastern Naval command
Visakhapatnam

SUBMARINE BATTERY RETURNS

1. The battery returns for Type-I and Type-II batteries being exploited in EKM and SSK class of submarines respectively are being rendered by command on a quarterly basis.

2. In order to furnish only the essential details of battery exploitation to IHQ, the format for quarterly battery returns is being revised as per enclosed format.

3. It is requested that consolidated battery returns on quarterly basis be furnished as per the revised format with immediate effect.

(Amit Bose)
Captain
PDEE

Encl:- Revised Format for Battery Returns

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Enclosure to DEE Policy Letter
EE/11/0621/POLICY/L-75/SM dated 09 Mar 11

QUARTERLY BATTERY USAGE DATA RETURN - HQWNC/ HQENC

Ser	Parameter	Submarine I	Submarine II	Submarine III	Submarine IV	Submarine ...N
1	Set no					
2	Type (I/ II or others, as applicable)					
3	Date of supply (group wise)					
4	Date of commissioning (group wise)					
5	Date of expiry (by time)					
6	Date and results of last two capacity trials					
7	Date and results of last two hydrogen evolution trials					
8	Total number of lagging cells (pit wise)					
9	Total number of bypassed cells (pit wise)					
10	Cycles consumed in last two quarters					
11	Total cycles consumed till date					
12	Cycles left till expiry (by cycles)					
13	Extension granted (by time/ cycles) if any, quoting authority					
14	Details of operational/ refit status of submarine					
15	Details of next planned refit					
16	Details of ABER raised					
17	Demand details					
18	Indent details					
19	Date of last renewal of Battery Paint					
20	Date of expiry of Battery Paint scheme					
21	Any other relevant information					

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Ministry of Defence (Navy)
New Delhi -110011

EE/11/0621/POLICY/L-87 08 Oct 12

The Flag Officer Commanding in chief (for CLO)
Headquarters Western Naval Command
Mumbai-400023

OVERHAULING OF RADAR MAST- SSK SUBMARINES

1. Shishumar class submarines are fitted with radar hoistable mast Type M612/186 (Part No 467-401-5281-02-00-00) manufactured by M/s Gabler Maschinenbau GMBH, Germany.

2. Cases of water ingress in radar mast leading to high VSWR and non-availability of radar have occurred onboard SSK submarines. DI/ DR had revealed that this was due to ingress of moisture into the radar waveguide inside the hoist able radar mast. The reason for ingress of moisture into the radar waveguides was appreciated due to the failure of 'O" rings/ sealing rings and deterioration of flexible wave guide.

3. Efforts towards DR, restricted to partial replacement of 'O' rings and patch repairs of the flexible waveguide sections were unsuccessful, wherein the defect persisted during the subsequent sea trials and the mas5t had to be once again dismantled at the shop floor. Repeat DR efforts comprising replacement of 'O" rings of all sections and replacement of flexible waveguide of the mast were successful.

4. A detailed causative analysis has brought out that a spare-kit comprising 50 spares, as listed at enclosure, is required for overhauling of SSK Radar.

5. In order to obviate recurrence of such defects in future, the following remedial measures need to be institutionalized and implemented during overhaul of the Radar Mast and its components :-

(a) Two complete set of 50 OEM supplied spares, required for overhaul of the Radar Mast, as per enclosed list, to be procured on a fast track by MO(MBI) and INCATED under single ILMS code.

(b) The MSL for these spares need to be suitably revised so as to ensure availability of two complete sets, duly considering the OEM promulgated shelf life for these spares.

(c) 01 additional set of original spares be procured and supplied to MO(Mbi) as sample for preparation of dimensional drawings and material specifications to meet emergency requirement through local sources/ in house facility.

(d) Overhauling of Radar Mast to be carried out using OEM supplied components only.

(e) Patch repair of flexible waveguide is to be avoided.

6. IHQ MoD (N)/ DEE Policy letter EE/11/0621/POLICY/L-68/RADAR/SM dated 30 Jul 10 is hereby cancelled.

(Amit Bose)
Commodore
PDEE

Encl : list of 50 OEM supplied spares

Enclosure to IHQ MoD (N)/ DEE letter EE/11/0621/POLICY/L-87 dated 08 Oct 12

KIT OF CONSUMABLE SPARES FOR OVERHAUL/ REPAIR OF RADAR HOISTABLE MAST SHISHUMAR CLASS SUBMARINES

SR	DETAILS AS PER TECHNICAL MANUAL 504/2 PART V & 409 PART V			DETAILS PROVIDED BY M/S GABLER MASCHINENBAU GMBH		QTY
	TM DWG. REF.	PART NO.	DESCRIPTION	PART NO.	DESCRIPTION	
1.	5042-001-0090	DIN3770-510X10NBR70SHORE-A	O-RING	109647	O-RING SEAL ACC DIN ISO 3601 510X10 NBR70SHORE-A	2
2.	5042-002-0030	467-401-5281-02-13-00	BUMBER	306364	RUBBER BUFFER / 467-401-5281-02-13-00	1
3.	5042-002-0050	2575-170.243NBR70SHORE-A	O-RING	109496	O-RING SEAL ACC DIN ISO 3601 142X4 NBR70SHORE-A/2575-170.243	1
4.	5042-002-0110	2575-246.813NBR70SHORE-A	O-RING	-	-	1
5.	5042-002-0120	2575-174.749NBR70SHORE-A	O-RING	109487	O-RING SEAL ACC DIN ISO 3601 90X3 NBR70SHORE-A/2575-174.749	1
6.	5042-002-0160	2575-146.739NBR70SHORE-A	O-RING	107070	O-RING SEAL ACC DIN ISO 3601 72X4 NBR70SHORE-A/2575-146.739	1
7.	5042-002-0230	L2511-005.050	SLUDGE SCRAPER	107298	SCRAPER 200/220X8 / L2511-005.050	4
8.	5042-002-	DIN7603-A10X13.5CU	SEALING RING	111835	SEALING RING DIN 7603 A10X13.5	12

SR	DETAILS AS PER TECHNICAL MANUAL 504/2 PART V & 409 PART V			DETAILS PROVIDED BY M/S GABLER MASCHINENBAU GMBH		QTY
	TM DWG. REF.	PART NO.	DESCRIPTION	PART NO.	DESCRIPTION	
	0280					
9.	5042-002-040A	0196-258.166	OMS-ROTOR SET	113601	OMS ROTOR SET MT 72/276 0196 180.00X195.50X5.9	1
10.	5042-002-0410	2575-025.421NBR70SHORE-A	O-RING	109673	O-RING SEAL ACC DIN ISO 3601 265X5 NBR70SHORE-A/2575-025.421	1
11.	5042-002-041A	0196-258.164	OMS-ROTOR SET	113602	OMS ROTOR SET MT 72/276 0196 250X265.5X5.10	1
12.	5042-002-0430	L2575-010.851NBR80SHORE-A	O-RING	107003	O-RING SEAL ACC DIN ISO 3601 130X5 NBR80SHORE-A/2575-010.851	1
13.	5042-002-0450	L0153-063.491	OMEGAT-ROD SEALING	113639	ROD SEALING L0153-063.491	1
14.	5042-002-0460	L2575-010.766NBR80SHORE-A	O-RING	153266	O-RING SEAL ACC DIN ISO 3601 110X5 NBR80SHORE-A/2575-010.766	1
15.	5042-002-0470	L2511-004.928	SLUDGE SCRAPER	-	-	1
16.	-	-	-	113640	SCRAPER R90/102X12A31	1
17.	5042-002-0490	467-401-5281-02-00-03	BACK-UP RING	306380	SUPPORT RING/ 467-401-5281-02-00-03	1
18.	5042-002-	L001-070.200	ROOF-SHAPED SEALING	107310	SLEEVE SEALING SET L0001-070.200	1

SR	DETAILS AS PER TECHNICAL MANUAL 504/2 PART V & 409 PART V			DETAILS PROVIDED BY M/S GABLER MASCHINENBAU GMBH		QTY
	TM DWG. REF.	PART NO.	DESCRIPTION	PART NO.	DESCRIPTION	
	0510		SET			
19.	5042-002-0590	2575-146.813NBR70SHORE-A	O-RING	107500	O-RING SEAL ACC DIN ISO 3601 195X5 NBR70SHORE-A/2575-146.813	2
20.	5042-002-0630	L2575-010.961NBR80SHORE-A	O-RING	169065	O-RING SEAL ACC DIN ISO 3601 180X5 NBR80SHORE-A/2575-010.961	1
21.	5042-002-0640	L2575-011.105NBR80SHORE-A	O-RING	169066	O-RING SEAL ACC DIN ISO 3601 290X5 NBR80SHORE-A/2575-011.105	1
22.	5042-002-0650	L2575-050.291NBR80SHORE-A	O-RING	169067	O-RING SEAL ACC DIN ISO 3601 175X5 NBR80SHORE-A/2575-050.291	1
23.	5042-002-0700	467-401-5281-02-00-00/068	RUBBER	350068	RUBBER / 467-401-5281-02-00-00/068	1
24..	5042-002-0750	467-401-5281-02-00-00/069	RUBBER	112901	PLATE RUBBER 70 SHORE2 / 467-401-5281-02-00-00/069	9
25.	5042-002-0780	467-401-5281-02-00-00/066	RUBBER	350069	RUBBER / 467-401-5281-02-00-00/066	5
26.	5042-002-0800	467-401-5281-02-00-00/067	RUBBER	350070	RUBBER / 467-401-5281-02-00-00/067	5
27.	5042-002-0880	2575-146.742NBR70SHORE-A	O-RING	104283	O-RING SEAL ACC DIN ISO 3601 82X4 NBR70SHORE-A/2575-146.742	2
28.	5042	DIN7603-A8X11.5CU	SEALING	10336	SEALING RING	6

SR	DETAILS AS PER TECHNICAL MANUAL 504/2 PART V & 409 PART V			DETAILS PROVIDED BY M/S GABLER MASCHINENBAU GMBH		QTY
	TM DWG. REF.	PART NO.	DESCRIPTION	PART NO.	DESCRIPTION	
	-002-0900		RING	3	DIN7603-A8X11.5X1.0CU	
29.	5042-002-0930	2575-143.645NBR70SHORE-A	O-RING	107051	O-RING SEAL ACC DIN ISO 3601 4X2 NBR70SHORE-A/2575-143.645	2
30.	5042-002-0940	DIN7603-A20X24CU	SEALING RING	109688	SEALING RING DIN7603-A20X24X2CU	1
31.	5042-002-1030	L2575-011.020NBR80SHORE-A	O-RING	169068	O-RING SEAL ACC DIN ISO 3601 220X5 NBR80SHORE-A/2575-011.020	8
32.	5042-002-1150	467-401-5281-02-19-00	BUMBER	306368	RUBBER BUFFER / 467-401-5281-02-19-00	1
33.	5042-002-1280	M8NR.303NYL0N6	DUBO-CYLINDER SCREW LOCKING	109853	DUBO CYLINDER SCREW LOCKING M8 NR.303	6
34.	5042-002-1430	2575-001.514NBR80SHORE-A	O-RING	153697	O-RING SEAL ACC DIN ISO 3601 65X3 NBR80SHORE-A/2575-010.514	1
35.	5042-002-1460	40X62X7VITON	RADIAL SHAFT SEAL	113595	SHAFT SEAL 40X62X7VITON	1
36.	5042-002-1500	467-401-5281-02-18-00	BUMBER	306367	RUBBER BUFFER / 467-401-5281-02-18-00	1
37.	5042-002-1510	2575-010.376NBR80SHORE-A	O-RING	169069	O-RING SEAL ACC DIN ISO 3601 44X7 NBR80SHORE-	1

SR	DETAILS AS PER TECHNICAL MANUAL 504/2 PART V & 409 PART V			DETAILS PROVIDED BY M/S GABLER MASCHINENBAU GMBH		QTY
	TM DWG. REF.	PART NO.	DESCRIPTION	PART NO.	DESCRIPTION	
					A/2575-010.376	
38.	5042-002-1530	2575-010.494NBR80SHORE-A	O-RING	169070	O-RING SEAL ACC DIN ISO 3601 62X4 NBR80SHORE-A/2575-010.494	1
39.	5042-002-1540	2575-010.480NBR80SHORE-A	O-RING	169071	O-RING SEAL ACC DIN ISO 3601 60X3 NBR80SHORE-A/2575-010.480	1
40.	5042-002-1550	2575-010.670NBR80SHORE-A	O-RING	112631	O-RING SEAL ACC DIN ISO 3601 90X5 NBR80SHORE-A/2575-010.670	1
41.	409-039-0020	L2575-010-945/80SHORE/NBR170	O-RING	169072	O-RING SEAL ACC DIN ISO 3601 170X5 NBR80SHORE/2575-010.945	3
42.	409-039-0060	467-401-5281-03-00-36	WEATHER PROTECTION	306532	ROOF-SHAPED COLLAR / 467-401-5281-03-00-36	1
43.	409-039-0110	2575-011-362VITON6/10X2	O-RING	-	-	2
44.	409-039-0150	L2575-010-977/80SHORE/NBR190	O-RING	169073	O-RING SEAL ACC DIN ISO 3601 190X5 NBR80SHORE/2575-010.977	2
45.	409-039-0160	1999-145-023/145/165X14	SEALING RING	107523	ROTOM. SEALING RING / 1999-145-023/145/165X14	2
46.	409-039-0200	L2575-010-972/80SHORE/NBR M14-185	O-RING	169074	O-RING SEAL ACC DIN ISO 3601 185X5 NBR80SHORE/2575-010.972	1
47.	409-	DIN7603-A10x13.5CU	SEALING	10393	SEALING RING	2

SR	DETAILS AS PER TECHNICAL MANUAL 504/2 PART V & 409 PART V			DETAILS PROVIDED BY M/S GABLER MASCHINENBAU GMBH		QTY
	TM DWG. REF.	PART NO.	DESCRIPTION	PART NO.	DESCRIPTION	
	039-0310		RING	1	DIN 7603 A10X13.5X1	
48.	409-039-0330	2575-107-023/70SHORE/NBR10 X2.5	O-RING	109430	O-RING SEAL ACC DIN ISO 3601 10X2.5 NBR70SHORE/2575-107.023	5
49.	409-039-0430	DIN3760-A120X150X12	RADIAL SHAFT SEAL	113624	SHAFT SEAL DIN 3760 A120X150X12	1
50.	-	-	-	107051	O-RING SEAL ACC DIN ISO 3601 4X2 NBR70SHORE	2

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New Delhi -110011

EE/11/0621/TWA MCA 62.5 18 Sep 12

The Flag Officer Submarines
Submarine Headquarters
Naval Base
Visakhapatnam-530014

MAINTENANCE & SUPPORT-TWA MCA 62.5

1. Refer to the following (not addressed to all):-

(a) SMHQ letter 342/11/L dated 30 Aug 12.

(b) DEE Fax EE/11/0621/TWA dated 08 Aug 12.

2. SMHQ vide letter ibid has raised various issues on the maintenance and support of TWA MCA 62.5 systems installed onboard EKM submarines.

3. IHQ MoD (N) comments on the issues raised by FOSM are as follows:-

(a) **Training of IN/ yard personnel**. A total of 44 personnel (13 officers, 23 sailors and 08 yard personnel) have been trained at INS Satavahana by OEM from 14-29 Jul 09. Additional hands on training have also been imparted by the OEM during installation and subsequent visits onboard various submarines.

(b) **STTE**. One set of STTE each has been provisioned at ND(Vzg) and ND(Mbi). Additionally, a diagnostic laptop has also been supplied along with STTE.

(c) **Documentation**. In addition to operator and maintainer documentation, Interactive Electronic Technical Manuals (IETM) highlighting maintenance procedures/ practices on the system has been provided to Commands, Repair yards, SMHQ, COMCOS and all units. No deficiencies in this documentation have been indicated to IHQ MOD (N) till date.

(d) **Depot Spares**. B&D spares for 07 systems have been provisioned at MO (Vzg) and MO (Mbi).

(e) **Renewal of PAC**. PAC was renewed (for MCA family of TWA's for 03 models-62.5, 60 & 30) for M/s Flash Forge, Vizag, rep of OEM, M/s Nereides, France on 03 Aug 12.

(f) **Approval of MAINTOPS**. Maintops of the system have been approved on 24 Jan 12.

(g) **Augmentation of OBS**. Approval for augmentation of OBS for the systems, comprising 49 items has been accorded on 29 Feb 12.

(h) **New Design Cables**. Improvement in design of two cable to eliminate water ingress in the pre amplifier part of the cable has been addressed by the OEM and 03 new cables with improved features and increased resistance to water ingress have been supplied to MO(Mbi). HQWNC has been directed to undertake trials of the cables. It is considered that the problems previously experienced due to water ingress would get addressed with the improved cable design.

(j) **AMC and RRC Proposals**. The AMC proposal by the OEM for 02 systems at WNC, amounting to Rs 2.77 Crores, works out to approx 37% of the system cost. Similarly, AMC proposal for 03 systems at ENC, amounting to Rs. 3.21 Crores, works out to approx 29% of the system cost. It is pertinent to mention that these proposals are not for Comprehensive AMC envisages only conduct of preventive maintenance and 02 corrective maintenance/ year and 01 day training. It is considered that such high cost of non-comprehensive AMC us neither tenable nor can be justified financially to MoD. The issue was also discussed during 10th review of availability/ preparedness of submarines by DCNS, wherein it was decided that AMC proposal is unsuitable and specific defects on systems be taken up with PAC firm under RRC at Command level and intimated to commands vide IHQ MoD(N)/ DEE fax ibid.

(k) **Preventive maintenance**. It is considered that the responsibility of carrying out preventive maintenance on any system is that of the submarine e crew and the Yard. This onus cannot be passed up to the OEM under an AMC. It is also pertinent to mention that the OEM has attributed several system faults to inadequate system, maintenance and highlighted the deficiencies to the crew during the previous visits onboard. This issue needs to be addressed by SMHQ critically.

4. In view of the above, the following are requested:-

(a) Conclusion of RRCs with the PAC firm at the earliest at both commands.

(b) SS/yard to undertake preventive maintenance. SMHQ to undertake gap analysis in preventive maintenance and incorporate remedial measures.

(c) Augmented OB spares to be procured at the earliest. SMHQ/ COMCOS to undertake audit of spare holdings at MOs and requirement of any further augmentation of spares be forwarded.

(d) Requirement of additional facility for repairs to be assessed and forwarded.

(KR Nair)
Rear Admiral
ACOM (IT&S)

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EE/11/0600/POLICY/SM

15 Jan 16

The Flag Officer Commanding in Chief
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Headquarters Eastern Naval command
Visakhapatnam 530014

The Flag Officer Commanding in Chief
(for CLO/ CLOGO)
Headquarters Western Naval command
Mumbai 400023

The Director General Quality Assurance (Navy)
(for DDGQA (N))
West Block-5, RK Puram
New Delhi – 110 066

TECHNICAL SPECIFICATIONS FOR SULPHURIC ACID FOR SUBMARINE BATTERIES

1. Refer to the following:-

(a) DQA (N) QAP NO DQAN/QAP/NS/2013/243/REV-1 dated 30 Aug 13.

(b) IHQ MoD (N)/ DEE fax of even number dated 23 Jul 15.

(c) IN Schedule for testing, inspection and acceptance of lead acid storage battery Type- EK-204 for 877 EKM submarines.

(d) Indian Standard 266:1993 (amended in 2003) (Reaffirmed 2010).

2. **Background**. Submarine batteries are high capacity Lead Acid Batteries, which are safety-critical and mission-critical products to enable a submarine to propel underwater for prolonged duration. Type-I batteries are installed onboard 877 EKM class submarines (procured from Russia) and Type-II batteries are installed onboard U-209 SSK class submarines (procured/ manufactured under license from HDW, Germany). *Concentrated sulphuric acid* of stringent quality specifications, which would otherwise have severe implication on its performance as well as its fair life onboard, is used for preparing the electrolyte for the battery prior commissioning the sets. Hence, availability of the specific quality of sulphuric acid is extremely critical for commissioning of the submarine batteries as per schedule.

3. **Characteristic Requirements for Sulphuric Acid**. The '*IN* Schedule' (Annexure II) for both Type-I and Type-II Batteries indicates the following as the benchmark quality for the concentrated Sulphuric acid:-

(a) Specifications for concentrated sulphuric acid shall be an approved 'AR Grade' and generally confirm to IS specifications 266:1993 (amended in 2003) (Reaffirmed 2010).

(b) *Additionally*, the acid shall not have impurities in excess of the following limits:-

(i)	Copper	:	1 mg/ litre
(ii)	Zinc	:	2.5 mg/ litre
(iii)	Manganese	:	0.3 mg/ litre
(iv)	Antimony	:	Nil
(v)	Platinum	:	Nil
(vi)	Nickel	:	1 mg/ litre

(c) The specification of 'AR Grade' sulphuric acid is, therefore, different from the specification of sulphuric acid for submarine batteries as specified in the '*IN* schedule' formulated by *IN* in consultation with M/s Exide Ltd and DQA (N).

(d) Testing for the specifications should be undertaken as per procedures mentioned in the IS, through an accredited laboratory.

4. Bureau of Indian Standards IS 266:1993 (amended in 2003) (Reaffirmed 2010), prescribes the requirements and methods of sampling / test for different grades of *Sulphuric Acid*. At present, the *AR grade sulphuric acid,* as per IS 266:1993, is being procured by the MOs for submarine batteries, which is inadequate to meet the requirements for submarine batteries.

5. In view of the above, following is to be undertaken:-

(a) *IN* Schedules for Type-I (Annexure-II at Page No. 26) and Type-II (Annexure-II at Page No. 27) Batteries be amended with regard to specifications for Sulphuric acid as per **Appendix 'A'** and promulgated as Release 2.0 – 2016.

(b) Revised Specification for concentrated Sulphuric Acid, as elucidated at **Appendix 'A'** to this letter, be utilised for all procurements of concentrated sulphuric acid for usage in Type-I and II submarine batteries.

(c) The existing item code ***'N6810-000101'***description ofwhich has been amended to ***'Sulphuric Acid for Submarine Battery'***, henceforth be utilised for procurement of acid for submarine batteries with these specifications.

(d) Commands to formulate BOO to identify a pool of vendors post confirming capability/ suitability for supplying the sulphuric acid for submarine batteries as per QR specifications and intimate to MOs.

(e) MOs to conclude RC with atleast two firms and to procure acid as per contractual timelines related to supply of batteries post intimation of vendors by Commands.

(f) DQAN is requested to incorporate the draft amended QAP as specified at **Appendix 'B'** for the Sulphuric acid for the submarine batteries.

(C Raghuram)
Commodore
PDEE

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Appendix 'A'
(Refers to Para 5)

SPECIFICATION FOR CONCENTRATED SULPHURIC ACID FOR SUBMARINE BATTERY (TYPE-I/ II) (ANNEXURE-2 OF *IN* SCHEDULE (RELEASE 2.0 - 2015) FOR TYPE-I AND TYPE-II BATTERY)

1. For preparing electrolyte of desired specific gravity for Type-I and II battery, the concentrated sulphuric acid should be approved AR Grade and conform to IS 266:1993 (Third Revision) (amended in 2003) (Reaffirmed 2010). In addition to the characteristic requirement specifications of the AR Grade (IS 266:1993), the concentrated sulphuric acid should also meet additional seven (Sl 11 – 17 below) requirements.

2. The characteristic requirement for the concentrated sulphuric acid to be used for Type-I and II battery is as listed below:-

Sl	Characteristic	Requirement
1.	Appearance	Clear, colourless and free from suspended matter
2.	Total Acidicity as H_2SO_4, percent by mass,Min	98.0
3.	Residue on ignition, percent by mass, Max	0.002
4.	Iron (as Fe), percent by mass, Max	0.000 05 (0.5 ppm)
5.	Chlorides (as Cl), percent by mass, Max	0.000 02 (0.2 ppm)
6.	Lead (as Pb), percent by mass, Max	0.001
7.	Arsenic (as As), percent by mass, Max	0.000 005 (0.05 ppm)
8.	Oxidizable impurities (as SO_2), percent by mass, Max	0.000 4 (4 ppm)
9.	Nitrates (as NO_2), percent by mass, Max	0.000 02 (0.2 ppm)
10.	Ammonia (as NH_3), percent by mass, Max	0.000 2 (2 ppm)
11.	Copper, Max	1 mg/ litre
12.	Zinc, Max	2.5 mg/ litre
13.	Manganese, Max	0.3 mg/ litre
14.	Antimony, Max	Nil
15.	Platinum, Max	Nil
16.	Nickel, Max	1 mg/ litre
17.	Specific Gravity, Min	1.840 mg/ litre at 20^{o}C

(* To be inserted as Annexure-2 of *IN* Schedule for Type-I and Type-II batteries)

Appendix ‘B’
(Refers to Para 5 (f))

‘DRAFT’ FOR INCLUSION IN THE FINAL QAP FOR ACCEPTANCE OF SULPHURIC ACID FOR SUBMARINE BATTERY

QAP No. (*Number to be indicated by DQA (N)*)

Part – II

ACCEPTANCE OF SULPHURIC ACID FOR SUBMARINE BATTERY

Sl	Characteristic/ Parameter	Requirement	Test method i.a.w IS 266:1993
1.	Appearance	Clear, colourless and free from suspended matter	Visual Examination
2.	Total Acidicity as H_2SO_4, percent by mass,Min	98.0	Clause A-2 in Annex-A
3.	Residue on ignition, percent by mass, Max	0.002	Clause A-3 in Annex-A
4.	Iron (as Fe), percent by mass, Max	0.000 05 (0.5 ppm)	Clause A-4 in Annex-A
5.	Chlorides (as Cl), percent by mass, Max	0.000 02 (0.2 ppm)	Clause A-5 in Annex-A
6.	Lead (as Pb), percent by mass, Max (follow Amendment -1 of Feb 2003)	0.001	Clause A-6 in Annex-A
7.	Arsenic (as As), percent by mass, Max	0.000 005 (0.05 ppm)	Clause A-7 in Annex-A
8.	Oxidizable impurities (as SO_2), percent by mass, Max	0.000 4 (4 ppm)	Clause A-8 in Annex-A
9.	Nitrates (as NO_2), percent by mass, Max	0.000 02 (0.2 ppm)	Clause A-16 in Annex-A
10.	Ammonia (as NH_3), percent by mass, Max	0.000 2 (2 ppm)	Clause A-11 in Annex-A
11.	Copper, Max	1 mg/ litre	Clause A-14 in Annex-A
12.	Zinc, Max	2.5 mg/ litre	Clause A-15 in Annex-A
13.	Manganese, Max	0.3 mg/ litre	Clause A-13 in Annex-A
14.	Antimony, Max	Nil	Clause A-17 in Annex-A
15.	Platinum, Max	Nil	Clause A-18 in Annex-A
16.	Nickel, Max	1 mg/ litre	Take 25 ml of sample. Heat to dryness. Add ammonia. Cool to room temperature. Add a pinch of dimethyl glyoxime to the above solution.

Sl	**Characteristic/ Parameter**	**Requirement**	**Test method i.a.w IS 266:1993**
			Observe for any pink colouration and compare with 1 ppm standard solution of Nickel in electrolyte to estimate Nickel content
17.	Specific Gravity, Min	1.840 mg/ litre at 20^{o}C	Stir the sample well and pour a quantity in a dry 250ml cylinder (refer *IS-3104 (Part-II) 1982*)) and find out specified gravity b suitable range (1.8 to 2.0) of calibrated hydrometer

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16 Feb 16

The Flag Officer Commanding in Chief
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Headquarters Eastern Naval command
Visakhapatnam 530014

The Flag Officer Commanding in Chief
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Mumbai 400023

The Director General Quality Assurance (Navy)
(for DDGQA (N))
West Block-5, RK Puram
New Delhi – 110 066

TECHNICAL SPECIFICATIONS FOR SULPHURIC ACID FOR SUBMARINE BATTERIES

1. Refer to IHQ MoD (N)/ DEE letter of even number dated 15 Jan 16.

2. Following amendments may be incorporated in the letter ibid:-

(a) **Appendix 'A', Para – 2, Sl – 17**. Specific Gravity, Min (Units)

For: - mg/ litre at 20^{o}C
Read: - g/ ml at 20^{o}C

(b) **Appendix 'B', Sl – 17**. Specific Gravity, Min (Units)

For: - mg/ litre at 20^{o}C
Read: - g/ ml at 20^{o}C

(VN Kaul)
Captain
Director

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09 Sep 16

The Flag Officer Commanding in Chief
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EXPLOITATION AND MAINTENANCE OF SUBMARINE BATTERY

1. **Background**. The Indian Navy presently operates two types of submarines, viz.877 EKM class submarine procured from Russia and the U-209 SSK class submarines procured /manufactured under license from HDW, Germany. These submarines are powered by high capacity Lead Acid Batteries which enable the submarines to propel underwater for prolonged duration.

2. **Aim**. The aim of this policy letter is to provide a methodology for efficient exploitation and maintenance of Submarine Main Battery.

Description of Submarine Battery.

3. **Type I Battery - Sindhughosh Class (EKM)**. EK-204 is the type of cell used onboard EKM class submarines. There are 240 cells divided into two groups of 120 cells each. No.1 group is located in the first compartment and No.2 group is located in third compartment. These compartments are also called ‘Battery Compartments’. The 120 cells in each group are connected in series. Further, both groups can be connected either in series or in parallel with the help of a ‘Series-Parallel’ switch, located in the fifth compartment (for the purpose of Main Propulsion Motor operation). Battery groups are connected in series only during emergency. Each battery group has one battery breaker to connect or disconnect it to the main propulsion network.

4. **Type II Battery - Shishumar Class (SSK)**.SS -126 type of cell used onboard SSK class of submarines. One set of main battery consists of 528 cells divided into the four partial battery groups 1, 2, 3 and 4. Each partial battery group consists of 132 cells connected in series. The partial battery groups 1 and 2 are housed in the battery room 1 and the partial battery group 3 and 4 in the battery room 2. The partial

groups are connected in parallel or series through ‘Main Switchboard’ according to the regime of operation.

5. **Schedule Maintenance**. Service life and performance of the main battery, essentially depends upon timely administration of maintenance charges. Knowledge of the inherent electrochemical process and laid down maintenance schedules is critical for the performance of the lead acid battery during its service life. Accordingly, failure to adhere to laid down maintenance in the Technical Manual (TM) will affect the performance and life of battery. The recording of parameters during scheduled maintenance carried out by Ship’s Staff onboard the submarines or yard during their maintenance at BCF, Sewri or Energy Block at ND(V) is essential for trend analysis during the service life of the main battery and for evaluation of its performance. The data is therefore to be diligently recorded and forwarded as part of the monthly battery returns being forwarded by COMsCOS as per format placed at **Encl I** (Type-I cells) and **Encl II** (Type – II cells). Further, the performance of the batteries is directly dependent on the impurities dissolved in the electrolyte. Although, stringent specification have been laid out for procurement of acid for electrolyte and DM water used for preparation of electrolyte during commissioning phase, it is prudent that the specifications of electrolyte be monitored quarterly (for weak cells) and quality of DM water from the bowser and DW tanks onboard be verified prior to topping up of cells.

Systems Associated with Main Batteries

6. The exploitation and maintenance of main batteries onboard is not possible without proper functioning of the associated systems. Since the battery associated systems directly affect the performance of the main batteries, these systems should be operational and any deviation from the specified limits is to be immediately brought to the notice of the SOA :-

(a) Battery Agitation System.

(b) Distilled Water System.

(c) Battery Cooling System.

(d) Battery Ventilation System.

(e) Gas Monitoring System.

(f) Pilot Cell Voltage Remote Measurement Circuit.

(g) Storage Battery Servicing Trolley.

(h) Hydrogen Analysers / Eliminators.

(j) Storage Battery Insulation Resistance Remote Measurement Circuit.

(k) Electrolyte Temperature monitoring system, Expansion tank level and Salinity in Storage Battery Water Cooling system, Air Temperature after burner and Air Coolers (in case of EKM submarines).

(l) Ampere- Hour Meters.

Battery Electrolyte Agitation System

7. The electrolyte agitation system is designed to equalise the electrolyte specific gravity throughout the container height of the cells which contributes to reduction of self discharge and facilitates equalisation of the electrolyte temperature during the process of charging and discharging. Type-I and Type-II cells are equipped with air agitation inlets intended for connecting air supply from the IP air dry system through filters and reducers. The quality of air through the agitation systems needs to be checked periodically and requisite filters are to be renewed/ cleaned as prescribed in the respective maintenance manual. Further, the electrolyte of weak cells is required to be analysed in the labs, once in every quarter, so as to ensure the impurities are within the prescribed limits and corrective action if required, should be undertaken in consultation with the battery OEM. Air consumption test of weak cells to be undertaken during full charge (or as and when required) to ascertain efficacy of the agitation system.

Significance of Air Agitation System

8. Sub optimal pressure and quality of agitation system would lead to the following:-

(a) The density of the electrolyte at different height (in the cell) will be different. At the bottom of the cells the density will be higher than the density on the top. Due to the difference in the potential set up between them, a circulating current may flow between the successive layers resulting in excessive and harmful self-discharge of the cell.

(b) As the density of the electrolyte is measured only from the top (level) of the cell, improper air agitation will give rise to an incorrect indication of the overall electrolyte density in the cell.

Distilled Water System

9. Type I and Type II cells are equipped for circulation of cooling water through positive and negative group bars to minimise temperature rise of the cell electrolyte.

Topping Up Cells

10. De-Mineralised (DM) water is used for topping up of the cells to bring their level up to the standard level, it is therefore essential that the quality of DM water from the bowzer and DW tanks onboard be verified prior to topping up of cells. The DM water report from the lab is also required to be forwarded as part of the monthly battery returns. The DM water consumption pattern will indicate the health of the cells, in case the consumption of DM water is high and frequent topping up of cells is

required, OEM assistance should be sought. A record of topping up is to be maintained and reflected in the monthly return.

Indicators and Control Equipment

11. The following battery parameters must be regularly monitored to ensure proper operation of the battery:-

(a) Cell Voltage. The individual cell voltages are to be regularly monitored. Voltages are used to signal the end of both charge and discharge. Battery monitoring system is to be maintained in an operational state.

(b) Ampere-Hours. The Ampere-hour meters indicate the amount of discharged and charged capacity. Ampere-meters for charge/ discharge are to be maintained for proper functioning.

(c) Hydrogen. The hydrogen gas concentration is sensed by sensors in the battery rooms and compartments. Calibration of sensors are to be in-date prior exploitation.

(d) Battery ventilation. The pressure difference in ‘air in’, ‘air out is to be monitored and the air flow should be adjusted, whenever required. The air flow measurements are to be undertaken post repairs on ventilation system.

(e) Electrolyte Specific Gravity. Manual measurement of electrolyte specific gravity is required to be undertaken using a hydrometer.

(f) Temperature. Only mercury free thermometers are to be used to measure the electrolyte temperature.

Battery Charging/Discharging and Exploitation

12. The various types of charges to be administered to the batteries and their periodicity are as follows. The procedure of charging is to be as per the OEM’s Technical Manual (TM) and details of the charges carried out in a month are to be recorded in the monthly battery returns.

(a) Intermediate Charge (IC) - Once a week.

(b) Partial Charge (PC) - Permitted only when a submarine is operating at sea as per the TM.

(c) Full Charge (FC) - Once in a month.

(d) Equalising Charge (EC) - Once in three months.

(e) Capacity Test (CT) - Once in one year or whenever the battery capacity is suspected.

(f) Hydrogen Evolution Test (HET) – Once in one year or whenever high hydrogen evolution is suspected.

Factors Influencing Battery Charging

13. Sufficient knowledge of factors influencing the charging procedure is essential to administer an appropriate charge to the batteries. These factors are as follows:-

(a) The dependency of change over voltage (CoV) on electrolyte temperature i.e., the higher the temperature, lower is the changeover voltage is reached. It is imperative that the CoV prescribed by the OEM in the TM be adhered to whilst undertaking charges at sea and harbour.

(b) The influence of air agitation, e.g. engaging air agitation right from the beginning of charge permits prolonged charging in the first charging step before the CoV is reached.

(c) The influence of excessive high temperature, will lead to low final charging voltages, accelerated corrosion, sulphation of negative plates and shortening of battery life.

(d) Battery compartment ventilation and Hydrogen concentration has to be regularly monitored.

(e) Battery charging can be performed by either onboard generators or from shore based charging stations. For administering a Full Charge, it is essential that shore based facility to provide DC voltage upto 360 Volt be catered for, since ship's generators cannot provide this voltage.

14. It is prohibited to undercharge the Battery or to make pauses in the charging procedure in the initial stage of charge except during emergency situations or when the Combat situation does not permit to end the charging as per procedure.

Maximum Safe Hydrogen Concentration

15. **LEL of H_2 gas and Alarm limits**. The Lower Explosive Limit (LEL) of H_2 gas is 4%. At concentration below LEL of 4%, the H_2 gas is considered to be 'too lean' (i.e. an explosion cannot occur even if source of ignition is present). However considering a safety margin of 50%, a limit of 2% is accepted as a standard norm for fail safe operations and safety intervention. Therefore, the only way to assure safety is to prevent the hydrogen concentration from approaching the flammable limit. In any case, ventilation system must be initiated before starting charging and to be continued throughout the charge. In case of Full and Equalising Charge, ventilation is to be continued for one hour after termination of charge. In the event of abnormal rise of hydrogen percentage, SOA has to be informed immediately and corrective actions iaw the TM be undertaken at the earliest.

Discharge of Battery

16. Capacity of the cells depends essentially on the value of the discharge current. Higher the discharge current, lower will be the available capacity. High current gives maximum speed but refers to low capacity with limited operating range and vice-versa. Thus maximum high currents are assumed to be applied only in tactical or emergency situations. Normal discharge rates for the battery range between the 100 hrs to 10 hrs discharge current. Optimum depth of discharge for routine operation shall be at about 50% of the capacity to reach maximum service life; recommended maximum depth of discharge should be limited to 80% as a special case during routine operation.

17. The above technical recommendation takes reference to peace-time operation and thus to related guarantee for the battery. It is evident that the battery can be discharged to 100 % of its capacity in case of emergency situations. Even the capacity test results in a 100 % discharge under controlled conditions. But in order to get a long service life (more than the guaranteed life) with the battery, regular deep discharges should be avoided. Deep discharges may also effect polarity reversal of individual cells. Discharge down to 100 % cut-off voltage shall be done not more than twice in a year including during the Capacity test. Single cell voltages shall be monitored and recorded accurately to ensure timely termination of discharge.

Capacity Test

18. Awareness of the battery capacity onboard, throughout its service life, is necessary as this parameter largely influences the ship's operability. To assess the same, Capacity test is to be carried out on the cells once in a year by discharging the battery at 20 hour rate down to 100 % cut-off voltage or whenever the battery capacity is suspected. HET of the battery is also to be undertaken as prescribed in the Technical Manual.

Self-Discharge

19. Self-discharge of Type-I and Type-II cells is very low lying in the range of 2 % per month with a fully charged battery and increases with rise in electrolyte temperature. Leakage currents can be avoided by cleaning away electrolyte layers (creeping paths), preventing the battery from contamination, keeping the cell surface clean and dry -free from any dirt, acid or water mist.

Temporary Idling of Battery

20. Every lead acid cell loses capacity by self-discharge at rest and tends to develop lead sulphate which can be reverted only partly by extensive charge/ discharge. In order to keep the battery operational and healthy, adequate treatment must be given, while it is disconnected from the ship's network. Following two cases may be considered:-

(a) <u>Idling for less than 4 weeks</u>

(i) Give a Full Charge before taking the cells out of operation.

(ii) Recharge at 200 A for two hours at the end of each week.

(iii) Apply trickle charge -connect the cells to an adjustable DC source of constant voltage with single cell terminal voltage of 2.20 to 2.25 V. Take care that the charging voltage remains constant throughout the trickle charge.

(iv) After the idling time, an Equalizing Charge has to be carried out.

(b) <u>Idling for more than 4 weeks</u>

(i) Give an Equalizing Charge before putting the battery/cells idle.

(ii) Recharge with 200 A for two hours weekly during time of rest.

(iii) Apply trickle charge -connect the cells to an adjustable DC source of constant voltage with single cell terminal voltage of 2.20 to 2.25 V. Take care that the charging voltage remains constant throughout the trickle charge and venting is done properly.

(iv) Discharge monthly at 20 hour rate for 6-8 hrs followed by a Full Charge (including related measurement and visual inspection).
(iv) If the idle period extends upto three months, then the Full Charge at the end of third month shall be preceded by a discharge at 20 hour rate upto 50% depth of discharge.

(v) Give an Equalizing Charge at the end of idle period.

(c) During the entire idle period, check acid level regularly and top up if necessary. Acid circulation should be done for minimum 2 hours per week and also after topping up.

(d) Appropriate entries are to be made in the monthly Battery returns indicating reasons for idling and corrective measures undertaken post idling of the cells.

<u>Safety Precautions</u>

21. Submarine Lead-Acid storage batteries are not difficult to operate and maintain but all actions, must be carried out with accurate precautions to ensure safety of personnel and prevent damage to the batteries.

<u>Need for Precaution</u>

22. The batteries in a modern submarine can release electrical energy at the rate of several thousand kilowatts. Any failure in the electrical circuits or equipment or occurrence of any short circuit may lead to release of huge amount of heat leading to melting of conductors and burning. Every care must be taken to keep all the connections firm and clean to prevent heating due to contact resistance, keep the cells, specially the top surface free from dusts or spilled acids to avoid current leakage. Prolonged acid contact may also cause damage to the lid surface. So the top surface of the lid shall be cleaned time to time using wet cloths followed by dry cloth to remove any spilled acid or acid mist.

Basic Safety Regulations

23. Following safety instructions should be adhered to:-

(a) Entrance to the battery room shall be restricted to authorized personnel.

(b) Enter the battery room wearing protective clothes only (cotton overall and not synthetic).

(c) Never carry any loose objects in the pockets.

(d) Use insulated tools only, remove tools after working.

(e) Never carry any bare metallic objects into the battery rooms. Torches with metallic body shall not be used.

(f) Never drop or put any tool or mechanical object on top of cells or connectors.

(g) Never touch neighbouring cell connectors simultaneously.

(h) Beware of any spark or open flame inside the battery room.Smoking is strictly prohibited.

(j) Keep hatches of the battery room shut permanently, except for movement.

(k) Do not enter the battery room during charging till at least one hour after termination of charging.

(l) Never store objects of any kind inside the battery room.

(m) Wash your hands after working with the battery.

Safety Audits

24. The audit of Battery associated systems are required to be undertaken during occasions as mentioned below :-

(a) Half yearly by Operational Authority as part of OLSAT.

(b) Yearly by Admin Authority as part of COMSAT.

(c) Prior Battery loading by Submarine Operating Authority (SOA).

ABER procedure and timelines

25. Due to the long lead time for procurement of Main Batteries, it is recommended that the ABER proceedings for the main batteries (Cat-I) should be initiated post installation of the new set onboard the unit to prevent delays in procurement.

Battery Returns

26. Main batteries are critical for meeting the mission requirements of a submarine. Therefore, maintenance of the batteries is required to be accorded high priority and has to be monitored at all levels. The battery return format for monitoring the performance of the batteries have been revised and are to be consolidated and forwarded to all as per the existing distribution list by respective COMsCOS in respect of Type-I and II battery as per format placed at **Encl1** and **Encl 2** respectively.

27. Additionally, the Main batteries are shifted to Energy Block/ BCF during dry docking of the submarines during refits or AMP for maintenance. The returns for the sets maintained at Energy Block, ND(V) or BCF, Sewri are required to be forwarded by Officer-in-Charge to COMsCOS for consolidation and forwarding to all concerned as per the existing distribution list.

Maintenance of Battery Pits

28. One of the most important aspects associated with the exploitation of submarine batteries is the maintenance of battery pits in healthy state. After monthly Full Charge and quarterly Equalising Charge, the cells are topped up with demineralised (DM) water as per laid down procedures in the battery manuals for Type-I and Type-II batteries. The cell top should be washed with DM water and dried with LP air followed by application of petroleum jelly. The acidic content, if present, settles at the base of the pit which is harmful for the surface of the battery pit. The battery pit needs to be flooded with DM water and flushed out till the battery pit is completely neutralised. The details of pit neutralization are required to be forwarded by the submarines to respective COMsCOS as part of the battery returns.

Extension of Battery Life

29. The battery life for lead acid battery depends on the following parameters:-

(a) Composition of active material in the positive and negative plates viz. the weight, density.

(b) Electrolyte specific gravity.

(c) Dispersement of lead in grid structure.

(d) Weight of lead and alloy composition in plate grids.

(e) Impurities in the cell that can cause excessive local action and gassing of the plates.

30. Since the inception of lead acid batteries onboard submarines, extension has been awarded in terms of life time, cycles consumed and some by both. Based on study carried out by SMHQ, extension has been awarded in terms of life of battery sets by cycles on a case to case basis (provided the battery is not expired by time), however extension of life of battery sets by time has not been granted due to non-availability of requisite parameters to estimate material state of batteries.

31. **Annual Workshop**. Annual workshops by the OEM on maintenance of Type-I and Type-II battery are to be coordinated by the commands. Visits to OEM premises by trainee officers/sailors is considered essential for better understanding, appreciation and knowledge and therefore must be made part of the sea training phase for award of dolphin.

32. **Adherence to Charging Schedule** The charging schedules are strictly to be adhered to as per the Technical Manual of the OEM. All stakeholders are required to emphasise the relevance and ensure administration of relevant type charge to the battery when due and in accordance with the described schedule in the TMs.

33. **Technical Manual** The contents of this policy letter are to be read in conjunction with the Technical Manuals promulgated by the OEM on maintenance of Type-I and Type-II battery.

34. It is requested that information contained in this letter be disseminated to all concerned.

(C Raghuram)
Commodore
PDEE
Directorate of Electrical Engineering

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Enclosure 1 to IHQ,MoD(N)/DEE letter EE/11/0600/POLICY/SM dated 09 Sep 16

MONTHLY FEEDBACK DATA RETURN - TYPE- I BATTERY INS ___________

1. **Set Particulars**

(a) Set No. ___________
(b) Date of manufacture ___________
(c) Date of supply to Navy ___________
(d) Commissioning date ___________
(e) Capacity during commissioning ___________
(f) Loading completion date ___________
(g) No. of cycles completed prior to loading ___________
(h) Cells loaded from (previous Unit / BCF / EB) ___________
(j) Total No. of cycles (on last day of the month) ___________
(k) Details of treatment cycle/density correction carried out during the month:-

S.No	Density Correction / Treatment cycle	Date (from - to)	Cell No(s)	Authority	Remarks (Efficacy of the evolution)

2. **Monthly Charge Particulars (In case of capacity trials only the final Equalising charge particulars need to be furnished)**

(a) Charge no and type of charge ____________
(b) Date and EOC voltage of present charge ____________
(c) DOD of present monthly charge ____________
(d) No. of intermediate charges ______ (sea) ________ (harbour)
(e) No. of partial charges ______ (sea) ________ (harbour)
(f) No. of battery cycles of Monthly charge ____________
(g) No. of battery cycles of Intermediate charges ____________
(h) No. of battery cycles of Partial charges ____________
(j) Total no. of monthly cycles ____________
(k) Initial parameters of monthly charge (to be recorded after half-an-hour on commencement of charge):-

Battery Group	Insulation (MΩ)	Group Voltage (V)	Avg Charging Current (1st stage) (A)	Pilot cells				
				Avg Density (gm/cc)	Avg Cell Voltage (V)	Avg Temp (C^o)	Avg Level (mm)	Avg H_2% in battery pit
Group-I								
Group-II								

(l) End of charge parameters of monthly charge (parameters to be recorded as per TM viz. voltage prior termination of charge; density and temperature after one hour; level as per 6-8 hours):-

Battery Group	Insulation (MΩ)	End of Charge Group Voltage (V)	Durat-ion of charge	All cells				
				Avg Density (gm/cc)	Avg Cell Voltage (V)	Avg Temp (C°)	Avg Level (mm)	Maximum H2% in batt-pit
Group-I								
Group-II								

(m) Details of lagging/leading cells if any:-

Battery Group	No. of cell lagging/ leading in density	No. of cells lagging/ leading in voltage	Details of lagging / leading cells by density			Details of lagging / leading cells by voltage		
			Cell Nos.	Lagging Density	Leading Density	Cell Nos	Lagging Voltage	Leading Voltage
Group-I								
Group-II								

3. **Particulars of Battery Associated Systems (Avg values for the month when the systems are operational)**:-

S.No	System	Recorded values	Status	Calibration date	Remarks
(a)	Cooling System	Pressure_____kg/cm^2	Sat/Unsat		
(b)	Ventilation System	Vacuum____ mm	Sat/Unsat		
(c)	Agitation System	Pressure____kg/cm^2 Flow rate____ lit/min	Sat/Unsat		
(d)*	H_2 Analysers	Max H_2 %	Sat/Unsat		
(e)*	H_2 Eliminators	Avg recorded Temperature ______^{o}C	Sat/Unsat		
(f)*	H_2 Burners	Avg recorded Temperature ______^{o}C	Sat/Unsat		
(g)	Salino-meter / Conductivity meter	Conductivity____mho-cm	Sat/Unsat		
(h)*	Battery pit Bilge Warning system	On/Off (status of indication at Pallady)	Sat/Unsat		
(j)*	Battery pit Bilge pumping System	Trim angles created for completely pumping out the battery pit _____ degrees	Sat/Unsat		
(k)*	Battery Pit pH value (pH Meters/ litmus test)	Before Flushing____ After Flushing______	Sat/Unsat		
(l)	DM System (Parameters of DM water used for flushing &	(i) **Authority**:- (ii) **Onboard analysis** pH _____	Sat/Unsat		

S.No	System	Recorded values	Status	Calibration date	Remarks
	topping)	Conductivity______ leakages __________			
(m)	Electrolyte analysis	**Authority**:-	Sat/Unsat		

4. **Maintenance/Repair Particulars**

(a) Maintenance Routines carried out ________________
(b) Repairs carried out ________________
(c) Cell loading/unloading particulars ________________
(d) Repairs undertaken on Associated systems ________________

5. **Major Evolutions**

(a) Date and capacity of last Capacity trials ________________
(b) Date and value of last H_2 Evolution trials ________________
(c) Date and value of Air Consumption Test (avg) ________________
(d) Date and result of calibration of electrical measuring instruments ________________

6. Any other relevant information

Signature of Electrical Officer Signature of Commanding Officer

OR

Officer-in-Charge (BCF/Energy Block)

Note: For monthly returns of batteries maintained at BCF Sewri or Energy Block, the returns are to be forwarded by Officer-in-Charges to COMsCOS for compilation and despatch. Only the serials marked '*' are not required to be forwarded.

II

Remarks of Squadron Electrical Officer

(a) Comments made by QAE (UB) or M/s Exide on the last monthly feedback report:-

(i) ____________________
(ii) ____________________
(iii) ____________________
(iv) ____________________

(b) Action taken based on the above comments:-

(i) ____________________
(ii) ____________________
(iii) ____________________
(iv) ____________________

(c) Any other relevant information ____________________

Signature of Squadron Electrical Officer

Enclosure 2 to IHQ,MoD(N)/DEE letter EE/11/0600/POLICY/SM dated 09 Sep 16

MONTHLY FEEDBACK DATA RETURN - TYPE - II BATTERY
INS_____________

1. **Set Particulars**

(a) Set No. ___________
(b) Date of manufacture ___________
(c) Date of supply to Navy ___________
(d) Commissioning date ___________
(e) Capacity during commissioning ___________
(f) Loading completion date ___________
(g) No of cycles completed prior to loading ___________
(h) Cells loaded from (Previous Unit / BCF) ___________
(j) Total No. of cycles (on last day of the month) ___________
(k) Details of treatment cycle/density correction carried out during the month:-

S. No	Density Correction / Treatment cycle	Date (from - to)	Cell No(s)	Authority	Remarks (Efficacy of the evolution)

2. **Monthly Charge Particulars (In case of capacity trials only the final Equalizing Charge particulars need to be furnished)**

(a) Charge no and type of charge ____________
(b) Date and EOC voltage of present charge ____________
(c) DOD of present monthly charge ____________
(d)
(e) No. of Intermediate Charges _______ (sea) ________ (harbour)
(f) No. of Partial Charges _______ (sea) ________ (harbour)
(g) No. of battery cycles of Full Charge ____________
(h) No. of battery cycles of Intermediate Charges ____________
(j) No. of battery cycles of Partial charges ____________
(k) Total no. of monthly cycles ____________
(l) Initial parameters of monthly charge (to be recorded after half-an-hour on commencement of charge):-

Battery Group	**Insulation (M Ohm)**	**Group Voltage (V)**	**Avg Charging Current (1^{st} stage) (A)**	**Pilot cells**				
				Avg Density (gm/cc)	**Avg Cell Voltage (V)**	**Avg Temp (C°)**	**Avg Level (mm)**	**Avg H2% in battery pit**
Group-I								
Group-II								
Group-III								
Group-IV								

(m) End of charge parameters of monthly charge (parameters to be recorded as per TM viz. voltage prior termination of charge; density and temperature after one hour; level as per 6-8 hours):-

Battery Group	Insulation (M Ohm)	End of Charge Group Voltage (V)	Durat-ion of charge	All cells				
				Avg Density (gm/cc)	Avg Cell Voltage (V)	Avg Temp (C°)	Avg Level (mm)	Maximum H2% in batt-pit
Group-I								
Group-II								
Group-III								
Group-IV								

(n) Details of lagging/leading cells if any:-

Battery Group	No. of cell lagging/ leading in density	No. of cells lagging/ leading in voltage	Details of lagging / leading cells by density			Details of lagging / leading cells by voltage		
			Cell Nos.	Lagging Density	Leading Density	Cell Nos	Lagging Voltage	Leading Voltage
Group-I								
Group-II								
Group-III								
Group-IV								

3. **Particulars of Battery Associated Systems (Avg values for the month when the systems are operational)**:-

S.No	System	Recorded values	Status	Calibration date	Remarks
(a)	Cooling System	Pressure_________kg/cm^2	Sat/Unsat		
(b)	Ventilation System	Vacuum______ mm	Sat/Unsat		
(c)	Agitation System	Pressure____bar Flow rate____ lit/min	Sat/Unsat		
(d)*	H_2 monitoring system	Max H_2 %	Sat/Unsat		
(e)*	H2 Eliminators	Avg recorded Temperature _____^oC	Sat/Unsat		
(f)	Conductivity meter	Conductivity______micro Siemens	Sat/Unsat		
(g)*	Battery Bilge Warning system	On/Off (status of indication at instrument panel)	Sat/Unsat		
(h)*	Battery Bilge pumping System	Trim angles created for completely pumping out the battery pit _____ degrees	Sat/Unsat		

S.No	System	Recorded values	Status	Calibration date	Remarks
(j)*	Pit pH value (pH Meters/ litmus test)	Before Flushing____ After Flushing_____	Sat/Unsat		
(k)	DM System (Values of DM water used for flushing & topping)	(i) **Authority**:- (ii) **Onboard analysis** pH ________ Conductivity______ leakages _________	Sat/Unsat		
(l)	Electrolyte analysis	**Authority**:-	Sat/Unsat		

4. **Maintenance/Repair Particulars**

(a) Maintenance Routines carried out ______________
(b) Repairs carried out _____________
(c) Cell loading/unloading particulars ______________
(d) Repairs undertaken on Associated systems ______________

5. **Major Evolutions**

(a) Date and capacity of last Capacity trials ______________
(b) Date and value of air consumption test (avg) ______________
(c) Date and result of calibration of electrical measuring instruments ______________

6. Any other relevant information

Signature of Electrical Officer Signature of Commanding Officer

OR

Officer-in-Charge (BCF/Energy Block)

Note: For monthly returns of batteries maintained at BCF Sewri or Energy Block, the returns are to be forwarded by Officer-in-Charges to COMsCOS for compilation and despatch. Only the serials marked '*' are not required to be forwarded.

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II

Remarks of Squadron Electrical Officer

(a) Comments made by QAE (UB) **or**M/s Exide on the last monthly feedback report:-

(i) ______________________________________
(ii) ______________________________________
(iii) _________________________________

(b) Action taken based on the above comments:-

(i) ______________________________________
(ii) ______________________________________
(iii) ______________________________________

(c) Any other relevant information ___________________

Signature of Squadron Electrical Officer

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Integrated Headquarters
Ministry of Defence
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New Delhi 110011

EE/11/0600/POLICY/SM

18 Feb 17

The Flag Officer Commanding in Chief
(for CLO / CLOGO/ CSMTO)
Headquarters Eastern Naval command
Visakhapatnam 530014

The Flag Officer Commanding in Chief
(for CLO/ CLOGO)
Headquarters Western Naval command
Mumbai 400023

The Director General Quality Assurance (Navy)
(for DDGQA (N))
West Block-5, RK Puram
New Delhi – 110 066

TECHNICAL SPECIFICATIONS FOR SULPHURIC ACID FOR SUBMARINE BATTERIES

1. Refer to IHQ MoD (N)/ DEE letter of even number dated 15 Jan and 16 Feb 16.

2. Based on recommendations of DQA(N), following amendments are to be incorporated in the letter ibid :-

a. **Appendix 'B', Sl 11-16**. In lieu of clauses of IS 266:1993, Inductively Coupled Plasma (ICP) equipment be appended for detection of impurities.

b. **Serial 6 of Appendix 'A' and 'B'**. Test method be read as 'Clause A-6 in Annex 'A' in conjunction with Amendment-1 of Feb 2003'.

c. **Serial 9 of Appendix 'A' & Appendix 'B'**. Nitrates (as NO_2) to be substituted as Nitrates (as NO_3)

(C Raghuram)
Commodore
PDEE
Directorate of Electrical Engineering

Copy to:-

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Naval Dockyard, Mumbai – 400 023

The Admiral Superintendent
(for DGM (L&W))
Naval Dockyard, Visakhapatnam – 530 0143

The Flag Officer Submarines
(for CSO 'Tech')
SMHQ, Naval Base
Visakhapatnam – 400023

The Material Superintendent
(for CMP/CPRO)
Material Organisation,
Ghatkopar (E), Mumbai

The Material Superintendent
(for CMP/CPRO)
Material Organisation
Kancharapalem PO, Visakhapatnam

The Commodore Commanding Submarines (East)
INS Virbahu
Visakhapatnam – 530014

The Commodore Commanding Submarines (West)
INS Vajrabahu
Mumbai – 400023

The Senior Vice President,
M/s Exide Industries Limited (Submarine Battery Division),
T-17, MIDC, Taloja,
Navi Mumbai – 410208

The General Manager-Marketing
M/s HBL Power Systems Ltd,
Nandigaon, Kothur Mandal,
Mahaboobnagar Distt,
Telangana State – 509223

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PDSMO **PDSMAQ** **PDLS** **PDPRO**

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Integrated Headquarters
Ministry of Defence (Navy)
New Delhi 110011

EE/11/0600/POLICY/SM 27 Dec 16

The Flag Officer Commanding in Chief
Headquarters, Western Naval command
(CSO (Tech)/ CSO (P&A))
Mumbai – 400 001

The Flag Officer Commanding in Chief
Headquarters, Eastern Naval command
(CSO (Tech)/ CSO (P&A))
Visakhapatnam – 530 014

PROVISIONING AND PROCUREMENT OF SUBMARINE BATTERIES AGAINST ABER

1. Refer to the following :-

a. IHQ MoD (N)/DLS letter LS/ROL/ABER dated 05 Apr 16.

b. IHQ MoD(N)/DEE letters EE/11/0600/Policy/SM dated 15 Jan and 16 Feb 16.

c. IHQ MoD(N)/DEE letters EE/11/0605 dated 11 Jul 2000 and EE/11/0606 dated 20 Jul 2001 for Type-I batteries.

2. **Background**. Submarine batteries are high capacity Lead Acid Batteries that are safety-critical and mission-critical equipment which enable a submarine to propel underwater for prolonged duration. Presently, M/s Exide, Mumbai and M/s HBL, Secunderabad are the IHQ approved vendors for supply of Type-I batteries (for EKMs) and M/s Exide, Mumbai is the only vendor for supply of Type-II batteries (for SSKs).

3. **Definition of Battery Set**. The list of battery spares, referred as battery compendium of spares, required during commissioning of the set and during installation onboard the submarine have been promulgated vide IHQ letters at para 1(c) ibid. To streamline the process of procurement of batteries for submarines, battery set for EKM and SSK class submarines is defined as following:-

a. **Type- I Battery set**. 248 cells + one set of accessories {only section-I (proprietary spares) as per the compendium}.

b. **Type-II Battery set**. 540 cells + one set of accessories as per battery compendium.

c. Of these two sets, 04 cells each would be retained at OEM premises for commissioning and monitoring of cell parameters, in sync with similar activities for the rest of the cells of the group.

4. Accordingly, a single pattern number for a battery set of each type as brought out at para 3 above will be promulgated to all concerned, post approval from competent authority.

5. **Present Status**. IHQ MoD (N)/ DLS vide letter at para 1(a) *ibid* has promulgated the procedure for undertaking ABER replacement of equipment. The submarine batteries are replaced based on service life expiry which in turn is defined by the consumption cycle/ date of commissioning and installation. The replacement of batteries onboard submarines is therefore a cyclic process based on residual life of batteries/ refit schedules and is inevitably a CAT-I replacement. As this parameter is critically monitored by the respective COMsCOS, the trigger for initiating ABER replacement of main batteries for all the submarines is to be indicated centrally by the respective COMsCOS. The demand for acid for commissioning of batteries, as hitertho will continue to be raised by the respective Dockyards i.a.w. the IHQ MoD(N) letters at para 1(b) ibid.

6. The process and responsibilities for demand of submarine batteries through the ABER route is elucidated below :-

(a) **ABER Standing Board**.

(i) A standing board for replacement of batteries is to be constituted by respective Command Headquarters on 01 Feb annually.

(ii) The standing board is to comprise of members from Command Headquarters, Naval Dockyards, MOs and respective COMsCOS.

(iii) The Board is to review the residual service life of battery sets as well as its material state, based on the latest capacity assessment trials, for all submarines at respective Commands and define/ finalise the requirement to replace the present set by 15 Feb.

(iv) This is required to be formulated assuming a procurement timeline of three years for contracting/ delivery post receipt of indent at MO or IHQ MoD (N)/ DLS.

(v) The battery set, held as War reserve, is to be rotated amongst the requirement of the submarines so that one set is always held as war reserve, while the present stock is used to meet the first-off requirement.

(vi) The requirement should also factor refit schedules of submarines, timelines for commissioning of batteries and existing capacities at BCF at Mumbai or Energy Block at Visakhapatnam.

(b) **Submarines**. Submarines are to initiate ABER proceedings immediately based on aforesaid requirements generated by the ABER standing boards and ensure placing of demands for the battery set by 15 Mar of the same year. The details of the demands are to be forwarded to respective COMsCOS by 20 Mar of the same year.

(c) **COMCOS**. COMsCOS are the repository of battery data for all submarines in the Command Headquarters. Following activities are to be undertaken by the respective COMsCOS :-

(i) Ensure ABER demands are placed by the respective submarines for the battery set by 15 Mar, duly considering a lead time of 03 years for provisioning.

(ii) Ensure conduct of capacity trials of batteries, as per promulgated periodicity, so as to get a better assessment of residual life of the battery set.

(iii) Ensure availability of consolidated three year ABER demands at MOs by 30 Mar so as to ensure procurement planning for the subsequent three year cycle.

(d) **MOs**. On the basis of consolidated three yearly ABER replacement requirements for submarine battery set projected by the respective COMsCOS, MOs are to generate consolidated indent by 31 May and initiate procurement action. The indents raised post consolidation are to reach IHQ MoD (N)/ DLS by 31 Oct of the same year, if they are required to be processed at IHQ MoD(N).

7. The following procedure for provisioning and supply of battery set and monitoring of the complete activity will be followed:-

(a) MOs to initiate consolidated procurement for battery sets and acid based on recommendations of the standing board and demands placed by the respective submarines and Yards.

(b) COMsCOS to monitor timelines for delivery of battery sets as per schedule and intimate delay, if any to respective Command Headquarters and IHQ MoD(N)/DLS.

(C Raghuram)
Commodore
PDEE
Directorate of Electrical Engineering

Copy to:-

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Naval Dockyard, Mumbai – 400023

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Internal:-

TA/COM **SO/COL** - (for info pls)

ACOL **ACOM (IT&S)** **ACOM (D&R)** **ACNS (SM**)

PDPRO **PDLS** **PDSMO** **PDSMAQ** **PDFM** **CSAILMS**