METRIC
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PERFORMANCE SPECIFICATION

BATTERY CELLS AND MODULES, VALVE REGULATED LEAD-ACID, MAIN STORAGE, SUBMARINE; GENERAL SPECIFICATION FOR

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers valve regulated lead-acid (VRLA) main storage battery cells (see 6.5.1), modules (see 6.5.3) and installation and checkout parts (see 6.8) for submarines.

1.2 Classification. Battery cells are of the types specified below. The required electrical capacity and configuration of the cells determine type characteristics as shown on the applicable specification sheet (see 3.1 and 6.2).

1.2.1 Types. Battery cell types are as follows:

a. Type B - 2675 ampere-hour cell, 1-hour rating

b. Type C - 2225 ampere-hour cell, 1-hour rating

1.2.2 Battery set configurations. Battery sets are configured for each class of submarine as follows:

a. SSBN/SSGN 726 Class – three strings (see 6.5.6) of 132 Type C cells, arranged in dual cell modules, with 88 modules in right-hand (see 6.5.3.2) orientation and 110 modules in left-hand (see 6.5.3.1) orientation.

b. SSN 688 Class – two strings (see 6.5.6) of 127 Type C cells, arranged in single cell modules, with 127 modules in right-hand (see 6.5.3.2) orientation and 127 modules in left-hand (see 6.5.3.1) orientation.

c. SSN 21 Class – one string (see 6.5.6) of 120 Type B cells and one string of 120 Type C cells, arranged in dual cell modules, with 40 modules of each type in right-hand (see 6.5.3.2) orientation and 20 modules of each type in left-hand (see 6.5.3.1) orientation.

d. SSN 774 Class – one string (see 6.5.6) of 126 Type B cells and one string of 126 Type C cells, arranged as follows: one single cell module and 31 dual cell modules of each type in right-hand (see 6.5.3.2) orientation, and one single cell module and 31 dual cell modules of each type in left-hand (see 6.5.3.1) orientation.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Sea Systems Command, ATTN: SEA 05M3, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to CommandStandards@navy.mil, with the subject line “Document Comment”. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-S-901	-	Shock Tests, H.I. (High-Impact); Shipboard Machinery, Equipment, and Systems, Requirements for
MIL-PRF-32273/1	-	Battery Cell, Valve Regulated Lead-Acid, Main Storage, Submarine, Classification Type B
MIL-PRF-32273/2	-	Battery Cell, Valve Regulated Lead-Acid, Main Storage, Submarine, Classification Type C

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or http://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

NAVAL SEA SYSTEMS COMMAND (NAVSEA) DRAWINGS

NAVSEA Drawing 201-7607331	-	VRLA Battery Tray Interface Control Drawing
NAVSEA Drawing 201-7666427	-	S/A SSN 4348K-SSN688CL, VRLA Battery and Tray Assembly Interface Drawing

(Copies of these documents are available from the Contracting Officer, Naval Surface Warfare Center, Crane Division, 300 Highway 361, Crane, IN 47522-5001.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 Qualification. Battery cells furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.4).

3.2.1 Qualification sample cells. This specification shall be used when fabricating qualification sample cells for inspection as specified in 4.2. Manufacturer's drawings shall be made available to support inspections required in section 4.

3.3 Electrical requirements. Cells shall meet the electrical requirements as specified in 3.3.1 and 3.3.2.

3.3.1 Service life. Service life (see 6.5.4) shall be as specified in the applicable specification sheet and shall be demonstrated as specified in 4.2.

3.3.2 Capacity. The rated ampere-hour (Ah) capacity and minimum allowable voltage of each cell shall be as specified in the applicable specification sheet. All cells for delivery shall have delivered a minimum of 90 percent of rated ampere-hour capacity at the 3-hour rate with no cell less than 1.70 volts at termination, either during or after cell formation.

3.3.3 Dielectric strength. Each cell shall be subjected to a dielectric strength test as specified in 4.4.9. The cell shall be filled and charged. The minimum allowable insulation resistance is 1 gig-Ohm.

3.4 Physical requirements. Cells shall meet physical requirements as specified in 3.4.1 through 3.4.8. Gelled electrolyte immobilization construction is prohibited.

3.4.1 Dimensions and materials. Cell dimensions and materials shall be as specified in the applicable specification sheet and drawings.

3.4.1.1 Cell jars and covers. Cell jars and covers shall be molded using Government owned molds as specified (see 6.2). The Government owned molds are designed for the cover to be heat sealed to the jar. Use of non-flame retardant polypropylene plastic resin shall be prohibited. The manufacturer shall notify the Government immediately upon identification of any problems with the Government owned molds that negatively impact product dimensions.

3.4.1.2 Cell tray. To ensure proper interface when installed aboard submarines, trays shall be constructed in accordance with NAVSEA Drawings 201-7607331 and 201-7666427. For SSN 21, SSN 774, and SSBN/SSGN 726 Classes, single and dual stacked installations shall be in accordance with NAVSEA Drawing 201-7607331. For SSN 688 Class single cell rack mount installations, trays shall be in accordance with NAVSEA Drawing 201-7666427. Tray masses are listed in the applicable specification sheets for information purposes only, are nominal values, and do not include cells.

3.4.1.3 Cell module. Cells shall be installed in trays, the combination of which shall be referred to as a module (see 6.5.3), for shipment and installation (see 6.2).

3.4.2 Cell mass. In the “filled and charged” condition, maximum cell mass shall not exceed the value specified in the applicable specification sheet when measured as specified in 4.3.

3.4.3 Pressure relief valves and flash arrestors. Two removable pressure relief valves with attached flash arrestors shall be provided for each cell in accordance with the battery cell manufacturer's standards and practices when inspected as specified in 4.4.4.

3.4.4 Markings. Cells shall be marked with a manufacturer’s unique alpha-numeric identifier used during production for quality assurance purposes. This number shall be visible when the cell is installed for use. Positive terminal posts shall be identified by either “POS” or “+” and contain red post caps or rings, and negative terminal posts shall be identified by either “NEG” or “-” and contain black post caps or rings. Inspection shall be as specified in 4.4.5.

3.4.5 Terminal screw threads. To ensure a standardized connection interface, each cell terminal shall be drilled and tapped with threads to receive bolts with M6x1-6H threads. Depth of the hole shall be 3.81±0.064 centimeters (1.5±0.025 inches) with 3.06±0.064 centimeters (1.206±0.025 inches) threaded from the top. The intercell connector terminal bolt shall be capable of being torqued to a minimum of 1.15 kilogram-meters (100 inch-pounds).

3.4.6 Installation and checkout parts. When specified (see 6.2), installation and checkout parts (see 6.8) for each set shall be provided in the quantities indicated by Table I.

TABLE I. Installation and checkout parts.

Part Nomenclature	Quantity
Flash arrestor/relief valve assembly with sealing mechanism	4 (All Classes)
Pressure vent removal and installation tool (if required)	2 (All Classes)
Cell numbering sticker sets with 20 blank spares	2 sets (SSN 688, SSN 21, SSN 774 Classes) 3 sets (SSBN/SSGN 726 Class)
Spare colored terminal post rings	10 red/10 black (All Classes)

3.4.7 Mercury. Mercury shall not be used in the manufacture of the cell or any of its components. Mercury shall not be used in any test or test equipment in which there is any danger of introducing mercury into the cell through accident or otherwise.

3.4.8 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.5 Environmental requirements. Environmental requirements shall be as specified in 3.5.1 and 3.5.2.

3.5.1 Temperature operating environment. Battery cells may be subjected to ambient temperatures of 0 to 55 °C while in storage or in operation. Nominal operating temperature will be 25 °C.

3.5.2 Shock. Modules shall meet the Grade A shock acceptance requirements of MIL-S-901 when tested as specified in 4.4.6. During and immediately following the shock test, cell voltage or current shall not show any permanent loss. Following the shock test, the cell shall yield at least 80 percent of rated capacity at the 3-hour (C/3) rate when tested as specified in 4.4.6.

3.6 Spares. Spare cells shall be provided when specified (see 6.2 for quantities, type, and orientation).

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Conformance inspection (see 4.3).

4.2 Qualification inspection. Qualification inspection shall be performed on Type B and C cells as specified in 4.2.1 and 4.2.2 and shall be conducted at a laboratory approved by the Government. Qualification shall be as specified in Table II. One module shall meet shock test requirements before service life testing is started. If Type B single cell module testing is successful, the Type B dual cell module, Type C single cell module, and Type C dual cell module shall be qualified for shock and service life by extension.

4.2.1 Qualification retention. In order to maintain qualification, each manufacturer shall submit annually a certification that the product and design previously qualified have not changed.

4.2.2 Sample cells. Eight sample Type B single cell modules and six sample Type C single cell modules shall be submitted and inspected as specified in Table II. Cells shall be delivered filled and activated.

TABLE II. Qualification inspections and tests.

Inspection or Test	Requirement Paragraph	Inspection/Test Paragraph
Service life	3.3.1	4.4.7
Capacity	3.3.2	4.4.1
Dielectric strength	3.3.3	4.4.9
Dimensions and materials	3.4.1	4.4.2
Cell mass	3.4.2	4.4.3
Pressure relief valve & flash arrestor	3.4.3	4.4.4
Markings	3.4.4	4.4.5
Terminal screw threads	3.4.5	4.4.8
Shock	3.5.2	4.4.6

4.3 Conformance inspection. Each production cell shall be inspected for conformance as specified in Table III.

TABLE III. Conformance inspections and tests.

Inspection or Test	Requirement Paragraph	Inspection/Test Paragraph
Capacity	3.3.2	4.4.1
Dielectric strength	3.3.3	4.4.9
Cell mass	3.4.2	4.4.3
Pressure relief valve & flash arrestor	3.4.3	4.4.4
Markings	3.4.4	4.4.5

4.4 Inspection methods.

4.4.1 Capacity. Testing for rated Ah capacity at the C/3 rate shall be conducted while in the formation phase of production. Any cell which fails to meet the requirements of the 3-hour capacity test shall be rejected. Objective evidence of each cell's Ah capacity and when capacity is reached in the formation or testing sequence of production shall be provided.

4.4.2 Dimensions and materials. Cell and tray dimensions shall be inspected for conformance to the applicable specification sheets and drawing requirements. Cell and tray materials shall be verified by manufacturer certificate of conformance as specified (see 6.2).

4.4.3 Mass measurement. Cells shall be weighed in the filled and charged condition. Individual cell mass shall be equal to or less than the maximum cell mass specified in the applicable specification sheet.

4.4.4 Pressure relief valves and flash arrestors. The cells shall be inspected for the presence of pressure relief valves with attached flash arrestors as specified in 3.4.3. Written certification that the valves and flash arrestors comply with manufacturer standards and practices shall be provided as specified (see 6.2).

4.4.5 Markings inspection. Cell markings shall be inspected for conformance to the requirements specified in 3.4.4.

4.4.6 Shock test. One module of the configuration being qualified shall be subjected to a shock test in accordance with MIL-S-901 as follows:

a. Test category – Medium weight
b. Shock grade – A
c. Equipment class – I
d. Shock test type – B
e. Mounting location – Hull
f. Mounting plane aboard ship – Face mounted, battery is installed on its side in a tray with its positive terminal posts vertically aligned
g. Mounting orientation aboard ship – Unrestricted

The module shall be installed in a Government furnished support structure and attached directly to the standard mounting platform in accordance with MIL-S-901. The module shall be subjected to a total of nine blows. The module shall be set to its normal upright position and be subjected to three vertical blows. The module shall be rotated 90 degrees and be subjected to three vertical blows and then rotated another 90 degrees and be subjected to three final vertical blows such that the X, Y, and Z axes of the module are subjected to the shock blows. Except during periods of storage, transport, or physical inspection after the blows; the module shall be float charged at 2.25±0.01 volts prior to and after each shock blow. During all shock blows, the module shall be delivering current at a constant rate between the 3-hour and 10-hour discharge rates. The discharges shall be interrupted between blows for as short of duration as practical to allow inspections, equipment adjustments, and module rotation. Voltage and current shall be continuously monitored and recorded starting not less than 15 seconds prior to each shock blow and every 1 millisecond during each shock blow. Except for interruptions for equipment adjustments and module rotation, voltage and current shall be measured every 5 seconds between blows and continuously for 15 seconds after the last shock blow. The module shall be removed from the shock test fixture and shall be float charged at a constant voltage of 2.25±0.01 volts for 8 hours prior to starting the capacity test discharge. A capacity discharge at the 3-hour rate (C/3) shall be conducted. The module shall meet the acceptance criteria specified in 3.5.2 after the test. Minor deformation or cracks in the battery jar, battery cover, or tray are acceptable as long as the electrical performance requirements are met. If there is no discernible degradation of voltage and current during the shock test and the first test discharge yields less than 80 percent of rated capacity, the module cells shall be given up to two additional charge and test discharge cycles to achieve 80 percent rated capacity at the C/3 rate. If any permanent loss in voltage or current occurs, or the module cells yield less than 80 percent of rated capacity after three attempts, the module cells shall be dissected to determine the cause of degradation.

4.4.6.1 Shock test failure. Failure of the module to meet the requirements specified in 3.5.2 or the following shall constitute failure of the shock test:

a. Cell voltage shows any permanent loss during the discharge cycles.

b. Battery cell fails to achieve 80 percent rated capacity at the C/3 rate. Three consecutive capacity discharges are allowed.

4.4.7 Service life test. A service life test shall be conducted on a 6-cell battery in accordance with the cycle life regime specified in 4.4.7.1. The battery shall meet the requirements specified in 3.3.1 (see 6.7 for shipboard installation information).

Note: To calculate current limits used during charging procedures, the rated ampere-hour capacity at the 8-hour rate shall be used. If, during the course of a test, cells are removed from the battery for sampling, etc., the battery shall be reconfigured to the remaining cells and the test parameters adjusted to reflect the fewer number of cells being tested. Ballast cells may be added to the string to accommodate test equipment requirements provided that the addition of cell(s) does not affect test control parameters.

4.4.7.1 Cycle life regime. The battery shall be subjected to the testing regime in accordance with 4.4.7.1.1 through 4.4.7.1.3.5 to determine and quantify the life of the battery under cyclic conditions simulating shipboard operations.

4.4.7.1.1 Test battery configuration. Six cells shall be connected in a series-parallel circuit with two strings of three cells each. Intercell busbars shall be provided by the manufacturer for the test that are designed for a current density of no more than 12,903 amperes per square centimeter (2,000 amperes per square inch). The group of cells shall provide a nominal voltage compatible with the operating limits of the test equipment. The test equipment shall be capable of monitoring individual cell voltages and temperatures. Measurements of cell weight shall be taken at the start and conclusion of the test.

4.4.7.1.2 Pre-test regime. Prior to initiating life cycle testing, the battery shall be subjected to a pre-test regime in accordance with 4.4.7.1.2.1 through 4.4.7.1.2.3.

4.4.7.1.2.1 Pre-test charge. The battery cells shall be in a fully charged condition. If not fully charged, the cells shall be boost charged at a constant voltage equal to 2.35 (±0.01) volts per cell for a period of 8 hours. The cells shall be allowed to equalize to a temperature of 21 to 30 °C before continuing.

4.4.7.1.2.2 Assess 3-hour rate capacity. The battery cells shall be discharged at a constant current at the 3-hour (C/3) discharge rate to an average cutoff voltage of 1.70 (±0.01) volts per cell or until any individual cell reaches 1.0 volt. Voltage, current, battery temperature, individual cell voltage, and ampere-hours as a function of time on discharge shall be recorded three times in the first hour, three times in the second hour, and every ten minutes thereafter until completion of the discharge or until termination due to low voltage of either the battery or an individual cell.

4.4.7.1.2.3 Recharge. Prior to and during testing in accordance with 4.4.7.1.3, the cells shall be recharged using the following profile:

Step 1: Recharge with a constant voltage of 2.35 (±0.01) volts per cell until the charge current tapers to 2.5A/100Ah (use rated capacity of series-parallel circuit to determine). (Note: To avoid feeding current from the battery back into the test equipment, an open circuit pause of up to 5 minutes may be inserted between charge steps to allow the battery voltage to decay below the voltage setpoint for the next charge step.)

Step 2: Lower the recharge voltage to 2.30 (±0.01) volts per cell and continue the recharge for a period of 5 hours.

Step 3: Lower the recharge voltage to 2.25 (±0.01) volts per cell. Continue the charge for a total recharge period of 24 hours. During the recharge, record voltage, current, temperature, individual cell voltages, ampere-hours and percent recharge as a function of time on recharge. Record data once every 5 minutes during the first hour of the charge and every hour for the duration of the charge. Plot the measured variables using time as the x-axis.

4.4.7.1.3 Test routine. The battery shall be cycled in accordance with 4.4.7.1.3.1 through 4.4.7.1.3.5 using the 7-day test profile specified in Table II of the applicable specification sheet.

4.4.7.1.3.1 Charge interruption. Following each discharge period, the battery shall be recharged using the 3-step charge procedure defined in 4.4.7.1.2.3 until the start of the next discharge evolution as specified in Table II of the applicable specification sheet. It is the intention of the test sequence that the battery will be interrupted during its recharge by subsequent discharge evolutions. After each discharge, the recharge sequence shall be restarted at Step 1 of 4.4.7.1.2.3.

4.4.7.1.3.2 Seventh day battery rest and recharge. No discharges are scheduled on the seventh day of the test sequence to allow the battery to complete the entire 3-step recharge procedure (see 4.4.7.1.2.3) and to continue on float charge for at least 12 to 18 hours. This is intended to bring the battery back to a fully charged condition at least once every 7-day period.

4.4.7.1.3.3 Test monitoring requirements. Throughout the entire 7-day cycle, battery voltage, current, temperature, individual cell voltages, and ampere-hours shall be monitored and recorded at the beginning and end of each step change in the test profile.

4.4.7.1.3.4 Six-week test sequence. Repeat the 7-day test profile using the test procedures specified in 4.4.7.1.3.1 through 4.4.7.1.3.3 until a total of 6 weeks of cyclic testing has been completed. After the sixth 7-day test profile, proceed to 4.4.7.1.3.4.1.

4.4.7.1.3.4.1 Periodic capacity test discharge procedure. Following completion of the sixth 7-day test profile, a capacity discharge test shall be performed on the battery cells. Before starting the capacity discharge test, the battery cells shall be boost charged at a constant voltage equal to 2.35 (±0.01) volts per cell for a period of 4 hours and then the charge shall be terminated. The cells shall be allowed to equalize to a temperature of 21 to 30 °C before proceeding to 4.4.7.1.3.4.2.

4.4.7.1.3.4.2 Periodic test discharge procedure. The cells shall be discharged at a constant current at the 3-hour (C/3) discharge rate to an average cutoff voltage of 1.70 volts per cell or until any individual cell reaches 1.0 volt. Voltage, current, battery temperature, individual cell voltages, and ampere-hours as a function of time on discharge shall be recorded three times in the first hour, three times in the second hour, and every ten minutes thereafter until completion of the discharge or until termination due to low voltage of either the battery or an individual cell.

4.4.7.1.3.4.3 Recharge after the test discharge. Following completion of 4.4.7.1.3.4.2, the battery cells shall be recharged using the 3-step recharge profile specified in 4.4.7.1.2.3.

4.4.7.1.3.5 Test routine continuance. Repeat cyclic testing in accordance with 4.4.7.1.3.1 thru 4.4.7.1.3.4.3 until the battery has accumulated a minimum of 240 equivalent Navy cycles (see 6.5.2), 96 months of cyclic testing, or its measured capacity during a capacity test discharge falls to less than 80 percent of its rated C/3 discharge capacity. If a single cell is limiting performance, the cell shall be removed and the test shall be continued with the remaining cells by either replacing the removed cell or jumpering a corresponding cell until a second cell (of the original six) fails. If battery capacity drops below 80 percent of the rated capacity at the 3-hour discharge rate during the tests specified in 4.4.7.1, restoration of battery capacity shall be attempted as specified by the manufacturer. No more than two consecutive attempts at capacity restoration shall be permitted. Record the number of attempts at capacity restoration and the method(s) used. Testing shall continue after successfully completing battery capacity restoration.

4.4.7.1.4 Service life test failure. The cell type (see 1.2.1) fails the service life test (see 4.4.7) when the following occurs:

a. Battery capacity is not restored (see 4.4.7.1.3.5) after two consecutive attempts.

b. Battery falls to less than 80 percent of its rated C/3 discharge capacity during two consecutive capacity discharge tests.

4.4.7.1.5 Failure analysis. After the termination of the service life test, a teardown analysis shall be performed on the failed cells to determine the failure mode. The teardown analysis shall include cells that failed and were removed during the test, as well as failed cells at the end of the test.

4.4.7.1.6 Reporting methods. Battery lifetime capacity under cyclic operating conditions shall be reported as total “equivalent Navy cycles”.

4.4.8 Terminal screw threads. Terminal bolts (see 3.4.5) with M6x1-6H threads shall be inserted into terminal openings to validate thread size and depth.

4.4.9 Dielectric strength test. Each cell shall be subjected to the dielectric strength test to determine compliance with 3.3.3.

4.4.9.1 Test setup. A tank of sufficient size to hold a cell shall be filled with a dilute solution of water and ammonia (approximately 1 cup of ammonia per gallon of water), where the water level comes up to the top edge of the side of the cell when lowered into the tank. Care shall be taken to submerge the cover to jar seal area while ensuring the water solution does not come over the top of the cell. If the tank is not metal, it shall be provided with a metal grounding strip extending from the rim of the tank down into the water solution to the bottom of the tank. Caution should be exercised to ensure that a ground path is not developed through the cell lifting device.

4.4.9.2 Measurement. Using a 500-volt calibrated megohmmeter (Megger Brand MIT430 or equivalent), obtain a reading between a cell terminal and the metal tank or grounding strip.

4.4.9.3 Pass and fail criteria. Cleaning and repair of the cell is permitted. If the insulation resistance is below the 1 gig-ohm requirement (see 3.3.3) after three attempts to correct, the cell shall be rejected.

4.4.9.4 Cell cleanliness. Prior to inserting the cell into the tray or alternate shipping restraint, the entire exterior of the cell shall be cleaned, wiped down, and dried.

4.4.9.5 Final dielectric strength test. After the cell is cleaned, dried, and inserted into the tray (tray cover shall be installed, if applicable) or alternate shipping restraint, perform a final dielectric strength test. Using a 500-volt calibrated megohmmeter (Megger Brand MIT430 or equivalent), obtain a reading between a cell terminal and the tray or alternate shipping restraint. The minimum allowable insulation resistance shall comply with 4.4.9.3.

4.5 Certified test reports. Test reports for qualification and conformance testing shall be prepared as specified (see 6.2). The test reports shall contain the following information at a minimum:

a. This specification number, revision, and date (required for both qualification and conformance testing).

b. The date and serial number of the NAVSEA letter of approval authorizing qualification testing (required for qualification testing only).

c. A statement that the product was constructed only from materials listed on the manufacturer's approved detailed construction drawing (required for qualification testing only).

d. A statement that the product meets all the requirements of this specification (required for qualification testing only).

e. Results of all tests indicating actual values obtained (required for both qualification and conformance testing).

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The valve regulated lead-acid (VRLA) cells are intended for use in submarine main storage batteries to furnish power for vital loads and other power-consuming equipment when the submarine is operating under conditions when the nuclear reactor or diesel engines cannot be used to supply power.

6.2 Acquisition requirements. Acquisition documents should specify, as necessary, the following:

a. Title, number, and date of the specification and applicable specification sheet or sheets.

b. Number of sets (see 6.5.5) of cells by ship configuration (see 1.2.2).

c. Quantity, type, and orientation of spare cells (see 3.6).

d. Identification of Government owned molds to be supplied to the manufacturer appropriately marked by the Government by cell type (see 3.4.1.1).

e. Certificate of conformance (see 4.4.2).

f. Certification that the valves and flash arrestors comply with manufacturer standards and practices (see 4.4.4).

g. Test report requirements (see 4.5).

h. Module air shipment requirements (see 6.3).

i. Whether installation and checkout parts (see 6.8) are required (see 3.4.6).

j. If partial shipments are permitted.

6.3 Air shipment. Modules, either single or dual cell, are to be shipped in accordance with International Air Transport Association (IATA) Dangerous Goods Regulations Packing Instruction #806 and Special Provisions A-48 and A-67.

6.4 Qualification. With respect to products requiring qualification, awards will be made only for products, which are, at the time of award of contract, qualified for inclusion in qualified products list QPL No. 32273 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Commander, Naval Sea Systems Command, ATTN: SEA 05M3, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to CommandStandards@navy.mil.

6.5 Definitions. The definitions specified in 6.5.1 through 6.5.6 are applicable to this specification.

6.5.1 Cell. An individual cell is a unit with a nominal terminal voltage of 2 volts DC and is complete with all hardware required by this specification.

6.5.2 Equivalent Navy cycle. An equivalent Navy cycle for a cell in ampere-hours of charge is equal to 80 percent of the 3-hour rate capacity in ampere hours multiplied by 1.08.

6.5.3 Module. A module is an assembly consisting of a steel tray with either one or two installed cells, and referred to as single or dual cell configuration, respectively. Modules facilitate battery shipment and shipboard installation.

6.5.3.1 Left-hand orientation. Cells and modules that have the positive terminals on the left side when facing the terminals.

6.5.3.2 Right-hand orientation. Cells and modules that have the positive terminals on the right side when facing the terminals.

6.5.4 Service life. Service life, expressed in months of service, quantifies the life of the submarine VRLA battery under cyclic conditions encountered during submarine operation. In a cyclic application, the battery is frequently operated through a series of discharge and charge evolutions. The cyclic conditions stress the cell's positive and negative active materials.

6.5.5 Set. A set is the total number of modules necessary to assemble one complete battery installation in a ship.

6.5.6 String. A string is a number of battery cells connected electrically in series and may constitute part of a battery when two or more strings are connected in parallel or a whole battery.

6.6 Sub-contracted material and parts. The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment covered by this specification and lose their separate identity when the equipment is shipped.

6.7 Intercell connectors and buswork installation information. To ensure design and installation compatibility, cell terminals will be bolted to copper interrow, crossover and intercell connectors, and buswork. Interrow, crossover and intercell connectors, and buswork may be solid or flexible to accommodate relative motion between two connected cells and between cells and the battery compartment bulkheads. The buswork will be designed to have a current density of no more than 12,903 amperes per square centimeter (2,000 amperes per square inch). Non-contact area parts of buswork and intercell connectors will be coated with plastisol and the contact areas will be silver electroplated to prevent corrosion of contact areas. Buswork and terminal contact areas will be coated with corrosion inhibiting treatment, NO-OX-ID A Special from SanChem Corporation or equivalent.

6.8 Installation and checkout parts. Installation and checkout parts include extra flash arrestor and relief valve assemblies with sealing mechanism; cell pressure vent removal and installation tool; cell numbering sticker sets; and red and black terminal polarity post rings.

6.9 Subject term (key word) listing.

Submarine Valve Regulated Lead Acid (SVRLA)

Preparing Activity:
Navy – SH
(Project 6140-2006-007)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.