MILITARY SPECIFICATION

BURNER, CARBON MONOXIDE AND HYDROGEN, CATALYTIC TYPE (MARK V)

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

1. SCOPE

1.1 This specification covers the design and construction of a Mark V burner for removing carbon monoxide and hydrogen from submarine atmospheres.

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

HH-P-46 - Packing; Asbestos, Sheet, Compressed.

MILITARY

MIL-C-104 - Crates, Wood; Lumber and Plywood Sheathed, Nailed and Bolted.
MIL-B-117 - Bags, Sleeve and Tubing-Interior Packaging.
MIL-S-901 - Shock Tests, H.I. (High-Impact); Shipboard Machinery, Equipment and Systems, Requirements for.
MIL-E-917 - Electric Power Equipment, Basic Requirements for (Naval Shipboard Use).
MIL-G-1149 - Gasket Materials, Synthetic Rubber, 50 and 65 Durometer Hardness.
MIL-S-1222 - Studs, Bolts, Hex Cap Screws, and Nuts.
MIL-E-2036 - Enclosures for Electric and Electronic Equipment, Naval Shipboard.
MIL-C-2212 - Controllers, Electric Motor, A.C. or D.C., and Associated Switching Devices, Naval Shipboard.
MIL-M-7793 - Meter, Time Totalizing.
MIL-A-8625 - Anodic Coatings, for Aluminum and Aluminum Alloys.
MIL-P-15024 - Plates, Tags and Bands for Identification of Equipment.
MIL-P-15024/5 - Plates, Identification.
MIL-P-15137 - Provisioning Technical Documentation for Repair Parts for Electrical and Mechanical Equipment (Naval Shipboard Use).
MIL-I-16411 - Insulation Felt, Thermal, Glass Fiber.
MIL-F-16552 - Filters, Air Environmental Control System, Cleanable, Impingement (High Velocity Type).
MIL-M-17060 - Motors, 60 Hertz, Alternating Current, Integral Horsepower (Shipboard Use).
MIL-E-17555 - Electronic and Electrical Equipment, Accessories and Repair Parts: Packaging and Packing of.
MIL-L-20213 - Lithium Hydroxide (LiOH), Technical.
MIL-C-21665 - Catalyst, Carbon Monoxide and Hydrocarbon Oxydizing (for Use In An Air Purifying Device Aboard Submarines).
MIL-H-22577 - Heating Elements, Electrical; Cartridge, Strip and Tubular Type.
MIL-M-24365 - Maintenance Engineering Analysis: Establishment of and Procedures and Formats for Associated Documentation.
MIL-H-46855 - Human Engineering Requirements for Military Systems, Equipment and Facilities.

STANDARDS

MILITARY

MIL-STD-167-1 - Mechanical Vibrations of Shipboard Equipment (Type I - Environmental and Type II - Internally Excited).
MIL-STD-278 - Fabrication, Welding and Inspection; and Casting Inspection and Repair for Machinery, Piping and Pressure Vessels In Ships of the United States Navy.

MILITARY (con.)
MIL-STD-471 - Maintainability Demonstration.
MIL-STD-681 - Identification Coding and Application of Hookup Wire.
MIL-STD-740 - Airborne and Structureborne Noise Measurements and Acceptance Criteria of Shipboard Equipment.
MIL-STD-756 - Reliability Prediction.
MIL-STD-769 - Thermal Insulation Requirements for Machinery and Piping.
MIL-STD-882 - System Safety Program for Systems and Associated Subsystems and Equipment: Requirements for.
MIL-STD-1399, Section 103 - Interface Standard for Shipboard Systems, Electric Power, Alternating Current.
MIL-STD-1472 - Human Engineering Design Criteria for Military Systems, Equipment and Facilities.
MIL-STD-1629 - Procedures for Performing a Failure Mode and Effect Analysis for Shipboard Equipment.

HANDBOOKS

MILITARY
MIL-HDBK-217 - Reliability Prediction of Electronic Equipment.

DRAWINGS

MILITARY
NAVSHIPS 5000-S1112-1385778 - Mounts, Resilient, EES Type.

PUBLICATIONS

MILITARY
NAVSEA 0900-LP-084-6010 - Handbook of Standardized Format for the Preparation of Reliability Demonstration Test Procedures.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
B334 - Nickel-Molybdenum-Chromium Alloy Plate and Sheet.
B336 - Nickel-Molybdenum-Chromium Alloy Rod.
B424 - Nickel-Iron-Chromium-Molybdenum-Copper Alloy Plate, Sheet and Strip.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Description. The burner shall be a device which picks up ambient air in the submarine and removes carbon monoxide and hydrogen at efficiencies no lower than those specified in table I. The air shall flow from the space through an inlet filter, a blower, inlet (first) pass of a heat exchanger, a heater, catalyst bed, outlet (second) pass of the heat exchanger, an aftercooler, an afterfilter and then to the space. An automatic temperature control system shall be incorporated to monitor the air temperature at the catalyst bed and maintain a temperature control sensitivity of 600°F + 10°F. The temperature of the air at the face of the catalyst bed shall not vary from 600°F plus or minus 25°F when measured in accordance with 4.6.7.2. Temperature indicators shall be provided to monitor air temperatures in the catalyst bed (650°F) and afterfilter chamber (160°F). The control system shall operate automatically to maintain the specified temperatures. A drain

plug shall be provided at the low point of the burner. Lifting pad eyes shall be provided that will support the burner during hoisting operations when fully loaded.

Table I - Efficiency for the burning of carbon monoxide and hydrogen.

Gas burned	Inlet concentration	Efficiency (percent burned)
Hydrogen	0.50 percent 1.00 percent 1.50 percent 1.80 percent	85 90 90 90
Carbon monoxide	50 p/m 100 p/m	85 90
Hydrogen and carbon monoxide	1.80 percent 100 p/m	90 90

3.2 Capacity. With the filters (air and lithium carbonate) and catalyst installed, the burner shall be designed for a minimum air flow of 650 cubic feet per minute (ft^3/min) with an external pressure differential of plus 3 inches water gage.

3.3 General design.

3.3.1 Ambient conditions. The burner shall operate at a ship's ambient temperature range of 40°F to 122°F, and a pressure of 30 inches of mercury (Hg) absolute, with variations of plus or minus 6 inches of Hg.

3.3.2 Services. The burner shall operate at rated capacity with the services specified in 3.3.2.1 and 3.3.2.2.

3.3.2.1 Cooling water shall be used for indirect cooling. The burner shall operate with water at 95°F, at a maximum gage pressure of 100 pounds per square inch (lb/in^2), and with maximum and minimum flow rates of 25 and 5 gallons per minute (gal/min), respectively. The maximum allowable pressure drop between the inlet and outlet water connections shall be 10 lb/in^2.

3.3.2.2 Power to be supplied shall be 440-volt, 3-phase, 60 hertz (Hz). The burner shall not require more than 26 kilowatts (kW).

3.3.3 Weight, mounting, and overall dimensions.

3.3.3.1 The loaded and empty weights, main mount locations and orientation, and the width, depth, and height dimensions shall be as shown on figure 1. The center of gravity of the burner shall be no more than 8 inches and as close as possible to a point in the center of a plane passing through and bounded by the four main mounts. The final location of the center of gravity is subject to the Naval Ship Engineering Center (NAVSEC) review.

3.3.3.2 Items requiring routine overhaul or periodic replacement, such as the inlet filter, blower, motor, aftercooler, afterfilter, temperature controls heater assembly, and pressure monitoring components shall be designed to be readily accessible and pass through a 25-inch diameter hatch and a 20-inch wide door.

3.3.4 Service connections. Unless otherwise specified (see 6.1.1), the cooling water and air connections and their location shall be as shown on figure 1.

3.3.5 Material. Only the materials and metals permitted by MIL-E-917 shall be used. Unless otherwise specified herein, structural parts shall be corrosion-resistant metals as specified in MIL-E-917. Aluminum protection by anodic treatment shall be provided in accordance with MIL-A-8625. Material used shall be subject to review by NAVSEC. The heat exchanger and the complete aftercooler shall be nickel-molybdenum-chromium alloy in accordance with ASTM B334 or ASTM B336. When any of the material is formed by any method which will reduce its corrosion-resistance the material shall be treated to restore it to its original corrosion-resistant condition. Welding shall be in accordance with MIL-STD-278. Nuts and bolts shall be corrosion-resisting steel of the 300 series in accordance with

MIL-S-1222. Component(s) containing mercury shall not be used. Components shall also be free from mercury contamination due to the manufacturing process, examination, tests, or the material having come in direct contact with mercury, any of its compounds, or with any mercury containing devices employing only a single boundary of containment. (A single boundary of containment is one which is not backed by a second seal or barrier to prevent contamination in event of rupture of the primary seal or barrier.) Galvanic action shall be kept to a minimum through the selection of proper materials. Use of other than 300 series corrosion-resisting steel shall be subject to NAVSEC review. Where welding of corrosion-resisting steel is required, material resistant to intergranular corrosion (precipitated carbides) shall be used.

3.3.6 Inclination. The burner shall meet the specified requirements when mounted in an upright condition and when subject to the various conditions of trim, list, pitch, and roll as follows:

	Submerged	Snorkel	Surface
Trim (permanent)	±30 degrees	+7 degrees	+7 degrees
Pitch amplitude	±7-1/2 degrees	±10 degrees	±10 degrees
Period of complete pitch:			
Cycle	120 seconds	6 seconds	6 seconds
List	15 degrees	15 degrees	15 degrees
Roll amplitude	±30 degrees	±30 degrees	±60 degrees below 10 knots 30 degrees above 10 knots
Period of complete roll cycle	14 seconds	14 seconds	12 seconds

Note: Equipment and machinery shall continue to operate and not be damaged due to trim angles up to 45 degrees for short periods of time (up to 5 minutes), under casualty conditions. Minor oil leaks or similar abnormal conditions will be permitted under this condition.

3.3.6.1 The conditions resulting from the following combinations shall be met:

(a) List and trim.
(b) List and pitch.
(c) Roll and trim (surface only).
(d) Roll and pitch.

Degrees shall be measured from vertical to either side for list and roll, and from the normal horizontal (fore and aft) plane up down for trim and pitch. The period shall be the time for one complete cycle, for example, the time for the ship to pitch or roll starting from one extreme to the other and return. Conditions of permanent list and roll, or trim and pitch, shall not be considered additive.

3.3.7 Interchangeability. Similar equipment and parts installed in burners furnished on the same contract or order, or manufactured to the same drawings, shall be interchangeable without the necessity of further machining or hand fitting of any kind. Where the contractor has previously furnished similar burners parts installed in previous burners shall be interchangeable with the parts furnished on the contract or order. This requirement is not intended to restrict improvements in design, operation, and maintenance. Changes will be subject to NAVSEC review.

3.3.8 Operation. After the burner has been filled, started, and control settings have been established, the burner shall be capable of operating over a 24-hour period with an average requirement of 5 minutes maximum per hour for routine operational checks exclusive of maintenance requirements.

3.3.9 System safety program. The contractor shall develop and maintain an effective system safety program that is planned and integrated into all phases of design, production, and testing of the equipment. The system safety program shall provide a disciplined approach to identify hazards and prescribe corrective actions in a timely cost effective manner in accordance with the system safety precedence established in MIL-STD-882. The system safety program tasks shall be specified in a formal plan (system safety program plan). The plan shall include requirements to be imposed on each subcontractor to assure compatibility with the system safety program for the equipment. MIL-STD-882 shall be used as guidance for preparing the system safety program plan (SSPP).

3.3.9.1 Safety testing. Tests shall be proposed in the SSPP to validate the safety of the equipment.

3.3.9.2 Integration of associated disciplines. The contractor shall indicate in the SSPP how safety will interface with other disciplines in order to prevent duplication of effort.

3.3.9.3 Safety design review. Safety shall be an integral part of all design reviews held for all the equipment, subsystems, and components. The contractor shall conduct system safety program reviews. Where possible, the system safety reviews shall be conducted as part of the overall program review to assess the status of compliance with the overall safety objectives. This review shall identify any deficiencies of the system with respect to safety and provide guidance for further analysis or design effort which may be required. Qualified contractor system safety personnel shall attend these design reviews. NAVSEA/NAVSEC shall be notified prior to each system safety program review, to permit participation by Navy personnel. Minutes of these system safety program reviews shall be prepared.

3.3.9.4 Safety analyses. Safety analyses shall be performed to identify hazardous conditions for the purpose of their elimination or control. Analyses shall be made to examine the equipment, subsystems, components and their interrelationship to include logistic support, training, maintenance, and operational environments.

3.3.10 Arrangement.

3.3.10.1 The arrangement shall be based on engineering and human engineering design factors to facilitate systematic operation and maintenance. Equipment requiring periodic maintenance shall be easily accessible and capable of being removed and replaced without interference. Access to the burner for maintenance and operation shall be limited to the front and both sides of the burner. The space required for maintenance and operation shall be limited to 30 inches in front and 12 inches on each side of the burner. The rear of the burner shall not be used accessiblity.

3.3.10.2 Components shall be arranged such that flow is downward through the catalyst bed, second pass of the heat exchanger, aftercooler, and afterfilter. The control panel and instrument panel shall be mounted on the front of the burner. The air intake and discharge shall be located as high as possible.

3.3.10.3 Adjustable controls on the front of the panel shall be accessible to the operator without having to stoop or bend over. To facilitate shipboard installation, the upper and lower mounts shall have a minimum of 6 inches clearance maintained around each mount.

3.4 Electrical input power. The burner shall be capable of operating with the following nominal voltage and frequency rating and with input electrical power requirements in accordance with MIL-STD-1399, Section 103.

Nominal voltage	Frequency	Voltage tolerance	Frequency tolerance
440 volt alternating current (a.c.), 3-phase	60 Hz	±5 percent	±5 percent

3.5 Noise.

3.5.1 Airborne noise. The airborne noise output of the burner shall not exceed the limits specified in table II when measured 3 feet from the equipment.

Table II - Airborne noise limits.

Octave band (Hz)	Sound pressure level (db)	Octave band (Hz)	Sound pressure level (db)
37.5 - 75	90	600 - 1200	75
75 - 150	85	1200 - 2400	75
150 - 300	80	2400 - 4800	75
300 - 600	80	4800 - 9600	75

3.5.2 Structureborne noise. The structureborne noise output of the burner shall not exceed the limits shown on figure 2. Accelerometer blocks used to obtain structureborne noise data shall remain on the equipment as delivered to the Government.

3.6 Shock. Burner shall withstand the shock requirements specified in MIL-S-901 for grade A, class II equipment. Burner shall be designed for installation on Navy type resilient mounts with a snubber arrangement as required, satisfactory to the command or agency concerned.

3.7 Vibration. Burner shall be capable of operating under conditions specified for type I environmental vibration as specified in MIL-STD-167-1 for frequencies up to and including 33 Hz.

3.8 Reliability and maintainability requirements.

3.8.1 Reliability. The mean-time-between-failure (MTBF), shall be a minimum of 2000 hours. A failure shall be defined as occurring when the burner ceases to function or its performance degrades below the requirements of this specification.

3.8.2 Maintainability. The mean-time-to-repair (MTTR), shall be a maximum of 4 man-hours.

3.8.3 Reliability prediction. The contractor shall perform a reliability prediction in accordance with MIL-STD-756 and MIL-HDBK-217. Where no valid failure rate data exists for piece parts or subassemblies, then the prediction shall be based on known operational failure rate data of a similar type equipment modified as necessary for differences in design, application, or other known factors. Prediction methods, failure rate data and their sources shall be fully documented. The predicted reliability shall be compared with the required value and if noncompliance is indicated, a corrective action plan shall be formulated for review and acceptance.

3.8.4 Failure mode and effects analysis. The contractor shall perform a failure mode and effects analysis (FMEA) in accordance with MIL-STD-1629. The analysis shall be conducted to the functional subassembly level of MIL-STD-1629, except for the temperature monitoring system and the control circuit which the analysis shall be extended to the individually replaceable item level.

3.8.5 Maintenance engineering analysis. The contractor shall perform a maintenance engineering analysis in accordance with MIL-M-24365. This analysis shall be conducted on all individually replaceable items in the burner.

3.8.6 Reliability demonstration test plan. The contractor shall prepare a reliability demonstration test plan using NAVSEA 0900-LP-084-6010 as a guide. This plan shall describe the procedures necessary to satisfy the test specified in 4.6.5.

3.8.7 Maintainability demonstration test plan. The contractor shall prepare a maintainability demonstration test plan in accordance with MIL-STD-471 in order to satisfy the test specified in 4.6.6.

3.8.8 Performance monitoring. Performance monitoring and related displays shall be provided that will allow continuous sensing of critical performance parameters and indications of performance degradation or approaching failure. The monitoring devices shall be centrally located. The monitor system shall include automated visual and audible alarm indications of burner or component failure and visual identification of a specific failed assembly or module.

3.8.9 Fault isolation. Where the failure of the lowest replaceable assembly, module, or part is not automatically identified by the monitor system or built-in test procedures, any special test equipment required for fault isolation shall be provided along with support equipment as required for removal/replacement, adjustment, calibration, and alinement. Emphasis shall be placed upon the adaptation and selection of standard items already in Government inventory.

3.8.10 Time totalizing meter. The burner shall incorporate a time totalizing meter in accordance with MIL-M-7793.

3.8.11 Human engineering. The design of the burner shall include the human engineering design requirements of MIL-H-46855 and MIL-STD-1472.

3.9 Component design.

3.9.1 Inlet filter. The inlet filter shall be reusable and cleanable. The filter arrangement shall be such that no bypass occurs. The filter shall be quickly and easily demountable for servicing and retained by quick opening fasteners. The filter shall be of the wire mesh type in accordance with MIL-F-16552. The pressure drop across a clean filter at 650 ft^3/min shall not exceed 0.5 inch water gage.

3.9.2 Blower. A blower shall be furnished and designed to operate continously under the conditions specified herein and at the back pressure afforded by the burner design and shall be of a nonoverloading design. The blower shall be direct-driven and include a hub with balancing provisions. The blower hub and motor balancing ring (see 3.9.16) shall be used to provide a balanced blower motor assembly. The blower discharge shall be connected to the burner inlet duct via a flexible connection to reduce noise transmission. The blower/motor assembly shall also be isolation mounted from the lower portion of the burner to reduce noise transmission.

3.9.3 Heat exchanger.

3.9.3.1 The heat exchanger shall be a counterflow type with downward flow through the second pass and shall be capable of transferring, to the inlet air, a minimum of 75 percent of the increased heat load of the air leaving the catalyst section. The heat exchanger shall be such that any of its surfaces which come in contact with the incoming air shall not come in contact with the air leaving the catalyst section. The heat exchanger flange surfaces and the mating flange surfaces shall be machined surfaces with a roughness less than 63 microinches root mean square (rms). The heat exchanger shall be designed to prevent any leakage between passes in excess of 20 standard cubic feet per minute (std ft^3/min) at 15 inches H_2O water gage differential. The heat exchanger core and seals shall be designed to prevent any leakage passes in excess of 20 std ft^3/min at 15 inches H_2O water gage differential. The heat exchanger core and seals shall be replaceable. An access for examination shall be provided at the inlet and outlet of the second pass. The second pass of the heat exchanger and aftercooler shall be designed to minimize devices in which halogen acid condensate or catalyst dust can collect, to provide maximum corrosion allowance, and to facilitate washing and the removal of catalyst dust.

3.9.3.2 The heat exchanger shall be a plate type design with a minimum plate thickness of 0.015 inch. The heat exchanger casing shall be 300 series corrosion-resisting steel.

3.9.4 Heater. Heating elements shall be hermetically sealed in accordance with type III of MIL-H-22577 except the heater dimensional tolerances shall be within plus or minus 5 percent. Special attention shall be given to terminal construction and materials in order to insure easy removal of terminal connections after continuous operation without damage to the heating element. Terminal connections shall be of a bus bar type arrangement. The watt density of the heater element shall not exceed 25 watts per square inch. The design shall be such that the individual heaters may be replaced in the heat assembly. The heater shall be of a design which is sealed and may be removed and replaced through an access plate on the front of the burner. The heater elements shall be nickel-copper alloy.

3.9.5 Catalyst bed. The catalyst bed shall be located in a horizontal position and the flow through it shall be downward. The catalyst bed shall be designed like a drawer and be removable from the front of the burner. The catalyst bed shall have a minimum volume of 1.35 cubic feet. The velocity through the bed when filled with catalyst shall not exceed 150 feet per minute (ft/min). The bed shall be constructed so that up to 10 percent setting of the catalyst will not permit air to bypass the catalyst. Provision shall be made to add or remove catalyst from the top of the bed. The catalysts shall be retained by two (top and bottom) nickel-iron-chromium-molybdenum-copper alloy in accordance with ASTM B424, perforated nonclogging plates designed to withstand the temperatures and temperatures cycling encountered without distortion. All other portions of the catalyst bed shall be 300 series corrosion-resisting steel.

3.9.6 Catalyst. The catalyst shall be in accordance with MIL-C-21665 (mesh size 3 to 8 mesh) and shall be provided in the quantity required to perform all tests specified herein. Catalyst is available from the Government. Catalyst will not be required for production units.

3.9.7 Lithium carbonate (Li2CO3). The contractor shall supply Li2CO3 necessary to perform all tests specified herein. Li2CO3 is available from the Government (see 3.9.9). Li2CO3 will not be required for production units.

3.9.8 Aftercooler. A water cooling coil shall be provided on the discharge side of the heat exchanger. The capacity of the external cooling coil shall be such that the temperature of air leaving the external cooling coil shall not exceed 120°F when 2 percent hydrogen is being burned in the catalyst. The external cooling coil shall be designed as part of the burner but shall be removable as an individual unit and shall be completely accessible from the front of the burner. The cooling coil shall be so arranged that condensation will not drain back into the burner. This performance shall be based on cooling with a maximum of 25 gal/min of 95°F fresh water. Water passages shall be tested for tightness and strength at 225 lb/in^2. The design temperature of the aftercooler shall be 500°F. The cooling water inlet and outlet shall terminate in a 1-inch iron pipe size (ips) nickel-copper alloy stub end. The air from the aftercooler shall discharge directly into the afterfilter chamber. The aftercooler shall be a tube and fin type design with a minimum water tube wall thickness of 0.028 inches.

3.9.9 Afterfilter. An acid clean-up afterfilter shall be provided downstream of the aftercooler. The design shall consist of six equally sized trays removable from the front of the burner. Each tray shall contain granular Li2CO3 in 2-inch depths. The Li2CO3 is obtained by completely carbonating Navy stock lithium hydroxide (LiOH) conforming to MIL-L-20213. The linear velocity through the afterfilter shall not exceed 53 ft/min. Structural members shall be 300 series corrosion-resistant steel. Areas exposed to discharge air shall be polytetrafluoroethylene coated. The air from the afterfilter shall discharge through a 114 square inch (maximum) opening. The temperature of the afterfilter airstream shall be monitored as described in 3.9.13.

3.9.10 Damper. Air flow through the burner shall be controlled by an externally mounted adjustable damper. Material shall be 300 series corrosion-resistant steel.

3.9.11 Mounts. Main mounts shall conform to Drawing 5000-S1112-1385778. The four main mounts shall be type 6E900. The design or actual loading of these mounts shall be less than the nominal rating; i.e., sustained load shall be less than 900 pounds. The temperature of these mounts at the hottest point shall be less than 150°F. This shall be accomplished without the use of water for cooling the mounts.

3.9.12 Air flow measuring system. A pressure gage and necessary pitot tube arrangement shall be provided for the purpose of determining the air flow through the burner. The accuracy of the air flow measuring system shall be within plus or minus 5 percent. The gage shall also be used for determining the pressure drop through the inlet filter, the heat exchanger inlet side, the catalyst bed, the heat exchanger outlet, aftercooler, and afterfilter. An instrument mounting bracket shall be provided at the front of the unit containing the pressure gage and valve manifolding. Panel cut-outs shall be provided as required to facilitate maintenance. Test plugs shall be provided to check the pressure gage calibration. The pressure gage shall be designed to withstand the maximum pressure developed by the blower. Corrosion-resistant steel (300 series) tubing, fittings and valves shall be used. Each valve shall be operated individually.

3.9.13 Temperature monitoring system. An automatic temperature control system shall be provided to indicate the air at the inlet edge and control the temperature of the catalyst bed. Controller shall have the following characteristics:

Ambient temperature operating range:	32°F to 160°F
Set point accuracy:	±0.25 percent full scale
Indicator accuracy:	± 1 percent full scale
Indicator range:	0° F to 800°F

Controller shall automatically control the heaters to maintain the air temperature at 600°F ± 10°F. Temperature indicators shall also be provided to monitor temperatures at the outlet edge of the catalyst bed and in the airstream of the afterfilter chamber. Temperature indicators shall be remote reading types located in the control panel on the front of the burner.

3.9.13.1 Independent high temperature control shall be provided to shutdown the burner on air overtemperature, i.e., 675°F ± 10°F at the inlet of the catalyst bed and 175°F ± 10°F in the afterfilter chamber. Manually operated electrical overrides of the shutdowns shall be provided. Indicating and shutdown sensors shall be of the thermocouple type. Indicating and shutdown sensors utilized in the catalyst bed and afterfilter chamber shall be located in a common sheath in each case. The sensor locations shall be fixed. The control systems shall indicate an excessive temperature of 650°F ± 10°F in the catalyst bed and 160°F ± 10°F in the afterfilter chamber. Red lights shall be provided to indicate these overtemperatures. The sensors and controllers associated with the catalyst bed control

shall be capable of operating continuously at temperatures up to 800°F. The temperature monitoring system shall be repairable without removing any other component.

3.9.14 Bypass system. A manual means of bypassing a portion of the incoming air around the heat exchanger shall be provided to keep the temperature a the catalyst bed from exceeding 650°F when burning hydrogen in any concentration up to 2 percent. The bypass system shall be operable from the front of the burner.

3.9.15 Insulation and gaskets. Hot external surfaces shall be insulated and lagged in accordance with MIL-STD-769 and MIL-I-16411 to reduce the insulation surface temperature to less than 150°F. A full face asbestos gasket, conforming to HH-P-46 shall be used for the catalyst access plate, heater access plate, and aftercooler access plate. Neoprene gaskets in accordance with MIL-G-1149, class 1, may be used in all other areas.

3.9.16 Motor. The electric motor shall conform to design B of MIL-M-17060 and the following:

(a) Type: Squirrel-cage induction.
(b) Voltage: 440 volts, 60 Hz, 3-phase.
(c) Enclosure: Dripproof protected 45 degrees.
(d) Horsepower: As required.
(e) Speed: 3600 r/min synchronous.
(f) Bearings: Ball.
(g) Duty: Continuous.
(h) Service: A.
(i) Ambient: 50°C.
(j) Insulation; class B, F, or H.
(k) Temperatures at rated load shall not exceed class B rises for 50°C ambient.
(l) The motor shall be for submarine service.
(m) Motor balancing rings are required.

3.9.17 Control circuit. The burner control circuit shall consist of a 440/110 volt transformer, relays in accordance with MIL-C-2212, thermoswitches for indication of excessive temperatures of catalyst bed and afterfilter chamber, fuses, automatic shutdown switches, and panel mounted override switches. Motor starting controllers shall conform to MIL-C-2212 and the following:

(a) Duty: Continuous.
(b) Operation: Magnetic, across-the-line.
(c) Protection: Undervoltages (LVP).
(d) Overload: Thermal overload relay.
(e) 440 volts, 3-phase, 60 Hz.
(f) Noise requirements specified in 3.5.
(g) Horsepower rating: As required.

The heaters shall be automatically controlled by a temperature control system to maintain the temperature of the air entering the catalyst bed at 600°F ± 10°F. A manual switch shall be provided so that heaters can be turned off when the blower is running. Overload protection shall be provided for the heaters. On light (amber) and power available light (white) shall be provided.

3.9.18 Electrical components. Electric components shall conform to the requirements of MIL-E-917 in addition to the requirements specified herein. Enclosures shall be dripproof in accordance with MIL-E-2036. Electrical components shall be capable of continuous operation when the compartment ambient temperature is 122°F and the burner is operating under normal conditions. Wiring shall be in accordance with MIL-STD-681. Panel wiring shall have terminal markers at both ends except wires less than 12 inches in length may be marked in the center only. Provision shall be included for grounding of the burner in accordance with MIL-E-917 at a single location.

3.9.19 Control panel. The control panel shall have a dripproof enclosure and shall serve as the enclosure for all electrical components mounted therein. Controllers, relays, transformers, amplifiers, and other similar devices shall be mounted in the control panel. The control panel cover shall be hinged and provided with captive screws. The cover design when open shall facilitate complete access to electrical components mounted within the enclosure. Components such as indicator lights, switches, information and identification plates, fuse receptacles, and similar devices shall be mounted conveniently on the front of the control panel. The cable entrance shall be at the rear of the control panel.

3.9.20 Discrete contact closure. A discrete contact closure shall be provided by an unpowered contact set and shall be used only for the purpose of providing burner operating status to the ship monitoring sub-system. Switch characteristics shall be 50 ohms or less contact resistance in the closed state and 6120 ohms or greater in the open state. Voltages supplied across the contacts of up to 160 volts rms, 60 or 400 Hz or up, to 60 volts direct current (d.c.) shall not damage the contacts when currents between 10 milliamperes (mA) and 100 mA are provided by the specified source voltages are passed through the closed contacts. Also these contacts shall not exhibit closed resistance greater than 50 ohms.

3.10 Identification and information plates. Each burner assembly shall be provided with an identification plate, an information plate, and an airflow range plate. Identification and information plates shall conform to types A, B, C, and D of MIL-P-15024 and MIL-P-15024/5.

3.10.1 Anodized aluminum photographic process. Anodized aluminum plates shall have the photosensitive silver compounds imbedded within the oxide layer. After photographic processing the image shall be sealed in the oxide layer by chemical treatment of the layer. Stamping of additional marking information shall not be permitted.

3.10.2 Identification plate shall contain the following information.

(a) Item name.
(b) Model and size (when applicable).
(c) National stock number.
(d) Component identification number (CID).
(e) Contract number.
(f) Manufacturer's name and address.

3.10.3 Information plate shall contain the following information:

(a) Simplified operating instructions.
(b) Range of air flows and temperatures.
(c) Safety precautions.

3.10.3.1 Information to appear on the information plate and the arrangement of the information shall be submitted to NAVSEC for review with drawings (see 3.12.1).

3.10.4 The air flow range plate shall be tabular (50 ft^3/min increments) or graphic and show the air flow versus the pressure drop for a range of 400 to 750 ft^3/min.

3.11 Repair parts. Repair parts shall be in accordance with method B, paragraph 3.3.2 of MIL-P-15137 (see 6.2). Items which are not normally required for one year's maintenance shall show a quantity of zero as the onboard allowance. To the extent that the contractor furnishes equipment(s) or component(s) identical to an equipment or component previously furnished to the Government for which an allowance parts list exists, then the onbaord repair parts shall be in accordance with the existing allowance parts list.

3.12 Technical data. The contractor shall prepare technical data in accordance with the data ordering documents included in the contract or order (see 6.1.2) for the following, and as specified in 3.12.1 through 3.12.2.5:

(a) Mercury free certification documentation (see 3.3.5).
(b) Reliability prediction (see 3.8.3).
(c) Failure mode and effects analysis (see 3.8.4).
(d) Maintenance engineering analysis (see 3.8.5).
(e) Reliability demonstration plan (see 3.8.6).
(f) Maintainability demonstration plan (see 3.8.7).
(g) Microfilming of engineering documents (see 3.12).
(h) Provisioning parts list, provisioning screening data, and certificate of prior submission (see 3.11).

3.12.1 Drawings. In addition to the drawing content required by the data ordering documents (see 6.1.2) the unique features specified in 3.12.1.1 through 3.12.1.3 shall be included.

3.12.1.1 Type II drawings. Type II drawings shall be so complete as to permit:

(a) Evaluation of performance and quality of the equipment against requirements of this specification.
(b) Evaluation of operational and personnel safety.

(c) Procurement of parts by the supply system.
(d) Installation, operation, maintenance, and repair of the equipment and all components thereof without manufacturer's assistance.

3.12.1.1.1 Assembly drawings. Assembly drawings shall include a sectional assembly with complete list of material, with references to applicable subassembly and detail drawings. The list of material shall include every part required in the assembly, including those parts not required to be detailed. This may necessitate some side or partial views in order to show parts not otherwise shown in the main section view. The list of materials shall include an indication of each part to be furnished as an onboard repair part (this is not a repair parts list). Assembly drawings shall also include performance data or curves, as applicable.

3.12.1.2 Type III drawings. Type III outline and diagram drawings shall be furnished as a supplemental drawing to all type II drawings. Certification data for motors and electrical equipment shall be prepared. Characteristics may be shown in separate tables and shall include information necessary to specifically verify or supplement drawings. Typical information required for certification data is speed, design rating conditions, rating or capacity, horsepower, type of drive, design fluid quantities, heat transfer area, design temperatures and flows, test pressures, and power requirements.

3.12.1.2.1 Dimensional outline drawings. The outline drawings of the assembled equipment shall be complete so that they can be used for installation guidance. Drawings shall show the following:

(a) Attached auxiliaries and foundation and mounting dimensional requirements.
(b) Table of weight of individual components and weight of complete unit.
(c) List of shipbuilder's connections showing size, type, and dimensions including method and sizes of fastenings, dimensions and clearances as required for installation and servicing plus supplementary data as necessary to permit installation without the contractor's assistance.
(d) Radii of gyration of complete net unit about each of the three principal axes.
(e) Vertical center of gravity for each assembly above the lowest extremity of the equipment support.
(f) Latent and sensible heat dissipation.
(g) Special handling procedures, as required.

3.12.1.2.2 Diagram drawings. The diagram drawings shall include a tabulation diagram, electrical schematic and electrical connection diagrams with certification data. Each diagram shall show by symbolic representation piping, fittings, valves, and wiring, as applicable. Valves, components accessories, controls and associated instruments shall be given a piece number and be identifiable with the certification data. Piece numbers shall be shown in a consecutive order around each diagram where practical.

3.12.1.3 Prints of drawings and detailed parts. Prints of drawings and detailed parts shall be submitted to NAVSEC for review prior to manufacture of equipment. Two copies of the drawings bound in 8-1/2 by 11 inch foldout sets shall be forwarded to NAVSEC with the final drawings.

3.12.2 Manuals. In addition to the general requirements covered by the data ordering documents (see 6.1.2), the unique features specified in 3.12.2.1 through 3.12.2.5 shall be included.

3.12.2.1 Technical manuals shall be submitted to NAVSEC for review. As a minimum, the manual shall include onboard repair procedures for component replacement for the following subassemblies: blower/motor, temperature control system, and heater assembly. The manual shall also include internal cleaning procedures for the aftercooler and heat exchanger, calibration, grounding and insulation repair procedures, component normal pressure drop ranges and electrical wiring diagrams.

3.12.2.2 Troubleshooting procedures shall be prepared and documented by level of maintenance: organizational, intermediate, and depot. They shall include a listing of the support and test equipment required to accomplish each set of procedures along with the estimated man-hours for accomplishment.

3.12.2.3 Section I of "Adjustments and Alignment" and Section II on "Repair" procedures shall be prepared and documented by level of repair: organizational, intermediate, and depot. They shall also include a listing of the support and test equipment required to accomplish each operation, the personnel requirements, and the estimated man-hours for accomplishment.

3.12.2.4 The parts list shall designate parts as either repairable or throwaway and indicate the recommended level for such action.

3.12.2.5 The detailed "Scheduled Maintenance" procedures for the organizational level of maintenance shall be recorded on maintenance requirement cards and additional information on maintenance index pages. Scheduled maintenance procedures for the intermediate and depot level of maintenance shall be delineated in the manual in corresponding detail, and the same format.

3.13 Workmanship. Welds shall be free of burrs and there shall be no excessive warpage in the final assemblies. Flange faces shall be within plus or minus 1/64-inch co-planarity, clean, smooth, and free of pits, burrs, and other defects. Sharp edges shall be rounded. Bolt holes shall be alined within plus or minus 1/32-inch. Bolt holes shall be no more than 1/32-inch oversized.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Inspection system. The contractor shall provide and maintain an inspection system in accordance with the data ordering document included in the contract or order (see 6.1.2).

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

(a) First unit tests (see 4.3).
(b) Production tests (see 4.4).

4.3 First unit tests. The first unit on each contract or order shall be subjected to the examination specified in 4.5 and the tests specified in 4.6.1 through 4.6.8.5.

4.4 Production tests. Production examination and tests shall be performed on each unit as follows:

(a) Examination (see 4.5).
(b) Airborne noise (see 4.6.1).
(c) Structureborne noise (see 4.6.2).
(d) Burning efficiency (see 4.6.7.1).
(e) Catalyst bed temperature (see 4.6.7.2).
(f) Afterfilter temperature (see 4.6.7.3).
(g) Resilient mount temperature (see 4.6.7.4).
(h) Surface and control box temperature (see 4.6.7.5).
(i) Excessive temperature shutdown (see 4.6.7.6).
(j) Burner warmup and cooldown (see 4.6.7.7).
(k) Burner assembly (see 4.6.8.2).
(l) Differential pressure manifold (see 4.6.8.3).
(m) Aftercooler (see 4.6.8.4).

4.5 Examination. Each burner shall be examined to determine conformance to the requirements of this specification for finish, dimensions, workmanship and all other requirements not involving tests.

4.6 Tests.

4.6.1 Airborne noise. Before and after the shock and vibration tests, the burner shall be tested for airborne noise as specified in MIL-STD-740.

4.6.2 Structureborne noise. Before the shock and vibration tests, the burner shall be subjected to the structureborne noise tests specified in MIL-STD-740. After the shock and vibration tests and correction of defects, the structureborne noise tests shall be repeated and shall meet the criteria shown on figure 2.

4.6.3 Shock. The burner shall be subjected to a high impact shock test to determine conformance to the requirements specified in 3.6. If the results of the shock test require any major changes in design, the test shall be repeated. The contractor shall completely disassemble the burner down to the component level after the shock test. All defects shall be corrected prior to final acceptance of the burner.

4.6.4 Vibration. The burner shall be vibration tested to determine conformance to the requirements specified in 3.7. The burner shall be installed for the test without the use of mounts.

4.6.5 Reliability demonstration test. The contractor shall conduct an endurance test on the first unit as specified in 4.6.5.1 and 4.6.5.2.

4.6.5.1 If not already accomplished on a previously supplied unit, the contractor shall conduct a 2000 hour endurance test on the first unit. The unit shall experience no failures in accumulating the 2000 hours of test time. Any shutdown of the unit excluding those caused by (a) equipment external to the contract unit, or (b) the 675°F temperature control device, when the unit is burning hydrogen and the temperature is within plus or minus 10°F of the set point, or (c) scheduled shutdowns to accommodate normal working hours, shall be cause to stop the test and reject the test unit. Prior to any retest, the contractor shall determine the cause of failure and correct the deficiency. The corrective action shall be reviewed by NAVSEC. Any additional retesting above the required 2000 hours will be determined by NAVSEC, but in no case shall the retest exceed 700 hours. The tests, or portion thereof, specified in 4.6.7 may be run concurrently with the endurance test. The test shall be conducted using atmosphere air at ambient conditions except if tests as specified in 4.6.7 are conducted concurrently. Performance tests (see 4.6.7) shall be met throughout the test period.

4.6.5.2 If the 2000 hour test has already been accomplished on a unit previously furnished, the contractor shall conduct a 250 hour test on the first unit. The 250 hour test shall be conducted as specified in 4.6.5.1 except 250 hour test and 500 hour retest times apply.

4.6.6 Maintainability demonstration test. A maintainability demonstration test shall be conducted for which the maximum repair time for any repair action shall not exceed 10 man-hours and the MTTR (man-hours) shall not exceed the specified MTTR (man-hours) of 4.0 man-hours. The maintainability test shall be performed within the area constraints specified in 3.3.10.1. Proposed maintenance tasks shall be included as part of the maintainability demonstration test plan. Actual task selection shall be made by the procuring activity at the time of the test. As a minimum, maintenance task times shall be demonstrated and recorded for the following burner components:

(a) Catalyst bed.
(b) Blower/motor assembly.
(c) Heater assembly.
(d) Aftercooler.
(e) Afterfilter.
(f) Heat exchanger.
(g) Temperature controllers.

4.6.7 Performance.

4.6.7.1 Burning efficiency. After the shock test, the burner shall be tested to determine its efficiency for removal of carbon monoxide and hydrogen. The burner shall be operated for the time periods and gas combinations specified in table III. The efficiencies described in table I (see 3.1) shall be demonstrated.

Table III - Burning efficiency.

Gas burned	Inlet concentration	Duration (hours)
Hydrogen	0.50 percent	1
	1.00 percent	1
	1.50 percent	1
	1.80 percent	1
Carbon monoxide	50 p/m	2
	100 p/m	2
Hydrogen and carbon monoxide	1.80 percent Hz 100 p/m CO	4

This test shall be conducted at a room temperature of 70°F ± 5°F and 45 to 55 percent relative humidity. During each test phase, the mechanical, thermal, and electrical operating parameters of the burner, as well as inlet and outlet gas concentrations shall be recorded.

4.6.7.2 Catalyst bed temperature. The uniformity of temperature across the face of the catalyst bed shall be demonstrated to be 600°F ± 25°F. A minimum of 24 equally spaced thermocouples located at the inlet screen in a single horizontal plane shall be utilized to measure these temperatures. A 24-point temperature profile at the outlet face of the catalyst bed shall be recorded to determine a representative outlet temperature monitoring location. Data shall be recorded each hour for 8 hours.

4.6.7.3 Afterfilter temperature. Temperatures in the afterfilter chamber shall be recorded and demonstrated to be below 175°F. Burner shall be operated for 4 hours at normal operating conditions of 600°F ± 10°F and 650 ft^3/min at a room temperature of 100°F during this test with cooling water secured.

4.6.7.4 Resilient mount temperature. After the burner has operated for 4 hours at a temperature of 600°F, temperature of resilient mounts shall be measured. The temperature of the rubber portions of the mounts shall not exceed 150°F.

4.6.7.5 Surface and control box temperature. Temperatures shall be recorded on external surfaces of the burner, including the inside of the control box after 4 hours of normal burner operation at 600°F. Temperatures in the control box shall not exceed 150°F. Burner surfaces exposed to operator contact shall not exceed 150°F.

4.6.7.6 Excessive temperature shutdown. Operation of the excessive temperature lights and shutdown functions shall be demonstrated. Warning lights shall turn on at 160°F ± 10°F and 650°F ± 10°F respectively for the afterfilter and catalyst bed areas. Shutdowns shall occur at 175°F ± 10°F and 675°F ± 10°F respectively for the afterfilter and catalyst bed areas. The catalyst bed shutdown test shall be performed by admitting hydrogen at increasing inlet concentrations without bypass operation. The afterfilter test shall be performed by securing cooling water flow.

4.6.7.7 Burner warmup and cooldown. Burner warmup time from switch-on to 600°F stabilization shall be measured and recorded. Burner cooldown time from heater switch-off to 150°F shall be measured and recorded.

4.6.7.8 Airflow calibration. The pitot flow meter shall be calibrated at room temperature over a flow range of 400 to 750 ft^3/min in increments of 50 ft^3/min.

4.6.7.9 Weight, center of gravity, and mount deflections. The complete burner assembly weight and center of gravity shall be measured and recorded. Individual weights of the aftercooler, heat exchanger, catalyst drawer, heater assembly, afterfilter drawers, blower and motor shall be measured and recorded. Mount deflections shall be measured by measuring the unloaded mount height and loaded mount heights.

4.6.8 Pressure tests.

4.6.8.1 Heat exchanger. The heat exchanger shall be pressure tested to determine conformance to the requirements specified in 3.9.3.

4.6.8.2 Burner assembly. The completed burner assembly, less blower and inlet filter assembly, shall be pneumatically pressure tested at 28 inches water gage for 1/2 hour, residual pressure shall be above 8 inches of water.

4.6.8.3 Differential pressure manifold. Each side of the differential pressure manifold shall be pressurized to 14 inches water gage with air with all valves in the off position. The unit shall be bubble-tight under water.

4.6.8.4 Aftercooler. The aftercooler shall be hydrostatically pressure tested at 225 lb/in^2. No leakage shall be allowed.

4.6.8.5 Post shock and vibration examination. The catalyst drawer, afterfilter drawers, aftercooler, and heater assembly shall be removed from the burner after completion of the shock and vibration tests and examined for damage. Additionally, the heat exchanger, the internal and external features of the burner and component parts shall be examined, in place for damage. Further disassembly shall be performed, as required, to fully assess any

damage incurred. Component redesign shall be effected to correct any significant problems. The record of examination and corrective action shall be included in the test data record.

4.7 Failure data collection, analysis, and corrective action. Provisions shall be made by the contractor for complete reporting of every malfunction, test failure, or performance degradation, its diagnosis and any proposed corrective action for all the tests specified in 4.6.

4.8 Rejection. Breakage, deformation, or failure to meet the requirements of this specification when examined and tested shall be cause for rejection.

4.9 Test procedures and reports. The contractor shall prepare test procedures and reports in accordance with the data ordering documents included in the contract or order (see 6.1.2) for the following, and as specified in 4.9.1 and 4.9.2:

(a) Airborne and structureborne noise (see 4.6.1 and 4.6.2).
(b) Shock (see 4.6.3).
(c) Vibration (see 4.6.4).
(d) Maintainability demonstration report (see 4.6.6).
(e) Factory acceptance (see 4.6.7).
(f) Failure/malfunction (see 4.7).

4.9.1 Prior to testing, two copies of a test procedure manual delineating the methods, instruments, and procedures used to accomplish the tests specified herein shall be furnished to NAVSEC for review. The manual shall also contain forms to indicate how the results of tests will be recorded. The results shall be recorded in an orderly manner to facilitate an engineering evaluation. The form for reporting noise tests shall be the chart from the graphic recorder. The acceptance of this manual does not relieve the contractor of his responsibility to perform accurate tests. Performance test report shall be submitted to NAVSEC separate from all other test reports.

4.9.2 Within two weeks after completion of the examination and tests of each burner on the contract or order, two copies of the measured and calculated data and the results of tests on the burner shall be furnished to NAVSEC. Within two weeks after completion of noise tests on each burner, copies of a manual containing the noise test procedures and a chart from the graphic recorder showing the noise test results shall be furnished.

4.10 Inspection of preparation for delivery. The preservation-packaging, packing, and marking shall be inspected for compliance with section 5 of this document.

5. PREPARATION FOR DELIVERY

(The preparation for delivery requirements specified herein apply only for direct Government procurements. For the extent of applicability of the preparation for delivery requirements of referenced documents listed in section 2, see 6.3.)

5.1 General requirements.

5.1.1 Technical data. Technical data depicting the preservation-packaging, packing, and marking; packaging and transportation data; and report(s) of the preservation-packaging, and packing tests shall be prepared by the contractor and submitted to the procuring activity.

5.1.2 Previous submittal. Data submitted under 5.1.1 herein for evaluation on previously procured identical equipment and parts is not required.

5.1.3 First unit sample. When specified (see 6.1.1), prior to beginning package production, a first unit pack of the equipment and its shipping container(s) shall be tested as specified in MIL-E-17555.

5.1.3.1 Dummy load. When a dummy load is substituted for the item(s) in preforming the rough handling test(s), instrumentation of the item is required. The details of instrumentation, location of accelerometers, shall be furnished as part of the required test report specified in 5.1.1 herein.

5.2 Preservation-packaging. Preservation-packaging shall be level A or C, as specified (see 6.1.1).

5.2.1 Level A. Each burner assembly shall be preserved-packaged in accordance with MIL-E-17555, method IIA and as follows:

(a) Openings into the burner shall not be capped, sealed, or plugged to assure effective action of the desiccant.
(b) Desiccant shall not be placed in any interior spaces of the burner. The desiccant shall be distributed within the barrier and shall be secured by taping or tying or otherwise secured to prevent movement, rupture of the desiccant bags, or damage to the barrier.
(c) The method of mounting the burner within the container shall insure the integrity of the requirements of MIL-STD-740.

5.2.2 Level C. Each burner assembly shall be preserved-packaged to afford protection against corrosion, deterioration, and physical damage during shipment from the supply source to the first receiving activity for immediate use. Caution shall be exercised to insure the integrity of the requirements cited in 5.2.1(c). The contractor's normal retail preservation-packaging methods may be utilized when such meets the requirements of this level.

5.3 Packing. Each burner, preserved-packaged as specified in 5.1, shall be packed level A, B, or C, as specified (see 6.1.1), and marked in accordance with MIL-E-17555. For levels A and B, the shipping container shall conform to MIL-C-104, type II, class 1 or 2, style optional.

5.4 Repair parts. Repair parts shall be preserved-packaged, packed, and marked in accordance with the levels of MIL-E-17555 as applicable for the intended use and destination as follows:

	Levels	
Destination	Preservation-packaging	Packing
Onboard (accompanying equipment)	A	C
Stock	A	B
Immediate use	C	C

5.4.1 Semi-conductors or solid state devices. Semi-conductors such as diodes, transistors, integrated circuits, as well as circuit boards or chassis in which they are incorporated, shall be individually packaged in a barrier bag conforming to class E, style 1, type I or II, or class F, style 1, type I of MIL-B-117. MIL-B-117 bag material shall employ aluminum foil as a laminate of the bag barrier material. Bag closure shall be effected by heat sealing. Leads and terminals shall be protected from damage by means of the container (carrier) design, die cut inserts, or by the use of noncorrosive cushioning material. Leads and other projecting parts may be used for positioning, but shall not be subjected to loads or other stresses such as bending or twisting that can damage the entry seals. For level C preservation-packing, semi-conductors or solid state devices subject to electromagnetic degradation shall be protected with a wrap of aluminum foil or a barrier bag employing aluminum foil as a laminate of the bag material. Leads and terminals shall be protected as specified herein. For level C preservation-packaging, semiconductors or solid state devices subject to electromagnetic degradation shall be protected with a wrap of aluminum foil or a barrier bag employing aluminum foil as a laminate of the bag material. Leads and terminals shall be protected as specified herein. Wraps and bags shall be closed by heat sealing.

5.5 Technical manuals. Technical manuals, which accompany shipments that are packed level A or B, shall be packaged in a transparent waterproof plastic bag, minimum 4 mil thick. Closure shall be by heat sealing. Technical manuals shall not be placed within any flexible sealed barrier enclosing components. The copy(s) of the manual shall be placed in the shipping container housing the main unit. Packing lists shall indicate which container contains the technical manual(s) and shall also state the approximate location therein. For ease of removability the location of the manual shall be such that it is readily accessible when the container is opened. Technical manuals, when shipped in bulk quantities, shall not be individually wrapped, but shall be packed in accordance with the requirements of the applicable technical manual specification or packed in containers conforming to the requirements for level A, B, or C, as specified (see 6.1.1). In addition, the shipping container housing the manual shall be marked "MANUALS ENCLOSED".

5.6 Data. Drawings, microfilm, miscellaneous reports, etc., to be forwarded to the procuring activity in compliance with the requirements of this specification shall be

packaged and packed level C in accordance with the applicable data specification, or where no preparation for delivery requirements exist, data shall be prepared in accordance with the level C requirements of MIL-E-17555.

6. NOTES

6.1 Ordering data.

6.1.1 Procurement requirements. Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Quantity of burners required.
(c) Location of service connections, if other than as specified (see 3.3.4).
(d) First unit packing test (see 5.1.3).
(e) Level of preservation-packaging and packing required (see 5.2 and 5.3).
(f) Marking required (see 5.3).
(g) Level of packing of manuals required (see 5.5).

6.1.2 Data requirements. When this specification is used in a procurement which invokes the provision of the "Requirements for Data" of the Armed Services Procurement Regulations (ASPR), the data identified below, which are required to be developed by the contractor, as specified on an approved Data Item Description (DD Form 1664), and which are required to be delivered to the Government, should be selected and specified on the approved Contract Data Requirements List (DD Form 1423) and incorporated in the contract. When the provisions of the "Requirements for Data" of the ASPR are not invoked in a procurement, the data required to be developed by the contractor and required to be delivered to the Government should be selected from the list below and specified in the contract.

Paragraph	Data requirements	Applicable DID	Options
3.12	Certification data/report	UDI-A-23264	----------
3.12	Reliability prediction	DI-R-2117	----------
3.12	Failure mode and effects analysis	DI-R-2115	----------
3.12	Maintenance engineering analysis report	UDI-L-26377	----------
3.12	Reliability demonstration plan	DI-R-2124	----------
3.12	Maintainability demonstration plan	DI-R-2129	----------
3.12	Microfilming of engineering documents	UDI-E-23140	----------
3.12	Provisioning parts list	DI-V-2078	Option 4, method B
3.12	Provisioning and other preprocurement screening data	UDI-V-23828	----------
3.12	Certificate of prior submission	DI-V-2075	----------
3.12.1	Drawings, engineering and associated lists	UDI-E-23174	Categories A, B, C, E, G, H, and I, form 2, types II and III
3.12.2	Manual, technical, preliminary	DI-M-2043	Type I of MIL-M-15071
3.12.2	Manual, technical, standard, basic issue	DI-M-2044	Type I of MIL-M-15071
3.12.2	Technical manual quality assurance data	DI-M-2051	----------
4.1.1	Inspection system program plan	DI-R-4803	----------
4.9	Noise test reports	UDI-T-23764	----------
4.9	Equipment shock test reports	UDI-T-23753	----------
4.9	Vibration testing report	UDI-T-23762	----------
4.9	Maintainability demonstration report	UDI-T-23565	----------

Paragraph	Data requirements	Applicable DID	Options
4.9	Factory acceptance test procedures	UDI-T-23982	----------
4.9	Failure/malfunction report	UDI-T-23724	----------
4.9.1	Test procedures	UDI-T-23649	----------
5.1.1	Drawing, preservation-packaging, packing and marking	UDI-E-23123	----------
5.1.1	Report, preservation-packaging and packing test	UDI-T-23766	----------
5.1.1	Packaging and transportation data	UDI-P-23508	----------

(Copies of data item descriptions required by the contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

6.1.2.1 The data requirements of 6.1.2 and any task in section 3, 4, or 5 of the specification required to be performed to meet a data requirement may be waived by the procuring/purchasing activity upon certification by the offeror that identical data were submitted by the offeror and accepted by the Government under a previous contract for identical item procured to this specfication. This does not apply to specific data which may be required for each procurement regardless of whether an identical item has been supplied previously (for example, test reports).

6.2 Management control system documents. The following management control system document should be included on DD Form 1660:

(a) MIL-P-15137 (see 3.11).

6.3 Sub-contracted material and parts. The preparation for delivery requirements of referenced documents listed in section 2 do not apply when material and parts are procured by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

Preparing activity:
Navy - SH
(Project 4460-N023)

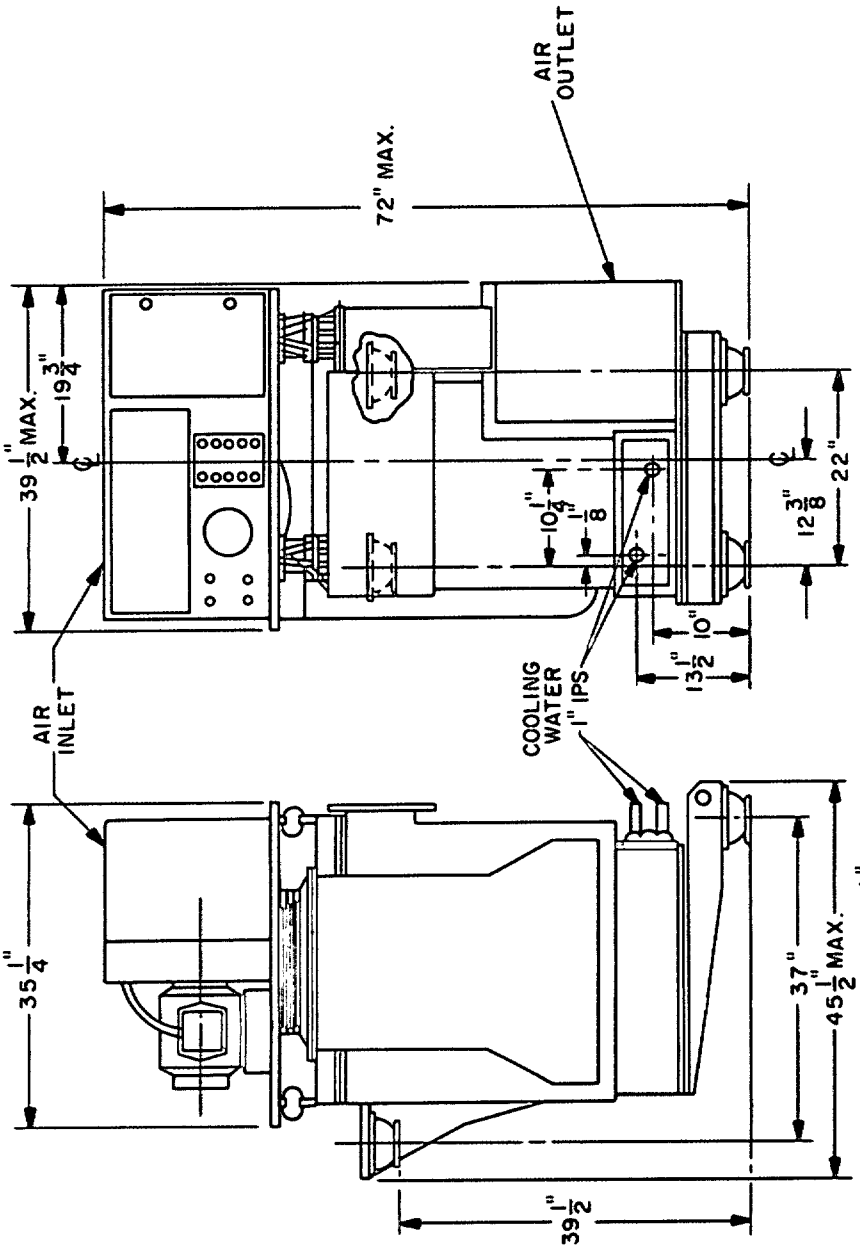

Figure 1 - Weight, overall dimensions and mount location.

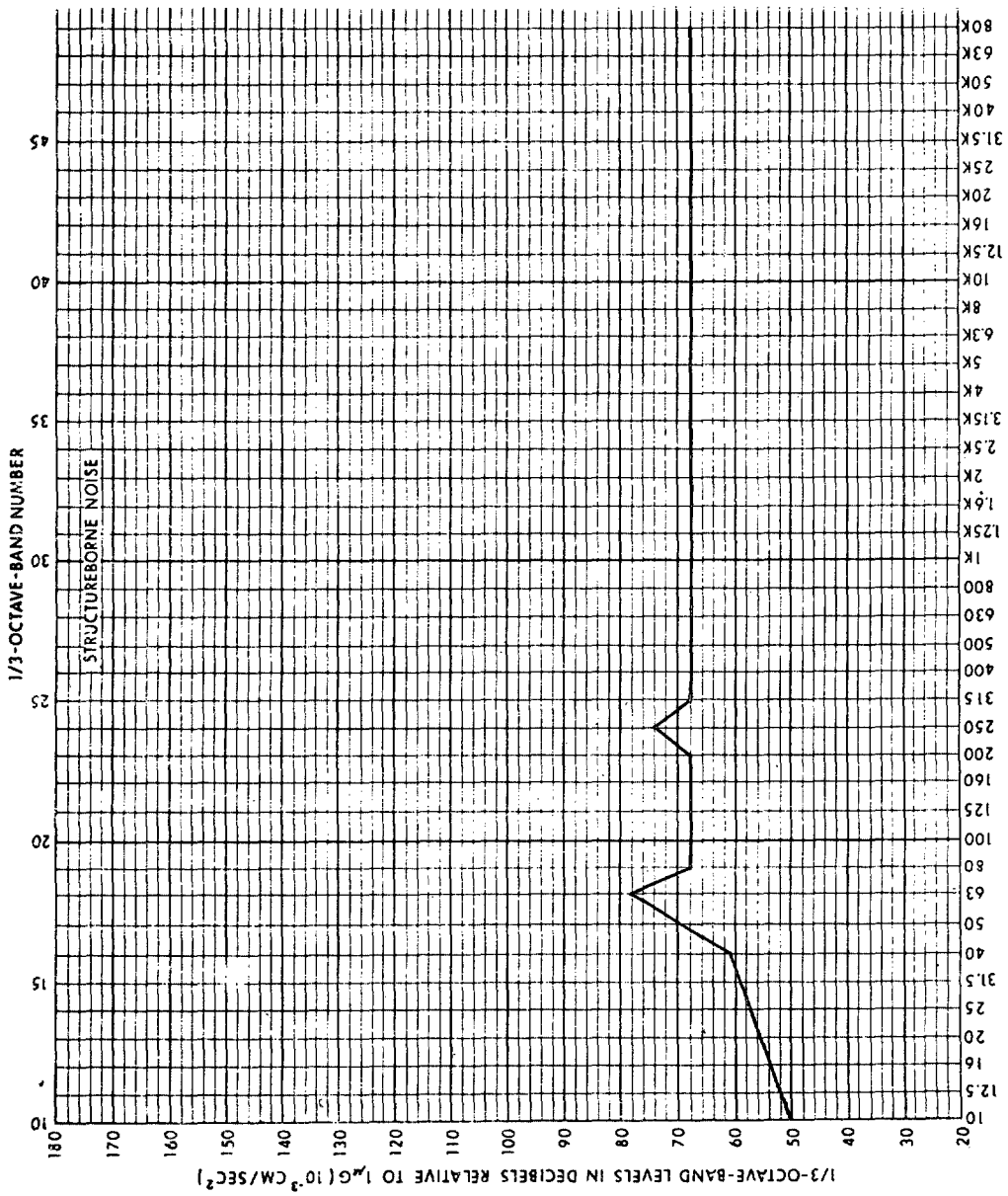

Figure 2 - Structureborne acceptance criteria.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

OMB Approval
No. 22-R255

INSTRUCTIONS: The purpose of this form is to solicit beneficial comments which will help achieve procurement of suitable products at reasonable cost and minimum delay, or will otherwise enhance use of the document. DoD contractors, government activities, or manufacturers/ vendors who are prospective suppliers of the product are invited to submit comments to the government. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements. Attach any pertinent data which may be of use in improving this document. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.

DOCUMENT IDENTIFIER AND TITLE

NAME OF ORGANIZATION AND ADDRESS

CONTRACT NUMBER

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY DOCUMENT REQUIREMENT CONSIDERED TOO RIGID

3. IS THE DOCUMENT RESTRICTIVE?

☐ YES ☐ NO *(If "Yes", in what way?)*

4. REMARKS

SUBMITTED BY *(Printed or typed name and address - Optional)*

TELEPHONE NO.

DATE

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REPLACES EDITION OF 1 JAN 66 WHICH MAY BE USED

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