

MIL-B-29511(EC)
26 January 1988

MILITARY SPECIFICATION

BUOY INTERFACE UNIT (BIU), J-3958/BRT-6

This specification is approved for use by the Space and Naval Warfare 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 the performance, manufacture, and test requirements for the Buoy Interface Unit, J-3958/BRT-6, hereinafter referred to as the BIU, and the Remote Indicator Cable Assemblies for Channel 1, CX-13319/BRT-6 and Channel 2, CX-13321/BRT-6, hereinafter referred to as the Remote Indicator Kit. The BIU and the Remote Indicator Kit are part of the Buoy Transmitting Set, AN/BRT-6.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbook form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Space and Naval Warfare Systems Command (SPAWAR 003-121), Washington, DC 20363-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

AMSC N/A

FSC 5820

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SPECIFICATIONS

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MIL-S-901	Shock Tests, H.I. (High-Impact); Shipboard Machinery, Equipment And Systems, Requirements For
MIL-P-13949	Plastic Sheet, Laminated, Metal Clad (For Printed Wiring Boards), General Specification For
MIL-E-16400G	Electronic, Interior Communication And Navigation Equipment, Naval Ship And Shore: General Specification For
MIL-E-17555	Electronic And Electrical Equipment, Accessories, And Provisioned Items (Repair Parts): Packaging And Packing Of
MIL-F-18264	Finishes: Organic, Weapons System, Application And Control Of
MIL-S-19500	Semiconductor Devices, General Specification For
MIL-C-21097	Connectors, Electrical, Printed Wiring Board, General Purpose, General Specification For
MIL-C-24643/45	Cable Electrical, 300 Volts, Type LS2U (Including Variation LS2UA)
MIL-C-28840	Connectors, Electrical, Circular Threaded, High Shock, High Density, Shipboard, Class D, General Specification For
MIL-B-29513	Buoy, Radio Transmitter, T-1455/BRT-6
MIL-M-38510	Microcircuits, General Specification For
MIL-P-55110	Printed Wiring Boards, General Specification For

STANDARDS

MILITARY

MIL-STD-105	Sampling Procedures And Tables For Inspection By Attributes
MIL-STD-108	Definitions Of And Basic Requirements For Enclosures For Electric And Electronic Equipment
MIL-STD-109	Quality Assurance Terms And Definitions
MIL-STD-167-1	Mechanical Vibrations Of Shipboard Equipment (Type I - Environmental And Type II - Internally Excited)

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MIL-STD-188-114	Electrical Characteristics Of Digital Interface Circuits
MIL-STD-275	Printed Wiring For Electronic Equipment
MIL-STD-454	Standard General Requirements For Electronic Equipment
DoD MIL-STD-461	Electromagnetic Emission And Susceptibility Requirements For The Control Of Electromagnetic Interference
MIL-STD-462	Electromagnetic Interference Characteristics, Measurement Of
MIL-STD-471	Maintainability Verification/ Demonstration/Evaluation
MIL-STD-781	Reliability Testing For Engineering Development, Qualification, And Production
MIL-STD-810	Environmental Test Methods And Engineering Guidelines
MIL-STD-965	Parts Control Program
DoD-STD-1399, Section 300	Interface Standard For Shipboard Systems, Electric Power, Alternating Current (Metric)
MIL-STD-1472	Human Engineering Design Criteria For Military Systems, Equipment And Facilities
MIL-STD-1683	Connectors And Jacketed Cable, Electric, Selection Standard For Shipboard Use
DoD-STD-1686	Electrostatic Discharge Control Program For Protection Of Electrical And Electronic Parts, Assemblies And Equipment (Excluding Electrically Initiated Explosive Devices) (Metric)
MIL-STD-2164	Environmental Stress Screening Process For Electronic Equipment
MS-27505	Connector, Receptacle, Electrical, Back Panel, Box Mounting Flange, Crimp Type, Bayonet Coupling, Series 1

HANDBOOKS

MILITARY

DoD-HDBK-263	Electrostatic Discharge Control Handbook For Protection Of Electrical And Electronic Parts, Assemblies And Equipment (Excluding Electrically Initiated Explosive Devices) (Metric)
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2.1.2 Government drawings and publications. The following Government drawing and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

DRAWING

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

F53711-409-6379608 Remote Indicator And Interconnecting Cables

PUBLICATIONS

NAVAL AIR SYSTEMS COMMAND (NAVAIR)

AS-4613 Application And Derating Requirements For Electronic Components, General Specification For

NAVAL UNDERWATER SYSTEMS CENTER (NUSC)

TM 851105 Technical Interface Specification For The UHF SATCOM Buoy

(Application for copies should be addressed to the Naval Underwater Systems Center, New London Laboratory, New London, CT 06320.)

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

2.2 Other publications. The following document forms a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the nongovernment documents which is current of the date of the solicitation.

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA RS-310-C-77 Racks, Panels, And Associated Equipment

(Application for copies should be addressed to Electronic Industries Association, 2001 Eye Street, NW, Washington, DC 20006.)

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(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets, or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations, unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 General. The BIU and Remote Indicator Kit shall be in accordance with MIL-E-16400G, to the extent specified herein.

3.1.1 First article. When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.3 and 6.3).

3.1.2 BIU description. The BIU is part of the Buoy Transmitting Set, AN/BRT-6 (see FIGURE 1). The BIU selectively interfaces two Radio Transmitter Buoys, T-1455/BRT-6 (buoys) specified in MIL-B-29513, to the Submarine Satellite Information Exchange System (SSIXS). The BIU monitors the status of the buoy during charging, controls parts of the message loading process, maintains a charge on the buoy during message processing, and contains a system test and fault isolation capability.

3.1.3 Remote Indicator Kit description. The Remote Indicator Kit consists of two cable assemblies which provide the electrical interconnections between the BIU and two buoys and provides an indicator which illuminates when the selected buoy is energized.

3.2 Performance. BIU performance shall be as specified in 3.2.1 through 3.2.7.

3.2.1 Prime power. Prime power shall be 115 volts alternating current (VAC), 60 hertz (Hz), single-phase, Type I, in accordance with DoD-STD-1399, Section 300. The power shall be connected via J1 as shown in FIGURE 2. Total current draw shall not exceed 3 amperes alternating current (AC). Input lines shall be fused at the load side of the power switch as shown in FIGURE 2. Spare fuses shall be located within the BIU.

3.2.2 Signal conversion. The BIU shall provide signal level shifting functions to accommodate the transfer of signals in accordance with NUSC TM 851105 between BIU inputs and outputs as specified in 3.2.2.1 and 3.2.2.2.

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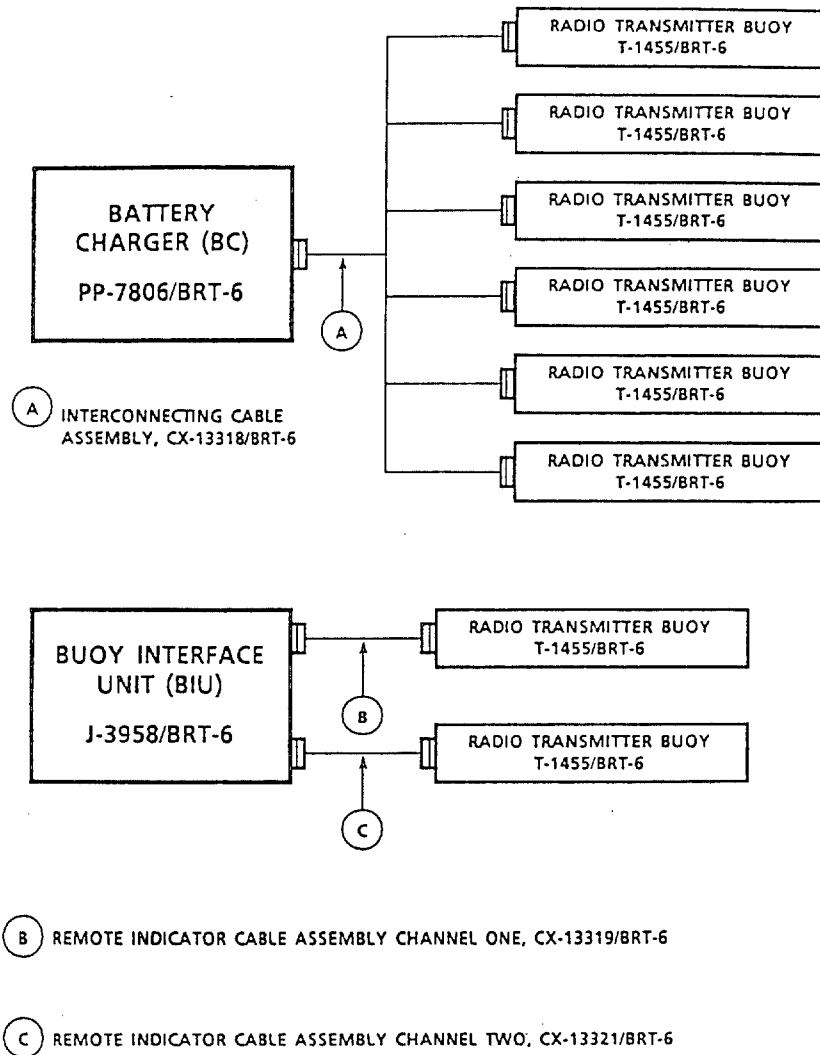


FIGURE 1. AN/BRT-6 buoy transmitting set block diagram.

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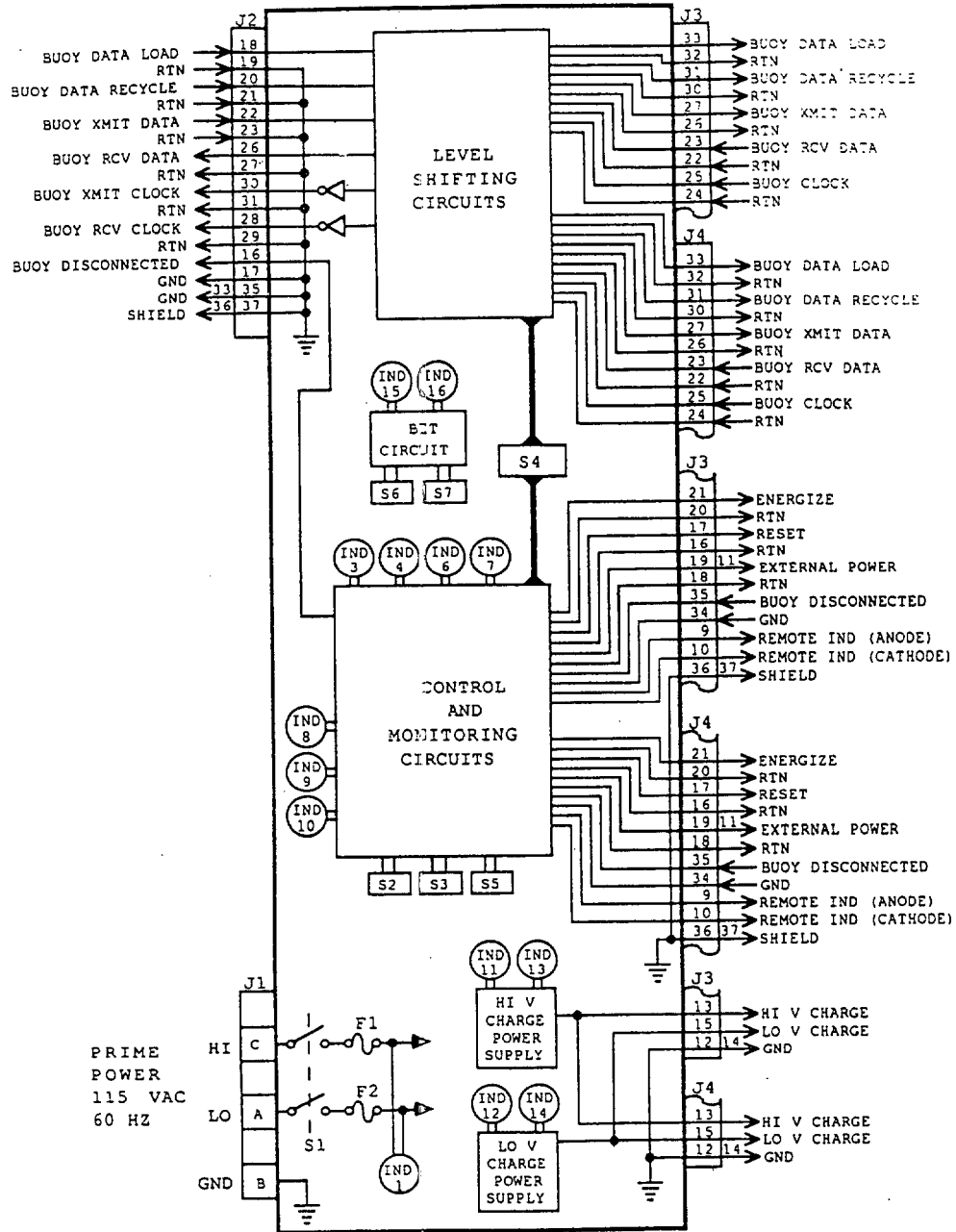


FIGURE 2. BIU.

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3.2.2.1 Signal types. Balanced and unbalanced signals shall conform to the requirements of MIL-STD-188-114 (inverted) low level. Five-volt (V) complementary metal oxide semiconductor (CMOS) signals shall conform to the requirements specified in a and b:

- a. Inputs: Binary 0, 0 volts direct current (VDC) to 1.5 VDC
Binary 1, 3.5 VDC to 5 VDC
Input impedance, 100,000 \pm 10,000 ohms
- b. Outputs: Binary 0, 0 VDC to 0.01 VDC open circuit
Binary 1, 4.50 VDC to 5.50 VDC open circuit
Load, 100,000 \pm 10,000 ohms
Output impedance, \leq 3000 ohms

3.2.2.2 Level shifting. The BIU shall shift unbalanced input signals via J2 to balanced signals (for remote buoys) and 5-V CMOS signals (for local buoys) for output via J3 and J4, as shown in FIGURE 2. The BIU shall shift 5-V CMOS and balanced input signals via J3 and J4 to unbalanced signals for output via J2, as shown in FIGURE 2. A means of selecting between balanced and 5-V CMOS signals shall be provided.

3.2.3 Charge outputs. The BIU shall provide four charging outputs consisting of one high (HI) voltage output and one low (LO) voltage output for each of two buoys in accordance with FIGURE 2. The HI voltage charging output shall be 65 VDC \pm 10 V open-circuit voltage and shall be a constant current source of 50 milliamperes (mA) \pm 5 mA. The LO voltage charging output shall be 30 VDC \pm 7 V open-circuit voltage and shall be a constant current source of 150 mA \pm 15 mA.

3.2.4 External buoy power. The BIU shall provide an output of +7.5 \pm 0.5 VDC at up to 275 mA for each buoy (EXTERNAL POWER outputs in FIGURE 2).

3.2.5 Controls and indicators. The BIU shall have controls and indicators as specified in 3.2.5.1 through 3.2.5.7.

3.2.5.1 Buoy select. S4 shall be a two-position switch located on the front panel and shall be labeled BUOY SELECT. The two positions shall be labeled BUOY 1 and BUOY 2. S4 shall be used to select which buoy (connector J3 or J4) transceives data and control signals.

3.2.5.2 Power. S1 shall be a two-position switch located on the front panel and shall be labeled with ON, OFF designations. IND 1 shall be located on the front panel and shall be labeled PWR. IND 1 shall illuminate when S1 is in the ON position. The AC input fuses F1 and F2 shall be located on the front panel, shall be labeled with their corresponding values and shall have blown fuse indicators.

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3.2.5.3 Charge indicators. IND 11 and IND 12 shall be located on the front panel and shall be labeled 28 VDC and 5 VDC, respectively. IND 11 and IND 12 shall illuminate when the BIU is charging respective HI and LO charge lines for BUOY 1. IND 13 and IND 14 shall be located on the front panel and shall be labeled 28 VDC and 5 VDC, respectively. IND 13 and IND 14 shall illuminate when the BIU is charging respective HI and LO charge lines for BUOY 2.

3.2.5.4 Buoy disconnected. IND 3 and IND 6 shall be located on the front panel and shall be labeled DISCONNECTED. IND 3 shall illuminate when BUOY 1 is not connected to the BIU (input J3-35 in FIGURE 2 not grounded). IND 6 shall illuminate when BUOY 2 is not connected to the BIU (input J4-35 in FIGURE 2 not grounded). The BUOY DISCONNECTED output via J2 shall conform to MIL-STD-188-114 (inverted) low level, unbalanced, and shall be HI when the buoy selected by S4 is connected and LO when it is disconnected.

3.2.5.5 Buoy energize. S2 shall be a momentary pushbutton switch located on the front panel and shall be labeled ENERGIZE. Depressing S2 shall provide a 5-V CMOS binary 1 signal to the buoy selected by S4 (ENERGIZE output in FIGURE 2) only when the ENERGIZE ENABLE condition is TRUE (see TABLE I) for the selected buoy. S5 shall be a momentary pushbutton switch located behind the BIU front panel and shall be labeled EMERGENCY ENERGIZE OVERRIDE. Depressing S5 shall provide a 5-V CMOS binary 1 signal to the selected buoy (ENERGIZE output in FIGURE 2) regardless of the ENERGIZE ENABLE condition.

TABLE I. Energize enable.

Conditions which set energize enable true	Conditions which set energize enable false
1. Positive transition of the recycle (input J2-20)	1. Load signal HI (input J2-18) 2. Power interruption of the BIU 3. Depressing reset (S3) 4. Buoy is disconnected

3.2.5.6 Buoy energized. IND 4 and IND 7 shall be located on the front panel and shall be labeled ENERGIZED. A buoy energized indicator shall be located at the buoy connector end of each cable assembly of the Remote Indicator Kit. IND 4 and the Buoy 1 cable assembly indicator shall illuminate when BUOY 1 is selected by S4, connected to the BIU, and drawing less than 80 mA from the BIU through the EXTERNAL POWER output via J3 (see FIGURE 2). IND 7 and the BUOY 2 cable assembly indicator shall illuminate when BUOY 2 is selected by S4, connected to the BIU, and drawing less than 80 mA from the BIU through the EXTERNAL POWER output via J4.

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3.2.5.7 Buoy reset. S3 shall be a momentary pushbutton switch located on the front panel and shall be labeled RESET. Depressing S3 when the buoy selected by S4 is connected to the BIU shall provide a 5-V CMOS binary 1 signal to the selected buoy (RESET output in FIGURE 2).

3.2.6 Built-in test (BIT) features. The BIT features shall provide verification of complete functional integrity of the BIU as specified in 3.2.6.1 through 3.2.6.3. It shall be possible to isolate a fault to a single least replaceable unit by use of the BIT features and front panel indicators.

3.2.6.1 Manual lamp test. S7 shall be a momentary pushbutton switch located on the front panel and labeled LAMP TEST. When depressed, all front panel indicators and Remote Indicator Kit indicators shall illuminate.

3.2.6.2 BIT test circuit. S6 shall be a momentary pushbutton switch located on the front panel and labeled CKT TEST. When the power is turned on and whenever S6 is depressed, the BIU self-test will automatically initiate. IND 16 shall be located on the front panel and shall be labeled TEST ON. All front panel indicators and Remote Indicator Kit indicators, except IND 16, shall illuminate; IND 16 shall flash during the self-test cycle. IND 15 shall be located on the front panel and shall be labeled FAILURE LEVEL SHIFT. IND 15 shall illuminate when a self-test failure occurs in the level shift circuits.

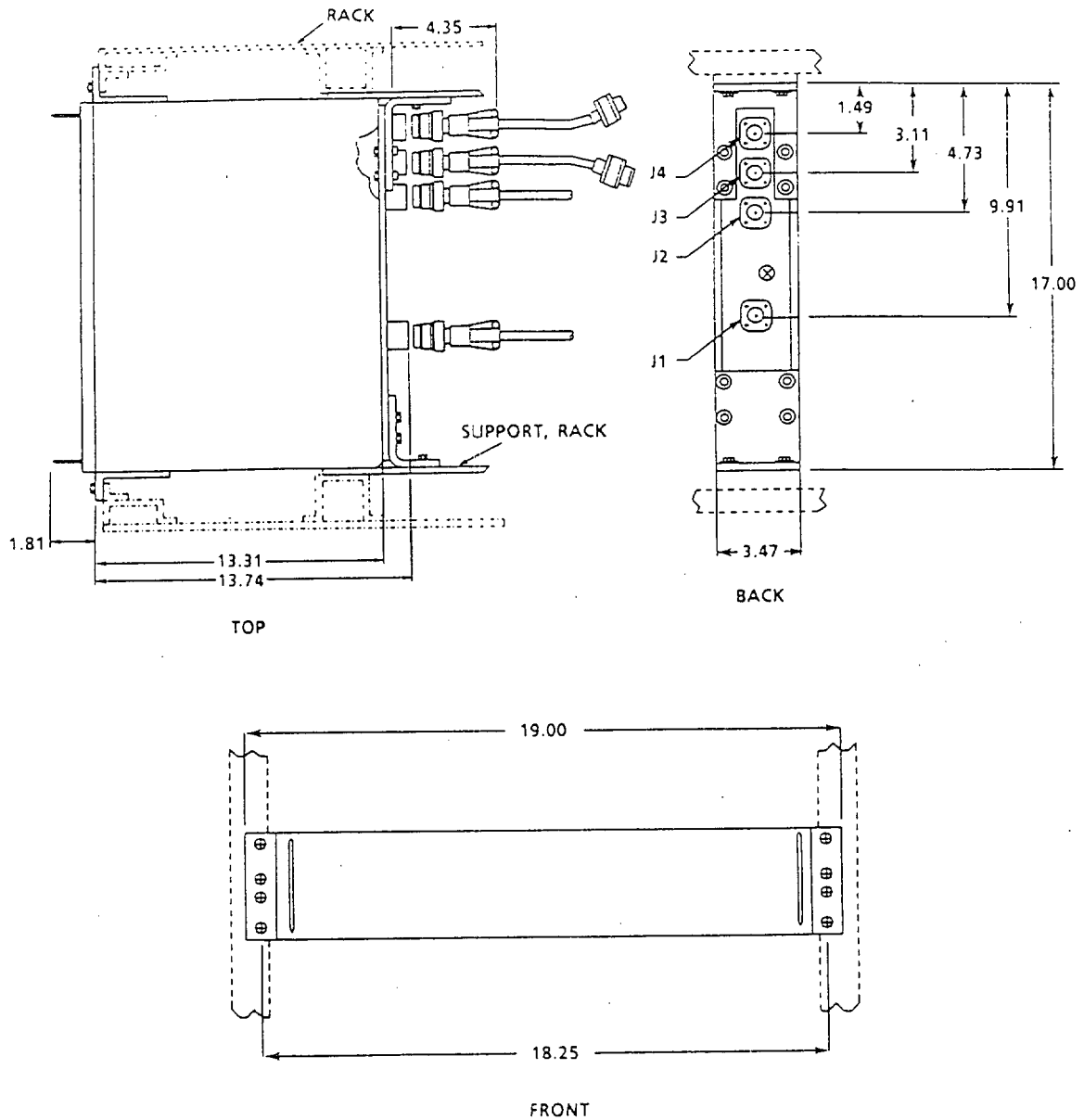
3.2.6.3 Internal power supply test. Internal power supply units in the BIU shall have independent power indicators which shall illuminate when the respective power supply is operating. IND 8, IND 9, and IND 10 shall be located on the front panel to provide this function. When an indicator is so used, it shall be labeled with the corresponding power supply voltage.

3.2.7 Leakage current. The leakage current shall not exceed 5 mA.

3.3 Physical characteristics. The physical characteristics shall be as specified in 3.3.1 through 3.3.7.4.

3.3.1 Dimensions and weight. The BIU shall consist of a front panel, chassis and slide, and enclosure cabinet. The BIU shall be capable of mounting in a standard electronic equipment rack in accordance with EIA RS-310-C-77, with the exceptions specified herein. A mounting bracket shall be used to support the BIU to the equipment rack at the rear of the enclosure. The BIU and mounting bracket dimension shall conform to the dimensions specified in FIGURE 3. The total weight of the BIU shall not exceed 35 pounds (lbs). Each Remote Indicator Kit cable assembly total weight shall not exceed 10 lbs and the length shall not exceed 20 feet.

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Note: 1. Unless otherwise specified, all tolerances are ± 0.05 .
 2. All dimensions are in inches.

FIGURE 3. BIU dimensions.

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3.3.2 Front panel. The BIU front panel shall be attached to the chassis and, in the closed position, shall become the front surface of the enclosure. The front panel shall attach to the enclosure by captive screws. Handles shall extend beyond all controls and dials and shall attach to the front panel. The front panel controls, indicators, and labels shall be in accordance with FIGURE 4.

3.3.3 Human engineering. The BIU shall conform to the human engineering operational and maintenance design criteria of MIL-STD-1472. The design of the operator and maintainer panel layouts and controls shall conform to 3.3.2 and MIL-STD-1472.

3.3.4 Configuration. The front panel and chassis shall mount via slides to the enclosure. The chassis shall be removable from the enclosure by depressing integral level latches on the chassis slides. The chassis slides shall provide full extensions of the chassis from the enclosure and shall rotate 90 degrees in both the clockwise and counterclockwise direction of the chassis. Guide pins at the rear of the chassis shall be used to position and hold the chassis in its closed position in the enclosure.

3.3.5 Accessibility. Accessibility shall be in accordance with MIL-STD-454, Requirement 36. Chassis slides shall be provided with automatically operated locks to lock the chassis in the operating position, and the extended and rotated positions.

3.3.6 Equipment cooling. The heat generated by the BIU shall be dissipated by the enclosure without forced air cooling.

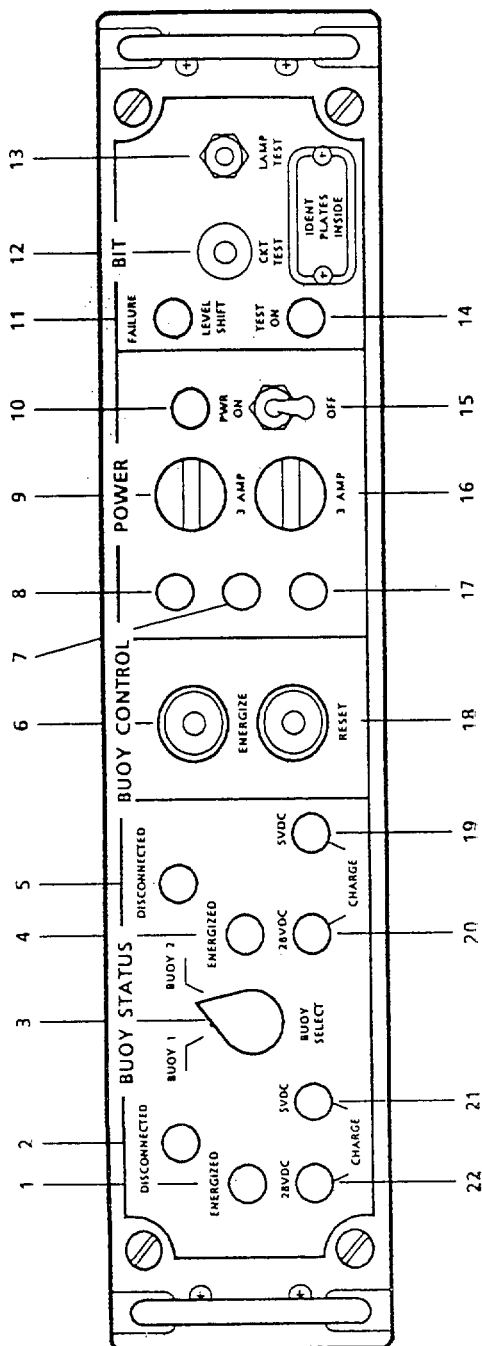
3.3.7 Cables and connectors. Cables and connectors shall be as specified in 3.3.7.1 through 3.3.7.4.

3.3.7.1 Remote Indicator Kit. The Remote Indicator Kit cables and connectors shall be in accordance with NAVSEA DWG F53711-409-6379608 and MIL-C-24643/45.

3.3.7.2 BIU internal cabling. Sufficient cable shall be provided internal to the enclosure to accommodate chassis extension and rotation. The cables shall be arranged and guided to prevent snagging or interference during chassis extension.

3.3.7.3 Connectors. All external electrical connectors shall be located on the rear of the enclosure and shall be in accordance with MS 27505, the types specified in TABLE II, MIL-STD-1683, and MIL-C-28840.

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|---|--|
| <ol style="list-style-type: none"> 1. Energized IND (Buoy 1) (IND 4) 2. Disconnected IND (Buoy 2) (IND 3) 3. Buoy select (S4) 4. Energized IND (Buoy 2) (IND 7) 5. Disconnected IND (Buoy 2) (IND 6) 6. Energize pushbutton (S2) 7. Power IND (IND 9) 8. Power IND (IND 8) 9. Ampere fuse (F1) 10. AC Power IND (IND 1) 11. Failure level shift IND (IND 15) | <ol style="list-style-type: none"> 12. CKT test pushbutton (S6) 13. Lamp test pushbutton (S7) 14. Test on IND (IND 16) 15. ON/OFF switch (S1) 16. 3 ampere fuse (F2) 17. Power IND (IND 10) 18. Reset pushbutton (S3) 19. 5 VDC charge IND (Buoy 2) (IND 14) 20. 28 VDC charge IND (Buoy 2) (IND 13) 21. 5 VDC charge IND (Buoy 1) (IND 12) 22. 28 VDC charge IND (Buoy 1) (IND 11) |
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FIGURE 4. BIU front panel controls and INDS.

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TABLE II. External connectors.

Connector	Type
J1	MS 27505E-17B-6P
J2	MS 27505E-15B-35S
J3	MS 27505E-15B-35SA
J4	MS 27505E-15B-35SB

3.3.7.4 Power connections. 115 VAC power cable connections within the BIU shall have the color and conductor assignments specified in TABLE III. Pin designations shall be as specified in TABLE III. Conductor insulation color shall be maintained from the BIU input connections to all components with the same voltage and frequency as the input power.

TABLE III. 115-VAC equipment power connections.

Pin designation	Conductor assignment	Insulation color
A	115 VAC return	White
B	Safety ground	Green
C	115 VAC HI (supply)	Black

3.4 Environmental service conditions. The equipment shall maintain specified performance under the environmental conditions specified in 3.4.1 through 3.4.8.

3.4.1 Temperatures. The BIU and Remote Indicator Kit shall maintain specified performance in the operating temperature range of 0°C Celsius (C) to 50°C. The equipment shall not be damaged nor shall operational performance be degraded when restored to the operating temperature range after being subjected to the nonoperating temperature range of -62°C to +71°C.

3.4.2 Humidity. The BIU and Remote Indicator Kit shall maintain the specified performance when exposed to a relative humidity of 95 percent for both continuous and intermittent periods, including conditions wherein condensation occurs in and on the equipment in the form of both water and frost.

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3.4.3 Salt fog (spray). The BIU and Remote Indicator Kit shall withstand the salt fog requirements of MIL-STD-810, Method 509.2.

3.4.4 Vibration. The BIU and Remote Indicator Kit shall withstand the vibration test specified in MIL-STD-167-1, Type I, at frequencies up to 33 Hz.

3.4.5 Mechanical shock. The BIU and Remote Indicator Kit shall withstand the shock tests of MIL-S-901, Grade A, Class I, Type A.

3.4.6 Enclosure. The BIU shall conform to the dripproof requirements of MIL-STD-108 when on an inclination of 45 degrees.

3.4.7 Inclination. The BIU shall withstand the inclination test of 4.5.10.

3.4.8 Electromagnetic compatibility (EMC). The BIU shall operate compatibly in a submarine radio frequency environment. The BIU shall conform to the requirements of MIL-STD-461, Part 6, for Class A5 equipment, as specified herein. Tests CE01 narrowband, CE03 narrowband, CS01, CS06 (at peak pulse of 400 V), RE01, RE02, RS01, RS02, and RS03 are applicable.

3.5 Parts, materials, and processes. Parts, materials, and processes shall be in accordance with the Parts, materials and processes paragraph of MIL-E-16400G, except as specified in 3.5.1 through 3.5.5. Nonstandard parts shall require approval before use. Proprietary parts shall be prohibited.

3.5.1 Parts. Control of all parts shall be in accordance with MIL-STD-965, Procedure I. Integrated circuits (IC) conforming to MIL-M-38510, Class B, semiconductors conforming to MIL-S-19500 JANTX, and quality level P resistors and capacitors conforming to MIL-S-19500 shall be used. Capacitors, semiconductor devices, resistors, and microelectronic devices shall be selected in accordance with MIL-STD-454, Requirement 2, Requirement 30, Requirement 33, and Requirement 64, respectively. Derating of electronic parts shall be accomplished in accordance with the requirements of AS-4613, Class B for a high ambient operating temperature of 50°C.

3.5.2 Unacceptable materials. Materials specified as unacceptable in MIL-E-16400G and in a through j shall not be used in the construction of the BIU and Remote Indicator Kit.

- a. Polychlorinated biphenyls
- b. Mercury and mercury compounds (not to be used in any component, process, test or inspection, or allowed to come into contact with the equipment at any time)
- c. Asbestos and asbestos compounds
- d. Fragile or brittle materials
- e. Flammable or combustible materials
- f. Beryllium and beryllium compounds

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- g. Lithium and lithium compounds
- h. Cast iron, or 303 SE corrosion-resistant steel
- i. Cadmium
- j. Materials containing carcinogens

3.5.3 Interchangeability. The BIU and Remote Indicator Kit shall conform to MIL-STD-454, Requirement 7.

3.5.4 Protective finish. All components of the BIU and Remote Indicator Kit shall be covered with a protective finish in accordance with MIL-F-18264 to provide corrosion resistance in a salt atmosphere. Aluminum shall not be left as a bare metal. The exterior and interior surfaces of the BIU shall be painted in accordance with the requirements of MIL-E-16400G for protected equipment (interior use).

3.5.5 Printed circuit boards (PCBs). PCBs shall be fabricated in accordance with MIL-STD-454, Requirement 17, and shall conform to the requirements of MIL-STD-275 and MIL-P-55110. The copper clad laminate from which PCBs are made shall be in accordance with MIL-P-13949. This requirement applies to both single layer and multilayer boards. Connectors used with PCBs shall be fabricated in accordance with MIL-C-21097. Removal and insertion of printed circuit assemblies shall not damage the assemblies or any other part of the equipment. Each assembly shall be keyed to prevent incorrect insertion.

3.5.6 Safety criteria. BIU design shall conform to the Safety criteria paragraph of MIL-E-16400G.

3.6 Electrostatic discharge protection (ESD) requirements. When metal oxide semiconductor parts and other parts sensitive to ESD, as specified in the Design protection paragraph of DoD-STD-1686 and DoD-HDBK-263 are used, the contractor shall incorporate protective circuitry in the BIU design, ensure that ESD sensitive parts, modules, PCBs, subassemblies, and so forth, are protected in all phases of handling and testing in accordance with DoD-STD-1686, affix warning labels to protective packaging and to the equipment, provide warnings in all relevant areas of the equipment technical manual, and use identification marking on all visible ESD sensitive subassemblies (that is, on card edge) before handling of the equipment by maintenance personnel. The assembled unit shall be protected to a level of Class 2, as specified in DoD-HDBK-263.

3.7 Reliability. The mean-time-between-failures of the BIU (θ_0 as defined by MIL-STD-781) shall be not less than 15,000 hours.

3.8 Maintainability. Maintainability shall be as specified in 3.8.1 through 3.8.3.

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3.8.1 Corrective maintenance requirements, organizational level. The BIU, including BIT, shall have a mean-corrective-maintenance-time (M_{ct}) not exceeding 0.5 hour and a maximum-corrective-maintenance-time (M_{maxct}) (95th percentile) not exceeding 1.5 hours when corrective maintenance is accomplished at the organizational level by the replacement of lowest assemblies (modules, PCBs, and chassis-mounted parts). Corrective maintenance includes interchange, reassembly, alignment, and check out for all corrective actions. BIT circuits are included in the corrective maintenance time requirement. The BIU is considered to be in a corrective maintenance mode whenever a failure (see 6.4) or malfunction occurs, including malfunctions that allow degraded operation.

3.8.2 Corrective maintenance requirements, depot level. The equipment shall be capable (inclusion of test points, and so forth) of repair within 24 hours at a depot facility. Corrective maintenance time includes preparation time; fault isolation; remove, repair, and replace time, or remove and replace time; warm-up time; and repair validation time.

3.8.3 Preventive maintenance. With the exception of cleaning, the equipment shall not require preventive maintenance; cleaning shall not exceed 3 hours per calendar year.

3.9 Identification and marking. Identification and marking shall be in accordance with the Identification and marking paragraph of MIL-E-16400G.

3.10 Workmanship. Workmanship shall be as specified in 3.10.1 and 3.10.2.

3.10.1 General workmanship. Workmanship shall be in accordance with MIL-STD-454, Requirement 9.

3.10.2 Workmanship screen. The equipment shall withstand a defect detection vibration screen and temperature cycling in accordance with MIL-STD-2164 and as specified in 4.9.2.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, 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.

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4.1.1 Responsibility for compliance. All items shall conform to all requirements of Section 3 and Section 5. The inspections set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Government verification. All quality assurance operations performed by the contractor will be subject to Government verification at any time. Verification will consist of, but is not limited to, a) surveillance of the operations to determine that practices, methods, and procedures of the written quality program are being properly applied, b) Government product inspection to measure quality of the product to be offered for acceptance, and c) Government inspection of delivered products to assure compliance with all inspection requirements of this specification. Failure of the contractor to promptly correct deficiencies discovered by him or of which he is notified shall be cause for suspension of acceptance until corrective action has been taken or until conformance of the product to prescribed criteria has been demonstrated.

4.1.3 Quality assurance terms and definitions. Quality assurance terms used in this specification shall be as defined in MIL-STD-109.

4.2 Classification of inspections. The inspection requirements specified herein are classified as specified in a through c:

- a. First article inspection (see 4.3)
- b. Quality conformance inspection (see 4.4)
 1. Production inspection (Group A) (see 4.4.1)
 2. Production control inspection (Group B) (see 4.4.2)
- c. Inspection of packaging (see 4.10)

4.3 First article inspection. Unless otherwise specified (see 6.2), one unit shall be required for first article inspection. First article inspection shall consist of all examination and testing necessary to determine compliance with the requirements of this specification. First article inspection shall include the tests specified in TABLE IV.

4.4 Quality conformance inspection. Quality conformance inspection shall be as specified in 4.4.1 through 4.4.3.

4.4.1 Production inspection (Group A). Production inspection shall be conducted on every item offered for delivery. Production inspection shall comprise such examinations and tests which will prove the workmanship and reveal omissions and errors of the production process. Production inspection

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shall include functional and performance tests at a limited number of points, tests which detect deviations from design, tests of controls and adjustments, and tests which detect hidden defects of materials. Production inspection shall include the examinations and tests specified in Group A of TABLE IV.

TABLE IV. Examinations and tests.

Examination or test	Requirement paragraph	Test paragraph	First article inspection	Quality conformance inspection	
				Group A	Group B
Performance	3.2	4.5.1	X	X	
Leakage current	3.2.7	4.5.2	X		X
Dimensions and weight	3.3.1	4.5.3	X	X	
Front panel	3.3.2	4.5.3	X	X	
Human engineering	3.3.3	4.5.3	X	X	
Configuration	3.3.4	4.5.3	X	X	
Accessibility	3.3.5	4.5.3	X	X	
Equipment cooling	3.3.6	4.5.4	X		X
Cables and connectors	3.3.7	4.5.3	X	X	
Temperature	3.4.1	4.5.4	X		X
Humidity	3.4.2	4.5.5	X		
Salt fog (spray)	3.4.3	4.5.6	X		
Vibration	3.4.4	4.5.7	X		X
Mechanical shock	3.4.5	4.5.8	X		
Enclosure	3.4.6	4.5.9	X		X
Inclination	3.4.7	4.5.10	X		
EMC	3.4.8	4.5.11	X		
Parts, materials, and processes	3.5	4.5.3, 4.5.12	X	X	
Safety	3.5.6	4.5.13	X	X	
ESD	3.6	4.6	X	X	
Reliability	3.7	4.7	X		X
Maintainability	3.8	4.8	X		
Identification and marking	3.9	4.5.3	X	X	
General workmanship	3.10.1	4.9.1	X	X	
Workmanship screen	3.10.2	4.9.2	X	X	

4.4.2 Production control inspection (Group B). Production control inspection shall be conducted on a sampling basis as specified in 4.4.2.1. Production control inspection shall consist of the examinations and tests throughout the entire range of operation; tests which will detect any deterioration of the design by wear of such items as dies, molds, and jigs, and by substitution of different parts; tests which detect deviations in the processing of the materials; tests to determine temperature rise produced in

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operation and ability of equipment to withstand this heat; tests of efficiency; and tests of the performance with other equipment in a system. The tests shall be performed on the complete BIU as offered for delivery. Production control inspection shall include the examinations and tests specified in TABLE IV, Group B.

4.4.2.1 Sampling plan for Group B inspection. The BIUs, submitted for Group B sampling tests, shall be selected by the contractor under the supervision of the Government quality assurance representative (QAR) and shall be representative of current production. Group B inspection, including sampling, shall conform to the procedures for small-sample inspection of MIL-STD-105, using the special inspection levels. Group B inspection shall be performed on equipment that has passed Group A inspection specified in 4.4.1. The inspection levels shall be S-3 for normal, tightened, and reduced inspection. One failure shall cause rejection.

4.4.2.2 Rejected lot. If an inspection lot is rejected, the contractor may withdraw the lot from further inspection. The contractor may also rework a rejected lot to correct the defective units and reinspect the lot using tightened inspection. Rejected lots shall be kept separate from new lots and shall not lose their identity.

4.4.2.3 Nonconforming production control sample BIU. If a sample BIU fails the inspection specified in 4.4.2, the contractor shall immediately investigate the cause of failure and shall report to the QAR the results thereof and details of the action taken to correct units of product which were manufactured under the same conditions, with the same materials, processes, and so forth. If the QAR does not consider that the corrective action will enable the product to conform to specified requirements, or if the contractor cannot determine the cause of failure, the matter shall be referred to the contracting officer or procuring activity.

4.4.3 Reinspection of conforming production control sample BIU. Unless otherwise specified (see 6.2), sample BIUs which have been subjected to, and have passed, production control inspection, may be accepted on the contract, provided they are resubjected to, and pass, production inspection after repair of all damage.

4.5 Test methods. The examinations and tests specified in TABLE IV shall be conducted in accordance with the applicable test methods and quality assurance provisions of MIL-E-16400G, except as specified in 4.5.1 through 4.5.13. Testing shall be performed at ambient pressure and room temperature, unless otherwise specified herein.

4.5.1 Performance test. The BIU and Remote Indicator Kit shall be subjected to a performance test including all operating controls to determine compliance with the performance requirements specified herein.

4.5.2 Leakage current test. The leakage current test shall be performed as specified in 4.5.2.1 through 4.5.2.3.

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4.5.2.1 Primary power source. Leakage current shall be measured at a steady-state power line voltage and frequency of 120 V, 60 Hz.

WARNING

THIS TEST MAY BE HAZARDOUS DUE TO THE UNGROUNDED CONDITION OF THE EQUIPMENT DURING THE TEST. DO NOT TOUCH EXPOSED METAL SURFACES.

THE UNITED STATES GOVERNMENT NEITHER ASSUMES NOR ACCEPTS RESPONSIBILITY FOR ANY INJURY OR DAMAGE THAT MAY OCCUR DURING OR AS A RESULT OF THIS TEST.

4.5.2.2 BIU test connection. After power removal, each BIU directly connected to an external power source and units deriving power from the BIU shall be placed on an insulated surface. All safety ground conductors between the BIU and units deriving power from the BIU shall be intact. The safety ground conductor between the equipment and the source power shall be disconnected during the test. OBSERVE WARNING STATEMENT. The BIU shall be connected as shown in FIGURE 5 for single-phase source power.

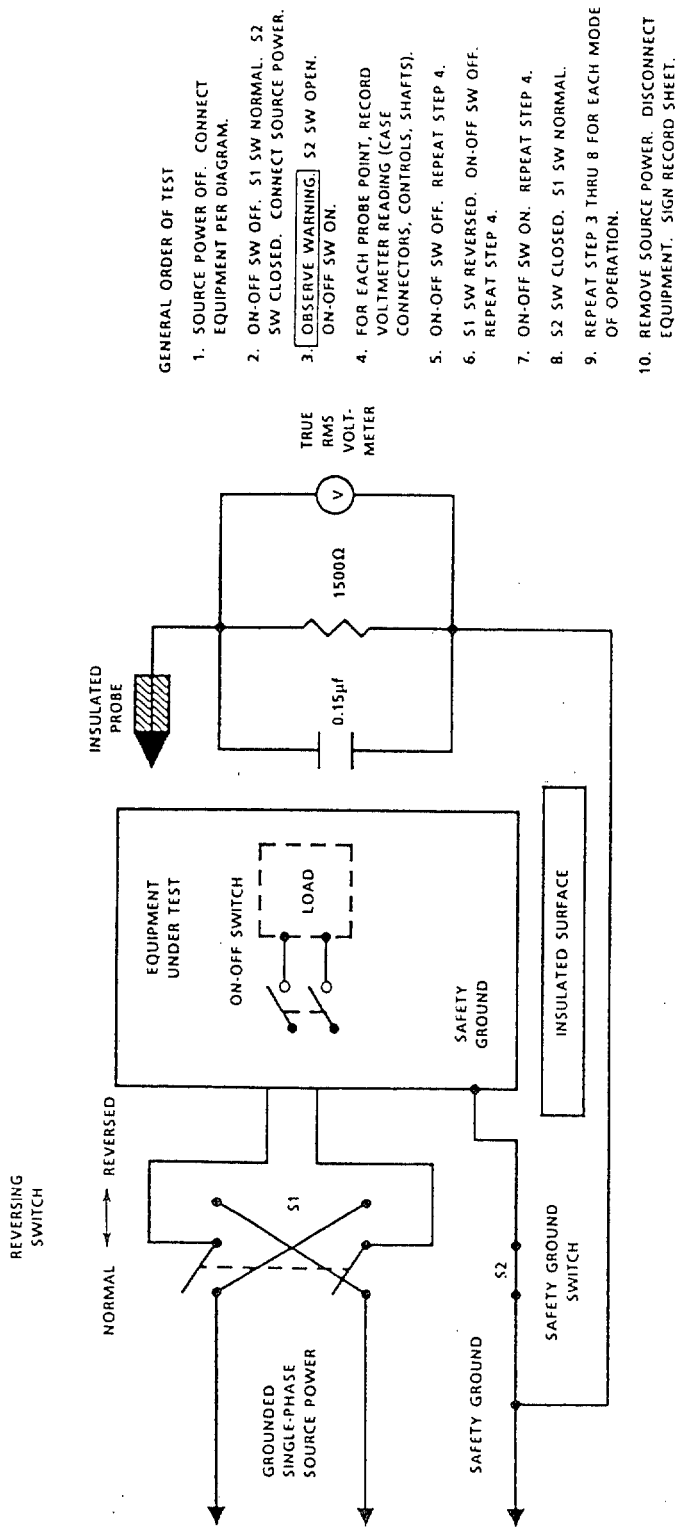
4.5.2.3 Measurement. Leakage current shall be measured on the BIU in its normal operating configuration. BIU controls in each operating mode shall be such that maximum power will be utilized during leakage current measurement. The leakage current shall be determined by the voltage-drop method. A true root-mean-square (rms) voltmeter shall be used. The voltage measured across the 1500-ohm resistor, when equal to 7.5 V, represents 5 mA of leakage current. The overall measurement error shall not exceed 5 percent. The probe shall be used on all external conducting parts. The voltage shall be measured from each part to ground for every combination of switch positions available in FIGURE 5. The disconnected safety ground conductor shall be reconnected immediately after the test is completed.

4.5.3 Surface examination. The BIU and Remote Indicator Kit shall be examined to ensure compliance with the applicable referenced specification paragraphs with respect to:

- a. Dimensions and weight (see 3.3.1)
- b. Front panel (see 3.3.2)
- c. Human engineering (see 3.3.3)
- d. Configuration (see 3.3.4)
- e. Accessibility (see 3.3.5)
- f. Cables and connectors (see 3.3.7)
- g. Parts, materials, and processes (see 3.5)
- h. Identification and marking (see 3.9)

In the process of examination, the item shall not be disassembled in a manner that will affect the performance, durability, or appearance of the item. The examination shall include a check of all operating controls, circuit functions, test provisions, and adjustments.

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GENERAL ORDER OF TEST

1. SOURCE POWER OFF. CONNECT EQUIPMENT PER DIAGRAM.
2. ON-OFF SW OFF. S1 SW NORMAL. S2 SW CLOSED. CONNECT SOURCE POWER.
3. **OBSERVE WARNING.** S2 SW OPEN. ON-OFF SW ON.
4. FOR EACH PROBE POINT, RECORD VOLTMETER READING (CASE CONNECTORS, CONTROLS, SHAFTS).
5. ON-OFF SW OFF. REPEAT STEP 4.
6. S1 SW REVERSED. ON-OFF SW OFF. REPEAT STEP 4.
7. ON-OFF SW ON. REPEAT STEP 4.
8. S2 SW CLOSED. S1 SW NORMAL.
9. REPEAT STEP 3 THRU 8 FOR EACH MODE OF OPERATION.
10. REMOVE SOURCE POWER. DISCONNECT EQUIPMENT. SIGN RECORD SHEET.

WARNING

DO NOT TOUCH EXPOSED METAL SURFACES

THIS TEST MAY BE HAZARDOUS DUE TO THE UNGROUNDED CONDITION OF THE EQUIPMENT DURING THE TEST. THE UNITED STATES GOVERNMENT NEITHER ASSUMES NOR ACCEPTS RESPONSIBILITY FOR ANY INJURY OR DAMAGE THAT MAY OCCUR FROM THE USE OF THIS DIAGRAM FOR LEAKAGE CURRENT MEASUREMENT.

FIGURE 5. Single-phase test diagram for leakage current measurement.

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4.5.4 Temperature tests. The BIU and Remote Indicator Kit shall be subjected to low and high temperature tests in accordance with MIL-STD-810, Method 502.2 and Method 501.2, to determine conformance to the requirements specified in 3.4.1.

4.5.5 Humidity test. The BIU and Remote Indicator Kit shall be subjected to a humidity test in accordance with MIL-STD-810, Method 507.2, to determine conformance to the requirements specified in 3.4.2.

4.5.6 Salt fog. The salt fog test specified in MIL-STD-810, Method 509.2, shall be applied to the finishes and coatings on parts and frame and enclosure structures as finally assembled for use. The test shall not be applied to the complete equipment.

4.5.7 Vibration test. The BIU shall be hard-mounted to the vibration table using a test fixture and shall be subjected to the amplitude inputs of MIL-STD-167-1, Vibratory displacement of environmental vibration table, for each of the three orthogonal axes (principal axes of BIU). The frequency range shall be between 4 Hz and 33 Hz. The BIU shall bolt to the test fixture identical to the electronics rack mounting design. The resonance frequency of the fixture shall be greater than 75 Hz. The BIU shall conform to the performance requirements specified herein, before, during, and after the test.

4.5.8 Mechanical shock. The BIU shall be hard-mounted to the shock table using a test fixture and shall be subjected to the shock inputs of MIL-S-901 for Grade A, Class I, Type A, equipment. The BIU shall be mounted to the test fixture identical to the electronics rack mounting design. The low weight, high impact shock table shall be used for the test. The BIU shall be energized and operating conditions checked after each shock blow. The BIU shall conform to the performance requirements specified herein after the test.

4.5.9 Enclosure. The BIU shall be tested in accordance with MIL-STD-108 to determine conformance to the requirements specified in 3.4.6.

4.5.10 Inclination test. The BIU shall be energized and fully operating during the test. The BIU shall be inclined at the rate of five cycles to seven cycles per minute in one plane to angles of 60 degrees on either side of vertical for a period sufficiently long to determine the characteristics under such motion or for a minimum of 30 minutes. The test shall be repeated with the BIU reoriented 90 degrees to the plane in which it was originally tested. At the conclusion of these cyclic tests, the cyclic motion shall be stopped and the inclination adjusted to an angle of 15 degrees. The BIU shall then be operated for a sufficient period to ensure that continuous operation can be maintained. The BIU shall then be rotated through vertical to 15 degrees in the opposite direction, and the test for continuous operation shall be repeated.

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4.5.11 EMC. Conformance to the requirements specified in 3.4.8 shall be verified by tests performed in accordance with MIL-STD-462. Interface connections with actual or simulated loads shall be utilized during testing.

4.5.12 Parts. Parts rescreening shall be implemented on all Military semiconductor devices.

4.5.12.1 ICs. The ICs shall be inspected as specified in a through c:

- a. 100 percent inspection
- b. Measure input/output logic
- c. Measure over temperature range 120°C (or the maximum component operating temperature, whichever is less) to 25°C

4.5.12.2 Transistors. Transistors shall be inspected as specified in a and b:

- a. Measure breakdown voltages (collector to emitter, collector to base, and base to emitter)
- b. Measure Hfe (minimum and maximum) (small signal short circuit forward current transfer ratio, common emitter (minimum and maximum)); I_{eo} (emitter cutoff current, direct current (DC), collector open); I_{co} (collector cutoff current, DC, emitter open); and I_{ceo} (collector cutoff current, DC, base open)

4.5.13 Safety verification. Examinations, analyses, and tests shall be performed to verify conformance to 3.5.6.

4.6 ESD testing. All ESD-susceptible equipment shall be tested for compliance with the requirements specified in DoD-STD-1686. Testing performed prior to first article testing for component classification shall be considered destructive and parts tested shall not be used in equipment delivered to the Government.

4.7 Reliability verification test. The BIU shall withstand a reliability verification test conducted in accordance with MIL-STD-781 and the test conditions specified in a through e:

a. Test time:	1500 hours
b. Accept criterion:	No failure
c. Reject criterion:	One or more failures
d. Electrical stress:	Prime power voltage cycling shall be 0.33 at nominal minus 7 percent, 0.33 at nominal, and 0.33 at nominal plus 7 percent, repetitive every hour.
e. Thermal stress:	Three cycles per day nominal
f. Moisture (humidity):	Ambient

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4.8 Maintainability equipment demonstration. Conformance to the requirements for maintainability M_{ct} and M_{maxct} (95th percentile) and BIT and built-in test equipment diagnostics effectiveness shall be determined by an organizational level maintainability demonstration in accordance with MIL-STD-471, Test Method 9. A total of 25 candidate corrective maintenance faults shall be selected in accordance with APPENDIX A of MIL-STD-471. The demonstration shall consist of a total of five corrective maintenance tasks, each requiring replacement of a failed subassembly or chassis-mounted part. The procuring activity or authorized representative shall determine a sample for the demonstration from the candidate faults. In addition, all preventive maintenance tasks shall be performed in accordance with the applicable procedures.

4.9 Workmanship. Workmanship shall be as specified in 4.9.1 through 4.9.2.2.

4.9.1 General workmanship. The BIU and Remote Indicator Kit, including subassemblies and assemblies, shall be examined for workmanship and soldering during the fabrication and assembly process and at the end item level for conformance to the requirements specified in 3.10.1. Each solder connection and its associated wiring or leads shall be visually examined.

4.9.2 Workmanship screen. Vibration and temperature cycling shall be performed on each BIU. Vibration shall be performed prior to temperature cycling. The vibration may be performed at the module, drawer, or end item level. All the hardware, including cables and connectors, shall be exposed to vibration.

4.9.2.1 Vibration. The vibration shall be random, or subject to procuring activity approval, pseudo-random or complex waveform vibration, for an accumulated time of 10 minutes in the axis deemed most susceptible to vibration excitation. All items shall be hard-mounted (without shock isolators) and subjected to the vibration conditions of FIGURE 6. Input vibration levels shall be measured at the mounting points of the item under vibration. If variations are found at these points, the level used for control purposes shall be the average of the levels at the mounting points. Control equipment having a bandwidth no greater than 10 Hz for vibration frequencies up to 500 Hz, and 100 Hz, for vibration frequencies above 500 Hz, shall be used for the control and analysis of the acceleration spectral density (ASD). The instantaneous acceleration peaks shall be limited to three times the rms acceleration level. The item shall be energized with appropriate input signals applied during the vibration to observe any abnormal conditions of the output functional characteristics. All failures occurring during screening shall be corrected and the vibration resumed.

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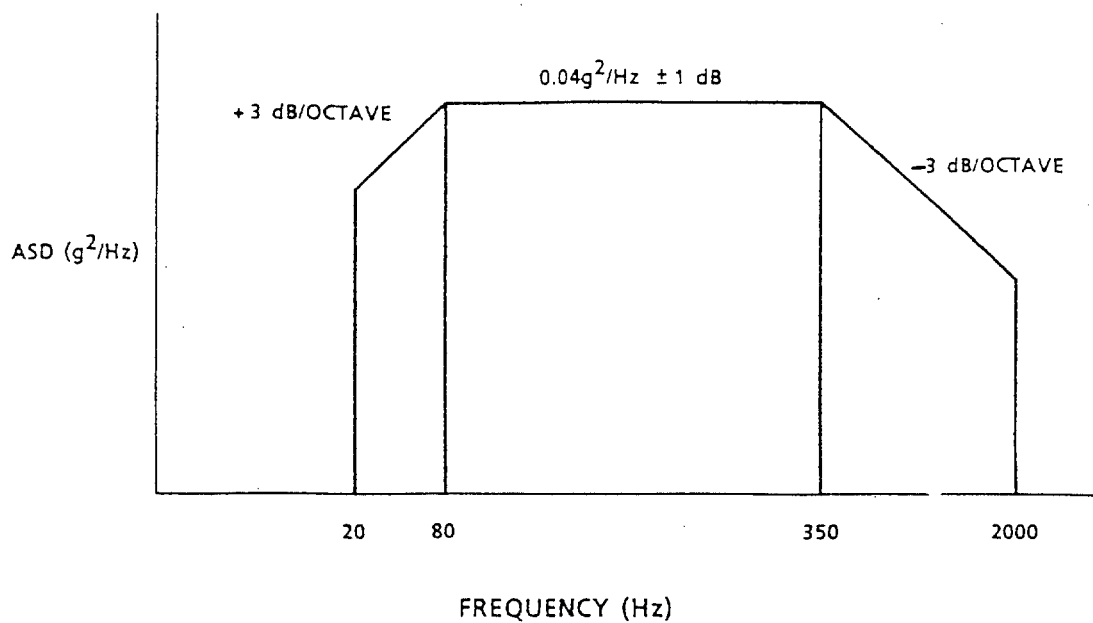


FIGURE 6. Random vibration curve.

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4.9.2.2 Temperature cycling. Each BIU shall be subjected to 10 cycles of the temperature curve shown in FIGURE 7. The temperature rate of change shall be not less than 5°C per minute. BIU power shall be turned on and off at the indicated times. The BIU shall be positioned for maximum exposure to the changing temperature. Where performance measurements are specified, a minimal functional operating test shall be performed. The dwell time shall be maintained until the largest electrical or electronic part in the BIU reaches 80 percent of the chamber temperature. When failure occurs, the BIU shall be repaired and the cycling continued for a cumulative total of 10 cycles.

4.10 Inspection of packaging. Inspection shall be conducted to ensure conformance with the requirements of Section 5.

5. PACKAGING

(The preparation for delivery requirements specified herein apply only for direct Government procurements. Preparation for delivery requirements of referenced documents listed in Section 2 do not apply unless specifically stated in the contract. Preparation for delivery requirements for products procured by contractors shall be specified in the individual order.)

5.1 Preservation, packaging, packing, and marking. Unless otherwise specified herein, preparation for delivery shall be in accordance with the applicable levels of preservation, packaging, packing, and marking specified in MIL-E-17555 (see 6.2).

6. NOTES

6.1 Intended use. The BIU and Remote Indicator Kit, covered by this specification, is intended for use on board all SSN and SSBN submarines as a part of the Buoy Transmitting Set, AN/BRT-6.

6.2 Ordering data. Procurement documents should specify:

- a. Title, number, and date of this specification
- b. Number of first article samples to be submitted if other than specified in 4.3
- c. When reinspected production control sample units may not be accepted (see 4.4.3)
- d. Levels of preservation, packaging, packing, and marking required (see 5.1)

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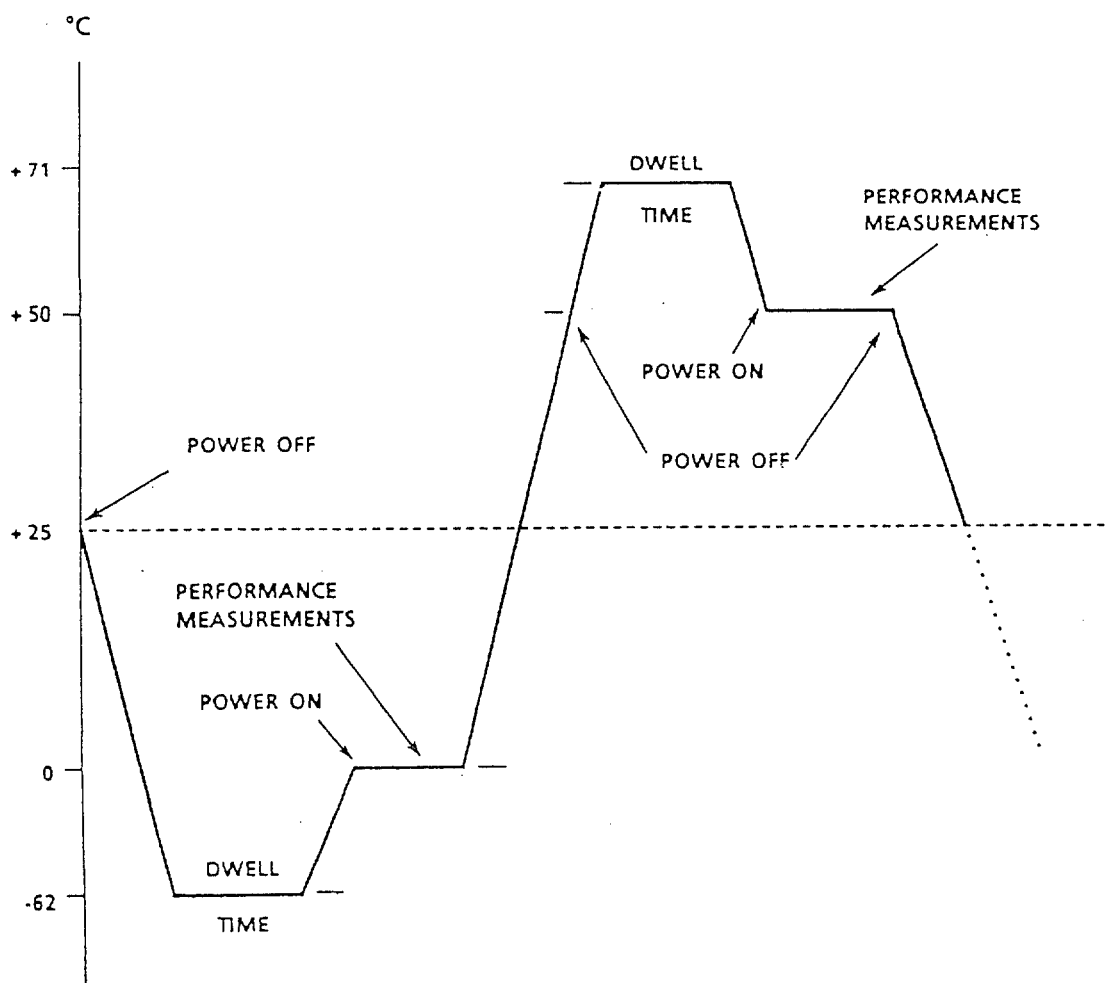


FIGURE 7. Random temperature curve.

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6.3 First article. When a first article inspection is required, the item(s) should be a first production unit. The first article should consist of one unit. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.4 Definition of failure. A failure is the inability to conform to the performance requirements specified herein.

6.5 Subject term (key word) listing.

AN/BRT-6
Battery Charger
Buoy Interface Unit
Buoy Transmitting Set
CX-13319/BRT-6
CX-13321/BRT-6
J-3958/BRT-6
PP-7866/BRT-6
Radio Transmitting Buoys
Remote Indicator Cable Assembly
Remote Indicator Kit
Satellite Information Exchange System
T-1455/BRT-6

6.6 Supersession data. This specification includes the requirements of ELEX-B-595.

Preparing activity:
NAVY - EC

(Project No. 5820-N856(EC))

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER MIL-A-29518		2. DOCUMENT TITLE	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION <i>(Mark one)</i>	
b. ADDRESS <i>(Street, City, State, ZIP Code)</i>		<input type="checkbox"/> VENDOR	
		<input type="checkbox"/> USER	
		<input type="checkbox"/> MANUFACTURER	
		<input type="checkbox"/> OTHER <i>(Specify):</i> _____	
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER <i>(Last, First, MI)</i> - Optional		b. WORK TELEPHONE NUMBER <i>(Include Area Code)</i> - Optional	
c. MAILING ADDRESS <i>(Street, City, State, ZIP Code)</i> - Optional		8. DATE OF SUBMISSION <i>(YYMMDD)</i>	