MILITARY SPECIFICATION

HEADERS - HERMETICALLY SEALED

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

This specification covers hermetically sealed headers designed to be used in hermetically sealed components.

1.2 Classification. Headers shall be furnished in the following forms as specified (see 3.1 and 6.1)

1.2.1 Sealing process. (as specified see 3.1) The sealing process is identified as follows:

Type I - Matched sealing (see 3.4.1).

Type II - Mismatched (Compression) sealing (see 3.4.2)

1.2.2 Temperature range. (as specified see 3.1) The temperature range is identified by a single letter in accordance with table I.

TABLE I. Temperature range.

Symbol	Temperature range
A	-65 to +125° C
B	-65 to +200° C

1.2.3 Sealing characteristics. (as specified see 3.1) The sealing characteristic is identified by a single digit in accordance with table II.

TABLE II. Sealing characteristics.

Symbol	Maximum leak rate 1/
1	1×10^{-6}
2	1×10^{-7}
3	1×10^{-8}

1/ Atmospheric cubic centimeters per second (atm cc/sec)

2. APPLICABLE DOCUMENTS

2.1 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

P-D-680 - Dry Cleaning Solvent.
QQ-C-320 - Chromium Plating (Electrodeposited).
QQ-N-290 - Nickel Plating (Electrodeposited)
QQ-S-365 - Silver Plating, Electrodeposited, General Requirements for.
QQ-S-571 - Solder; Tin Alloy; Lead Tin Alloy; and Lead Alloy.
TT-I-735 - Isopropyl Alcohol.
TT-T-291 - Thinner, Paint, Volatile Spirits (Petroleum Spirits).
PPP-B-566 - Boxes, Folding, Paperboard.
PPP-B-636 - Box, Fiberboard.
PPP-B-676 - Boxes, Setup.
PPP-T-60 - Tape, Pressure-Sensitive Adhesive, Waterproof, for Packaging.
PPP-T-76 - Tape, Pressure-Sensitive Adhesive Paper, Water Resistant (For Carton Sealing).

MILITARY

MIL-I-10 - Insulating Materials, Electrical, Ceramic, Class L.
MIL-P-116 - Preservation, Methods of.
MIL-T-10727 - Tin Plating, Electrodeposited or Hot-Dipped for Ferrous and Non-Ferrous Metals.
MIL-C-14550 - Copper Plating (Electrodeposited).
MIL-C-26074 - Coating Nickel-Phosphorus, Electroless Nickel, Requirements for.
MIL-G-45204 - Gold Plating, Electrodeposited.
MIL-C-45662 - Calibration System Requirements.

STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
MIL-STD-454 - Standard General Requirements for Electronic Equipment.
MIL-STD-1276 - Lead, Weldable, For Electronic Component Parts.

(Copies of specifications, standards, drawings, and publications required by suppliers 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 document forms 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.

NATIONAL BUREAU OF STANDARDS

Handbook H28 - Screw-Thread Standards for Federal Services.

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.)

3. REQUIREMENTS

3.1 Detail requirements. The individual item requirements shall be as specified herein and in accordance with the applicable associated detail header drawing. In the event of any conflict between requirements of this specification and the applicable detail header drawing, the latter shall govern.

3.1.1 Detail header drawing. The detail drawing shall specify the following variables:

(a) Title and number of this document.

(b) Sealing process (see 1.2.1).

(c) Temperature range (see 1.2.2).

(d) Sealing characteristics (see 1.2.3).

(e) Materials and finish (see 3.3, 3.3.3, and 3.3.4).

(f) Insulator material (see 3.3.2).

(1) Vendor's glass or glass ceramic proprietary part or type number (see 3.3.2.2).

(g) Terminal material, size, and finish (see 3.4.3).

(h) Mounting studs, polarizing terminals and brackets (see 3.4.5).

(i) Insulation resistance value, if other than 10,000 megohms minimum (see 3.6).

(j) Dielectric strength test voltages, if other than 1250 ±50 volts RMS 60 Hz (see 4.7 2(a)).

(k) Thermal shock insulation resistance value, if other than 1,000 megohms minimum (see 3.8).

(l) Physical dimensions and mounting dimensions (see 3.4).

(m) Marking as required.

3.2 First article sample. Prior to beginning production, the sample shall be tested as specified in 4.5.2 (see 6.3)

3.3 Materials. Materials and finishes shall be as specified herein, unless otherwise specified (see 3.1). Other types of material, possessing superior characteristics, may be used which will enable the header to meet the specified performance requirements, when substantiated with acceptable test data and when authorized by the applicable detail header drawing (see 3.1). Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product.

3.3.1 Fungus resistant materials Nonmetallic parts of the header shall be fungus inert in accordance with requirement 4 of MIL-STD-454.

3.3.2 Insulating materials.

3.3.2.1 Ceramic. Ceramic insulating material shall conform to MIL-I-10, Grade L-422 or higher Ceramic used for external surface shall be glazed, unless otherwise specified (see 3.1). Surfaces shall not be treated with silicones or greases.

3.3.2.2 Glass or glass ceramics. Vendor proprietary glasses or glass ceramics may be used, provided they are compatible with the body materials used in matched or mismatched sealing types, and provided data is on file supporting their test acceptance. The vendor's proprietary part or type number shall be reflected on the applicable detail header drawing (see 3.1). Surfaces shall not be treated with silicones or greases.

3.3.2.3 Glass and ceramic insulator defects. There shall be no evidence of glass or ceramic insulator defects, as classified by the following visual discrepancies (see figure 1).

(a) Broken or open blister leaving sharp edges.

(b) Blisters larger than 1/32-inch, or a cluster of blisters with combined lengths of more than one-half of the circumference of a seal around a terminal, whichever is the smaller.

(c) Foreign inclusions on the insulator, or foreign material on the surface. (Small agglomerates of pigmenting color are acceptable.)

(d) Individual cracks appearing on both top and bottom surfaces.

(e) Circumferential surface cracks which extend more than 90 degrees. (After exposure to the terminal strength tests, meniscus cracks around a terminal are permissible, provided they do not extend outward more than 1/32-inch or more than one-third of the distance between the terminal and the corresponding rim of the body, whichever is the lesser.)

(f) Radial surface cracks which extend more than 1/32-inch or more than one-third of the distance from terminal to terminal or from the terminal to the corresponding rim of the body, whichever is the lesser.

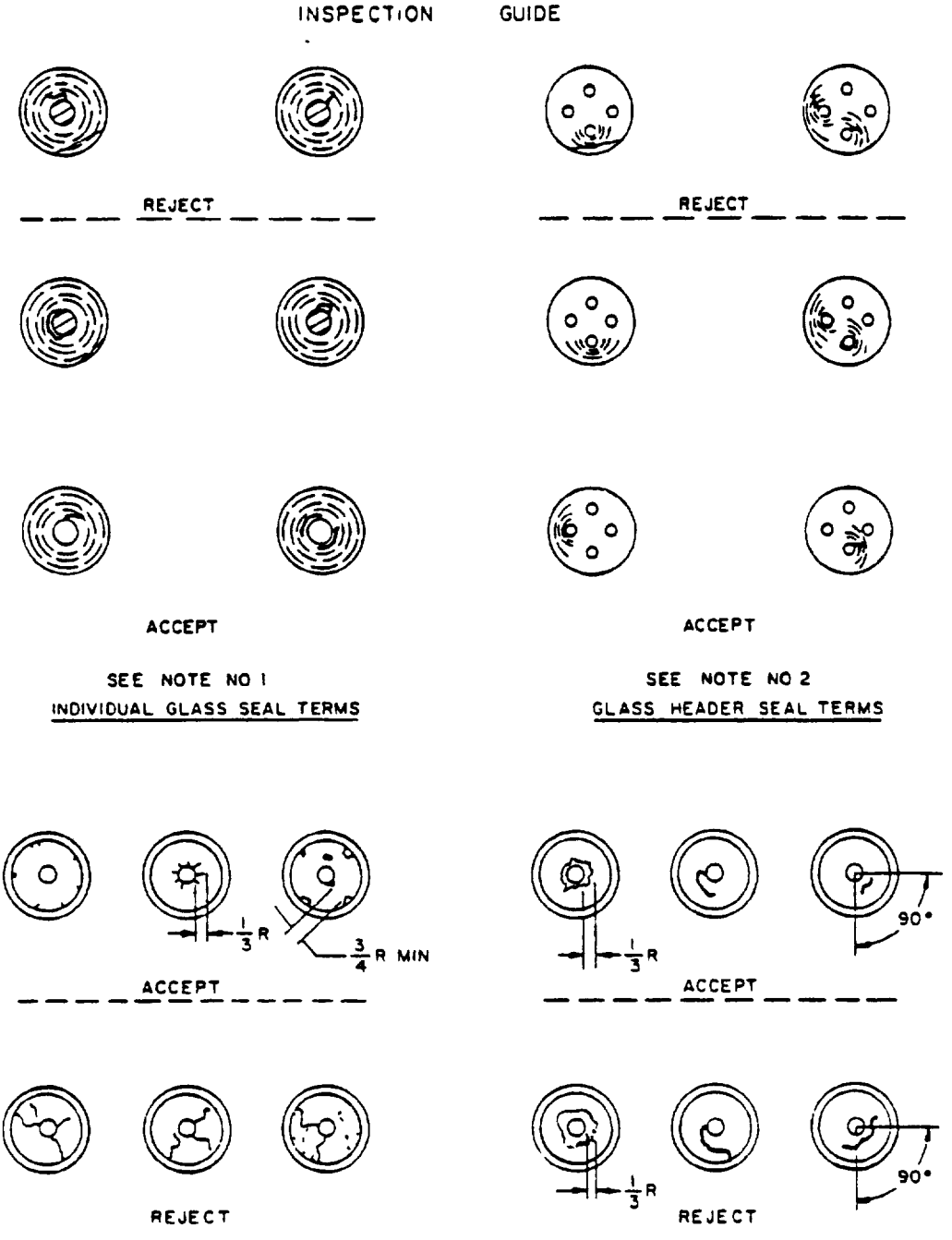
(g) Surface chips shall not be permissible. (After exposure to the terminal strength tests, surface chips around the terminals are permissible, provided the chip lengths or widths do not exceed 1/32-inch or one-third of the distance from terminal to the corresponding rim of the body, whichever is the lesser.)

(h) Surface pocks in excess of one-fifth of the insulator thickness shall not be permissible.

(i) The insulator meniscus shall not extend up the terminal greater than .020 inch or one-third of the terminal diameter, whichever is the greater, unless otherwise specified (see 3.1).

3.3.3 Metals. Unless otherwise specified (see 3.1), cadmium plating shall not be used for plating any part of the header, while zinc and electro-deposited tin plating shall not be used for plating internal portions of the header. Metals shall be of a corrosion-resistant type, or shall be plated or treated to resist corrosion (see 3.9). All plating shall be in accordance with 3.3.4.

3.3.3.1 Dissimilar metals. When dissimilar metals are used in intimate contact with each other, protection against electrolysis and corrosion shall be provided. The use of dissimilar metals in contact, which tends toward active electrolytic corrosion (particularly brass, copper, or steel used in contact with aluminum or aluminum alloy), is not acceptable. However, metal spraying or metal plating of dissimilar base metals to provide similar or suitable abutting surfaces is permitted. Dissimilar metals shall be as defined in 6.4 through 6.4.4 inclusive and table X.



NOTES:
1. Broken lines indicate radial distance between wire and outer edge of glass divided into four equal parts
2. Broken lines indicate radial distance between wire and outer edge of glass header (or between adjacent wires) divided into four equal parts.

FIGURE 1 Surface defects

3.3.4 Finishes. The finishes listed in table III are recommended for use with the header materials. All plating thicknesses and undercoatings shall be as specified by the applicable detail header drawing (see 3.1).

TABLE III. Header material finishes.

Plating type	Applicable documents
Chromium (electrodeposited)	QQ-C-320
Copper (electrodeposited)	MIL-C-14550
Nickel (electroless)	MIL-C-26074
Sulfamate nickel (electrodeposited)	QQ-N-290
Tin (electrodeposited) 1/	MIL-T-10727 followed by a flow process
Gold (electrodeposited)	MIL-G-45204
Silver	QQ-S-365
Solder	QQ-S-571

1/ Bright tin, tintilate, or other electrodeposited methods incorporating organic brightness shall not be used on internal surfaces of headers for electromechanical switching devices.

3.4 Design and construction. The headers shall be of the design, construction, and physical dimensions specified by the applicable detail header drawing (see 3.1).

3.4.1 Matched sealing (Type I). Selection of materials shall be such that sealing is accomplished by the action of the matched properties of the header materials.

3.4.2 Mismatched sealing (Type II). Selection of materials shall be such that sealing is accomplished by the action of the mismatched properties of the header materials.

3.4.3 Electrical terminals. Electrical terminals shall be as specified (see 3.1). Recommended terminal configurations are shown in figure 2. Recommended terminal materials shall be as listed in table IV.

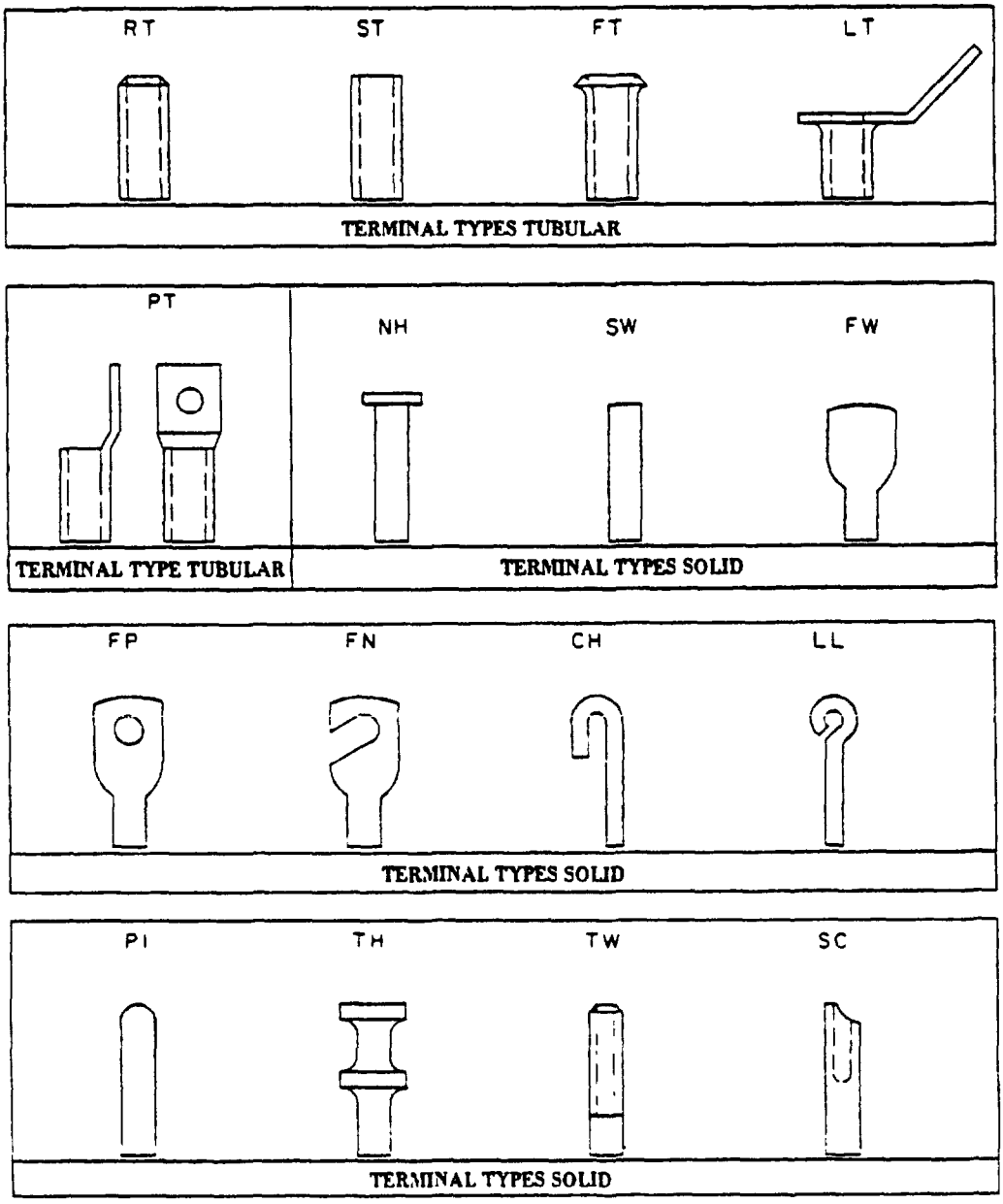
TABLE IV. Terminal information.

Material	Ohms/cir mil ft	Ohms per linear inch vs diameter 1/					
		.017	020	030	040	050	060
Iron, nickel alloy 2/	260	.0750	.0541	.0241	.0136	.0087	.0060
Iron, nickel alloy, 1/3 copper cored	75	.0217	.0157	.0069	.0039	.0025	0018
Iron, nickel, chromium alloy	570	.1641	.1191	.0528	.0297	.0190	0131
Iron, nickel, chromium alloy, 1/3 copper cored	165	.0475	.0344	.0153	.0086	0055	.0038
Iron, nickel, cobalt alloy 3/	290	.0848	.0613	0273	.0153	.0098	0068

1/ Ohmic values are rounded off and are based upon wire values, without benefit of external plating.

2/ Composition of alloy per MIL-STD-1276, type F.

3/ Composition of alloy per MIL-STD-1276, type K.



RT – ROUNDED TUBE
ST – STRAIGHT TUBE
FT – FLARED TUBE
LT – HOLLOW TUBE LUG
PT – FLATTENED TUBE

NH – NAIL HEAD
SW – STRAIGHT WIRE
FW – FLATTENED WIRE
FP – FLATTENED AND PIERCED
FN – FLATTENED AND NOTCHED
CH – CANE HOOK

LL – LOOP
PI – PLUG IN
TH – DOUBLE TURRET
TW – THREADED
SC – SOLDER CUP

FIGURE 2. Terminal configuration

3.4.3.1 Plug-in welded terminals. Plug-in terminals used in conjunction with external sockets or welded connections shall be gold plated in accordance with MIL-G-45204, type II, class 1, over nickel plate 0.0001 to 0.0003 inch thick.

3.4.3.2 Solder terminals. Solder terminals shall be treated to facilitate soldering. Coatings such as hot solder or hot-tin dip are acceptable. Gold plating shall not be used for solder-lug terminals.

3.4.3.3 Terminal defects. There shall be no evidence of terminal defects, as classified by the following visual discrepancies

(a) Indentations, with depths exceeding one-fourth of the terminal diameter.

(b) Fractures in the terminal.

(c) Evidence of foreign materials which may be detrimental to the achievement of a reliable solder or weld joint.

(d) Reduction of the terminal diameter in excess of 15 percent of the terminal diameter.

3.4.4 Threaded parts. All threaded parts shall be in accordance with Handbook H28. Where practical, all threads shall be in conformity with the coarse-thread series.

3.4.5 Mounting studs, polarizing terminals and brackets. When mounting studs and polarizing terminals are included as part of the header, they shall be made an integral part of the header body by welding, brazing, or fusion.

3.4.6 Body. There shall be no evidence of body defects, such as burrs, chips or holes (voids) as defined in 6.2. Deposited finishes (when applicable) must be smooth, evenly deposited, clean and produce complete coverage.

3.5 Dielectric withstanding voltage (at atmospheric pressure). When headers are tested as specified in 4.7.2, they shall withstand the test voltages specified therein without damage, and there shall be no leakage current in excess of 100 microampere nor evidence of damage due to arcing (air discharge), flashover (surface discharge), or insulation breakdown (puncture discharge).

3.6 Insulation resistance. When headers are tested as specified in 4.7.3, the insulation resistance shall be not less than 10,000 megohms, unless otherwise specified (see 3.1).

3.7 Seal (hermetic). When headers are tested as specified in 4.7.4, there shall be no leakage in excess of the value specified (see table II and 3.1).

3.8 Thermal shock. When headers are tested as specified in 4.7.5, the insulation resistance shall be not less than 1,000 megohms at the high temperature extreme, unless otherwise specified (see 3.1 and 6.1) Following this test, there shall be no cracking, peeling, or flaking of the finish and the dielectric withstanding voltage at atmospheric pressure shall be as specified in 3.5.

3.9 Salt spray (corrosion). When headers are tested as specified in 4.7.6, there shall be no evidence of peeling, chipping, or blistering of the finish, nor exposure of base metal. Following this test the dielectric withstanding voltage at atmospheric pressure and insulation resistance shall be as specified in 3.5 and 3.6

3.10 Terminal strength. When headers are tested as specified in 4.7.7, there shall be no evidence of loosening or breaking of the terminal, and there shall be no deformation to the threads of screw terminals, nor shall there be any other damage which would adversely affect the normal use of the header. Bending of plug-in terminals shall not be construed as damage, provided they can be reformed in a manner to permit proper mating with the applicable socket. Bending of other

terminals shall not be construed as damage; chipping of the meniscus around the terminal shall not be construed as damage, provided the header seal leak rate is not in excess of the specified value (see table II, 3.1, and 3.7).

3.11 Moisture resistance. When headers are tested as specified in 4.7.8, there shall be no evidence of breaking, cracking, chipping, or loosening of the terminals. After the 24-hour drying period, the dielectric withstanding voltage, insulation resistance, and seal shall be as specified in 3.5, 3.6, and 3.7, respectively.

3.12 Solderability (applicable to solderable terminals). When headers are tested as specified in 4.7.9, all solderable surfaces including pin terminals shall be at least 95 percent covered with a continuous new solder coating. The remaining 5 percent may contain only small pin holes or rough spots (these shall not be concentrated in one area). Bare base metal where the solder dip failed to cover the original coating is an indication of poor solderability, and shall be cause for failure. For solder-lug terminals, 95 percent of the total length of fillet, which is between the standard wrap wire and the terminal shall be tangent to the surface of the terminal being tested, and shall be free of pinholes, voids. A ragged or interrupted line at the point of tangency between the fillet and the terminal under test shall be considered a failure.

3.13 Resistance to soldering heat (applicable to solder terminals). When headers are tested as specified in 4.7.10, the insulation resistance (see 3.6) shall be not less than 1,000 megohms nor shall the maximum leak rate exceed the value specified (see table II, 3.1, and 3.7).

3.14 Workmanship - Headers shall be manufactured and processed in a careful and workmanlike manner. They shall be free from dirt, grease, loose and deposited foreign materials, holes, chips or malformation.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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 Test Equipment and Inspection Facilities - Test and measuring equipment and facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection shall be established and maintained by the supplier. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-C-45662.

TABLE V MATERIALS INSPECTION

Ceramic	3.3.2.1	MIL-I-10
Glass	3.3.2.2	MIL-I-10
Chromium (electrodeposited)	3.3.4	QQ-C-320
Nickel (electroless)	3.3.4	MIL-C-26074
Copper (electrodeposited)	3.3.4	MIL-C-14550
Sulfamate nickel (electrodeposited)	3.3.4	QQ-N-290
Tin (electrodeposited)1/	3.3.4	MIL-T-10727 followed by a flow process
Silver	3.3.4	QQ-S-365
Solder	3.3.4	QQ-S-571
Gold (electrodeposited)	3.3.4	MIL-G-45204

1/ Bright tin, tintilate, or other electrodeposited methods incorporating organic brightness shall not be used on internal surface of headers for electromechanical switching devices

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

(a) Materials inspection (see 4.3).

(b) First article inspection (see 4.5).

(c) Quality conformance inspection (see 4.6).

(d) Inspection of preparation for delivery (see 4.6.5)

4.3 Materials inspection. Materials inspection shall consist of certification supported by verifying data that the materials listed in table V, used in fabricating the hermetically sealed headers, are in accordance with the applicable referenced specifications or requirements prior to such fabrication.

4.4 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the "GENERAL REQUIREMENTS" of MIL-STD-202.

4.5 First article inspection. First article inspection shall be performed by the supplier, after award of contract and prior to production, at a location acceptable to the Government. First article inspection shall be performed on sample units which have been produced with equipment and procedures normally used in production.

4.5.1 Sample size. Fifteen headers shall be subjected to first article inspection.

4.5.2 Inspection routine. The sample shall be subjected to the inspections specified in table VI, in the order shown. All sample units shall be subjected to the inspections of group I. The sample shall then be divided equally into three groups of five units each and subjected to the inspection for their particular group.

4.5.3 Failures. One or more failures shall be cause for refusal to grant first article approval.

4.6 Quality conformance inspection.

4.6.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspections. Except as specified in 4.6.4.4, delivery of products which have passed the group A inspection shall not be delayed pending the results of group B inspection.

4.6.2 Inspection lot. An inspection lot shall consist of all the headers of the same body (size, materials, and finish), the same insulators, the same terminals (with allowable variations in terminal types, provided they are of the same material diameter and finish), utilizing the basic manufacturing process requirements, produced under essentially the same conditions, and offered for inspection at one time.

4.6.3 Group A inspection. Group A inspection shall consist of the examination and tests specified in table VII, in the order shown.

4.6.3.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality level (AQL) shall be as specified in table VII. Major and minor defects shall be as defined in MIL-STD-105

4.6.3.2 Rejected lots. If an inspection lot is rejected, the supplier may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

TABLE VI. First article inspection.

Examination or test	Requirement paragraph	Method paragraph	Number of sample units to be inspected	Number of failures
Group I				
Visual and mechanical examination	3.1, 3.3, 3.4, 3.15	4.7.1	15	0
Dielectric withstanding voltage	3.5	4.7.2		
Insulation resistance	3.6	4.7.3		
Seal (hermetic)	3.7	4.7.4		
Group II				
Salt spray	3.9	4.7.6	5	
Dielectric withstanding voltage	3.5	4.7.2		
Insulation resistance	3.6	4.7.3		
Terminal strength	3.10	4.7.7		
Seal	3.7	4.7.4		
Group III				
Thermal Shock	3.8	4.7.5	5	
Moisture resistance	3.11	4.7.8		
Dielectric withstanding voltage	3.5	4.7.2		
Insulation resistance	3.6	4.7.3		
Seal	3.7	4.7.4		
Group IV				
Solderability (when applicable)	3.12	4.7.9	5	
Resistance to solder heat (when applicable)	3.13	4.7.10		
Insulation resistance	3.6	4.7.3		
Seal	3.7	4.7.4		
Terminal strength	3.10	4.7.7		
Seal	3.7	4.7.4		

TABLE VII. Group A inspection.

Examination or test	Requirement paragraph	Test method paragraph	AQL (percent defective)	
			Major	Minor
Visual & mechanical examination	3.1, 3.3, 3.4, 3.15	4.7.1	1.0	4.0
Dielectric withstanding voltage	3.5	4.7.2	1.0	
Insulation resistance	3.6	4.7.3		
Seal	3.7	4.7.4		

4.6.4 Group B inspection. Group B inspection shall consist of the examinations and tests specified in table VIII, in the order shown, and the sample shall be selected from inspection lots that have passed group A inspection.

TABLE VIII GROUP B INSPECTION

Examination or test	Requirement paragraph	Method paragraph
Group I (1/3 of sample)		
Salt spray	3.9	4.7.6
Dielectric withstanding voltage	3.5	4.7.2
Insulation resistance	3.6	4.7.3
Terminal strength	3.10	4.7.7
Seal	3.7	4.7.4
Group II (1/3 of sample)		
Thermal Shock	3.8	4.7.5
Moisture resistance	3.11	4.7.8
Dielectric withstanding voltage	3.5	4.7.2
Insulation resistance	3.6	4.7.3
Seal	3.7	4.7.4
Group III (1/3 of sample)		
Solderability (when applicable)	3.12	4.7.9
Resistance to solder heat (when applicable)	3.13	4.7.10
Insulation resistance	3.6	4.7.3
Seal	3.7	4.7.4
Terminal strength	3.10	4.7.7
Seal	3.7	4.7.4

4.6.4.1 Sampling Plan - The sampling plan shall be in accordance with MIL-STD-105 for special inspection level S2. The A.Q.L. shall be 4.0 (percent defective) for all group B tests combined.

4.6.4.2 - Disposition of sample units. Sample units which have been subjected to Group B inspection shall not be delivered on the contract or order.

4.6.4.3 - Rejected lots. If an inspection lot is rejected, the supplier may withdraw the lot from further inspection. The supplier may also rework a rejected lot to correct the defects or screen out 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.

4.6.5 Inspection of preparation for delivery. Sample packages and packs and the inspection of the preservation and packaging, packing and marking for shipment and storage shall be in accordance with the requirements of section 5.

4.7 Methods of examination and test.

4.7.1 Visual and mechanical examination. Headers shall be examined to verify that the materials finishes, design, construction, physical dimensions, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3, 3.4, and 3.15). During visual inspections the use of a 10-power magnification is required. Prior to examination, the header shall be precleaned using one part by volume of isopropyl alcohol, grade A or B of TT-I-735, and three parts by volume of paint thinner, grade 1 of TT-T-291 or dry cleaning solvent, type I of P-D-680.

4.7.2 Dielectric withstanding voltage (at atmospheric pressure) (see 3.5). Headers shall be tested in accordance with method 301 of MIL-STD-202. The following details shall apply:

(a) Test voltage - 1250 ±50 volts RMS, 60 Hz, unless otherwise specified (see 3.1).

(b) Duration of applications - 60 ±5 seconds for first article and group B tests; 5 seconds for group A tests.

(c) Points of application - Test voltages shall be applied between the body casing and all insulated terminals and between all adjacent mutually insulated terminals.

(d) Maximum leakage current - 0.5 milliampere.

(d) Examination after test - Headers shall be examined for evidence of arcing, flashover, breakdown of insulation, and damage.

4.7.3 Insulation resistance (see 3.6). Headers shall be tested in accordance with method 302 of MIL-STD-202. The following details shall apply:

(a) Test-condition letter - B.

(b) Points of measurement - Measurements shall be made between the body and all insulated terminals and between all adjacent mutually insulated terminals.

4.7.4 Seal (hermetic) (see 3.7). Headers shall be tested in accordance with method 112 of MIL-STD-202. The following details shall apply:

(a) Test condition letter - C, procedure IIIa or IIIb.

(b) Leakage-rate sensitivity - as specified (see 3.1).

4.7.5 Thermal shock (see 3.8). Headers shall be tested in accordance with method 107 of MIL-STD-202. The following details shall apply:

(a) Special mounting - Headers shall be suspended in the test chamber by twine or other nonheat-conducting material in a plane parallel to normal air flow.

(b) Test-condition letter - B or C, as applicable (see table I).

(c) Measurements after cycling - Headers shall be examined for cracking, peeling, and flaking of finish, and dielectric withstanding voltage and insulation resistance shall be measured as specified in 4.7.2 and 4.7.3 respectively.

4.7.6 Salt spray (corrosion) (see 3.9). Headers shall be tested in accordance with method 101 of MIL-STD-202. The following details and exceptions shall apply:

(a) Test-condition letter - B.

(b) Measurements after exposure - Headers shall be washed and then air dried for 24 hours. After the 24-hour drying period, the dielectric withstanding voltage at atmospheric pressure and insulation resistance shall be measured as specified in 4.7.2 and 4.7.3, respectively.

(c) Examination after test - Headers shall be examined for evidence of corrosion, pitting, chipping, blistering of finish, and exposure of base metal.

4.7.7 Terminal strength (see 3.10). Headers shall be tested in accordance with the following as applicable. Unless otherwise specified herein, two terminals of each discrete design, material, size and configuration shall be tested. However, if there be only one of such a design, material, size and configuration, it shall be tested. Following this test, seal shall be tested as specified in 4.7.4.

4.7.7.1 Pull test (all terminal types). Terminals shall be tested in accordance with method 211 of MIL-STD-202, test-condition letter A. The specified force (see table IX shall be applied in the direction of the axes of the termination.

TABLE IX. Pull test.

Terminal dia	Seal length .050 (1.27mm)	.060 (1.52mm)	.080 (2.03mm)	.090 (2.29mm)	.125 (3.18mm)	.145 (3.68mm)
<.026 (.66mm)	3 (1.36)	5 (2.27)	5 (2.27)	5 (2.27)		
.027 - .035 (.69mm - .89mm)	8 (3.63)	12 (5.45)	20 (9.08)	20 (9.08)	22 (9.99)	24 (10.90)
.036 - .045 (.91mm - 1.14mm)	10 (4.54)	16 (7.26)	35 (15.89)	35 (15.89)	40 (18.16)	44 (19.98)
.046 - .060 (1.17mm - 1.52mm)	15 (6.81)	25 (11.35)	55 (24.97)	57 (25.89)	65 (29.51)	70 (31.78)

Pull, lbs (kg)

4.7.7.2 Bend test (flat/tab terminals). Flat/tab terminals shall be tested in accordance with method 211 of MIL-STD-202, test-condition letter B, for total of two complete bends (+45° to 0° to -45° to 0° and repeat).

4.7.7.3 Twist test (straight wire terminals). All straight wire terminals shall be tested in accordance with method 211 of MIL-STD-202, test-condition letter D, except each terminal shall be rotated 45° clockwise, 90° counterclockwise and 45° clockwise. Each terminal shall be subjected to two complete twist cycles (twist test shall not apply to straight wire terminals having a diameter greater than 0.036 inch).

4.7.7.4 Torque test (screw terminals only). All terminals shall be tested in accordance with method 211 of MIL-STD-202, test-condition letter E, except as follows:

Screw size	Torque (lb-in.)
4-40	4.4
6-32	10.0
8-32	20.0
10-32	32.0
10-24	35.0

4.7.8 Moisture resistance (see 3.11). Headers shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply:

(a) Mounting - On a corrosion-resistant panel by normal mounting means

(b) Initial measurements - Not applicable.

(c) Polarization - During steps 1 to 6 inclusive, a polarizing voltage of 100 volts dc shall be applied between all terminals tied together and the metal panel. The negative polarity shall be applied to the metal panel. Steps 7a and 7b are not applicable.

(d) Final measurements - Upon completion of step 6 of the final cycle, the insulation resistance shall be measured as specified in 4.7.3. After a 24-hour drying period, the dielectric withstanding voltage at atmospheric pressure, insulation resistance, and seal shall be measured as specified in 4.7.2, 4.7.3, and 4.7.4, respectively.

(e) Examinations during final measurement and after test - Headers shall be examined for evidence of corrosion, breaking, cracking, or spalling. Mounting hardware shall be removed at the end of the test.

4.7.9 Solderability (applicable to solder terminals) (see 3.12). Headers with solderable surfaces shall be tested in accordance with method 208 of MIL-STD-202. The following details shall apply:

(a) Number of termination of each part to be tested - All.

(b) Depth of immersion in flux and solder - Terminals shall be immersed to within 1/16-inch of the insulator or body, whichever is the lesser.

4.7.10 Resistance to soldering heat (applicable to solderable terminals) (see 3.13). Headers shall be tested in accordance with method 210 of MIL-STD-202. The following details and exceptions shall apply:

(a) Depth of immersion in molded solder - Within 0.060 ±0.20 inch of the insulator or body, whichever is the lesser.

(b) Test condition letter - B.

(c) Measurements after test - Insulation resistance and seal shall be tested as specified in 4.7.3 and 4.7.4, respectively.

5. PREPARATION FOR DELIVERY

(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 or order. Preparation for delivery requirements for products procured by contractors shall be specified in the individual order.)

5.1 Preservation and packaging. Preservation and packaging shall be level A or C, as specified (see 6.1).

5.1.1 Level A.

5.1.1.1 Cleaning. Headers shall be cleaned in accordance with MIL-P-116, process C-1

5.1.1.2 Drying. Headers shall be dried in accordance with MIL-P-116.

5.1.1.3 Preservative application. None required.

5.1.1.4 Unit packaging. Headers shall be individually packaged in accordance with MIL-P-116, method III insuring compliance with the general requirements paragraph under methods of preservation (unit protection) and the physical protection requirements paragraph therein.

5.1.1.5 Intermediate packaging. Headers, packaged as described in 5.1.1.4, shall be placed in intermediate containers conforming to PPP-B-566 or PPP-B-676. Intermediate containers shall be uniform in size, shape and quantities, shall be of minimum tare and cube, and shall contain multiples of five unit packages, not to exceed 50 packages. No intermediate packaging is required when the total quantity shipped to a single destination is less than 50 unit packages.

5.1.2 Level C. Cleaned and dried headers shall be packaged in a manner that will afford adequate protection against corrosion, deterioration and physical damage during shipment from supply source to the first receiving activity.

5.2 Packing. Packing shall be level A, B, or C, as specified (see 6.1).

5.2.1 Level A. The packaged headers shall be packed in fiberboard containers conforming to PPP-B-636, class weather resistant, style optional, special requirements. In lieu of the closure and waterproofing requirements in the appendix of PPP-B-636, closure and waterproofing shall be accomplished by sealing all seams, corners, and manufacturer's joint with tape, 2 inches minimum width, conforming to PPP-T-60, class 1 or PPP-T-76. Banding (reinforcement requirements) shall be applied in accordance with the appendix to PPP-B-636 using nonmetallic or tape banding only.

5.2.2 Level B. The packaged headers shall be packed in fiberboard containers conforming to PPP-B-636, class domestic, style optional, special requirements. Closures shall be in accordance with the appendix thereto. For Army procurement, fiberboard containers shall be class weather-resistant as specified in level A.

5.2.3 Level C. The packaged headers shall be packed in shipping containers in a manner that will afford adequate protection against damage during direct shipment from the supply source to the first receiving activity. These packs shall conform to the applicable carrier rules and regulations.

5.3 Marking. In addition to any special marking required by the contract or order, each unit package, intermediate and exterior container shall be marked in accordance with MIL-STD-129.

5.4 General.

5.4.1 Exterior containers. Exterior containers (see 5.2.1, 5.2.2 and 5.2.3) shall be of a minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered items to the greatest extent practicable.

5.4.2 Navy procurements. For Navy procurements the use of polystyrene loose fill material (such as strips, strand, and beads) is prohibited for packaging and packing applications.

6. NOTES

6.1 Ordering data. Procurement documents should specify the following:

(a) Title, number and date of this specification.

(b) Sealing process required (see 1.2.1).

(c) Applicable temperature range (see 1.2.2).

(d) Sealing characteristic required (see 1.2.3).

(e) Design and construction (see 3.4)

(f) Levels of preservation and packaging and packing, and applicable marking (see section 5).

6.2 Definitions. The following definitions are applicable to terms used in this specification.

6.2.1 Blemish. A stained or discolored area attributable to normal composition and/or forming Whenever the presence of foreign material is suspected, the definition inclusion' applies.

6.2.2 Inclusion. Foreign material imbedded within the ceramic or a stain other than from normal composition and forming.

6.2.3 Blister. A bubble or gaseous inclusion at the surface which if broken could form a pit, pock, or hole.

6.2.4 Burr. A fragment of excess material or foreign particle adhering to the surface.

6.2.5 Chip. An area along an edge or corner where the material has broken off.

6.2.6 Closed chip. A fractured area on the edge or corner of a ceramic when the material has not broken off.

6.2.7 Crack. A line of fracture in the ceramic without complete separation.

6.2.8 Hole. A depression in the surface of the ceramic, the bottom of which is not visible by normal (20/20) vision under 200 foot candles of illumination.

6.2.9 Pit. A shallow surface depression or crater.

6.2.10 Pock. A partially closed cavity on the surface.

6.2.11 Pore. An internal cavity which may be exposed by cutting, grinding, or polishing to become a pit, pock or hole.

6.2.12 Surface marks. Relatively long, narrow, shallow, groove or cut in the surface.

6.3 First article. Invitations for bids should provide that the Government reserves the right to waive the requirement for first article samples as to those bidders offering a product which has been previously procured 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 procurement.

6.4 Intermetallic contact. The finishing of metallic areas to be placed in intimate contact by assembly presents a special problem, since intermetallic contact of dissimilar metals results in electrolytic couples which promote corrosion through galvanic action. To provide the required corrosion protection, intermetallic couples are restricted to those permitted by table X. Table X shows metals and alloys (or plates) by groups which have common electromotive forces (EMF) within 0.05 volt when coupled with a saturated calomel electrode in sea-water at room ambient temperatures. All members of a group are considered as completely compatible, one with the other. Compatible couples between groups have been specified in table X based on a potential difference of 0.25 volt maximum. To simplify any arithmetic involved, table X shows, in addition to EMF against a calomel electrode, a derived "anodic index" with Group 1 (gold, etc.) as 0 and Group 18 (magnesium, etc.) as 175. Subtraction of a lower group anodic index gives the EMF difference in hundredths of a volt.

6.4.1 Groups. Table X sets up 18 primary groups. It may be noted that neither the metallurgical similarity or dissimilarity of metals is the parameter for selection of compatible couples. All members within a group, regardless of metallurgical similarity, are considered inherently nonsusceptible to galvanic action, when coupled with any member within the group; for example, such dissimilar metals as platinum and gold. Similarly, such basically dissimilar alloys as austenitic stainless steel, silver-solder, and low brass (all members of Group 5) are inherently nonsusceptible when coupled together.

6.4.2 Compatibility graphs. Permissible couple series are shown in table X by the graphs at the right. Members of groups connected by lines will form permissible couples. A O indicates the most cathode member of each series, a O an anodic member, and the arrow indicates the anodic direction.

6.4.3 Selection of compatible couples. Proper selection of metals in the design of equipment will result in fewer intermetallic contact problems. For example, for sheltered exposure, neither silver nor tin require protective finishes. However, since silver has an anodic index of 15 and tin 65, the EMF generated as a couple is 0.50 volt, which is not allowable by table X. In this case, other metals or plates will be required. It should be noted that, in intermetallic couples, the member with the higher anodic index is anodic to the member with the lower anodic index and will be ussectible to corrosion in the presence of an electrolytic medium. If the surface area of the cathodic part is significantly greater than that of the anodic part, the corrosive attack on the contact area of the anodic part may be greatly intensified. Material selection for intermetallic contact parts, therefore, should establish the smaller part as the cathodic member of the couple, whenever practicable.

6.4.4 Plating. When base metals intended for intermetallic contact form couples not allowed by table X they are to be plated with those metals which will reduce the potential difference to that allowed by table X.

TABLE X. Compatible couples 1/ (see 6.4).

Group No	Metallurgical category	EMF (volt)	Anodic index (0.01 v)	Compatible couples
1	Gold, solid and plated, gold-platinum alloys, wrought platinum (most cathodic)	+0.15	0	
2	Rhodium plated on silver-plated copper	+0.05	10	
3	Silver, solid or plated, high silver alloys	0	15	
4	Nickel, solid or plated, monel metal, high nickel-copper alloys	-0.15	30	
5	Copper, solid or plated, low brasses or bronzes, silver solder, German silver, high copper-nickel alloys, nickel-chromium alloys; austenitic corrosion-resistant steels	-0.20	35	
6	Commercial yellow brasses and bronzes	-0.25	40	
7	High brasses and bronzes, naval brass, Muntz metal	-0.30	45	
8	18 percent chromium type corrosion-resistant steels	-0.35	50	
9	Chromium, plated, tin, plated, 12 percent chromium type corrosion-resistant steels	-0.45	60	
10	Tin-plate, terneplate, tin-lead solder	-0.50	65	
11	Lead, solid or plated, high lead alloys	-0.55	70	
12	Aluminum, wrought alloys of the duralumin type	-0.60	75	
13	Iron, wrought, gray, or malleable, plain carbon and low alloy steels, armco iron	-0.70	85	
14	Aluminum, wrought alloys other than duralumin type, aluminum, case alloys of the silicon type	-0.75	90	
15	Aluminum, cast alloys other than silicon type, cadmium, plated and chromated	-0.80	95	
16	Hot-dip-zinc plate galvanized steel	-1.05	120	
17	Zinc, wrought, zinc-base die-casting alloys zinc plated	-1.10	125	
18	Magnesium and magnesium-base alloys, cast or wrought (most anodic)	-1.60	175	

1/ Compatible couples - potential difference of 0.25 volt maximum between groups

Custodians
Army - EL
Navy - EC
Air Force - 85

Review activities:
Army - EL, MU
Navy - SH, AS, OS
Air Force - 11, 17, 85
DSA - ES

User activities.
Army - AT, ME, AV
Navy - MC
Air Force -

Preparing activity:
Navy - EC

Agent
DSA - ES

(Project 5940-0261)

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MATERIAL PROCURED UNDER A

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A GIVE PARAGRAPH NUMBER AND WORDING

B RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

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