REVISIONS			
SYMBOL	DESCRIPTION	DATE	APPROVAL
—	RELEASED	9/5/91	S.A. Naus

SHEET REVISION STATUS

SH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
REV	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SH	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
REV	--	--	--	--	--	--														

ORIGINATOR T.J. Perry T.J. Perry/Unisys	DATE 7/9/91	FSC: 5935
APPROVED S.E. Archer-Davies/Unisys	7-9-91	Connectors, Electrical, Rectangular, Polarized Shell, For Space Flight Use, Detail Specification For
CODE 311 APPROVAL S.A. Naus/GSFC S.A. Naus	7/22/91	
CODE 311 SUPERVISORY APVL D.G. Cleveland/GSFC D.G. Cleveland	7/22/91	
ADDITIONAL APPROVAL Code 408 Daniel R Mangra	8/29/91	S-311-P-718

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND 20771

CAGE CODE: 25306

1. SCOPE

1.1 Purpose. This specification covers the general provisions for multi-contact electrical connectors with crimp-type removable contacts capable of continuous operation in a space environment within a temperature range of -65° to +125°C. They are intended to be used for power and signal interfaces between the main structure and subsystem modules of a large spacecraft designed for in-orbit replacement of modules. The connectors will also be used to provide the required electrical interfacing between the main spacecraft structure and the launch vehicle interface.

1.2 GSFC detail specification. Specific connector, backshell and contact series provisions are described in the applicable GSFC detail specifications. The type designations for connectors, backshells and contacts shall be as specified in the applicable GSFC detail specification.

2. APPLICABLE DOCUMENTS

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

2.1 Specifications.

2.1.1 Federal.

None

2.1.2 Military.

MIL-C-38999	Connectors, Electrical, Circular, Miniature, High Density, Quick Disconnect (Bayonet, Threaded, and Breech Coupling), Environment Resistant, Removable Crimp and Hermetic Solder Contacts, General Specification For
MIL-I-17214	Indicator, Permeability: Low-Mu (Go-No-Go)
MIL-Q-9858	Quality Program Requirements

2.1.3 NASA/Goddard.

S-311-P-718/4	Backshell Kits, Connector, Rectangular, EMI Shielding, Strain Relief (Sizes 1, 2, 3) for Space Flight Use, Detail Specification For

2.2 Standards.

MIL-STD-130	Marking of U.S. Government Property
MIL-STD-202	Testing Methods for Electronic and Electrical Parts
MIL-STD-454	Standard General Requirements for Electronic Equipment
MIL-STD-1285	Marking of Electrical and Electronic Parts
MIL-STD-889	Dissimilar Metals
MIL-STD-1344	Test Methods for Electrical Connectors

2.3 Other publications.

ASTM E595	Standard Test Method Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment

2.4 Copies of documents. Copies of federal and military documents can be obtained from the Standardization Document Order Desk, 700 Robbins Avenue, Building #4-Section D, Philadelphia, PA 19111-5094. Copies of ASTM publications are available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

2.5 Order of precedence. In the event of any conflict between the text of this specification and the detail specification, the detail specification shall have precedence. In the event of any conflict between the text of this specification or the detail specification and the references cited herein, the text of this specification or detail specification shall take precedence. However, nothing in this text shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

Individual connector, backshell and contact requirements shall be as specified herein and in accordance with the applicable detail specifications (1.2).

3.1 Qualification. Connectors, backshells and contacts furnished under the specification shall be products which have been granted qualification approval by GSFC. Qualification approval shall be based on the following:

3.1.1 Design and source approval. Before qualification under this specification, the manufacturer's facilities shall be subject to survey (at the option of GSFC by he Office of Flight

Assurance, GSFC). Compliance with Specification MIL-Q-9858 is required. In addition, the history and detailed engineering of the specific connector design will be reviewed, as will the documented manufacturing and quality control procedures. Only those sources approved in the design and source approval phase shall be eligible for qualification or award of contract under this specification. Source approval and design approval do not constitute part qualification or an equivalent thereof.

3.1.2 Part qualification. Connectors, contacts and backshells shall be products which have passed the qualification inspection requirements of this specification.

3.2 Loss of qualification status and applying for requalification.

3.2.1 Loss of qualification. Qualification status shall be withdrawn following any change in the design, processing, materials, or quality-control procedures which in the opinion of the GSFC Parts Branch significantly departs from those used on the qualified part. In addition, qualification status may be withdrawn as a result of discrepancies noted by GSFC, the procuring activity, or for failures experienced in equipment which are attributable to the manufacturer's part.

3.2.2 Applying for requalification. The manufacturer may apply for requalification of this part after he has demonstrated that satisfactory measures were taken to correct the conditions leading to his loss of qualification and after he complies with all standard qualification prerequisites as defined by the GSFC Parts Branch.

3.3 Identification.

3.3.1 Connector, backshell and contact identification. The connector item identification consists of the type designation (1.2), the date-lot identification, and serial numbers (3.3.2). Contacts shall be color banded as specified in the detail specification. Backshells shall be identified by a type designation and date lot code.

3.3.2 Date-lot identification. The manufacturer shall be responsible for the assignment of a date and lot identification code per MIL-STD-1285 which will reflect the year and week of production and the numerical order of the lot produced during the week of production. A serial number shall also be assigned by the manufacturer, so as to uniquely identify a specific connector.

3.4 Materials, design, and construction. Connectors, backshells and contacts shall be of the materials, design, construction, and physical dimensions as specified herein and in the detail

specification (1.2). Materials and finishes not specified which are known to sublimate in a hard vacuum, such as cadmium, shall not be used. Finishes shall be uniform in appearance and free from breaks, scratches, and other defects which will reduce the serviceability of the parts.

3.4.1 Materials.

3.4.1.1 Nonmagnetic materials. For the applicable level of residual magnetism, the materials used shall be nonmagnetic insofar as the state-of-the-art permits. In no case shall a material be used which will prevent the finished product from meeting the residual magnetism requirements of the detail specification.

3.4.1.2 Dissimilar metals. Dissimilar metals, as defined in MIL-STD-889, shall not be used in intimate contact with each other without suitable protection against electrolytic corrosion in accordance with requirement 16 of MIL-STD-454.

3.4.2 Insert design. The insert shall be a one piece design with proper sections and radii to prevent chipping, cracking, or breaking in assembly or in normal use. Inserts shall not be hollowed out. Pin-entry openings and chamfers on socket insert faces shall be as small as practicable. The insert engaging faces shall be as designed and constructed such that all air paths between cavities at the connector interfaces are eliminated when the connectors are mated. The socket insert face shall be of a rigid plastic material. The insert shall be so designed that positive locking of the contacts in the insert is provided.

3.4.3 Interchangeability. Connectors, backshells and contacts having the same respective type designation shall be completely interchangeable with each other under this specification.

3.4.4 Connector, backshell and contact dimensions. Connector, backshell and contact dimensions and tolerances shall be as specified in 1.2. Tolerances include allowances for warpage and shrinkage.

3.5 Identification marking. Each connector and backshell shall be permanently and legibly marked per MIL-STD-130 (3.3.1). Connectors failing to meet all the requirements of this specification shall not have the connector or backshell identification established under 3.3.1 unless otherwise authorized by GSFC.

3.6 Performance (1.2).

3.6.1 Insulation resistance (IR). When specified, connectors shall be tested in accordance with 4.9.1. The minimum value of

insulation resistance between any two contacts and any contact to shell shall be 5000 megohms.

3.6.2 Dieletric-withstanding voltage (DWV). When specified, connectors shall show no evidence of damage, arcing, or breakdown when tested in accordance with 4.9.2, using the voltages specified in the detail specification.

3.6.3 Mating and unmating forces. When specified, connectors shall be tested in accordance with 4.9.3. The forces required to mate and unmate the connectors shall not exceed the limits specified in the detail specification. The connectors used in this test shall have a complete complement of contacts.

3.6.4 Contact retention (in insert). When specified, connectors and contacts shall be tested in accordance with 4.9.4. The connectors shall meet the limits specified in the detail specification.

3.6.5 Insert retention (in shell). When specified, connectors shall be tested in accordance with 4.9.5. The connector inserts shall not be dislodged from their normal position within their shells when a load, as specified in the detail specification, is applied.

3.6.6 Vibration. When specified, connectors shall be tested in accordance with 4.9.6. Mated connectors shall not be damaged and there shall be no loosening of parts caused by vibration. Counterpart connectors shall be retained in full engagement and there shall be no interruption of electrical continuity longer than 10 microseconds.

3.6.7 Physical shock. When specified, connectors shall be tested in accordance with 4.9.7. Mated connectors shall not be damaged and there shall be no loosening of parts caused by shock. Counterpart connectors shall be retained in full engagement and there shall be no interruption of electrical continuity longer than 10 microseconds.

3.6.8 Thermal shock. When specified, connectors shall be tested in accordance with 4.9.8. The connectors shall show no evidence of physical damage. Following the thermal shock test, the connectors shall withstand the sea-level dielectric-withstanding voltage test of 3.6.2.

3.6.9 Salt spray (corrosion). When specified, connectors shall be tested in accordance with 4.9.9. The connectors shall show no visible evidence of exposure of base metal that would interfere with their normal operation.

3.6.10 Moisture resistance. When specified, connectors shall be tested in accordance with 4.9.10. The connectors shall withstand

the sea-level dielectric-withstanding voltage test of 3.6.2. The insulation resistance shall be 1000 megohms, minimum, measured in accordance with 3.6.1. The connectors shall show no evidence of physical damage.

3.6.11 Residual magnetism. When specified, connectors shall be tested in accordance with 4.9.11. The relative permeability of connectors, with contacts installed but unwired, shall be less than 2.

3.6.12 Examination of product. When specified, connectors, backshells and contacts shall be examined to ensure conformance with all requirements of this and the detail specification. Examination shall be performed to assure compliance with the following requirements:

(a) Dimensions
(b) Materials
(c) Design and construction
(d) Weight
(e) Platings (finishes)

— Applicable portions of this and applicable detail specification

(f) Identification (3.3)
(g) Interchangeability (3.4.3)

3.6.13 Workmanship. When specified, connectors and backshells shall be examined under 3X magnification and contacts under 10X (minimum) and high-intensity light, and rejected for the following defects:

3.6.13.1 Shells, backshells and/or hardware.

(a) Any evidence of spotting or film formation (e.g., dark spots, blotches, and lines)
(b) Damaged or improperly processed (e.g., dents and bends)
(c) Metallic or nonmetallic contamination
(d) Plating defects (e.g., peeling, chipping, and voids)
(e) Improper or damaged marking

3.6.13.2 Inserts and seals.

(a) Discoloration

(b) Cracking or chipping

(c) Flashes larger than 0.005 inch (hard insulators); 0.010 inch (resilient insulators)

(d) Metallic or nonmetallic contamination (dust or other contaminants)

(e) Improper or damaged marking

(f) Damaged or improperly processed

NOTE: Minor surface chips are permissible if they are only a matter of appearance. Cracks having any indication of entering the mass of the insulator are not acceptable.

3.6.13.3 Contacts.

(a) Any evidence of spotting or film formation (e.g., dark spots, blotches, and lines)

(b) Damaged or improperly processed

(c) Burrs larger than 0.003 inch

(d) Plating defects (e.g., peeling, chipping, and voids)

(e) Metallic or nonmetallic contamination

(f) Absence of sleeve on socket contacts (if applicable)

3.6.14 Vacuum effects (material outgassing). When specified, materials shall be tested in accordance with 4.9.12. Material outgassing shall not exceed the limits specified in the detail specification.

3.6.15 Dry circuit. When specified, connectors shall be tested in accordance with 4.9.13. A minimum of 20 percent, but not less than four contact pairs of each connector shall be tested, except the coaxial contacts.

3.6.16 Contact resistance. When specified, connectors shall be tested in accordance with 4.9.14. A minimum of 20 percent but not less than four contact pairs of each contact type from each contact arrangement shall be tested. However, when the quantity of a specific contact type is less than four, all contacts shall be tested. The contact resistance shall not exceed the limits specified in the detail specification.

3.6.17 Contact engagement and separation. When specified, socket contacts shall be tested in accordance with 4.9.15. A minimum of 20 percent, but not less than four contacts from each connector shall be tested. Contact forces shall conform to those specified in the detail specification.

3.6.18 Durability. When specified, connectors shall be tested in accordance with 4.9.16. After the 250th cycle the mating and unmating forces (3.6.3) and the contact resistance (3.6.16) shall be met, except for the coaxial contacts.

3.6.19 Maintenance aging. When specified, connectors and contacts shall be tested in accordance with 4.9.17. Connectors and contacts then shall be capable of passing the contact-retention test (3.6.4) after the 10th insertion.

3.6.20 Coaxial contacts. When specified, coaxial contacts shall be tested in accordance with 4.9.18. Contacts shall be subjected to DWV, IR, Nominal Impedance and Voltage Standing Wave Ratio (VSWR) over the frequency range specified.

3.6.21 RF leakage. When coaxial contacts are tested as specified in 4.9.19 the total leakage, contact-to-contact, shall be down 60db. Three sets (1 set = 2 contact pairs) of each contact style (designator 14 and 5) shall be tested.

3.6.22 EMI effectiveness (applicable only to connectors equipped with EMI spring fingers). When tested as specified in 4.9.20, mated connectors equipped with the appropriate backshells as defined in GSFC S-311-P-718/4 shall exhibit a leakage attenuation (db) minimum of 60 over the frequency range of from 10KHz to 100 MHz and 40 over the frequency range of from 100 MHz to 10 GHz.

3.6.23 Shell to shell conductivity (applicable only to connectors equipped with EMI spring fingers). When tested as specified in 4.9.21, the resistance across mated connector interfaces, when measured from backshell-to-backshell, shall not exceed 0.0025 Ω/interface. The probes shall not puncture or otherwise damage the connector finish.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified, the manufacturer is responsible for the performance of all qualification and acceptance inspection requirements as specified herein and in the detail specifications. GSFC reserves the right to reinspect connectors for any requirements deemed necessary and to designate representatives for in-plant surveillance and acceptance function in connection with procurement of connectors and contacts to this and the detail specification.

4.2 Classification of inspection. The inspection of connectors and contacts shall be classified as follows:

(a) Qualification inspection (4.5)

(b) Acceptance inspection (4.6)

4.3 Inspection conditions. Unless otherwise specified, all tests, measurements, inspections, and examinations required by this and the detail specification shall be conducted under any combination of conditions within the following ranges. Any specified condition shall not affect the other two ambient ranges.

(a) Temperature - 20° to +30°C (+68° to +86°F)

(b) Relative Humidity - 30 to 80 percent

(c) Barometric pressure - 24 to 31 inches of mercury

4.4 Preparation of samples. Connectors shall be paired and each connector half shall be serialized. Connector-pairing shall be maintained throughout all tests and examinations. The quantity of samples, wire types and sizes, and other pertinent details shall be as specified in the detail specification. The samples shall be taken from a production run and shall be produced with equipment and procedures normally used in production.

4.5 Qualification inspection. Qualification inspection shall consist of the examinations and tests shown in Table I, performed in the sequence specified, and in the detail specifications.

4.5.1 Qualification objective. Qualification inspections and tests determine if the construction, design, materials, and processes employed in the manufacture of the connectors and contacts inspected allow the connectors and contacts to comply with the requirements of this and the applicable detail specification.

4.5.2 Qualification rejection. There shall be no failures in any examination or test of the connectors or contacts submitted for qualification inspection. After any failure, the activity responsible for qualification shall be notified by the manufacturer of all details related to the changes made in the connector or contacts before initiating any further tests deemed necessary to assure compliance with the connector or contract requirements of this and the applicable detail specification.

4.5.3 Qualification of additional connectors. Qualification may be granted, on the basis of similarity, to connectors or contacts which differ only in minor details from those submitted for qualification testing. Qualification is contingent on the degree

of similarity and successful evaluation of test data submitted to validate the difference.

4.5.4 Disposition of qualification sample units. Connectors or contacts subjected to qualification inspection shall not be delivered on a contract or order.

Table 1. Qualification inspection sequence.

Inspection	Requirement	Method
	Paragraph	
Examination of product	3.6.12	-
Vacuum effects (outgassing)	3.6.14	4.9.12
Workmanship	3.6.13	-
Residual magnetism	3.6.11	4.9.11
Maintenance aging	3.6.19	4.9.17
Insert retention (in shell)	3.6.5	4.9.5
Contact retention	3.6.4	4.9.4
Dielectric-withstanding voltage	3.6.2	4.9.2
Insulation resistance	3.6.1	4.9.1
Dry circuit	3.6.15	4.9.13
Crimp-contact resistance	3.6.16	4.9.14
Contact engagement and separation	3.6.17	4.9.15
Mating and unmating force	3.6.3	4.9.3
Thermal shock	3.6.8	4.9.8
Moisture resistance	3.6.10	4.9.10
Vibration	3.6.6	4.9.6
Physical shock	3.6.7	4.9.7
Durability	3.6.18	4.9.16
Salt Spray (corrosion)	3.6.9	4.9.9
Coaxial contacts	3.6.20	4.9.18
RF Leakage	3.6.21	4.9.19
EMI Effectiveness *	3.6.22	4.9.20
Shell to Shell Conductivity *	3.6.23	4.9.21

* Applicable only to connectors equipped with EMI Spring Fingers.

4.6 Acceptance inspections. Acceptance inspections shall consist of these examinations and tests:

(a) Periodic inspections (4.6.3)

(b) Final inspection (4.6.4)

NOTE: Sequence of inspections/tests is optional, except DWV shall precede IR.

4.6.1 Acceptance objective. Acceptance inspections and tests are intended to assure compliance of production connectors and contacts with the requirements of this and the detail specification.

4.6.2 Acceptance rejection. There shall be no failures in any examination or test of the connectors or contacts submitted for acceptance. If any failure results, the contractor shall take any corrective action necessary to assure compliance with this and the applicable detail specification. Acceptance inspection need not be held up, after such failure, while the manufacturer is investigating the cause of the failure and instituting corrective action. Final acceptance of connectors or contacts related to the failure shall not be made until it is determined that the items meet all requirements of this and the detail specification (4.6.4).

4.6.3 Periodic inspection. If a qualified source has been inactive, or for other reasons has not supplied GSFC with connectors or contacts for a reasonable length of time, periodic inspection of the source may be required. The inspection criteria will be determined at the time a periodic inspection is deemed necessary, and may include tests of sufficient magnitude and duration to ensure that the connectors and contacts continue to comply with the requirements of this and the applicable detail specification.

4.6.4 Final inspection. As a minimum, each connector, backshell and contact shall be 100-percent inspected for the following:

(a) Connectors - Final inspection per connector detail specification. (1.2)

(b) Contacts - Final inspection per contact detail specification. (1.2)

(c) Backshells - Final inspection per backshell detail specification. (1.2)

4.6.5 Lot rejection criteria. If, during the 100-percent final inspection, over 10 percent of either the connectors or contacts are discarded, the procuring activity shall be notified and the

respective lots shall be rejected and will not be subject to reinspection unless approval is granted by the procuring activity.

4.6.6 Retention of qualification. As a basis for retention of qualification, the manufacturer shall be requested to furnish a summary of acceptance inspection results annually. The test summary shall be submitted to the activity specified in 6.1.

4.7 Failure analysis. A failure analysis shall be performed on each connector, backshell or contact having failed during qualification inspection. The failure analysis shall be designated to isolate the cause(s) of failure and yield adequate conclusions to initiate a plan for corrective action to eliminate the cause to prevent recurrence of the type of failure mode reported (4.8.3).

4.8 Documentation and data submittal.

4.8.1 Required records. Connectors, backshells and contacts manufactured under this specification shall be supported by suitable records showing compliance with specified requirements. The manufacturer's quality-assurance personnel must certify the test and inspection results, and this fact should be indicated on a connector's, backshell's or contact's record by means of inspection stamps, signatures, or other approved methods. Records shall be linked to a specific connector, backshell and contact lot by type designation, lot-date code, and serial numbers, where applicable.

4.8.2 Final inspection report or certification. Final inspection (4.6.4) documentation shall show clearly that tests were conducted in accordance with specified requirements. The manufacturer shall certify that each connector, backshell or contact meets all applicable specification requirements. A copy of this certification shall accompany each connector, backshell or contact shipment, identifying the connectors, backshells or contacts so certified. The manufacturer shall prepare the required documentation. The original is retained by the manufacturer; two copies are forwarded to the procuring activity.

4.8.3 Failure analysis report. Two copies of the Failure Analysis Report (4.7) shall be submitted to GSFC, one copy to the address listed in 6.1, and one copy to the procuring activity. The report shall include, as a minimum, the following information:

(a) Date defect occurred

(b) Lot number, lot size, and serial number (where applicable)

(c) Connector, backshell or contact type designation

(d) Test and/or examination at which defect was first noted

(e) Failure mode

(f) Cause of failure

(g) Corrective action taken or to be taken

(h) Effect of failure on other connectors, backshells or contacts in the inspection lot

(i) Purchase orders or contracts affected

4.8.4 Document cross-reference. All documentation, whether retained or submitted by the manufacturer, shall be cross-referenced to the applicable contract or purchase order.

4.8.5 Record retention. All records pertinent to a specific connector, backshell or contact shall be retained by the manufacturer for a minimum of 4 years.

4.9 Test methods.

4.9.1 Insulation resistance (3.6.1). Unmated connectors shall be tested in accordance with MIL-STD-202, method 302, test condition B. The resistance shall be measured separately between three pairs of adjacent contacts and between the shell and three contacts closest to the shell.

4.9.2 Dielectric-withstanding voltage.

4.9.2.1 Sea level (3.6.2). The connectors shall be tested in accordance with MIL-STD-202, method 301. Sea-level voltages shall be applied for 1 minute between three pairs of adjacent contacts and between the shell and three contacts closest to the shell.

4.9.2.2 High altitude. The connectors shall be tested per MIL-STD-202, method 105. The following details and exceptions shall apply: Voltages shall be applied after 30 minutes of simulated altitude. Contacts shall be tested as described for sea level.

(a) Mounting: The connectors shall be mounted in the pressure chamber in a manner to permit application of test voltages with simultaneous visual observation.

(b) Test Conditions: MIL-STD-202, method 105, test condition C.

(c) Tests at reduced pressure: While at reduced pressure, the connectors shall be subjected to the applicable voltage while being observed for arcing and electrically checked for breakdown.

4.9.3 Connector mating and unmating forces (3.6.3). The female connectors shall be mounted in such a way that a force may be applied axially to mate and unmate the male connector. This force shall be applied gradually and shall be equally distributed along the male connector. A suitable device shall be used to measure this force to determine conformance with the limits specified in the detail specification.

4.9.4 Contact retention (in insert) (3.6.4). An axial load shall be applied to the engaging end of the contacts under test (pins and sockets). The load shall be gradually increased, at a rate not to exceed 1 pound per second, to the applicable limits specified in the detail specification. The forces shall be maintained for a minimum of 15 seconds.

4.9.5 Insert retention (in shell) (3.6.5). Inserts, with or without contacts, shall be subjected to axial loads in each direction. The loads shall be gradually increased at an approximate rate of 10 psi per second until the maximum load, as specified in the detail specification, is reached. The maximum load shall be maintained for 5 seconds. The portion of the load-applying device that touches the surface of the insert may be shaped to clear the contacts, if installed; the contact openings, if contacts are not installed; or the raised areas on the inserts (bosses, barriers, or identifiers).

4.9.6 Vibration (3.6.6). A suitable clamping arrangement shall hold the connectors together during the test. The connectors shall be subjected to the test as specified in MIL-STD-202, method 204, test condition D. (For reference only: vibration test conditions - amplitude of 0.06 inch DA or 20G, which ever is less; frequency range of from 10 Hz to 2 KHz; 20 minutes sweep time). The sweep shall be performed three times in each of three mutually perpendicular directions (total 9 times) instead of 12 times per direction as specified in MIL-STD-202, Method 204.

A current of 100 milliamperes shall pass through the series-wired contacts. Contacts shall be monitored to determine if the continuity requirement of 3.6.6 is met. The wires shall be clamped to a non-vibrating point, 12 inches minimum from the connectors.

4.9.7 Physical shock (3.6.7). The shock-testing device and method shall be as specified in MIL-STD-202, method 213, test condition G. The connectors shall be subjected to 10 blows in each of three mutually perpendicular axes. The receptacles shall

be mounted on the shock device or carriage. The plugs shall be engaged with the receptacles and held together by a suitable clamping arrangement. All contacts shall be connected in series with a current of 100 milliamperes flowing through them. Contacts shall be monitored to determine if the continuity requirement of 3.6.7 is met. The leads shall be secured to a clamping point that moves with the connector at a minimum distance of 12 inches from the connectors.

4.9.8 Thermal shock (3.6.8). Mated connectors shall be tested in accordance with MIL-STD-1344, Method 1003.1, test condition A. The temperature of Step 1 shall be -65° (-0, +5°C) and the temperature of Step 3 shall be +125°C (+0, -5°C).

4.9.9 Salt spray (corrosion) (3.6.9). Mated connectors shall be tested as specified in MIL-STD-202, method 101, test condition B. Immediately after exposure, the connectors shall be washed with tap water and dried for 12 hours, maximum, in a circulating air oven at a temperature of 38 ± 3°C.

4.9.10 Moisture resistance (3.6.10). Mated connectors shall be submitted to the moisture resistance test in accordance with MIL-STD-202, method 106, with the following exceptions and details:

(a) Step 7b, vibration, is not required.

(b) There shall be no drip loops in the wires.

(c) Wires shall be brought out of the chamber through vapor-tight seals.

(d) There shall be no wire splices in the chamber.

(e) After completion of the sixth step of the final cycle, before removal from the chamber, the insulation resistance shall be measured in accordance with 3.6.1; the limit of 3.6.10 shall be observed.

4.9.11 Residual magnetism (3.6.11). Contacts shall be installed in the connectors before testing. The residual magnetism test shall be performed in a magnetically quiet area, i.e, machines, electronic equipment, vehicles, and personnel traffic are restricted. Permeability shall be checked with an instrument conforming to MIL-I-17214.

4.9.12 Vacuum effects (material outgassing) (3.6.14). Material specimens shall be tested in accordance with ASTM E595.

4.9.13 Dry circuit (3.6.15). Figure 1 shows the circuit for performing the dry-circuit test:

(a) Pin-socket contacts shall be engaged as in normal service.

(b) Adjust R1 until the open-circuit voltage is 30 to 34 millivolts.

(c) Adjust R2 so that the current through the contacts is limited to 10 +5 microamperes.

(d) The current through the contacts shall be observed for variations

(e) Reverse the polarity of the test voltage and perform step (d).

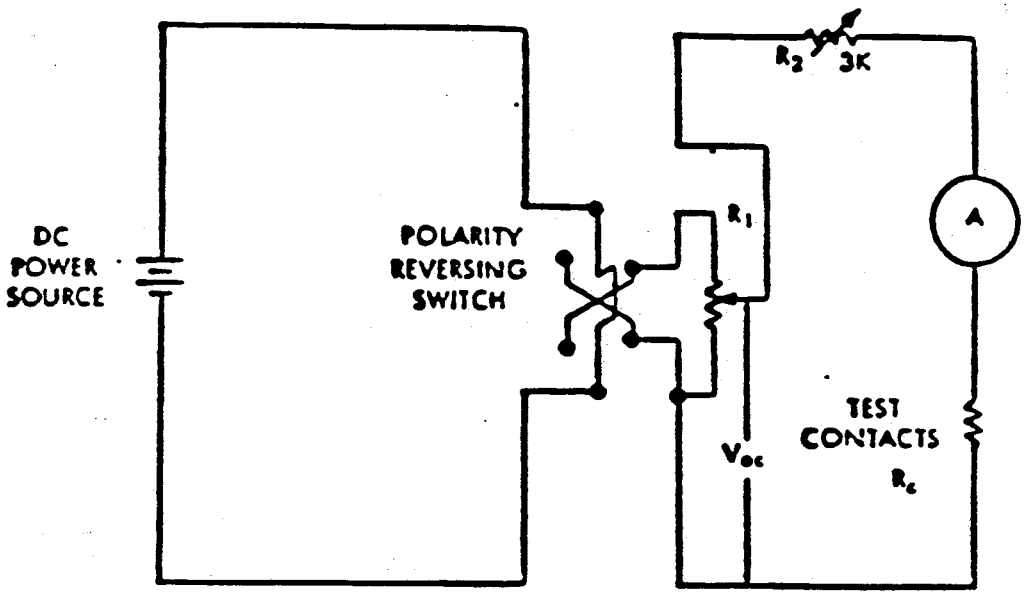


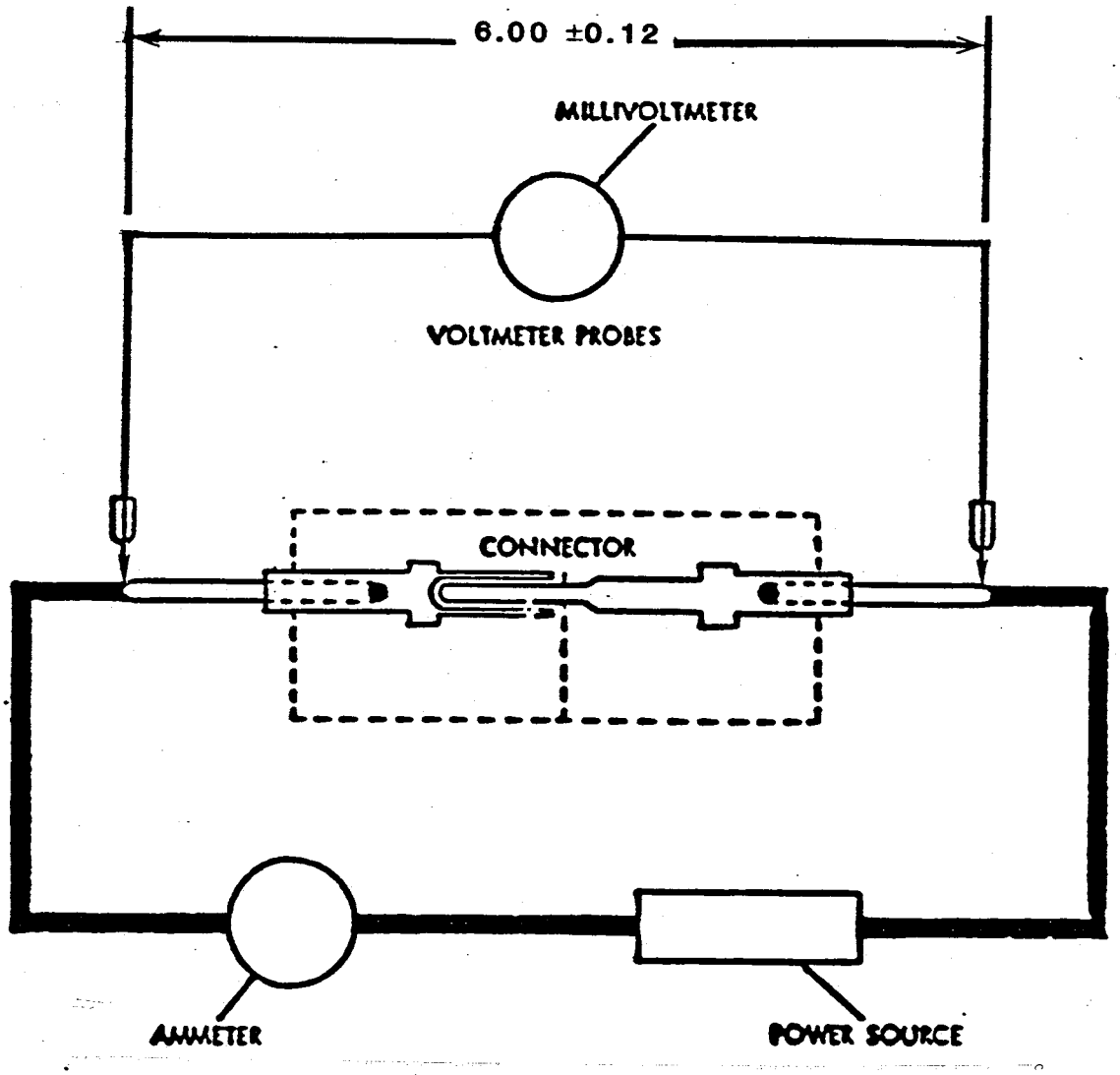
Figure 1. Circuit for testing dry circuits.

4.9.14 Contact resistance (3.6.16). The voltage drop shall be measured using the voltmeter-ammeter method and the circuit in Figure 2.

4.9.15 Contact engagement and separation (3.6.17). The socket contacts shall be tested as follows: Gradually increasing loads shall be applied until the steel test pin properly engages with or separates from the socket contacts. The test pins shall be defined in the detail connector specification. The maximum diameter test pin shall be inserted and withdrawn from each

socket three times. The engaging and separation forces shall be measured on the third insertion and withdrawal. Then the minimum diameter test pin shall be inserted and withdrawn one time, to measure the forces.

4.9.16 Durability (3.6.18). Counterpart connectors shall be mated and unmated 250 times. The rate of insertion and withdrawal shall not exceed 300 cycles per hour. A cycle is defined as one insertion and one withdrawal. Tests shall be conducted using normal integral engaging hardware (jackscrew), where applicable.



Note: Dimensions are in inches.

Figure 2. Voltage drop-test wiring diagram.

4.9.17 Maintenance aging (3.6.19). All contacts, from both connector halves, shall be removed and reinserted once using approved tools. A minimum of 20 percent but no less than four of each contact type (see contact arrangements) shall be removed and reinserted nine more times. However, when the quantity of a specified contact type is less than four, all contacts shall be tested. Care shall be exercised to prevent damage to the dielectric.

4.9.18 Coaxial contacts (3.9.20). The coaxial contacts shall be tested in accordance with the parameters of the detail specification.

4.9.19 RF leakage (3.6.21). The mating connector-contact pairs to be tested shall be assembled and tested as shown in Figure 3. The tests shall be performed at 2.2 GHz and the RF power source shall have a dynamic range sufficient to perform the tests. Other test setups may be used provided that the test goal is not compromised.

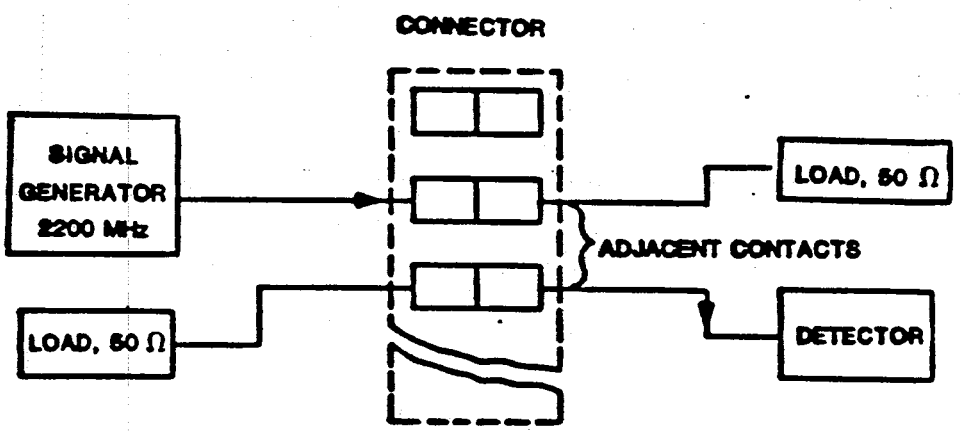


Figure 3. R.F. leakage test.

4.9.20 EMI effectiveness (applicable only to connectors equipped with EMI spring fingers). The EMI shielding effectiveness of mated connectors with EMI backshells shall be measured as follows:

(a) Frequency range of 10KHz to 100MHz - (See Figure 4) R.F. current to be driven end to end through the shell of the mated connector set by attachment of wide copper straps at

each end of the backshells. A single center conductor to be passed through the entire assembly and terminated at one end by a 50 ohm coaxial load and at the other end by the EMI test receiver. These last two connections to be accomplished via type "N" coaxial receptacles, mounted to flat plate flanges which in turn are bolted over the EMI backshell end opening. The measurement shall consist of obtaining a reference reading by connecting the signal generator directly to the EMI test receiver. Then the same generator would be connected to the current driving straps referred to above and the EMI test receiver would be connected to the coax receptacle opposite the end terminated with a 50 ohm load. This reading would be expressed in db below the reference reading and would be equivalent to transfer impedance in db below 50 ohms.

(b) Frequency range of 100 MHz to 1 GHz - (See Figure 5) Suspend a length of #22 AWG bare copper wire 5 centimeters above the copper ground plane between two type "N" coaxial connectors. Each of these connectors would be mounted on a "L" shaped bracket which in turn is "C-clamped" to the copper ground plane. The distance between the connectors would be set to the length of the mated test connector set. This test wire would then be terminated at one end with a 50 ohm coaxial load and at the other end with a NM 37/57 (Stoddard-Singer) or equivalent receiver. The test wire would be illuminated with a reference field from a source antenna and signal generator located 1 meter from the test wire. A reference reading would be taken at each frequency to be tested. The test wire assembly would then be replaced with the mated test connector set as described above for the lower frequency testing and the NM 37/57 receiver connected to the output coax connector as before. A reading would be taken on the receiver at each of the test frequencies used for the unshielded test wire. The difference in the readings between the test wire levels and the mated test connector levels in db is defined as shielding effectiveness for this purpose.

(c) Frequency range of from 1 GHz to 10 GHz - using the mode stirred technique specified in MIL-STD-1344, method 3008.

4.9.21 Shell to shell conductivity (applicable only to connectors equipped with EMI spring fingers). The resistance of mated connectors shall be measured across the mated connector interfaces in accordance with MIL-STD-1344, method 3007. The connectors shall then be inspected in accordance with 3.6.13.1.

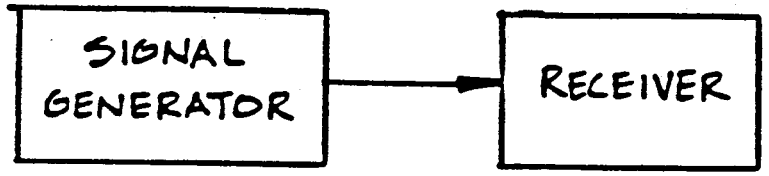


Figure 4a. Reference.

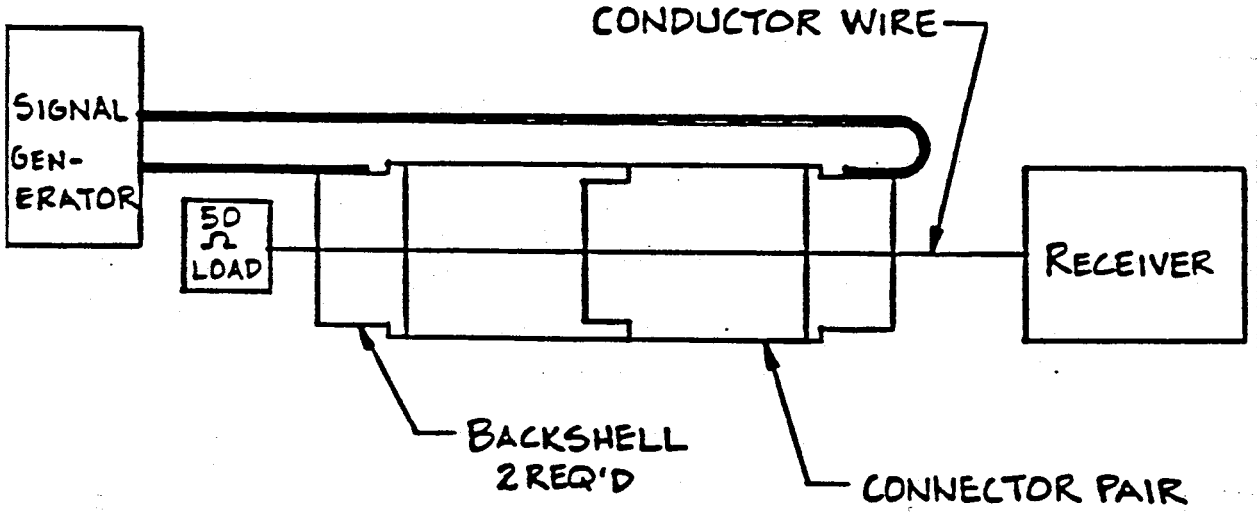


Figure 4b. Transfer impedance.

Figure 4. Shielding effectiveness measurement (10 KHz to 100 KHz).

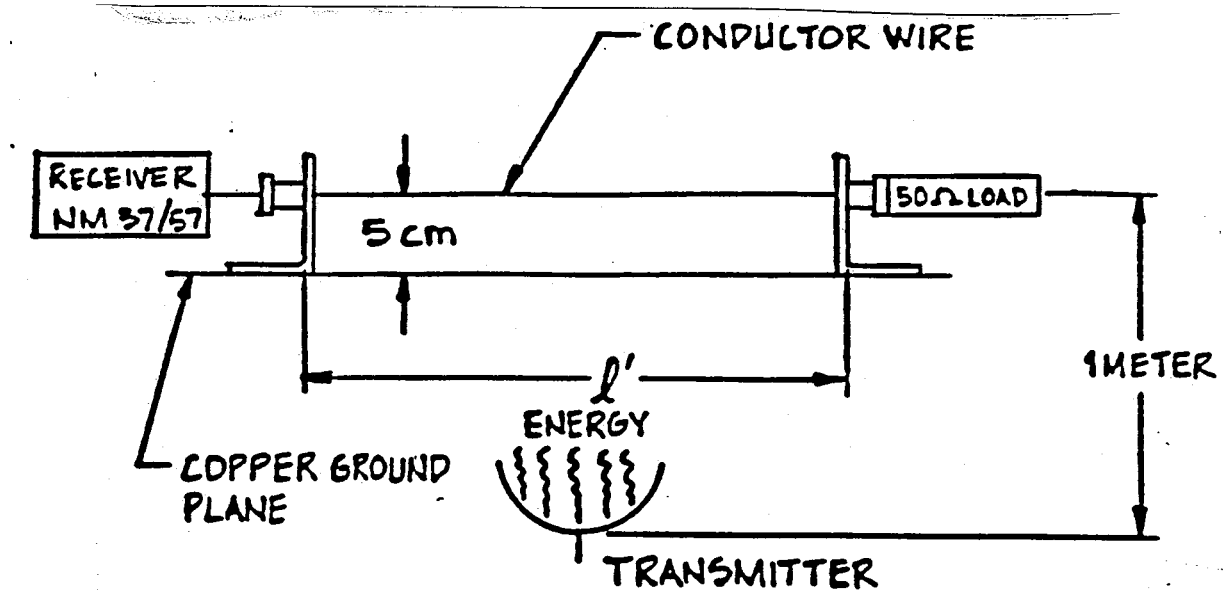


Figure 5a. Baseline energy level.

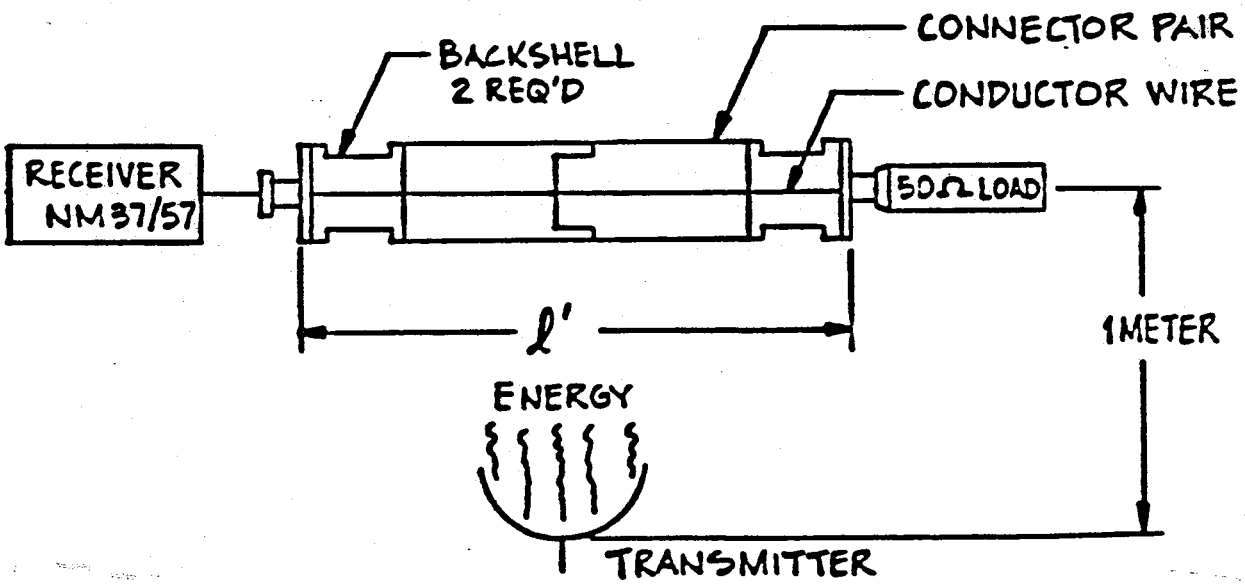


Figure 5b. Shielded energy level.

Figure 5. Shielding effectiveness measurement (100 MHz to 1 GHz).

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Unless otherwise specified, the manufacturer shall be responsible for packaging connectors, backshells and contacts in a manner which prevents degradation, corrosion, deterioration, or physical damage, and for ensuring that the packages have a safe delivery and are in good condition. The manufacturer shall be responsible for any damage to or deterioration of connectors, backshells or contacts resulting from faulty or improper packing, preservation, or packaging, and shall replace such connectors, backshells and/or contacts with acceptable connectors, backshells and/or contacts without cost to GSFC or to the procuring activity.

5.1.1 Level A. Connectors, backshells or contacts furnished shall be protected and packaged to afford protection at all handling points between the manufacturer's final inspection and the user's final installation. The connectors, backshells or contacts shall be individually packaged in a transparent rigid plastic container with an enclosing cap or a hinged cover at one end.

5.1.1.1 Packaging marking. Each plastic holder containing a connector, backshell or contact shall be permanently and legibly marked with the following:

NOTE: If the connector, the backshell or the contact identification, as provided by other means, is visible and readable through the container, the container marking is waived.

(a) Connector identification, backshell identification or contact identification (3.3.1)

(b) Lot-date code (3.3.2)

5.1.2 Level B. Connectors, backshells or contacts shall be individually packaged in a heat-sealed polyethylene bag. The poly-bag shall be of such size and construction as to permit two heat resealings after shipment from the manufacturer, and without disturbing the packaging markings.

5.1.2.1 Poly-bag marking. The requirements and note in paragraph 5.1.1.1 apply.

5.2 Packing. Containers enclosing the packaged connectors, backshells or contacts to be furnished under this specification shall be packed in an exterior container using cushioning on all sides to prevent movement. Required documentation (4.8.2) shall be enclosed in this outer container. As a minimum, units packaged as specified shall be packed in containers of the type,

size, and kind commonly used for the purpose, in a manner that will assure acceptance by common carrier and safe delivery at the destination. Shipping containers shall comply with the uniform freight classification rules or regulations of other carriers as applicable to the mode of transportation.

5.2.1 Packing marking. Each container shall be permanently and legibly marked in accordance with the instructions contained in the purchase order.

6. NOTES

6.1 Data address. When supplemental data, reports, or information requests are to be transmitted to GSFC, the following address shall be used unless otherwise specified:

NASA/GSFC
Greenbelt, MD 20771
Attn: QPLD Administrator
Code 311

6.2 Definitions. The following definitions shall apply to this specification:

(a) Pin - A male contact, normally connected to the dead side of a circuit.

(b) Socket - A female contact, normally connected to the live side of a circuit.

(c) Insert - That portion of a connector which holds the contacts in their proper arrangement and insulates them, electrically, from each other and from the shell.

(d) Connector shell - The metallic case into which the insert and contacts are assembled.

(e) Burr - A metallic particle either attached by a metallic bond or stuck to the surface. (Uneven edges are not called burrs if they are attached firmly and do not interfere with the normal use of the connector).

(f) Lot - Inspection lot, i.e., a collection of units from which a sample is to be drawn and inspected to determine conformance with the acceptability criteria. Each lot shall consist of units of product of a single type, grade, class, size. and composition, manufactured under the same conditions and at essentially the same time.

(g) Interfacial seal - An insulator which provides sealing of mated connectors over the whole area of the interface to provide sealing around each contact.

(h) Wire seal - An insulator that covers the rear portion of the connector and a short length of the incoming wire to keep moisture, dirt, air, and dust from entering the connector.

(i) Sleeve - A metal tube fitted over the tube section of a socket's contact. The sleeve prevents over-stress of the socket contact's spring mechanism when mated with a pin contact.

(j) Coaxial receptacle contact - The coaxial contact which contains the pin center contact.

(k) Coaxial plug contact - The coaxial contact which contains the socket center contact.

(l) Scoop proof - Scoop proof refers to the impossibility of a mating plug connector being inadvertently cocked into a mating receptacle and damaging or electrically shorting the contacts.

(m) Backshell - A connector accessory for use with electrical connectors which provides strain relief cable support and suppression of radio frequency and electromagnetic interference.

6.3 Ordering data. Procurement documents should specify the following:

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

(b) Connector, backshell and/or contact type designation (1.2)

(c) Level of preservation and packaging (5.1)

6.4 Qualification provisions. With respect to products requiring qualification, awards will be made only for products which have been tested and approved by GSFC before the time set for opening of bids. The attention of the suppliers is called to this requirement; manufacturers should arrange to have qualification tests made on products which they propose to offer to GSFC to become eligible for awards of contracts or orders for products covered by this specification. The manufacturer shall bear the cost of qualification inspection to this specification. Information pertaining to qualification of products may be obtained from the activity whose address is listed in 6.1.

6.5 Notice. When GSFC drawings, specifications, or other data are used for any purpose other than in connection with a definitely related GSFC procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; the fact that GSFC might have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not be regarded by implication or otherwise as in any manner licensing the holder or any person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodian:

Code 311.2
Goddard Space Flight Center
Greenbelt, MD 20771