AMPLIMITE* HDP-20 Subminiature D Connector With F Crimp Contacts

1. SCOPE

1.1. Content

This specification covers the performance, test and quality requirements for the AMPLIMITE* HDP-20 subminiature D connectors with removable F crimp contacts. The assembly consists of a two piece plastic housing which has integral plastic retention tines and two metal shells which secure the housing components.

1.2. Qualification

When tests are performed on the subject product line, the procedures specified in Figure 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

1.3. Qualification Test Results

Successful qualification testing on the subject product line was completed on 06Oct89. The Qualification Test Report number for this testing is 501-99. This documentation is on file at and available from Engineering Practices and Standards (EPS).

2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the latest edition of the document applies. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

2.1. TE Connectivity (TE) Documents

- 114-40030: Application Specification (AMPLIMITE* HDP-20 & Economy Crimp Snap Subminiature D Commercial Connectors)
- 501-99: Qualification Test Report (AMPLIMITE* HDP-20 Subminiature D Connector With F Crimp Contacts)

2.2. Industry Standard

EIA-364: Electrical Connector/Socket Test Procedures Including Environmental Classifications

2.3. Reference Document

109-197: Test Specification (AMP Test Specifications vs EIA and IEC Test Methods)

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of the design, construction and physical dimensions specified on the applicable product drawing.

3.2. Material

Materials used in the construction of this product shall be as specified on the applicable product drawing.

3.3. Ratings

- Voltage: 250 volts AC
- Current: Fully loaded and energized connectors, see Figure 4
  - 18 AWG: 3.1 amperes
  - 22 AWG: 2.0 amperes
  - 28 AWG: 1.2 amperes
- Temperature: -55 to 105°C

3.4. Performance and Test Description

Product is designed to meet the electrical, mechanical and environmental performance requirements specified in Figure 1. Unless otherwise specified, all tests are performed at ambient temperature.

3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Examination of product.	Meets requirements of product drawing and Application Specification 114-40030.	EIA-364-18. Visual and dimensional (C of C) inspection per product drawing.
Final examination of product.	Meets visual requirements.	EIA-364-18. Visual inspection.
ELECTRICAL		
Low level contact resistance.	15 milliohms maximum.	EIA-364-23. Subject specimens to 100 milliamperes maximum and 20 millivolts maximum open circuit voltage. See Figure 3.
Contact resistance, specified current.	Wire Size (AWG) / Test Current (amperes) / Resistance Maximum (milliohms) 18 / 3.1 / 15 20 / 2.4 / 15 22 / 2.0 / 15 24 / 1.6 / 15 26 / 1.3 / 15 28 / 1.2 / 15	EIA-364-6. Measure potential drop of mated contacts assembled in housing. Calculate resistance. See Figure 3.
Insulation resistance.	5000 megohms minimum initial. 500 megohms minimum final.	EIA-364-21. Test between adjacent contacts of unmated specimens.
Withstanding voltage.	One minute hold with no breakdown or flashover. 0.5 milliampere maximum leakage current.	EIA-364-20, Condition I. 1000 volts AC at sea level. Test between adjacent contacts of unmated specimens.

Figure 1 (continued)

Test Description	Requirement	Procedure
Temperature rise vs current.	30°C maximum temperature rise at specified current.	EIA-364-70, Method 1. Stabilize at a single current level until 3 readings at 5 minute intervals are within 1°C. See Figure 4.
MECHANICAL		
Vibration, random.	No discontinuities of 1 microsecond or longer duration. See Note.	EIA-364-28, Test Condition V, Condition F. Subject mated specimens to 20.71 G's rms between 50 to 2000 Hz. Fifteen minutes in each of 3 mutually perpendicular planes. See Figure 5.
Mechanical shock.	No discontinuities of 1 microsecond or longer duration. See Note.	EIA-364-27, Method A. Subject mated specimens to 50 G's half-sine shock pulses of 11 milliseconds duration. Three shocks in each direction applied along 3 mutually perpendicular planes, 18 total shocks. See Figure 5.
Durability.	See Note.	EIA-364-9. Mate and unmate gold flash specimens for 100 cycles, and 30 µin gold specimens for 500 cycles at a maximum rate of 200 cycles per hour.
Mating force.	Size / Posn / Without Ground Indents (N [lbf] maximum) / With Indents (N [lbf] maximum) 1 / 9 / 12.5 [2.8] / 133.4 [30] 2 / 15 / 20.9 [4.7] / 146.8 [33] 3 / 25 / 34.7 [7.8] / 164.6 [37] 4 / 37 / 51.6 [11.6] / 177.9 [40] 5 / 50 / 69.4 [15.6] / 195.7 [44]	EIA-364-13. Measure force necessary to mate specimens at a maximum rate of 25.4 mm [1 in] per minute.
Unmating force.	Size / Posn / Without Ground Indents (N [lbf] maximum) / With Indents (N [lbf] maximum) 1 / 9 / 12.5 [2.8] / 133.4 [30] 2 / 15 / 20.9 [4.7] / 146.8 [33] 3 / 25 / 34.7 [7.8] / 164.6 [37] 4 / 37 / 51.6 [11.6] / 177.9 [40] 5 / 50 / 69.4 [15.6] / 195.7 [44]	EIA-364-13. Measure force necessary to unmate specimens at a maximum rate of 25.4 mm [1 in] per minute.
Contact insertion force.	13.3 N [3 lbf] maximum per contact.	EIA-364-5. Measure force necessary to insert contact into housing.

Figure 1 (continued)

Test Description	Requirement	Procedure
Contact retention force.	Contacts shall nor dislodge from housing when subjected to a minimum force of 44.5 N [10 lbf].	EIA-364-29. Apply specified to contacts in an axial direction and hold for 6 seconds.
Contact engaging force.	2.2 N [8 ozf] maximum per contact.	EIA-364-37. Measure force necessary to insert gage A to a depth of 5.6 mm [.220 in]. See Figure 6.
Contact separating force.	0.208 N [.75 ozf] minimum per contact.	EIA-364-37. Size 2 times using gage A. Insert gage B to a depth of 5.6 mm [.220 in] and measure force necessary to separate gage B. See Figure 6.
Crimp tensile.	Wire Size (AWG) / Crimp Tensile (N [lbf] minimum) 18 — 120.1 [27] 20 — 89 [20] 22 — 53.4 [12] 24 — 35.6 [8] 26 — 20 [4.5] 28 — 12 [2.7]	EIA-364-8. Determine crimp tensile at a maximum rate of 25.4 mm [1 in] per minute.
ENVIRONMENTAL		
Thermal shock.	See Note.	EIA-364-32, Test Condition VII. Subject unmated specimens to 5 cycles between -55 and 105°C.
Humidity/temperature cycling.	See Note.	EIA-364-31, Method III with cold shock. Subject mated specimens to 10 cycles (10 days) between 25 and 65°C at 80 to 100% RH.
Temperature life.	See Note.	EIA-364-17, Method A, Test Condition 4, Test Time Condition C. Subject mated specimens to 105°C for 500 hours.
Mixed flowing gas.	See Note.	EIA-364-65, Class IIIA (4 gas). Subject mated specimens to environmental Class IIIA for 20 days.

NOTE *Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence shown in Figure 2.*

Figure 1 (end)

3.6. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group (a)				
	1	2	3	4	5
	Test Sequence (b)				
Initial examination of product	1	1	1	1	1
Low level contact resistance	3,7	2,8			
Contact resistance, specified current	8				
Insulation resistance			3,7		
Withstanding voltage			4,8		
Temperature rise vs current		3,9			
Vibration, random	5	7(c)			
Mechanical shock	6				
Durability	4	4			4
Mating force	2				2,5
Unmating force	9				3,6
Contact insertion force			2		
Contact retention force			9		
Contact engaging force				2	
Contact separating force				3	
Crimp tensile				4	
Thermal shock			5		
Humidity/temperature cycling			6		
Temperature life		6			
Mixed flowing gas		5			
Final examination of product	10	10	10	5	1,7

NOTE

(a) See paragraph 4.1.A.
(b) Numbers indicate sequence in which tests are performed.
(c) Discontinuities shall not be measured. Energize at 18°C level for 100% loadings per Quality Specification 102-950.

Figure 2

4. QUALITY ASSURANCE PROVISIONS

4.1. Qualification Testing

A. Specimen Selection

Connector housings and contacts shall be prepared in accordance with applicable Instruction Sheets and selected at random from current production. Test groups shall consist of the following:

1. Test Groups 1 and 3 shall consist of 10, size 1 (9 position) crimp-snap connector mated pairs (plugs without grounding indents), fully loaded with crimp-snap contacts with insulation support and crimped to 24 AWG wire. Group 1 uses gold flash and 30 gold contacts. Group 3 uses only gold flash contacts. Cable clamps are to be used on all connectors. During vibration and physical shock tests, screwlocks and male screws are to be used to secure the connectors.

2. Test Group 2 shall consist of 15 mated pairs, size 5 (50 position) crimp-snap connectors. Five mated pairs are loaded with 18 AWG wires, 5 with 24 AWG wire and 5 with 28 AWG wire. The plugs have no grounding indents, and the wires are crimped to contacts without insulation support. The contacts are gold flash plated. Cable clamps are to be used on all connectors.

3. Test Group 4 shall consist of 30 each of contacts with insulation support crimped to 24, 26, and 28 AWG wire. The 18, 20 and 22 AWG wires are crimped to contacts without insulation support. The contacts are gold flash plated.

4. Test Group 5 shall consist of 5 of each size of mated pairs fully loaded with contacts. The plugs have grounding indents. The contacts are gold flash plated.

B. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in Figure 2.

4.2. Requalification Testing

If changes significantly affecting form, fit or function are made to the product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

4.3. Acceptance

Acceptance is based on verification that the product meets the requirements of Figure 1. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

4.4. Quality Conformance Inspection

The applicable quality inspection plan shall specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.

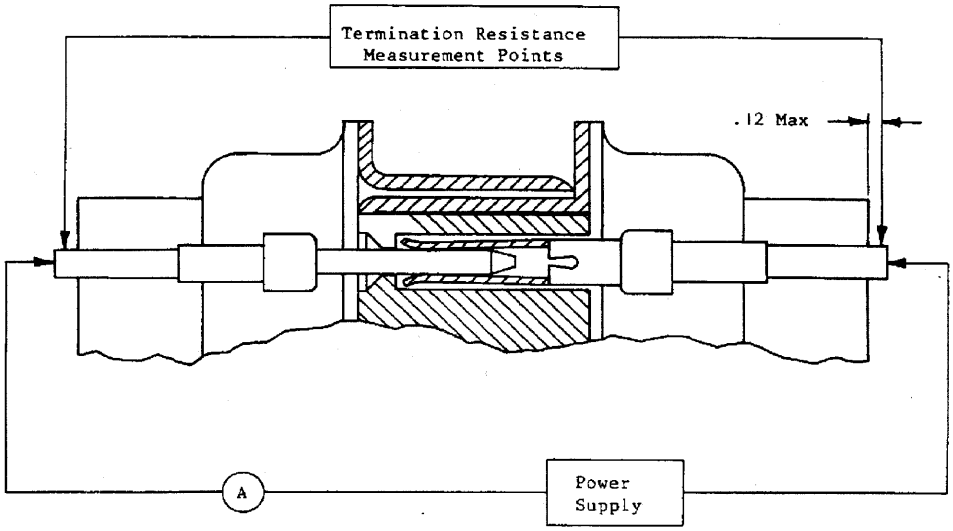


Figure 3
Low Level Contact Resistance Measurement Points

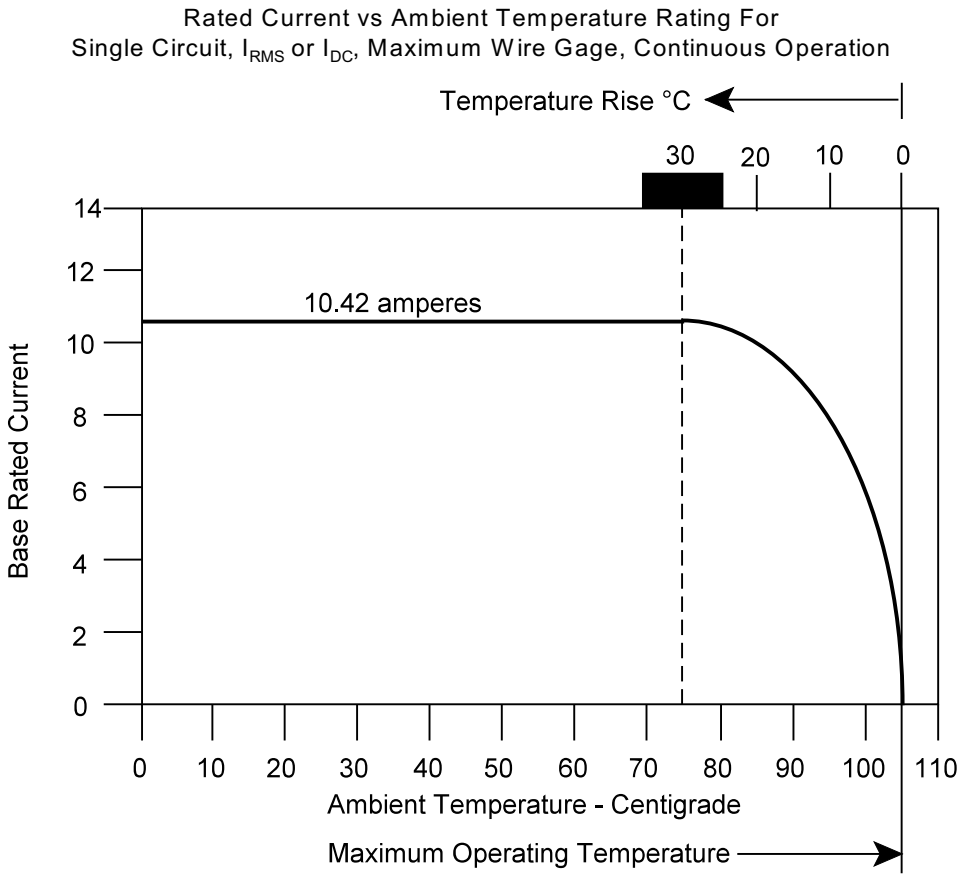


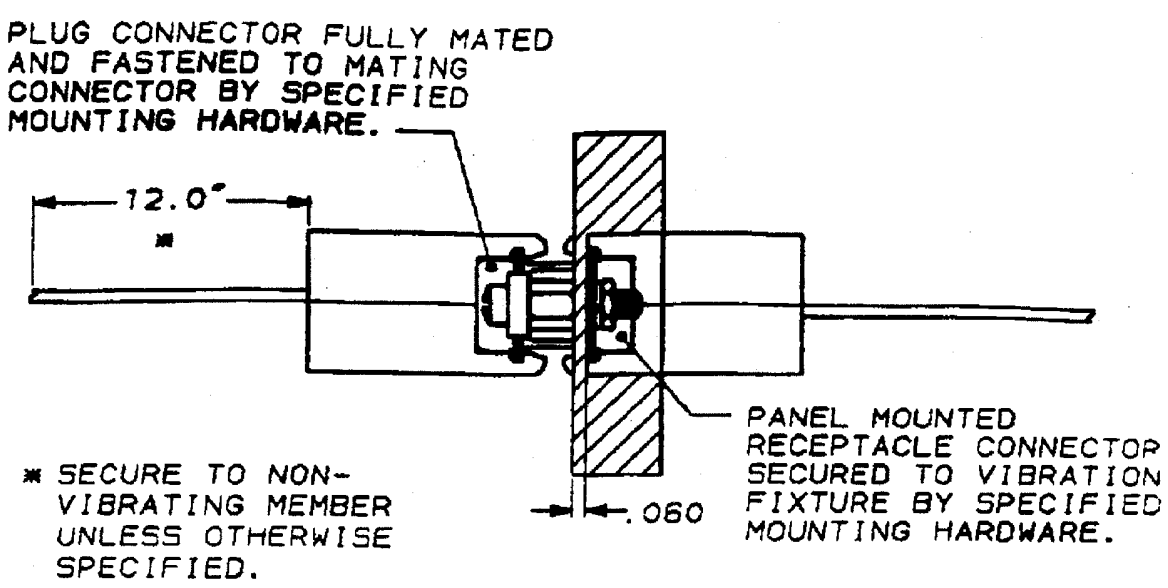
Figure 4A
Current Carrying Capability

Percent Connector Loading	Wire Size AWG					
	28	26	24	22	20	18
Single contact	.384	.450	.536	.647	.795	1
26	.237	.278	.342	.400	.491	.618
50	.164	.193	.229	.277	.341	.428
76	.132	.155	.184	.222	.273	.344
100	.114	.134	.159	.192	.236	.297

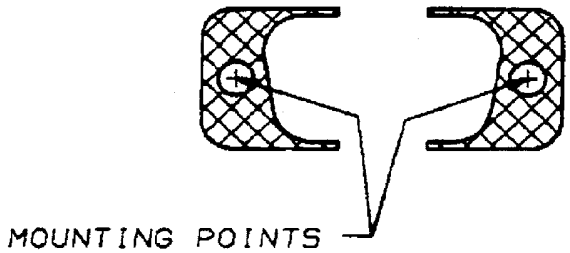
NOTE

*To determine acceptable current carrying capacity **per contact** for percentage connector loading and wire gage indicated, use the Multiplication Factor (F) from the above chart and multiply it times the Base rated Current for a single circuit at the maximum ambient operating temperature shown in Figure 4A.*

Figure 4B
Current Rating



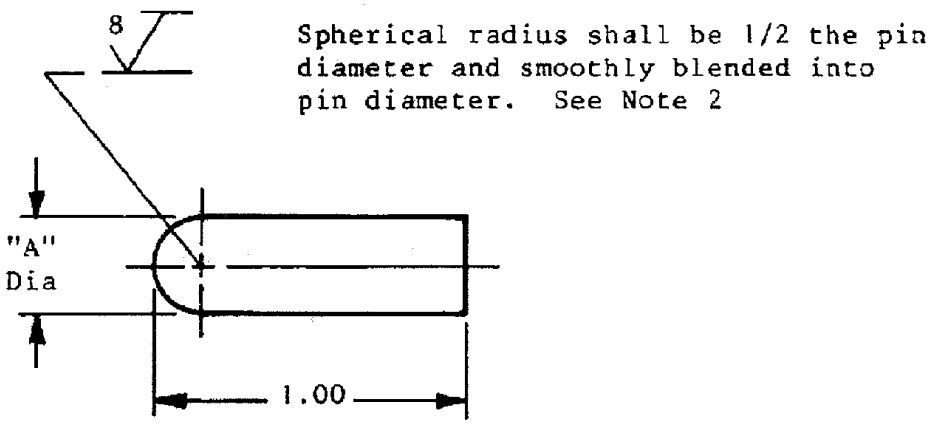
NOTE: RECEPTACLE CONNECTOR TO BE MOUNTED ON VIBRATION FIXTURE UNLESS OTHERWISE SPECIFIED.



SHELL SIZE	FIXTURE NUMBER
1	
2	
3	468165
4	
5	468166

VIBRATION LEVEL IS APPLIED TO THE SPECIFIED CONNECTOR MOUNTING AREA ( ) OF THE VIBRATION FIXTURE.

Figure 5
Vibration and Mechanical Shock Mounting Fixture



Gage	Part Number	"A" Diameter
A	92-944011-1	.0410 +.0000/-.0001
B	92-944011-2	.0390 +.0001/-0000

NOTE

1. *Gage Material: High speed steel lapped finish to 1 microinch.*
2. *Do not change size or finish of "A" Diameter where spherical radius blends.*
3. *Heat Treat to RC 62-64.*
4. *This gage is for contact size 20.*

Figure 6

AMPLIMITE* Shielding Hardware Connector

1. SCOPE

1.1. Content

This specification covers the performance, tests and quality requirements for AMPLIMITE* connectors with shielding hardware.

1.2. Qualification

When tests are performed on the subject product line, the procedures specified in 109-Series Test Specifications shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

2.1. TE Connectivity (TE) Documents

A. 109-1: General Requirements for Test Specifications

B. 109 Series: Test Specifications as indicated in Figure 1.

C. 114-40006: Connectors, AMPLIMITE HDE-20 for Overmolding

D. 114-40007: Connectors, AMPLIMITE HDP-20 for Overmolding

E. 501-83: Test Report

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of the design, construction and physical dimensions specified on the applicable product drawing.

3.2. Materials

A. Connector

1. Shields: Thermoplastic, UL 94V-O
2. Shells: Steel

B. Hardware

1. Shields: Steel
2. Ferrules: Copper

3.3. Ratings

A. Current

1. AMPLIMITE HDP-20: 7.5 amperes per contact maximum
2. AMPLIMITE HDE-20: 5.0 amperes per contact maximum, see Para.3.5.(a)

B. Storage Temperature: -55 to 105℃. While this is the operating temperature of the connector, the operating environment used must not exceed the limits of either the connector or the cable

3.4. Performance and Test Description

Connectors and hardware shall be designed to meet the electrical, mechanical and environmental performance requirements specified in Figure 1. Since the results of many of the tests are dependent not only on the hardware and the connectors, but also on the cable, the cable must be chosen to meet the electrical, mechanical and environmental performance requirements in Figure 1 or the stresses derated appropriately

3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Examination of Product	Meet requirements of product drawing and Application Specifications 114-40006 and 114-40007	Visual, dimensional and functional per applicable inspection plan.
ELECTRICAL		
Dielectric Withstanding Voltage	1.0 kvac dielectric withstanding voltage, one minute hold. One milli- ampere maximum leakage current.	Test between contacts and shield of mated connector assemblies; Test Specification 109-29-1.
Shielding Effectiveness	Shielding shall decrease emissions by the following minimum levels: MHz — Shielding 30 to 216 — 35 dB 216 to 1000 — 15 dB	Measure shielding effectiveness of double ended single braid cable; Test Specification 109-90.
MECHANICAL		
Vibration (b)	No discontinuities greater than 1 microsecond.	Subject mated connectors to 10-55-10 Hz traversed in 1 minute at .06 inches total excursion; 2 hours in each of 3 mutually perpendicular planes; Test Specification 109-21-1.
Physical Shock	No discontinuities greater than 1 microseconds.	Subject mated connectors to 50 G's half-sine in 11 milliseconds; 3 shocks in each direction applied along the 3 mutually perpendicular planes; Test Specification 109-26-1.
Cable Pullout	No discontinuities greater than 1 microsecond for shield circuit.	Gradually apply 50 pounds weigh to cable, see Figure 3, maintain weight for 1 hour; Test Specification 109-46, cond A.
Circular Jacket Cable Flexing	No evidence of damage, cracking or chipping.	Subject cable to 100 cycles at a rate of 12 to 14 cycles per minute, see Figure 4; Test Specification 109-20.

Figure 1 (continued)

Test Description	Requirement	Procedure
ENVIRONMENTAL		
Thermal Shock (b) (c)	Dielectric withstanding voltage; insulation resistance.	Subject mated connectors to 5 cycles between -55° and 105℃; Test Specification 109-22.
Industrial Mixed Flowing Gas	Shielding effectiveness final	Subject mated connectors to environmental class III for 10 days; Test Specification 109-85-3.

NOTE

(a) Maximum rated current that can be carried by this product is limited by maximum operating temperature of housings, which is 30℃.Variables which shall be considered for each application are: wire size, connector size, contact material, and ambient temperature.

(b) Shall remain mated and show no evidence of damage, cracking or chipping.

(c) The temperature range of this test must be adjusted as necessary to assure that the temperatures of the cable assemblies are exposed to shall not exceed the temperature rating of either the cable or the connector.

Figure 1 (end)

3.6. Connector and Hardware Qualification and Requalification Tests and Sequences

Test or Examination	Test Group (a)		
	1	2	3
	Test Sequence (b)		
Examination of Product	1	1	1
Dielectric Withstanding Voltage	2, 8		
Shielding Effectiveness	3, 9	2, 4	2, 4
Vibration	4		
Physical Shock	5		
Cable Pullout	6		
Circular Jacket cable Flexing	7		
Thermal Shock			3
Industrial Mixed Flowing Gas		3	

NOTE

(a) See Para 4.1.A.

(b) Numbers indicate sequence in which tests are performed.

Figure 2

4. QUALITY ASSURANCE PROVISIONS

4.1. Qualification Testing

A. Sample Selection

Connector housings and contacts shall be prepared in accordance with applicable Instruction Sheets. They shall be selected at random from current production. All test groups shall consist of a minimum of 6 double ended cable assemblies of each type (HDE-20 and HDP-20) with shielding hardware crimped on but not overmolded. The cable shall be constructed as follows:

1. 0.032 inch maximum single jacket, 75 to 80 shore durometer
2. Overall tinned copper braid, 90% coverage.
3. Overall foil shield with drain wire
4. The above items constitute approximately 88% of the cross sectional area of the cable
5. All contacts terminated.

Each cable assembly shall have a cable length of 6 feet + .5 inch between the connector back shells as specified in Test Specification 109-90.

B. Test Sequence

Qualification inspection shall be verified by testing samples as specified in Figure 2.

C. Acceptance

1. Test results from development on pre-qualification samples will be used to determine upper and lower one-sided statistical tolerance limits for 99% reliability at 95% confidence, as follows. Let Xbar and s denote the sample average and standard deviation, respectively, of the test data. Let k denote the normal distribution one-sided tolerance factor for 95% confidence and 99% reliability. The value of k varies with sample size. Values of k are given in various tables, for example, NBS Handbook 91, Factors for One-Sided Tolerance Limits for Normal Distribution. Suitability of the normal distribution for representing the data shall be verified with normal probability plots, goodness of fit tests, etc.

   Then the upper one-sided tolerance limit for 99% reliability at 95% confidence is given by Xbar + ks. The interpretation of thistolerance limit is as follows: based on the test data, and assuming a normal distribution for the test data, we can be 95% confident that 99% of the population of values represented by the sample data will not exceed Xbar + ks. For any test parameter for which there is specified an upper requirement which is not to be exceeded, satisfactory performance of the product is achieved when the value of Xbar + ks does not exceed the requirement value.

   The lower one-sided tolerance limit for 95% confidence and 99% reliability is given by Xbar - ks. This has a similar interpretation and corresponding application to lower requirement values.

2. Failures attributed to equipment, test setup, or operator deficiencies shall not disqualify the product. When product failure occurs, corrective action shall be taken and samples resubmitted for qualification.

4.2. Requalification Testing

Requalification shall be established by the cognizant divisional engineering function and may consist of all or any part of the overall qualification program provided that it is conducted within the required time period.

4.3. Quality Conformance Inspection

The applicable quality inspection plan will specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.

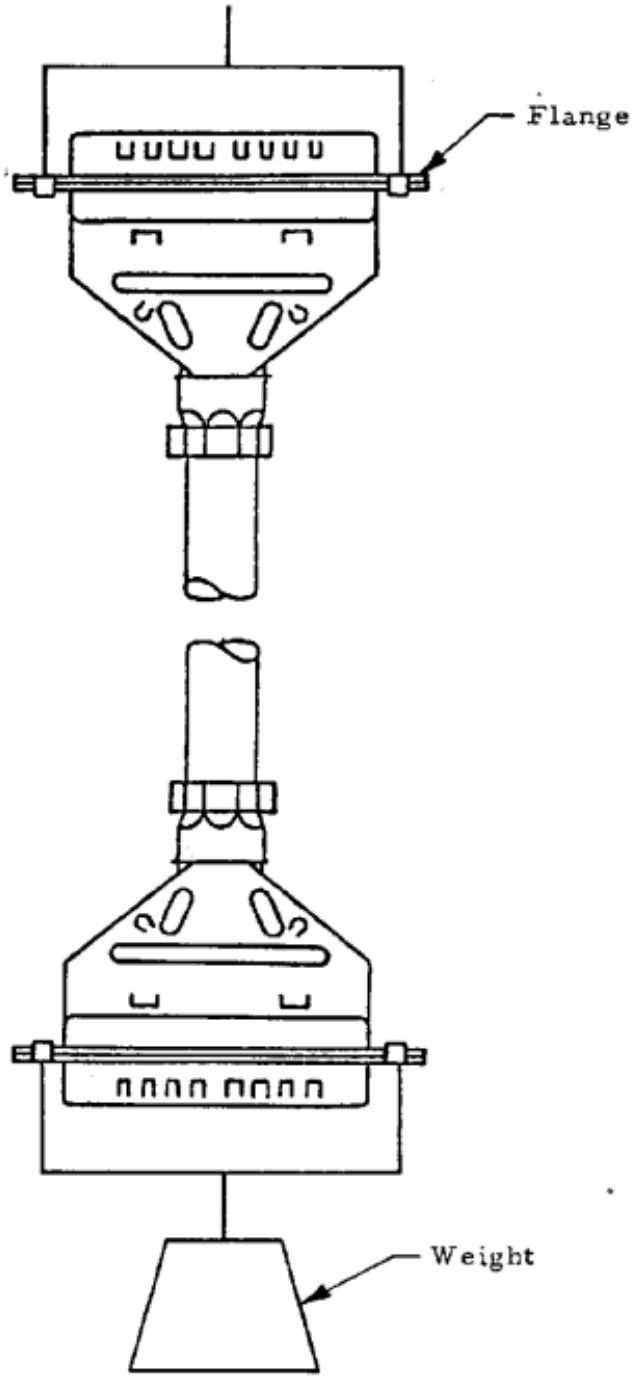


Figure 3
Cable Pullout

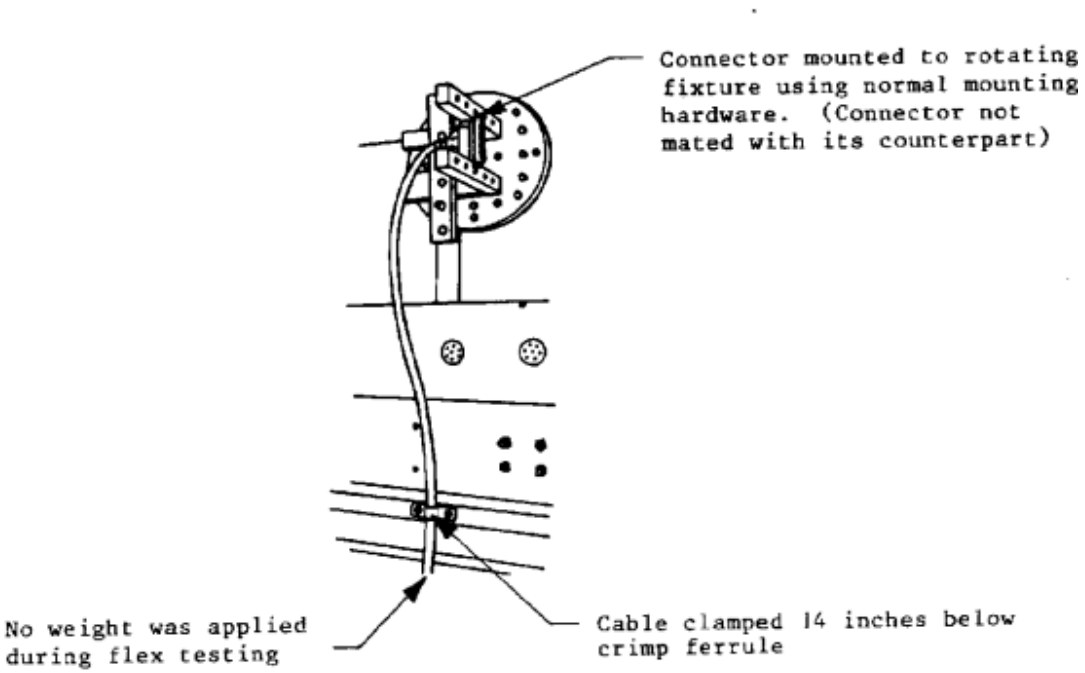


Figure 4
Circular Jacket Cable Flexing