Society of Cable Telecommunications Engineers

ENGINEERING COMMITTEE
Interface Practices Subcommittee

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Cable Retention Force Testing of Trunk & Distribution Connectors

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1. Scope

1. The purpose of this document is to define a standard test procedure to prepare, test and document the retention forces of a given connector/cable assembly, as whole or separate components.
2. This test is intended to determine the tensile forces required to cause one or more of the following conditions in a connector/cable assembly under test:
   - Catastrophic cable structural failure.
   - Connector structural failure.
   - Separation due to slip at the connector/cable interface.

2. Compliance Notation

shall	This word or the adjective "***required***" means that the item is an absolute requirement of this specification.
shall not	This phrase means that the item is an absolute prohibition of this specification.
forbidden	This word means the value specified ***shall*** never be used.
should	This word or the adjective "*recommended*" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighted before choosing a different course.
should not	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
may	This word or the adjective "*optional*" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.
deprecated	Use is permissible for legacy purposes only. Deprecated features may be removed from future versions of the standard. Implementations should avoid use of deprecated features.

3. Abbreviations and Definitions

3.1. Abbreviations

3.2. Definitions

Adapters/Fixtures	A mechanical device typically located between the test stand Load Cell or Crosshead and the DUT
Cable Jacket	The material covering the outer conductor (shield) to provide environmental and physical protection.
Center Conductor	The centermost portion of coaxial cable, typically consisting of solid copper, copper clad aluminum, or other conductive wire.
Chart Recorder	A device for plotting test results such as stress-strain curves.
Dielectric	The insulating and support material between the outer surface of the center conductor and the inside surface of the outer conductor (shield).
DUT	Device under Test, also referred to as specimen or sample.

Elastic Limit	the maximum stress a DUT is subjected to and will return to its original length once the load is released.
Flooding Compound	A material or substance placed between the outer conductor (shield) and the inside surface of the cable jacket to provide protection to the coaxial cable.
Load Cell	A calibrated, sensitive and precision device attached to one end of the test stand that converts tensile or compressive energy into electrical signals for the Chart Recorder or Data Acquisition Unit.
Outer Conductor (Shield)	the outermost portion of coaxial cable, typically consisting of copper, aluminum, or other conductive material.
Pin Connector	A device to interface coaxial RF cable to equipment.
Proportional Limit	the point on a stress-strain curve at which the DUT begins to deviate from the straight-line relationship between stress and strain.
RS232 Link	A computer output port capable of sending actual test data to a remote computer with data acquisition equipment, for processing with data analysis software
Splice Connector	A device to interface two pieces of coaxial RF cable.
Strain	is the amount by which a dimension of a device changes when subjected to a load, divided by the original value of the dimension
Stress	is force per unit area in pounds per square inch (psi). If stress lengthens or stretches material, it is called tensile stress.
Test Stand	The physical device to mechanically perform a tensile/compressive test.
Three Piece Connector	Typically incorporates an pin body, center nut and back nut.
Two Piece Connector	Typically incorporates an pin body and a back nut.
Ultimate Strength	Or Tensile Strength, is the maximum stress value obtained on a stress-strain curve.
Yield Point	A point on the stress-strain curve with a sudden increase in strain without a corresponding increase in the stress.

4. Equipment

1. A tensile test machine (Example- Instron Model 1156) or an equivalent system of separate components that provide the following:
   a. Equipment ***shall*** be adequate for the load being tested with a system accuracy of ±0.5 percent.
   b. A movable crosshead capable of constant travel at 2 inches/minute
   c. Chart recorder or similar feature capable of providing a plot of crosshead extension vs. load.
2. Appropriate adapters to connect test sample between crosshead and base. See Figure 1 for typical connector adapter.
3. Cable and connectors
4. Cable preparation & installation tools
5. Temperature Chamber capable of maintaining a constant test temperature between – 40 °F to 140 °F.
6. Applicable Safety Equipment (Safety Glasses, Equipment Guards, etc., as required)

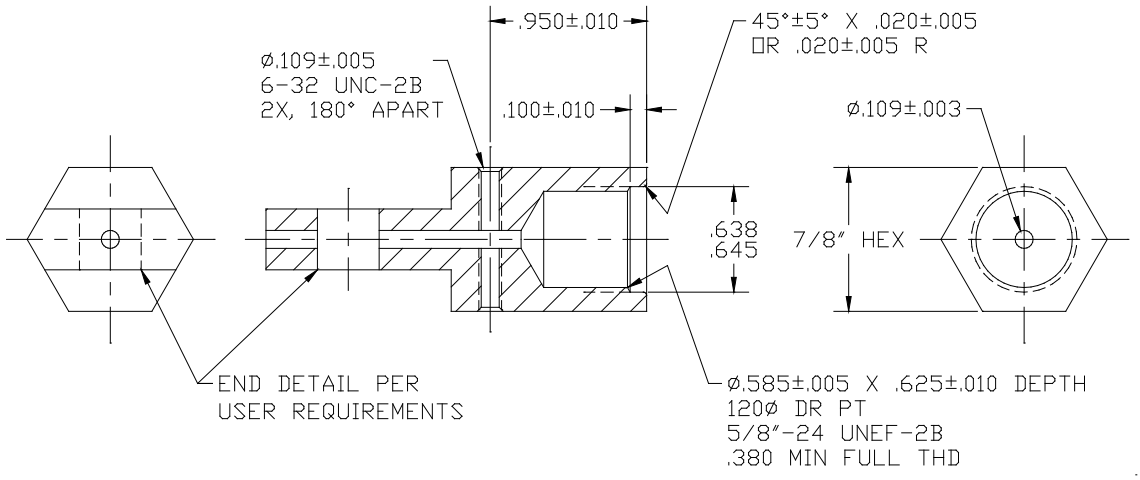

Figure 1: Typical Test Fixture

Note: Supply each test fixture with two #6-32 x 3/8" long Hex Socket, Cup Point Set Screws.

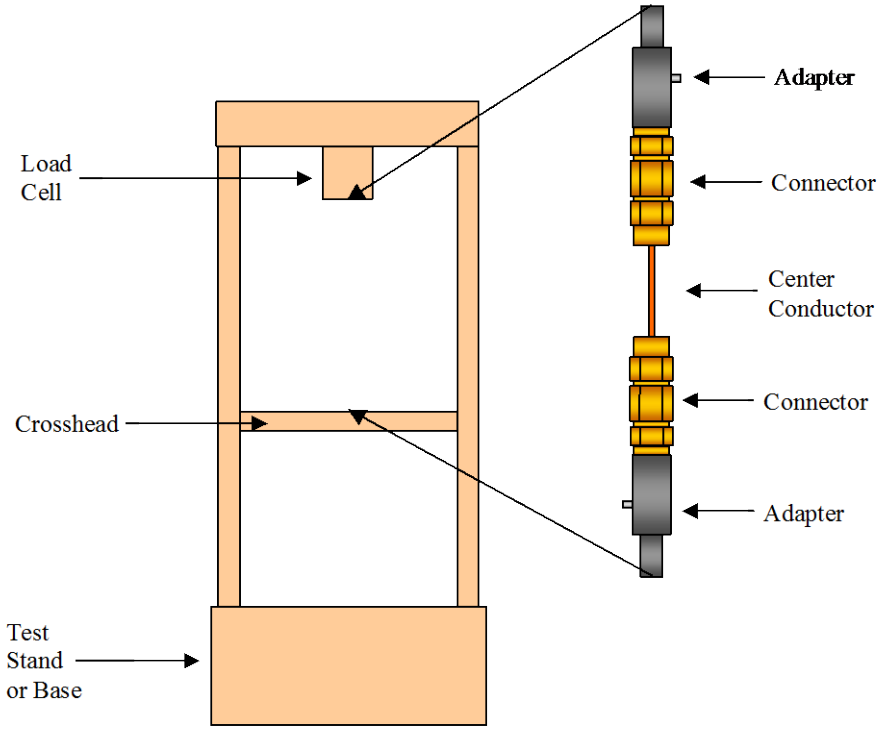

Figure 2: Diagram of a Typical Test Stand & Device Under Test

Note: Equipment varies. The load cell of some test stands *may* be affixed to the crosshead.

5. Test Sample PREPARATION

5.1. Center Conductor to Pin Connector

5.1.1. Prepare a four-inch (4") minimum length of center conductor with all dielectric removed.

Note: It *may* be necessary to prepare an additional section of cable outer conductor (shield) and jacket (if applicable) with the center conductor and dielectric removed. Position the cable shield (and jacket if applicable) into the connector back nut assembly. Ensure this section of cable does not interfere with the center conductor gripping mechanism of the tensile test equipment and/or connector.

5.1.2. Using the connector manufacturer's recommended tightening procedures, install and tighten prepared center conductor into a connector.

5.1.3. Select appropriate test fixture to grip center conductor, or prepare a second pin connector as shown in figure 3 below.

5.1.4. Attach test fixtures (adapters) to the Pin connector(s) (or center conductor) as required. Secure connector center conductor pin to fixture prior to testing to prevent pin movement.

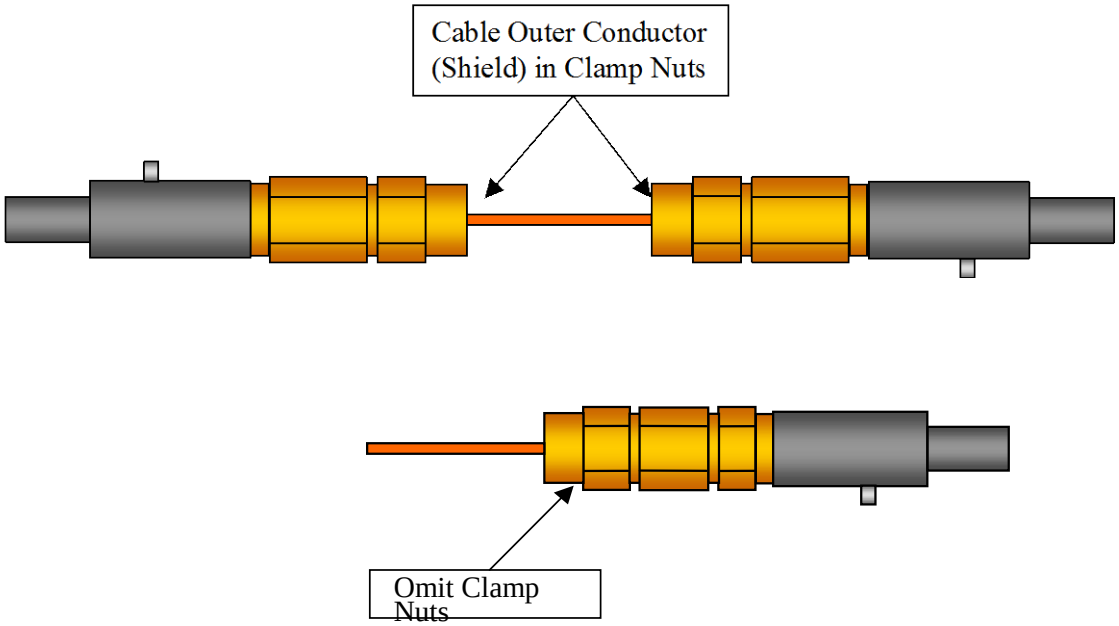

Figure 3: Test Sample Configurations, Center Conductor Pull

5.2. Outer Conductor* (Shield) to Pin Connector

5.2.1. Prepare an appropriate length of cable using cable preparation tools as recommended by the connector and/or cable manufacturer.

5.2.2. Cut the center conductor of cable flush with the end of the Outer Conductor* (Shield).

5.2.3. Install prepared cable into the connector under test using the connector manufacturer's recommended installation procedures.

5.2.4. Select appropriate test fixture to grip cable outer conductor, or prepare a second pin connector as shown in Figure 4 below.

5.2.5. Attach test fixtures (adapters) to the Pin connectors(s) or cable as required.

* *May* include flooding compounds and cable jacket.

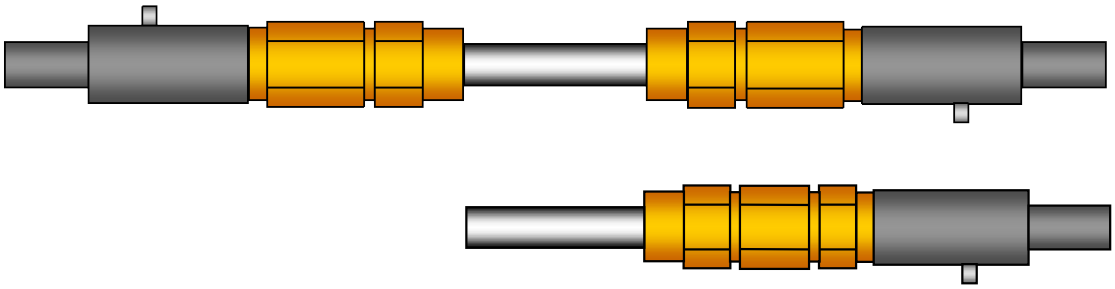

Figure 4: Test Sample Configurations, Outer Conductor Pull

5.3. Combined Center Conductor and Outer Conductor* (Shield) to Pin Connector

5.3.1. Prepare an appropriate length of cable using cable preparation tools as recommended by the connector and/or cable manufacturer.

5.3.2. Install prepared cable into the connector under test using the connector manufacturer's recommended installation procedures.

5.3.3. Select appropriate test fixture to grip the cable, or prepare a second pin connector as shown in Figure 5 below.

5.3.4. Attach test fixtures (adapters) to the Pin connectors(s) or cable as required.

- *May* include flooding compounds and cable jacket.

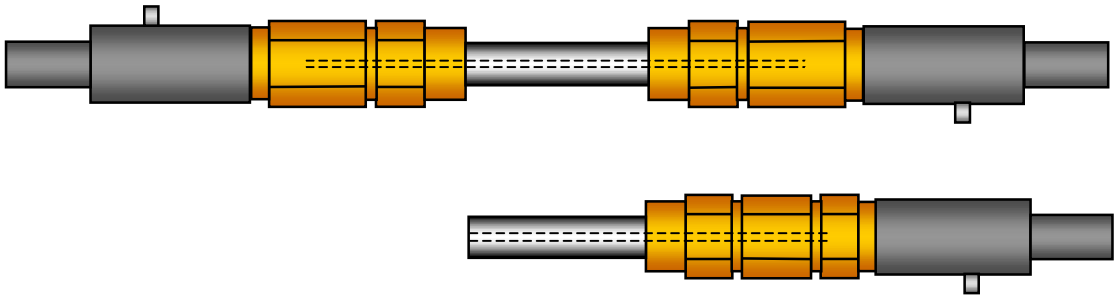

Figure 5: Test Sample Configurations, Combined Conductor Pull

6. Test Procedure

WARNING! PROCEED WITH CAUTION! Failure to follow test equipment operational instruction could result in serious bodily injury or property damage!

6.1. Verify that the units under test are at the specified test temperature prior to performing any tests.

6.1.1. DUT shall be conditioned for a minimum of 1 hour at test temperature prior to test.

6.2. Install the DUT into the tensile test system using the necessary fixtures, adapters and anchor pins. Caution: Use extreme care to avoid personal injury and/or damage to equipment.

NOTE:

DUT may be conditioned in a temperature chamber and transferred to test apparatus and conducting test in a timely manner.

DUT may be conditioned on the test apparaturs using a temperature chamber enclosure designed to surround the DUT while being tested.

6.3. Zero the force and extension settings as required.

6.4. Engage the recording device (if applicable).

6.5. Initiate the test sequence.

6.6. Conclude the test once the desired effect has been achieved.

6.7. Disengage the recording device (if applicable).

7. Test Data & Documentation

7.1. Inspect test samples as required.

7.2. The results of the test *shall* be documented.

7.3. Test Data

7.3.1. Cable Description

7.3.1.1. Cable Manufacturer/Part Number _____

7.3.1.2. Cable Type _____

7.3.2. Connector Description

7.3.2.1. Connector Manufacturer/Part Number _____

7.3.3. Cable Prep Description

7.3.3.1. Prep Tool Used _____

7.3.3.2. Hex Flat Dimensions (if applicable)

1) _____ 2) _____ 3) _____

7.3.4. Test Setup Description

Crosshead Speed	Full Scale Load	Test Temperature

7.3.5. Axial Load

Sample	Maximum Load
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Average	