

**CONSTRUCTION**



**Mechanical and Dimensional Requirements for Connectors**

- \* Each PATCH CORD shall be terminated in an eight-position modular plug connector **complying with the mechanical and contact specifications in ANSI/TIA-1096-A.**



**Gold Plating Requirements for Connector Contacts**

- \* Contact finish in the region of contact shall be **hard gold** and shall have a **minimum gold thickness of 1.2700 µm (50 µin).**
- \* The hard gold finish shall comply with the gold surface layer and nickel barrier layer requirements in section 5.1, HARD GOLD CONTACTS, of ANSI/TIA-1096-A
- \* A **smooth, burr-free surface shall exist** at the interface. **Contact surface roughness shall be 0.8128 µm (32 µin) maximum.** Compliance can be determined by observation with 10X magnification. Compare surface protrusions and burrs on the contact surface with a 32-µin, ground-surface-finish gauge.



**Solderless Connections**

- \* **Solderless connections shall meet the requirements of the appropriate IEC standard** as follows:
  - \* Insulation displacement terminations: **IEC 60352-3 or IEC 60352-4**
  - \* Crimp terminations: **IEC 60352-2**
  - \* Insulation piercing terminations: **IEC 60352-6**
  - \* Press-in connection: **IEC 60352-5**
  - \* Spring clamp terminations: **IEC 60352-7**
- \* Where a type of solderless termination is not covered by one of the standards listed above, a similar level of performance shall be determined according to 4.2.2.6 of **IEC 60603-7**



**Material Requirements for Connectors**

- \* A connector shall have a **minimum flame rating of V-1 (Sentinel is V-0, a higher rating) at the minimum thickness used**



**Cables**

- \* PATCH CORD cables shall be constructed of **four twisted pairs of stranded conductors**, optional shield(s), and an overall jacket.
- \* PATCH CORDS shall be UL Listed Communications Cable (**DUZX**)
- \* Cables used for PATCH CORDS shall meet the requirements in section 5.5, "Cord cable mechanical performance", in **ANSI/TIA-568-C.2-2009**



**Insulated Conductor Color Codes for Connectors**

- \* PATCH CORDS shall be terminated in either a **T568A or T568B configuration.** Both ends shall use the same configuration



**Lengths**

- \* The measured length of a PATCH CORD shall be within +/- 10% of the identified length when measured from the face of one connector to the face of the connector at the far end of the cable



**PERFORMANCE**

**General and Performance Category Tests**

**General**

- \* Tests shall be conducted in accordance with the **American Society for Testing and Materials Standard Test Methods (ASTM)**

**Performance Category Testing**

- \* Category 5e (unshielded and shielded), 6 (unshielded and shielded) and 6a (shielded only) PATCH CORDS shall be subjected to each of the tests required for PATCH CORDS (i.e. Return Loss and Near End Crosstalk) indicated in **ANSI/TIA-568-C.2**
- \* PATCH CORDS shall be tested bi-directionally at room temperature 20°C±3°C & 50±5% Relative Humidity. PATCH CORDS may be tested coiled. The referee method is for the cords to be straightened during the test.
- \* The test equipment to be used for testing shall be a **laboratory grade network analyzer** with baluns and test heads in compliance with **ANSI/TIA-568-C.2**.
- \* When different lengths of a particular PATCH CORD construction are being evaluated, the samples shall include the shortest, longest and mid-length cable assemblies

**Strain-Relief Test**

- \* The plug is to be mounted with the cord hanging in a vertical position. A **force of 50 N (11.25 lbf)** is to be gradually applied to the cord. The direction of application of the force is to be varied from directly downward to **an angle of 45 degrees** from the vertical in all directions. The force is to be applied for a **period of 1 minute**
- \* When the **strain-relief means utilizes a plastic part**, the test shall be repeated on **a new sample that has been oven aged for 7 days at 70°C (158°F)** and then allowed to reach room temperature
- \* The **cable shall not pull out of the plug as a result of the applied force. After the strain relief test(s) the performance category tests in section 6.2 shall be repeated and the PATCH CORD shall comply with the applicable requirements for the category**

**Flexing Test**

- \* A PATCH CORD shall be capable of withstanding **500 cycles of flexing** when tested in accordance with 8.1.1 or 8.1.2 below. The cable shall not pull out of the plug as a result of the applied force. **After the flexing test the performance category tests in section 6.2 shall be repeated and the PATCH CORD shall comply with the applicable requirements for the category**
- \* The PATCH CORD shall be tested in accordance with **IEC 61935-2:2010**, Specification for the testing of balanced and coaxial information technology cabling - Part 2: **Cords as specified in ISO/IEC 11801 and related standards, Edition 3.0 2010-07; Section 7.3, "Flexure"**. The **rate of flexure shall be 20 per minute**
- \* The PATCH CORD shall be tested in accordance with **IEC 61935-2:2010**, Specification for the testing of balanced and coaxial information technology cabling - Part 2: **Cords as specified in ISO/IEC 11801 and related standards, Edition 3.0 2010-07; Section 7.3, "Flexure"**. The **rate of flexure shall be 20 per minute**
- \* Each cable assembly is to be subjected to **500 complete flexing cycles**. A flexing cycle consists of rotation of the jaws from the vertical (centered) position until 90 degrees to one side, back past the vertical position until 90 degrees to the other side, and back to the vertical position. The rate of testing is to be 10 cycles per minute.
- \* **After the test, the balanced cord interface dimensions shall be within the specified limits.** Electrical test requirements stated in the relevant detail specification shall be complied with.



**PERFORMANCE (cont)**

**General and Performance Category Tests**

**Mechanical Operation Test**

- \* **Modular plugs** used on a PATCH CORD shall be able to withstand 750 mating cycles (insertions and withdrawals) without degradation of performance
- \* The **plug shall be subjected to 750 mating cycles without electrical load.** The minimum interval between cycles shall be 5 s. Mating and unmating of the plug and jack should be at a rate of 10 mm/s (0.4 in/s). The **mating jack shall be new and in compliance with ANSI/TIA-1096-A.** Mechanical aids which simulate normal operation may be used provided that they do not introduce abnormal stresses
- \* **After the test, the performance category tests in section 6.2 shall be repeated and the PATCH CORD shall comply with the applicable requirements for the category**

**Dielectric Voltage-Withstand Test**

- \* PATCH CORDS and connectors previously subjected to the temperature test shall be subjected to this test.
- \* **Immediately following the Temperature Test, the same devices shall withstand without arc-over or breakdown, the application of a 1000 volts dc test potential.**  
The test potential shall be applied between each of the contacts of the connector and between the contacts and any non-current-carrying metal parts.
- \* The applied potential is to be increased from zero until the required test voltage is reached, and is to be held at that voltage for a period of 1 minute. The increase in the applied potential is to be at a uniform rate and as rapid as is consistent with its value being correctly indicated by a voltmeter.

**MANUFACTURING AND PRODUCTION**

**Continuity Test**

- \* All PATCH CORDS shall be tested to verify that for each product: a) The conductors are connected to the intended terminals of the connector, and b) There is electrical continuity throughout the entire length of the conductor/contact assembly.

**Gold Surface Layer Verification**

- \* The verification of the gold surface layer in the specified contact interface area shall meet the following requirements:
- \* The material content shall be 99% pure gold minimum
- \* The material density shall be 17 grams/cm<sup>3</sup> minimum
- \* The minimum gold thickness in the specified interface area shall be 1.2700 μm (50 μin)
- \* The Knoop microindentation hardness value shall be between 130 and 250 when measured in accordance with ASTM E384-05a using a load force of 0.245 N (25 g)
- \* Test specimens shall exhibit no corrosion products having a diameter greater than 0.05 mm (0.002 in) when tested for porosity and other surface defects per EIA-364-53B
- \* A smooth, burr-free surface shall exist at the interface in the contact area. Contact surface roughness shall be 0.8128 μm (32 μin) maximum



**MARKINGS**

**General Markings**

- \* The shipping package of each cable assembly shall be marked where it will be plainly visible with the following:
  - \* The manufacturer's name, trade name, or trademark or other descriptive marking by which the organization responsible for the product may be identified;
  - \* A distinctive catalog number or the equivalent;
  - \* The maximum data transmission rate tested; and
  - \* The length of the cable.
- \* If a manufacturer produces or assembles cable assemblies at more than one factory, a distinctive marking, which may be in code, shall be provided such that the cable assembly can be identified as the product of a particular factory.
- \* An attached tag on the PATCH CORD is marked with an appropriate performance level designation, such as the Category number designation 5e, 6 or 6a, to indicate the requirements in the standard to which the cable was investigated. Surface marking on the cable is acceptable



**FOLLOW-UP SERVICE PROGRAM**

**FUS Program Requirements**

- \* The Follow-Up Program for this Certification Service will be documented in the Follow-Up Services Procedure. The program consists of Follow-Up examinations by the UL Representative at the factory and Follow-Up testing at UL on samples selected by the UL Representative
- \* UL Representative's Examination and Testing. The UL Representative will visit the manufacturer on a quarterly basis. During each inspection, the UL Representative shall examine all production bearing or intended to bear the Certification Marking. This will include a construction review of the product to determine compliance with the UL Follow-Up Service Procedure description.
- \* Follow-Up at UL. Twice each year, the UL Representative shall select three (3) of the shortest and three (3) of the longest PATCH CORD samples of a performance category and mail them to the UL test office for Follow-Up testing. The selected samples shall be subjected to all of the tests (i.e. Return Loss and Near End Crosstalk)

