



108-32097 Revision 1

HFT5000

Heat-Shrinkable Fabric Tubing (Orange)

SCOPE

This Quality Assurance Specification establishes the quality standard for TE Connectivity Orange Heat-shrinkable Fabric Tubing (HFT) which consists of heat shrinkable members in the hoop direction (weft) and protective fibres in the longitudinal direction (warp).

The product is intended for use in applications where protection of a substrate (e.g. cable), from wear due to abrasion is required. HFT5000 (orange) is equivalent in performance to the black product and meets the performance requirements of Specification RW 2060. In RW2060, functional characteristics are described in terms of product installed onto rubber hose which also provides a convenient standard test substrate for the orange product.

In addition, HFT5000 (orange) meets the performance requirements contained within this specification.

Approved Signatories

This document is electronically reviewed and approved - therefore no signatures will appear.

1. REVISION HISTORY

| Revision Number | Change Request | Date | Incorporated By |
|-----------------|-----------------|----------|-----------------|
| 1 | Initial release | 16-08-16 | V. Hill |
| | | | |

2. REQUIREMENTS

2.1 Composition, Appearance and Colour

Heat shrinkable, cross-linked, modified polyolefin monofilament weft fibres and polyester, multifilament warp fibres.

The longitudinal warp fibres shall be orange.
The monofilament weft fibres shall be black.

With correct product selection, the product shall be essentially orange in colour after installation.

2.2 Dimensions

Dimensions shall be as specified in the relevant specification control drawing (SCD).

2.3 Test Requirements

The product shall meet the test requirements of Table 1.

3 TEST METHODS

3.1 Preparation of Test Specimens

Refer to individual test clauses for the required sample configuration.

Tests shall be carried out on product samples installed horizontally onto the substrate in a hot air oven at $180\pm 5^{\circ}\text{C}$ for 10 minutes.

| Sample Configuration | Product | Substrate | | | HFT Sample Length (mm) |
|----------------------|-----------------|-----------|---------------|-------------|------------------------|
| | | Type | Diameter (mm) | Length (mm) | |
| 1 | HFT5000-20/10-3 | Metal Rod | 10 | 130 | 100 |
| 2 | HFT5000-20/10-3 | Metal Rod | 13 | 130 | 100 |

After cooling, the installed samples shall be subjected to the tests described in this specification.

3.2 Visual

The installed samples shall be examined with the naked eye for any signs of splitting or damage.

3.3 Abrasion Resistance

This test is carried out essentially in accordance with ISO 6722-1, Clause 5.12, Scrape Abrasion with the following modifications:

- 4 samples are prepared as per configuration 1, clause 3.1.
- 4 individual tests are carried out on the following surfaces of the product (“catch-lock”, opposite “catch-lock” and 2 remaining “plain” surfaces – e.g. all sides of product at 90° intervals)
- Each test is carried out on a new sample.
- Vertical force of 7N.
- 20mm stroke length.
- During the test, the abrasion needle is not required to lift at each end of the abrasion stroke.

3.4 Dynamic Cut-Through Resistance

This test is carried out essentially in accordance with BS G 212, clause 2.15.4 with the following modifications:

- Samples are prepared as per configuration 2, clause 3.1.
- The test is carried out using a tensometer with suitable “dynamic cut-through” fixture, and relevant test parameters to mimic the BS G 212 test*.
- Test to be carried out at a temperature of $20 (\pm 3)^{\circ}\text{C}$.
- 4 measurements are carried out on the following 4 surfaces of each sample (“catch-lock”, opposite “catch-lock” and 2 remaining “plain” surfaces – tests at 90° intervals).
- Sample to be moved 10mm longitudinally between each measurement.

* It has been calculated that in-line cut-through equipment with a load application speed of 8791g/min (0.0862kN/min) is equivalent to BS G 212 “lever” apparatus with a test speed 700 g/min. See section 4 “RELATED STANDARDS & ISSUE”.

3.5 Short Term (Accelerated) Ageing

Sample Set 1 - 4 samples are prepared as per configuration 1, clause 3.1.

Sample Set 2 - 4 samples are prepared as per configuration 2, clause 3.1.

Samples are conditioned horizontally in a fan assisted air circulating oven for 240hrs at 150(\pm 3) $^{\circ}$ C.

On removal from the oven, the samples shall be allowed to stabilise at ambient conditions, visually examined and then subjected to:

- Abrasion resistance test as per clause 3.3 (Sample Set 1)
- Dynamic cut-through resistance test as per clause 3.4 (Sample Set 2)

3.6 Long Term Ageing

Sample Set 3 - 4 samples are prepared as per configuration 1, clause 3.1.

Sample Set 4 - 4 samples are prepared as per configuration 2, clause 3.1.

Samples are conditioned horizontally in a fan assisted air circulating oven for 3000hrs at 125(\pm 3) $^{\circ}$ C.

On removal from the oven, the samples shall be allowed to stabilise at ambient conditions, visually examined and then subjected to:

- Abrasion resistance test as per clause 3.3 (Sample Set 3)
- Dynamic cut-through resistance test as per clause 3.4 (Sample Set 4)

4. RELATED STANDARDS & ISSUE

| | |
|--|---|
| ISO 6722-1:2011(E) | Road vehicles -- Unscreened low-tension cables Part 1: Test methods |
| BS G 212:1971 (03-2000) | Specification for General requirements for aircraft electrical cables |
| TE Connectivity | Dynamic Cut-Through Resistance Calculation Laboratory Notebook 5519/76 (R. Davies) |
| Subsequent amendments to, or revisions of, any of the above publications apply to this standard only when incorporated in it by updating or revision. | |

5. SAMPLING

Tests shall be carried out on a sample taken at random from each batch of finished product. A batch of product is defined as that quantity manufactured at any one time from the same component batches.

Testing frequency shall be Production Routine or Qualification. Production Routine tests consisting of Visual Examination, Dimensions and Longitudinal Change shall be carried out on every batch of product.

Qualification tests shall be carried out to the requirements of the Design Authority and shall be carried out on the specified size which shall qualify all sizes in the range.

6. PACKAGING

Packaging shall be in accordance with good commercial practice. Each package shall bear an identification label showing material quantity, description, size and batch number. Additional information shall be supplied as specified in the contract or order

TABLE 1 - Test Requirements**(In addition to the performance requirements covered in RW2060)**

| Test | Test Method Clause | Test Requirements | |
|---|--------------------|--|-------|
| Abrasion Resistance | 3.3 | Number of Abrasion Cycles to Failure (min.)* | 20000 |
| Dynamic Cut-Through Resistance | 3.4 | Dynamic Cut-through force (N) (min.) | 300 |
| Short Term (Accelerated) Ageing 240hrs/150°C | 3.5 | Number of Abrasion Cycles to Failure (min.)* | 10000 |
| | | Dynamic Cut-through force (N) (min.) | 300 |
| Long Term Ageing 3000hrs/125°C | 3.6 | Number of Abrasion Cycles to Failure (min.)* | 10000 |
| | | Dynamic Cut-through force (N) (min.) | 300 |

* Note: During testing, “spaces” can occur in fabric products causing the test mandrel to become visible before the end of the test (electrical “cut-out”, i.e. electrical contact between test blade and metal test mandrel can occur at a significant number of cycles after the test mandrel first becomes visible).

In line with a policy of continual product development, TE Connectivity reserves the right to make changes in construction, materials and dimensions without further notice. You are advised, therefore, to contact TE Connectivity, should it be necessary to ensure that this document is the latest issue.