SPECIFICATION RW-2512

TE 108-121015

HT-SCE and HT-CT
HEAT SHRINK MARKER SLEEVES

SCOPE

This quality assurance specification establishes the quality standard for a heat-shrinkable identification sleeving for use in applications where high performance during exposure to organic fluids, especially oils and diesel fuel is required. These special requirements are detailed in Table 5.

The operating temperature for this product is -55℃ to +225℃ (-67 to +437℉).

This system is an automatic method of identifying items by printing a mark on HT-SCE product range. The mark is permanent upon printing. This system is not recommended where strain relief properties are required.

The marker shall be fabricated from cross linked polymer tubing, flattened and then mounted on a carrier as HT-SCE or supplied as flattened spooled continuous tube as HT-CT. All sizes 2:1 shrink ratio except size 3/32 which is 3:1 shrink ratio (refer to Table 1 for more details).

The marker system comprises specific printers and ribbons; refer to TE document 411-121005 'TE Identification Printer Product Ribbon Matrix'. Products printed with the white or silver ribbons may not fully comply with this specification when exposed to some aggressive fluids, details on page 15. Compliance to this specification can only be guaranteed if TE Connectivity approved printers and ribbons are used.

Unless specified, the tube size for qualification testing is 6.4mm.

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1 REVISION HISTORY

Revision Number	Description of change	Date	Incorporated By
1	RT-1806 (original)	---	---
2	---	---	---
3	Integrated in to RW doc	July 2004	Alan Kean
4	Addition of printer ribbon matrix, removal of obsolete specs.	Jan 2013	Lee Smith
5	Standardise test fluids, addition of UV resistance test	Nov 2013	Alan Kean
6			

2 SCOPE

The tests in this specification, as completed on HT-SCE products, define the performance of a high temperature, self-extinguishing, heat shrink marker sleeve for rail, aerospace and construction industries. Test procedures have been selected based on the ability of that test to provide key performance data which can be used by an engineer to provide information which can be used to validate the fit form and function of installed products.

3 REQUIREMENTS

3.1 Composition, appearance and color

The sleeving shall be fabricated from irradiated, thermally-stabilised polyolefin compound.
It shall be homogeneous and essentially free from flaws, defects, pinholes, bubbles, seams, cracks or inclusions. The marker sleeves shall be White unless otherwise specified.

4 DIMENSIONS

The product shall be supplied in one of the following formats:

- HT-SCE As shown in figure 1 to the dimensions of Table 1.
- HT-CT Continuous tubing to the dimensions of Table 1.

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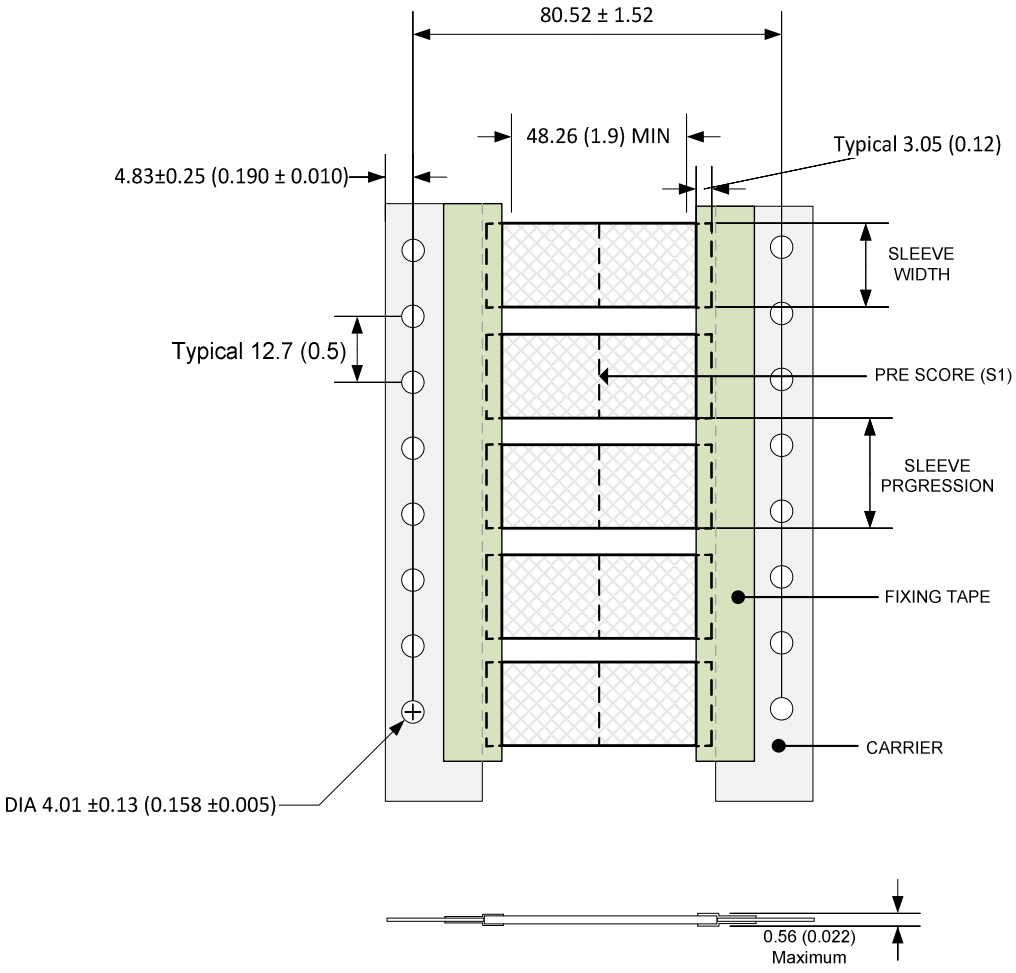
5 FIGURE 1: HT-SCE SLEEVE FORMAT



Dimensions in mm (inch)

Heat Shrink Product in as Supplied “D” (Expanded) and in the Recovered State “d”.

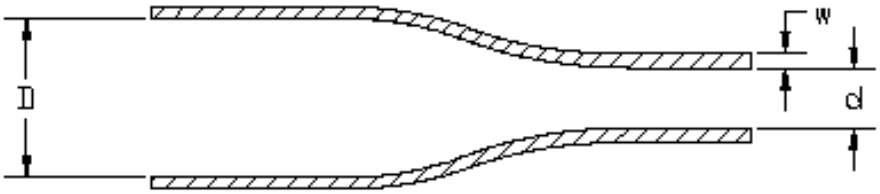


Figure 2. Product Dimensions Change During Recovery

6 DIMENSIONS

HT-SCE and HT-CT						
Part Description	**Minimum Supplied Inside Diameter mm (inches)**	**Maximum Recovered Inside Diameter mm (inches)**	**Wall Thickness after Recovery mm (inches)**	**Minimum Sleeve Flattened Width mm (inches)**	**Sleeve Progression[1] mm (inches)**	**Nominal Weight of single sleeve (~50mm long) grams**
HT-SCE-3/32	2.36 (0.093)	0.79 (0.031)	0.38 ± 0.08 (0.015 ± 0.003)	4.32 (0.17)	12.70 ± 0.64 (0.500 ± 0.025)	0.14
HT-SCE-1/8	3.18 (0.125)	1.58 (0.0625)	0.38 ± 0.08 (0.015 ± 0.003)	5.84 (023.)	12.70 ± 0.64 (0.500 ± 0.025)	0.21
HT-SCE-3/16	4.75 (0.187)	2.38 (0.0935)	0.38 ± 0.08 (0.015± 0.003)	8.00 (0.315)	12.70 ± 0.76 (0.500 ± 0.030)	0.29
HT-SCE-1/4	6.35 (0.250)	3.18 (0.1250)	0.38 ± 0.08 (0.015 ± 0.003)	10.7 (0.42)	16.94 ± 0.89 (0.667 ± 0.035)	0.38
HT-SCE-3/8	9.53 (0.375)	4.76 (0.1875)	0.38 ± 0.08 (0.015 ± 0.003)	15.49 (0.61)	25.40 ± 0.89 (1.000 ± 0.035)	0.53
HT-SCE-1/2	12.70 (0.500)	6.35 (0.250)	0.38 ± 0.08 (0.015 ± 0.003)	20.3 (0.80)	29.64 ± 1.00 (1.167 ± 0.040)	0.73
HT-SCE-3/4	19.05 (0.750)	9.53 (0.3750)	0.38 ± 0.08 (0.015 ± 0.003)	30.5 (1.20)	42.34 ± 1.00 (1.667 ± 0.040)	1.30
HT-SCE-1	25.40 (1.000)	12.70 (0.500)	0.43 ± 0.10 (0.017 ± 0.004)	40.4 (1.59)	50.80 ± 1.00 (2.000 ± 0.040)	1.61
HT-SCE-1-1/2	38.10 (1.500)	19.05 (0.750)	0.43 ± 0.10 (0.017 ± 0.004)	60.2 (2.37)	71.96 ± 1.00 (2.833 ± 0.040)	2.51

Table 1. Product dimensions

[1] Sleeve progression column is applicable only for ladder format

7. TEST REQUIREMENTS

This specification details the requirements for the HT family of products. Table 4 lists the general requirements and Table 5 lists the specific performance.

8. TEST METHODS

8.1. Preparation of Test Specimens

When required by the test procedure, product shall be printed using printers and ribbons specified by TE Connectivity. The full list can be found in TE document 411-121005 'TE Identification Printer Product Ribbon Matrix'.

Print random characters onto the sleeving to within approximately 6mm (1/4 inch) of both ends using font type Arial 10 bold. Markers are to be removed from the carrier (non-continuous products) or cut/perforated and separated using TE approved printer systems (HT-CT) before testing. Test in 'fully recovered' form.

The marking shall be examined for legibility in accordance with TE Document 411-121002 Print Contrast Reference Scale. The initial print contrast must be 8 or above.

As required, sleeves or tubing should be recovered by placing them in a forced air oven for 3 minutes at 200±5℃. Specimens will be removed from the ove n and allow to cool to 23±3℃ for at least 4 hours before continuing. Where required by the test method, testing shall be done on continuous tubing (D-SCE-FLAT). No pre-conditioning period is required prior to testing except where specified.

Unless otherwise specified, all tests shall be made at a temperature of 23±2℃.

8.2. Workmanship

Visually examine three samples for workmanship using normal vision and without magnification. Check for flaws, defects, pinholes, bubbles, seams, cracks or inclusions. The visual examination should be made with the specimen placed inside a laboratory light box with D65 illumination.

Measure the colour of as received sleeves before any printing using a spectrophotometer. Measure and record values for l*a*b* using the 3mm aperture and D65 illuminance. Colour results are recorded for information only.

8.3. Print Performance

8.3.1. Mark Adherence

Three fully recovered sleeves shall be prepared as detailed in Clause 8.1 and tested in accordance with TE 109-121012. Samples shall be tested using a Crockmeter fitted with an eraser and 1kg load using the number of rubs specified in the requirement table.

After the Mark Adherence test, the marking shall be examined for legibility using normal reading vision. Print contrast shall be evaluated in accordance with TE 411-121002.

8.3.2. Solvent Resistance

Nine fully recovered sleeves shall be prepared as detailed in Clause 8.1 and tested in accordance with TE 109-121014.

The marking shall be examined for legibility using normal reading vision. Print contrast shall be evaluated in accordance with TE 411-121002

8.3.3. Fluid Resistance, Mark Permanence

The test method shall be as specified in TE 109-121039. Prepare three fully recovered markers as detailed in Clause 8.1. Markers shall be completely immersed in each of the fluids for the times and at the temperatures specified in the requirements table. The volume of the fluid shall not be less than 20 times that of the specimen. After immersion, the markers are lightly blotted with tissue paper to remove excess surface fluid and air dried at 23±2℃ for 45±15min. Samples are tested with a Crockmeter fitted with 'Super Twill' cloth and a 1kg load.

Additional testing in IPA is required using three as received and three fully recovered markers as detailed in Clause 8.1. Load the Super Twill' cloth with IPA and test for mark permanence as detailed in TE 108-121-012.

After the print permanence test, marking shall be examined for legibility using normal reading vision. Print contrast shall be evaluated in accordance with TE 411-121002.

8.4. Physical Testing

8.4.1. Dimensions and Longitudinal Change

The test method shall be as specified in TE 109-121003.
Three 50mm long marker sleeves shall be tested for inside diameter, and a further three 150mm long sleeves taken from a continuous reel shall be tested for Longitudinal Change. For Longitudinal Change, two gauge marks shall be positioned 100mm apart on each sleeve. The markers shall be recovered in a fan assisted air-circulating oven using the details given in 8.1 and the distance between gauge lengths and inside diameter of each shall be measured, after cooling to room temperature. The longitudinal change shall be expressed as a percentage of the original gauge length. The minimum and maximum recovered wall thickness shall be determined.

8.4.2. Tensile Strength and Ultimate Elongation

The test method shall be as specified in TE 109-121002. Test five recovered tubular specimens 125mm long. An initial jaw separation of 50mm with a gauge length of 20mm and rate of jaw separation of 100±5mm per minute shall be used.

8.4.3. Specific Gravity

Samples of un-printed product shall be tested to the procedure as specified in TE 109-121015. Three specimens of fully recovered tubing 25mm long should be tested. Test specimens should be prepared to prevent trapping of air.

8.4.4. Split Testing

The test method shall be as specified in TE 109-121031. Ten perforated or scored marker sleeves should be tested. Samples should be recovered, onto pre-heated mandrel for at the time and temperature stated in the test method. Samples should be examined for splitting after cooling to 23±2℃ as specified in section 8.1.

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8.5. Thermal Testing

8.5.1. Heat Shock

The test method shall be as specified in TE 109-121007. Six sleeves shall be prepared as detailed in section 8.1. Specimens shall be conditioned for 4 hours at 275±2℃ (437±5℉) in an air circulating oven. Remove the markers and leave to cool to room temperature for a minimum of 2 hours at 23±2℃ (73±5℉).

After conditioning three samples shall be tested for Mark Adherence in accordance with section 8.3.1.

The marking shall be examined for legibility using normal reading vision. Print contrast shall be evaluated in accordance with TE 411-121002.

The three remaining samples shall be tested for resistance to bending. Mandrel diameter for HT-SCE-6.4 size tubing is 19.1mm.

8.5.2. Heat Ageing

The test method shall be as specified in TE 109-121008. Six sleeves shall be prepared as detailed in section 8.1. Specimens shall be conditioned for 168 hours at 225±2℃ (302±5℉) in an air circulating oven. Markers shall be removed and allowed to cool to room temperature for a minimum of 4 hours at 23±2℃ (73±5℉).

After conditioning three samples shall be tested for Mark Adherence, in accordance with section 8.3.1.

The marking shall be examined for legibility using normal reading vision. Print contrast shall be evaluated in accordance with TE 411-121002. The remaining three samples shall be tested for resistance to bending. Mandrel diameter for HT-SCE 6.4 size tubing is 19.1mm.

8.5.3. Low Temperature Flexibility

The test method shall be as specified in TE 109-121006. Six fully recovered sleeves shall be prepared as detailed in section 8.1. Specimens shall be conditioned for 4 hours at -55±2℃ in a cold chamber. After conditioning, and whilst still at -55±2℃, half of the samples shall be immediately tested for resistance to bending. Mandrel diameter for HT-SCE 6.4 size tubing is 19.1mm.

Three of each of the remaining markers shall be removed from the cold chamber and allowed to return to room temperature for a minimum of 2 hours at 23±2℃. Samples shall be tested for Mark Adherence in accordance with section 8.3.1. The marking shall be examined for legibility using normal reading vision. Print contrast shall be evaluated in accordance with TE 411-121002.

8.5.4 Thermal Cycling

The test method shall be as specified in TE 109-121057. Six recovered samples should be prepared for testing as detailed in section 8.1. Specimens shall be conditioned for six cycles of thirty minutes at -196±5℃ and then thirty minutes at 200℃±5℃ in an air circulating oven. After the final cycle remove the markers and leave to cool to room temperature for a minimum of 2 hours at 23±2℃

Three samples shall be tested for Mark Adherence in accordance with TE 108-121012. The marking shall be examined for legibility using normal reading vision. Print contrast shall be evaluated in accordance with TE 411-121002.

The three remaining samples shall be tested for resistance to bending. Mandrel diameter for HT-SCE 6.4 size tubing is 19.1mm.

8.6. Environmental Testing

8.6.1. Copper Mirror Corrosion

The test method shall be as specified in TE 109-121009. Three glass test tubes should be used. Prepare one control tube with copper mirror only, and two tubes with mirrors and printed product. Prepare samples out of recovered specimens, using at least 150mm^2 surface area of product in each tube. Use a printed sample 10mm long. After the test, mirrors should be assessed for corrosion.

8.6.2. Water Absorption

The test method shall be as specified in TE 109-121016. Three 25mm long helical samples should be cut from recovered printed tubing specimens. Samples should be weighed after drying in the oven and after immersion in water. The mean average of three samples should be stated.

8.6.3. UV Resistance

The test shall be carried out using a UV-O-meter chamber in accordance with ASTM G154. Test for 1000 hours at 1.35 W/m^2/nm irradiance.

Prepare six printed, recovered samples for testing.

Condition two sets of markers prepared as specified in section 8.1 to the following regimes:

i) UVA type fluorescent bulbs, consisting of a repeating cycle of 8 hours exposure at 60±2℃ (140℉) followed by 4 hours of condensation at 50±2 ℃ (122℉).

ii) UVB type fluorescent bulbs, consisting of a repeating cycle of 8 hours exposure at 60±2℃ (140℉) followed by 4 hours of condensation at 50±2 ℃ (122℉).

After conditioning test half of the sleeves for flexibility using a 90º mandrel bend test. Mandrel diameter for HT-SCE 6.4 size tubing is 19.1mm. Samples shall be visually examined for cracking or splitting.

The remainder of the samples shall be measured for Test Mark Adherence in accordance with section 8.3.1. The marking shall be examined for legibility using normal reading vision. Print contrast shall be evaluated in accordance with
TE 411-121002.

8.6.4 Vacuum Outgassing

Recover three finished markers for 3 minutes at 200±5℃ (392±9℉) and test for percent total weight loss and percent volatile condensable materials. The conditions for testing are: Exposure time, 24 hours; sample temperature, 130±2℃ (266 ± 4℉); condensing surface temperature, 18±3℃ (64±5℉); and pressure, not greater than 1 x 10-5 Torr. The vacuum shall be provided by a diffusion pump and a liquid nitrogen trap. The apparatus shall consist of a glass sample chamber, refluxing liquid heat source and a polished stainless steel plate in close contact with a copper cold finger cooled internally by circulating water. The axis of the exit of the sample chamber shall be perpendicular to and approximately 7 mm from the cooled condensing plate. Use a micro balance to weigh the specimens before and after conditioning and calculate total weight loss. Weigh the condensing plate before and after to calculate percent volatile condensable material.

8.7. Electrical Testing

8.7.1. Dielectric strength

The test method shall be as specified in TE 109-121005. Five printed 150mm long specimens to be recovered onto clean steel mandrels (ensuring a tight fit) 24 hours before testing. A 25mm wide aluminium self-adhesive foil electrode to be installed in the centre of each of the recovered and cooled down samples. Average dielectric strength of five samples to be recorded as the result.

8.7.2. Volume Resistivity

The test method shall be as specified in TE 109-121017. Three 200-250mm long printed specimens are to be recovered onto clean 300mm long, steel mandrels (no larger in diameter than 15% of the fully recovered diameter of the tested tubing). Each sample should have a 150mm long silver paint electrode painted a minimum 4 hours before testing. Average volume resistivity value should be recorded as the result.

8.8. Fire Safety

8.8.1. Fire Propagation, ASTM D2671 Procedure B

Five printed samples shall be prepared and tested in accordance with TE method 109-121053. 460mm long samples should be installed onto 530mm long mandrels. Each sample should have a paper flag indicator 250mm above the flame impingement point. The flame should be applied to the sample at a 70° angle. The flame should be applied five times; each application is 15s on and 15s off.

The duration of burning and percentage of the burnt area shall be recorded.

8.8.2. EN45545-2 Flammability Hazard Level, Oxygen Index, BS EN ISO 4589-2

The test method shall be as specified in TE 109-121054. Tests shall be carried out on 3mm thick plaques of the material from which the sleeving is fabricated. The plaque should be irradiation cross-linked to the same degree as the sleeving. Test piece dimensions shall be 6.5 ± 0.5mm x 80 ± 1mm x 3 ± 0.5mm cut from the plaques. Samples shall be conditioned for at least 24hrs at 23±2℃ (73±5℉) prior to testing. A new test piece shall be used for each determination.

8.8.3. Surface Flammability, Flame Spread Index, Is, ASTM E162

This test is performed in accordance with ASTM E162, with the following modification: Instead of testing a moulded plaque, 25.4mm continuous tubing printed with two lines of text is used.

To arrange the samples to form the specified exposed area, 13mm wide cement board fingers are cut from a single board. Six 75mm lengths are cut from the tube, which is then recovered over the cut cement board fingers. The cement board fingers are butted together to form a single sheet. Five single sheets are placed side by side vertically for each test to create the required test specimens. Samples are conditioned for at least 24 hours at 23±2℃ (73±5℉) before fire testing.

8.8.4. Smoke Optical Density, Ds, ASTM E662

This test is performed in accordance with ASTM E662, with the following modification: Instead of testing a moulded plaque, 25.4mm continuous tubing printed with two lines of text is used.

To arrange the samples to form the specified exposed area, 13mm wide cement board fingers are cut from a single board. Six 75mm lengths are cut from the tube, which is then recovered over the cut cement board fingers. The cement board fingers are butted together to form a single sheet. Samples are conditioned for at least 24 hours at 23±2℃ (73±5℉) before fire testing. Testing is carried out using an NBS smoke chamber with a 25kW/m^2 radiant heat. Tests are carried out with and without a pilot flame.

8.8.5. Heat Release, ASTM E1354

This test is performed in accordance with ASTM E1354, with the following modification: Instead of testing moulded plaques, 25.4mm continuous tubing which has been printed with two lines of text is used.

To arrange the samples to form the specified exposed area, 13mm wide cement board fingers are cut from a single board. Six 75mm lengths are cut from the tube, which is then recovered over the fingers. The cement board fingers are butted together to form a single sheet. Samples are conditioned for at least 24 hours at 23±2℃ (73±5℉) before fire testing.

Samples are tested using a 50kW/m2 heat flux. Average Heat Release Rate, Maximum (peak) heat release rate and Average Specific Extinction Area at 3 minutes is measured.

8.8.6. Toxic Gas Generation, Bombardier SMP 800-C

This test is performed in accordance with Bombardier SMP 800-C, with the following modification: Instead of testing a moulded plaque, 25.4mm continuous tubing printed with two lines of text is used is used to represent end use condition.

To arrange the samples to form the specified exposed area, 13mm wide cement board fingers are cut from a single board. Six 75mm lengths are cut from the tube, which is then recovered over the cut cement board fingers. The cement board fingers are butted together to form a single sheet. Samples are conditioned for at least 24 hours at 23±2℃ (73±5℉) before fire testing

SMP 800-C is carried out during the ASTM E662 test. Gases are extracted and analysed using the techniques described in SMP 800-C

9. RELATED DOCUMENTS

9.1. Related Standards and Issue

ASTM D2671: 1999	Standard Test Methods for Heat-Shrinkable Tubing for Electrical Use
ASTM G-154-12a	Standard plastics for operating light and water exposure apparatus (fluorescent UV condensation type) for exposure of non-metallic materials.
AMS-DTL-23053E	Insulating Sleeving, Electrical, Heat Shrinkable, General Specification for Marking of Electrical Insulation Materials.
BS 4G 198-3: 1999	Sleeves and moulded components for aircraft electric cables and equipment wires. Specification for heat shrinkable sleeving for binding, insulation and identification
BS 6853:1999	Code of Practice for Fire Precautions In The Design and Construction of Passenger Carrying Trains
IEC 60684-2: 1997	Flexible insulating sleeving - Part 2: Methods of test
BS EN ISO 4589-2: 1996	Plastics – Determination of burning behaviour by oxygen index - Part 2: Ambient temperature test
NF X 70 – 100: 1986	Fire Tests Analysis of Pyrolysis and Combustion Gases Tube Furnace Method
NF F 16-101: 1988	Railway Rolling stock fire behaviour choice of materials Rolling Stock Classification A1
DIN 5510-2: 2009-05	Preventive fire protection in railway Vehicles-Part 2 Fire behaviour and fire side effects of materials and parts; classification, requirements and test methods. Dripping Classification ST2
BS EN 45545-2: 2013+A1:2015	Railway applications- Fire protection on railway vehicles
SAE AS5942: 2014	Marking of Electrical Insulating Materials

Table 2. Details of related standards

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9.2. Table 3: TE Connectivity Documents

TE Reference	Title	Complies with
411-121002	TE Connectivity Print contrast reference scale	---
411-121005	TE Identification Printer Product Ribbon Matrix	---
109-121002	Tensile Strength and Ultimate Elongation at 23℃	ASTM D2671
109-121003	Dimensions	---
109-121005	Dielectric strength	ASTM D2671 (ASTM D149)
109-121006	Low Temperature Flexibility	IEC 60684-2
109-121007	Heat Shock	SAE-AS-23053 ASTM D2671
109-121008	Heat Ageing	SAE-AS-23053 ASTM D2671
109-121009	Copper Mirror Corrosion	AMS DTL 23053
109-121012	Print Permanence testing using the Mechanical Crockmeter	SAE AS5942
109-121014	Resistance to Solvents	MIL 202 Method 215
109-121015	Specific Gravity	ASTM D792
109-121016	Water Absorption	ASTM D570
109-121017	Volume Resistivity	ASTM D2671 ASTM D257
109-121031	Split Testing	---
109-121039	Fluid Immersion Testing at Room Temperature	---
109-121053	Flammability testing	ASTM D2671, procedure B
109-121054	Limited Oxygen Index	BS EN ISO 4589-2:1999
109-121057	Thermal Cycling using liquid Nitrogen	---

The current document issue should be used and reference made in the qualification report

10. SAMPLING

Tests shall be carried out on a sample taken at random from a batch. A batch is defined as that quantity of product extruded at any one time.

Testing frequency shall be Production Routine or Qualification.

Production routine tests consisting of visual examination, dimensions and longitudinal change, print quality and adherence of marking shall be carried out on every batch of sleeving.

Qualification tests shall be carried out to the requirements of the Design Authority.

11. STORAGE CONDITIONS

HT-SCE should be stored in its original packaging, with any plastic covers which were included during shipping. Store out of direct sunlight in a clean, dry, dust free, environment. Product should not be stored outside of the designed storage temperature, which is -10℃ (14℉) to 40℃ (104℉), and 50±30% RH.

12. PACKAGING

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

13. STORAGE LIFE[2]

When stored as prescribed above, the shelf life of HT-SCE is 144 months from date of manufacture.

[2] Storage life is a guideline based on 30 years of experience. TE Connectivity cannot provide any test data to validate this statement.

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7 TABLE 4: GENERAL REQUIREMENTS FOR IDENTIFICATION PRODUCTS

PROPERTY	TEST METHOD	UNITS	REQUIREMENTS	RW-2512 SECTION
PRINT PERFORMANCE				
Print Quality			Legible, minimum print contrast C8	8.1.
Mark Adherence	TE 109-121012 100 rubs, 1kg load, eraser	---	Legible, minimum print contrast C3	8.3.1.
Solvent Resistance Solution A Solution B Solution C	TE Document 109-121014 100 strokes, tooth brush	---	Legible, minimum print contrast C3	8.3.2.
Fluid Resistance, Mark Permanence Reference test oil IRM 902 MIL-PRF-23699 lubricating oil Skydrol LD-4 phosphate ester hydraulic fluid MIL-H-83282 hydraulic fluid JP8 jet fuel Diesel fuel Propylene glycol de-icing fluid 50/50 Tap water 5% Sodium chloride solution 1% Teepol detergent	TE 109-121039 24 hours' immersion at 23±2℃, followed by 20 wipes at 1kg load	---	Legible, minimum print contrast C3[1]	8.3.3.
Isopropyl alcohol (IPA)	TE108-121012 20 cycles, soaked "Super Twill" cloth	---	Legible, minimum print contrast C3	8.3.3.

[1]For optimum performance black ribbon should be used where possible, see 411-121005. White and silver ribbons do not fully meet these requirements in harsher fluids; for example Skydrol LD-4, Diesel and JP-8.

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PROPERTY	TEST METHOD	UNITS	REQUIREMENTS	RW-2512 SECTION
PHYSICAL TESTING				
Workmanship	Laboratory light box with D65 lighting, using normal or corrected vision at 14 inches.	---	In accordance with section 8.2	8.2.
Dimensions	TE 109-121003	mm	Table 1	8.4.1.
Longitudinal Change	TE 109-121003	%	20 maximum	8.4.1.
Tensile Strength	TE 109-121002	MPa	24.1 minimum	8.4.2.
Ultimate Elongation	TE 109-121002	%	200 Minimum	8.4.2.
Specific Gravity	TE 109-121015	---	1.80 Maximum	8.4.3.
Split Test	TE 109-121031	%	100 minimum	8.4.4
THERMAL TESTING				
Heat Shock 4 hours at 275±3℃ Mandrel Bend Mark Adherence	TE 109-121007 TE 109-121012 50 rubs, 1kg load, eraser	---	No damage to the marker and print Legible, minimum print contrast C3	8.5.1.
Heat Ageing 168hrs at 225±2℃ Mandrel Bend Mark Adherence	TE 109-121008 TE 109-121012 50 rubs, 1kg load, eraser	---	No damage to the marker and print Legible, minimum print contrast C3	8.5.2.
ENVIRONMENTAL TESTING				
Copper Mirror Corrosion 16 Hours at 200℃	TE 109-121009	%	Damaged area of copper mirror, 8 maximum	8.6.1.
Water Absorption	TE 109-121016	%	1 Maximum	8.6.2.
UV Resistance followed by, Mandrel Bend Mark Adherence	ASTM G154 UVA and UVB (8 hours dry/4 hours wet cycle) 360°bend around a mandrel (10 x thickness) TE 109-121012 20 rubs, 1kg load, eraser		1000 hours at each irradiance No damage to the marker and print Legible, minimum print contrast 3	8.6.3.
ELECTRICAL				
Dielectric Strength	TE 109-121005	kV/mm	23.6 Minimum	8.7.1.
Volume Resistivity	TE 109-121017	Ohm cm	1 x 10^{12} Minimum	8.7.2.

PROPERTY	TEST METHOD	UNITS	REQUIREMENTS	RW-2512 SECTION
FIRE SAFETY				
Fire Propagation, ASTM D2671 Procedure B	TE 109-121053 ASTM D2671 procedure B	---	Burn time shall not exceed 30 seconds, and not more than 25% of indicator flag shall be burned or charred. No dripping or flowing. No burning of cotton.	8.8.1.
EN45545-2 Flammability Hazard rating: BS EN ISO 4589-2 Oxygen Index (OI),	 BS EN ISO 4589-2 TE 109-121054	 %	Requirement set R24 Hazard Level Classification 3[3] 32% Minimum	8.8.2.
Surface Flammability, Flame Spread Index (Is)	ASTM E 162	---	35 Maximum	8.8.3.
Specific Optical Smoke Density, Ds Flaming Mode 1.5 minutes 4 minutes Flaming Mode 1.5 minutes 4 minutes	ASTM E 662 25kW/m^2 radiant heat source. Flaming mode and non-flaming mode.		 100 Maximum 200 Maximum 100 Maximum 200 Maximum	8.8.4.
Heat Release[4] Average Heat Release Rate (180 s) Maximum (Peak) Heat Release Rate Average specific extinction area (180 s)	ASTM E1354 50kWm^2 applied heat flux with retainer frame	 kW/m^2 kW/m^2 m^2/kg	 ≤ 120 Over course of test ≤ 140 ≤ 500	8.8.5.

[3] R22 / HL3 supports unlimited internal use, in any operating category and rail car design.
[4] There is currently no requirement for Heat Release testing. TE have incorporated proposed changes to existing FRA 49 CFR Ch. II, Part 238, App. B as recommended by the National Association of State Fire Marshals

PROPERTY	TEST METHOD	UNITS	REQUIREMENTS	RW-2512 SECTION
Toxic Gas Generation Bombardier BMS 800-C Carbon Monoxide (CO) Carbon Dioxide (CO2) Nitrogen Oxides (NO2) Sulphur Dioxide (SO2) Hydrogen Chloride (HCl) Hydrogen Fluoride (HF) Hydrogen Bromide (HBr) Hydrogen Cyanide (HCN)	 Gas extracted during ASTM E662 test. 25kW/m^2 radiant heat source. Flaming mode and non-flaming mode assessed, worst case reported.	 ppm	Maxima: 3500 90000 100 100 500 100 100 100	8.8.6.

8 SPECIFIC REQUIREMENTS FOR HT-SCE HEAT SHRINK SLEEVING

PROPERTY	TEST METHOD	UNITS	REQUIREMENTS	RW-2512 SECTION
THERMAL				
Temperature cycling: 6 cycles of: 0.5hr at -196±5℃ (-321±9℉) 0.5hr at 200±5℃ (392±5℉) Followed by Print performance	 IEWI-046 IEWI-012	 %	 50 minimum, legible	8.5.4
ENVIRONMENTAL				
Vacuum Outgassing TML (Total Mass Loss) VCM (Volatile Condensable Material)	ASTM E 595 Exposure time, 24hr sample temp. 130±2℃ (266±4℉); Condensing surface temp. 18±3℃ (64±5℉); and pressure, not greater than 1x10^{-5} Torr	 % %	 1.0 Maximum 0.1 Maximum	8.6.4

Table 5. Specific Test Requirements for HT-SCE product range

9 TEST FLUIDS DESCRIPTION

Fluid	Description
IRM902	Reference Oil (replacement for ASTM oil NO. 2)
MIL-PRF-23699	Synthetic lubricating oil STD class (NATO Code 0-156). Has replaced MIL-L-7808 oil at temperatures above 25℃.
Skydrol LD-4	Widely used aviation phosphate ester based hydraulic fluid.
MIL-H-83282	The principal hydraulic fluid used in military aircraft. It replaces MIL-H-5606.
JP-8	Kerosene based jet fuel, replacement for JP-4. NATO code is F-34. It's specified by MIL-DTL-83133 and British Defence Standard 91-87.
Diesel Fuel (BS EN 590:2009+A1)	General fuel used in transportation
Propylene Glycol de-icing fluid (SAE-AMS-1424)	Aerospace De-icing fluid, 50/50 % mixture with water
Tap Water	Universal solvent
5% Sodium chloride solution	Sodium chloride is a universal compound used in many chemicals and de-icing fluids
Detergent (1% Teepol)	Commonly used industrial detergent
IPA - Isopropyl alcohol	Widely used as a solvent and cleaner

Table 6: Description of Test Fluids

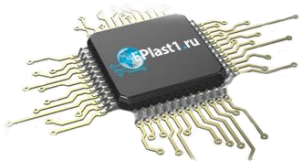
Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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