



SPECIFICATION RW-2513

TE 108-121016

CABLE MARKERS – CM-SCE and CM-SCE-TP Including HL Cable Marker range

Tie on Identification Product

SCOPE

This quality assurance specification establishes the requirements and performance of CM-SCE, CM-SCE-TP and HL Cable Markers. Designed to identify cable, wire bundles, pipes and conduits. The performance requirements are detailed in Table 7.

The operating temperature for this product is -55°C to +135°C.

This system is an automatic method of identifying items by printing a mark on the cable marker product range. The mark is permanent upon printing.

Products are available in various sizes with four and six fixing holes depending on description.

The cable marker shall be fabricated from cross linked polymer produced with fixing holes in a continuous form, perforated for easy removal from the backbone.

The marker system comprises specific printers and ribbons; refer to TE Connectivity (TE) document 411-121005 "TE Identification Printer, Product Ribbon Matrix. Compliance to this specification can only be guaranteed if TE Connectivity approved printers and ribbons are used.

Laser markable using industrial standard YAG lasers.

The marker size for qualification testing is ½".

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1 SCOPE

The tests in this specification, as completed on CM-SCE products, define the performance of a tie-on, self-extinguishing, cable marker for rail, aerospace, construction and other 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 validate the fit, form and function of installed products.

2 COMPOSITION, APPEARANCE AND COLOR

The cable markers 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 cable marker shall be white or yellow as standard, other colors available on request.

The cable markers are not recommended for use on certain types of neoprene, customers should verify suitability of use.

3 DIMENSIONS

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

- CM-SCE as shown in figures 1 to 4.
- CM-SCE-TP as shown in figures 5 to 8.
- HL to the dimensions of table 1 shown in figure 9.



3.1 System 6 Products – CM-SCE

Note: Dimensions in mm

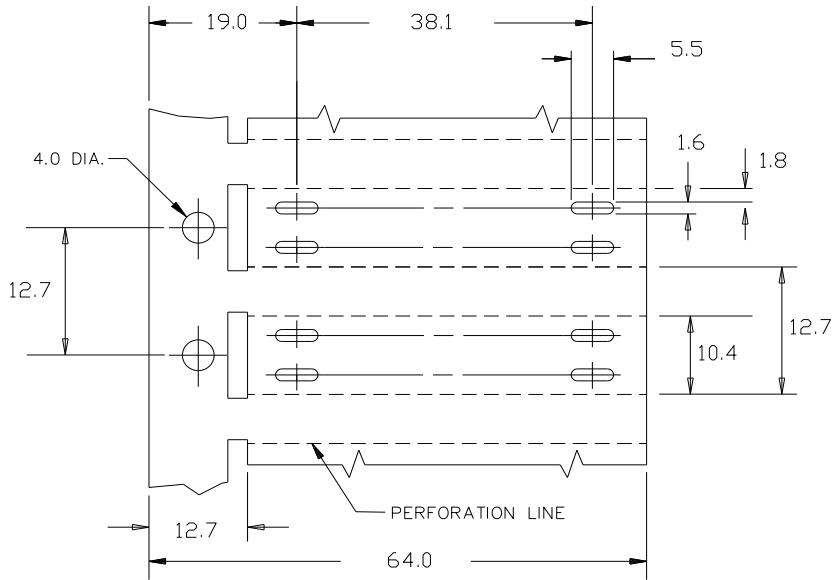


Figure 1: 1/4" four-hole product (CM-SCE-1/4-4H)
Marker thickness 0.51±0.1mm

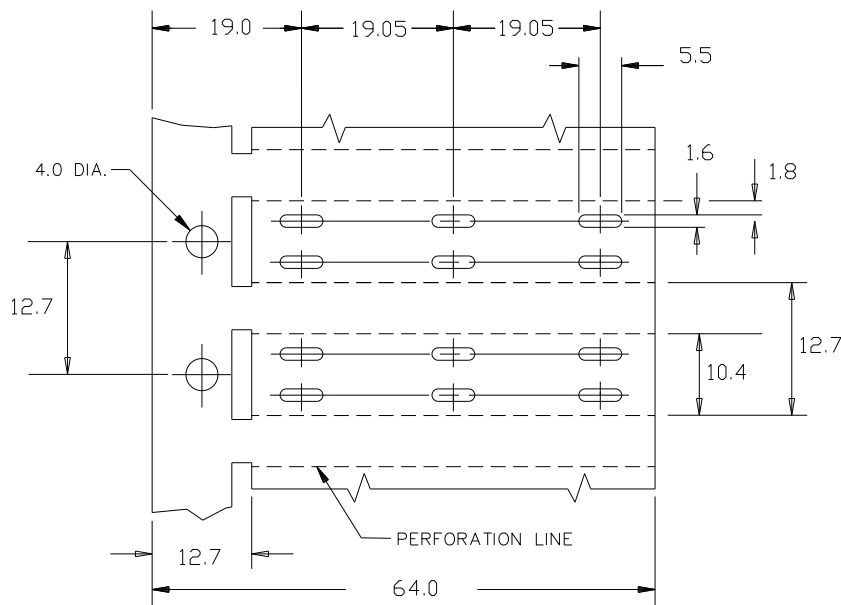


Figure 2: 1/4" six-hole product (CM-SCE-1/4-6H)
Marker thickness 0.51±0.1mm

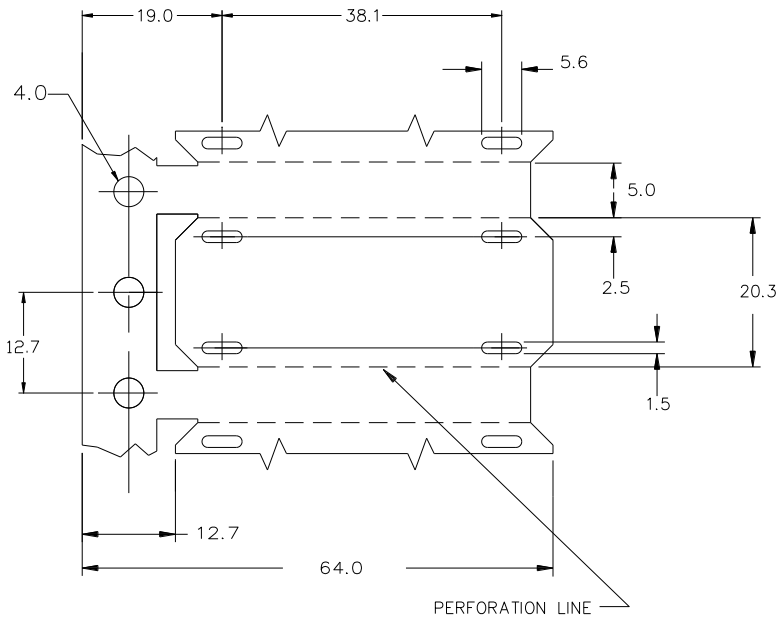


Figure 3: 1/2" four-hole product
(CM-SCE-1/2-4H)
Marker thickness 0.51 ± 0.1 mm

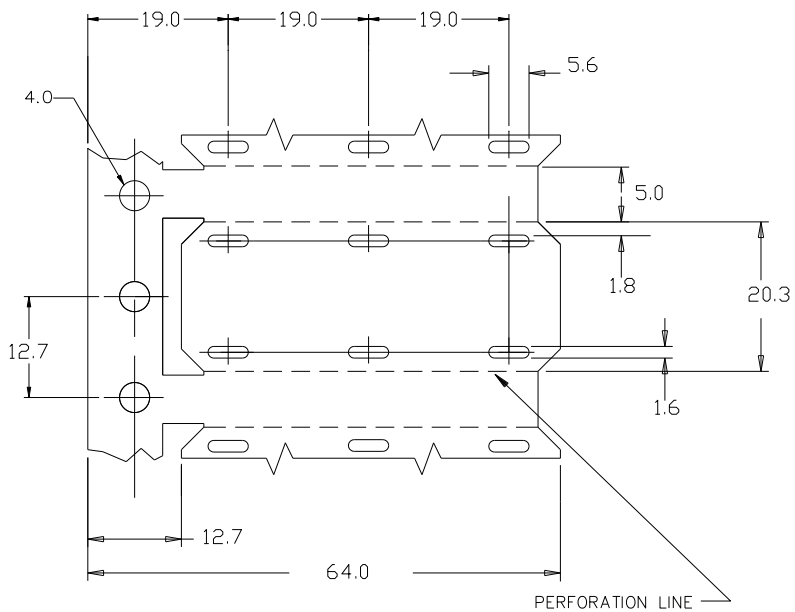


Figure 4: 1/2" six-hole product
(CM-SCE-1/2-6H)
Marker thickness 0.51 ± 0.1 mm



3.2 System 6 Products – CM-SCE-TP

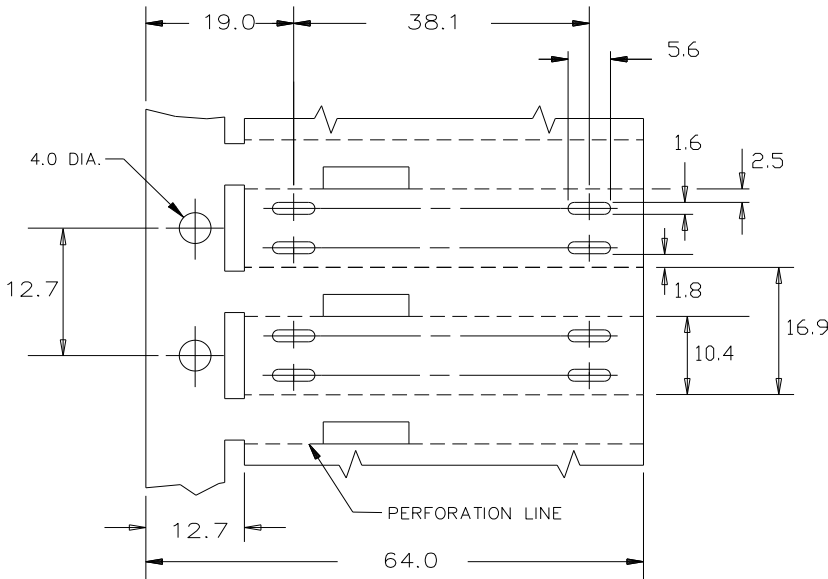


Figure 5: 1/4" four-hole TP product (CM-SCE-TP-1/4-4H)
Marker thickness 0.51±0.1mm

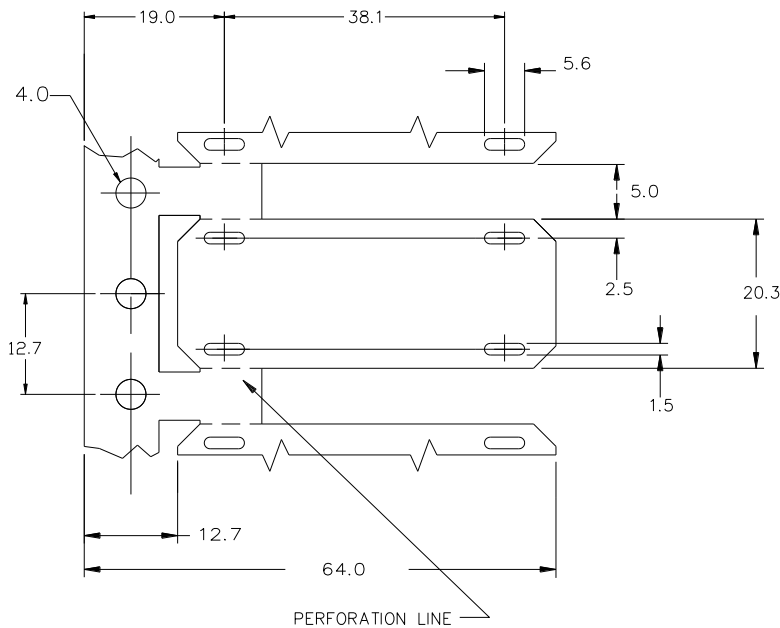


Figure 6: 1/2" four-hole TP product (CM-SCE-TP-1/2-4H)
Marker thickness 0.51±0.1mm

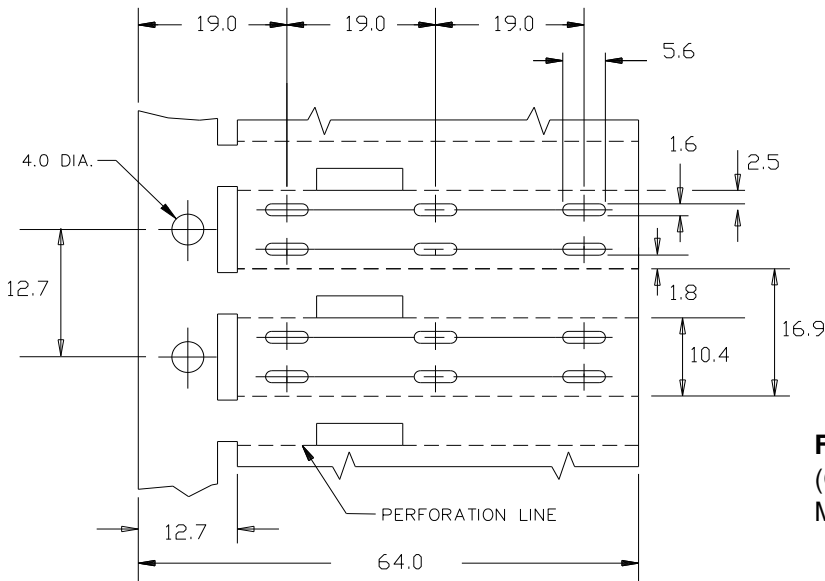


Figure 7: 1/4" six-hole TP product
(CM-SCE-TP-1/4-6H)
Marker thickness 0.51 ± 0.1 mm

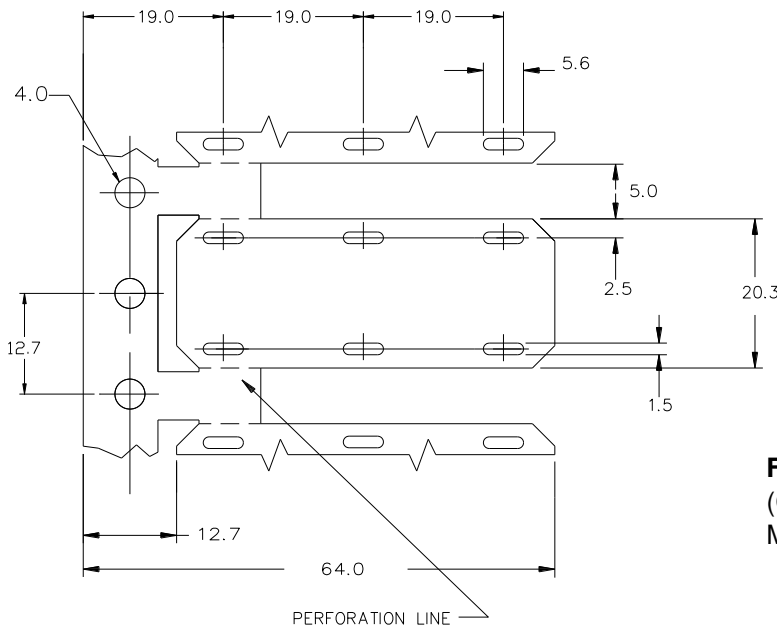


Figure 8: 1/2" six-hole product
(CM-SCE-TP-1/2-6H)
Marker thickness 0.51 ± 0.1 mm



3.3 HSI Format – HL Products

HL products are supplied as individual markers stuck to a paper carrier either with or without tractor drive holes as shown below.

Marker thickness 0.60±0.05mm

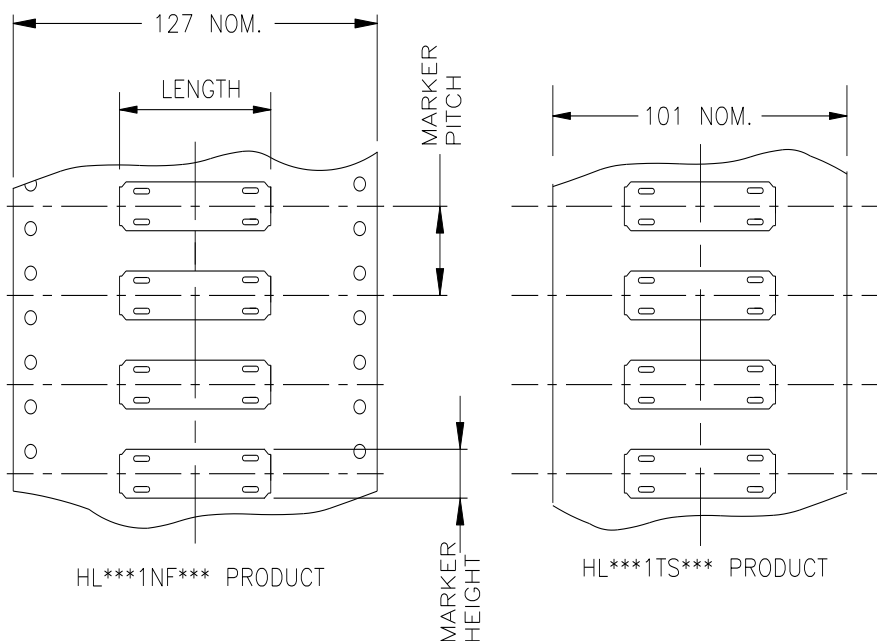


Figure 9: HL formats – Only four-hole available in HSI range

TABLE 1 – Available HL dimensions

Product Description	Product Pitch (mm)		Marker Height (mm)	Available Marker lengths Last 3 digits in description ¹				
	HL**1NF	HL**1TS		025	033	038	050	070
HL104	25.4	12.7	10.4	45	53	58	70	90
HL150	25.4	25.4	15.0	45	53	58	70	90
HL203	25.4	25.4	20.3	45	53	58	70	90
HL253	50.8	50.8	25.3	45	53	58	70	90

¹ Last three digits of product description represents the printable length between fixing holes.



4 RELATED DOCUMENTS

4.1 TE Documents

TE Reference Number	Title	Complies with
109-121002	Tensile Strength and Ultimate Elongation Test	ASTM D 638
109-121003	Dimensions	ASTM D 2671 (section 8-13)
109-121006	Low Temperature Flexibility	SAE-AS-23053 (section 36-43) IEC 60684-2
109-121007	Heat Shock	SAE-AS-23053 ASTM D2671 (section 26-30)
109-121008	Heat Ageing Test	SAE-AS-23053 ASTM D2671 (section 49-54)
109-121009	Copper Mirror Corrosion	ASTM D2671 (section 93 procedure A)
109-121012	Mark Adherence	SAE AS5942 (section 4.3.1) EN 6069-407
109-121014	MIL STD 202 Method 215	MIL STD 202 Method 215
109-121015	Specific Gravity	ASTM D792
109-121016	Water Absorption	ASTM D570
109-121039	Fluid Immersion Testing at Room Temperature	N/A
109-121054	Limiting Oxygen Index	EN ISO 4589-2
411-121002	Print Contrast Reference Scale	EN 6059-407
411-121005	Printer Product Ribbon Matrix	N/A

Table 2: Test method references and TE Documents

4.2 International Standards

Document Number (Use current revision)	Title
ASTM D570	Standard test method for water absorption of plastics
ASTM D 638	Standard test method for Tensile Properties of Plastics
ASTM D792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D 2671 (section 8-13)	Standard Test Methods for Heat-Shrinkable Tubing for Electrical Use
EN ISO 4589-2	Plastics – Determination of Burning Behaviour by Oxygen Index – Part 2: Ambient-temperature test.
EN 6059-407	Aerospace series. Electrical cables, installation. Protection sleeves. Test Methods. Mark adherence and print permanence.
IEC 60684-2	Flexible Insulating Sleeving – Part 2: Methods of Test.
MIL STD 202 Method 215	Electronic and Electrical Component Parts, Method 215 – Resistance to solvents.
SAE-AS-23053	Insulation Sleeving, Electrical, Heat Shrinkable, General Specification for
SAE AS5942	Marking of Electrical Insulating Materials

Table 3: International and National Standards



5 SAMPLING

Tests shall be completed on samples taken at random from a batch of product. A batch of markers is defined as the quantity of flat strip extruded at any one time.

Testing frequency shall be production routine or qualification.

Production routine tests consist of visual examination, dimensions, print quality and print adherence. Production routine testing shall be completed on every batch.

Qualification testing shall be a full testing program to this product specification at a frequency defined by the design authority.

6 PACKAGING

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

7 TEST METHODS

7.1 Workmanship

Visually examine a random selection of three markers for quality of workmanship using normal vision. The marker shall be free from flaws, defects, pinholes, bubbles, seam, cracks, or inclusions. The colour will be a clear representation of that ordered

7.2 Preparation of Samples

When required by the test procedure, markers 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 marker using font type Arial 10 bold. The quality of the mark shall be as given in section 7.3.1. Markers are to be removed from the carrier before testing.

Unless otherwise specified, all tests shall be made at a temperature of $23\pm 2^{\circ}\text{C}$.

Note: TE does not have a recommended dot matrix ribbon or printer for products that do not have "TP" or "TS" in the description. Customers using this product should verify the performance of the product if an unrecommended printer system is used.

7.3 Print Performance

7.3.1 Print Quality

Samples shall be prepared as detailed in 7.2. The quality of the print shall be assessed against TE document 411-121002, Print Contrast reference Scale, and shall be a minimum of C8 or above.

7.3.2 Mark Adherence

Three markers, removed from the carrier, shall be prepared as in 7.2 and then tested for mark adherence in accordance with TE test method 109-121012. The print shall be rubbed using a load of 1kg (2.2lbs) and the number of rubs given in table 4. After the test the print will be assessed against TE document 411-121002.



7.3.3 Solvent Resistance

Twelve markers prepared as detailed 7.2 are tested to MIL 202 method 215, TE Document 109-121014. A set of three markers is used for each solvent. After the number of brushes detailed in table 4 the markers shall be assessed against TE document 411-121002.

7.3.4 Fluid Resistance

Markers prepared as given in 7.2 shall be immersed in the fluids listed in table 4, three markers shall be used per fluid. The markers shall be immersed for the time and temperature given in the table. The volume of fluid shall be such that amount of fluid is no less than 20 times that of the sample.

After immersion in the fluid the markers for the time period given the samples shall be removed, dabbed with tissue paper to remove any excess fluid. They will then be air dried for 45 ± 15 min at room temperature. Samples are then rubbed with a Crockmeter fitted with "Super Twill" as detailed in 109-121012, they shall be rubbed using a load of 1kg (2.2lbs) and the number of rubs given in table 4.

7.4 Physical Testing

7.4.1 Dimensions

Measure the dimensions of a random selection of three markers in accordance with 109-121003. The product shall meet the dimensions given in the figures above in section 3.

7.4.2 Tensile Strength and Ultimate Elongation

Unpunched sheet from the same batch as the cable markers is required for this test. Dumbbells are cut from the unpunched sheet and tested in accordance with the method detailed in 109-121002 using a crosshead speed of 500mm/min. The average of five results shall be reported.

7.4.3 Specific Gravity

Samples of unprinted cable markers shall be tested for specific gravity in accordance test method 109-121015. The average of three results shall be reported.

7.5 Thermal Testing

7.5.1 Heat Shock

Six samples are tested in total, printed as detailed in section 7.2. Suspend all samples in an air circulating oven for the time and temperature detailed in table 4. After the conditioning period allow the samples to return to room temperature. Three of the samples shall be tested for print performance as detailed in 109-121012 using the number of rubs detailed in table 4. The print shall then be assessed in accordance with 411-121002.

The remaining three samples shall be bent around a mandrel of the diameter given in table 4. After the bending operation the samples shall be examined for any signs of cracking or damage.



7.5.2 Heat Ageing

Six samples are tested in total, printed as detailed in section 7.2. Suspend all samples in an air circulating oven for the time and temperature detailed in table 4. After the conditioning period allow the samples to return to room temperature. Three of the samples shall be tested for print performance as detailed in 109-121012 using the number of rubs detailed in table 4. The print shall then be assessed in accordance with 411-121002.

The remaining three samples shall be bent around a mandrel of the diameter given in table 4. After the bending operation the samples shall be examined for any signs of cracking or damage.

7.5.3 Low Temperature Flexibility

Six samples are tested in total, printed as detailed in section 7.2. Suspend all samples in an air circulating oven for the time and temperature detailed in table 4. After the conditioning period allow the samples to return to room temperature. Three of the samples shall be tested for print performance as detailed in 109-121012 using the number of rubs detailed in table 4. The print shall then be assessed in accordance with 411-121002.

The remaining three samples shall be bent around a mandrel of the diameter given in table 4. After the bending operation the samples shall be examined for any signs of cracking or damage.

7.6 Chemical Testing

7.6.1 Copper Mirror Corrosion

Cut a representative material sample from the cable marker and test for copper mirror corrosion in accordance with ASTM D2671 Procedure A, TE Document 109-121009. The test temperature, time and requirements are detailed in table 4.

7.6.2 Water Absorption

Three samples, 25mm in diameter, are cut either from a suitable sized finished product or sheet from the same batch used to produce the product. The samples are then tested in accordance with TE test method 109-121016.

7.7 Fungus Resistance

Printed samples, prepared as given in section 7.2, are tested in accordance with ASTM G21. After the 28day exposure samples are washed and then tested for print adherence in accordance with 109-121012 using the number of rubs given in table 4. The print is then assessed in accordance with 411-121002.

7.8 Flammability

The Limiting Oxygen Index (LOI) of the compound used to manufacture the cable markers shall be determined in accordance with EN ISO 4589-2, TE document 109-121054. The minimum required LOI is detailed in table 4.



8 PRODUCT REQUIREMENTS

PROPERTY	TEST METHOD	UNITS	REQUIREMENTS	RW-2513 SECTION
PRINT PERFORMANCE				
Print Quality	411-121002	---	Legible, minimum print contrast C8	7.3.1
Mark Adherence	109-121012 100 rubs, 1kg load, eraser	---	Legible, minimum print contrast C3	7.3.2
Solvent Resistance Solution A Solution B Solution C Solution D	MIL 202 Method 215 109-121014 50 strokes, toothbrush	---	Legible, minimum print contrast C3	7.3.3
Fluid Resistance, Mark Permanence MIL-PRF-7808 Turbine engine oil Skydrol 500B phosphate ester hydraulic fluid MIL-PRF 5606 hydraulic fluid JP8 jet fuel AVGAS 100LL 5% Sodium chloride solution Anti-icing fluids to SAE-AS-8243 ²	TE 109-121039 24 hours immersion at 23±2°C, followed by 20 wipes, 1kg load (109-121012)	---	Legible, minimum print contrast C3 ¹	7.3.4
PHYSICAL PROPERTIES				
Dimensions	109-121003	mm	As section 3	7.4.1
Tensile Strength Speed 500mm/min (19.7"/min)	109-121002	MPa (psi)	10.3 (1500) minimum	7.4.2
Ultimate Elongation Speed 500mm/min (19.7"/min)	109-121002	%	200 minimum	7.4.2
Specific Gravity	109-121015	---	1.48 maximum	7.4.3

Table 4: Product requirements

² A 50/50 mix of Propylene Glycol and Water



PROPERTY	TEST METHOD	UNITS	REQUIREMENTS	RW-2513 SECTION
THERMAL PERFORMANCE				
Heat Ageing 168hr @ 175±2°C (347±4°F) followed by: Mandrel Bend (7.9mm (5/16") diameter) Mark Adherence	109-121008	---	No Damage to marker and print legible after 50 rubs, 1kg. Minimum contrast 3	7.5.1
	109-121012			
Heat Shock 4hr @ 250±2°C (482±4°F) followed by: Mandrel Bend (7.9mm (5/16") diameter) Mark Adherence	109-121007	---	No dripping flowing or cracking and print legible after 50 rubs, 1kg. Minimum contrast 3	7.5.2
	109-121012			
Low Temperature Flexibility 4hr @ -55±2°C (-67±4°F) followed by: Mandrel Bend (7.9mm (5/16") diameter) Mark Adherence	109-121006	---	No Damage to marker and print legible after 50 rubs, 1kg. Minimum contrast 3	7.5.3
	109-121012			
CHEMICAL PROPERTIES				
Copper Mirror Corrosion	109-121009	%	Non-Corrosive	7.6.1
Water Absorption	109-121016	%	0.5 maximum	7.6.2
ENVIRONMENTAL				
Fungus Resistance 28day exposure followed by Mark Adherence	ASTM G21	---	Fungus growth rating 1 maximum. Print legible after 20 rubs, 1kg. Minimum contrast 3.	7.7.1
	109-121012			
FLAMMABILITY				
Limiting Oxygen Index (LOI)	EN ISO 4589-2 109-121054	%	25 minimum	7.8

Table 4 continued

9 TEST FLUIDS

Fluid	Description
MIL-PRF-7808	Synthetic base lubricating oil for aircraft turbine engines (NATO Code 0-148). Formally MIL-L-7808.
Skydrol 500B4	Widely used aviation phosphate ester based hydraulic fluid.
MIL-PRF-5606	Petroleum base hydraulic fluid with operating temp -54 to 135°C (-65 to 275°F). NATO code H-515. Formally 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.
AVGAS 100LL	Is a low lead general fuel used in aviation
5% Sodium chloride solution	Sodium chloride is a universal compound used in many chemicals and de-icing fluids
Anti-icing fluid to SAE-AS-8243	Aerospace De-icing fluid, 50/50 % mixture of Propylene Glycol with water. Formally MIL-A-8243

Table 5: Test Fluid details