Specification RW-2500

Document Number: 108-121003

TMS Marker System

SCOPE

This quality assurance specification, when used with the individual product specification sheets, establishes the product performance characteristics.

The IBM daisy wheel printer and ink cartridge developed for the TMS family is now obsolete. TE can only guarantee the performance properties covered in this standard, and not any marking applied using non-recommended printing systems. Where non-standard printing systems are used, customer are required to carry out their own validation testing.

Laser markable using industrial standard YAG lasers.

Approved Signatories:

This document is electronically reviewed and approved by TE Connectivity.

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1. REQUIREMENTS

1.1 Product Specification Sheets

The individual markers shall be in accordance with the applicable specification sheet. In the event of conflict between this basic specification and the specification sheet, the requirements of the specification sheet shall prevail.

1.2 Form

The TMS Markers shall be fabricated from modified radiation cross-linked polymers on a carrier suitable for processing with commercially available print equipment.

2. PRODUCT DRAWING

2.1 See individual Product Specification Sheet for product drawings and dimensions.

3. TEST REQUIREMENTS

This specification details the requirements for the TMS family of products. Details below are to be used in conjunction with the applicable product specification sheet, e.g. for TMS-CM use this specification with RW-2500-12.

3.1 Qualification Tests

Qualification tests are those performed on finished markers or marker material submitted for qualification as a satisfactory product and shall consist of all tests listed in the applicable specification sheet.

3.2 Acceptance Tests

Acceptance tests are those performed on finished markers submitted for acceptance under the contract. Acceptance tests shall consist of the following: dimensions, longitudinal change and pull-off force, unless otherwise specified in the applicable specification sheet.

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4. RELATED DOCUMENTS

4.1 Identification Engineering Work Instructions IEWI

TE Doc. Number	TE reference	TE Title	Complies with
109-121002	IEWI-002	Tensile Strength and Ultimate Elongation at 23°C	ASTM D2671 (section 44-48) ASTM D412
109-121003	IEWI-003	Dimensions	ASTM D2671 (section 8-13) ASTM D876
109-121006	IEWI-006	Low Temperature Flexibility	SAE-AS-23053 (section 36 -43) IEC 60684-2
109-121007	IEWI-007	Heat Shock	SAE-AS-23053 ASTM D2671 (section 26-30)
109-121008	IEWI-008	Heat Resistance	SAE-AS-23053 ASTM D2671 (section 49-54)
109-121009	IEWI-009	Copper Mirror Corrosion	ASTM D2671 (section 93 procedure A)
109-121010	IEWI-010	Copper Contact Corrosion	ASTM D 2671 (procedure B)
109-121015	IEWI-015	Specific Gravity	ASTM 2671, ASTM D792
109-121046	IEWI-046	Thermal Cycling	
109-121052	IEWI-052	External Test House Matrix	
109-121053	IEWI-053	Flammability Testing	ASTM D2671 (section 71 procedure B)
109-121054	IEWI-054	Limiting Oxygen Index	LOI EN 45545-2 , BS6853

Table 4. Test References

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4.2. Reference Documents

RW-2500-1	Specification for High temperature Heat Shrink Identification Markers sleeves HTMS / HTTMS
RW-2500-2	Specification for Heat Shrink Identification Marker Sleeves - TMS
RW-2500-3	Specification for Thin-Wall Heat Shrink Marker Sleeves - TW-TMS
RW-2500-12	Specification for Tie on Markers - TMS-CM
RW-2500-13	Specification for High Temperature Tie on Markers - HTMS-CM / HTTMS-CM
ASTM D412-06a	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
ASTM D876-13	Standard Test Method for Non-rigid Vinyl Chloride Polymer Tubing used for Electrical Insulation
ASTM D2671: 1999	Standard Test Methods for Heat-Shrinkable Tubing for Electrical Use
SAE AMS 23053 SAE AMS 23053/5	Insulation Sleeving, Electrical, Heat Shrinkable, Polyolefin, Flexible, Cross-linked.
EN 45545-2	Railway applications - Fire protection on railway vehicles
BS 6853	Code of Practice for Fire Precautions in the Design and Construction of Passenger Carrying Trains.
TE Doc. No: 411-121008	Installation of Heatshrink Marker Sleeves
(Subsequent amendments to, or revisions of, any of the above publications apply to this standard only when incorporated in it by updating or revision.)	

Table 5. Reference Documents

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5. SAMPLING

5.1 Qualification Test Samples

Qualification test samples shall consist of 50 feet (15m) of continuous marker material and the appropriate number of finished markers necessary to run all the tests listed in the applicable specification sheet. Qualification of any one size shall qualify all sizes in each applicable specification sheet.

5.2 Acceptance Test Samples

Acceptance test samples shall consist of the appropriate number of finished markers necessary to run the specified tests.

6. PACKAGING

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

7. Test Procedures

7.1 General

Unless otherwise specified, the tubing identification shall be removed from the carrier and recovered for testing. Where required by test method limitations, testing shall be done on unfinished material.

Testing shall be completed as detailed in the individual product specification sheet. Extra information and detail is given below for some specific tests.

TABLE 1: Suggested Stranded Wire Size for Low Temperature Flexibility

Sleeve Size	Suggested Stranded Wire size	
	AWG Size	Stranding
3/32	18	19/30
1/8	14	19/27
3/16	10	37/26
1/4	10	7 x 15/30
3/8	6	19 x 7/27
1/2	4	19 x 7/25

7.2 Dimensions, Dimensional Recovery and Longitudinal Change

7.2.1 Tubular Specimens

Test three markers in accordance with ASTM D 2671 for dimensions as supplied, dimensions as recovered and longitudinal change. The recovery time and temperature shall be as specified on the applicable specification sheet.

7.2.2 Flat Specimens

Measure three markers for length, width and thickness as specified in the appropriate specification sheet.

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7.3 Tensile Strength and Ultimate Elongation

7.3.1 Tubular Specimens

Test tensile strength and ultimate elongation on three specimens cut from unfinished tubing. The specimens shall be in accordance with ASTM D 2671, using 1 inch (25mm) bench marks and a 2 inch (50.8mm) initial jaw separation, at the speed specified in the applicable specification sheet.

7.3.2 Flat Specimens

Prepare 3 specimens in the form of 1/4 inch strips cut in the direction of extrusion from un-punched strip. Use 1 inch (25mm) bench marks and 2 inch (50.8mm) jaw separation. Run at the speed specified in the applicable specification sheet.

Note: test specimens should not be annealed before testing

7.4 Specific Gravity

Measure specific gravity on tubular and flat specimens in accordance with ASTM D2671.

7.5 Low Temperature Flexibility

7.5.1 Tubular Specimens

Recover three specimens over a stranded wire as described in Table 1. Condition the specimens and wire for 4 hours at the temperature specified in the applicable specification sheet. While at this temperature, bend the specimens through 90 degrees, in approximately 2 seconds, over a similarly conditioned mandrel, selected in accordance with the appropriate table of the applicable specification sheet, and examine the specimen for cracks.

7.5.2 Flat Specimens

Cut three samples, 6mm (1/4 inch) wide by 150mm (6 inch) long, from irradiated un-punched sheet. Condition the specimens and wire for 4 hours at the temperature specified in the applicable specification sheet. While at this temperature, bend the specimens through 90 degrees, in approximately 2 seconds, over a similarly conditioned mandrel, selected in accordance with the appropriate table of the applicable specification sheet, and examine for cracks.

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7.6 Heat Shock

7.6.1 Tubular Specimens

Condition three specimens for 4 hours at the temperature specified in the applicable specification sheet in a forced air oven. Remove the specimens from the oven, cool to room temperature and bend through 90 degrees, in approximately 2 seconds, over a mandrel selected in accordance with the applicable specification sheet. Visually examine the specimens for evidence of dripping, flowing or cracking. Disregard any side cracking caused by flattening of the specimens on the mandrel.

7.6.2 Flat Specimens

Remove three cable marker specimens conditioned in accordance with Section 7.6.1, from the oven and cool to room temperature. Bend through 90 degrees in approximately 2 seconds over a mandrel selected in accordance with the applicable specification sheet. Visually examine specimens for evidence of dripping, flowing or cracking.

7.7 Heat Ageing

7.7.1 Tubular Specimens

Recover three specimens over a stranded wire as described in Table 1. Condition the specimens at the time and temperature specified in the applicable specification sheet in a forced air oven. After conditioning, remove the specimens from the oven, cool to room temperature and examine for cracks. Bend each of the three specimens through 90 degrees, in approximately 2 seconds, over a mandrel selected in accordance with the applicable specification sheet and examine for cracks. Disregard any side cracking caused by flattening of the specimens on the mandrel.

7.7.2 Flat Specimens

Condition 3 cable marker specimens at the time and temperature specified in the applicable specification sheet, in a forced air oven. After conditioning, remove the specimens from the oven, cool to room temperature and examine visually.

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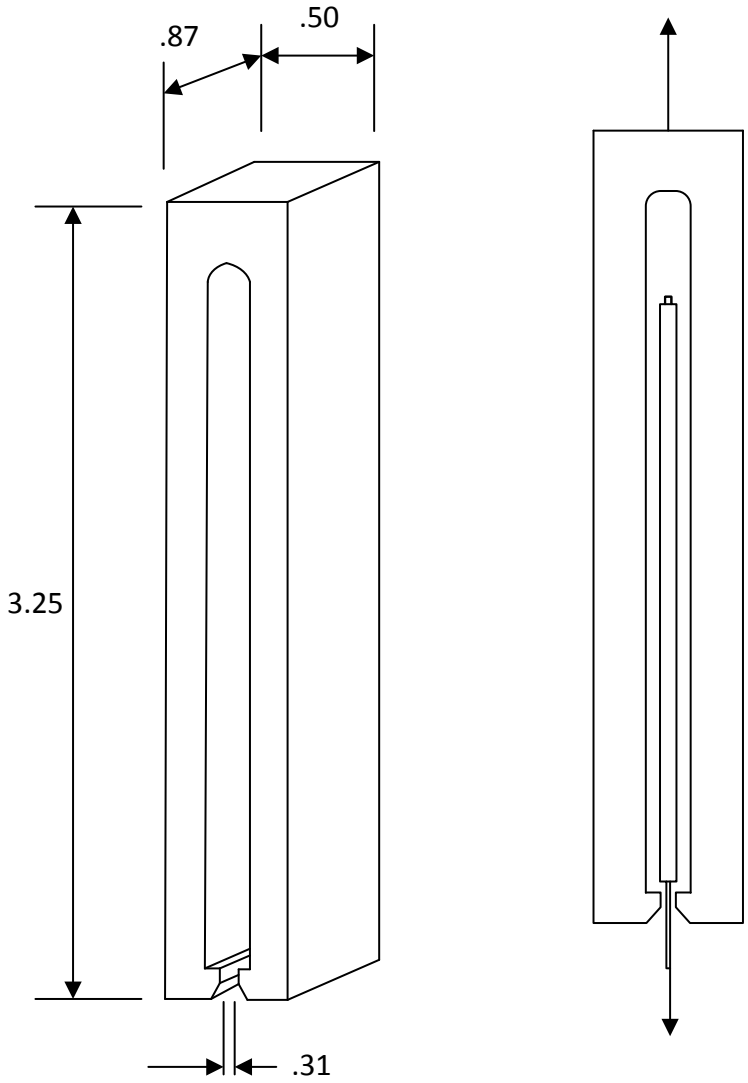
7.8 Pull off Force

Test three finished tubular markers using the jig shown in figure 1. The pull off jig shall be fitted the top jaw of a tensile test machine and the sample held in the lower jaw. The pull-off force shall be the average of the three readings required to completely remove the markers from the carrier using a cross head speed of 50.8mm/min (2 inches/minute)

Figure 1: Pull off Jig



Dimensions in inches

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7.9 Corrosive Effect

Test two specimens in accordance with ASTM D 2671, Procedure A. The time and temperature shall be as specified in the applicable specification sheet. Evidence of corrosion shall be the removal of copper from a mirror leaving an area of transparency greater than 5 percent of its total area.

Copper Contact corrosion testing may be required for some tubing identification products, see applicable product specification sheet for details.

7.10 Flammability

Test details are as given in the applicable product specification sheet.

7.11 Vacuum Outgassing

Recover three finished markers for 3 minutes at 200±5°C (392±9°F) 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°C (266±4°F); condensing surface temperature, 18±3°C (64±5°F); 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 changer, 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 7mm 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.

7.12 Temperature Cycling

Recover three markers, over a stranded wire as described in Table 1 and subject them to the number of temperature cycles specified in the applicable specification sheet. The temperature cycle shall be as follows: 0.5 hours immersed in liquid nitrogen at -196±5°C (-321±9°F) followed immediately by 0.5 hours in a 200±5°C (392±9°F) forced air oven. After the final cycle, allow the specimens to stabilize to room temperature. Bend the specimens through 90 degrees, in approximately 2 seconds, over a mandrel selected in accordance with the applicable specification sheet. Examine the specimens for cracking.

8.0 Rejection and Retest

Failure of any sample to conform to any of the requirements of this specification sheet shall be cause for rejection of the lot represented. Markers which have been rejected may be replaced or reworked to correct the defects and resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and action taken to correct the defects shall be furnished to the inspector.

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