Specification RW-2500-2

Document Number: 108-121005

TMS

Heat Shrinkable Identification Sleeves

SCOPE

This quality assurance specification sheet, when used with RW-2500, establishes the product characteristics.

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

The IBM daisy wheel printer and ink cartridge developed for TMS 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, customers are required to carry out their own validation testing.

Products are available in 2:1 shrink ratio (refer to Table 1 for more details).

Laser markable using industrial standard YAG lasers.

The tube size for qualification testing is ¼ inch (6.4mm) as supplied internal diameter.

Approved Signatories:

This document is electronically reviewed and approved by TE Connectivity.

While TE Connectivity has made every reasonable effort to ensure the accuracy of the information in this specification, TE Connectivity does not guarantee that it is error-free, nor does TE Connectivity make any other representation, warranty or guarantee that the information is accurate, correct, reliable or current. TE Connectivity reserves the right to make any adjustments to the information contained herein at any time without notice. TE Connectivity expressly disclaims all implied warranties regarding the information contained herein, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose. The dimensions in this document are for reference purposes only and are subject to change without notice. Specifications are subject to change without notice. Consult TE Connectivity for the latest dimensions and design specifications.

If this document is printed it becomes uncontrolled.

1. REQUIREMENTS

1.1 Composition and Appearance

The product shall be fabricated from irradiated, thermally stabilized modified polyolefin compound. It shall be homogeneous and essentially free from flaws, defects, pinholes, bubbles, seams, cracks or inclusions.

1.2 Dimensions

The product shall be supplied as cut sleeves mounted on bandoliers/carrier as shown in figure 1 and to the dimensions shown in table 1 or 2.

2. PRODUCT DRAWING

2.1 TMS as supplied

Note: Dimensions in inches (mm)

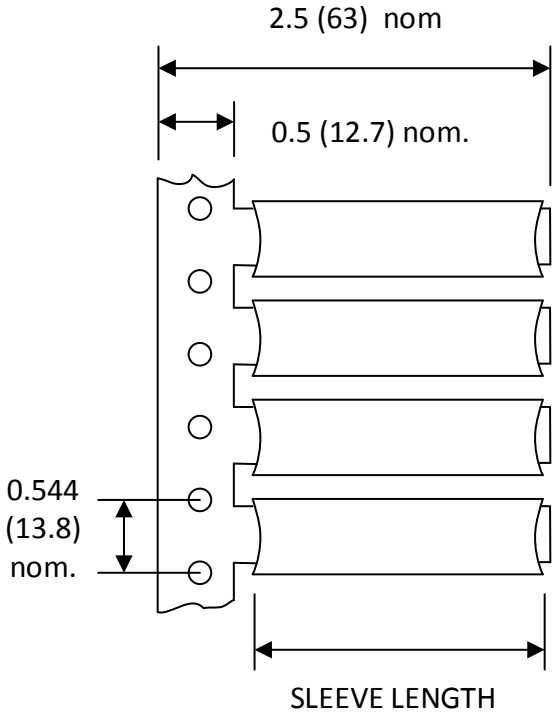


Figure 1. TMS format

While TE Connectivity has made every reasonable effort to ensure the accuracy of the information in this specification, TE Connectivity does not guarantee that it is error-free, nor does TE Connectivity make any other representation, warranty or guarantee that the information is accurate, correct, reliable or current. TE Connectivity reserves the right to make any adjustments to the information contained herein at any time without notice. TE Connectivity expressly disclaims all implied warranties regarding the information contained herein, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose. The dimensions in this document are for reference purposes only and are subject to change without notice. Specifications are subject to change without notice. Consult TE Connectivity for the latest dimensions and design specifications.

If this document is printed it becomes uncontrolled.

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

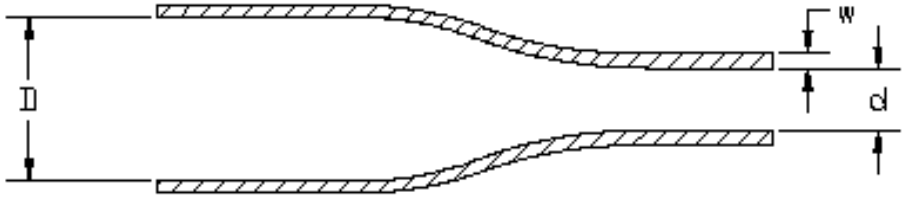


Figure 2. Product Dimensions Change During Recovery

Product Description	AS SUPPLIED				AS RECOVERED			
	Minimum Inside Diameter		Minimum Marking Length		Maximum Inside Diameter		Wall Thickness	
	inch	mm	inch	mm	inch	mm	inch	mm
TMS-3/32-1.50	0.093	2.36	1.50	38.10	0.046	1.17	0.023 ± .003	0.58 ± 0.08
TMS-1/8-1.50	0.125	3.17	1.50	38.10	0.062	1.57	0.023 ± .003	0.58 ± 0.08
TMS-3/16-1.50	0.187	4.74	1.50	38.10	0.093	2.36	0.025 ± .003	0.64 ± 0.08
TMS-1/4-1.50	0.250	6.35	1.50	38.10	0.125	3.17	0.025 ± .003	0.64 ± 0.08
TMS-3/8-1.50	0.375	9.50	1.50	38.10	0.187	4.75	0.025 ± .003	0.64 ± 0.08
TMS-1/2-1.50	0.475	12.07	1.60	40.64	0.250	6.35	0.025 ± .003	0.64 ± 0.08
TMS-3/32-1.75	0.093	2.36	1.75	44.45	0.046	1.17	0.023 ± .003	0.58 ± 0.08
TMS-1/8-1.75	0.125	3.17	1.75	44.45	0.062	1.57	0.023 ± .003	0.58 ± 0.08
TMS-3/16-1.75	0.187	4.74	1.75	44.45	0.093	2.36	0.025 ± .003	0.64 ± 0.08
TMS-1/4-1.75	0.250	6.35	1.75	44.45	0.125	3.17	0.025 ± .003	0.64 ± 0.08
TMS-3/8-1.75	0.375	9.50	1.75	44.45	0.187	4.75	0.025 ± .003	0.64 ± 0.08
TMS-3/4	0.710	18.00	1.65	42.00	0.375	9.53	0.030 ± .004	0.76 ± 0.10
TMS-1-1/2	1.500	38.00	1.65	42.00	0.610	15.50	0.045 ± .004	1.15 ± 0.10

TABLE 1: TMS product dimensions

While TE Connectivity has made every reasonable effort to ensure the accuracy of the information in this specification, TE Connectivity does not guarantee that it is error-free, nor does TE Connectivity make any other representation, warranty or guarantee that the information is accurate, correct, reliable or current. TE Connectivity reserves the right to make any adjustments to the information contained herein at any time without notice. TE Connectivity expressly disclaims all implied warranties regarding the information contained herein, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose. The dimensions in this document are for reference purposes only and are subject to change without notice. Specifications are subject to change without notice. Consult TE Connectivity for the latest dimensions and design specifications.

If this document is printed it becomes uncontrolled.

Product Description	AS SUPPLIED				AS RECOVERED			
	Minimum Inside Diameter		Minimum Marking Length		Maximum Inside Diameter		Wall Thickness	
	inch	mm	inch	mm	inch	mm	Inch (±.003)	mm (±0.08)
TMS-1/8-OX-1.50	0.125	3.17	1.50	38.10	0.046	1.17	0.027	0.69
TMS-3/16-OX-1.50	0.187	4.74	1.50	38.10	0.062	1.57	0.029	0.74
TMS-1/4-OX-1.50	0.250	6.35	1.50	38.10	0.093	2.36	0.029	0.74
TMS-3/8-OX-1.50	0.375	9.50	1.70	43.18	0.125	3.17	0.028	0.71
TMS-1/8-OX-1.75	0.125	3.17	1.75	44.45	0.046	1.17	0.027	0.69
TMS-3/16-OX-1.75	0.187	4.74	1.75	44.45	0.062	1.57	0.029	0.74
TMS-1/4-OX-1.75	0.250	6.35	1.75	44.45	0.093	2.36	0.029	0.74

Table 2: TMS-OX product dimensions

3. TEST REQUIREMENTS

This specification details the requirements for the TMS of products. Table 6 lists the general tests for Identification Products.

Product Size	Mandrel Diameter	
	inch	mm
3/32 through 3/16	5/16	7.9
1/4 through 1-1/2	3/4	19.0

TABLE 3: Test Mandrel Dimensions for Heat Shock, Heat Ageing and Low Temperature Flexibility

While TE Connectivity has made every reasonable effort to ensure the accuracy of the information in this specification, TE Connectivity does not guarantee that it is error-free, nor does TE Connectivity make any other representation, warranty or guarantee that the information is accurate, correct, reliable or current. TE Connectivity reserves the right to make any adjustments to the information contained herein at any time without notice. TE Connectivity expressly disclaims all implied warranties regarding the information contained herein, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose. The dimensions in this document are for reference purposes only and are subject to change without notice. Specifications are subject to change without notice. Consult TE Connectivity for the latest dimensions and design specifications.

If this document is printed it becomes uncontrolled.

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
109-121004	IEWI-004	Secant Modulus	ASTM D882
109-121005	IEWI-005	Dielectric Strength	ASTM D2671 (section 20-25) ASTM D149
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	SAE AS 23053
109-121015	IEWI-015	Specific Gravity	ASTM 2671, ASTM D792
109-121016	IEWI-016	Water Absorption	ASTM 2671, ASTM D570
109-121017	IEWI-017	Volume Resistivity	ASTM D2671 (section 75-78) ASTM D257
109-121031	IEWI-031	Split Resistance	-
109-121039	IEWI- 039	Fluid Resistance at Room Temperature	-
109-121046	IEWI-046	Thermal Cycling	-
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

While TE Connectivity has made every reasonable effort to ensure the accuracy of the information in this specification, TE Connectivity does not guarantee that it is error-free, nor does TE Connectivity make any other representation, warranty or guarantee that the information is accurate, correct, reliable or current. TE Connectivity reserves the right to make any adjustments to the information contained herein at any time without notice. TE Connectivity expressly disclaims all implied warranties regarding the information contained herein, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose. The dimensions in this document are for reference purposes only and are subject to change without notice. Specifications are subject to change without notice. Consult TE Connectivity for the latest dimensions and design specifications.

If this document is printed it becomes uncontrolled.

4.2. Reference Documents

ASTM D149-09(2013)	Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.
ASTM D257-14	Standard Test Methods for DC Resistance or Conductance of Insulating Materials.
ASTM D412-06a: 2013	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.
ASTM D570-98(2010)e1	Standard Test Method for Water Absorption of Plastics.
ASTM D792-13	Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
ASTM D876-13	Standard Test Methods for Non-Rigid Vinyl Chloride Polymer Tubing used for Electrical Insulation.
ASTM D882-12	Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
ASTM D2671-13	Standard Test Methods for Heat-Shrinkable Tubing for Electrical Use
BS EN ISO 4589-2: 1996	Plastics – Determination of burning behavior by oxygen index - Part 2: Ambient temperature test
SAE AMS 23053 SAE AMS 23053/5	Insulation Sleeving, Electrical, Heat Shrinkable, Polyolefin, Flexible, Cross-linked.
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

While TE Connectivity has made every reasonable effort to ensure the accuracy of the information in this specification, TE Connectivity does not guarantee that it is error-free, nor does TE Connectivity make any other representation, warranty or guarantee that the information is accurate, correct, reliable or current. TE Connectivity reserves the right to make any adjustments to the information contained herein at any time without notice. TE Connectivity expressly disclaims all implied warranties regarding the information contained herein, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose. The dimensions in this document are for reference purposes only and are subject to change without notice. Specifications are subject to change without notice. Consult TE Connectivity for the latest dimensions and design specifications.

If this document is printed it becomes uncontrolled.

5. SAMPLING

Tests shall be carried out on samples taken at random from a batch of product.

A batch of markers is defined as that quantity of tubing extruded at any one time.

Testing frequency shall be production routine or qualification.

Production routine tests consisting of visual examination, dimensions and longitudinal change, pull off force will be carried out on every batch of product.

6. 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.

While TE Connectivity has made every reasonable effort to ensure the accuracy of the information in this specification, TE Connectivity does not guarantee that it is error-free, nor does TE Connectivity make any other representation, warranty or guarantee that the information is accurate, correct, reliable or current. TE Connectivity reserves the right to make any adjustments to the information contained herein at any time without notice. TE Connectivity expressly disclaims all implied warranties regarding the information contained herein, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose. The dimensions in this document are for reference purposes only and are subject to change without notice. Specifications are subject to change without notice. Consult TE Connectivity for the latest dimensions and design specifications.

If this document is printed it becomes uncontrolled.

7. General Tests for Identification Products

PROPERTY	TEST METHOD	UNITS	REQUIREMENTS
PHYSICAL			
Visual Examination		-	RW-2500-2 Section 1.1
Dimensions 3 min at 200±3°C (392±5°F)	IEWI-003	mm (inch)	In accordance with Table 1 or 2
Longitudinal Change 3 min at 200±3°C (392±5°F)	IEWI-003	%	0 to 10
Tensile Strength Speed 50.8mm/min (2”/min)	IEWI-002	MPa (psi)	10.3 (1500) minimum
Ultimate Elongation Speed 50.8mm/min (2”/min)	IEWI-002	%	200 minimum
Specific Gravity	IEWI-015	g/cm^3	1.35 maximum
Split Testing	IEWI-031	%	100 pass
Pull off force: Size: 3/32 to 1/4 Size: 3/8 to 1/2 Size: 3/4 to 1-1/2	RW-2500 Section 7.8	N (lbs force)	22.2 (5.0) 26.7 (6.0) 23.1 (5.2)
THERMAL			
Heat Ageing 336hr 175±2°C (347±3°F) Mandrel Bend	IEWI-008	-	No cracking or damage to the sleeve.
Heat Shock 4hr at 250±2°C (482±3°F) Mandrel Bend	IEWI-007	-	No dripping, flowing, or cracking.
Thermal Cycling 4 cycles of 1hr at -55°C and 1hr 135°C Mandrel Bend	IEWI-046	-	No damage to the marker.
Low Temperature Flex 4hr at -55±2°C (-67±3°F) Mandrel Bend	IEWI-006	-	No cracking.

Table 6. General Tests for Identification Products

While TE Connectivity has made every reasonable effort to ensure the accuracy of the information in this specification, TE Connectivity does not guarantee that it is error-free, nor does TE Connectivity make any other representation, warranty or guarantee that the information is accurate, correct, reliable or current. TE Connectivity reserves the right to make any adjustments to the information contained herein at any time without notice. TE Connectivity expressly disclaims all implied warranties regarding the information contained herein, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose. The dimensions in this document are for reference purposes only and are subject to change without notice. Specifications are subject to change without notice. Consult TE Connectivity for the latest dimensions and design specifications.

If this document is printed it becomes uncontrolled.

PROPERTY	TEST METHOD	UNITS	REQUIREMENTS
ELECTRICAL			
Dielectric Strength	IEWI-005	kV/m (V/mil)	19.7 (500) minimum
Volume Resistivity	IEWI-017	Ohm cm	10^{14} minimum
CHEMICAL			
Copper Mirror Corrosion 16hr at 175±2°C (347±4°F)	IEWI-009	%	Non corrosive
Water Absorption	IEWI-016	%	0.5 maximum
ENVIRONMENTAL			
Fungus Resistance 56 day exposure Followed By: Tensile Strength Elongation at break Dielectric strength	ISO 846 Method B IEWI-002 IEWI-002 IEWI-005	 MPa % kV/mm	 10.3 minimum 200% minimum 19.7
Flammability Procedure B	IEWI-053	s %	Burn time, after last flame application, shall not exceed one minute, and not more than 25% of indicator flag shall be burned or charred. No dripping or flowing.
LOI (limiting oxygen index)	IEWI-054	%	28 minimum

Table 6. General Tests for Identification Products - continued

While TE Connectivity has made every reasonable effort to ensure the accuracy of the information in this specification, TE Connectivity does not guarantee that it is error-free, nor does TE Connectivity make any other representation, warranty or guarantee that the information is accurate, correct, reliable or current. TE Connectivity reserves the right to make any adjustments to the information contained herein at any time without notice. TE Connectivity expressly disclaims all implied warranties regarding the information contained herein, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose. The dimensions in this document are for reference purposes only and are subject to change without notice. Specifications are subject to change without notice. Consult TE Connectivity for the latest dimensions and design specifications.

If this document is printed it becomes uncontrolled.

8. Specific tests for TMS product

PROPERTY	TEST METHOD	UNITS	REQUIREMENTS
PHYSICAL			
Restricted shrinkage 30 minutes at 175±2°C (347±4°F) followed by: Visual examination Voltage withstand of 2000V for 1minute	SAE AS 23053/5	 - -	 No Cracks Pass
Secant Modulus	IEWI-004	%	172.4 maximum
Expanded Concentricity	IEWI-003	%	70 minimum
ENVIRONMENTAL			
Fungus Resistance 56 day exposure Followed By: Tensile Strength Elongation at break Dielectric strength	ISO 846 Method B IEWI-002 IEWI-002 IEWI-005	 MPa % kV/mm	 10.3 minimum 200% minimum 19.7
Fluid Resistance 24hr at 23°C in the fluids below, followed by: Tensile Strength Dielectric Strength Test Fluids: MIL-PRF-23699 MIL-H-5606 JP-8 (jet fuel) Kilfrost DF Plus MIL-L-7808 5% Sodium Chloride solution	IEWI-039 IEWI-002 IEWI-005	 MPa (PSI) kV/mm	 6.9 (1000) 15.8

Table 7. Specific Tests for TMS Products

While TE Connectivity has made every reasonable effort to ensure the accuracy of the information in this specification, TE Connectivity does not guarantee that it is error-free, nor does TE Connectivity make any other representation, warranty or guarantee that the information is accurate, correct, reliable or current. TE Connectivity reserves the right to make any adjustments to the information contained herein at any time without notice. TE Connectivity expressly disclaims all implied warranties regarding the information contained herein, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose. The dimensions in this document are for reference purposes only and are subject to change without notice. Specifications are subject to change without notice. Consult TE Connectivity for the latest dimensions and design specifications.

If this document is printed it becomes uncontrolled.

PROPERTY	TEST METHOD	UNITS	REQUIREMENTS
THERMAL			
Heat Ageing 168hr at 175±2°C (347±4°F) followed by: Ultimate Elongation	 IEWI-008 IEWI-002	 %	 100 minimum
Color & color Stability 24hr at 175±2°C (347±4°F)	SAE AS 23053	-	No significant visual change, recognizable color. Measure and record only.
CHEMICAL			
Copper Contact Corrosion 24hr at 175±2°C (347±4°F)	IEWI-010	-	No pitting or blackening of copper.

Table 7. Specific Tests for TMS Products continued

TE (Logo) is a trademark.

ASTM is a trademark of the American Society for Testing and Materials. Other logos, product and Company names mentioned herein may be trademarks of their respective owners.

While TE Connectivity has made every reasonable effort to ensure the accuracy of the information in this specification, TE Connectivity does not guarantee that it is error-free, nor does TE Connectivity make any other representation, warranty or guarantee that the information is accurate, correct, reliable or current. TE Connectivity reserves the right to make any adjustments to the information contained herein at any time without notice. TE Connectivity expressly disclaims all implied warranties regarding the information contained herein, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose. The dimensions in this document are for reference purposes only and are subject to change without notice. Specifications are subject to change without notice. Consult TE Connectivity for the latest dimensions and design specifications.

If this document is printed it becomes uncontrolled.