

## 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.**

TE CONNECTIVITY, SWINDON, UK

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## 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)

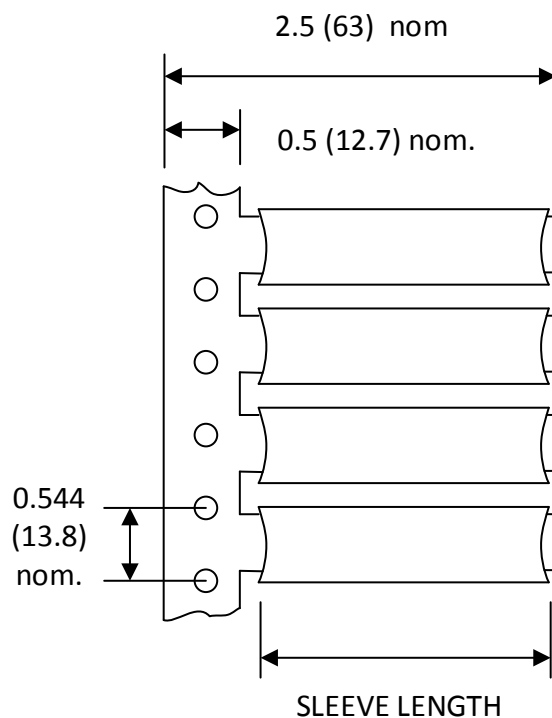


Figure 1. TMS format

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

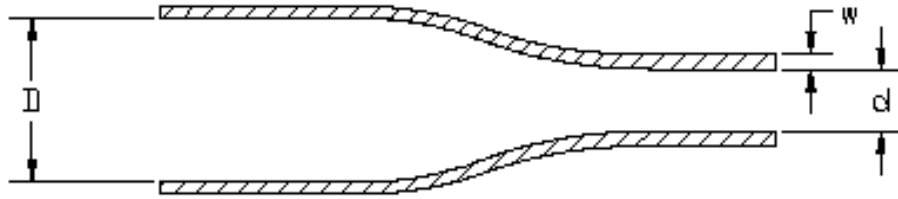


Figure 2. Product Dimensions Change During Recovery

| 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

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| Product Description | AS SUPPLIED             |      |                        |       | AS RECOVERED            |      |                 |               |
|---------------------|-------------------------|------|------------------------|-------|-------------------------|------|-----------------|---------------|
|                     | Minimum Inside Diameter |      | Minimum Marking Length |       | Maximum Inside Diameter |      | Wall Thickness  |               |
|                     | inch                    | mm   | inch                   | mm    | inch                    | mm   | Inch<br>(±.003) | mm<br>(±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

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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)<br>ASTM D412      |
| 109-121003     | IEWI-003     | Dimensions                                       | ASTM D2671 (section 8-13)<br>ASTM D876       |
| 109-121004     | IEWI-004     | Secant Modulus                                   | ASTM D882                                    |
| 109-121005     | IEWI-005     | Dielectric Strength                              | ASTM D2671 (section 20-25)<br>ASTM D149      |
| 109-121006     | IEWI-006     | Low Temperature Flexibility                      | SAE AS 23053 (section 36 -43)<br>IEC 60684-2 |
| 109-121007     | IEWI-007     | Heat Shock                                       | SAE AS 23053<br>ASTM D2671 (section 26-30)   |
| 109-121008     | IEWI-008     | Heat Resistance                                  | SAE AS 23053<br>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)<br>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**

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#### 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<br>SAE AMS 23053/5   | Insulation Sleeving, Electrical, Heat Shrinkable, Polyolefin, Flexible, Cross-linked.   |
|  |   |
| TE Doc. No: 411-121008   | Installation of Heatshrink Marker Sleeves   |
| <b>(Subsequent amendments to, or revisions of, any of the above publications apply to this standard only when incorporated in it by updating or revision.)</b> |   |

**Table 5. Reference Documents**

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## 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.

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## 7. General Tests for Identification Products

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

**Table 6. General Tests for Identification Products**

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| PROPERTY  | TEST METHOD  | UNITS                     | REQUIREMENTS  |
|---|--|---------------------------|---|
| <b>ELECTRICAL</b>   |  |                           |   |
| <b>Dielectric Strength</b>  | IEWI-005   | kV/m (V/mil)              | 19.7 (500) minimum  |
| <b>Volume Resistivity</b>   | IEWI-017   | Ohm cm                    | 10 <sup>14</sup> minimum  |
| <b>CHEMICAL</b>   |  |                           |   |
| <b>Copper Mirror Corrosion</b><br>16hr at 175±2°C (347±4°F)   | IEWI-009   | %                         | Non corrosive   |
| <b>Water Absorption</b>   | IEWI-016   | %                         | 0.5 maximum   |
| <b>ENVIRONMENTAL</b>  |  |                           |   |
| <b>Fungus Resistance</b><br>56 day exposure<br>Followed By:<br>Tensile Strength<br>Elongation at break<br>Dielectric strength | ISO 846 Method B<br><br>IEWI-002<br>IEWI-002<br>IEWI-005 | <br><br>MPa<br>%<br>kV/mm | <br><br>10.3 minimum<br>200% minimum<br>19.7  |
| <b>Flammability</b><br>Procedure B  | IEWI-053   | s<br>%                    | 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. |
| <b>LOI (limiting oxygen index)</b>  | IEWI-054   | %                         | 28 minimum  |

Table 6. General Tests for Identification Products - continued

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## 8. Specific tests for TMS product

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

**Table 7. Specific Tests for TMS Products**

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

Table 7. Specific Tests for TMS Products continued

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- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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