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Specification	**RW-3031**
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RayOLOn Sleeve
Insulating, Sealing, Elastomeric, Roll-On Sleeve

1. SCOPE

This specification establishes the quality standard for one type, non-halogen containing, crosslinked, dual wall, flexible, elastomeric roll-on sleeve, whose diameter will expand for sealing of connectors, and cable splices

2. APPLICABLE DOCUMENTS

MIL-STD-1344A	Test Methods for Electrical Connectors
MIL-STD-202F	Test Methods for Electronic and Electrical Component Parts
MIL-STD-810C	Method 508.5. Fungus Growth on Synthetic Polymeric Materials
ASTM D257-93	Standard Test Method for DC Resistance or Conductance of Materials
ASTM D2671-95	Standard Test Methods for Heat Shrinkable Tubing for Electrical Use
ASTM D792-91	Test Methods for Density of Plastics by Displacement
ASTM D570-95	Standard Test Method for Water Absorption of Plastics.
ASTM D638-96	Standard Test Methods for Tensile Properties of Plastics.
ASTM D635-96	Test Method for Rate of Burning of Self Supporting Plastics in a Horizontal Position
ASTM G26-96	Practice for Operating Light -Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Non-Metallic Materials
AMS-DTL-23053E	Insulation Sleeving, Electrical, Heat Shrinkable, Detailed Specification for,

Subsequent amendments to, or revisions of any of the above publications apply to this standard only when incorporated in it by updating or revision.

3. PROPERTIES

3.1 Material

The sleeve shall be fabricated from thermally stabilized, modified EPDM rubber and shall be cross linked. It shall contain no halogens.

3.2 Color

The sleeve shall be black**.**

3.3 Configuration

It shall be formed in a continuous two-layer tube, essentially free from flaws, defects, pinholes, bubbles, cracks and inclusions. An inner lubricant shall add lubricity for the sleeve to roll upon itself making it easy for “roll-on” installation. The product is provided on a paper core and is bagged with sealing components as a kit.

4. REQUIREMENTS

The sleeve shall meet the requirements of Tables 1 and 2.

5. QUALITY ASSURANCE PROVISIONS

5.1 CLASSIFICATION OF TESTS

5.1.1 **Qualification Tests**

Qualification tests are those performed on the sleeves submitted for qualification as a satisfactory product and shall consist of all the tests listed in this specification.
Unless otherwise specified, all testing shall be performed on jacket material only.

5.1.2 **Production Routine Tests**

Production Routine Tests shall be carried out on every batch, unless otherwise specified and shall consist of the following: Dimensions and Bond Line Leak Test.

6. SAMPLING INSTRUCTIONS

6.1 **Qualification** Test Samples

Qualification Test Samples shall normally consist of a sufficient quantity of one size, taken from the range, which shall qualify all sizes**.** Unless otherwise indicated, the specimen quantity for any test shall be five (5).

6.2 **Production Routine Test Samples**

Production Routine Test Samples shall consist of three (3) specimens per each 100 pieces in a manufacturing batch, to perform all the tests in 5.1.2. Specimens shall be selected at random from each batch. A batch shall consist of all sleeves of the same size, from the same production run, and offered for inspection at the same time.

7. SERVICE LIFE TEST PROCEDURES

Unless otherwise specified the sleeves shall be conditioned for 4 hours at 23°C and 50% relative humidity prior to testing.

7.1 **Dimensions**

The test method shall be as specified in paragraph A and B below.
The length and inside diameter of finished sleeving shall be measured**.** The specimens shall be measured and compared to Table 1.

A**. I.D. Verification**

Check the product for a tight fit as it rests on its tubing core. The sleeve should not be able to freely slide over the core. Measure the core dimension and compare it to Table 1.

B. **O.D. Verification**

Check the specification for the product size being tested and select the appropriate upper size range test mandrel. Remove the sleeve from its core and slide it onto the test mandrel. The product should be able to be rolled onto the tapered mandrel (Figure 1) without cracking, leaking lubricant at the bonded seam or splitting (a tapered mandrel may be used to aid in installing the sleeve).

7.2 **Bond Line Sealing Test**

Five specimens shall be tested for bond line sealing. After conditioning, the specimens shall be installed on a mandrel 1.1 times (minimum) the size of the core tube listed in Table 1. The mandrel shall be 2.5 times the length of the sleeve. The sleeve shall be rolled back and forth, to and from each end, five times. There shall be no evidence of leakage of internal lubricant at the bond line

7.3 **Temperature Life**

Install five specimens on a mandrel 1.5 X the core diameter specified in Table 1. Condition the installed sleeves in accordance with MIL-STD 1344, Method 1005, Test Condition 2, 70°C for 1000 hours (Test Time D). This conditioning shall be followed by the Bond Line Sealing Test of paragraph 7.2. There shall be no leaking of internal lubricant after testing in accordance with paragraph 7.2.

7.4 **Service Life Test**

Test 5 specimens in accordance with the Bond Line Sealing Test per paragraph 7.2, except cycle the sleeve through fifty (50) cycles end to end on the mandrel. There shall be no leakage of internal lubricant at the bond line.

7.5 **Humidity**

Install 5 specimens on a mandrel 1.5 X the core diameter specified in Table 1. Condition the installed sleeves in accordance with MIL-STD 1344, Method 1002, Type II, except perform 5 conditioning cycles between 28 and 60°C at 95% relative humidity. Test the specimens in accordance with paragraph 7.2 after conditioning.

7.6 **Sand and Dust Exposure**

Install five specimens on a mandrel 1.5 X the core diameter specified in Table 1. Test for sand and dust exposure per MIL-STD 202, Method 110. At the end of the test inspect each specimen for sand and dust migration under the sleeve. Note the observation*. Then test each specimen for Bond Line Sealing per 7.2.

7.7 **Blowing Rain**

Install five specimens on a mandrel 1.5 X the core diameter specified in Table.
Step 1 - Subject the specimens to constant rain rate of 2 inches /hour for ten minutes; 5 inches/ hour for five minutes and 2 inches/ hour for fifteen minutes.
Step 2 - Apply blowing wind at 40 mph (3500 ft /min) in the horizontal plane (through the core of the mandrel the sleeve is on) adding rain at 2 inches/hour applied for 15 minutes.
At the end of the test inspect each specimen for water migration under the sleeve. Note the observation*.
Subject the specimens to Bond Line Sealing per 7.2.

7.8 **U.V. Resistance**

Install five specimens on a mandrel 1.5 X the core diameter supplied with the product. Subject the installed specimens to UV radiation in a Xenon Arc weather chamber in accordance with ASTM G-26-96 “Practice for Operating Light - Exposure Apparatus (Xenon-arc Type) With and Without Water for Exposure of Nonmetallic Materials” (a.k.a. ASTM G2565-92a). Suspend the specimens in a vertical hanging plane for continuous exposure to light and intermittent exposure to water spray. The test shall be run for 1500 hours with inspections after each 500 hours. After 1500 hours inspect the sleeves and subject them to the Bond Line Leak Test of 7.2. Any leaking of internal lubricant shall constitute a failure.

7.9 **Temperature Shock**

Install five specimens on a mandrel 1.5 X the core diameter specified in Table 1.
Subject the specimens to 5 thermal cycles from -63°C to +90°C per MIL-STD-1344, Method 1003, Test condition A. Test the sleeve for Bond Line Sealing in accordance to 7.2. Any leaking of internal lubricant shall constitute a failure.

7.10 **Salt Fog Test**

Install five specimens on a aluminum mandrel 1.5 X the core diameter specified in Table 1. Test in accordance with MIL-STD-1344, Method 1001 using 5% aqueous NaCl solution. Expose the mandrel to 1000 hours of testing. Inspect the mandrels for corrosion under the sleeve at the end of the test. Note the observation*. Test the sleeve for Bond Line Sealing in accordance to 7.2. Any leaking of internal lubricant shall constitute a failure.

7.11 **Vibration**

Install three specimens on a cable splice sized in the mid-range of the sleeve size range. Mount the sleeves in a fixture and test for harmonic vibration in accordance with MIL-STD-202, Method 201, Test Condition A, 15g peak, in the range 10 -55 Hz. Test the sleeves in three axis for a duration of 2 hours per axis. Once complete, test the sleeve for Bond Line Sealing in accordance to 7.2. Any leaking of internal lubricant shall constitute a failure.

7.12 **Resistance to Fungus**

Three sleeves shall be mounted on cables and provided for fungus testing in accordance with MIL-STD 810, Method 508.5. The sleeves shall be bathed in warm deionized water prior to inoculation. The sleeves shall be inspected for growth level at the end of the 28 day test.

7.13 **Fluid Resistance**

Three sleeves shall be immersed at 23 ± 2°C for 24 hours in the fluids listed. Allow the sleeves to drain for one hour after removal from the fluid. After conditioning in the fluid and draining, the sleeve is subjected to the Bond Line Sealing Test of 7.2.

MIL-H-5606 hydraulic fluid
MIL-L-7808 lubricating oil
MIL-A-8243 de-icing fluid
Coolanol 25 dielectric fluid (synthetic silicate ester based)

8. MATERIAL TESTS

The following tests are to be performed on the jacket material only. Five strips or die cut specimens shall be lightly wiped with a rag or cloth moistened with IPA. The specimens should then be conditioned for 4 hours at 23C and 50 % RH prior to testing. The reported values for any given requirement shall be the average of the five specimens tested

8.1 **Tensile Strength**

The test method shall be as specified in ASTM D412, Method A, with cross head speed of 20 inches /minute. The test shall be carried out at a temperature of 23± 2°C.

8.2 **Ultimate Elongation**

The test method shall be as specified in ASTM D412, Method A, with cross head speed of 20 inches /minute. The test shall be carried out at a temperature of 23± 2°C.

8.3 **Low temperature Flex**

Five 1/4-inch wide specimens cut from sleeves shall be conditioned, along with a 3/8-inch *(9.5-mm)* mandrel, in a cold chamber at -40 ± 2°C for 4 hours. After completion of the conditioning, and while still in the cold chamber, each specimen shall be bent around the mandrel through not less than 360 degrees within 10 ± 2 seconds. The specimens then shall be visually examined for cracks.

8.4 **Dielectric Strength**

Five sleeves shall be slit and prepared for Dielectric testing in accordance with ASTM D149, Method A. Test to breakdown and record the value normalized for wall thickness in terms of V/mil *(MV/m)*.

8.5 **Volume Resistivity**

Five sleeves shall be slit and prepared for volume resistivity testing in accordance with ASTM D257.

8.6 **Water Absorption**

Three sleeves shall be slit and prepared for water absorption testing in accordance with ASTM D570

8.7 **Flammability**

Five specimens shall be tested for flammability in accordance with ASTM D635-96. The test shall be conducted on strips cut from each specimen. The strips shall be wiped with an IPA dampened chem-wipe or cloth rag prior to conditioning per paragraph 7.0. The maximum burn rate shall not exceed that shown in the specification based upon wall thickness.

8.8 **Density**

Five specimens shall be prepared and tested for density in accordance with ASTM D792.

9. PREPARATION FOR DELIVERY

9.1 **Form**

The sleeves shall be supplied as a kit in individual bags unless otherwise specified

9.2 **Packaging**

Packaging shall be in accordance with good commercial practice.

9.3 **Marking**

Each container of roll-on sleeve kits shall be permanently and legibly marked with the size, quantity, manufacturer's identification, and batch number**.**

∗ *Leaks in these tests are indications of improper sizing. Check the dimensions from Table 1.*

TABLE 1
SLEEVE DIMENSIONS

inches *(mm)*			
Part Number	**Internal Diameter**		**Wall Thickness**
	I.D.(max) as Supplied	**Core Tube (max.)**	**+/- 0.010 *(+/- 0.26)***
LNCL-11-XX	0.33 *(8.4)*	0.39 *(9.9)*	0.081 *(2.06)*
LNCL-12-XX	0.42 *(10.7)*	0.53 *(13.5)*	0.090 *(2.29)*
LNCL-13-XX	0.61 *(15.5)*	0.72 *(18.3)*	0.095 *(2.41)*
LNCL-14-XX	0.85 *(21.6)*	0.97 *(24.7)*	0.095 *(2.41)*
LNCL-15-XX	1.22 (31.0)	1.38 *(35.1)*	0.115 *(2.92)*

XX refers to the length of the sleeve in millimeters

TABLE 2
REQUIREMENTS

MATERIAL PROPERTY	**UNIT**	**REQUIREMENTS**	**TEST METHOD**
PHYSICAL			Section 7.1
Dimensions	in *(mm)*	In accordance with Table 1	ASTM D 2671
Tensile Strength	psi *(Mpa)*	1200 minimum. *(8.3 minimum)*	Section 8.1 ASTM D412
Ultimate Elongation	Percent	100 Min.	Section 8.2 ASTM D412
Density	g/cm^3	1.1 maximum	Section 8.8 ASTM D792
Low Temperature Flexibility 4 hrs at -40 ± 2°C		No Cracking	Section 8.3 SAE-DTL-23053
ELECTRICAL			
Dielectric Strength	V/mil *(MV/m)*	225 minimum *(8.86 minimum)*	Section 8.4, ASTM D149
Volume Resistivity	Ohm-cm	1x 10E12	Section 8.5., ASTM D257
CHEMICAL			
Flammability	Burn rate	40 mm/min maximum	Section 8.7, ASTM D635
Water Absorption 24 hrs at 23 ± 3°C		0.5% maximum.	Section 8.6, ASTM D570
IN SERVICE TESTS		No leaks of internal lubricant	All conditioning followed by tests for Bond Line Sealing per Section 7.2
Temperature Life - 70°C for 1000 hrs			Section 7.3
Service Life - 50 cycles			Section 7.4
Humidity -5 cycles, 28-60° centigrade @ 95% RH			Section 7.5 - MIL-STD-1344, Method 1002
Sand and Dust Exposure			Section 7.6, MIL-STD-202, Method 110.
Blowing Rain			Section 7.7
U.V. Resistance (Xenon arc)			Section 7.8, ASTM G-26
Temperature Shock			Section 7.9 MIL-STD 1344 Method 1003, Cond A.
Salt Fog - 1000 hrs			Section 7.10, MIL-STD-1344, Method 1001
Vibration - 15g, 3 axis			Section 7.11 MIL-STD-202 Method 201, Test Cond A
Fungus Resistance - 28 days			Section 7.12, MIL-STD 810, Method 508.5

TABLE 2 Continued

MATERIAL PROPERTY	UNIT	REQUIREMENTS	TEST METHOD
IN SERVICE TESTS (cont)		No leaks of internal lubricant	All conditioning followed by tests for Bond Line Sealing per Section 7.2
Fluid Resistance, 24 hrs @23C MIL-H-5606 hydraulic fluid MIL-L-7808 lubricating fluid MIL-A-8243 de-icing fluid Coolanol 25 dielectric fluid - (synthetic silicate ester based)			Section 7.13

In line with a policy of continual product development, Tyco reserves the right to make changes in construction, materials and dimensions without further notice. You are advised, therefore, to contact a Tyco Electronics representative, should it be necessary to ensure that this document is the latest issue.