

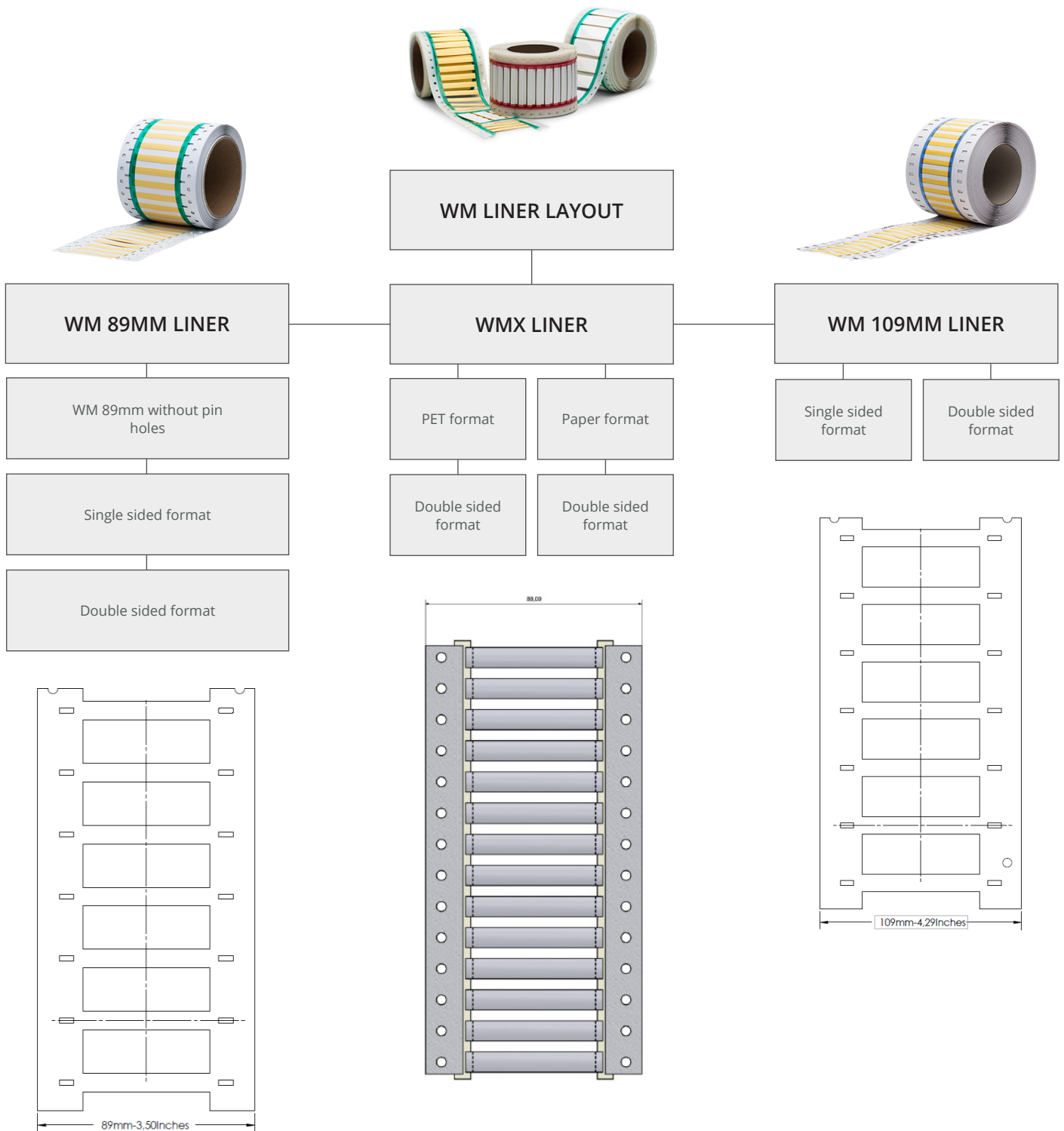


LINK SOLUTIONS

Cable and wire products  
**Identification**  
Wire Marker Catalogue



# Available Formats



## Available Tube Grades

PRODUCT GROUP	TUBE GRADE	CHARACTERISTICS	COMPLIANCES
WMX-WM89-WM109	C3	The C3- 3:1 shrink ratio, heat shrinkable wire Markers are made of, flame retardant in inch sizes heat shrinkable polyolefin tubing with ideal printability properties for identification purposes. The C3 material are fabricated to meet the material performance requirements of the AMS-DTL -23053/5 class 1 and meet the features in Airbus specification NSA 937201. The compound is also UL224 and CSA compliant. Ideal for Aerospace, military, industrial and energy applications. Marker sleeves meet the mark permanence requirements of AS5942 and MIL 202 Method 215K	CSA 22.2 No. 198- SAE-AMS-DTL-23053/5 SAE AS 81531 / 5942 MIL-STD-202F method 215J AMS-DTL-23053/5 AIRBUS NSA937201
WMX-WM89-WM109	ZH	The ZH heatshrink tubing are made of halogen free, flame retardant, heat shrinkable polyolefin tubing with ideal printability properties for identification purposes. The compound of the tubing is excluded for halogens and offers excellent fire safety characteristics combined with minimal smoke emission. The material meet Boeing BS 7239 for toxic gas generation M7 specification- The ZH material is classified with EN45545-2 Class HL3 requirement set R22 (interior) and R23 (exterior) and be used without any restriction for any application.	EN 45545-2 (R22-R23) BS 6853 DIN5510-2 UNI CEI 11170-3 NFPA130 (ASTM E 162, ASTM E 662, BSS 7239) SAE AS 81531 / 5942 MIL-STD-202F method 215J
WMX-WM89-WM109	LFH	The LFH printable heatshrink tubing are made of halogen free, flame retardant and low smoke heat shrinkable polyolefin tubing with ideal printability properties for identification purposes. The compound of the tubing is excluded for halogens and offers excellent low fire hazard characteristics combined with minimal smoke emission.	UL224 File E361238 CSA File 220127 SAE AS 81531 / 5942 MIL-STD-202F method EN50343 Annex H Section H.3
WMX-WM89-WM109	LFH-3X	The LFH printable heatshrink tubing are made of halogen free, flame retardant and low smoke heat shrinkable polyolefin tubing with ideal printability properties for identification purposes. The compound of the tubing is excluded for halogens and offers excellent low fire hazard characteristics combined with minimal smoke emission.	UL224 File E361238 CSA File 220127 SAE AS 81531 / 5942 MIL-STD-202F method 215J EN50343 Annex H Section H.3
WMX-WM89-WM109	HT	The HT printable heatshrink tubing are made of semi flexible highly flame retardant polyvinylidene fluoride tubing. High temperature rated thin wall markers with high transparency. Excellent chemical resistance to most industrial fuels, chemicals, solvents and high degree of mechanical strength properties suitable for aerospace, defense and mass transit applications. It is inherently flame retardant, semi-rigid and highly resistant to most industrial fuels, chemicals and solvents.	UL224 SAE-AMS-DTL-23053/8 SAE AS 81531 / 5942 MIL-STD-202F method 215J
WMX-WM89-WM109	DR	The DR printable is printable irradiated cross linked, flame retardant, semi-rigid, diesel oil resistant heat shrinkable polyolefin tubing. Especially suitable for railways and complies with SNCF requirements NF F 00608 cat. A & H. Used where resistance to organic fluids, common fuels, lubricants and solvents properties are required for use in mass transit, aerospace, marine and industrial installations.	NF F 00-608 cat A & H UL224 VW-1 SAE-AMS-DTL-23053/6 Class 1 SAE AS 81531 / 5942 MIL-STD-202F method 215J
WMX-WM89-WM109	AMD	The AMD printable heatshrink are made of highly flame retardant, self-extinguishing and very flexible heat shrinkable polyolefin tubing with ideal printability properties for identification purposes within aerospace, military and defence specified applications. UL VW1/CSA recognized and complies to AMS-DTL-23053/5 Class 1&3. This heatshrink are very versatile through excellent balance of chemical, electrical and mechanical properties.	UL224 SAE-AMS-DTL-23053/5 SAE AS 81531 / 5942 MIL-STD-202F method 215J
WMX-WM89-WM109	AMD-3X	The AMD printable heatshrink are made of highly flame retardant, self-extinguishing and very flexible heat shrinkable polyolefin tubing with ideal printability properties for identification purposes within aerospace, military and defence specified applications. UL VW1/CSA recognized and complies to AMS-DTL-23053/5 Class 1&3. This heatshrink is very versatile through excellent balance of chemical, electrical and mechanical properties.	UL224 SAE-AMS-DTL-23053/5 SAE AS 81531 / 5942 MIL-STD-202F method 215J
WMX-WM89-WM109	3-1	The 3-1 heatshrink tubing are made of halogen free, flame retarded, heat shrinkable polyolefin tubing with ideal printability properties for identification purposes. The compound of the tubing is excluded for halogens and offers excellent fire safety characteristics combined with minimal smoke emission. Material: Irradiated cross-linked flexible flame-retarded polyolefin Shrink Temperature: Min 90 dgc.	SAE-AMS-DTL-23053/5 class 1&3 UL224 600V VW-1 rating CSA 22.2 No. 198.1-98 SAE AS 81531 / 5942 MIL-STD-202F method 215J
WMX-WM89-WM109	ZHR	ZHR-2X and 3X Heat Shrinkable Wire Markers are made of halogen free, flame retardant and low smoke heat shrinkable polyolefin tubing with ideal printability properties for identification purposes, which provides fluid resistance as per EN50343. This product meets rail standards EN50343 Appendix H and EN45545-2 requirement set R22/R23 hazard level classification 1 and 2. The compound of the tubing is excluded for halogens and offers excellent low fire hazard characteristics combined with minimal smoke emission. It can also be used for applications where limited fire hazard characteristics are necessary.	Diesel Resistance: EN50343 annex H (section 6.6) Fire Propagation: EN45545-1 HL3, R22-R23 Chemical and Diesel Resistance: EN50343 annex H (section 6.6) MIL-STD-202F Method 215J Mark Permanence: EN50343 annex H (section 6.6) & SAE AS-5942

# 3-1

## Halogen free, Flame retardant heat shrinkable identification sleeve

### TECHNICAL DATA SHEET

Revision Number. 1  
Last Edited 24. juli 2018



The WM-3-1 are 3:1 flexible heat shrinkable wire markers. Made of heat UL & CSA recognised shrinkable polyolefin tubing with ideal printability properties for identification purposes. Supplied on rolls and flattened format on various liner types.

Ideal for a wide variety of applications where flammability and self-extinguishing characteristics are required.

This product is designed for use in Automotive, Military, Aerospace applications, machinery, Industrial machinery, Electronics wire bundling harnesses and assemblies, panel building.

Meets ASTM D2671 & UL VW-1 standard for flammability which makes the material flame-retarded (PBDE/PBB-free), self-extinguishing and passes vertical burn test. The sleeve meet the material requirements of the SAE-AMS-DTL-23053/5 class 1 & 3.

### Industry



Industry



Marine



Wind power



Commercial



Aerospace



Construction



Railway



Military



Electrical installations



Petrochemical



Telecom

### STANDARD TUBE COLOR



### OTHER TUBE COLORS ON REQUEST



### BACKING TAPE COLORS



### MATERIAL

Extruded, cross linked polyolefin.

### SHRINK RATIO

3:1

### OPERATING TEMPERATURE

-55°C to +135°C  
(-67°F to 275°F)

### SHRINK TEMPERATURE

>90°C (130°F)

### COMPLIANCES

Mark Permanence:

SAE AS-5942 Superceeds

SAE AS 81531:1998 Section 4.6.2

Recommended black ribbon:

FTI-Y, FTI-X

Chemical Resistance to solvents:

MIL-STD-202G

Test method 215j

### INDUSTRY STANDARDS

SAE-AMS-DTL-23053/1 class 1&3

### FLAMMABILITY

UL224 VW-1 125°C 600V

File No. E48762

CSA C 22.2 198.1 600V VW-1

File No. 033298-0-000

### STORAGE

Cool and dry in original packaging. Recommended temperature at +10°C to +25°C and 45-55% relative humidity. Use within 2 years from date of manufacture.

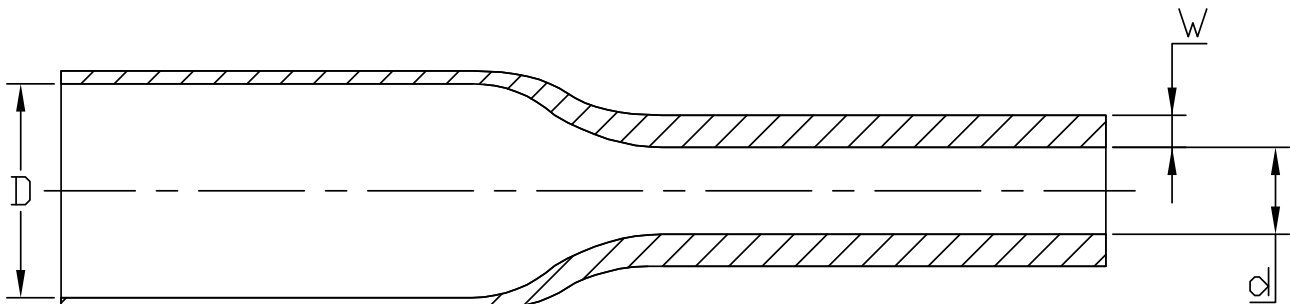
### APPLICATIONS

Specific developed to be used in Automotive, Defence, Aerospace, industrial, electronics, cable harnesses, Industrial marking, insulation, wire bundling and mechanical protection.

# Product Dimensions

## DIMENSIONS 3:1

SIZE, INCHES	SIZE, MM	MINIMUM ID (D), AS SUPPLIED MM (INCHES)	MAXIMUM ID, RECOVERED (D) MM (INCHES)	RECOVERED WALL THICKNESS (W), MM (INCHES)
3/32	1.5/0,5	1.50 (0.059)	0.50 (0,019)	0.50
1/8	3.0/1	3.00 (0.118)	1.0 (0.039)	0.60
3/16	4.8/1,6	4.80 (0.188)	1.6 (0.063)	0.65
1/4	6.0/2	6.0 (0.236)	2.0 (0.078)	0.70
3/8	9.0/3	9.0 (0.354)	3.0 (0.118)	0.80
1/2	12.0/4	12.0 (0.472)	4.0 (0.157)	0.85
3/4	18.0/6	18.0 (0.70)	6.0 (0.236)	1.00
1	24.0/8	24.0 (0.944)	8.0(0.314)	1.20
1 ½	40.0/13	40.0 (1.57)	13.0 (0.512)	1.25



Heat Shrink Product in as supplied "D" and fully recovered state "d" with recovered wall "W"

# General Tests for Identification Products

## PHYSICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Tensile strength	ASTM D 638	13.00 MPA
Elongation at break	ASTM D 638	≥400%
Longitudinal change	SAE-AMS-DTL-23053	-7%
Specific gravity	ASTM D 792	1,34
Secant Modulus	ASTM D 882	65 MPa

## ELECTRICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Dielectric strength	ASTM D876	≥30.00 kV/mm
Volume resistivity	ASTM D876	$3.10 \times 10^{14} \Omega/\text{cm}$
Voltage Rating	UL 224	600Volt
Dielectric Voltage Withstand (2.5kV x 60s)	UL 224	Pass no breakdown

## CHEMICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Water absorption	ASTM D 570	0,25%
Copper corrosion (158°C x 168h)	SAE-AMS-DTL-23053	No corrosion
Stability against copper (158°C x 168)	SAE-AMS-DTL-23053	Elongation min 100% - Pass
Fluid Resistance (after immersion 24°C x24h)	SAE-AMS-DTL-23053	7,25-14 MPa Min 6,9 MPa (Tensile Strength)
Fungus Resistance	SAE-AMS-DTL-23053 requirement ASTM G21	Pass
Ozone resistance	NF F 00-608	No cracking or sweating - Pass

## THERMAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Heat shock 4 hours at 250°C	SAE-AMS-DTL-23053	No dripping, cracking or flowing - Pass
Heat aging 168 hours at 158°C	SAE-AMS-DTL-23053	Elongation ≥400%
Flammability	UL224	VW-1 Pass » Flame retardant
Low temperature flexibility / Bending (-55°C x 4h)	UL 224	No cracking, no break, pass

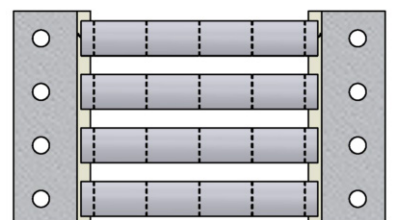
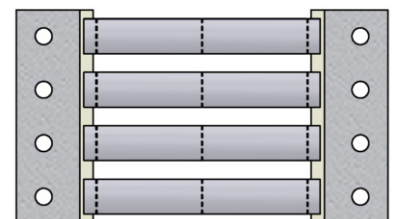
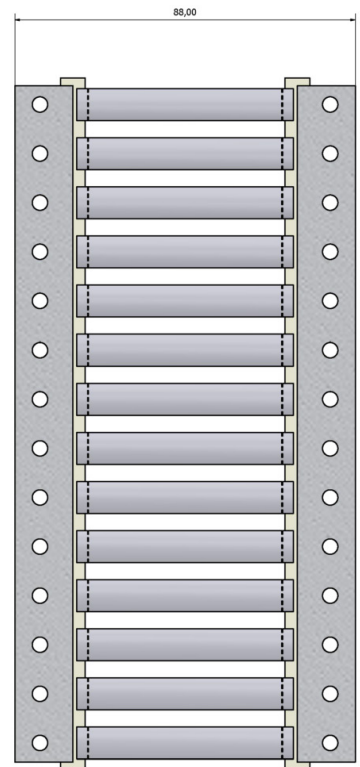
## Environmental UV Stability

PROPERTIES	TEST METHOD	TYPICAL VALUE
UV-A	ASTM G154 - Machine setup Temp 50-60°C (140°F) Cycle 8 h light 4h condensation UV wavelength 280-400nm Test duration 1000 h of exposure.	Pass - No damage to the marker and print legible after 20 rubs in accordance with SAE-AS 815314.6.2

## Product code

WM - DS -AMD- 3X - 024 - 125 - YW

<b>FAMILY</b> WM89 = 89 mm liner WM109= 109mm liner WMX= TMS Style	WM
<b>DOUBLE SIDED</b> Only shown if double sided	DS
<b>GRADE SLEEVES</b> See Page 6	AMD
<b>SHRINK RATIO</b> If nothing shown its 2x shrink Ratio	3X
<b>DIAMETER</b> 024 = 2.4mm 032 = 3.2mm	024
<b>LENGTH</b> Length 125 = 12.5mm - 3 scores Length 165 = 16.5mm - 2 scores Length 250 = 25.0mm - 1 score Length 038 = 38.0mm - 0 score	125
<b>COLOR</b> WE= White YW=Yellow	YW



## Available options -

SIZE MM	SIZE INCHES	STANDARD	BULK	JUMBO
1,5 x 50 mm	3/32 - 2.0	1.000	5.000	10.000
3,0 x 50 mm	1/8 - 2.0	1.000	5.000	10.000
4,8 x 50 mm	3/16 - 2.0	1.000	5.000	10.000
6,0 x 50 mm	1/4 - 2.0	1.000	3.000	6.000
9,0 x 50 mm	3/8 - 2.0	500	2.000	4.000
12,0 x 50 mm	1/2 - 2.0	500	1.500	3.000
18,0 x 50 mm	3/4 - 2.0	500	1.500	3.000
24,0 x 50 mm	1 - 2.0	300	1.000	2.000
40,0 x 50 mm	1 1/2 - 2.0	100	600	1.200

## Other Spool sizes on request -

## Ordering description

ORDERING DESCRIPTION EXAMPLES	STANDARD PACK SIZE	SUPPLIED DIAMETER		RECOVERED DIAMETER		RECOMMENDED USE RANGE (MIN-MAX)	
		pcs	mm	inches	mm	inches	mm
Family-Tube Grade-3X-015-50-Colour	1.000	1,5 x 50mm	3/32-2.0	0.5	0.031	0.8-1.9	0.032-0.075
Family-Tube Grade-3X-030-50-Colour	1.000	3,0 x 50mm	1/8-2.0	1.0	0.042	1.1-2.6	0.044-0.105
Family-Tube Grade-3X-048-50-Colour	1.000	4,8 x 50mm	3/16-2.0	1,6	0.062	1.7-4.0	0.069-0.160
Family-Tube Grade-3X-060-50-Colour	1.000	6,0 x 50mm	1/4-2.0	2.0	0,095	2.3-5.4	0.091-0.215
Family-Tube Grade-3X-090-50-Colour	500	9,0 x 50mm	3/8-2.0	3.0	0.125	3.4-8.1	0.137-0.320
Family-Tube Grade-3X-120-50-Colour	500	12,0 x 50mm	1/2-2.0	4.0	0,187	4.6-10.7	0.183-0.425
Family-Tube Grade-3X-180-50-Colour	500	18,0 x 50mm	3/4-2.0	6.00	0.250	6.9-16.2	0.275-0.640
Family-Tube Grade-3X-250-50-Colour	300	24,0 x 50mm	1-2.0	8.00	0.33	9.2-21.5	0.366-0.850
Family-Tube Grade-3X-400-50-Colour	100	40,0 x 50mm	1 1/2-2.0	13.0	0.51	20.9-33.0	0.825-1.300



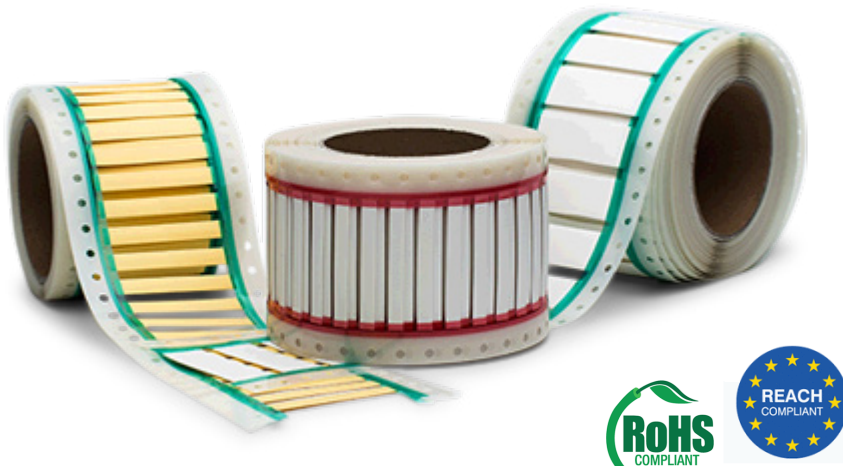
## Related Standard Test Methods And Documents

Document	Description
ASTM D 570	Water absorption
ASTM D638	Heat aging 168 at 158°C
ASTM D 638	Tensile strength testing
ASTM D 638	Elongation at break testing
ASTM D 792	Specific gravity
ASTM D 876	Dialectrical strength
ASTM D 876	Volume resistivity
ASTM D 882	Secant modulus
AMS-DTL-23053/5 class 1 & 3	Material specification heatshrinkable polyolefin flexible, cross-linked
ASTM D257 -IEC 93	Volume resistivity $\Omega$ -cm
SAE-AMS-DTL-23053	Insulation Sleeving, Electrical, Heat Shrinkable, General Specification for marking of electrical insulation materials
MIL-STD-202G Test method 215J	Chemical resistance to solvents mark permance
NF F00-608:1995	This document defines the characteristics, testing, certification of heat-shrinkable sleeve marker for mechanical and electrical protection used in railway equipment.
SAE AS5942;2014	Marking og insulation materials- Print permanence testing using the mechanical crockmeter
UL224 VW-1	This Standard specifies the requirements for insulating tubing that is usually round in cross-section and that consists entirely of extruded compounds whose characteristic constituents are thermosetting, elastomeric, or thermoplastic polymers (see Table 1 for materials and ratings). These requirements also cover heat-shrinkable and crosslinked tubing.

# Flame retardant self-extinguishing identification Sleeves

## TECHNICAL DATA SHEET

Revision Number. 1  
Last Edited 24. juli 2018



The AMD 2X and 3X Heat Shrinkable Wire Markers are made of flame retardant, self-extinguishing flexible heat shrinkable polyolefin tubing with ideal printability properties for identification purposes. This product is designed for aerospace, military, defence and marine applications where UL224 and SAE-AMS-DTL-23053/5 class 1 & 3 characteristics are required. For use in wire bundling and assemblies, panel building. AMD grade identification sleeves meets UL224 VW-1/CSA and AMS-DTL-23053/5 class 1 & 3. The AMD grade identification sleeve are very versatile through excellent balance of chemical, electrical and mechanical properties.

## Industry



Industry



Marine



Wind power



Commercial



Aerospace



Construction



Railway



Military /  
Defence



Electrical  
installations



Petrochemical



Telecom

## STANDARD TUBE COLOR



## OTHER TUBE COLORS ON REQUEST

## BACKING TAPE COLORS



## MATERIAL

Extruded, cross linked polyolefin.

## SHRINK RATIO

2:1 & 3:1

## OPERATING TEMPERATURE

-40°C to +135°C  
(-40°F to 275°F)

## SHRINK TEMPERATURE

>90°C (130°F)

## COMPLIANCES

Mark Permanence:  
SAE AS-5942 Superceeds  
SAE 81531:1998, point 4.6.2  
Recommended black ribbon:  
FTI-Y, FTI-X  
Chemical Resistance to solvents:  
AMS-DTL-23053/5  
MIL-STD-202G  
Test method 215j

## INDUSTRY STANDARDS

SAE-AMS-DTL-23053/5 class 1 & 3

## FLAMMABILITY

UL224 125°C 600 VW-1  
File E203950  
CSA 125°C 600V VW-1  
File 220127

## STORAGE

Cool and dry in original packaging. Recommended temperature at +10°C to +25°C and 45-55% relative humidity. Use within 2 years from date of manufacture.

## APPLICATIONS

Specific developed to be used in aerospace, military, defence, marine cable harnesses, marking, insulation, wire bundling and mechanical protection.

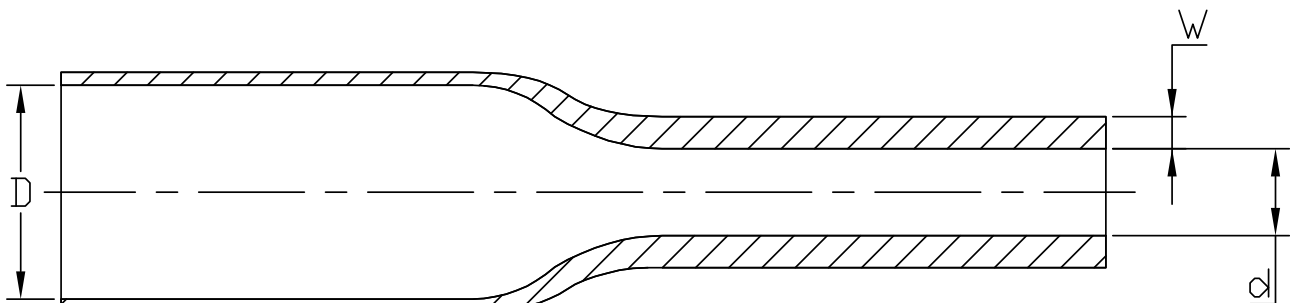
# Product Dimensions

## DIMENSIONS 2:1

SIZE, INCHES	SIZE, MM	MINIMUM ID (D), AS SUPPLIED MM (INCHES)	MAXIMUM ID, RECOVERED (D) MM (INCHES)	RECOVERED WALL THICKNESS (W), MM (INCHES)
3/32	2.4	2.79 (0.109)	1.18 (0.046)	0.49±0.06 (0.019 ± 0.002)
1/8	3.2	3.64 (0.143)	1.59 (0.063)	0.51±0.06 (0.02 ± 0.002)
3/16	4.8	5.26 (0.207)	2.36 (0.093)	0.54±0.06 (0.02 ± 0.002)
1/4	6.4	6.92 (0.272)	3.18 (0.125)	0.56±0.06 (0.022 ± 0.002)
3/8	9.5	10.2 (0.401)	4.75 (0.187)	0.59±0.06 (0.023 ± 0.002)
1/2	12.7	13.5 (0.531)	6.35 (0.250)	0.60±0.07 (0.024 ± 0.003)
3/4	19.1	20.1 (0.791)	9.53 (0.374)	0.62±0.07 (0.024 ± 0.003)
1	25.4	26.7 (1.05)	12.7 (0.500)	0.63±0.07 (0.025 ± 0.003)
1 ½	38.1	39.8 (1.57)	19.1 (0.750)	0.64±0.07 (0.025 ± 0.003)
2	50.8	53.0 (2)	25.4 (1.0)	0.64±0.08 (0.025 ± 0.003)
3	76.2	79.4 (3)	38.1 (1.5)	0.64±0.09 (0.025 ± 0.003)

## DIMENSIONS 3:1

SIZE, INCHES	SIZE, MM	MINIMUM ID (D), AS SUPPLIED MM (INCHES)	MAXIMUM ID, RECOVERED (D) MM (INCHES)	RECOVERED WALL THICKNESS (W), MM (INCHES)
3/32	2.4	2.79 (0.109)	0.79 (0,031)	0.57±0.10 (0.022 ± 0.004)
1/8	3.2	3.64 (0.143)	1.0 (0.039)	0.61±0.10 (0.024 ± 0.004)
3/16	4.8	5.26 (0.207)	1.6 (0.063)	0.67±0.10 (0.0263 ± 0.004)
1/4	6.4	6.92 (0.272)	2.4 (0.094)	0.71±0.10 (0.0279 ± 0.004)
3/8	9.5	10.2 (0.401)	3.2 (0.126)	0.77±0.10 (0.030 ± 0.004)
1/2	12.7	13.5 (0.531)	4.75 (0.187)	0.80±0.10 (0.031 ± 0.004)
3/4	19.1	20.1 (0.791)	6.4 (0.250)	0.84±0.15 (0.0330 ± 0.006)
1	25.4	26.7 (1.05)	8.47(0.333)	0.86±0.15 ( 0.034 ± 0.006)
1 ½	38.1	39.8 (1.57)	12.9 (0.507)	0.89±0.15 (0.035 ± 0.006)
2	50.8	53.0 (2)	17.2 (0.677)	0.90±0.15 (0.035 ± 0.006)
3	76.2	79.4 (3)	25.8 (1.05)	0.92±0.15 (0.036 ± 0.006)



Heat Shrink Product in as supplied "D" and fully recovered state "d" with recovered wall "W"

# General Tests for Identification Products

## PHYSICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Tensile strength	ASTM D638	10.3 Mpa (min.)
Elongation at break	ASTM D638	≥200%
Longitudinal change	UL224	+/-5%
2% Secant Modulus	SAE-AMS-DTL-23053/5	118MPa
Water absorption	SAE-AMS-DTL-23053/5	0.09 %
Specific gravity	ASTM D 792	1.34g/ cm <sup>3</sup>

## ELECTRICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Dielectric strength	ASTM D876	19.7 kV/mm <sup>2</sup> no flashover or dielectric breakdown occurred
Volume resistivity	ASTM D876	≥ 10 <sup>14</sup> Ω/cm
Voltage Rating	UL224	600 Volt

## CHEMICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Chemical resistance	AMS-DTL-23053/5	Good
Copper corrosion	SAE-AMS-DTL-23053/5	No corrosion
Copper stability	SAE-AMS-DTL-23053/5	No corrosion
Fluid resistance (23°C, 24h) AMS-DTL-23053	ASTM D638	6.9 Min

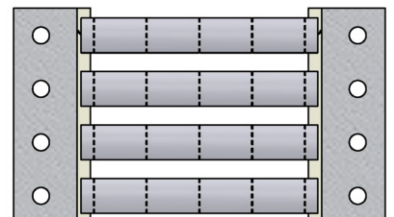
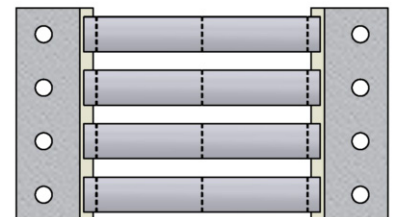
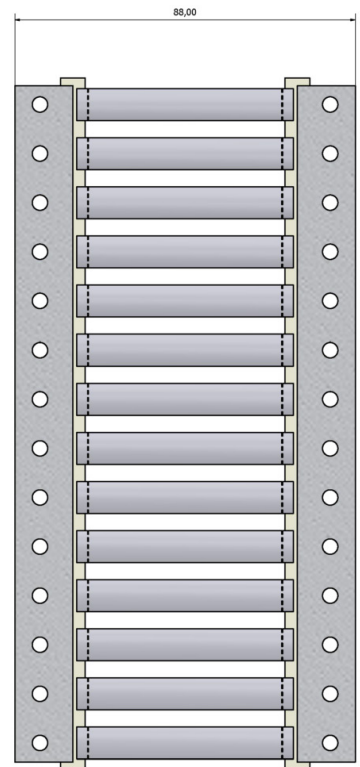
## THERMAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Heat shock 4 hours at 250°C	AMS-DTL-23053/5	No dripping, cracking or flowing
Elongation after heat aging 168 hours at 175°C	ASTM D 638	Elongation 100%
Flammability	UL224 VW-1 - ASTM2671-13 Section 68 - SAE-AMS-DTL 23053/5A	Pass » Flame retardant
Low temperature flexibility / bending	ASTM D2671- SAE-AMS-DTL-230537/5	No cracking - pass

## Product code

WM - DS -AMD- 3X - 024 - 125 - YW

<b>FAMILY</b> WM89 = 89 mm liner WM109= 109mm liner WMX= TMS Style	WM
<b>DOUBLE SIDED</b> Only shown if double sided	DS
<b>GRADE SLEEVES</b> See Page 6	AMD
<b>SHRINK RATIO</b> If nothing shown its 2x shrink Ratio	3X
<b>DIAMETER</b> 024 = 2.4mm 032 = 3.2mm	024
<b>LENGTH</b> Length 125 = 12.5mm - 3 scores Length 165 = 16.5mm - 2 scores Length 250 = 25.0mm - 1 score Length 038 = 38.0mm - 0 score	125
<b>COLOR</b> WE= White YW=Yellow	YW



## Available options -

SIZE MM	SIZE INCHES	STANDARD	BULK	JUMBO
2,4 x 50 mm	3/32 - 2.0	1.000	5.000	10.000
3,2 x 50 mm	1/8 - 2.0	1.000	5.000	10.000
4,8 x 50 mm	3/16 - 2.0	1.000	5.000	10.000
6,4 x 50 mm	1/4 - 2.0	1.000	3.000	6.000
9,5 x 50 mm	3/8 - 2.0	500	2.000	4.000
12,7 x 50 mm	1/2 - 2.0	500	1.500	3.000
19,0 x 50 mm	3/4 - 2.0	500	1.500	3.000
25,4 x 50 mm	1 - 2.0	300	1.000	2.000
38,1 x 50 mm	1 1/2 - 2.0	100	600	1.200
50,8 x 50 mm	2 - 2.0	100	600	1.200

## Other Spool sizes on request -

## Ordering description

ORDERING DESCRIPTION EXAMPLES	STANDARD PACK SIZE	SUPPLIED DIAMETER		RECOVERED DIAMETER		RECOMMENDED USE RANGE (MIN-MAX)	
	pcs	mm	inches	mm	inches	mm	inches
Family-Tube Grade-3X-024-50-Colour	1.000	2,4 x 50mm	3/32-2.0	0.7	0.031	0.8-1.9	0.032-0.075
Family-Tube Grade-3X-032-50-Colour	1.000	3,2 x 50mm	1/8-2.0	1.0	0.042	1.1-2.6	0.044-0.105
Family-Tube Grade-3X-048-50-Colour	1.000	4,8 x 50mm	3/16-2.0	1,5	0.062	1.7-4.0	0.069-0.160
Family-Tube Grade-3X-064-50-Colour	1.000	6,4 x 50mm	1/4-2.0	2.3	0,095	2.3-5.4	0.091-0.215
Family-Tube Grade-3X-095-50-Colour	500	9,5 x 50mm	3/8-2.0	3.1	0.125	3.4-8.1	0.137-0.320
Family-Tube Grade-3X-127-50-Colour	500	12,7 x 50mm	1/2-2.0	4.75	0,187	4.6-10.7	0.183-0.425
Family-Tube Grade-3X-190-50-Colour	500	19,0 x 50mm	3/4-2.0	6.35	0.250	6.9-16.2	0.275-0.640
Family-Tube Grade-3X-254-50-Colour	300	25,4 x 50mm	1-2.0	8.47	0.33	9.2-21.5	0.366-0.850
Family-Tube Grade-3X-381-50-Colour	100	38,1 x 50mm	1 1/2-2.0	12.9	0.51	20.9-33.0	0.825-1.300
Family-Tube Grade-3X-508-50-Colour	100	50,8 x 50mm	2-2.0	17.2	0.68	27.9-44.9	1.100-1.750

## Related Standard Test Methods And Documents

Document	Description
ASTM D638 -	Tensile strength and ultimate elongation specification
ASTM D638-	Heat aging 168 at 158°C specification
ASTM D 2671	Flammability testing. Heat shock 4 hours at 225°C - specification
ASTM D2671 -UL224	Longitudinal change- specificatiion
ASTM D 792	Specific gravity specification
ASTM D876	Dialectrical strength - Volume resistivity- specification
ASTM D2671B - UL224	Copper corrosion (Section 93 procedure A) damaged area of copper mirror,
AMS-DTL-23053/5	Insulation Sleeving, Electrical, Heat Shrinkable, Polyolefin, Flexible, Crosslinked specification
A STM D876	Volume resistivity $\Omega$ -cm
ASTM D 635-HB - SAE-AMS-DTL-23053/5	Flammability resistance - Fire propagation
MIL 202 Method 215	Resistance to-of solvents. Test methods for electronic and electrical component parts
SAE AS5942;2014	Marking og insulation materials- Print permanence testing using the mechanical crockmeter
UL224	This Standard specifies the requirements for insulating tubing that is usually round in cross-section and that consists entirely of extruded compounds whose characteristic constituents are thermosetting, elastomeric, or thermoplastic polymers (see Table 1 for materials and ratings). These requirements also cover heat-shrinkable and crosslinked tubing.

# C3

## Military Grade Self Extinguishing Identification Sleeves

### TECHNICAL DATA SHEET

Revision Number. 1  
Last Edited 24. juli 2018



The C3- 3:1 shrink ratio, heat shrinkable wire Markers are made of, flame retardant in inch sizes heat shrinkable polyolefin tubing with ideal printability properties for identification purposes.

The C3 material are fabricated to meet the material performance requirements of the AMS-DTL -23053/5 class 1 and meet the features in Airbus specification NSA 937201. The compound is also UL224 and CSA compliant Ideal for Aerospace, military, industrial and energy applications.

Marker sleeves meet the mark permanence requirements of AS5942 and MIL 202 Method 215K.

### Industry



Industry



Marine



Wind power



Commercial



Aerospace



Construction



Railway



Military

Electrical installations



Petrochemical



Telecom

### STANDARD TUBE COLOR



### NON STANDARD COLORS

Available on request

### BACKING TAPE COLORS



### MATERIAL

Extruded, cross linked polyolefin.

### SHRINK RATIO

3:1

### OPERATING TEMPERATURE

-55°C up to +135°C

(-67°F to 275°F)

Shrink Temperature

≥90° (194°F)

### COMPLIANCES

Mark Permanence:

SAE AS-5942

Print Resistance to solvents:

MIL-STD-202G

Test method 215K

### RECOMMENDED BLACK RIBBON

FTI-Y, FTI-X

### FIRE PROPAGATION

ASTM D2671 Procedure B

### TOXICITY

N-A

### AIRBUS STANDARD

NSA937201 Table 7

UL224 125°C

Certificate E228117

### CSA-C22.2

No. 198.1-06

### Material performance

AMS SAE DTL 23053/5 Class 1

### STORAGE

Cool and dry in original packaging. Recommended temperature at +10°C to +25°C and 45-55% relative humidity. Use within 2 years from date of manufacture.

### APPLICATIONS

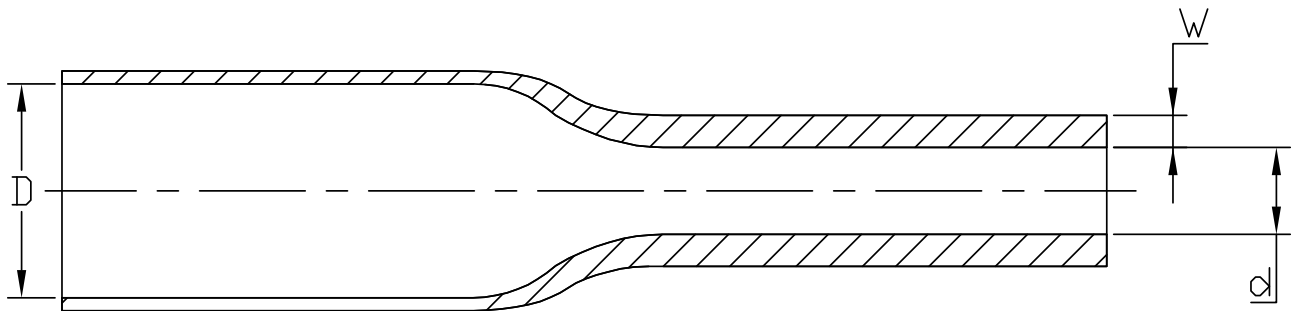
Specific developed to be used in Aerospace, Military, Industrial, energy marking, insulation, wire bundling and mechanical protection.



# Product Dimensions

## DIMENSIONS 3:1

SIZE, INCHES	SIZE, MM	MINIMUM ID (D), AS SUPPLIED MM (INCHES)	MAXIMUM ID, RECOVERED (D) MM (INCHES)	RECOVERED WALL THICKNESS (W), MM (INCHES)
3/32	2.4	2.5 (0.098)	0.8 (0.031)	0.43 (0.017)
1/8	3.2	3.4 (0.134)	1.0 (0.039)	0.43 (0.017)
3/16	4.8	5.0 (0.196)	1.6 (0.063)	0.43 (0.017)
1/4	6.4	6.5 (0.255)	2.0 (0.079)	0.56 (0.022)
3/8	9.5	10.0 (0.393)	3.0 (0.118)	0.56 (0.022)
1/2	12.7	13.0 (0.511)	4.0 (0.157)	0.56 (0.022)
3/4	19.1	19.3 (0.76)	6.0 (0.236)	0.80 (0.031)
1	25.4	25.7 (1.01)	8.0 (0.314)	0.81 (0.031)
1 ½	38.1	38.3 (1.50)	12.7 (0.50)	0.90 (0.035)



Heat Shrink Product in as supplied "D" and fully recovered state "d" with recovered wall "W"

## Airbus NSA 937201 Material Compliance

SIZE, INCHES	SIZE, MM	MINIMUM ID (D), AS SUPPLIED MM (INCHES)	MAXIMUM ID, RECOVERED (D) MM (INCHES)	RECOVERED WALL THICKNESS (W), MM (INCHES)	MAX MASS PER 1 METER (G)
3/32	2.4	2.5 (0.098)	0.8 (0.031)	0.43 (0.017)	3.0
1/8	3.2	3.4 (0.134)	1.0 (0.039)	0.43 (0.017)	3.7
3/16	4.8	5.0 (0.196)	1.6 (0.063)	0.43 (0.017)	4.0
1/4	6.4	6.5 (0.255)	2.0 (0.079)	0.56 (0.022)	6.1
3/8	9.5	10.0 (0.393)	3.0 (0.118)	0.56 (0.022)	9.0
1/2	12.7	13.0 (0.511)	4.0 (0.157)	0.56 (0.022)	11.0
3/4	19.1	19.3 (0.76)	6.0 (0.236)	0.80 (0.031)	20.5
1	25.4	25.7 (1.01)	8.0 (0.314)	0.81 (0.031)	27.7
1 ½	38.1	38.3 (1.50)	12.7 (0.50)	0.90 (0.035)	59.0

# General Tests for Identification Products

## PHYSICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Tensile strength	ASTM D 638	>11.0 N/mm <sup>2</sup> .
Elongation at break	ASTM D 638	≥200%
Longitudinal change	ASTM D 2671	≤+5% to ≤ -10%
Water absorption	ASTM D 570	0,20%
Specific gravity	ASTM D 792	1,40 g/cm <sup>3</sup>

## ELECTRICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Dielectric strength	ASTM D 2671	20.0 kV/mm <sup>2</sup>
Volume resistivity	ASTM D 257	≥ 10 <sup>14</sup> Ω/cm

## CHEMICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Chemical resistance	AMS-DTL-23053/5	Good
Copper corrosion	ASTM D 2671 B	No corrosion
Fungus resistance	AMS-DTL-7444	No Growth

## THERMAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Heat shock 4 hours at 250°C	ASTM D 2671	No dripping, cracking or flowing
Heat aging 168 hours at 175°C	ASTM D638	Elongation ≥ 200%
Flammability	ASTM D 635-HB	Pass » flame retardant
Low temperature flexibility	1h at - 55°C ASTM D2671C	No cracking, no break, no detachment of coating
Optical density of smoke (D <sub>m</sub> )	N-A	N-A
Smoke index	N-A	N-A

## FIRE PROPAGATION

PROPERTIES	TEST METHOD	TYPICAL VALUE
Fire resistance	ASTM D 2671 procedure B	pass
Flammability	UL224	pass

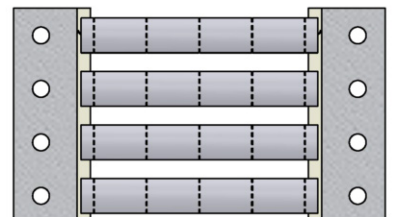
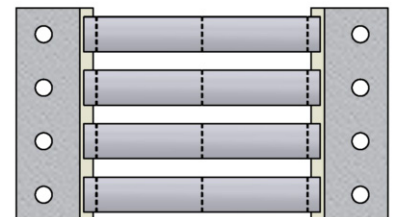
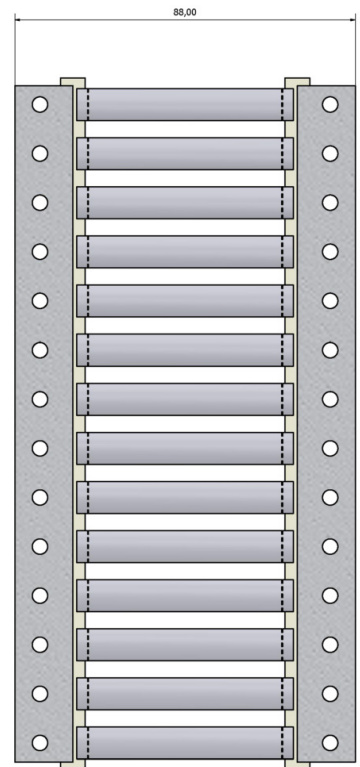
## ENVIRONMENTAL UV STABILITY

PROPERTIES	TEST METHOD	TYPICAL VALUE
UV-A	ASTM G154 - Machine setup Temp 50-60°C (140°F) Cycle 8 h light 4h condensation UV wavelength 280-400nm Test duration 1000 h of exposure.	Pass - No damage to the marker and print legible after 20 rubs in accordance with AS3349/SAE AS 8153.

## Product code

WM - DS -AMD- 3X - 024 - 125 - YW

<b>FAMILY</b> WM89 = 89 mm liner WM109= 109mm liner WMX= TMS Style	WM
<b>DOUBLE SIDED</b> Only shown if double sided	DS
<b>GRADE SLEEVES</b> See Page 6	AMD
<b>SHRINK RATIO</b> If nothing shown its 2x shrink Ratio	3X
<b>DIAMETER</b> 024 = 2.4mm 032 = 3.2mm	024
<b>LENGTH</b> Length 125 = 12.5mm - 3 scores Length 165 = 16.5mm - 2 scores Length 250 = 25.0mm - 1 score Length 038 = 38.0mm - 0 score	125
<b>COLOR</b> WE= White YW=Yellow	YW



## Available options -

SIZE MM	SIZE INCHES	STANDARD	BULK	JUMBO
2,4 x 50 mm	3/32 - 2.0	1.000	5.000	10.000
3,2 x 50 mm	1/8 - 2.0	1.000	5.000	10.000
4,8 x 50 mm	3/16 - 2.0	1.000	5.000	10.000
6,4 x 50 mm	1/4 - 2.0	1.000	3.000	6.000
9,5 x 50 mm	3/8 - 2.0	500	2.000	4.000
12,7 x 50 mm	1/2 - 2.0	500	1.500	3.000
19,0 x 50 mm	3/4 - 2.0	500	1.500	3.000
25,4 x 50 mm	1 - 2.0	300	1.000	2.000
38,1 x 50 mm	1 1/2 - 2.0	100	600	1.200
50,8 x 50 mm	2 - 2.0	100	600	1.200

## Other Spool sizes on request -

## Ordering description

ORDERING DESCRIPTION EXAMPLES	STANDARD PACK SIZE	SUPPLIED DIAMETER		RECOVERED DIAMETER		RECOMMENDED USE RANGE (MIN-MAX)	
	pcs	mm	inches	mm	inches	mm	inches
Family-Tube Grade-3X-024-50-Colour	1.000	2,4 x 50mm	3/32-2.0	0.7	0.031	0.8-1.9	0.032-0.075
Family-Tube Grade-3X-032-50-Colour	1.000	3,2 x 50mm	1/8-2.0	1.0	0.042	1.1-2.6	0.044-0.105
Family-Tube Grade-3X-048-50-Colour	1.000	4,8 x 50mm	3/16-2.0	1,5	0.062	1.7-4.0	0.069-0.160
Family-Tube Grade-3X-064-50-Colour	1.000	6,4 x 50mm	1/4-2.0	2.3	0,095	2.3-5.4	0.091-0.215
Family-Tube Grade-3X-095-50-Colour	500	9,5 x 50mm	3/8-2.0	3.1	0.125	3.4-8.1	0.137-0.320
Family-Tube Grade-3X-127-50-Colour	500	12,7 x 50mm	1/2-2.0	4.75	0,187	4.6-10.7	0.183-0.425
Family-Tube Grade-3X-190-50-Colour	500	19,0 x 50mm	3/4-2.0	6.35	0.250	6.9-16.2	0.275-0.640
Family-Tube Grade-3X-254-50-Colour	300	25,4 x 50mm	1-2.0	8.47	0.33	9.2-21.5	0.366-0.850
Family-Tube Grade-3X-381-50-Colour	100	38,1 x 50mm	1 1/2-2.0	12.9	0.51	20.9-33.0	0.825-1.300
Family-Tube Grade-3X-508-50-Colour	100	50,8 x 50mm	2-2.0	17.2	0.68	27.9-44.9	1.100-1.750

## Related Standard Test Methods And Documents

Document	Description
AMS-DTL-23053/5	Insulation Sleeving, Electrical, Heatshrinkable, Polyolefin, Flexible Crosslinked. Chemical resistance
ASTM D638	Tensile strength and ultimate elongation
ASTM D638	Heat aging 168 at 150°C
ASTM D2671 heat shock (section 26-30), procedure b	Flammability testing. Heat shock 4 hours at 175°C
ASTM D2671	Longitudinal change
ASTM D2671 (Section 79-80) ASTM D570	Water absorption. 2 Maximum
ASTM D2671 (Section 20-25)	Dielectric strength. 20 minimum
ASTM D2671B	Copper corrosion (Section 93 procedure A) damaged area of copper mirror,
AMS-DTL-23053/5	Chemical resistance - <b>good</b>
ASTM D257	Volume resistivity
ASTM D 635-HB -	Flammability resistance - Fire propagation
ASTM D E 662	Optical density of smoke (D <sub>m</sub> ) measured in flaming mode and non flaming mode in single smoke chamber test.
ASTM D792 Method A ?-	Specific gravity
ASTM G154	UV resistance test method
AIRBUS 937201	This standard specifies the dimensions, tolerances, required characteristics and the mass of an identification sleeve for electric cable.
BS EN ISO 4589-1: 1999 - Oxygen Index	Limited Oxygen Index- flammability hazard rating. Determination of burning behavior by oxygen index - part 2: ambient temperature test. 32% minimum
DIN 54837	DIN 54837 Testing of materials, small components and component sections for rail vehicles- determination of burning behaviour using a gas burner
IEC 60684-2	Low temperature flexibility
NF C 20-455	Fire hazard testing glowin/hot-wire based test methods. Glow-wire apparatus and common test procedure.c Replaced by EN ISO 60695-2-11
MIL 202 Method 215	Resistance to-of solvents. Test methods for electronic and electrical component parts
SAE AS5942;2014	Marking og insulation materials- Print permanence testing using the mechanical crockmeter
UL224 and CSA-C22.2	Extruded tubing, Insulation, Electrical, Flexible, Heat Shrinkable Poleolefin Tubing produced to flammability ratings

# DR

## Diesel resistant, self extinguishing heat shrinkable identification sleeve

### TECHNICAL DATA SHEET

Revision Number. 1  
Last Edited 24. juli 2018



The WM-DR-3X Heat Shrinkable Wire Markers are made of diesel resistant, heat shrinkable polyolefin tubing with ideal printability properties for identification purposes, which provides fluid resistance as per NF-F00-608. Ideal for applications where diesel resistancy characteristics are required. This product is designed for use in railway and aerospace applications, wire bundling harnesses and assemblies, panel building. The fluid resistance of the material has passed the NF-F00-608 linked to SNCF specifications where especially oils for long periods have been tested at elevated temperatures. Meets ASTM D2671 & UL VW-1 standard for flammability which makes the material self-extinguishing and passes vertical burn test. The sleeve meet the material requirements of the SAE-AMS-DTL-23053/6 class 1.

### Industry



Industry



Marine



Wind power



Commercial



Aerospace



Construction



Railway



Military



Electrical installations



Petrochemical



Telecom

### STANDARD TUBE COLOR



### OTHER TUBE COLORS ON REQUEST

### BACKING TAPE COLORS



### MATERIAL

Extruded, cross linked polyolefin.

### SHRINK RATIO

3:1

### OPERATING TEMPERATURE

-40°C to +125°C  
(-40°F to 193°F)

### SHRINK TEMPERATURE

>90°C (130°F)

### COMPLIANCES

Mark Permanence:  
SAE AS-5942 Superceeds  
SAE AS 81531:1998 Sewction 4.6.2  
NF F00-608 fluid test cat A & H  
Recommended black ribbon:  
FTI-Y, FTI-X  
Chemical Resistance to solvents:  
MIL-STD-202G  
Test method 215j

### INDUSTRY STANDARDS

NFF F-00-608 cat. A & H  
MIL-DTL-23053/6 class 1

### FLAMMABILITY

AMS-DTL-23053 1999 4.6.14  
ASTM D2671-09 Section 68-74 Procedure B and AMS-DTL-23053/6:1999 UL224

### STORAGE

Cool and dry in original packaging. Recommended temperature at +10°C to +25°C and 45-55% relative humidity. Use within 2 years from date of manufacture.

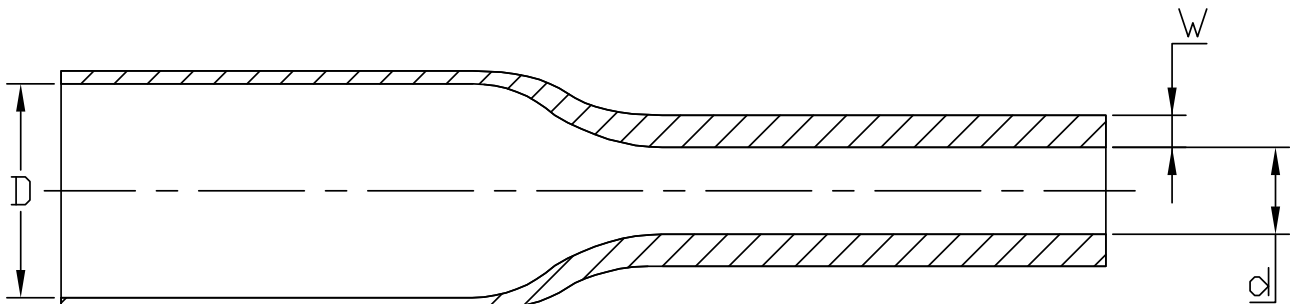
### APPLICATIONS

Specific developed to be used in Rail, Defence, Aerospace, cable harnesses, Industrial marking, insulation, wire bundling and mechanical protection.

# Product Dimensions

## DIMENSIONS 3:1

SIZE, INCHES	SIZE, MM	MINIMUM ID (D), AS SUPPLIED MM (INCHES)	MAXIMUM ID, RECOVERED (D) MM (INCHES)	RECOVERED WALL THICKNESS (W), MM (INCHES)
3/32	2.4	2.79 (0.109)	0.79 (0.031)	0.57±0.10 (0.022 ± 0.004)
1/8	3.2	3.64 (0.143)	1.0 (0.039)	0.61±0.10 (0.024 ± 0.004)
3/16	4.8	5.26 (0.207)	1.6 (0.063)	0.67±0.10 (0.0263 ± 0.004)
1/4	6.4	6.92 (0.272)	2.4 (0.094)	0.71±0.10 (0.0279 ± 0.004)
3/8	9.5	10.2 (0.401)	3.2 (0.126)	0.77±0.10 (0.030 ± 0.004)
1/2	12.7	13.5 (0.531)	4.75 (0.187)	0.80±0.10 (0.031 ± 0.004)
3/4	19.1	20.1 (0.791)	6.4 (0.250)	0.84±0.15 (0.0330 ± 0.006)
1	25.4	26.7 (1.05)	8.47(0.333)	0.86±0.15 ( 0.034 ± 0.006)
1 ½	38.1	39.8 (1.57)	12.9 (0.507)	0.89±0.15 (0.035 ± 0.006)
2	50.8	53.0 (2)	17.2 (0.677)	0.90±0.15 (0.035 ± 0.006)
3	76.2	79.4 (3)	25.8 (1.05)	0.92±0.15 (0.036 ± 0.006)



Heat Shrink Product in as supplied "D" and fully recovered state "d" with recovered wall "W"

# General Tests for Identification Products

## PHYSICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Tensile strength	NF F00-608	17.21 Mpa (min.)
Elongation at break	NF F00-608	≥200%
Longitudinal change	NF F00-608	<10%
Tensile strength after heat aging	NF F00-608	<25%
Elongation at break after heat aging	NF F00-608	<25%
Tensile Strength after diesel oil	NF F00-608	≥7MPa
Elongation at break after diesel oil	NF F00-608	≥200%
Water absorption	NF F00-608	<2%
IRM 902 oil Tensile strength (50 °C x 72h)	MIL-DTL-23053E	16.2 N/mm <sup>2</sup>
IRM 902 oil Ultimate elongation (50 °C x 72h)	MIL-DTL-23053E	540%
IRM 903 oil Tensile strength (70 °C x 168h)	MIL-DTL-23053E	12.2 N/mm <sup>2</sup>
IRM 903 oil Ultimate elongation (70 °C x 168h)	MIL-DTL-23053E	535%
Petrol oil 97 Tensile strength (24 °C x 24h)	MIL-DTL-23053E	13.7 N/mm <sup>2</sup>
Petrol oil 97 Ultimate elongation (24 °C x 24h)	MIL-DTL-23053E	550%
Hydraulic fluid MIL-PRF-5606 (24 °C x 24h)	MIL-DTL-23053E	17.2 N/mm <sup>2</sup>
Hydraulic fluid MIL-PRF-5606 (24 °C x 24h)	MIL-DTL-23053E	523%

## ELECTRICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Dielectric strength	NF F00-608	31.56 kV/mm <sup>2</sup>
Volume resistivity	IEC 93	1.82 x10 <sup>14</sup> Ω/cm

## CHEMICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Chemical resistance	AMS-DTL-23053/E	Good
Copper corrosion	ASTM D 2671B	No corrosion

## THERMAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Heat shock 4 hours at 225°C	AMS-DTL-23053:1999 4.6.8	No dripping, cracking or flowing through to 360°C
Heat aging 168 hours at 158°C	ASTM D 638	Elongation 100%
Flammability	NF F00-608	VW-1 Pass » Flame retardant
Oxygen Index	NF F00-608	28%
Low temperature flexibility / Bending	NF F00-608	No cracking, no break, pass

## Environmental UV Stability

PROPERTIES	TEST METHOD	TYPICAL VALUE
UV-A	ASTM G154 - Machine setup Temp 50-60°C (140°F) Cycle 8 h light 4h condensation UV wavelength 280-400nm Test duration 1000 h of exposure.	Pass - No damage to the marker and print legible after 20 rubs in accordance with SAE-AS 815314.6.2

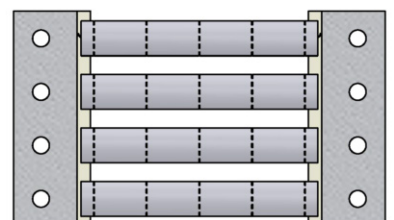
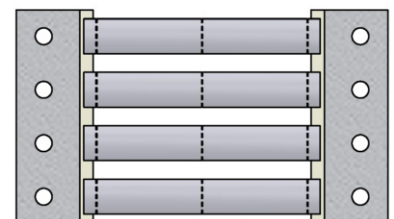
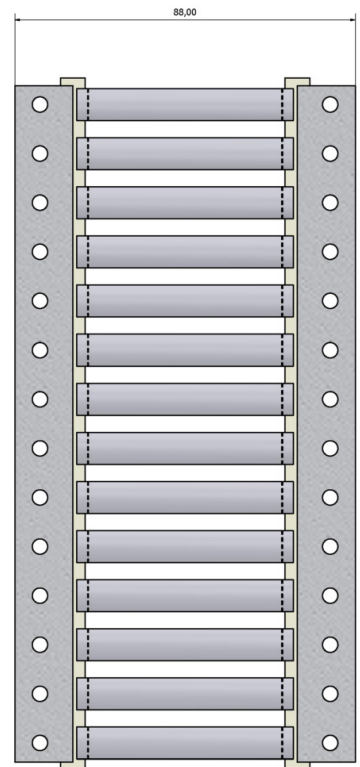
This information and data is believed to be accurate and reliable. Although the information and recommendations set forth herein are presented in good faith and believed to be correct as of this date, Link Solutions makes no representations as to the completeness or accuracy thereof. We place at your disposal the technical information necessary for the correct use of our products. As conditions and methods of use are beyond our control, that the person receiving the same will make their own determination as to the suitability for their purpose. We reserve the right to modify characteristics with the aim of improving the product and adapting it to the requirements of the market.



## Product code

WM - DS -AMD- 3X - 024 - 125 - YW

<b>FAMILY</b> WM89 = 89 mm liner WM109= 109mm liner WMX= TMS Style	WM
<b>DOUBLE SIDED</b> Only shown if double sided	DS
<b>GRADE SLEEVES</b> See Page 6	AMD
<b>SHRINK RATIO</b> If nothing shown its 2x shrink Ratio	3X
<b>DIAMETER</b> 024 = 2.4mm 032 = 3.2mm	024
<b>LENGTH</b> Length 125 = 12.5mm - 3 scores Length 165 = 16.5mm - 2 scores Length 250 = 25.0mm - 1 score Length 038 = 38.0mm - 0 score	125
<b>COLOR</b> WE= White YW=Yellow	YW



## Available options -

SIZE MM	SIZE INCHES	STANDARD	BULK	JUMBO
2,4 x 50 mm	3/32 - 2.0	1.000	5.000	10.000
3,2 x 50 mm	1/8 - 2.0	1.000	5.000	10.000
4,8 x 50 mm	3/16 - 2.0	1.000	5.000	10.000
6,4 x 50 mm	1/4 - 2.0	1.000	3.000	6.000
9,5 x 50 mm	3/8 - 2.0	500	2.000	4.000
12,7 x 50 mm	1/2 - 2.0	500	1.500	3.000
19,0 x 50 mm	3/4 - 2.0	500	1.500	3.000
25,4 x 50 mm	1 - 2.0	300	1.000	2.000
38,1 x 50 mm	1 1/2 - 2.0	100	600	1.200
50,8 x 50 mm	2 - 2.0	100	600	1.200

## Other Spool sizes on request -

## Ordering description

ORDERING DESCRIPTION EXAMPLES	STANDARD PACK SIZE	SUPPLIED DIAMETER		RECOVERED DIAMETER		RECOMMENDED USE RANGE (MIN-MAX)	
	pcs	mm	inches	mm	inches	mm	inches
Family-Tube Grade-3X-024-50-Colour	1.000	2,4 x 50mm	3/32-2.0	0.7	0.031	0.8-1.9	0.032-0.075
Family-Tube Grade-3X-032-50-Colour	1.000	3,2 x 50mm	1/8-2.0	1.0	0.042	1.1-2.6	0.044-0.105
Family-Tube Grade-3X-048-50-Colour	1.000	4,8 x 50mm	3/16-2.0	1,5	0.062	1.7-4.0	0.069-0.160
Family-Tube Grade-3X-064-50-Colour	1.000	6,4 x 50mm	1/4-2.0	2.3	0,095	2.3-5.4	0.091-0.215
Family-Tube Grade-3X-095-50-Colour	500	9,5 x 50mm	3/8-2.0	3.1	0.125	3.4-8.1	0.137-0.320
Family-Tube Grade-3X-127-50-Colour	500	12,7 x 50mm	1/2-2.0	4.75	0,187	4.6-10.7	0.183-0.425
Family-Tube Grade-3X-190-50-Colour	500	19,0 x 50mm	3/4-2.0	6.35	0.250	6.9-16.2	0.275-0.640
Family-Tube Grade-3X-254-50-Colour	300	25,4 x 50mm	1-2.0	8.47	0.33	9.2-21.5	0.366-0.850
Family-Tube Grade-3X-381-50-Colour	100	38,1 x 50mm	1 1/2-2.0	12.9	0.51	20.9-33.0	0.825-1.300
Family-Tube Grade-3X-508-50-Colour	100	50,8 x 50mm	2-2.0	17.2	0.68	27.9-44.9	1.100-1.750

## Related Standard Test Methods And Documents

Document	Description
ASTM D638	Heat aging 168 at 158°C
ASTM D 2671 C	Flammability testing.
ASTM D2671 -UL224	Longitudinal change
ASTM G154-GB/T1408	Dialectrical strength.
ASTM D2671B - UL224	Copper corrosion (Section 93 procedure A) damaged area of copper mirror,
AMS-DTL-23053/6 class 1	Matrial specification
ASTM D257 -IEC 93	Volume resistivity $\Omega$ -cm
MIL-DTL-23053E	Insulation Sleeving, Electrical, Heat Shrinkable, General Specification for marking of electrical insulation materials
MIL-STD-202G Test method 215J	Chemical resistance to solvents mark permance
NF F00-608:1995	This document defines the characteristics, testing, certification of heat-shrinkable sleeve marker for mechanical and electrical protection used in railway equipment.
SAE AS5942;2014	Marking og insulation materials- Print permance testing using the mechanical crockmeter
UL224 VW-1	This Standard specifies the requirements for insulating tubing that is usually round in cross-section and that consists entirely of extruded compounds whose characteristic constituents are thermosetting, elastomeric, or thermoplastic polymers (see Table 1 for materials and ratings). These requirements also cover heat-shrinkable and crosslinked tubing.

# HT

## High Temperature, heat shrink identification sleeves

### TECHNICAL DATA SHEET

Revision Number. 1  
Last Edited 24. juli 2018



The WM-HT-2X Heat Shrinkable Wire Markers are made of flame retarded modified PVDF tubing with ideal printability properties for identification purposes.

Ideal for applications where high temperature and extreme fluid resistance characteristics are required.

This product is designed for use in Aerospace, Defence, and Mass Transit applications, wire bundling and assemblies, panel building and industrial installations.

Meets AMS-DTL-23053/18 UL224 VW-1 for vertical burn test / flammability. This product is not recommended where strain relief is required.

## Industry



Industry



Marine



Wind power



Commercial



Aerospace



Construction



Railway



Military



Electrical installations



Petrochemical



Telecom

### STANDARD TUBE COLOR



### OTHER TUBE COLORS ON REQUEST

### BACKING TAPE COLORS



### MATERIAL

Extruded flame retarded polyvinylidene fluoride.

### SHRINK RATIO

2:1

### OPERATING TEMPERATURE

-55°C to +225°C  
(-67°F to 437°F)

### MIN RECOVERY TEMPERATURE

>200°C (392°F)

### MIN RECOVERY TEMPERATURE

>135°C (275°F)

### SPECIFICATION / APPROVALS

SAE-AMS-DTL-23053/18 class 1  
UL224 VW-1

### STORAGE

Cool and dry in original packaging. Recommended temperature at +10°C to +25°C and 45-55% relative humidity. Use within 2 years from date of manufacture.

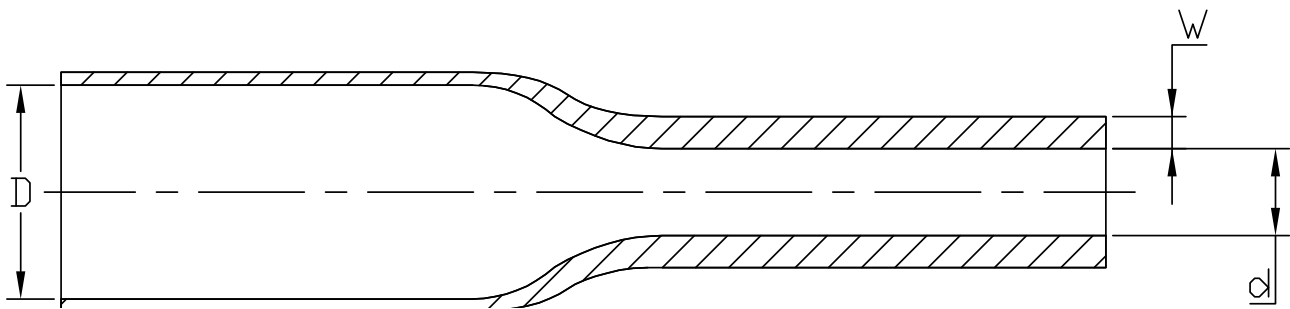
### APPLICATIONS

Specific developed to be used in Aerospace, Defence, Mass Transit, cable harnesses, Industrial marking, insulation, wire bundling and mechanical protection.

# Product Dimensions

## DIMENSIONS 2:1

SIZE, INCHES	SIZE, MM	MINIMUM ID (D), AS SUPPLIED MM (INCHES)	MAXIMUM ID, RECOVERED (D) MM (INCHES)	RECOVERED WALL THICKNESS (W), MM (INCHES)
3/32	2.4	2.36 (0.09)	1.18 (0.046)	0.49±0.06 (0.019 ± 0.002)
1/8	3.2	3.18 (0.125)	1.59 (0.063)	0.51±0.06 (0.02 ± 0.002)
3/16	4.8	4.75 (0.187)	2.36 (0.093)	0.54±0.06 (0.02 ± 0.002)
1/4	6.4	6.35 (0.252)	3.18 (0.125)	0.56±0.06 (0.022 ± 0.002)
3/8	9.5	9.53 (0.375)	4.75 (0.187)	0.59±0.06 (0.023 ± 0.002)
1/2	12.7	12.7 (0.50)	6.35 (0.250)	0.60±0.07 (0.024 ± 0.003)
3/4	19.1	19.05 (0.75)	9.53 (0.374)	0.62±0.07 (0.024 ± 0.003)
1	25.4	25.4 (1.00)	12.7 (0.500)	0.63±0.07 (0.025 ± 0.003)
1 ½	38.1	38.1 (1.50)	19.1 (0.750)	0.64±0.07 (0.025 ± 0.003)
2	50.8	50.8 (2)	25.4 (1.0)	0.64±0.08 (0.025 ± 0.003)
3	76.2	76.10 (3)	38.1 (1.5)	0.64±0.09 (0.025 ± 0.003)



Heat Shrink Product in as supplied "D" and fully recovered state "d" with recovered wall "W"

## General Tests for Identification Products

### PHYSICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Tensile strength	ASTM D412	≥31,3 Mpa (min.)
Elongation at break	ASTM D421	≥330%
Longitudinal change	SAE-AMS-DTL-23053	+5%
Specific gravity	ASTM D 792	1,73 g/cm <sup>3</sup>
Secant Modulus	ASTM D882	≥730 MPA

### ELECTRICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Dielectric strength	ASTM D 2671	≥43 kV/mm
Volume resistivity	ASTM D 876	≥ 9,1 x 10 <sup>14</sup> Ω/cm
Voltage Rating		600 Volt

### CHEMICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Fluid resistance	AMS-DTL-23053/5	Good - Pass
Water absorption	ASTM D 570	≤ 0,2 %
Flammability	UL224 VW-1	Pass
Fungus resistance	ASTM G 21	Pass

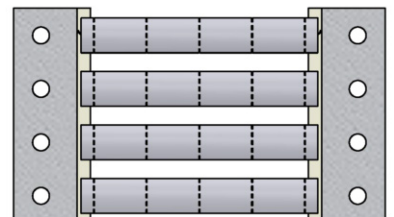
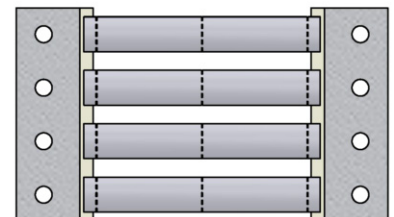
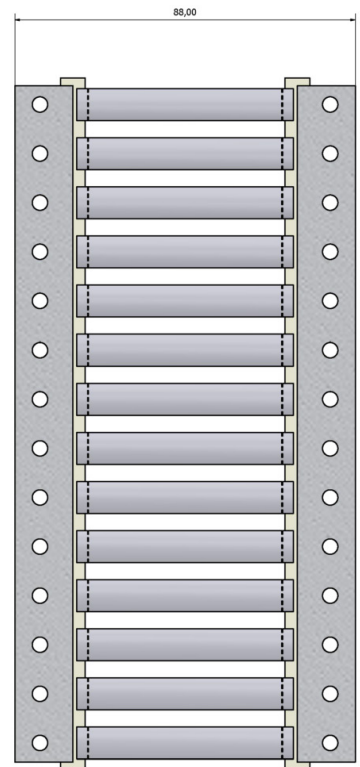
### THERMAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Heat shock 4 hours at 250°C	SAE-AMS-DTL-23053	No dripping, cracking or flowing - Pass
Heat aging 168 hours at 225°C	SAE-AMS-DTL-23053	Elongation ≥200%
Copper corrosion (225°C x 16h)	SAE-AMS-DTL-23053	Pass
Low temperature flexibility (-55°C x4h)	SAE-AMS-DTL-23053	Pass
Copper corrosion (160°C x16h)	SAE-AMS-DTL-23053	Pass
Clairity stability (200°C x 24h)	SAE-AMS-DTL-23053	Pass

## Product code

WM - DS -AMD- 3X - 024 - 125 - YW

<b>FAMILY</b> WM89 = 89 mm liner WM109= 109mm liner WMX= TMS Style	WM
<b>DOUBLE SIDED</b> Only shown if double sided	DS
<b>GRADE SLEEVES</b> See Page 6	AMD
<b>SHRINK RATIO</b> If nothing shown its 2x shrink Ratio	3X
<b>DIAMETER</b> 024 = 2.4mm 032 = 3.2mm	024
<b>LENGTH</b> Length 125 = 12.5mm - 3 scores Length 165 = 16.5mm - 2 scores Length 250 = 25.0mm - 1 score Length 038 = 38.0mm - 0 score	125
<b>COLOR</b> WE= White YW=Yellow	YW



## Available options -

SIZE MM	SIZE INCHES	STANDARD	BULK	JUMBO
2,4 x 50 mm	3/32 - 2.0	1.000	5.000	10.000
3,2 x 50 mm	1/8 - 2.0	1.000	5.000	10.000
4,8 x 50 mm	3/16 - 2.0	1.000	5.000	10.000
6,4 x 50 mm	1/4 - 2.0	1.000	3.000	6.000
9,5 x 50 mm	3/8 - 2.0	500	2.000	4.000
12,7 x 50 mm	1/2 - 2.0	500	1.500	3.000
19,0 x 50 mm	3/4 - 2.0	500	1.500	3.000
25,4 x 50 mm	1 - 2.0	300	1.000	2.000
38,1 x 50 mm	1 1/2 - 2.0	100	600	1.200
50,8 x 50 mm	2 - 2.0	100	600	1.200

## Other Spool sizes on request -

## Ordering description

ORDERING DESCRIPTION EXAMPLES	STANDARD PACK SIZE	SUPPLIED DIAMETER		RECOVERED DIAMETER		RECOMMENDED USE RANGE (MIN-MAX)	
	pcs	mm	inches	mm	inches	mm	inches
Family-Tube Grade-3X-024-50-Colour	1.000	2,4 x 50mm	3/32-2.0	0.7	0.031	0.8-1.9	0.032-0.075
Family-Tube Grade-3X-032-50-Colour	1.000	3,2 x 50mm	1/8-2.0	1.0	0.042	1.1-2.6	0.044-0.105
Family-Tube Grade-3X-048-50-Colour	1.000	4,8 x 50mm	3/16-2.0	1,5	0.062	1.7-4.0	0.069-0.160
Family-Tube Grade-3X-064-50-Colour	1.000	6,4 x 50mm	1/4-2.0	2.3	0,095	2.3-5.4	0.091-0.215
Family-Tube Grade-3X-095-50-Colour	500	9,5 x 50mm	3/8-2.0	3.1	0.125	3.4-8.1	0.137-0.320
Family-Tube Grade-3X-127-50-Colour	500	12,7 x 50mm	1/2-2.0	4.75	0,187	4.6-10.7	0.183-0.425
Family-Tube Grade-3X-190-50-Colour	500	19,0 x 50mm	3/4-2.0	6.35	0.250	6.9-16.2	0.275-0.640
Family-Tube Grade-3X-254-50-Colour	300	25,4 x 50mm	1-2.0	8.47	0.33	9.2-21.5	0.366-0.850
Family-Tube Grade-3X-381-50-Colour	100	38,1 x 50mm	1 1/2-2.0	12.9	0.51	20.9-33.0	0.825-1.300
Family-Tube Grade-3X-508-50-Colour	100	50,8 x 50mm	2-2.0	17.2	0.68	27.9-44.9	1.100-1.750



## Related Standard Test Methods And Documents

Document	Description
ASTM D638 - ASTM G154 - ISO 37 -GB/T1040	Tensile strength and ultimate elongation
ASTM D638- ISO188	Heat aging 168 at 158°C
ASTM D 2671	Flammability testing. Heat shock 4 hours at 225°C
ASTM D2671 -UL224	Longitudinal change
ASTM G154-GB/T1408	Dialectrical strength.
ASTM D2671B - UL224	Copper corrosion (Section 93 procedure A) damaged area of copper mirror,
AMS-DTL-23053/5	Chemical resistance - <b>good</b>
ASTM D257 -IEC 93	Volume resistivity $\Omega$ -cm
ASTM D 635-HB - SAE-AMS-DTL-23053/5	Flammability resistance - Fire propagation
GB/T 1040	Test Conditions for moulding and extrusion plastics
SAE AS5942;2014	Marking og insulation materials- Print permanence testing using the mechanical crockmeter
BS EN 50343:2014 Annex H Section H.3	Railway applications. Rolling stock. Rules for installation of cabling- Mark Permanence
UL224	This Standard specifies the requirements for insulating tubing that is usually round in cross-section and that consists entirely of extruded compounds whose characteristic constituents are thermosetting, elastomeric, or thermoplastic polymers (see Table 1 for materials and ratings). These requirements also cover heat-shrinkable and crosslinked tubing.

# LFH - 3X

## Halogen Free, Flame retardant low smoke identification Sleeves

### TECHNICAL DATA SHEET

Revision Number. 1  
Last Edited 24. juli 2018



The WM-LFH-2X and 3X Heat Shrinkable Wire Markers are made of halogen free, flame retardant and low smoke heat shrinkable polyolefin tubing with ideal printability properties for identification purposes, which provides fluid resistance as per EN50343.

Ideal for applications where limited fire hazard characteristics are required. This product is designed for use in commercial and industrial sectors wire bundling and assemblies, panel building and industrial installations. Meets UL224 and CSA standard for flammability

### Industry



Industry



Marine



Wind power



Commercial



Aerospace



Construction



Railway



Military



Electrical installations



Petrochemical



Telecom

### STANDARD TUBE COLOR



### OTHER TUBE COLORS ON REQUEST

### BACKING TAPE COLORS



### MATERIAL

Extruded, cross linked polyolefin.

### SHRINK RATIO

2:1 & 3:1

### OPERATING TEMPERATURE

-40°C to +125°C  
(-40°F to 193°F)

### SHRINK TEMPERATURE

>90°C (130°F)

### COMPLIANCES

Mark Permanence:  
SAE AS-5942  
BS EN 50343:2014 Annex H  
Section H.3  
Recommended black ribbon:  
FTI-Y, FTI-X

Chemical Resistance to solvents:

MIL-STD-202G  
Test method 215j

### SPECIFICATION / APPROVALS

UL224File E361238  
CSA File 220127

### STORAGE

Cool and dry in original packaging. Recommended temperature at +10°C to +25°C and 45-55% relative humidity. Use within 2 years from date of manufacture.

### APPLICATIONS

Specific developed to be used in commercial , cable harnesses, Industrial marking, insulation, wire bundling and mechanical protection.

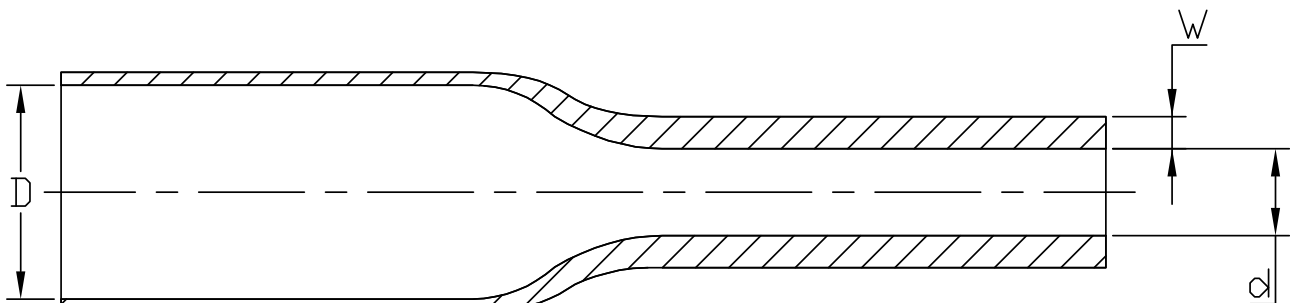
# Product Dimensions

## DIMENSIONS 2:1

SIZE, INCHES	SIZE, MM	MINIMUM ID (D), AS SUPPLIED MM (INCHES)	MAXIMUM ID, RECOVERED (D) MM (INCHES)	RECOVERED WALL THICKNESS (W), MM (INCHES)
3/32	2.4	2.79 (0.109)	1.18 (0.046)	0.49±0.06 (0.019 ± 0.002)
1/8	3.2	3.64 (0.143)	1.59 (0.063)	0.51±0.06 (0.02 ± 0.002)
3/16	4.8	5.26 (0.207)	2.36 (0.093)	0.54±0.06 (0.02 ± 0.002)
1/4	6.4	6.92 (0.272)	3.18 (0.125)	0.56±0.06 (0.022 ± 0.002)
3/8	9.5	10.2 (0.401)	4.75 (0.187)	0.59±0.06 (0.023 ± 0.002)
1/2	12.7	13.5 (0.531)	6.35 (0.250)	0.60±0.07 (0.024 ± 0.003)
3/4	19.1	20.1 (0.791)	9.53 (0.374)	0.62±0.07 (0.024 ± 0.003)
1	25.4	26.7 (1.05)	12.7 (0.500)	0.63±0.07 (0.025 ± 0.003)
1 ½	38.1	39.2 (1.54)	19.1 (0.750)	0.64±0.07 (0.025 ± 0.003)
2	50.8	53.0 (2)	25.4 (1.0)	0.64±0.08 (0.025 ± 0.003)
3	76.2	79.4 (3)	38.1 (1.5)	0.64±0.09 (0.025 ± 0.003)

## DIMENSIONS 3:1

SIZE, INCHES	SIZE, MM	MINIMUM ID (D), AS SUPPLIED MM (INCHES)	MAXIMUM ID, RECOVERED (D) MM (INCHES)	RECOVERED WALL THICKNESS (W), MM (INCHES)
3/32	2.4	2.79 (0.109)	0.79 (0,031)	0.57±0.10 (0.022 ± 0.004)
1/8	3.2	3.64 (0.143)	1.0 (0.039)	0.61±0.10 (0.024 ± 0.004)
3/16	4.8	5.26 (0.207)	1.6 (0.063)	0.67±0.10 (0.0263 ± 0.004)
1/4	6.4	6.92 (0.272)	2.4 (0.094)	0.71±0.10 (0.0279 ± 0.004)
3/8	9.5	10.2 (0.401)	3.2 (0.126)	0.77±0.10 (0.030 ± 0.004)
1/2	12.7	13.5 (0.531)	4.75 (0.187)	0.80±0.10 (0.031 ± 0.004)
3/4	19.1	20.1 (0.791)	6.4 (0.250)	0.84±0.15 (0.0330 ± 0.006)
1	25.4	26.7 (1.05)	8.47(0.333)	0.86±0.15 ( 0.034 ± 0.006)
1 ½	38.1	39.8 (1.57)	12.9 (0.507)	0.89±0.15 (0.035 ± 0.006)
2	50.8	53.0 (2)	17.2 (0.677)	0.90±0.15 (0.035 ± 0.006)
3	76.2	79.4 (3)	25.8 (1.05)	0.92±0.15 (0.036 ± 0.006)



Heat Shrink Product in as supplied "D" and fully recovered state "d" with recovered wall "W"

## General Tests for Identification Products

### PHYSICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Tensile strength	GB/T1040	10.3 Mpa (min.)
Elongation at break	GB/T1040	≥200%
Longitudinal change	UL224	+/-5%

### ELECTRICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Dielectric strength	GB/T1408	15.8 kV/mm <sup>2</sup>
Volume resistivity	GB/T1408	≥ 10 <sup>14</sup> Ω/cm

### CHEMICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Chemical resistance	AMS-DTL-23053/5	Good
Copper corrosion	UL224	No corrosion
Copper stability	UL224	No corrosion

### THERMAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Heat shock 4 hours at 250°C	ASTM D 2671	No dripping, cracking or flowing
Heat aging 168 hours at 158°C	ASTM D 638	Elongation 100%
Flammability	UL224	Pass » Flame retardant

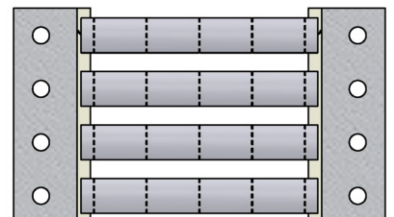
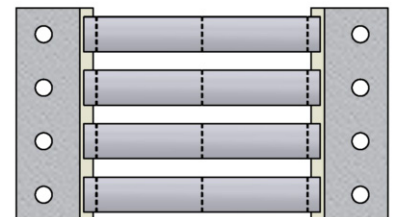
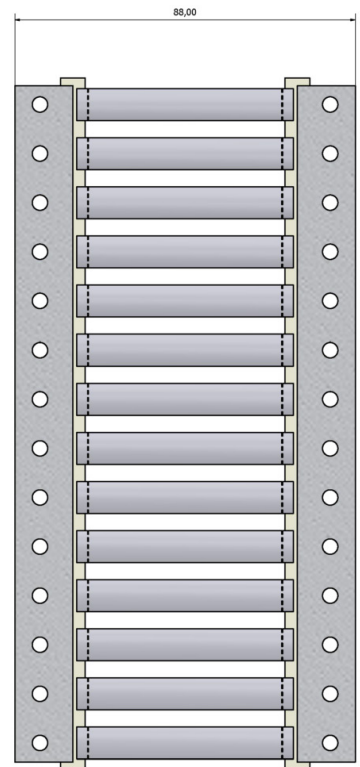
## Environmental UV Stability

PROPERTIES	TEST METHOD	TYPICAL VALUE
UV-A	ASTM G154 - Machine setup Temp 50-60°C (140°F) Cycle 8 h light 4h condensation UV wavelength 280-400nm Test duration 1000 h of exposure.	Pass - No damage to the marker and print legible after 10 rubs in accordance with BS EN 50343:2014 Annex H Section H.3.

## Product code

WM - DS -AMD- 3X - 024 - 125 - YW

<b>FAMILY</b> WM89 = 89 mm liner WM109= 109mm liner WMX= TMS Style	├──┘
<b>DOUBLE SIDED</b> Only shown if double sided	├──┘
<b>GRADE SLEEVES</b> See Page 6	├──┘
<b>SHRINK RATIO</b> If nothing shown its 2x shrink Ratio	├──┘
<b>DIAMETER</b> 024 = 2.4mm 032 = 3.2mm	├──┘
<b>LENGTH</b> Length 125 = 12.5mm - 3 scores Length 165 = 16.5mm - 2 scores Length 250 = 25.0mm - 1 score Length 038 = 38.0mm - 0 score	├──┘
<b>COLOR</b> WE= White YW=Yellow	├──┘



## Available options -

SIZE MM	SIZE INCHES	STANDARD	BULK	JUMBO
2,4 x 50 mm	3/32 - 2.0	1.000	5.000	10.000
3,2 x 50 mm	1/8 - 2.0	1.000	5.000	10.000
4,8 x 50 mm	3/16 - 2.0	1.000	5.000	10.000
6,4 x 50 mm	1/4 - 2.0	1.000	3.000	6.000
9,5 x 50 mm	3/8 - 2.0	500	2.000	4.000
12,7 x 50 mm	1/2 - 2.0	500	1.500	3.000
19,0 x 50 mm	3/4 - 2.0	500	1.500	3.000
25,4 x 50 mm	1 - 2.0	300	1.000	2.000
38,1 x 50 mm	1 1/2 - 2.0	100	600	1.200
50,8 x 50 mm	2 - 2.0	100	600	1.200

## Other Spool sizes on request -

## Ordering description

ORDERING DESCRIPTION EXAMPLES	STANDARD PACK SIZE	SUPPLIED DIAMETER		RECOVERED DIAMETER		RECOMMENDED USE RANGE (MIN-MAX)	
	pcs	mm	inches	mm	inches	mm	inches
Family-Tube Grade-3X-024-50-Colour	1.000	2,4 x 50mm	3/32-2.0	0.7	0.031	0.8-1.9	0.032-0.075
Family-Tube Grade-3X-032-50-Colour	1.000	3,2 x 50mm	1/8-2.0	1.0	0.042	1.1-2.6	0.044-0.105
Family-Tube Grade-3X-048-50-Colour	1.000	4,8 x 50mm	3/16-2.0	1,5	0.062	1.7-4.0	0.069-0.160
Family-Tube Grade-3X-064-50-Colour	1.000	6,4 x 50mm	1/4-2.0	2.3	0,095	2.3-5.4	0.091-0.215
Family-Tube Grade-3X-095-50-Colour	500	9,5 x 50mm	3/8-2.0	3.1	0.125	3.4-8.1	0.137-0.320
Family-Tube Grade-3X-127-50-Colour	500	12,7 x 50mm	1/2-2.0	4.75	0,187	4.6-10.7	0.183-0.425
Family-Tube Grade-3X-190-50-Colour	500	19,0 x 50mm	3/4-2.0	6.35	0.250	6.9-16.2	0.275-0.640
Family-Tube Grade-3X-254-50-Colour	300	25,4 x 50mm	1-2.0	8.47	0.33	9.2-21.5	0.366-0.850
Family-Tube Grade-3X-381-50-Colour	100	38,1 x 50mm	1 1/2-2.0	12.9	0.51	20.9-33.0	0.825-1.300
Family-Tube Grade-3X-508-50-Colour	100	50,8 x 50mm	2-2.0	17.2	0.68	27.9-44.9	1.100-1.750

## Related Standard Test Methods And Documents

Document	Description
ASTM D638 - ASTM G154 - ISO 37 -GB/T1040	Tensile strength and ultimate elongation
ASTM D638- ISO188	Heat aging 168 at 158°C
ASTM D 2671	Flammability testing. Heat shock 4 hours at 225°C
ASTM D2671 -UL224	Longitudinal change
ASTM G154-GB/T1408	Dielectrical strength.
ASTM D2671B - UL224	Copper corrosion (Section 93 procedure A) damaged area of copper mirror,
AMS-DTL-23053/5	Chemical resistance - <b>good</b>
ASTM D257 -IEC 93	Volume resistivity $\Omega$ -cm
ASTM D 635-HB - SAE-AMS-DTL-23053/5	Flammability resistance - Fire propagation
GB/T 1040	Test Conditions for moulding and extrusion plastics
SAE AS5942;2014	Marking og insulation materials- Print permanence testing using the mechanical crockmeter
BS EN 50343:2014 Annex H Section H.3	Railway applications. Rolling stock. Rules for installation of cabling- Mark Permanence
UL224	This Standard specifies the requirements for insulating tubing that is usually round in cross-section and that consists entirely of extruded compounds whose characteristic constituents are thermosetting, elastomeric, or thermoplastic polymers (see Table 1 for materials and ratings). These requirements also cover heat-shrinkable and crosslinked tubing.

# ZH

## Low Smoke 0-Halogen Flame-retardant Identification Sleeves

### TECHNICAL DATA SHEET

Revision Number. 1  
Last Edited 4. december 2018



The ZH-2X Heat Shrinkable Wire Markers are made of halogen free, flame retardant and low smoke heat shrinkable polyolefin tubing with ideal printability properties for identification purposes. Ideal for applications where limited fire hazard and low smoke characteristics are required.

The zero halogen material coupled with low smoke and low toxic fume emissions makes this product ideal in enclosed spaces such as mass transit, marine and industrial installations.

The compound of the tubing is excluded for halogens and offers excellent low fire hazard characteristics combined with minimal smoke emission.

The ZH material is classified with EN45545-2 Class HL3 requirement set R22 (interior) and R23 (exterior) and be used without any restriction for any application.

### Industry



Industry



Marine



Wind power



Commercial



Aerospace



Construction



Railway



Military



Electrical installations



Petrochemical



Telecom

### STANDARD TUBE COLOR



### TUBE COLORS ON REQUEST



### BACKING TAPE COLORS



### MATERIAL

Extruded, cross linked polyolefin.

### SHRINK RATIO

2:1

### OPERATING TEMPERATURE

-55°C up to +105°C

(-67°F to 221°F)

Shrink Temperature

≥90° (194°F)

### COMPLIANCES

Mark Permanence:

SAE AS-5942

LUL 3349

Print Resistance to solvents:

MIL-STD-202G

Test method 215K

### RECOMMENDED BLACK RIBBON

FTI-Y, FTI-X

### INDUSTRY STANDARDS

EN45545-2 Class HL3 R22-23

NF F 16-101

London Underground

1-085 A3

BOEING BSS 7239

UNI CEI 11170-3 (LR4)

DIN 5510-2

BS6853: 1999 vehicle category 1a

### STORAGE

Cool and dry in original packaging. Recommended temperature at +10°C to +25°C and 45-55% relative humidity. Use within 2 years from date of manufacture.

### APPLICATIONS

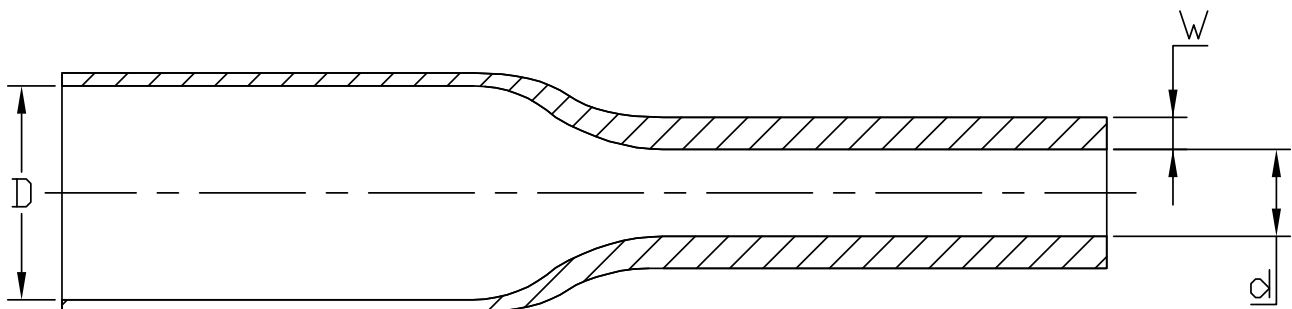
Specific developed to be used in Rail, Aerospace, Marine, Industrial marking, insulation, wire bundling and mechanical protection.



# Product Dimensions

## DIMENSIONS 2:1

SIZE, INCHES	SIZE, MM	MINIMUM ID (D), AS SUPPLIED MM (INCHES)	MAXIMUM ID, RECOVERED (D) MM (INCHES)	RECOVERED WALL THICKNESS (W), MM (INCHES)
3/32	2.4	2.5 (0.098)	1.2 (0.047)	0.43 (0.017)
1/8	3.2	3.6 (0.142)	1.6 (0.063)	0.55 (0.022)
3/16	4.8	5.2 (0.189)	2.4 (0.094)	0.55 (0.022)
1/4	6.4	6.7 (0.263)	3.2 (0.126)	0.65 (0.025)
3/8	9.5	10.0 (0.393)	4.8 (0.189)	0.65 (0.025)
1/2	12.7	13.6 (0.53)	6.4 (0.250)	0.65 (0.025)
3/4	19.1	20.4 (0.80)	9.5 (0.374)	0.70 (0.027)
1	25.4	27.0 (1.06)	12.7 (0.500)	0.85(0.033)
1 ½	38.1	40.0 (1.57)	19.1 (0.750)	0.90(0.035)
2	50.8	50.8 (2)	25.4 (1.0)	0.90(0.035)



Heat Shrink Product in as supplied "D" and fully recovered state "d" with recovered wall "W"

# General Tests for Identification Products

## PHYSICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Tensile strength	ASTM D 638	10.0 N/mm <sup>2</sup> .
Elongation at break	ASTM D 638	≥200%
Longitudinal change	ASTM D 2671	-10% to +5%
Water absorption	ASTM D 570	≤ 0,15%
Specific gravity	ASTM D 792	1,40

## ELECTRICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Dielectric strength	ASTM D 2671	20.0 kV/mm <sup>2</sup>
Volume resistivity	ASTM D 257	≥ 10 <sup>14</sup> Ω/cm

## CHEMICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Chemical resistance	EN 60684-2-36	Good - Pass
Copper corrosion	ASTM D 2671 B	No corrosion
Copper stability	N-A	N-A

## THERMAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Heat shock 4 hours at 175°C	ASTM D 2671	No dripping, cracking or flowing
Heat aging 168 hours at 150°C	ASTM D 638	Elongation ≥ 100%
Flammability	ASTM D 635-HB	Pass » flame retardant
Low temperature flexibility / Bending	1h at - 55°C EN 60684-2	No cracking, no break, no detachment of coating
Optical density of smoke (D <sub>m</sub> )	ASTM E 662	Flaming mode 41 , non flaming mode 111
Smoke index	NF F 16-101	Smoke class F1

## FIRE PROPAGATION COMPARISON

NORMATIVES	TOXICITY	LOW OXYGEN INDEX (LOI)	SMOKE DENSITY	FLAMMABILITY INDEX	CAPACITY OF FORMING DROPS
EN45545-2	HL3	HL3	HL3	-	-
NF F 16 101	-	-	Class F1	Class I4	-
BS 6853	1a	1a	1a	-	-
DIN 5510-2	Pass	-	SR2	-	ST1
NFPA130	Pass	-	Pass	-	-
UNI CEI 11170-3	LR4	LR4	-	LR4	-

## Fire behavior Standard Classification for Identification Products

STANDARDS	CLASSIFICATION	USAGE
EN 45545-2 (R22:R23)	HL3	Unlimited Usage All Vehicles
BS6853	1a	Unlimited Usage All Vehicles
UNI CEI 11170-3	LR4	Unlimited Usage All Vehicles
DIN 5510-2	SR2, ST1	Usage Limited
NF F 16-101	F1 & I4	Usage Limited to External Vehicles
NFPA 130	-	Usage Permitted upon agreement with end user

## Compliance on fire behavior for Identification Products

### TEST METHOD

STANDARDS	FLAME PROPAGATION	TOXICITY	SMOKE DENSITY	LOW OXYGEN INDEX
<b>BS6853</b>		BS 6853 appendix B1 or NF X-70-100	BS 6853 D8.3	ISO 4589-2
<b>NF F-16 101</b>	NF EN 60-695-2	NF X 70-100	NF X 10-702-1 & 2	ISO 4589-2
<b>NFPA130</b>	ASTM E 162	BSS 7239	ASTM E 662	
<b>EN 45545-2</b>		NF X 70-100 600°C	EN ISO 5659-2	ISO 4589-2
<b>DIN 5510-2</b>	DIN 54837	DIN ISO 5510-2	DIN 54837	

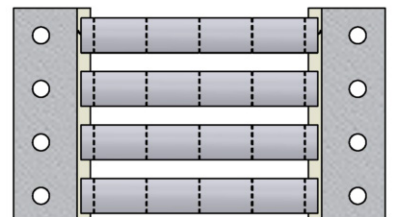
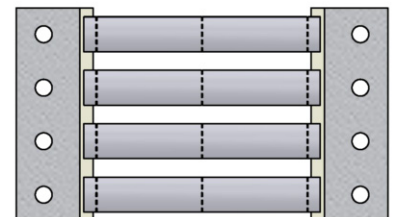
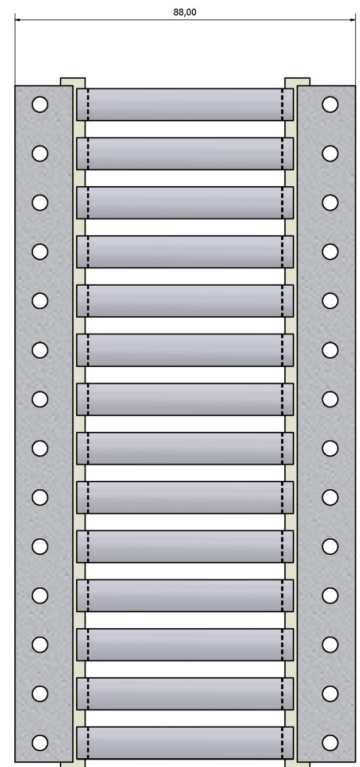
## Environmental UV Stability

PROPERTIES	TEST METHOD	TYPICAL VALUE
UV-A	ASTM G154 - Machine setup Temp 50-60°C (140°F) Cycle 8 h light 4h condensation UV wavelength 280-400nm Test duration 1000 h of exposure.	Pass - No damage to the marker and print legible after 20 rubs in accordance with SAE-ASAS3349/ SAE AS 81531.

## Product code

WM - DS -AMD- 3X - 024 - 125 - YW

<b>FAMILY</b> WM89 = 89 mm liner WM109= 109mm liner WMX= TMS Style	WM
<b>DOUBLE SIDED</b> Only shown if double sided	DS
<b>GRADE SLEEVES</b> See Page 3 & 4	AMD
<b>SHRINK RATIO</b> If nothing shown its 2x shrink Ratio	3X
<b>DIAMETER</b> 024 = 2.4mm 032 = 3.2mm	024
<b>LENGTH</b> Length 125 = 12.5mm - 3 scores Length 165 = 16.5mm - 2 scores Length 250 = 25.0mm - 1 score Length 038 = 38.0mm - 0 score	125
<b>COLOR</b> WE= White YW=Yellow	YW



## Available options -

SIZE MM	SIZE INCHES	STANDARD	BULK	JUMBO
2,4 x 50 mm	3/32 - 2.0	1.000	5.000	10.000
3,2 x 50 mm	1/8 - 2.0	1.000	5.000	10.000
4,8 x 50 mm	3/16 - 2.0	1.000	5.000	10.000
6,4 x 50 mm	1/4 - 2.0	1.000	3.000	6.000
9,5 x 50 mm	3/8 - 2.0	500	2.000	4.000
12,7 x 50 mm	1/2 - 2.0	500	1.500	3.000
19,0 x 50 mm	3/4 - 2.0	500	1.500	3.000
25,4 x 50 mm	1 - 2.0	300	1.000	2.000
38,1 x 50 mm	1 1/2 - 2.0	100	600	1.200
50,8 x 50 mm	2 - 2.0	100	600	1.200

## Other Spool sizes on request -

## Ordering description

ORDERING DESCRIPTION EXAMPLES	STANDARD PACK SIZE	SUPPLIED DIAMETER		RECOVERED DIAMETER		RECOMMENDED USE RANGE (MIN-MAX)	
	pcs	mm	inches	mm	inches	mm	inches
Family-Tube Grade-3X-024-50-Colour	1.000	2,4 x 50mm	3/32-2.0	0.7	0.031	0.8-1.9	0.032-0.075
Family-Tube Grade-3X-032-50-Colour	1.000	3,2 x 50mm	1/8-2.0	1.0	0.042	1.1-2.6	0.044-0.105
Family-Tube Grade-3X-048-50-Colour	1.000	4,8 x 50mm	3/16-2.0	1,5	0.062	1.7-4.0	0.069-0.160
Family-Tube Grade-3X-064-50-Colour	1.000	6,4 x 50mm	1/4-2.0	2.3	0,095	2.3-5.4	0.091-0.215
Family-Tube Grade-3X-095-50-Colour	500	9,5 x 50mm	3/8-2.0	3.1	0.125	3.4-8.1	0.137-0.320
Family-Tube Grade-3X-127-50-Colour	500	12,7 x 50mm	1/2-2.0	4.75	0,187	4.6-10.7	0.183-0.425
Family-Tube Grade-3X-190-50-Colour	500	19,0 x 50mm	3/4-2.0	6.35	0.250	6.9-16.2	0.275-0.640
Family-Tube Grade-3X-254-50-Colour	300	25,4 x 50mm	1-2.0	8.47	0.33	9.2-21.5	0.366-0.850
Family-Tube Grade-3X-381-50-Colour	100	38,1 x 50mm	1 1/2-2.0	12.9	0.51	20.9-33.0	0.825-1.300
Family-Tube Grade-3X-508-50-Colour	100	50,8 x 50mm	2-2.0	17.2	0.68	27.9-44.9	1.100-1.750

## Related Standard Test Methods And Documents

Document	Description
ASTM D638	Tensile strength and ultimate elongation
ASTM D638	Heat aging 168 at 150°C
ASTM D2671 heat shock (section 26-30), procedure b	Heat shock 4 hours at 175°C
ASTM D2671	Longitudinal change
ASTM D2671 (Section 79-80) ASTM D570	Water absorption. 2 Maximum
ASTM D149	Dielectric strength. 20 minimum
ASTM D2671B	Copper corrosion (Section 93 procedure A) damaged area of copper mirror,
EN 60684-2-36	Chemical resistance to selected fluids
ASTM D257	Volume resistivity
ASTM D 635-HB -	Flammability resistance - Fire propagation
ASTM D E 662	Optical density of smoke (D <sub>m</sub> ) measured in flaming mode and non flaming mode in single smoke chamber test.
ASTM D792 Method A	Specific gravity
Boeing BS 7239	Toxic gas generation M7. Gases produced for analysis are generated in a specified, calibrated smoke chamber during standard rate of smoke generation testing (ASTM E 662), in both flaming combustion and non-flaming pyrolytic decomposition test modes
BS EN ISO 4589-1: 1999 - Oxygen Index	Limited Oxygen Index- flammability hazard rating. Determination of burning behavior by oxygen index - part 2: ambient temperature test. 32% minimum
BS 6853 (1999) vehicle category 1a	Code of practice for fire precautions in the design and construction of passenger carrying trains
DIN 54837	DIN 54837 Testing of materials, small components and component sections for rail vehicles- determination of burning behaviour using a gas burner
DIN 5510-2	German railway normative related to fire protection on railway vehicles
ISO 5659-2: 2017	Optical density of smoke (D <sub>m</sub> ) measured in flaming mode and non flaming mode in single smoke chamber test.
EN45545-2	Railway applications. Rolling stock fire protection on railway vehicles. - Part 2 requirements for fire behavior of materials and components. Fire hazard class. 1,2 & 3 R22 (Interior) & R23 (exterior)
IEC 60684-2 - 14	Low temperature flexibility
London Underground Standard 1-085	Revision A3, Fire safety performance of materials
NF C 20-455	Fire hazard testing glowin/hot-wire based test methods. Glow-wire apparatus and common test procedure. Replaced by EN ISO 60695-2-11
NF F 16-101: 1988	Railway rolling stock fire behavior choice of materials Rolling stock classification A1.
NF X 70-100: 1986	Fire tests analysis of pyrolysis and combustion gases tube furnace method
NF X 10-702-1/2	Determination of the opacity of smoke in a non-renewed atmosphere. the resulting density /time curve is used to calculate the smoke index
NF T 51-071: 1999	Oxygen index test. This test have been replaced by IEC 60695-2-11/EN 60965-2-11
MIL 202 Method 215	Resistance to-of solvents. Test methods for electronic and electrical component parts
SAE AS5942;2014	Marking og insulation materials- Print permanence testing using the mechanical crockmeter
UNI CEI 11170-3 "Superseded"	Italian railway normative related to fire protection on railway vehicles. This standard has been superseded by EN 45545-2



# Low Fire Hazard And Fluid Resistant Identification Sleeves

## TECHNICAL DATA SHEET

Revision Number. 1  
Last Edited 24. juli 2018



The WM-ZHR-2X and 3X Heat Shrinkable Wire Markers are made of halogen free, flame retardant and low smoke heat shrinkable polyolefin tubing with ideal printability properties for identification purposes, which provides fluid resistance as per EN50343.

Ideal for applications where limited fire hazard characteristics and diesel resistance are required.

The zero halogen material coupled with low smoke and low toxic fume emissions makes this product ideal in enclosed spaces such as mass transit, marine and industrial installations.

Resistant to diesel and key fluids in rail and other industries.

The compound of the tubing is excluded for halogens and offers excellent low fire hazard characteristics combined with minimal smoke emission.

## Industry



Industry



Marine



Wind power



Commercial



Aerospace



Construction



Railway



Military



Electrical installations



Petrochemical



Telecom

### STANDARD TUBE COLOR



### TUBE COLORS ON REQUEST



### BACKING TAPE COLORS



### MATERIAL

Extruded, cross linked polyolefin.

### SHRINK RATIO

2:1 & 3:1

### OPERATING TEMPERATURE

-55°C up to +125°C

### SHRINK TEMPERATURE

>90°C

### COMPLIANCES

Mark Permanence:

SAE AS-5942

EN50343 Annex H (section 6.6)

Recommended black ribbon:

FTI-Y, FTI-X

Resistance to solvents:

MIL-STD-202G

Test method 215j

Diesel Resistance :

EN 50343:2014 Annex H

### FIRE PROPAGATION

EN45545-2 HL3, R22/23.

NF F 16 101

### TOXICITY

BS6853: 1999

### STORAGE

Cool and dry in original packaging. Recommended temperature at +10°C to +25°C and 45-55% relative humidity. Use within 2 years from date of manufacture.

### APPLICATIONS

Specific developed to be used in Rail , Rail Car, Marine, Motorsports and Industrial marking,insulation, wire bundling and mechanical protection.



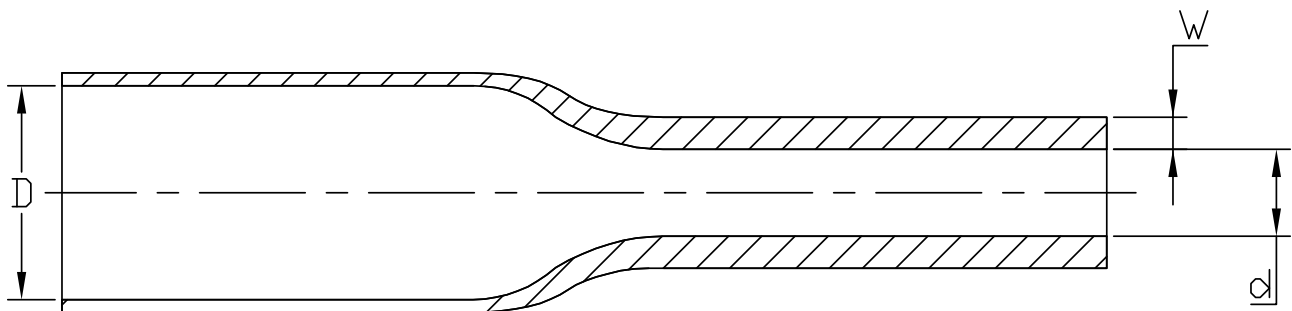
# Product Dimensions

## DIMENSIONS 2:1

SIZE, INCHES	SIZE, MM	MINIMUM ID (D), AS SUPPLIED MM (INCHES)	MAXIMUM ID, RECOVERED (D) MM (INCHES)	RECOVERED WALL THICKNESS (W), MM (INCHES)
3/32	2.4	2.4 (0.094)	1.2 (0.047)	0.49±0.06 ( ± 0.002)
1/8	3.2	3.2 (0.126)	1.6 (0.063)	0.51±0.06 (0.06 ± 0.002)
3/16	4.8	4.8 (0.189)	2.4 (0.094)	0.54±0.06 (0.06 ± 0.002)
1/4	6.4	6.4 (0.250)	3.2 (0.126)	0.56±0.06 (0.022 ± 0.002)
3/8	9.5	9.5 (0.374)	4.8 (0.189)	0.59±0.06 (0.023 ± 0.002)
1/2	12.7	12.7 (0.5)	6.4 (0.250)	0.60±0.07 (0.024 ± 0.003)
3/4	19.1	19.1 (0.750)	9.5 (0.374)	0.62±0.07 (0.024 ± 0.003)
1	25.4	25.4 (1.0)	12.7 (0.500)	0.63±0.07 (0.025 ± 0.003)
1 ½	38.1	38.1 (1.5)	19.1 (0.750)	0.64±0.07 (0.025 ± 0.003)
2	50.8	50.8 (2)	25.4 (1.0)	0.64±0.08 (0.025 ± 0.003)
3	76.2	76.2 (3)	38.1 (1.5)	0.64±0.09 (0.025 ± 0.003)

## DIMENSIONS 3:1

SIZE, INCHES	SIZE, MM	MINIMUM ID (D), AS SUPPLIED MM (INCHES)	MAXIMUM ID, RECOVERED (D) MM (INCHES)	RECOVERED WALL THICKNESS (W), MM (INCHES)
3/32	2.4	2.4 (0.094)	0.8 (0.031)	0.57±0.10 (0.022 ± 0.004)
1/8	3.2	3.2 (0.126)	1.0 (0.039)	0.61±0.10 (0.024 ± 0.004)
3/16	4.8	4.8 (0.189)	1.6 (0.063)	0.67±0.10 (0.0263 ± 0.004)
1/4	6.4	6.4 (0.250)	2.4 (0.094)	0.71±0.10 (0.0279 ± 0.004)
3/8	9.5	9.5 (0.374)	3.2 (0.126)	0.77±0.10 (0.030 ± 0.004)
1/2	12.7	12.7 (0.5)	4.8 (0.189)	0.80±0.10 (0.031 ± 0.004)
3/4	19.1	19.1 (0.750)	6.4 (0.250)	0.84±0.15 (0.0330 ± 0.006)
1	25.4	25.4 (1.0)	8.4 (0.331)	0.86±0.15 ( 0.034 ± 0.006)
1 ½	38.1	38.1 (1.5)	12.7 (0.500)	0.89±0.15 (0.035 ± 0.006)
2	50.8	50.8 (2)	18.0 (0.708)	0.90±0.15 (0.035 ± 0.006)
3	76.2	76.2 (3)	25.4 (1.0)	0.92±0.15 (0.036 ± 0.006)



Heat Shrink Product in as supplied "D" and fully recovered state "d" with recovered wall "W"

## General Tests for Identification Products

### PHYSICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Tensile strength	ASTM G 154	10.3 Mpa (min.)
Elongation at break	ISO 37	≥200%
Longitudinal change	UL224	+/-5%

### ELECTRICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Dielectric strength	ASTM G 154	15.8 kV/mm <sup>2</sup>
Volume resistivity	IEC 93	≥ 10 <sup>14</sup> Ω/cm
Voltage withstand	IEC 243	2500 V/60 sec.

### CHEMICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Chemical resistance	AMS-DTL-23053/5	Good
Copper corrosion	UL224	No corrosion
Copper stability	UL224	No corrosion

### THERMAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Heat shock 4 hours at 225°C	ASTM D 2671	No dripping, cracking or flowing
Heat aging 168 hours at 158°C	ISO 188	Elongation 100%
Flammability	SAE-AMS-DTL-23053/5	Pass » flame retardant
Low temperature flexibility	1h at - 55°C	No cracking

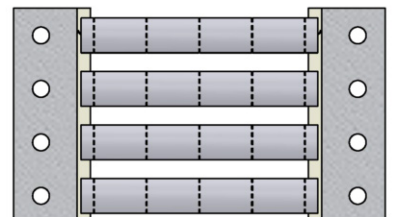
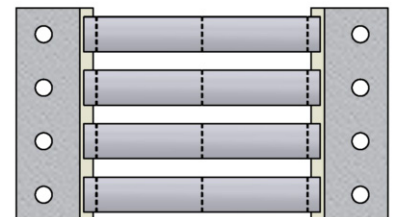
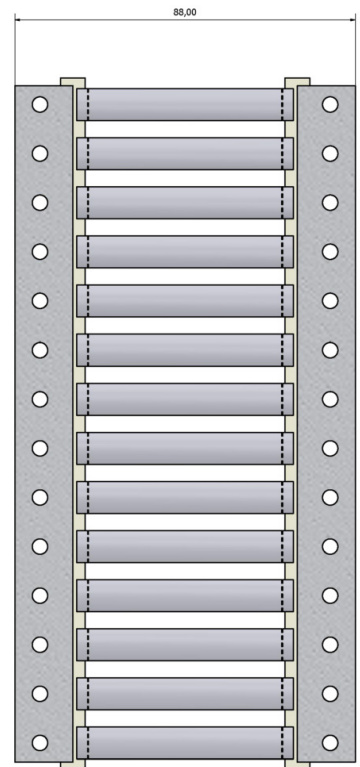
### FIRE PROPAGATION

NORMATIVES	TOXICITY	LOW OXYGEN INDEX	SMOKE GENERATION / DENSITY	FLAMMABILITY INDEX
EN45545-2	CIT 0.07 (HL3)	43.9% (R22 - HL3)	4.4 Ds(max) (HL3)	
NF F 16 101		>32% (I2)		< 40%
BS 6853	R value 0.56	≥34%	A0 0.017	R<1 (class 1a)
DIN 5510-2	FED 0.13		SR2	Class S4 Drop formation class ST2

## Product code

WM - DS -AMD- 3X - 024 - 125 - YW

<b>FAMILY</b> WM89 = 89 mm liner WM109= 109mm liner WMX= TMS Style	WM
<b>DOUBLE SIDED</b> Only shown if double sided	DS
<b>GRADE SLEEVES</b> See Page 3 & 4	AMD
<b>SHRINK RATIO</b> If nothing shown its 2x shrink Ratio	3X
<b>DIAMETER</b> 024 = 2.4mm 032 = 3.2mm	024
<b>LENGTH</b> Length 125 = 12.5mm - 3 scores Length 165 = 16.5mm - 2 scores Length 250 = 25.0mm - 1 score Length 038 = 38.0mm - 0 score	125
<b>COLOR</b> WE= White YW=Yellow	YW



## Available options -

SIZE MM	SIZE INCHES	STANDARD	BULK	JUMBO
2,4 x 50 mm	3/32 - 2.0	1.000	5.000	10.000
3,2 x 50 mm	1/8 - 2.0	1.000	5.000	10.000
4,8 x 50 mm	3/16 - 2.0	1.000	5.000	10.000
6,4 x 50 mm	1/4 - 2.0	1.000	3.000	6.000
9,5 x 50 mm	3/8 - 2.0	500	2.000	4.000
12,7 x 50 mm	1/2 - 2.0	500	1.500	3.000
19,0 x 50 mm	3/4 - 2.0	500	1.500	3.000
25,4 x 50 mm	1 - 2.0	300	1.000	2.000
38,1 x 50 mm	1 1/2 - 2.0	100	600	1.200
50,8 x 50 mm	2 - 2.0	100	600	1.200

## Other Spool sizes on request -

## Ordering description

ORDERING DESCRIPTION EXAMPLES	STANDARD PACK SIZE	SUPPLIED DIAMETER		RECOVERED DIAMETER		RECOMMENDED USE RANGE (MIN-MAX)	
		pcs	mm	inches	mm	inches	mm
Family-Tube Grade-3X-024-50-Colour	1.000	2,4 x 50mm	3/32-2.0	0.7	0.031	0.8-1.9	0.032-0.075
Family-Tube Grade-3X-032-50-Colour	1.000	3,2 x 50mm	1/8-2.0	1.0	0.042	1.1-2.6	0.044-0.105
Family-Tube Grade-3X-048-50-Colour	1.000	4,8 x 50mm	3/16-2.0	1,5	0.062	1.7-4.0	0.069-0.160
Family-Tube Grade-3X-064-50-Colour	1.000	6,4 x 50mm	1/4-2.0	2.3	0,095	2.3-5.4	0.091-0.215
Family-Tube Grade-3X-095-50-Colour	500	9,5 x 50mm	3/8-2.0	3.1	0.125	3.4-8.1	0.137-0.320
Family-Tube Grade-3X-127-50-Colour	500	12,7 x 50mm	1/2-2.0	4.75	0,187	4.6-10.7	0.183-0.425
Family-Tube Grade-3X-190-50-Colour	500	19,0 x 50mm	3/4-2.0	6.35	0.250	6.9-16.2	0.275-0.640
Family-Tube Grade-3X-254-50-Colour	300	25,4 x 50mm	1-2.0	8.47	0.33	9.2-21.5	0.366-0.850
Family-Tube Grade-3X-381-50-Colour	100	38,1 x 50mm	1 1/2-2.0	12.9	0.51	20.9-33.0	0.825-1.300
Family-Tube Grade-3X-508-50-Colour	100	50,8 x 50mm	2-2.0	17.2	0.68	27.9-44.9	1.100-1.750

## Related Standard Test Methods And Documents

Document	Description
ASTM D638 - ASTM G154 - ISO 37	Tensile strength and ultimate elongation
ASTM D638- ISO188	Heat aging 168 at 158°C
ASTM D2671 heat shock (section 26-30), procedure b	Flammability testing. Heat shock 4 hours at 225°C
ASTM D2671 -UL224	Longitudinal change
ASTM D2671 (Section 79-80) ASTM D570	Water absorption. 2 Maximum
ASTM G154	Dielectrical strength.
ASTM D2671B - UL224	Copper corrosion (Section 93 procedure A) damaged area of copper mirror,
AMS-DTL-23053/5	Chemical resistance -
ASTM D257 -IEC 93	Volume resistivity Ω-cm
ASTM D 635-HB - SAE-AMS-DTL-23053/5	Flammability resistance - Fire propagation
ASTM D E 662	Optical density of smoke (D <sub>m</sub> ) measured in flaming mode and non flaming mode in single smoke chamber test.
BS EN ISO 4589-1: 1999 - Oxygen Index %	Limited Oxygen Index- flammability hazard rating. Determination of burning behavior by oxygen index - part 2: ambient temperature test. 32% minimum
BS 6853 (1999) vehicle category 1a	Code of practice for fire precautions in the design and construction of passenger carrying trains
BS 6853 (1999) Annex D	BS 6853 Annex D: Methods for measuring smoke density. A <sub>0</sub> . The test is performed inside a chamber measuring 3 metres by 3 metres by 3 metres and the test is sometimes referred to as the three metres cube test. The test duration is 40 minutes.
BS 6853 (1999) Annex B	Determination of weighted summation of toxic fume, (R value). BS6853-code of practice of fire precautions in the design and construction of passenger carrying trains
DIN 5510	DIN 5510 determine the fire classification of railway vehicle material and structure by burning behaviour, smoke density and dropping behaviour.
ISO 5659-2: 2017	Optical density of smoke (D <sub>m</sub> ) measured in flaming mode and non flaming mode in single smoke chamber test.
EN45545-2	Railway applications. Rolling stock fire protection on railway vehicles. - Part 2 requirements for fire behavior of materials and components. Fire hazard level class. HL1,HL 2 & HL 3 - R22-R23
EN50343 annex H section 6.6 - Fluid resistance	Railway applications - Rolling stock - Rules for installation of cabling. Resistance to mineral oil, liquid fluid (IRM902, IRM 903) immersed up to 240 hours and thereafter 10 rubs with eraser.
IEC 60684-2 - ASTM 2671 (section 36-43) procedure C - BS EN 60684-3-216	Low temperature flexibility. Wind to specific mandrel 1 hour at -55°C
IEC 243- ASTM-D-3755	Voltage withstand. Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials Under Direct-Voltage Stress
London Underground Standard 1-085	Revision A3, Fire safety performance of materials
NF C 20-455	Fire hazard testing glowin/hot-wire based test methods. Glow-wire apparatus and common test procedure.c. Replaced by EN ISO 60695-2-11
NF F 16-101: 1988	Railway rolling stock fire behavior choice of materials Rolling stock classification A1
NF T 51-071: 1999	Oxygen index test. This test have been replaced by IEC 60695-2-11/EN 60965-2-11
MIL 202 Method 215	Resistance to-of solvents. Test methods for electronic and electrical component parts
SAE AS5942;2014	Marking og insulation materials- Print permanence testing using the mechanical crockmeter



LINK SOLUTIONS

