

# ZHR Continuous medium spool Low Fire Hazard And Fluid Resistant Identification Sleeves

## TECHNICAL DATA SHEET

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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 EN50343-2.

ZHR meets the 60684-3-216 standard. Test report available.

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



## 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 (FTI-X / FTI-HXX)  
EN50343 Annex H (section 6.6)

## Resistance to solvents

MIL-STD-202

Test method 215 (FTI-X / FTI-HXX)

## Diesel Resistance

EN 50343:2014 Annex H

## Resistance to selected fluids

BS IEC60684-3-216

## Material compliance

BS IEC60684-3-216

## Recommended black ribbon

FTI-X FTI-HXX

## ALTERNATIVE RIBBONS

FTI-Y, FTI-HX

## RECOMMENDED WHITE RIBBON

FTI-HLD-CO-WE

## FIRE PROPAGATION

EN45545-2 HL3, R22/23/R24  
NF F 16 101

## LASER PRINT

UV lasers 355nm

## 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

Specifically developed for the industries marked in green to the left. Can also be used for insulation, wire bundling and mechanical protection.

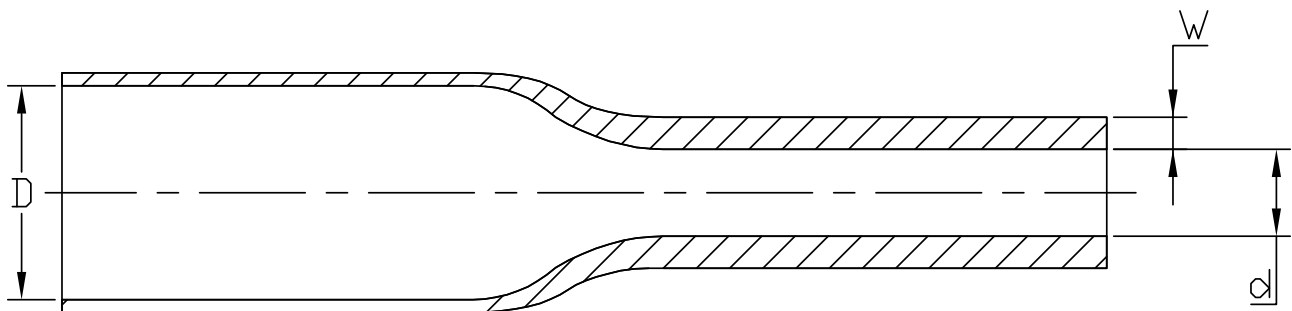
# Product Dimensions

## 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

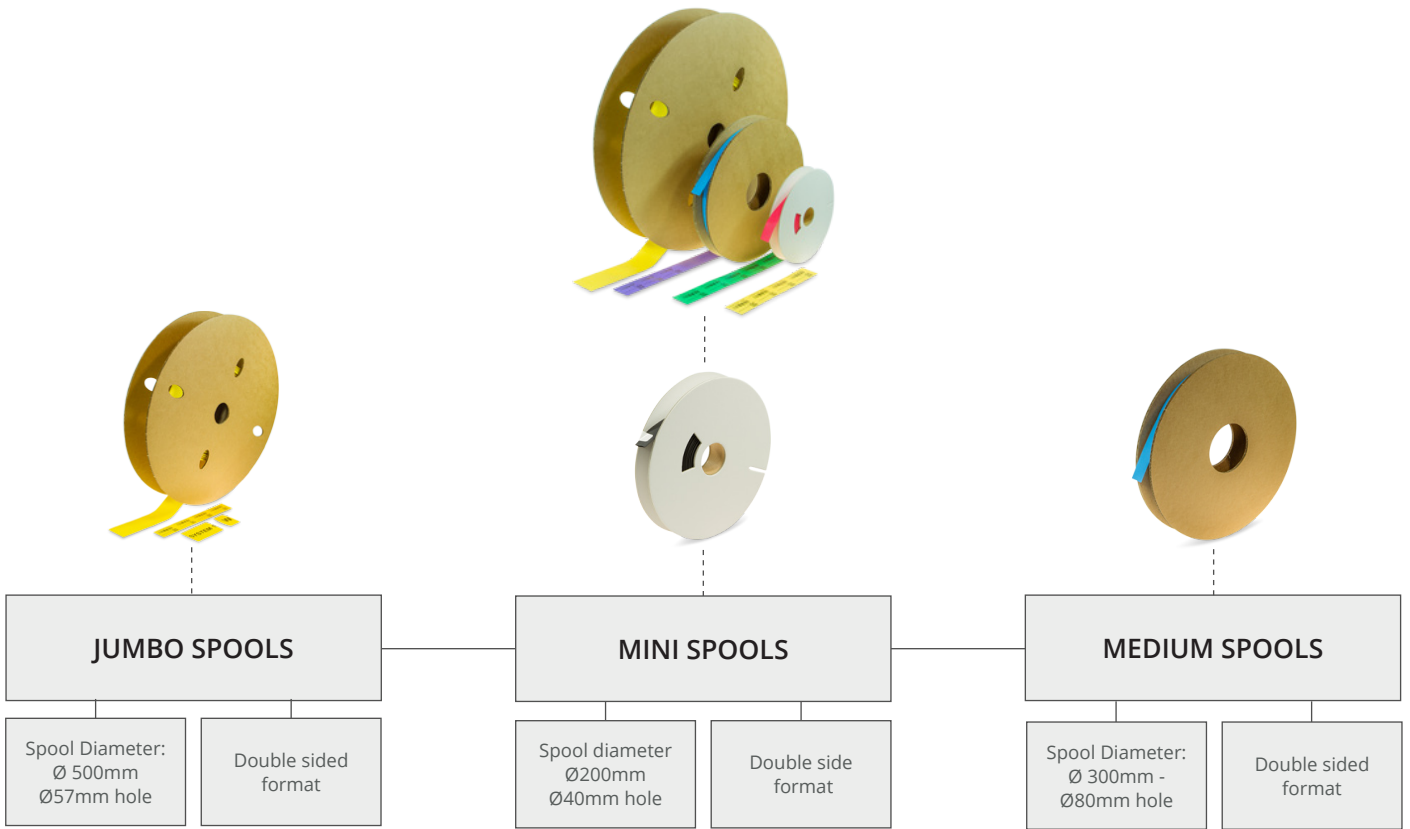
## THERMAL

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

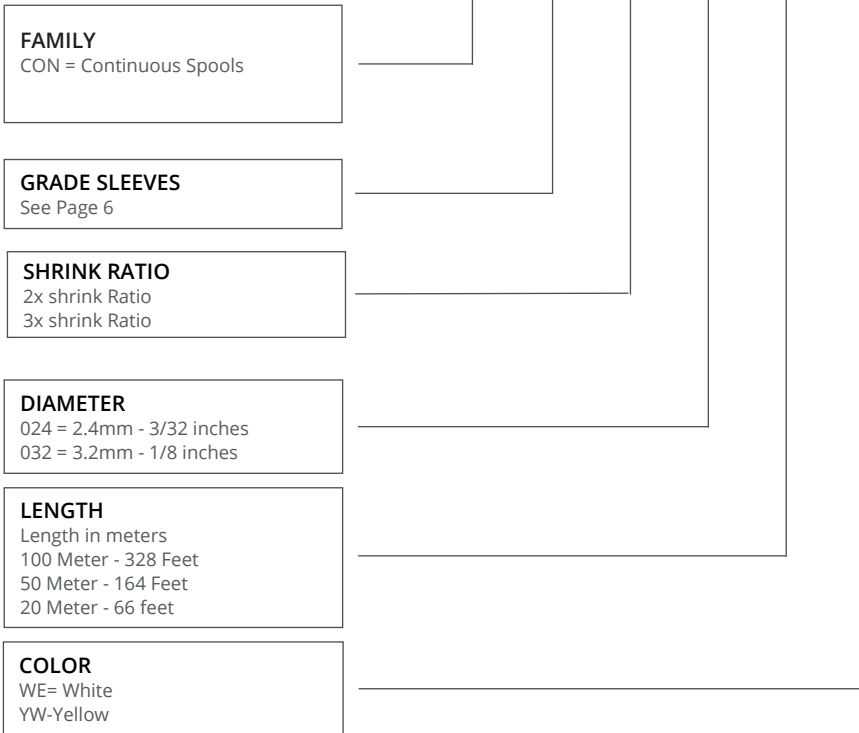
NORMATIVES	TOXICITY	LOW OXYGEN INDEX	SMOKE GENERATION / DENSITY	FLAMMABILITY INDEX
EN45545-2	CIT 0.07 (HL3)	43.9% (R22 - HL3)	4.4 Ds(max) (HL3)	
NF F 16 101		>32% (I2)		< 40%
BS 6853	R value 0.56	≥34%	A0 0.017	R<1 (class 1a)
DIN 5510-2	FED 0.13		SR2	Class S4 Drop formation class ST2

# Available Formats



## Product code

CON - ZHR - 3X - 024 -100M- YW



## Available options -

SIZE MM	SIZE INCHES	MINI SPOOL LENGTH METER	MEDIUM SPOOL LENGTH METER	JUMBO SPOOL LENGTH METER
2,4 mm	3/32	20 Meter - 66 Feet	50 Meter - 164 Feet	100 Meter - 328 Feet
3,2 mm	1/8	20 Meter - 66 Feet	50 Meter - 164 Feet	100 Meter - 328 Feet
4,8 mm	3/16	20 Meter - 66 Feet	50 Meter - 164 Feet	100 Meter - 328 Feet
6,4 mm	1/4	20 Meter - 66 Feet	50 Meter - 164 Feet	100 Meter - 328 Feet
9,5 mm	3/8	15 Meter - 49 Feet	50 Meter - 164 Feet	100 Meter - 328 Feet
12,7 mm	1/2	15 Meter - 49 Feet	25 Meter - 82 Feet	50 Meter - 164 Feet
19,0 mm	3/4	15 Meter - 49 Feet	25 Meter - 82 Feet	50 Meter - 164 Feet
25,4	1	15 Meter - 49 Feet	25 Meter - 82 Feet	50 Meter - 164 Feet
38,1 mm	1 1/2	10 Meter - 33 Feet	25 Meter - 82 Feet	50 Meter - 164 Feet
50,8	2	10 Meter - 33 Feet	25 Meter - 82 Feet	50 Meter - 164 Feet
76.2	3	10 Meter - 33 Feet	25 Meter - 82 Feet	50 Meter - 164 Feet

## Other spool lengths on request - \*

# 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 heat shrinkable polyolefin tubing with ideal printability properties for identification purposes. C3 meets NFPA 130 requirements. The C3 material is fabricated to meet the material performance requirements of the AMS-DTL-23053/5 class 1 and meets the features in Airbus specification NSA 937201. The compound is also UL224 and CSA compliant. Ideal for aerospace, military, industrial and energy applications. The marker sleeves meets the mark permanence requirements of AS5942 and MIL 202 Method 215K	EN 60684-3-209 NFPA 130 UL224 CSA 22.2 No. 198- SAE-AMS-DTL-23053/5 SAE AS 5942 MIL-STD-202F method 215 AMS-DTL-23053/5 AIRBUS NSA937201
WMX-WM89-WM109	ZH	The ZH heatshrink tubing is 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 meets Boeing BS 7239 for toxic gas generation M7 specification, and is classified with EN45545-2 Class HL3 requirement set R22 (interior) and R23 (exterior). R24 by test method EN ISO 4589-2, burning behavior determined by Oxygen Index only and be used without any restriction for any application. NFPA 130 & EN 60684-3-216 test report are available on request	EN 45545-2 HL3, R22/R23/R24 NFPA 130 EN 60684-3-216 LUL 1-085 A3 compliant BS 6853 (1999) cat 1a DIN5510-2 UNI CEI 11170-3 NF F 16 101 ASTM E 662, BSS 7239 SAE 5942 MIL-STD-202 method 215
WMX-WM89-WM109	LFH	The LFH printable heatshrink tubing is made of halogen-free flame retardant and low smoke heat shrinkable polyolefin tubing with ideal printing properties for identification purposes. The compound is excluded for halogens and offers excellent low fire hazard characteristics combined with minimal smoke emission.	UL224 CSA 22.2 No. 198- SAE AS 81531 / 5942 MIL-STD-202 method 215 EN50343 Annex H Section H.3
WMX-WM89-WM109	LFH-3X	The LFH printable heatshrink tubing is made of halogen-free flame retardant and low smoke heat shrinkable polyolefin tubing with ideal printing properties for identification purposes. The compound is excluded for halogens and offers excellent low fire hazard characteristics combined with minimal smoke emission.	UL224 CSA 22.2 No. 198- SAE AS 5942 MIL-STD-202 method 215 EN50343 Annex H Section H.3
WMX-WM89-WM109	HT	The HT printable heatshrink tubing is 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 5942 MIL-STD-202 method 215
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 railway 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 Class A & H UL224 SAE-AMS-DTL-23053/6 Class 1 SAE AS 5942 MIL-STD-202 method 215
WMX-WM89-WM109	AMD	The AMD printable heatshrink is 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.	NFPA 130 UL224 SAE-AMS-DTL-23053/5 Class 1 & 3 SAE AS 5942 MIL-STD-202 method 215
WMX-WM89-WM109	AMD-3X	The AMD printable heatshrink is 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.	NFPA 130 UL224 SAE-AMS-DTL-23053/5 SAE AS 5942 MIL-STD-202 method 215
WMX-WM89-WM109	3-1	The 3-1 flexible heatshrink tubing is made of flame retarded, heat shrinkable polyolefin tubing with ideal printability properties for identification purposes. The 3-1 tubing meets the requirements of a wide range of industrial standards such as SAE-AMS-DTL 23053/5 class 1 & 3. Yellow green version available. 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 5942 MIL-STD-202 method 215
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, which provides fluid resistance as per EN50343. The product meets rail standards EN50343 Appendix H and EN45545-2 requirement set R22/R23/R24 hazard level classification 1 and 2 and BS EN IEC 60684-3-216 . 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-R24 Chemical and Diesel Resistance: EN50343 annex H (section 6.6) MIL-STD-202 Method 215 Mark Permanence: EN50343 annex H (section 6.6) & SAE AS-5942

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.

## Ordering description

ORDERING DESCRIPTION EXAMPLES	STANDARD SPOOL SIZE	SUPPLIED DIAMETER		RECOVERED DIAMETER		RECOMMENDED USE RANGE (MIN-MAX)	
		meter	mm	inches	mm	inches	mm
Family-Tube Grade-3X-024-100-Colour	100 Meter - 328 Feet	2,4	3/32	0.8	0.031	0.8-1.9	0.032-0.075
Family-Tube Grade-3X-032-100-Colour	100 Meter - 328 Feet	3,2	1/8	1.0	0.039	1.1-2.6	0.044-0.105
Family-Tube Grade-3X-048-100-Colour	100 Meter - 328 Feet	4,8	3/16	1,6	0.063	1.7-4.0	0.069-0.160
Family-Tube Grade-3X-064-100-Colour	100 Meter - 328 Feet	6,4	1/4	2.4	0,094	2.3-5.4	0.091-0.215
Family-Tube Grade-3X-095-50-Colour	100 Meter - 328 Feet	9,5	3/8	3.2	0.126	3.4-8.1	0.137-0.320
Family-Tube Grade-3X-127-50-Colour	50 Meter - 164 Feet	12,7	1/2	4.8	0,189	4.6-10.7	0.183-0.425
Family-Tube Grade-3X-190-50-Colour	50 Meter - 164 Feet	19,0	3/4	6.4	0.250	6.9-16.2	0.275-0.640
Family-Tube Grade-3X-254-50-Colour	50 Meter - 164 Feet	25,4	1	8.4	0.331	9.2-21.5	0.366-0.850
Family-Tube Grade-3X-381-50-Colour	50 Meter - 164 Feet	38,1	1 1/2	12.7	0.500	20.9-33.0	0.825-1.300
Family-Tube Grade-3X-508-50-Colour	50 Meter - 164 Feet	50,8	2	24.4	0.708	27.9-44.9	1.100-1.750
Family-Tube Grade-3X-762-50-Colour	50 Meter - 164 Feet	76.2	3	25.4	1.0	45.0	1.75-3.54

## 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	Dialectrical 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 $\Omega$ -cm
ASTM D 635-HB - SAE-AMS-DTL-23053/5	Flammability resistance - Fire propagation
ASTM D E 662	Optical density of smoke ( $D_m$ ) 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. A0. 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 ( $D_m$ ) 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.
EN 60684-3	Flexible insulating sleeving - Part 3: Specifications for individual types of sleeving - Sheet 248: General purpose, heat-shrinkable, dual wall polyolefin sleeving, flame retarded, shrink ratios 2:1, 3:1, 4:1
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