LINK SOLUTIONS

ZH Continuous Medium Spools

Low Smoke 0-Halogen Flame-retardant Identification Sleeves

TECHNICAL DATA SHEET

Revision Number. 1
Last Edited 24. mar. 2020

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 emmisions 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.
ZH meets the NFPA 130 Standard.
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

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
NFPA 130
NF F 16-101
London Underground
1-085 A3
BOEING BSS 7239
UNI CEI 11170-3 (LR4)
DIN 5510-2
BS6853: 1999 vehicle catagory 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.

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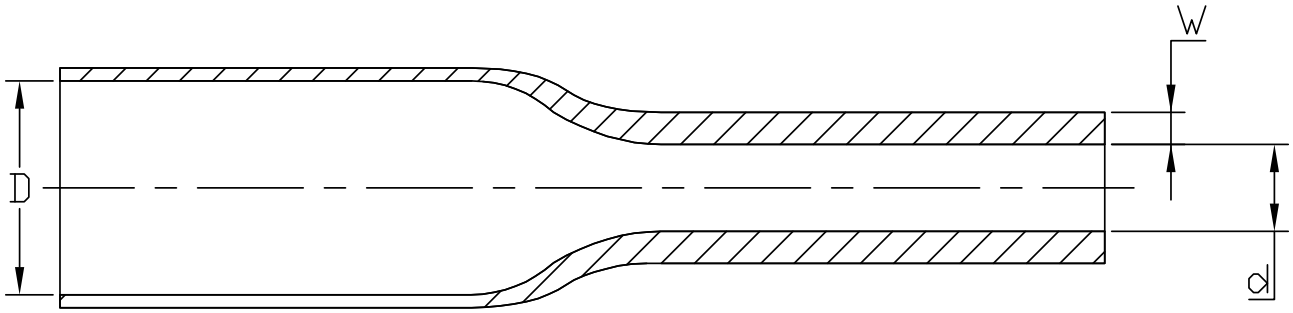
Product Dimensions

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"

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General Tests for Identification Products

PHYSICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Tensile strength	ASTM D 638	10.0 N/mm².
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/mm²
Volume resistivity	ASTM D 257	≥ 10^{14} Ω/cm

CHEMICAL

PROPERTIES	TEST METHOD	TYPICAL VALUE
Chemical resistance	EN 60684-2-36	Good - Pass
Copper corrosion	EN 60684-2-33	No chemical interaction: PASS
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_s)	ASTM E 662	Flaming mode 41 , non flaming mode 111
Smoke index	NF F 16-101	Smoke class F1
Surface Flammability of Materials - Flame Spread Index - Tested on 19.1 mm sleeve ???	ASTM E 162	Specified Maximum = 35
Heat and visible smoke release rate	ASTM E 1354	Average Heat Release Rate & Average specific Extinguishing area M^2 / kg at 3 minutes is measured
Generation of Toxic gases 3x3 inches sample burning in controlled setting	BSS 7239	Toxicity for CO, HF, HCN, HCl, SO2 and NOx in Combustion Gases

FIRE PROPAGATION COMPARISON

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BS 6853 - Superceded	1a	1a	1a	-	-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

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Fire behavior Standard Claasification 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	National Fire Protection Association	Usage Permitted upon agreement with end user
BSS 7239	Boeing	Usage Permitted upon agreement with end user

Compliance on fire behavior for Identification Products

TEST METHOD

STANDARDS	FLAME PROPAGATION FLAME SPREAD INDEX	TOXICITY	SMOKE OPTICAL DENSITY	LOW OXYGEN INDEX	HEAT AND VISIBLE SMOKE RELEASE
BS6853		BS 6853 appendix B1 or NF X-70-100	BS 6853 D8.3	ISO 4589-2	
NF F-16 101	NF EN 60-695-2	NF X 70-100	NF X 10-702-1 & 2	ISO 4589-2	
NFPA130	ASTM E 162	BSS 7239	ASTM E 662	N/A	ASTM E 1354
EN 45545-2		NF X 70-100 600°C	EN ISO 5659-2	ISO 4589-2	
DIN 5510-2	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.

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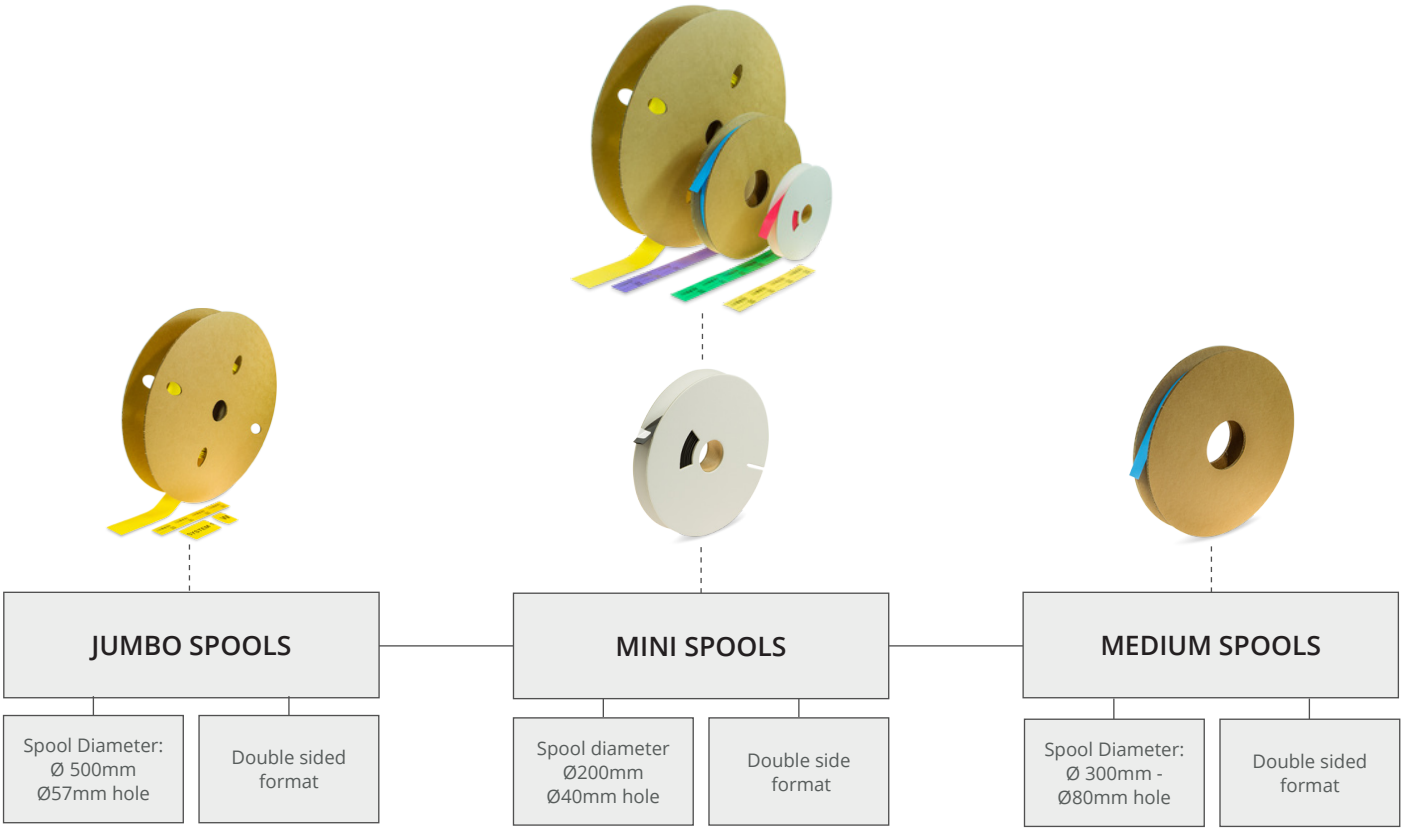
Available Formats



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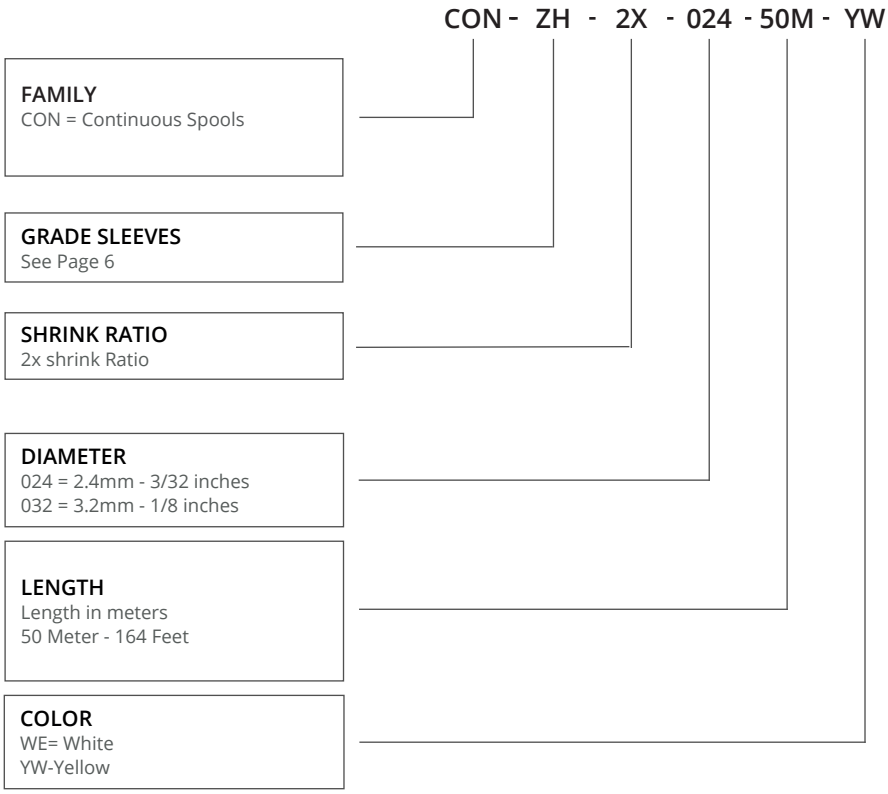
Product code



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

Other spool lengths on request - *

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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. C3 meets NFPA 130 requirements. The C3 material are fabrikated 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	NFPA 130 UL224 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 HL3, R22/R23 NFPA 130 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 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 CSA 22.2 No. 198- SAE AS 81531 / 5942 MIL-STD-202F method 215J 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 CSA 22.2 No. 198- 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 Class A & H UL224 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.	NFPA 130 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.	NFPA 130 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

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Ordering description example medium spools ZH grade

ORDERING DESCRIPTION EXAMPLES	STANDARD SPOOL SIZE	SUPPLIED DIAMETER		RECOVERED DIAMETER		RECOMMENDED USE RANGE (MIN-MAX)	
	Meter	mm	inches	mm	inches	mm	inches
Family-Tube Grade-2X-024-50M-Colour	50 Meter - 164 Feet	2,4	3/32	1,2	0.047	0.8-1.9	0.032-0.075
Family-Tube Grade-2X-032-50M-Colour	50 Meter - 164 Feet	3,2	1/8	1.6	0.063	1.1-2.6	0.044-0.105
Family-Tube Grade-2X-048-50M-Colour	50 Meter - 164 Feet	4,8	3/16	2,4	0.094	1.7-4.0	0.069-0.160
Family-Tube Grade-2X-064-50M-Colour	50 Meter - 164 Feet	6,4	1/4	3,2	0,0126	2.3-5.4	0.091-0.215
Family-Tube Grade-2X-095-50M-Colour	50 Meter - 164 Feet	9,5	3/8	4,8	0.189	3.4-8.1	0.137-0.320
Family-Tube Grade-2X-127-25M-Colour	25 Meter - 82 Feet	12,7	1/2	6,4	0,250	4.6-10.7	0.183-0.425
Family-Tube Grade-2X-190-25M-Colour	25 Meter - 82 Feet	19,0	3/4	9,5	0.374	6.9-16.2	0.275-0.640
Family-Tube Grade-2X-254-25M-Colour	25 Meter - 82 Feet	25,4	1	12,7	0.500	9.2-21.5	0.366-0.850
Family-Tube Grade-2X-381-25M-Colour	25 Meter - 82 Feet	38,1	1 1/2	19,1	0.750	20.9-33.0	0.825-1.300
Family-Tube Grade-2X-508-25M-Colour	25 Meter - 82 Feet	50,8	2	25,4	1	27.9-44.9	1.100-1.750

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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	Longtitudinal change
ASTM D2671 (Section 79-80) ASTM D570	Water absoption. 2 Maximum
ASTM D149	Dialectrical strength. 20 minimum
ASTM D2671B replaced by EN 60684-2-33	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 -	Flamiability resistance - Fire propagation
ASTM D E 662	Optical density of smoke generated by solid matrials, ($D_{s)}$ measured in flaming mode and non flaming mode in single smoke chamber test.
ASTM D E 162	Flame Spread Index . Surface Flammability of Materials Using a Radiant Heat Energy Source
ASTM D E 1354	Heat and Visible Smoke Release Rates of Materials and Products using an Oxygen Comsumption (Cone) Caloriemeter
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 catagory 1a	Code of practice for fire precautions in the design and construction of passanger 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 ($D_{m)}$ 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 class. HL1,2 & 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.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 X 70-100: 1986	Fire tests analasis of pyrolysis and cumbustion 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 calclulate 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
NFPA 130	National Fire Protection Association. Standard for fixed guideway transit and passenger rail systems This tandard specifies fire protection and life safety requirements for underground, surface and elevated fixed guideway transit and passenger rail systems
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

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