

UL and CSA Low Smoke Zero Halogen Type LFMC (6700 Series)

Scope

This specification covers Kaf-Tech® LIQUID-TUFF™ LOW SMOKE ZERO HALOGEN (LSZH) UL Liquidtight Flexible Metal Conduit designed for use as a raceway for power, control and communication cables in accordance with Article 350 of the National Electric Code. The product is intended for applications where limiting smoke and toxic materials of combustion are important considerations. The product is Underwriters Laboratories Inc. (UL) Listed for use at 80°C (176°F) in a dry location, 60°C (140°F) in a wet location and 70°C (158°F) in an oily location. It is also UL Listed for direct burial, outdoor use, sunlight resistance and for -40°C (-40°F) low temperature applications. In addition the product is CSA certified for use at 75°C (167°F) in dry and oily locations and for minus -40°C (-40°F) low temperature applications. This Liquidtight Flexible Steel Conduit is manufactured and tested in accordance with Underwriters Laboratories Inc. Standard UL 360 and CSA Group Standard CSA C22.2 Number 56. The product carries the UL Listing Mark and the CSA Certification Mark. Underwriters Laboratories Inc. does not list any manufacturers Liquidtight Flexible Metal Conduit as being low smoke zero halogen.

Construction

The LIQUID-TUFF™ LSZH Liquidtight Flexible Metal Conduit shall be formed from zinc coated galvanized low carbon steel strip having a uniform width and thickness. There shall be a continuous bonding strip built into the conduit core for the 3/8 through 1-1/4 trade sizes. The construction shall be in accordance with UL 360 and CSA C22.2 Number 56 requirements. The finished LIQUID-TUFF™ LSZH Liquidtight Flexible Metal Conduit Type LFMC dimensions shall be in accordance with Table 5.1 of UL 360 and Table 2 of CSA C22.2 No. 56 which is summarized in Table 1.

CSA Certification pending

Jacket – TPU

A rugged low-smoke, moisture, oil, sunlight resistant and flame retardant thermoplastic polyurethane jacket shall be applied directly over the flexible metal conduit. The physical properties of the jacket material shall comply with the UL 360 Standard. The Low Smoke Zero Halogen jacket shall be tested to and comply with ASTM® E162 – Flame Spread Index, ASTM® E662 – Smoke Density Generation and Bombardier SMP-800C – Toxic Gas Generation. The test results are summarized in Table 2. Underwriters Laboratories Inc. (UL) does not list any manufacturers jacket compound as being low smoke zero halogen. The jacket wall thickness shall be in accordance with Table 4.1 of UL 360 and Table 4 of CSA C22.2 No.56 which is summarized in Table 1. Jacket: Black.

Grounding

Permanent circuit ground protection is provided through the continuous bonding strip built into the conduit core in trade sizes 3/8 through 1-1/4. A separate grounding conductor is required by the NEC® for all trade sizes 1-1/2 and larger. The Canadian Electric Code requires a grounding conductor for all trade sizes of Liquidtight Flexible Steel Conduit.

Markings

The surface of the outer jacket shall be clearly marked with a legible print legend in compliance with the UL 360 Standard and CSA C22.2 No. 56.

Performance Tests

In accordance with UL 360 and CSA C22.2 No. 56, the completed UL LIQUID-TUFF™ LSZH Liquidtight Flexible Steel Conduit shall meet all of the performance requirements outlined in Appendix A.

800-757-6996



Description

- Low smoke, zero halogen raceway
- Low toxicity generation characteristics
- Hot dipped zinc galvanized low carbon steel core
- Excellent temperature ratings
- Black thermoplastic polyurethane jacket
- UL bonding strip 3/8 – 1-1/4 for grounding
- Sunlight resistant
- Flame retardant TPU jacket

Temperature Rating

- 80°C (176°F) DRY
- 60°C (140°F) WET
- 70°C (158°F) OIL RESISTANT
- -40°C (-40°F) LOW TEMPERATURE

Applications

Suitable for use in:

- NEC® 350 Liquidtight Flexible Metal Conduit Type LFMC
- Wet Locations
- Direct Burial in earth
- Concrete Embedment
- Exposure to Sunlight and Weather
- Grounding in 3/8 to 1-1/4 trade sizes per NEC® 250.118(6)
- Service Entrance Wiring up to 6 feet per NEC® 230.43(15)
- Connections to Cabinets and Wall Outlets in Underfloor Raceways per NEC® 390.15
- Cable Trays per NEC® 392.10(A) and Table 392.10(A) Wiring Methods
- Flexible Connections in Hazardous Locations: Class I Div 2 NEC® 501.10(B)(2)(4), Class II Div 1 NEC® 502.10(A)(2)(2), Class II Div 2 NEC® 502.10(B)(2), Class III Div 1 NEC® 503.10(A)(3)(2) and Class III Div 2 NEC® 503.10(B)
- Wiring in Spaces Above Class I Locations per NEC® 511.7(A)(1)
- Raised Computer Room Floors per NEC® 645.5(E)(1)(b)(11)
- Feeders and services where flexible connections are required in Floating Buildings per NEC® 553.7(B)
- Marinas and Boatyards per NEC® 555.13(A)(1)
- Electric Signs and Outdoor Lighting per NEC® 600.31(A) and 600.32(A)(1)
- Flexible Connections for hoists and cranes per NEC® 610.11(C)
- Wiring Elevators, Dumbwaiters, Escalators, Moving Walks, Platforms and Stairway Chairlifts per NEC® 620.21
- Motors for Permanently Installed Pools where Flexible Connections are required per NEC® 680.21(A)(2)
- Spas and Hot Tubs where Flexible Connections are required per NEC® 680.42(A)(1)
- Feeders for Natural and Artificially Made Bodies of Water where Flexible Connections are required per NEC® 682.13
- Solar Photovoltaic (PV) Systems per NEC® 690.31(A)
- Fire Pump Wiring per NEC® 695.6(D)
- Electric Fire Pump Control Wiring per NEC® 695.14(E)
- Non-plenum applications where reduced smoke and toxic materials of combustion is required

References & Ratings

- Underwriters Laboratories Inc. Standard: UL 360 File: E26540
- CSA Group: Standard: C22.2 No. 56 Master Contract No. 157782
- NFPA 70 NEC® Article 350
- UL Listed in all Trade Sizes for Direct Burial which includes Concrete Encasement
- Conduit in Trade Sizes 1 ½ and larger require an equipment grounding conductor per NEC® 350.60
- Compound meets UL 94 with a V-0 Rating and No Flaming Drips
- Meets the requirements of the UL 360 Vertical Flame Test
- Meets the requirements of ASTM® E 162 Flame Spread Index passing with No Flaming Drips
- Meets the requirements of ASTM® E 662 Flaming and Non-Flaming Smoke Generation passing with No Flaming Drips
- Meets Bombardier SMP-800C requirements for Toxic Gas Generation

CSA Certification pending

Reference Standards	
UL 360	Standard for Liquidtight Flexible Metal Conduit
CSA C22.2 No. 56	Standard for Flexible Metal Conduit and Liquidtight Flexible Metal Conduit
UL 514B	Standard for Conduit, Tubing and Cable Fittings
UL 94	Standard Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
NFPA 70	National Electric Code (NEC®) Articles 250, 230, 350, 390, 392, 501, 502, 503, 511, 553, 555, 600, 610, 620, 645, 680, 682, 690 and 695
NEMA RV 3	Application and Installation Guidelines for Flexible and Liquidtight Flexible Metal Conduits
ASTM® E162	Standard Test Method for Surface Flammability
ASTM® E 662	Standard Test Method for Specific Optical Density
SMP 800-C	Bombardier Toxic Gas Generation

TABLE 1.

ORDERING INFORMATION						PRODUCT DIMENSIONS/BEND RADIUS			
Product Code	Trade Size	Metric Designator	Coil Length (feet)	Reel Length (feet)	Approx. Weight/100 feet (pounds)	Min. Average Thickness of Jacket (inches)	Internal Diameter (min/max) inches	Over Jacket (min/max) (inches)	Bend Radius (inches)
6701-30-00	3/8	12	100	–	24	0.03	0.484/0.504	0.690/0.710	2
6702-30-00	1/2	16	100	–	31	0.03	0.622/0.642	0.820/0.840	3.25
6702-45-00	1/2	16	–	500	31	0.03	0.622/0.642	0.820/0.840	3.25
6702-60-00	1/2	16	–	1000	31	0.03	0.622/0.642	0.820/0.840	3.25
6703-30-00	3/4	21	100	–	47	0.035	0.820/0.840	1.030/1.050	4.25
6703-45-00	3/4	21	–	500	47	0.035	0.820/0.840	1.030/1.050	4.25
6703-60-00	3/4	21	–	1000	47	0.035	0.820/0.840	1.030/1.050	4.25
6704-30-00	1	27	100	–	78	0.035	1.041/1.066	1.290/1.315	6.5
6704-41-00	1	27	–	400	78	0.035	1.041/1.066	1.290/1.315	6.5
6705-24-00	1-1/4	35	50	–	102	0.035	1.380/1.410	1.630/1.660	8
6705-40-00	1-1/4	35	–	200	102	0.035	1.380/1.410	1.630/1.660	8
6706-24-00	1-1/2	41	50	–	107	0.04	1.575/1.600	1.865/1.900	9
6707-24-00	2	53	50	–	144	0.04	2.020/2.045	2.340/2.375	11.12

NOTE: All dimensions and weights are subject to normal manufacturing tolerances. Not listed for grounding. Larger trade sizes and other colors are available. Please inquire.

Table 2. LIQUID-TUFF™ LSZH Combustion and Flammability Properties

Property	Test	Results
Vertical Burn (Material)	UL 94	UL Listed: V-0 Rating No Flaming Drips
Vertical Burn (Conduit)	UL 360	UL Listed: Passed
Oxygen Index % (Material)	ASTM® D 2863	25%
Flame Spread Index	ASTM® E-162	Passed No Flaming Drips
Smoke Generation (Flaming)	ASTM® E662 (NFPA-258)	Ds=13 @ 1.5 min Ds=57 @ 4.0 min No Flaming Drips
Smoke Generation (Non-flaming)	ASTM® E662 (NFPA-258)	Ds=1 @ 1.5 min Ds=8 @ 4.0 min No Flaming Drips
Toxic Gas Generation	Bombardier SMP-800C	Pass

Testing performed by independent test laboratory. Test results available upon request.

Appendix A

UL Performance Tests	CSA Performance Tests
UL 360 Standard	CSA C22.2 NO. 56 STANDARD
RESISTANCE TEST	-
FAULT CURRENT	-
IMPACT	-
	COLD IMPACT
TENSION	TENSION
CRUSHING	-
PIPE STIFFNESS for DIRECT BURIAL	PIPE STIFFNESS for DIRECT BURIAL
ROOM TEMPERATURE FLEXIBILITY	-
LOW TEMPERATURE FLEXIBILITY	LOW TEMPERATURE FLEXIBILITY
ZINC COATING	ZINC COATING
VERTICAL FLAME	VERTICAL FLAME
PHYSICAL PROPERTIES of JACKET	PHYSICAL PROPERTIES of JACKET
ORIGINAL TENSILE and ELONGATION	ORIGINAL TENSILE and ELONGATION
AIR OVEN AGING TESTS	AIR OVEN AGING TESTS
OIL IMMERSION in AIR OVEN TESTS	OIL IMMERSION in AIR OVEN TESTS
DEFORMATION TEST	DEFORMATION TEST
MECHANICAL WATER ABSORPTION	-
MOISTURE PENETRATION	-
SUNLIGHT RESISTANCE	-
TEST for SECURENESS of FITTINGS	COMPATIBILITY with CONNECTORS
TEST for DURABILITY of INK PRINTING	-
	PINHOLE TEST