

LSZH Flame Retardant Cables

0.6/1kV Multi-Core

XLPE Insulated, Unarmoured & Armoured, LSZH Sheathed Cable

Description: CU/XLPE/LSZH-AT-UV or CU/XLPE/LSZH/SWA/LSZH-AT-UV

Model Code: XL-AT-UV or XLSL-AT-UV



Application :	This cable is mainly used in power stations, mass transit underground passenger systems, airports, petrochemical plants, hotels, hospitals, and high-rise buildings.
Voltage rating :	0.6/1kV
Construction :	Plain annealed copper (IEC 60228 Class 2), XLPE compound insulated, unarmoured or galvanized steel wires armoured, anti-termite and UV resistant LSZH compound sheathed cable
Insulation colour :	White (With black numbering)
Sheath colour :	Black
Specification :	IEC 60502-1, BS 6724, IEC 60332-1-2, IEC 60332-3, IEC 60754, IEC 61034-2
Operating temperature :	90°C

No. of Core	Conductor		Insulation	Unarmoured Cable			Armoured Cable		
	Nominal Area	No./Diam. of Strand	Thickness	Part No.	Approx. Overall Diam.	Approx. Weight	Part No.	Approx. Overall Diam.	Approx. Weight
	(mm²)	(no./mm)	(mm)		(mm)	(kg/km)		(mm)	(kg/km)
5	1.5	7/0.53	0.7	07056478	12.8	215	07056284	16.5	497
7				07076478	13.7	260	07076284	17.5	565
10				07106478	16.8	365	07106284	21.5	850
12				07126478	17.3	405	07126284	22.0	905
19				07196478	19.9	570	07196284	24.7	1150
27				07276478	23.5	770	07276284	29.5	1624
37				07376478	26.1	1000	07376284	32.0	1940
48				07486478	30.3	1255	07486284	36.5	2384
5	2.5	7/0.67	0.7	08056478	13.8	280	08056284	18.0	583
7				08076478	14.9	350	08076284	20.1	787
10				08106478	18.4	485	08106284	23.7	1011
12				08126478	19.0	545	08126284	24.6	1096
19				08196478	21.9	780	08196284	28.2	1570
27				08276478	25.9	1060	08276284	32.3	2000
37				08376478	29.5	1380	08376284	36.0	2470
48				08486478	33.7	1770	08486284	41.6	3340
5	4	7/0.85	0.7	09056478	15.4	375	09056284	20.8	812
7				09076478	16.7	476	09076284	22.1	957
10				09106478	20.8	670	09106284	27.0	1400
12				09126478	21.5	760	09126284	27.6	1510
19				09196478	24.9	1105	09196284	31.2	2000
27				09276478	30.2	1520	09276284	36.4	2630
37				09376478	33.9	2000	09376284	41.5	3580
48				09486478	39.0	2600	09486284	46.4	4370

Current rating and voltage drop

For Unarmoured Cable, please refer to Table 12 & 13 (Page 56)

For Armoured Cable, please refer to Table 14 & 15 (Page 57)

For Rating Factors, please refer to Table 26 (Page 63)

TESTS

Flame Propagation Tests (IEC 60332, BS EN 60332)

Tests on Electric Cables under Fire Conditions

Part 1 : Tests on a single vertical insulated wire or cable
Part 3 : Tests on bunched wires and cables under fire condition

Flame retardant cables prevent flame propagation during a fire emergency. Our cable's protective material includes additives such as aluminium hydroxide or magnesium hydroxide. When the protective materials comes into contact with fire, the by-product from the endothermic reaction is gaseous water which will help envelop the flame, and thereby exclude oxygen from the fire.



In this reaction, the decomposition products are non-toxic and the mineral phases MgO and Al₂O₃ are alkaline, reducing the likelihood of acidic, corrosive gases exiting the plastic. This ensures higher levels of safety.

This test is also conducted on both a single cable as well as bunched vertical cables. This is because flame propagation along a vertical bunch of cables depends on other factors such as the volume of combustible material exposed and cables' geometrical configuration, which differ across single and bunched cables.

The IEC 60332-3 specifies methods for assessing flame retardance of bunched cables comprising of varying densities of combustible material.

IEC 60332-3	Total volume of non-metallic material in the bunched cables on a vertical ladder	Duration exposed to flame
	(litres)	(mins)
IEC 60332-3-22 (Cat. A)	7	40
IEC 60332-3-23 (Cat. B)	3.5	40
IEC 60332-3-24 (Cat. C)	1.5	20

Passing criteria: After the burning has ceased, the charred portion should not exceed a height of 2.5 meters.

Acid Gas Emission Tests (IEC 60754, BS EN 60754)

Test on Gases Evolved During Combustion of Materials from Cables

When fire comes into contact with polyvinyl chloride (PVC) or chlorine-containing material, hydrogen chloride gas (HCl) is released. The HCl gas could cause irritation to the eyes, mouth, throat, nose, and lungs. At Keystone Cable, all our fire resistant and flame retardant cables use Low Smoke Zero Halogen (LSZH) compounds to prevent the formation of HCl gases from the burning of cables.

The standards determine the degree of acidity of gases evolved during the combustion of cable materials by measuring pH and conductivity.

Passing Criteria: The weighted pH value is not less than 4.3 when related to 1 litre of water, and the weighted value of conductivity is not more than 10µS/mm when related to 1 litre of water.

Smoke Emission Tests (IEC 61034, BS EN 61034)

Measurement of Smoke Density of Electric Cables Burning under Defined Conditions

The "3-meter cube test" measures the amount of smoke generated by cables in the event of a fire. The cables are placed in a 3m³ enclosure. A beam of light is transmitted from one window of the chamber to the opposite window. The cables are subjected to fire in the chamber, and the light transmission is recorded.

Passing Criteria: A minimum light transmission value of 60%.

Fire Resistant Tests (SS 299, BS 6387, IEC 60331)

Specification for Performance Requirements for Cables Required to Maintain Circuit Integrity under Fire Conditions

During fire evacuations, it is important for critical electrical installations including fire alarms, smoke detectors, sprinklers, emergency lightings, and exit lights to function optimally. At Keystone Cable, we conduct these stringent tests by simulating the environment for our fire resistant cables to ensure that they pass the safety requirements and will perform during such emergencies. The protocol letter assigned to the cable reflects the level of testing the cable has gone through and passed.

SS 299:2021, BS 6387:2013 are recognised as the stringent fire resistant test standards for power cables.

Resistance to Fire Alone (SS 299:2021, BS 6387:2013)

Protocol C	Cables are subjected to fire at 950°C for 3 hours
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Resistance to Fire with Water (SS 299:2021, BS 6387:2013)

Protocol W	Cables are subjected to fire at 650°C for 15 minutes, then at 650°C with water spray for another 15 minutes.
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Resistance to Fire with Mechanical Shock (SS 299:2021, BS 6387:2013)

Protocol Z	Cables are subjected to fire at 950°C for 15 minutes with mechanical shock applied every 30s.
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IEC 60331-21 is commonly used as a basic fire resistant test standard.

Resistance to Fire Alone (IEC 60331-21 for common test)

	Cables are subjected to fire at 750°C for 90 minutes
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SS 299:2021 does not specify the essential construction standard and test requirement for small power, instrument, and control cables of less than 0.6/1kV. Based on market's requirement, SS 299-1:1998 will be used for these cables to test circuit integrity accordingly.

Resistance to Fire Alone (SS 299 Part 1:1998)

Category A	Cables are subjected to fire at 650°C for 3 hours
Category B	Cables are subjected to fire at 750°C for 3 hours
Category C	Cables are subjected to fire at 950°C for 3 hours

Resistance to Fire with Water (SS 299 Part 1:1998)

Category W	Cables are subjected to fire at 650°C for 15 minutes, then at 650°C with water spray for another 15 minutes.
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Resistance to Fire with Mechanical Shock (SS 299 Part 1:1998)

Category X	Cables are subjected to fire at 650°C for 15 minutes with mechanical shock applied every 30s.
Category Y	Cables are subjected to fire at 750°C for 15 minutes with mechanical shock applied every 30s.
Category Z	Cables are subjected to fire at 950°C for 15 minutes with mechanical shock applied every 30s.

Passing criteria: No short circuit during the respective testing period.

Current Rating and Voltage Drop

XLPE (or LSZH) Insulated Cables
Multi-Core, Unarmoured



tel (65) 6367 0107 fax (65) 6365 2963
www.keystone-cable.com

Multi-Core Cables with XLPE (or LSZH) Insulation, PVC (or LSZH) Outersheath 300/500V or 0.6/1kV

Table 12 : Current-Carrying Capacities (Amp)
[CU/XLPE/PVC, CU/XLPE/LSZH or CU/MT/XLPE/LSZH Cables]

Conductor Operating Temperature : 90°C
Ambient Temperature : 30°C

IEC 60502-1

Conductor Cross-sectional Area	Reference Method 4 (enclosed in an conduit insulated wall etc)	Reference Method 3 (enclosed in conduit on a wall or ceiling, or in trunking)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray), or Reference Method 13 (in free air)	
	one 3-core or 4-core cable, 3-phase a.c.	one 2-core cable, 1-phase a.c. or d.c.	one 3-core or 4-core cable, 3-phase a.c.	one 2-core cable, 1-phase a.c. or d.c.	one 3-core or 4-core cable, 3-phase a.c.	one 2-core cable, 1-phase a.c. or d.c.	one 3-core or 4-core cable, 3-phase a.c.
1	2	3	4	5	6	7	8
mm ²	A	A	A	A	A	A	A
1.5	16.5	22	19.5	24	22	26	23
2.5	22	30	26	33	30	36	32
4	30	40	35	45	40	49	42
6	38	51	44	58	52	63	54
10	51	69	60	80	71	86	75
16	68	91	80	107	96	115	100
25	89	119	105	138	119	149	127
35	109	146	128	171	147	185	158
50	130	175	154	209	179	225	192
70	164	221	194	269	229	289	246
95	197	265	233	328	278	352	298
120	227	305	268	382	322	410	346
150	259	334	300	441	371	473	399
185	295	384	340	506	424	542	456
240	346	459	398	599	500	641	538
300	396	532	455	693	576	741	621
400	472	625	536	803	667	865	741

Note : For rating factors of ambient temperature other than 30°C, please refer to Table 23 (Page 62)

Table 13 : Voltage Drop (Per Amp Per Meter)
[CU/XLPE/PVC, CU/XLPE/LSZH or CU/MT/XLPE/LSZH Cables]

Conductor Operating Temperature : 90°C

IEC 60502-1

Conductor Cross-sectional Area	2-core cable, d.c.	2-core cable, 1-phase a.c.			3-core or 4-core cables, 3-phase a.c.		
1	2	3			4		
mm ²	mV/A/m	mV/A/m			mV/A/m		
1.5	31	31			27		
2.5	19	19			16		
4	12	12			10		
6	7.9	7.9			6.8		
10	4.7	4.7			4.0		
16	2.9	2.9			2.5		
		r	x	z	r	x	z
25	1.85	1.85	0.160	1.90	1.60	0.140	1.65
35	1.35	1.35	0.155	1.35	1.15	0.135	1.15
50	0.98	0.99	0.155	1.00	0.86	0.135	0.87
70	0.67	0.67	0.150	0.69	0.59	0.130	0.60
95	0.49	0.50	0.150	0.52	0.43	0.130	0.45
120	0.39	0.40	0.145	0.42	0.34	0.130	0.37
150	0.31	0.32	0.145	0.35	0.28	0.125	0.30
185	0.25	0.26	0.145	0.29	0.22	0.125	0.26
240	0.195	0.200	0.140	0.24	0.175	0.125	0.21
300	0.155	0.160	0.140	0.21	0.140	0.120	0.185
400	0.120	0.130	0.140	0.190	0.115	0.120	0.165

Note : r = resistive component; x = reactive component; z = impedance value

Current Rating and Voltage Drop

XLPE (or LSZH) Insulated Cables
Multi-Core, Armoured



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www.keystone-cable.com

Multi-Core Cables with XLPE (or LSZH) Insulation, Armoured, PVC or LSZH Outersheath 0.6/1kV

Table 14 : Current-Carrying Capacities (Amp)
[CU/XLPE/PVC/SWA/PVC, CU/XLPE/LSZH/SWA/LSZH, CU/MT/XLPE/LSZH/SWA/LSZH Cables]

Conductor Operating Temperature : 90°C

Ambient Temperature : 30°C

Ground Temperature : 15°C

Depth of Laying : 0.5m

Soil Thermal Resistivity : 1.2 k•m/W

BS 6724

IEC 60502-1

Conductor Cross-sectional Area	Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated horizontal cable tray) or Reference Method 13 (in free air)		In single-way ducts		Laid direct in ground	
	one 2-core cable, 1-phase a.c. or d.c.	one 3-core or 4-core cable, 3-phase a.c.	one 2-core cable, 1-phase a.c. or d.c.	one 3-core or 4-core cable, 3-phase a.c.	one 2-core cable, 1-phase a.c. or d.c.	one 3-core or 4-core cable, 3-phase a.c.	one 2-core cable, 1-phase a.c. or d.c.	one 3-core or 4-core cable, 3-phase a.c.
1	2	3	4	5	6	7	8	9
mm ²	A	A	A	A	A	A	A	A
1.5	27	23	29	25	-	23	-	28
2.5	36	31	39	33	-	30	-	36
4	49	42	52	44	-	40	-	48
6	62	53	66	56	-	50	-	60
10	85	73	90	78	-	65	-	80
16	110	94	115	99	115	94	140	115
25	146	124	152	131	145	125	180	150
35	180	154	188	162	175	150	215	180
50	219	187	228	197	210	175	255	215
70	279	238	291	251	260	215	315	265
95	338	289	354	304	310	260	380	315
120	392	335	410	353	355	300	430	360
150	451	386	472	406	400	335	480	405
185	515	441	539	463	455	380	540	460
240	607	520	636	546	520	440	630	530
300	698	599	732	628	590	495	700	590
400	787	673	847	728	660	560	790	670

Note : For rating factors of ambient temperature other than 30°C, please refer to Table 23 (Page 62)
For rating factors of ground temperature other than 15°C, please refer to Table 24 (Page 62)

Table 15 : Voltage Drop (Per Amp Per Meter)
[CU/XLPE/PVC/SWA/PVC, CU/XLPE/LSZH/SWA/LSZH, CU/MT/XLPE/LSZH/SWA/LSZH Cables]

Conductor Operating Temperature : 90°C

BS 6724

IEC 60502-1

Conductor Cross-sectional Area	2-core cable, d.c.	2-core cables, 1-phase a.c.			3-core or 4-core cables, 3-phase a.c.			2-core cables, 1-phase a.c.	3-core or 4-core cables, 3-phase a.c.
								In ducts or in ground	In ducts or in ground
1	2	3			4			5	6
mm ²	mV/A/m	mV/A/m			mV/A/m			mV/A/m	mV/A/m
1.5	31.0	31.0			27.0			31.0	25.0
2.5	19.0	19.0			16.0			19.0	15.0
4	12.0	12.0			10.0			12.0	9.7
6	7.9	7.9			6.8			7.9	6.5
10	4.7	4.7			4.0			4.7	3.9
16	2.9	2.9			2.5			2.9	2.6
		r	x	z	r	x	z		
25	1.850	1.850	0.160	1.900	1.600	0.140	1.650	1.900	1.600
35	1.350	1.350	0.155	1.350	1.150	0.135	1.150	1.350	1.200
50	0.980	0.990	0.155	1.000	0.860	0.135	0.870	1.000	0.870
70	0.670	0.670	0.150	0.690	0.590	0.130	0.600	0.690	0.610
95	0.490	0.500	0.150	0.520	0.430	0.130	0.450	0.520	0.450
120	0.390	0.400	0.145	0.420	0.340	0.130	0.370	0.420	0.360
150	0.310	0.320	0.145	0.350	0.280	0.125	0.300	0.350	0.300
185	0.250	0.260	0.145	0.290	0.220	0.125	0.260	0.290	0.250
240	0.195	0.200	0.140	0.240	0.175	0.125	0.210	0.240	0.210
300	0.155	0.160	0.140	0.210	0.140	0.120	0.185	0.210	0.190
400	0.120	0.130	0.140	0.190	0.115	0.120	0.165	0.190	0.180

Note : r = resistive component; x = reactive component; z = impedance value

Table 23 : Correction Factor for Ambient Air Temperature Other Than 30°C to be Applied to the Current-Carrying Capacities for Cables in Free Air

Ambient Temperature (°C)	Insulation				
	PVC (70°C)	XLPE (90°C)	HT-PVC (90°C)	Rubber (85°C)	Rubber (60°C)
10	1.22	1.15	-	-	-
15	1.17	1.12	-	-	-
20	1.12	1.08	-	-	-
25	1.06	1.04	1.03	1.02	-
30	1.00	1.00	1.00	1.00	1.00
35	0.94	0.96	0.97	0.95	0.91
40	0.87	0.91	0.94	0.90	0.82
45	0.79	0.87	0.91	0.85	0.71
50	0.71	0.82	0.87	0.80	0.58
55	0.61	0.76	0.84	0.74	0.41
60	0.50	0.71	0.80	0.67	-
65	0.35	0.65	0.76	0.60	-
70	-	0.58	0.71	0.52	-
75	-	0.50	0.61	0.43	-
80	-	0.41	0.50	0.30	-
85	-	0.29	0.35	-	-

Table 24 : Correction Factor for Ambient Ground Temperature Other Than 15°C to be Applied to the Current-Carrying Capacities for Cables in Ducts or in Ground

Ground Temperature (°C)	Insulation	
	PVC (70°C)	XLPE (90°C)
10	1.04	1.03
15	1.00	1.00
20	0.95	0.97
25	0.90	0.93
30	0.85	0.89
35	0.80	0.86
40	0.74	0.82
45	0.67	0.77
50	0.60	0.73
55	-	0.68
60	-	0.63
65	-	0.58

Table 25 : Correction Factors for Ambient Temperature & Group Installation

Correction for groups of more than one circuit of single-core cables, or more than one multi-core cable

Reference Methods of Installation		Correction Factor (Cg)													
		Number of Circuits or Multi-Core Cables													
		2	3	4	5	6	7	8	9	10	12	14	16	18	20
Enclosed (Method 3 or 4) or bunched and clipped to a non-metallic surface (Method 1)		0.80	0.70	0.65	0.60	0.57	0.54	0.52	0.50	0.48	0.45	0.43	0.41	0.39	0.38
Single layer clipped to a non-metallic surface (Method 1)	Touching	0.85	0.79	0.75	0.73	0.72	0.72	0.71	0.70	-	-	-	-	-	-
	Spaced*	0.94	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Single layer multi-core on a perforated metal cable tray (Method 11)	Touching	0.86	0.81	0.77	0.75	0.74	0.73	0.73	0.72	0.71	0.70	-	-	-	-
	Spaced*	0.91	0.89	0.88	0.87	0.87	-	-	-	-	-	-	-	-	-
Single layer single-core on a perforated metal cable tray, touching (Method 11)	Horizontal	0.90	0.85	-	-	-	-	-	-	-	-	-	-	-	-
	Vertical	0.85	-	-	-	-	-	-	-	-	-	-	-	-	-
Single layer multi-core touching on ladder supports		0.86	0.82	0.80	0.79	0.78	0.78	0.78	0.77	-	-	-	-	-	-

* Space means a clearance between adjacent surfaces of at least one cable Diam. (D_e). Where the horizontal clearance between adjacent cables exceeds 2 D_e, no correction factor need be applied

Note : 1 The factors in the table are applicable to a group of cables all of the same sizes. The value of the current derived from application of the appropriate factors is the maximum continuous current to be carried by any of the cables in the group.

2 If, due to known operating conditions, a cable is expected to carry not more than 30% of its grouped rating, it may be ignored for the purpose of obtaining the rating factor for the rest of the group.

For example, a group of N loaded cables would normally require a group reduction factor of C_g applied to the tabulated I_t. However, if M cables in the group carry loads which are not greater than 0.3C_g I_t amperes, the other cables can be sized by using the group rating factor corresponding to (N-M) cables.

Table 26 : Correction Factor for Cables with More Than 4 Loaded Cores

No. of Loaded Cores	5	6	7	10	12	14	19
Correction Factor	0.72	0.67	0.63	0.56	0.53	0.51	0.45
No. of Loaded Cores	24	27	30	37	44	46	48
Correction Factor	0.42	0.40	0.39	0.36	0.34	0.33	0.33

Note: 1. The current-carrying capacity for a cable in the size range 1.5 to 4mm², having more than 4 loaded cores, is obtained by multiplying the current-carrying capacity of a 2-core, having the same installation type, by the factor selected from this table. The current-carrying for the 2-core cable is that for the installation condition to be used for the multi-core cable.

2. If due to known operating conditions, a core is expected to carry not more than 30% of its current-carrying capacity in the multi-core cable, it may be ignored for the purpose of obtaining the correction factor for the number of loaded cores.

3. If due to known operating conditions, a core is expected to carry not more than 30% of its rating, after applying the correction factor for the total number of current-carrying cores, it may be ignored for the purpose of obtaining the correction factor for the number of loaded cores.

For example, the current-carrying capacity of a cable having N loaded cores would normally be obtained by multiplying the current-carrying capacity of a 2-core, having the same insulation type, by the factor selected from this table for N cores. That is $I_{z1c} = I_{z2c} \times C_{gN}$ where:

I_{z1c} is the current-carrying capacity for the multi-core cable after applying the correction factor for the total number of current-carrying cores.

I_{z2c} is the tabulated current-carrying capacity of a 2-core cable, having the same insulation type as the multi-core cable.

C_{gN} is the correction factor from Table 26 for the total number of current-carrying cores.

However, if M cores in the cable carry loads which are not greater than $0.3 \times I_{z2c} \times C_{gN}$, the current-carrying capacity can be obtained by using the correction factor corresponding to (N-M) cores.

The 'not greater than $0.3 \times I_{z2c} \times C_{gN}$ ' calculation should be applied before the adjacent multi-core cable grouping factor, if applicable, from Table 23 from BS 7671. The 30% rule should not be further applied to any adjacent cable grouping factor calculations.

I_{z1c} should be greater than or equal to I_n or I_b as appropriate, divided by the relevant correction factor(s) C, that is $I_{z1c} \geq I_n$ or I_b / C