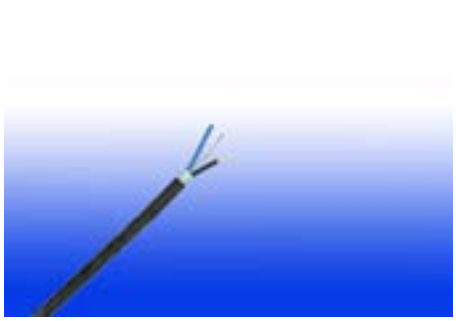
Caledonian

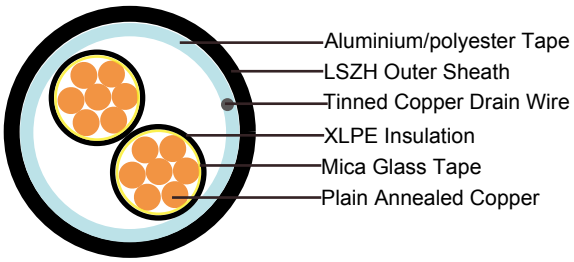
EN 50288-7
Fire resistant
Instrumentation Cables

TABLE OF CONTENTS

Fire Resistant Overall Screened Instrumentation Cables (Multicore)

RE-2X(St)H...CI





APPLICATION

The LSZH sheathed cables are generally used for indoor installation and suitable for wet and damp areas. Generally, the cables are used within industrial process manufacturing plants for communication, data and voice transmission signals and services. Also used for the interconnection of electrical equipment and instruments, the LSZH sheath can reduce toxic smoke and fume emission.

STANDARDS

Basic design to BS EN 50288-7 (formerly BS 5308)

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ (Optional); BS EN 50200 (PH30/PH60/PH120)
Flame Retardance (Single vertical wire or cable test)	IEC 60332-1-2; EN 60332-1-2
Reduced Fire Propagation (Vertically-mounted bundled wires & cables test)	IEC 60332-3-24; EN 60332-3-24
Halogen Free	IEC 60754-1; EN 50267-2-1
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2
Minimum Smoke Emission	IEC 61034-2; EN 61034-2

VOLTAGE RATING

300, 500V

CABLE CONSTRUCTION

Conductor: Plain or metal coated copper wire, solid, stranded or flexible according to IEC 60228 class 1, 2 and class 5.
Fire Barrier: Mica glass tape.
Insulation: Extruded XLPE compound according to EN 50290-2-29. LSZH, PE, PP compound can be offered as options.
Overall Screen: Aluminium/polyester tape is applied over the laid up cores with metallic side down in contact with tinned copper drain wire, 0.5mm². Copper braid screen or aluminium/polyester tape combined with copper braid screen can be offered as option.

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Outer Sheath: Halogen free flame retardant compound to EN 50290-2-27.

Outer Sheath Option: UV resistance, hydrocarbon resistance, oil resistance, anti-rodent and anti-termite properties can be offered as option.

COLOUR CODE

Insulation Colour: Colours and/or additional ring markings and/or symbols achieved by the use of coloured insulation or by a coloured surface using extrusion, printing or painting.

Outer Sheath: Black. Other colours can be offered upon request.

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation: -30°C - +90°C

Temperature range fixed installation: -5°C - +50°C

Maximum short circuit temperature (5 Seconds): 250°C

Minimum bending radius: 7.5 x Overall Diameter

ELECTRICAL PROPERTIES

300V

Conductor Area Size		mm^2	0.5	0.75	1.0	1.5
Insulation Thickness (Nominal)		mm	0.4	0.4	0.4	0.5
Insulation Thickness (Minimum)		mm	0.26	0.26	0.26	0.35
Conductor Resistance (20°C)		ohm/km	36.7	25.0	18.5	12.3
Minimum Insulation Resistance (20°C)		Mohm/km	1000			
Maximum Mutual Capacitance		nf/km	250			
Capacitance Unbalance		pf/500m	500			
Maximum L/R (Ratio)		µH/Ω	25	25	25	40
Operating Voltage		V	300			
Dielectric Strength for 1 Minute	AC	V	≥1000			
	DC	V	≥2000			

500V

Conductor Area Size	mm^2	0.5	0.75	1.0	1.5	2.5
Insulation Thickness (Nominal)	mm	0.6	0.6	0.6	0.6	0.7
Insulation Thickness (Minimum)	mm	0.44	0.44	0.44	0.44	0.53
Conductor Resistance (20°C)	ohm/km	36.7	25.0	18.5	12.3	7.4
Minimum Insulation Resistance (20°C)	Mohm/km	1000				
Maximum Mutual Capacitance	nf/km	250				
Capacitance Unbalance	pf/500m	500				
Maximum L/R (Ratio)	µH/Ω	25	25	25	40	60
Operating Voltage	V	500				

Dielectric Strength for 1	AC	V	≥2000
Minute	DC	V	≥3000

CONSTRUCTION PARAMETERS

300V

Conductor		RE-2X(St)H...CI			
No. of Core X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	kg/km
$0.5mm^2$					
2x0.5	2	0.4	0.9	7.4	65
3x0.5	2	0.4	0.9	7.8	79
4x0.5	2	0.4	0.9	8.5	95
5x0.5	2	0.4	0.9	9.3	112
8x0.5	2	0.4	1.0	11.1	164
10x0.5	2	0.4	1.0	13.0	200
12x0.5	2	0.4	1.0	13.4	226
14x0.5	2	0.4	1.0	14.1	254
16x0.5	2	0.4	1.0	14.8	283
20x0.5	2	0.4	1.1	16.3	348
24x0.5	2	0.4	1.1	18.5	412
27x0.5	2	0.4	1.1	19.0	450
30x0.5	2	0.4	1.2	19.9	503
37x0.5	2	0.4	1.2	21.4	598
40x0.5	2	0.4	1.2	22.2	639
$0.75mm^2$					
2x0.75	2	0.4	0.9	7.7	73
3x0.75	2	0.4	0.9	8.2	91
4x0.75	2	0.4	0.9	8.9	110
5x0.75	2	0.4	1.0	9.9	136
8x0.75	2	0.4	1.0	11.7	192
10x0.75	2	0.4	1.1	13.9	244
12x0.75	2	0.4	1.1	14.3	276
14x0.75	2	0.4	1.1	15.1	311
16x0.75	2	0.4	1.1	15.9	347
20x0.75	2	0.4	1.2	17.4	426
24x0.75	2	0.4	1.3	20.0	517
27x0.75	2	0.4	1.3	20.5	565
30x0.75	2	0.4	1.3	21.2	616
37x0.75	2	0.4	1.3	22.9	733
40x0.75	2	0.4	1.4	24.0	800
$1.0mm^2$					
2x1.0	2	0.4	0.9	8.2	84
3x1.0	2	0.4	0.9	8.6	106
4x1.0	2	0.4	0.9	9.4	129
5x1.0	2	0.4	0.9	10.3	154
8x1.0	2	0.4	1.0	12.4	229

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Conductor		RE-2X(St)H...CI			
No. of Core X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	kg/km
10x1.0	2	0.4	1.0	14.5	281
12x1.0	2	0.4	1.0	15.0	322
14x1.0	2	0.4	1.0	15.8	365
16x1.0	2	0.4	1.1	16.9	419
20x1.0	2	0.4	1.2	18.5	516
24x1.0	2	0.4	1.2	21.1	612
27x1.0	2	0.4	1.2	21.6	672
30x1.0	2	0.4	1.2	22.4	735
37x1.0	2	0.4	1.3	24.4	896
40x1.0	2	0.4	1.3	25.3	960
$1.5mm^2$					
2x1.5	2	0.5	0.9	9.1	104
3x1.5	2	0.5	0.9	9.6	134
4x1.5	2	0.5	1.0	10.8	172
5x1.5	2	0.5	1.0	11.8	205
8x1.5	2	0.5	1.1	14.1	306
10x1.5	2	0.5	1.1	16.6	377
12x1.5	2	0.5	1.1	17.1	433
14x1.5	2	0.5	1.2	18.3	503
16x1.5	2	0.5	1.2	19.3	564
20x1.5	2	0.5	1.3	21.1	694
24x1.5	2	0.5	1.3	24.1	824
27x1.5	2	0.5	1.4	24.8	922
30x1.5	2	0.5	1.4	25.8	1009
37x1.5	2	0.5	1.4	27.9	1211
40x1.5	2	0.5	1.5	29.1	1317

500V

Conductor		RE-2X(St)H...CI			
No. of Core X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	kg/km
$0.5mm^2$					
2x0.5	2	0.6	0.9	8.2	74
3x0.5	2	0.6	0.9	8.7	91
4x0.5	2	0.6	0.9	9.5	109
5x0.5	2	0.6	0.9	10.3	129
8x0.5	2	0.6	1.0	12.4	189
10x0.5	2	0.6	1.0	14.6	231
12x0.5	2	0.6	1.1	15.2	272
14x0.5	2	0.6	1.1	16.0	305
16x0.5	2	0.6	1.1	16.9	339
20x0.5	2	0.6	1.2	18.5	416

Conductor		RE-2X(St)H...CI			
No. of Core X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	kg/km
24x0.5	2	0.6	1.2	21.1	492
27x0.5	2	0.6	1.2	21.6	537
30x0.5	2	0.6	1.3	22.6	599
37x0.5	2	0.6	1.3	24.4	711
40x0.5	2	0.6	1.3	25.4	760
$0.75mm^2$					
2x0.75	2	0.6	0.9	8.5	82
3x0.75	2	0.6	0.9	9.0	102
4x0.75	2	0.6	0.9	9.9	125
5x0.75	2	0.6	1.0	11.0	154
8x0.75	2	0.6	1.0	13.0	218
10x0.75	2	0.6	1.0	15.3	268
12x0.75	2	0.6	1.0	15.8	305
14x0.75	2	0.6	1.1	16.8	355
16x0.75	2	0.6	1.1	17.8	396
20x0.75	2	0.6	1.2	19.5	486
24x0.75	2	0.6	1.3	22.4	590
27x0.75	2	0.6	1.3	22.9	645
30x0.75	2	0.6	1.3	23.8	703
37x0.75	2	0.6	1.4	25.9	854
40x0.75	2	0.6	1.4	26.9	914
$1.0mm^2$					
2x1.0	2	0.6	0.9	9.0	93
3x1.0	2	0.6	0.9	9.5	118
4x1.0	2	0.6	1.0	10.6	151
5x1.0	2	0.6	1.0	11.6	179
8x1.0	2	0.6	1.0	13.7	257
10x1.0	2	0.6	1.1	16.3	325
12x1.0	2	0.6	1.1	16.9	372
14x1.0	2	0.6	1.1	17.8	421
16x1.0	2	0.6	1.2	19.0	482
20x1.0	2	0.6	1.2	20.5	579
24x1.0	2	0.6	1.3	23.7	702
27x1.0	2	0.6	1.3	24.2	770
30x1.0	2	0.6	1.3	25.1	841
37x1.0	2	0.6	1.4	27.4	1023
40x1.0	2	0.6	1.4	28.4	1096
$1.5mm^2$					
2x1.5	2	0.6	0.9	9.5	109
3x1.5	2	0.6	1.0	10.3	146
4x1.5	2	0.6	1.0	11.3	180
5x1.5	2	0.6	1.0	12.3	215
8x1.5	2	0.6	1.1	14.8	322
10x1.5	2	0.6	1.2	17.6	407

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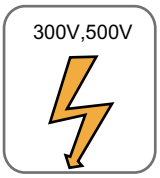
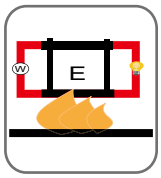
Conductor		RE-2X(St)H...CI			
No. of Core X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	kg/km
12x1.5	2	0.6	1.2	18.2	466
14x1.5	2	0.6	1.2	19.2	529
16x1.5	2	0.6	1.2	20.2	592
20x1.5	2	0.6	1.3	22.1	729
24x1.5	2	0.6	1.4	25.5	881
27x1.5	2	0.6	1.4	26.1	969
30x1.5	2	0.6	1.4	27.1	1060
37x1.5	2	0.6	1.5	29.5	1290
40x1.5	2	0.6	1.5	30.6	1383
$2.5mm^2$					
2x2.5	2	0.7	1.0	10.9	150
3x2.5	2	0.7	1.0	11.6	195
4x2.5	2	0.7	1.0	12.7	243
5x2.5	2	0.7	1.1	14.2	301
8x2.5	2	0.7	1.2	17.0	452
10x2.5	2	0.7	1.3	20.3	570
12x2.5	2	0.7	1.3	21.0	657
14x2.5	2	0.7	1.3	22.1	748
16x2.5	2	0.7	1.4	23.5	854
20x2.5	2	0.7	1.4	25.5	1034
24x2.5	2	0.7	1.5	29.4	1248
27x2.5	2	0.7	1.6	30.3	1395
30x2.5	2	0.7	1.6	31.4	1528
37x2.5	2	0.7	1.7	34.2	1859
40x2.5	2	0.7	1.7	35.5	1995

Note: Other conductor sizes & core configurations are available upon request.



Rated Voltage

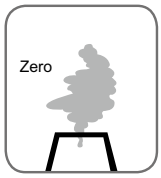
Standard



Circuit Integrity
IEC 60331-23/BS 6387(Optional)

Flame Retardancy

Reduced Fire Propagation
EN 60332-3-24



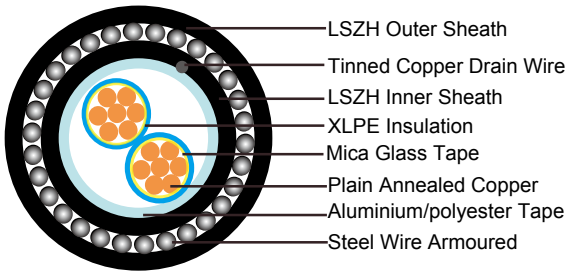
Halogen Free
IEC 60754-1

Low Corrosivity
IEC 60754-2

Low Smoke Emission
IEC 61034-2

Fire Resistant Overall Screened, Armoured Instrumentation Cables (Multicore)

RE-2X(St)HSWAH...CI



APPLICATION

The armoured LSZH sheathed cables are generally used when the risk of mechanical damage is increased. The galvanized steel wire armour provides excellent protection. Generally, the cables are used within industrial process manufacturing plants for communication, data and voice transmission signals and services. Also used for the interconnection of electrical equipment and instruments, the LSZH sheath can reduce toxic smoke and fume emission.

STANDARDS

Basic design to BS EN 50288-7 (formerly BS 5308)

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ (Optional); BS EN 50200 (PH30/PH60/PH120)
Flame Retardance (Single vertical wire or cable test)	IEC 60332-1-2; EN 60332-1-2
Reduced Fire Propagation (Vertically-mounted bundled wires & cables test)	IEC 60332-3-24; EN 60332-3-24
Halogen Free	IEC 60754-1; EN 50267-2-1
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2
Minimum Smoke Emission	IEC 61034-2; EN 61034-2

VOLTAGE RATING

300, 500V

CABLE CONSTRUCTION

Conductor: Plain or metal coated copper wire, solid, stranded or flexible according to IEC 60228 class 1, 2 and class 5.

Fire Barrier: Mica glass tape.

Insulation: Extruded XLPE compound according to EN 50290-2-29. LSZH, PE, PP compound can be offered as options.

Overall Screen: Aluminium/polyester tape is applied over the laid up cores with metallic side down in contact with tinned copper drain wire, 0.5mm². Copper braid screen or aluminium/polyester tape combined with copper braid screen can be offered as option.
Inner Sheath: Thermoplastic LSZH compound.
Armouring: Galvanised steel wire.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered).
Outer Sheath Option: UV resistance, hydrocarbon resistance, oil resistance, anti-rodent and anti-termite properties can be offered as option.

COLOUR CODE

Insulation Colour: Colours and/or additional ring markings and/or symbols achieved by the use of coloured insulation or by a coloured surface using extrusion, printing or painting.
Outer Sheath: Black. Other colours can be offered upon request.

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation: -30°C - +90°C
Temperature range fixed installation: -5°C - +50°C
Maximum short circuit temperature (5 Seconds): 250°C
Minimum bending radius: 10 x Overall Diameter

ELECTRICAL PROPERTIES

300V

Conductor Area Size		mm^2	0.5	0.75	1.0	1.5
Insulation Thickness (Nominal)		mm	0.4	0.4	0.4	0.5
Insulation Thickness (Minimum)		mm	0.26	0.26	0.26	0.35
Conductor Resistance (20°C)		ohm/km	36.7	25.0	18.5	12.3
Minimum Insulation Resistance (20°C)		Mohm/km	1000			
Maximum Mutual Capacitance		nf/km	250			
Capacitance Unbalance		pf/500m	500			
Maximum L/R (Ratio)		µH/Ω	25	25	25	40
Operating Voltage		V	300			
Dielectric Strength for 1 Minute	AC	V	≥1000			
	DC	V	≥2000			

500V

Conductor Area Size	mm^2	0.5	0.75	1.0	1.5	2.5
Insulation Thickness (Nominal)	mm	0.6	0.6	0.6	0.6	0.7

Insulation Thickness (Minimum)		mm	0.44	0.44	0.44	0.44	0.53
Conductor Resistance (20°C)		ohm/km	36.7	25.0	18.5	12.3	7.4
Minimum Insulation Resistance (20°C)		Mohm/km	1000				
Maximum Mutual Capacitance		nf/km	250				
Capacitance Unbalance		pf/500m	500				
Maximum L/R (Ratio)		μH/Ω	25	25	25	40	60
Operating Voltage		V	500				
Dielectric Strength for 1 Minute	AC	V	≥2000				
	DC	V	≥3000				

CONSTRUCTION PARAMETERS

300V

Conductor		RE-2X(St)HSWAH...CI					
No. of Core X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Thickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
0.5mm^2							
2x0.5	2	0.4	0.9	0.9	1.3	11.8	287
3x0.5	2	0.4	0.9	0.9	1.3	12.2	312
4x0.5	2	0.4	0.9	0.9	1.3	12.9	346
5x0.5	2	0.4	0.9	0.9	1.3	13.7	383
8x0.5	2	0.4	1.0	0.9	1.4	15.7	491
10x0.5	2	0.4	1.0	0.9	1.4	17.6	579
12x0.5	2	0.4	1.0	0.9	1.4	18.0	616
14x0.5	2	0.4	1.0	0.9	1.4	18.7	663
16x0.5	2	0.4	1.0	0.9	1.4	19.4	713
20x0.5	2	0.4	1.1	1.25	1.5	21.8	960
24x0.5	2	0.4	1.1	1.25	1.5	24.0	1103
27x0.5	2	0.4	1.1	1.25	1.5	24.5	1155
30x0.5	2	0.4	1.2	1.25	1.5	25.4	1239
37x0.5	2	0.4	1.2	1.25	1.6	27.1	1403
40x0.5	2	0.4	1.2	1.25	1.6	27.9	1474
0.75mm^2							
2x0.75	2	0.4	0.9	0.9	1.3	12.1	304
3x0.75	2	0.4	0.9	0.9	1.3	12.6	333
4x0.75	2	0.4	0.9	0.9	1.4	13.5	380
5x0.75	2	0.4	1.0	0.9	1.4	14.5	433
8x0.75	2	0.4	1.0	0.9	1.4	16.3	536
10x0.75	2	0.4	1.1	0.9	1.5	18.7	657
12x0.75	2	0.4	1.1	0.9	1.5	19.1	702
14x0.75	2	0.4	1.1	0.9	1.5	19.9	758
16x0.75	2	0.4	1.1	1.25	1.5	21.4	945
20x0.75	2	0.4	1.2	1.25	1.6	23.1	1089
24x0.75	2	0.4	1.3	1.25	1.6	25.7	1273

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Conductor		RE-2X(St)HSWAH...CI					
No. of Core X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Thickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
27x0.75	2	0.4	1.3	1.25	1.6	26.2	1337
30x0.75	2	0.4	1.3	1.25	1.6	26.9	1414
37x0.75	2	0.4	1.3	1.25	1.7	28.8	1607
40x0.75	2	0.4	1.4	1.25	1.7	29.9	1712
$1.0mm^2$							
2x1.0	2	0.4	0.9	0.9	1.3	12.6	326
3x1.0	2	0.4	0.9	0.9	1.3	13.0	360
4x1.0	2	0.4	0.9	0.9	1.4	14.0	413
5x1.0	2	0.4	0.9	0.9	1.4	15.0	461
8x1.0	2	0.4	1.0	0.9	1.4	17.0	591
10x1.0	2	0.4	1.0	0.9	1.5	19.3	713
12x1.0	2	0.4	1.0	0.9	1.5	19.8	767
14x1.0	2	0.4	1.0	1.25	1.5	21.3	960
16x1.0	2	0.4	1.1	1.25	1.5	22.4	1052
20x1.0	2	0.4	1.2	1.25	1.5	23.0	1204
24x1.0	2	0.4	1.2	1.25	1.6	26.8	1406
27x1.0	2	0.4	1.2	1.25	1.6	27.3	1483
30x1.0	2	0.4	1.2	1.25	1.6	28.1	1574
37x1.0	2	0.4	1.3	1.25	1.7	30.3	1823
40x1.0	2	0.4	1.3	1.6	1.7	31.9	2121
$1.5mm^2$							
2x1.5	2	0.5	0.9	0.9	1.4	13.7	379
3x1.5	2	0.5	0.9	0.9	1.4	14.2	423
4x1.5	2	0.5	1.0	0.9	1.4	15.4	491
5x1.5	2	0.5	1.0	0.9	1.4	16.4	552
8x1.5	2	0.5	1.1	0.9	1.5	18.9	727
10x1.5	2	0.5	1.1	1.25	1.5	22.1	1000
12x1.5	2	0.5	1.1	1.25	1.5	22.6	1075
14x1.5	2	0.5	1.2	1.25	1.5	23.8	1184
16x1.5	2	0.5	1.2	1.25	1.6	25.0	1294
20x1.5	2	0.5	1.3	1.25	1.6	26.8	1488
24x1.5	2	0.5	1.3	1.25	1.7	30.0	1741
27x1.5	2	0.5	1.4	1.25	1.7	30.7	1866
30x1.5	2	0.5	1.4	1.6	1.7	32.4	2191
37x1.5	2	0.5	1.4	1.6	1.8	34.7	2502
40x1.5	2	0.5	1.5	1.6	1.8	35.9	2663

500V

Conductor		RE-2X(St)HSWAH...CI					
No. of Core X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Thickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
$0.5mm^2$							
2x0.5	2	0.6	0.9	0.9	1.3	12.6	317
3x0.5	2	0.6	0.9	0.9	1.3	13.1	346
4x0.5	2	0.6	0.9	0.9	1.4	14.1	393
5x0.5	2	0.6	0.9	0.9	1.4	14.9	437
8x0.5	2	0.6	1.0	0.9	1.4	17.0	553
10x0.5	2	0.6	1.0	0.9	1.5	19.4	664
12x0.5	2	0.6	1.1	0.9	1.5	20.0	723
14x0.5	2	0.6	1.1	1.25	1.5	21.5	908
16x0.5	2	0.6	1.1	1.25	1.5	22.4	973
20x0.5	2	0.6	1.2	1.25	1.5	24.0	1106
24x0.5	2	0.6	1.2	1.25	1.6	26.8	1288
27x0.5	2	0.6	1.2	1.25	1.6	27.3	1350
30x0.5	2	0.6	1.3	1.25	1.6	28.3	1447
37x0.5	2	0.6	1.3	1.25	1.6	30.1	1623
40x0.5	2	0.6	1.3	1.6	1.7	32.0	1925
$0.75mm^2$							
2x0.75	2	0.6	0.9	0.9	1.3	12.9	335
3x0.75	2	0.6	0.9	0.9	1.3	13.4	368
4x0.75	2	0.6	0.9	0.9	1.4	14.5	420
5x0.75	2	0.6	1.0	0.9	1.4	15.6	481
8x0.75	2	0.6	1.0	0.9	1.4	17.6	598
10x0.75	2	0.6	1.0	0.9	1.5	20.1	720
12x0.75	2	0.6	1.0	1.25	1.5	21.3	900
14x0.75	2	0.6	1.1	1.25	1.5	22.3	986
16x0.75	2	0.6	1.1	1.25	1.5	23.3	1059
20x0.75	2	0.6	1.2	1.25	1.6	25.2	1222
24x0.75	2	0.6	1.3	1.25	1.6	28.1	1431
27x0.75	2	0.6	1.3	1.25	1.6	28.6	1504
30x0.75	2	0.6	1.3	1.25	1.6	29.5	1592
37x0.75	2	0.6	1.4	1.6	1.7	32.5	2041
40x0.75	2	0.6	1.4	1.6	1.7	33.5	2143

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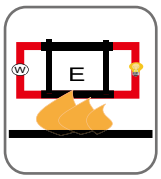
Conductor		RE-2X(St)HSWAH...CI					
No. of Core X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Thickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
$1.0mm^2$							
2x1.0	2	0.6	0.9	0.9	1.3	13.4	357
3x1.0	2	0.6	0.9	0.9	1.4	14.1	403
4x1.0	2	0.6	1.0	0.9	1.4	15.2	466
5x1.0	2	0.6	1.0	0.9	1.4	16.2	521
8x1.0	2	0.6	1.0	0.9	1.4	18.3	655
10x1.0	2	0.6	1.1	1.25	1.5	21.8	939
12x1.0	2	0.6	1.1	1.25	1.5	22.4	1003
14x1.0	2	0.6	1.1	1.25	1.5	23.3	1084
16x1.0	2	0.6	1.2	1.25	1.6	24.7	1200
20x1.0	2	0.6	1.2	1.25	1.6	26.3	1353
24x1.0	2	0.6	1.3	1.25	1.6	29.4	1587
27x1.0	2	0.6	1.3	1.25	1.7	30.1	1691
30x1.0	2	0.6	1.3	1.6	1.7	31.7	1995
37x1.0	2	0.6	1.4	1.6	1.7	34.0	2274
40x1.0	2	0.6	1.4	1.6	1.8	35.2	2411
$1.5mm^2$							
2x1.5	2	0.6	0.9	0.9	1.3	14.1	394
3x1.5	2	0.6	1.0	0.9	1.4	14.9	453
4x1.5	2	0.6	1.0	0.9	1.4	15.9	513
5x1.5	2	0.6	1.0	0.9	1.4	17.0	577
8x1.5	2	0.6	1.1	0.9	1.5	19.6	760
10x1.5	2	0.6	1.2	1.25	1.5	23.1	1064
12x1.5	2	0.6	1.2	1.25	1.6	23.9	1157
14x1.5	2	0.6	1.2	1.25	1.6	24.9	1254
16x1.5	2	0.6	1.2	1.25	1.6	25.9	1355
20x1.5	2	0.6	1.3	1.25	1.7	28.0	1575
24x1.5	2	0.6	1.4	1.6	1.7	32.1	2052
27x1.5	2	0.6	1.4	1.6	1.7	32.7	2164
30x1.5	2	0.6	1.4	1.6	1.8	33.9	2316
37x1.5	2	0.6	1.5	1.6	1.8	36.3	2651
40x1.5	2	0.6	1.5	1.6	1.8	37.3	2793
$2.5mm^2$							
2x2.5	2	0.7	1.0	0.9	1.4	15.5	474
3x2.5	2	0.7	1.0	0.9	1.4	16.2	537
4x2.5	2	0.7	1.0	0.9	1.4	17.3	616
5x2.5	2	0.7	1.1	0.9	1.5	19.0	723
8x2.5	2	0.7	1.2	1.25	1.5	22.5	1090
10x2.5	2	0.7	1.3	1.25	1.6	26.0	1336
12x2.5	2	0.7	1.3	1.25	1.6	26.7	1446
14x2.5	2	0.7	1.3	1.25	1.7	28.0	1593
16x2.5	2	0.7	1.4	1.25	1.7	29.4	1751
20x2.5	2	0.7	1.4	1.6	1.8	32.3	2223
24x2.5	2	0.7	1.5	1.6	1.8	36.2	2608

Conductor		RE-2X(St)HSWAH...CI					
No. of Core X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Thickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
27x2.5	2	0.7	1.6	1.6	1.9	37.3	2814
30x2.5	2	0.7	1.6	1.6	1.9	38.4	2998
37x2.5	2	0.7	1.7	1.6	1.9	41.2	3451
40x2.5	2	0.7	1.7	1.6	2.0	42.7	3670

Note: Other conductor sizes & core configurations are available upon request.

Rated Voltage

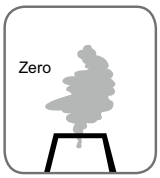
Standard



Circuit Integrity
IEC 60331-23/BS 6387(Optional)

Flame Retardancy
BS EN 60332-1-2

Reduced Fire Propagation
EN 60332-3-24



Halogen Free
IEC 60754-1

Low Corrosivity
IEC 60754-2

Low Smoke Emission
IEC 61034-2

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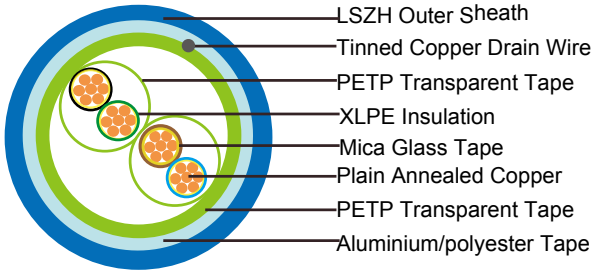
Fire Resistant Overall Screened Instrumentation Cables (Multipair)

RE-2X(St)H...CI



APPLICATION

The unarmoured LSZH sheathed cables are generally used for indoor installation and suitable for wet and damp areas. Generally, the cables are used within industrial process manufacturing plants for communication, data and voice transmission signals and services. Also used for the interconnection of electrical equipment and instruments, the LSZH sheath can reduce toxic smoke and fume emission.

STANDARDS

Basic design to BS EN 50288-7 (formerly BS 5308)

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ (Optional); BS EN 50200 (PH30/PH60/PH120)
Flame Retardance (Single vertical wire or cable test)	IEC 60332-1-2; EN 60332-1-2
Reduced Fire Propagation (Vertically-mounted bundled wires & cables test)	IEC 60332-3-24; EN 60332-3-24
Halogen Free	IEC 60754-1; EN 50267-2-1
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2
Minimum Smoke Emission	IEC 61034-2; EN 61034-2

VOLTAGE RATING

300V, 500V

CABLE CONSTRUCTION

Conductor: Plain or metal coated copper wire, solid, stranded or flexible according to IEC 60228 class 1, 2 and class 5.

Fire Barrier: Mica glass tape.

Insulation: Extruded XLPE compound according to EN 50290-2-29. LSZH, PE, PP compound can be offered as options.

Pairs: Two insulated conductors uniformly twisted together with a lay not exceeding 100mm (≤1.5mm^2) or 150mm (for 2.5mm^2).
Binder Tape: PETP transparent tape.
Overall Screen: Aluminium/polyester tape is applied over the laid up pairs with metallic side down in contact with tinned copper drain wire, 0.5mm². Copper braid screen or aluminium/polyester tape combined with copper braid screen can be offered as option.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered).
Outer Sheath Option: UV resistance, hydrocarbon resistance, oil resistance, anti-rodent and anti-termite properties can be offered as option.

COLOUR CODE

Insulation Colour: Colours and/or additional ring markings and/or symbols achieved by the use of coloured insulation or by a coloured surface using extrusion, printing or painting.
Outer Sheath: Black. Other colours can be offered upon request.

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation: -30°C - +90°C
Temperature range fixed installation: -5°C - +50°C
Maximum short circuit temperature (5 Seconds): 250°C
Minimum bending radius: 7.5 x Overall Diameter

ELECTRICAL PROPERTIES

300V

Conductor Area Size		mm^2	0.5	0.75	1.0	1.5
Insulation Thickness (Nominal)		mm	0.4	0.4	0.4	0.5
Insulation Thickness (Minimum)		mm	0.26	0.26	0.26	0.35
Conductor Resistance (20°C)		ohm/km	36.7	25.0	18.5	12.3
Minimum Insulation Resistance (20°C)		Mohm/km	1000			
Maximum Mutual Capacitance		nf/km	250			
Capacitance Unbalance		pf/500m	500			
Maximum L/R (Ratio)		μH/Ω	25	25	25	40
Operating Voltage		V	300			
Dielectric Strength for 1	AC	V	≥1000			
Minute	DC	V	≥2000			

500V

Conductor Area Size	mm^2	0.5	0.75	1.0	1.5	2.5
Insulation Thickness (Nominal)	mm	0.6	0.6	0.6	0.6	0.7

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Insulation Thickness (minimum)		mm	0.44	0.44	0.44	0.44	0.53
Conductor Resistance (20°C)		ohm/km	36.7	25.0	18.5	12.3	7.4
Minimum Insulation Resistance (20°C)		Mohm/km	1000				
Maximum Mutual Capacitance		nf/km	250				
Capacitance Unbalance		pf/500m	500				
Maximum L/R (ratio)		µH/Ω	25	25	25	40	60
Operating Voltage		V	500				
Dielectric Strength for 1 Minute	AC	V	≥2000				
	DC	V	≥3000				

CONSTRUCTION PARAMETERS

300V

Conductor		RE-2X(St)H...CI			
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	kg/km
$0.5mm^2$					
1x2x0.5	2	0.6	0.9	7.4	65
2x2x0.5	2	0.4	0.9	10.8	110
3x2x0.5	2	0.4	1.0	11.7	146
4x2x0.5	2	0.4	1.0	12.9	177
5x2x0.5	2	0.4	1.1	14.3	218
8x2x0.5	2	0.4	1.1	17.0	310
10x2x0.5	2	0.4	1.1	20.0	380
12x2x0.5	2	0.4	1.2	20.9	446
16x2x0.5	2	0.4	1.2	23.3	560
20x2x0.5	2	0.4	1.3	25.5	687
24x2x0.5	2	0.4	1.3	29.3	815
$0.75mm^2$					
1x2x0.75	2	0.4	0.9	7.7	73
2x2x0.75	2	0.4	1.0	11.6	133
3x2x0.75	2	0.4	1.0	12.3	168
4x2x0.75	2	0.4	1.1	13.8	215
5x2x0.75	2	0.4	1.1	15.1	255
8x2x0.75	2	0.4	1.1	17.9	366
10x2x0.75	2	0.4	1.2	21.4	463
12x2x0.75	2	0.4	1.2	22.2	529
16x2x0.75	2	0.4	1.3	24.9	685
20x2x0.75	2	0.4	1.4	27.3	840
24x2x0.75	2	0.4	1.4	31.2	997
$1.0mm^2$					
1x2x1.0	2	0.6	0.9	8.2	84
2x2x1.0	2	0.4	1.0	12.3	155
3x2x1.0	2	0.4	1.1	13.3	206

Conductor		RE-2X(St)H...CI			
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	kg/km
4x2x1.0	2	0.4	1.1	14.6	254
5x2x1.0	2	0.4	1.1	16.0	303
8x2x1.0	2	0.4	1.2	19.3	452
10x2x1.0	2	0.4	1.2	22.8	557
12x2x1.0	2	0.4	1.3	23.8	654
16x2x1.0	2	0.4	1.4	26.7	847
20x2x1.0	2	0.4	1.4	29.0	1021
24x2x1.0	2	0.4	1.5	33.5	1234
$1.5mm^2$					
1x2x1.5	2	0.5	0.9	9.1	104
2x2x1.5	2	0.5	1.1	14.0	203
3x2x1.5	2	0.5	1.1	14.9	263
4x2x1.5	2	0.5	1.2	16.7	338
5x2x1.5	2	0.5	1.2	18.3	404
8x2x1.5	2	0.5	1.3	22.0	605
10x2x1.5	2	0.5	1.4	26.3	762
12x2x1.5	2	0.5	1.4	27.2	876
16x2x1.5	2	0.5	1.5	30.6	1137
20x2x1.5	2	0.5	1.6	33.4	1395
24x2x1.5	2	0.5	1.7	38.5	1683

500V

Conductor		RE-2X(St)H...CI			
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	kg/km
$0.5mm^2$					
1x2x0.5	2	0.6	0.9	8.2	74
2x2x0.5	2	0.6	1.0	12.3	134
3x2x0.5	2	0.6	1.0	13.1	168
4x2x0.5	2	0.6	1.1	14.6	214
5x2x0.5	2	0.6	1.1	16.1	253
8x2x0.5	2	0.6	1.2	19.3	371
10x2x0.5	2	0.6	1.2	22.9	456
12x2x0.5	2	0.6	1.3	23.9	532
16x2x0.5	2	0.6	1.4	26.8	685
20x2x0.5	2	0.6	1.4	29.1	818
24x2x0.5	2	0.6	1.5	33.6	991
$0.75mm^2$					
1x2x0.75	2	0.6	0.9	8.5	82
2x2x0.75	2	0.6	1.0	12.9	151

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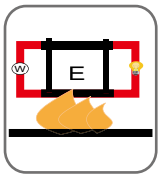
Conductor		RE-2X(St)H...Cl			
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	kg/km
3x2x0.75	2	0.6	1.1	14.0	200
4x2x0.75	2	0.6	1.1	15.3	245
5x2x0.75	2	0.6	1.2	17.1	301
8x2x0.75	2	0.6	1.2	20.3	430
10x2x0.75	2	0.6	1.3	24.3	544
12x2x0.75	2	0.6	1.3	25.1	620
16x2x0.75	2	0.6	1.4	28.2	800
20x2x0.75	2	0.6	1.5	30.8	979
24x2x0.75	2	0.6	1.6	35.6	1183
1.0mm^2					
1x2x1.0	2	0.6	0.9	9.0	93
2x2x1.0	2	0.6	1.0	13.6	173
3x2x1.0	2	0.6	1.1	14.7	231
4x2x1.0	2	0.6	1.2	16.4	295
5x2x1.0	2	0.6	1.2	18.0	351
8x2x1.0	2	0.6	1.2	21.4	507
10x2x1.0	2	0.6	1.3	25.6	641
12x2x1.0	2	0.6	1.4	26.7	751
16x2x1.0	2	0.6	1.5	30.0	970
20x2x1.0	2	0.6	1.5	32.6	1167
24x2x1.0	2	0.6	1.6	37.6	1410
1.5mm^2					
1x2x1.5	2	0.6	0.9	9.5	109
2x2x1.5	2	0.6	1.1	14.7	214
3x2x1.5	2	0.6	1.2	15.8	286
4x2x1.5	2	0.6	1.2	17.4	354
5x2x1.5	2	0.6	1.3	19.4	436
8x2x1.5	2	0.6	1.3	23.1	635
10x2x1.5	2	0.6	1.4	27.6	801
12x2x1.5	2	0.6	1.5	28.7	938
16x2x1.5	2	0.6	1.6	32.3	1214
20x2x1.5	2	0.6	1.7	35.3	1487
24x2x1.5	2	0.6	1.8	40.7	1793
2.5mm^2					
1x2x2.5	2	0.7	1.0	10.9	150
2x2x2.5	2	0.7	1.2	16.9	293
3x2x2.5	2	0.7	1.2	18.0	384
4x2x2.5	2	0.7	1.3	20.1	493
5x2x2.5	2	0.7	1.4	22.4	607
8x2x2.5	2	0.7	1.4	26.7	894
10x2x2.5	2	0.7	1.6	32.1	1145
12x2x2.5	2	0.7	1.6	33.2	1321

Conductor		RE-2X(St)H...CI			
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	kg/km
16x2x2.5	2	0.7	1.7	37.3	1714
20x2x2.5	2	0.7	1.9	40.9	2130
24x2x2.5	2	0.7	2.0	47.2	2564

Rated Voltage

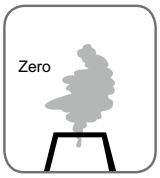
Standard



Circuit Integrity
IEC 60331-23/BS 6387(Optional)

Flame Retardancy
BS EN 60332-1-2

Reduced Fire Propagation
EN 60332-3-24



Halogen Free
IEC 60754-1

Low Corrosivity
IEC 60754-2

Low Smoke Emission
IEC 61034-2

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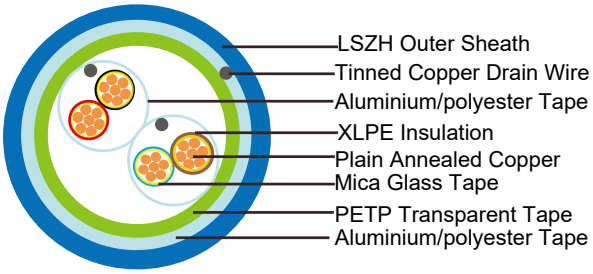
Fire Resistant Individual and Overall Screened Instrumentation Cables (Multipair)

RE-2X(St)H PiMF...CI



APPLICATION

The unarmoured LSZH sheathed cables are generally used for indoor installation and suitable for wet and damp areas. Generally, the cables are used within industrial process manufacturing plants for communication, data and voice transmission signals and services. Also used for the interconnection of electrical equipment and instruments, the LSZH sheath can reduce toxic smoke and fume emission.

STANDARDS

Basic design to BS EN 50288-7 (formerly BS 5308)

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ (Optional); BS EN 50200 (PH30/PH60/PH120)
Flame Retardance (Single vertical wire or cable test)	IEC 60332-1-2; EN 60332-1-2
Reduced Fire Propagation (Vertically-mounted bundled wires & cables test)	IEC 60332-3-24; EN 60332-3-24
Halogen Free	IEC 60754-1; EN 50267-2-1
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2
Minimum Smoke Emission	IEC 61034-2; EN 61034-2

VOLTAGE RATING

300V, 500V

CABLE CONSTRUCTION

Conductor: Plain or metal coated copper wire, solid, stranded or flexible according to IEC 60228 class 1, 2 and class 5.

Fire Barrier: Mica glass tape.

Insulation: Extruded XLPE compound according to EN 50290-2-29. LSZH, PE, PP compound can be offered as options.

Pairs: Two insulated conductors uniformly twisted together with a lay not exceeding 100mm (≤1.5mm^2) or 150mm (for 2.5mm^2).

Individual Screen: Aluminium/polyester tape is applied over each pair with metallic side down in contact

with tinned copper drain wire, 0.5mm².

Binder Tape: PETP transparent tape.

Overall Screen: Aluminium/polyester tape is applied over the laid up pairs with metallic side down in contact with tinned copper drain wire, 0.5mm². Copper braid screen or aluminium/polyester tape combined with copper braid screen can be offered as option.

Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered).

Outer Sheath Option: UV resistance, hydrocarbon resistance, oil resistance, anti-rodent and anti-termite properties can be offered as option.

COLOUR CODE

Insulation Colour: Colours and/or additional ring markings and/or symbols achieved by the use of coloured insulation or by a coloured surface using extrusion, printing or painting.

Outer Sheath: Black. Other colours can be offered upon request.

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation: -30°C - +90°C

Temperature range fixed installation: -5°C - +50°C

Maximum short circuit temperature (5 Seconds): 250°C

Minimum bending radius: 7.5 x Overall Diameter

ELECTRICAL PROPERTIES

300V

Conductor Area Size		mm^2	0.5	0.75	1.0	1.5
Insulation Thickness (Nominal)		mm	0.4	0.4	0.4	0.5
Insulation Thickness (Minimum)		mm	0.26	0.26	0.26	0.35
Conductor Resistance (20°C)		ohm/km	36.7	25.0	18.5	12.3
Minimum Insulation Resistance (20°C)		Mohm/km	1000			
Maximum Mutual Capacitance		nf/km	250			
Capacitance Unbalance		pf/500m	500			
Maximum L/R (Ratio)		µH/Ω	25	25	25	40
Operating Voltage		V	300			
Dielectric Strength for 1 Minute	AC	V	≥1000			
	DC	V	≥2000			

500V

Conductor Area Size	mm^2	0.5	0.75	1.0	1.5	2.5
Insulation Thickness (Nominal)	mm	0.6	0.6	0.6	0.6	0.7
Insulation Thickness (Minimum)	mm	0.44	0.44	0.44	0.44	0.53

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Conductor Resistance (20°C)		ohm/km	36.7	25.0	18.5	12.3	7.4
Minimum Insulation Resistance (20°C)		Mohm/km	1000				
Maximum Mutual Capacitance		nf/km	250				
Capacitance Unbalance		pf/500m	500				
Maximum L/R (Ratio)		µH/Ω	25	25	25	40	60
Operating Voltage		V	500				
Dielectric Strength for 1	AC	V	≥2000				
Minute	DC	V	≥3000				

CONSTRUCTION PARAMETERS

300V

Conductor		RE-2X(St)H PiMF...CI			
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	kg/km
0.5mm^2					
2x2x0.5	2	0.4	1.0	12.0	138
3x2x0.5	2	0.4	1.0	12.7	173
4x2x0.5	2	0.4	1.1	14.2	222
5x2x0.5	2	0.4	1.1	15.6	263
8x2x0.5	2	0.4	1.1	18.5	377
10x2x0.5	2	0.4	1.2	22.2	478
12x2x0.5	2	0.4	1.2	23.0	545
16x2x0.5	2	0.4	1.3	25.8	705
20x2x0.5	2	0.4	1.4	28.2	865
24x2x0.5	2	0.4	1.5	32.5	1046
0.75mm^2					
2x2x0.75	2	0.4	1.0	12.6	155
3x2x0.75	2	0.4	1.1	13.6	206
4x2x0.75	2	0.4	1.1	15.0	253
5x2x0.75	2	0.4	1.2	16.7	312
8x2x0.75	2	0.4	1.2	19.8	449
10x2x0.75	2	0.4	1.3	23.6	567
12x2x0.75	2	0.4	1.3	24.4	648
16x2x0.75	2	0.4	1.4	27.5	839
20x2x0.75	2	0.4	1.5	30.0	1028
24x2x0.75	2	0.4	1.5	34.5	1221
1.0mm^2					
2x2x1.0	2	0.4	1.0	13.4	177
3x2x1.0	2	0.4	1.1	14.4	238
4x2x1.0	2	0.4	1.2	16.1	304
5x2x1.0	2	0.4	1.2	17.7	363
8x2x1.0	2	0.4	1.2	21.0	528
10x2x1.0	2	0.4	1.3	25.1	667
12x2x1.0	2	0.4	1.4	26.2	782

Conductor		RE-2X(St)H PiMF...CI			
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	kg/km
16x2x1.0	2	0.4	1.5	29.4	1012
20x2x1.0	2	0.4	1.5	32.0	1220
24x2x1.0	2	0.4	1.6	36.9	1473
$1.5mm^2$					
2x2x1.5	2	0.5	1.1	15.2	230
3x2x1.5	2	0.5	1.2	16.4	309
4x2x1.5	2	0.5	1.2	18.1	384
5x2x1.5	2	0.5	1.3	20.1	472
8x2x1.5	2	0.5	1.3	24.0	690
10x2x1.5	2	0.5	1.4	28.7	870
12x2x1.5	2	0.5	1.5	29.9	1021
16x2x1.5	2	0.5	1.6	33.6	1323
20x2x1.5	2	0.5	1.7	36.7	1622
24x2x1.5	2	0.5	1.8	42.3	1955

500V

Conductor		RE-2X(St)H PiMF...CI			
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	kg/km
$0.5mm^2$					
2x2x0.5	2	0.6	1.0	13.4	157
3x2x0.5	2	0.6	1.1	14.5	208
4x2x0.5	2	0.6	1.1	15.9	254
5x2x0.5	2	0.6	1.2	17.7	313
8x2x0.5	2	0.6	1.2	21.1	447
10x2x0.5	2	0.6	1.3	25.2	565
12x2x0.5	2	0.6	1.4	26.3	660
16x2x0.5	2	0.6	1.5	29.5	850
20x2x0.5	2	0.6	1.5	32.1	1018
24x2x0.5	2	0.6	1.6	37.0	1230
$0.75mm^2$					
2x2x0.75	2	0.6	1.1	14.2	184
3x2x0.75	2	0.6	1.1	15.2	233
4x2x0.75	2	0.6	1.2	16.9	297
5x2x0.75	2	0.6	1.2	18.6	353
8x2x0.75	2	0.6	1.3	22.3	523
10x2x0.75	2	0.6	1.4	26.7	660
12x2x0.75	2	0.6	1.4	27.6	754
16x2x0.75	2	0.6	1.5	31.0	972
20x2x0.75	2	0.6	1.6	33.9	1190
24x2x0.75	2	0.6	1.7	39.1	1436
$1.0mm^2$					
2x2x1.0	2	0.6	1.1	15.0	207
3x2x1.0	2	0.6	1.2	16.2	276

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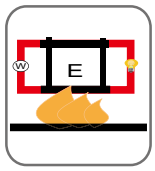
Conductor		RE-2X(St)H PiMF...CI			
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	kg/km
4x2x1.0	2	0.6	1.2	17.8	340
5x2x1.0	2	0.6	1.3	19.8	418
8x2x1.0	2	0.6	1.3	23.6	605
10x2x1.0	2	0.6	1.4	28.2	764
12x2x1.0	2	0.6	1.5	29.3	893
16x2x1.0	2	0.6	1.6	33.0	1153
20x2x1.0	2	0.6	1.7	36.0	1411
24x2x1.0	2	0.6	1.8	41.6	1701
$1.5mm^2$					
2x2x1.5	2	0.6	1.1	16.0	241
3x2x1.5	2	0.6	1.2	17.2	324
4x2x1.5	2	0.6	1.3	19.2	414
5x2x1.5	2	0.6	1.3	21.1	496
8x2x1.5	2	0.6	1.4	25.4	740
10x2x1.5	2	0.6	1.5	30.3	932
12x2x1.5	2	0.6	1.6	31.5	1091
16x2x1.5	2	0.6	1.7	35.4	1410
20x2x1.5	2	0.6	1.8	38.7	1727
24x2x1.5	2	0.6	1.9	44.7	2080
$2.5mm^2$					
2x2x2.5	2	0.7	1.2	18.4	324
3x2x2.5	2	0.7	1.3	19.8	439
4x2x2.5	2	0.7	1.4	22.0	563
5x2x2.5	2	0.7	1.5	24.5	691
8x2x2.5	2	0.7	1.6	29.4	1033
10x2x2.5	2	0.7	1.7	35.1	1298
12x2x2.5	2	0.7	1.8	36.5	1519
16x2x2.5	2	0.7	1.9	41.0	1965
20x2x2.5	2	0.7	2.1	45.0	2434
24x2x2.5	2	0.7	2.2	51.9	2927

Rated Voltage

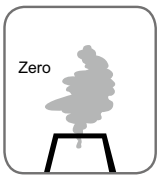
Standard



Circuit Integrity
IEC 60331-23/BS 6387(Optional)

Flame Retardancy
BS EN 60332-1-2

Reduced Fire Propagation
EN 60332-3-24



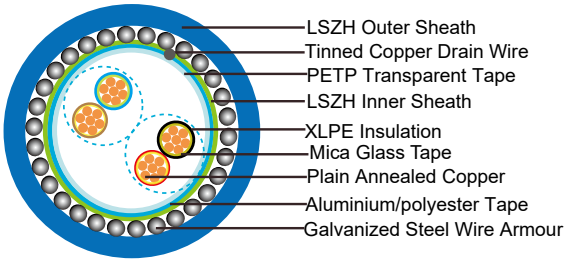
Halogen Free
IEC 60754-1

Low Corrosivity
IEC 60754-2

Low Smoke Emission
IEC 61034-2

Fire Resistant Overall Screened, Armoured Instrumentation Cables (Multipair)

RE-2X(St)HSWAH...CI



APPLICATION

The armoured LSZH sheathed cables are generally used when the risk of mechanical damage is increased. The galvanized steel wire armour provides excellent protection. Generally, the cables are used within industrial process manufacturing plants for communication, data and voice transmission signals and services. Also used for the interconnection of electrical equipment and instruments, the LSZH sheath can reduce toxic smoke and fume emission.

STANDARDS

Basic design to BS EN 50288-7 (formerly BS 5308)

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ (Optional); BS EN 50200 (PH30/PH60/PH120)
Flame Retardance (Single vertical wire or cable test)	IEC 60332-1-2; EN 60332-1-2
Reduced Fire Propagation (Vertically-mounted bundled wires & cables test)	IEC 60332-3-24; EN 60332-3-24
Halogen Free	IEC 60754-1; EN 50267-2-1
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2
Minimum Smoke Emission	IEC 61034-2; EN 61034-2

VOLTAGE RATING

300V, 500V

CABLE CONSTRUCTION

Conductor: Plain or metal coated copper wire, solid, stranded or flexible according to IEC 60228 class 1, 2 and class 5.

Fire Barrier: Mica glass tape.

Insulation: Extruded XLPE compound according to EN 50290-2-29. LSZH, PE, PP compound can be offered as options.

Pairs: Two insulated conductors uniformly twisted together with a lay not exceeding 100mm (≤1.5mm^2) or 150mm (for 2.5mm^2).
Binder Tape: PETP transparent tape.
Overall Screen: Aluminium/polyester tape is applied over the laid up pairs with metallic side down in contact with tinned copper drain wire, 0.5mm². Copper braid screen or aluminium/polyester tape combined with copper braid screen can be offered as option.
Inner Sheath: Thermoplastic LSZH compound.
Amouring: Galvanized steel wire armour.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered).
Outer Sheath Option: UV resistance, hydrocarbon resistance, oil resistance, anti-rodent and anti-termite properties can be offered as option.

COLOUR CODE

Insulation Colour: Colours and/or additional ring markings and/or symbols achieved by the use of coloured insulation or by a coloured surface using extrusion, printing or painting.
Outer Sheath: Black. Other colours can be offered upon request.

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation: -30°C - +90°C
Temperature range during installation: -5°C - +50°C
Maximum short circuit temperature (5 Seconds): 250°C
Minimum bending radius: 10 x Overall Diameter

ELECTRICAL PROPERTIES

300V

Conductor Area Size		mm^2	0.5	0.75	1.0	1.5
Insulation Thickness (Nominal)		mm	0.4	0.4	0.4	0.5
Insulation Thickness (Minimum)		mm	0.26	0.26	0.26	0.35
Conductor Resistance (20°C)		ohm/km	36.7	25.0	18.5	12.3
Minimum Insulation Resistance (20°C)		Mohm/km	1000			
Maximum Mutual Capacitance		nf/km	250			
Capacitance Unbalance		pf/500m	500			
Maximum L/R (Ratio)		µH/Ω	25	25	25	40
Operating Voltage		V	300			
Dielectric Strength for 1 Minute	AC	V	≥1000			
	DC	V	≥2000			

500V

Conductor Area Size		mm^2	0.5	0.75	1.0	1.5	2.5
Insulation Thickness (Nominal)		mm	0.6	0.6	0.6	0.6	0.7
Insulation Thickness (Minimum)		mm	0.44	0.44	0.44	0.44	0.53
Conductor Resistance (20°C)		ohm/km	36.7	25.0	18.5	12.3	7.4
Minimum Insulation Resistance (20°C)		Mohm/km	1000				
Maximum Mutual Capacitance		nf/km	250				
Capacitance Unbalance		pf/500m	500				
Maximum L/R (Ratio)		μH/Ω	25	25	25	40	60
Operating Voltage		V	500				
Dielectric Strength for 1 Minute	AC	V	≥2000				
	DC	V	≥3000				

CONSTRUCTION PARAMETERS

300V

Conductor		RE-2X(St)HSWAH...CI					
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Thickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
$0.5mm^2$							
1x2x0.5	2	0.4	0.9	0.9	1.3	11.8	287
2x2x0.5	2	0.4	0.9	0.9	1.4	15.4	431
3x2x0.5	2	0.4	1.0	0.9	1.4	16.3	490
4x2x0.5	2	0.4	1.0	0.9	1.4	17.4	553
5x2x0.5	2	0.4	1.1	0.9	1.5	19.1	644
8x2x0.5	2	0.4	1.1	1.25	1.5	22.5	945
10x2x0.5	2	0.4	1.1	1.25	1.5	25.5	1123
12x2x0.5	2	0.4	1.2	1.25	1.5	26.4	1219
16x2x0.5	2	0.4	1.2	1.25	1.6	29.0	1434
20x2x0.5	2	0.4	1.3	1.6	1.6	31.2	1841
24x2x0.5	2	0.4	1.3	1.6	1.7	35.9	2148
$0.75mm^2$							
1x2x0.75	2	0.4	0.9	0.9	1.3	12.1	304
2x2x0.75	2	0.4	1.0	0.9	1.4	16.2	476
3x2x0.75	2	0.4	1.0	0.9	1.4	16.9	530
4x2x0.75	2	0.4	1.1	0.9	1.5	18.6	626
5x2x0.75	2	0.4	1.1	0.9	1.5	19.9	703
8x2x0.75	2	0.4	1.1	1.25	1.5	23.4	1035
10x2x0.75	2	0.4	1.2	1.25	1.6	27.1	1269
12x2x0.75	2	0.4	1.2	1.25	1.6	27.9	1361
16x2x0.75	2	0.4	1.3	1.25	1.6	30.7	1614
20x2x0.75	2	0.4	1.4	1.6	1.7	33.9	2086
24x2x0.75	2	0.4	1.4	1.6	1.8	38.0	2436

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Conductor		RE-2X(St)HSWAH...CI					
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Thickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
1.0mm^2							
1x2x1.0	2	0.4	0.9	0.9	1.3	12.6	326
2x2x1.0	2	0.4	1.0	0.9	1.4	16.9	516
3x2x1.0	2	0.4	1.1	0.9	1.5	18.1	604
4x2x1.0	2	0.4	1.1	0.9	1.5	19.4	688
5x2x1.0	2	0.4	1.1	1.25	1.5	21.5	907
8x2x1.0	2	0.4	1.2	1.25	1.5	24.8	1168
10x2x1.0	2	0.4	1.2	1.25	1.6	28.5	1412
12x2x1.0	2	0.4	1.3	1.25	1.6	29.5	1543
16x2x1.0	2	0.4	1.4	1.6	1.7	33.5	2071
20x2x1.0	2	0.4	1.4	1.6	1.8	35.8	2364
24x2x1.0	2	0.4	1.5	1.6	1.8	40.3	2773
1.5mm^2							
1x2x1.5	2	0.5	0.9	0.9	1.4	13.7	379
2x2x1.5	2	0.5	1.1	0.9	1.5	18.8	622
3x2x1.5	2	0.5	1.1	0.9	1.5	19.7	706
4x2x1.5	2	0.5	1.2	1.25	1.6	22.4	975
5x2x1.5	2	0.5	1.2	1.25	1.6	24.0	1100
8x2x1.5	2	0.5	1.3	1.25	1.6	27.7	1431
10x2x1.5	2	0.5	1.4	1.6	1.7	32.9	1966
12x2x1.5	2	0.5	1.4	1.6	1.7	33.8	2119
16x2x1.5	2	0.5	1.5	1.6	1.8	37.4	2546
20x2x1.5	2	0.5	1.6	1.6	1.9	40.4	2952
24x2x1.5	2	0.5	1.7	1.6	1.9	45.5	3467

500V

Conductor		RE-2X(St)HSWAH...CI					
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Thickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
0.5mm^2							
1x2x0.5	2	0.6	0.9	0.9	1.3	12.6	317
2x2x0.5	2	0.6	1.0	0.9	1.4	16.9	496
3x2x0.5	2	0.6	1.0	0.9	1.4	17.7	551
4x2x0.5	2	0.6	1.1	0.9	1.5	19.4	648
5x2x0.5	2	0.6	1.1	1.25	1.5	21.6	857
8x2x0.5	2	0.6	1.2	1.25	1.5	24.8	1089
10x2x0.5	2	0.6	1.2	1.25	1.6	28.6	1313
12x2x0.5	2	0.6	1.3	1.25	1.6	29.6	1424
16x2x0.5	2	0.6	1.4	1.6	1.7	32.7	1912
20x2x0.5	2	0.6	1.4	1.6	1.7	35.0	2145
24x2x0.5	2	0.6	1.5	1.6	1.8	40.4	2533
0.75mm^2							

Conductor		RE-2X(St)HSWAH...CI					
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Thickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
1x2x0.75	2	0.6	0.9	0.9	1.3	12.9	335
2x2x0.75	2	0.6	1.0	0.9	1.4	17.5	529
3x2x0.75	2	0.6	1.1	0.9	1.5	18.8	616
4x2x0.75	2	0.6	1.1	1.25	1.5	20.8	824
5x2x0.75	2	0.6	1.2	1.25	1.5	22.6	940
8x2x0.75	2	0.6	1.2	1.25	1.6	26.0	1196
10x2x0.75	2	0.6	1.3	1.25	1.6	30.0	1450
12x2x0.75	2	0.6	1.3	1.6	1.7	31.0	1771
16x2x0.75	2	0.6	1.4	1.6	1.7	34.1	2087
20x2x0.75	2	0.6	1.5	1.6	1.8	37.6	2401
24x2x0.75	2	0.6	1.6	1.6	1.9	42.6	2837
$1.0mm^2$							
1x2x1.0	2	0.6	0.9	0.9	1.3	13.4	357
2x2x1.0	2	0.6	1.0	0.9	1.4	18.2	569
3x2x1.0	2	0.6	1.1	0.9	1.5	19.5	667
4x2x1.0	2	0.6	1.1	1.25	1.5	21.7	893
5x2x1.0	2	0.6	1.2	1.25	1.6	23.7	1036
8x2x1.0	2	0.6	1.2	1.25	1.6	27.1	1314
10x2x1.0	2	0.6	1.3	1.6	1.7	31.5	1817
12x2x1.0	2	0.6	1.4	1.6	1.7	32.6	1974
16x2x1.0	2	0.6	1.5	1.6	1.8	36.8	2356
20x2x1.0	2	0.6	1.5	1.6	1.8	39.4	2667
24x2x1.0	2	0.6	1.6	2.0	1.9	44.6	3492
$1.5mm^2$							
1x2x1.5	2	0.6	0.9	0.9	1.3	14.1	394
2x2x1.5	2	0.6	1.1	0.9	1.5	19.5	650
3x2x1.5	2	0.6	1.2	1.25	1.5	21.3	883
4x2x1.5	2	0.6	1.2	1.25	1.6	23.1	1020
5x2x1.5	2	0.6	1.3	1.25	1.6	25.1	1171
8x2x1.5	2	0.6	1.3	1.25	1.7	29.0	1516
10x2x1.5	2	0.6	1.4	1.6	1.8	34.0	2081
12x2x1.5	2	0.6	1.5	1.6	1.8	35.5	2269
16x2x1.5	2	0.6	1.6	1.6	1.9	39.3	2722
20x2x1.5	2	0.6	1.7	1.6	2.0	42.5	3153
24x2x1.5	2	0.6	1.8	1.6	2.0	47.9	3701
$2.5mm^2$							
1x2x2.5	2	0.7	1.0	0.9	1.4	15.5	474
2x2x2.5	2	0.7	1.2	1.25	1.5	22.4	927
3x2x2.5	2	0.7	1.2	1.25	1.6	23.7	1070
4x2x2.5	2	0.7	1.3	1.25	1.6	25.8	1252
5x2x2.5	2	0.7	1.4	1.25	1.7	28.3	1461
8x2x2.5	2	0.7	1.4	1.6	1.7	32.6	2114
10x2x2.5	2	0.7	1.6	1.6	1.9	39.1	2643
12x2x2.5	2	0.7	1.6	1.6	1.9	40.2	2868

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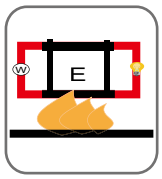
Conductor		RE-2X(St)HSWAH...CI					
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Thickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
16x2x2.5	2	0.7	1.7	2.0	2.0	44.5	3803
20x2x2.5	2	0.7	1.9	2.0	2.1	48.3	4441
24x2x2.5	2	0.7	2.0	2.5	2.2	54.8	5770

Rated Voltage

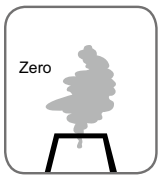
Standard



Circuit Integrity
IEC 60331-23/BS 6387(Optional)

Flame Retardancy
BS EN 60332-1-2

Reduced Fire Propagation
EN 60332-3-24



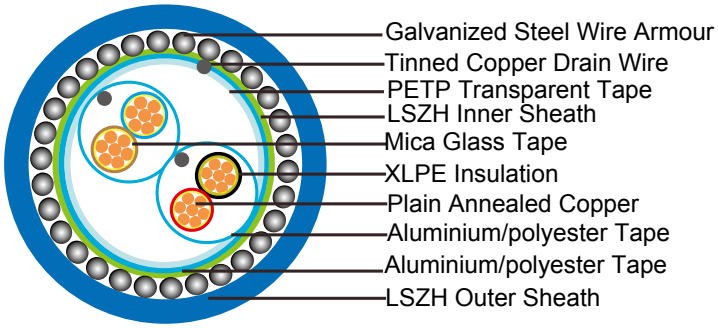
Halogen Free
IEC 60754-1

Low Corrosivity
IEC 60754-2

Low Smoke Emission
IEC 61034-2

Fire Resistant Individual and Overall Screened, Armoured Instrumentation Cables (Multipair)

RE-2X(St)HSWAH PiMF...CI



APPLICATION

The armoured LSZH sheathed cables are generally used when the risk of mechanical damage is increased. The galvanized steel wire armour provides excellent protection. Generally, the cables are used within industrial process manufacturing plants for communication, data and voice transmission signals and services. Also used for the interconnection of electrical equipment and instruments, the LSZH sheath can reduce toxic smoke and fume emission.

STANDARDS

Basic design to BS EN 50288-7 (formerly BS 5308)

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ (Optional); BS EN 50200 (PH30/PH60/PH120)
Flame Retardance (Single vertical wire or cable test)	IEC 60332-1-2; EN 60332-1-2
Reduced Fire Propagation (Vertically-mounted bundled wires & cables test)	IEC 60332-3-24; EN 60332-3-24
Halogen Free	IEC 60754-1; EN 50267-2-1
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2
Minimum Smoke Emission	IEC 61034-2; EN 61034-2

VOLTAGE RATING

300V, 500V

CABLE CONSTRUCTION

Conductor: Plain or metal coated copper wire, solid, stranded or flexible according to IEC 60228 class 1, 2 and class 5.

Fire Barrier: Mica glass tape.

Insulation: Extruded XLPE compound according to EN 50290-2-29. LSZH, PE, PP compound can be offered as options.

Pairs: Two insulated conductors uniformly twisted together with a lay not exceeding 100mm (≤1.5mm^2) or 150mm (for 2.5mm^2).
Individual Screen: Aluminium/polyester tape is applied over the laid up pairs with metallic side down in contact with tinned copper drain wire, 0.5mm².
Binder Tape: PETP transparent tape.
Overall Screen: Aluminium/polyester tape is applied over the laid up pairs with metallic side down in contact with tinned copper drain wire, 0.5mm². Copper braid screen or aluminium/polyester tape combined with copper braid screen can be offered as option.
Inner Sheath: Thermoplastic LSZH compound.
Amouring: Galvanized steel wire armour.
Outer Sheath: Thermoplastic LSZH compound according to EN 50290-2-22.
Outer Sheath Option: Thermoplastic LSZH compound. UV resistance, hydrocarbon resistance, oil resistance, anti-rodent and anti-termite properties can be offered as option.

COLOUR CODE

Insulation Colour: Colours and/or additional ring markings and/or symbols achieved by the use of coloured insulation or by a coloured surface using extrusion, printing or painting.
Outer Sheath: Black. Other colours can be offered upon request.

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation: -30°C - +90°C
Temperature range during installation: -5°C - +50°C
Maximum short circuit temperature (5 Seconds): 250°C
Minimum bending radius: 10 x Overall Diameter

ELECTRICAL PROPERTIES

300V

Conductor Area Size		mm^2	0.5	0.75	1.0	1.5
Insulation Thickness (Nominal)		mm	0.4	0.4	0.4	0.5
Insulation Thickness (Minimum)		mm	0.26	0.26	0.26	0.35
Conductor Resistance (20°C)		ohm/km	36.7	25.0	18.5	12.3
Minimum Insulation Resistance (20°C)		Mohm/km	1000			
Maximum Mutual Capacitance		nf/km	250			
Capacitance Unbalance		pf/500m	500			
Maximum L/R (Ratio)		µH/Ω	25	25	25	40
Operating Voltage		V	300			
Dielectric Strength for 1	AC	V	≥1000			
Minute	DC	V	≥2000			

500V

Conductor Area Size		mm^2	0.5	0.75	1.0	1.5	2.5
Insulation Thickness (Nominal)		mm	0.6	0.6	0.6	0.6	0.7
Insulation Thickness (Minimum)		mm	0.44	0.44	0.44	0.44	0.53
Conductor Resistance (20°C)		ohm/km	36.7	25.0	18.5	12.3	7.4
Minimum Insulation Resistance (20°C)		Mohm/km	1000				
Maximum Mutual Capacitance		nf/km	250				
Capacitance Unbalance		pf/500m	500				
Maximum L/R (Ratio)		μH/Ω	25	25	25	40	60
Operating Voltage		V	500				
Dielectric Strength for 1 Minute	AC	V	≥2000				
	DC	V	≥3000				

CONSTRUCTION PARAMETERS

300V

Conductor		RE-2X(St)HSWAH PiMF...Cl					
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Tickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
0.5mm^2							
2x2x0.5	2	0.4	1.0	0.9	1.4	16.6	490
3x2x0.5	2	0.4	1.0	0.9	1.4	17.3	546
4x2x0.5	2	0.4	1.1	0.9	1.5	19.0	644
5x2x0.5	2	0.4	1.1	1.25	1.5	20.7	851
8x2x0.5	2	0.4	1.1	1.25	1.5	24.0	1067
10x2x0.5	2	0.4	1.2	1.25	1.6	28.0	1309
12x2x0.5	2	0.4	1.2	1.25	1.6	28.6	1403
16x2x0.5	2	0.4	1.3	1.6	1.7	32.4	1888
20x2x0.5	2	0.4	1.4	1.6	1.7	34.8	2152
24x2x0.5	2	0.4	1.5	1.6	1.8	39.3	2542
0.75mm^2							
2x2x0.75	2	0.4	1.0	0.9	1.4	17.2	524
3x2x0.75	2	0.4	1.1	0.9	1.5	18.4	613
4x2x0.75	2	0.4	1.1	0.9	1.5	19.8	697
5x2x0.75	2	0.4	1.2	1.25	1.5	22.2	937
8x2x0.75	2	0.4	1.2	1.25	1.6	25.5	1197
10x2x0.75	2	0.4	1.3	1.25	1.6	29.3	1451
12x2x0.75	2	0.4	1.3	1.25	1.6	30.0	1578
16x2x0.75	2	0.4	1.4	1.6	1.7	34.1	2095
20x2x0.75	2	0.4	1.5	1.6	1.8	36.8	2415
24x2x0.75	2	0.4	1.5	1.6	1.8	41.3	2800

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Conductor		RE-2X(St)HSWAH PiMF...Cl					
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Tickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
1.0mm^2							
2x2x1.0	2	0.4	1.0	0.9	1.4	18.0	567
3x2x1.0	2	0.4	1.1	0.9	1.5	19.2	667
4x2x1.0	2	0.4	1.2	1.25	1.5	21.6	909
5x2x1.0	2	0.4	1.2	1.25	1.6	23.4	1036
8x2x1.0	2	0.4	1.2	1.25	1.6	26.7	1319
10x2x1.0	2	0.4	1.3	1.6	1.7	31.7	1821
12x2x1.0	2	0.4	1.4	1.6	1.7	32.8	1982
16x2x1.0	2	0.4	1.5	1.6	1.8	36.2	2372
20x2x1.0	2	0.4	1.5	1.6	1.8	38.8	2692
24x2x1.0	2	0.4	1.6	2.0	1.9	43.9	3516
1.5mm^2							
2x2x1.5	2	0.5	1.1	1.25	1.5	20.7	805
3x2x1.5	2	0.5	1.2	1.25	1.6	22.1	937
4x2x1.5	2	0.5	1.2	1.25	1.6	23.8	1072
5x2x1.5	2	0.5	1.3	1.25	1.6	25.8	1232
8x2x1.5	2	0.5	1.3	1.25	1.7	29.9	1604
10x2x1.5	2	0.5	1.4	1.6	1.8	35.5	2198
12x2x1.5	2	0.5	1.5	1.6	1.8	36.7	2400
16x2x1.5	2	0.5	1.6	1.6	1.9	40.6	2887
20x2x1.5	2	0.5	1.7	2.0	2.0	43.9	3679
24x2x1.5	2	0.5	1.8	2.0	2.0	49.5	4311

500V

Conductor		RE-2X(St)HSWAH PiMF...Cl					
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Thickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
0.5mm^2							
2x2x0.5	2	0.6	1.0	0.9	1.4	18.0	548
3x2x0.5	2	0.6	1.1	0.9	1.5	19.3	638
4x2x0.5	2	0.6	1.1	1.25	1.5	21.4	853
5x2x0.5	2	0.6	1.2	1.25	1.6	23.4	987
8x2x0.5	2	0.6	1.2	1.25	1.6	26.8	1241
10x2x0.5	2	0.6	1.3	1.25	1.7	31.1	1522
12x2x0.5	2	0.6	1.4	1.25	1.7	32.2	1656
16x2x0.5	2	0.6	1.5	1.6	1.8	36.3	2214
20x2x0.5	2	0.6	1.5	1.6	1.8	38.9	2493
24x2x0.5	2	0.6	1.6	2.0	1.9	44.0	3278
0.75mm^2							
2x2x0.75	2	0.6	1.1	0.9	1.5	19.0	608

Conductor		RE-2X(St)HSWAH PiMF...CI					
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Thickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
3x2x0.75	2	0.6	1.1	1.25	1.5	20.7	806
4x2x0.75	2	0.6	1.2	1.25	1.6	22.6	943
5x2x0.75	2	0.6	1.2	1.25	1.6	24.3	1059
8x2x0.75	2	0.6	1.3	1.25	1.6	28.0	1361
10x2x0.75	2	0.6	1.4	1.6	1.7	33.3	1882
12x2x0.75	2	0.6	1.4	1.6	1.7	34.2	2014
16x2x0.75	2	0.6	1.5	1.6	1.8	37.8	2402
20x2x0.75	2	0.6	1.6	1.6	1.9	40.9	2769
24x2x0.75	2	0.6	1.7	2.0	2.0	46.3	3622
$1.0mm^2$							
2x2x1.0	2	0.6	1.1	0.9	1.5	19.8	652
3x2x1.0	2	0.6	1.2	1.25	1.5	21.7	883
4x2x1.0	2	0.6	1.2	1.25	1.6	23.5	1018
5x2x1.0	2	0.6	1.3	1.25	1.6	25.5	1167
8x2x1.0	2	0.6	1.3	1.25	1.7	29.6	1504
10x2x1.0	2	0.6	1.4	1.6	1.7	34.8	2049
12x2x1.0	2	0.6	1.5	1.6	1.8	36.1	2250
16x2x1.0	2	0.6	1.6	1.6	1.9	40.0	2692
20x2x1.0	2	0.6	1.7	2.0	1.9	43.0	3409
24x2x1.0	2	0.6	1.8	2.0	2.0	48.8	4017
$1.5mm^2$							
2x2x1.5	2	0.6	1.1	1.25	1.5	21.5	841
3x2x1.5	2	0.6	1.2	1.25	1.6	22.9	980
4x2x1.5	2	0.6	1.3	1.25	1.6	24.9	1140
5x2x1.5	2	0.6	1.3	1.25	1.7	27.0	1305
8x2x1.5	2	0.6	1.4	1.6	1.7	32.0	1905
10x2x1.5	2	0.6	1.5	1.6	1.8	37.1	2331
12x2x1.5	2	0.6	1.6	1.6	1.9	38.5	2566
16x2x1.5	2	0.6	1.7	2.0	2.0	42.6	3401
20x2x1.5	2	0.6	1.8	2.0	2.0	45.9	3892
24x2x1.5	2	0.6	1.9	2.0	2.1	52.1	4590
$2.5mm^2$							
2x2x2.5	2	0.7	1.2	1.25	1.6	24.1	1022
3x2x2.5	2	0.7	1.3	1.25	1.0	25.5	1186
4x2x2.5	2	0.7	1.4	1.25	1.7	27.9	1405
5x2x2.5	2	0.7	1.5	1.25	1.8	30.6	1639
8x2x2.5	2	0.7	1.6	1.6	1.8	36.2	2392
10x2x2.5	2	0.7	1.7	1.6	2.0	42.3	2955
12x2x2.5	2	0.7	1.8	2.0	2.0	43.7	3567
16x2x2.5	2	0.7	1.9	2.0	2.1	48.5	4280

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FIREFLIX Fire Resistant Instrumentation Cables

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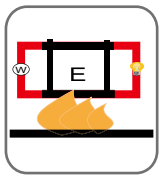
Conductor		RE-2X(St)HSWAH PiMF...CI					
No. of Pairs X Cross Section	Class of Conductor	Nominal Insulation Thickness	Nominal Inner Sheath Thickness	Nominal Armour Wire Diameter	Nominal Outer Sheath Thickness	Approx. Overall Diameter	Approx. Weight
mm^2		mm	mm	mm	mm	mm	kg/km
20x2x2.5	2	0.7	2.1	2.5	2.2	52.6	5499
24x2x2.5	2	0.7	2.2	2.5	2.4	59.9	6505

Rated Voltage

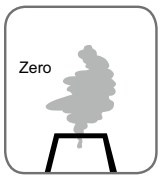
Standard



Circuit Integrity
IEC 60331-23/BS 6387(Optional)

Flame Retardancy
BS EN 60332-1-2

Reduced Fire Propagation
EN 60332-3-24



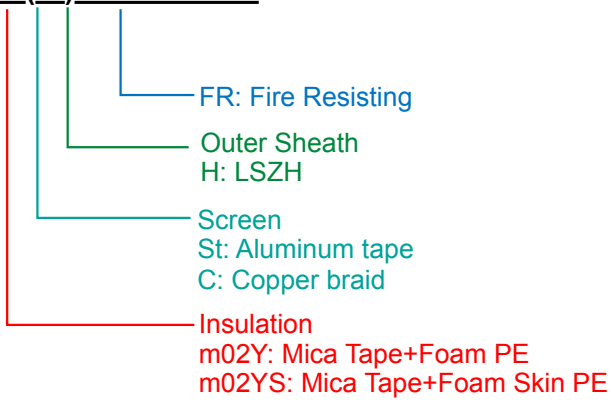
Halogen Free
IEC 60754-1

Low Corrosivity
IEC 60754-2

Low Smoke Emission
IEC 61034-2

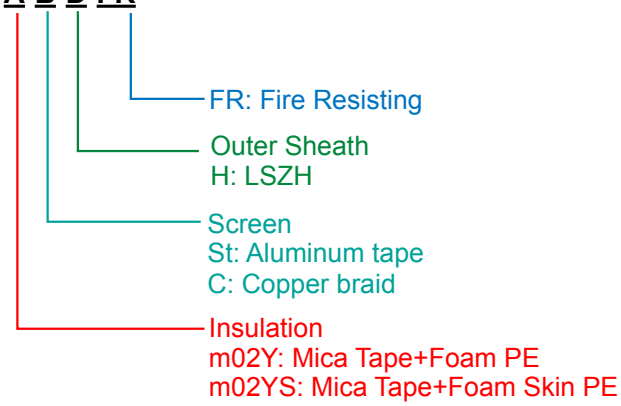
TYPE CODES FOR INSTRUMENTATION CABLES

RE-2X(St)H-SWA-H...CI



TYPE CODES FOR RS485 DATABUS CABLES

RE-A-B-D-FR



EN 50288-7 COLOUR CODE

Unless otherwise specified e.g. by means of numbered cores or tapes, the coding for identification shall be given in IEC 60189-2 or EN 60708, as appropriate. The colours shall meet the requirements of 4.4 of EN 50288-1.

Coloured or numbered non-hygroscopic binder tapes may be applied over screened cabling elements as identification.

4.4 of EN 50288-1:

When required, the insulated conductors shall be identified by colours and/or additional ring markings and/or symbols achieved by the use of coloured insulation or by a coloured surface using extrusion, printing or painting. Colours shall be clearly identifiable and shall correspond reasonably with the standard colours shown in HD 402.

The colour(s) or the symbol used for core identification shall be durable such that it cannot be removed when tested to EN 50289-3-8.

Technical Information for Fire Properties

FIRE RESISTANT CABLES

In all fire disasters, fire smoke, heat and toxic fumes are the main obstacles to safe evacuation of a building or area. A major contribution towards overcoming these hazards is the use of fire resistant and non-halogenated cables.

Caledonian fire resistant cables, branded under Fireflix, provide the following features:

- Fire resistance
- Long-term circuit integrity in a fire
- Minimum smoke emission
- Flame retardance
- Reduced fire propagation
- Zero halogen

Fireflix cables are mainly used in the wiring of:

- Fire resistant safety circuits
- Public address and emergency voice communication systems in high-rise building
- Control and instrumentation services in industrial, commercial and residential complexes
- High-temperature installation conditions

CABLE CONSTRUCTION

Fireflix cables have been developed to maintain circuit integrity in a fire and to ensure maximum safe evacuation of personnel with no detrimental effects like toxic gases or smoke.

Fireflix cables are constructed in the following typical design:

- Solid/stranded annealed copper conductor
- Glass mica tape/silicone rubber as flame barrier
- XLPE/silicone rubber as insulation
- LSZH/flame retardant PVC as sheath

Fireflix cables are offered in either single core, multicore or multi-pair constructions. The insulation material can be elastomeric (EPR, SR), thermosetting (XLPE, LSZH) or thermoplastic (EVA, PVC) to meet different stringent environment requirement. The cables may be armoured or braided, with or without metallic screen, depending on different applications. Caledonian can provide PE, PU, PVC, SHF1, SHF2 or LSZH materials as outer sheath for different applications.

INTERNATIONAL STANDARD COMPLIANCE

The fire resistant cables manufactured by caledonian comply with either one or combination of the following standards.

What is Fire Resistance

In a fire, the electrical systems must be able to keep functioning for a suitable length of time. This is particularly important for safety equipments used in emergency ventilation, emergency lighting, and alarm systems, together with the power supply to transport facilities and elevators.

Fire resistance means that the cable or the cable system where the cable is installed is capable to continue

to operate even in case of fire for a specific period of time from 30 to 180 minutes.

Circuit integrity (Insulation integrity) refers to tests for the cables only. This is denoted by FE180 in some European countries such as Germany and Belgium. Functional integrity refers to tests on cables and systems (ladders, cable tray, clamps etc). It is denoted by E30, E60, E90 indicating the cable resistance for 30, 60 and 90 minutes according to a specific test and different installation systems.

The functional integrity and the circuit integrity are not related in any way as regards their content. The former is a system test and the circuit (insulation) integrity is an individual cable test. The integrated system test for functional integrity is regarded as a technical benchmark in the cable industry.

DESIGN STANDARD IN ACCORDANCE WITH DIFFERENT STANDARDS

BS 7629-1:2015 – Electric cables. Specification for 300/500V fire resistant screened, fixed installation cables having low emission of smoke and corrosive gases when affected by fire. Part 1: Multicore Cables.

This standard apply to cables with thermosetting insulation of rated voltage 300/500V which conform to the performance requirements for cables required to maintain limited circuit integrity under those fire conditions of BS 6387 specified as C, W and Z. Those cables are intended for use in fire alarm and emergency lighting applications.

The cables are suitable for operation at a maximum sustained conductor temperature of 70°C although the insulation is suitable for operation at higher temperatures. Use at a temperature not exceeding 90°C is allowed for terminations within an enclosure providing the cable conductor temperature outside the enclosure does not exceed 70°C.

The standards apply to cables with a rated voltage of 300/500V, and
-two, three and four-core circular cables with uninsulated circuit protective conductor
-7,12 or 19 cores with an uninsulated drain wire

They contain a metallic layer which provides electrostatic screening.

BS 7846:2015 – Electric cables. Thermosetting insulated, armoured, fire resistant cables of rated voltage 600/1000V for fixed installation, having low emission to smoke and corrosive gases when affected by fire.

Some circuits requiring an equivalent level of fire resistance need to be designed for larger cables than are found in BS 7629-1. Such circuits may be for the main emergency supply, fire fighting lifts, sprinkler system and water pumps, smoke extraction fans, fire shutters or smoke dampers. These larger cables are standardized in BS 7846 which covers the size range and LSZH performance under BS 6724. Through the use of mica tape to supplement the insulation, the cables can pass BS 6387 CWZ and additionally the ‘standard’ or ‘enhanced’ grade as specified in BS 5839-1.
The cables are intended for use in fixed installations in industrial areas, buildings and similar applications, where maintenance of power supply during a fire is essential and where the evolution of smoke and corrosive

gases must be kept to a minimum.

The circuit integrity performance under fire conditions is assessed on the basis of various tests where resistance to fire, resistance to fire with water, and resistance to fire with mechanical shock are assessed separately or in combination. The cables are designated by the following categories:

Category F1- resistance to fire alone
Category F2- resistance to fire, resistance to fire with water, resistance to fire with mechanical shock, assessed separately.
Category F3- resistance to fire with mechanical shock and water assessed in combination.
The cables are wire armoured and
-two, three, four and five-core stranded copper conductor
-multicore auxiliary stranded copper conductor.

BS EN 60702 – Mineral insulated cables with a rated voltage not exceeding 750V.

BS EN 60702-1:2002 applies to mineral insulated general wiring cables with copper or copper alloy sheath and copper conductors and with rated voltage of 500V (light duty grade) and 750V (heavy duty grade). Provision is made for a corrosion resistant extruded outer covering over the copper sheath, when required. The standard sets out requirements for the optional outer covering, which includes requirements for halogen free covering and the thickness of the covering. The standard includes routine tests including a spark test on the outer covering. Sample tests includes such as flame retardance, emission of acidic and corrosive gases and smoke emission. Type tests such as fire resistance are included.

Mineral insulated cables are extremely resistant but rigid and a particular care has to be paid during installation to prevent moisture absorption by the mineral oxide.

500V grade cable includes the following conductor sizes:
- single and twin conductor cables up to 4mmsq csa
- three, four and seven conductor cables up to 2.5mmsq csa

750V grade cable provides for:
- single conductor cables up to 400mmsq csa
- two, three and four conductor cables up to 25mmsq csa
- seven conductor cables up to 4mmsq csa
- twelve conductor cables up to 2.5mmsq csa
- nineteen conductor cables up to 1.5mmsq csa

The fire related properties by the cable standards are summarised in the following table:

Cable Standard and type		Fire related properties	
BS 7629	Thermosetting insulated cables with limited circuit integrity when affected by fire	BS EN 60332-1	Tests on electric cables under fire conditions - single core cable.
		BS EN 61034-2	Measurement of smoke density of electric cables burning under defined conditions.
		BS 6387 Cat C, W and Z	Performance requirements for cables required to maintain integrity under fire conditions. Fire burning under defined conditions.
		BS EN 60754-1	Gases evolved during combustion of electric cables.
BS 7846	600/1000 V armoured electric cables having low emissions of smoke and corrosive gases when affected by fire	BS EN 60332-1	Tests on electric cables under fire conditions - single core cable.
		BS EN 60332-3-24	Tests on electric cables under fire conditions - bunched cables.
		BS EN 61034-2	Measurement of smoke density of electric cables burning under defined conditions.
		BS EN 60754-1	Gases evolved during combustion of electric cables.
		BS 7846 Cat F1, F2 or F3	Performance requirements for cables required to maintain integrity under fire conditions.
BS EN 60702	Mineral insulated cables with a rated voltage not exceeding 750V	BS EN 60332-1	Tests on electric cables under fire conditions - single core cable.
		BS EN 61034-2 (for zero-halogen coverings)	Measurement of smoke density of electric cables burning under defined conditions.
		BS EN 60754-1 (for zero-halogen coverings)	Gases evolved during combustion of electric cables.
		BS 6387 Cat C, W and Z	Performance requirements for cables required to maintain integrity under fire conditions.

CODE OF PRACTICE IN ACCORDANCE WITH DIFFERENT STANDARDS

BS 5839-1:2013 (Fire detection and fire alarm systems for buildings. Code of practice for system design, installation, commissioning and maintenance).

This standard provides recommendations for the planning, design, installation, commissioning and maintenance of fire detection and fire alarm systems in and around building, other than dwellings. It recommends the use of fire resisting cables for mains power supply circuit and all critical signal path in such systems. It does not recommend whether or not a fire alarm system should be installed in any given premises. Cables are described in clause 26. This standard introduces two different levels of resistance of cables during a fire (standard and enhanced grade).

BS 5839-6:2013 - Fire detection and fire alarm systems for buildings. Code of practice for the design, installation and maintenance of fire detection and fire alarm systems in dwellings.

This code of practice covers every type of fire detection ‘system’, from a simple self-contained battery smoke alarm right through to major hard wired 24V systems.

BS 5839-6 also covers almost every conceivable type of premises, including:
Bungalows
Multi-storey houses
Individual flats
Individual maisonettes
Mobile homes
Individual sheltered accommodation
Houses in multiple occupation (HMOs)
NHS housing in the community

BS 5839-6 is primarily concerned with saving lives and reducing injuries. BS 5839-6 grades fire detection systems from Grade F up to Grade A. Generally speaking, the greater the fire risk and the more demanding the application, the more comprehensive the system needs to be.

BS 5839-8:2013 - Fire detection and fire alarm systems for buildings. Code of practice for the design, installation, commissioning and maintenance of voice alarm systems.

Many people believe they can simply use their PA system to provide a voice message in the event of an emergency like a fire. Unfortunately PA systems, whilst very good for providing music and messages, are not guaranteed to work when there is an emergency. This is where the British Standard BS 5839 - 8:2013 on

Voice Alarm comes into use, as it clearly defines the requirements of a true VA system. A true VA system is a highly secure public address system which has the following features;

-All internal and external circuits are monitored for faults
-A minimum battery back up of 24 hours standby and 30 minutes alarm.
-A monitored secure link to a fire alarm panel
-A number of pre-recorded emergency messages
-Incorporates an emergency ‘firemans’ microphone

BS 5839-9:2011 - Fire detection and fire alarm systems for buildings. Code of practice for the design, installation, commissioning and maintenance of emergency voice communication systems.

An emergency voice communication systems (EVCS) is a fixed, secure, bi-directional, full duplex voice communication system to assist fire fighters in an emergency in high rise buildings or large sites where radio communication may not work, and covers the operation of both fire telephones and disabled refuge systems. Where both systems are fitted to a building, BS 5839-9 specifies these should be a single system.

BS 5266-1:2005 - Emergency lighting. Code of practice for the emergency lighting of premises.

The purpose of emergency lighting, anti-panic lighting and standby lighting is to ensure that the main fire exit routes from a building or open and high risk areas are sufficiently lit in the case of a mains failure, in order to allow persons to safely evacuate the areas or premises. Manual fire alarm points, first aid points, fire fighting and safety equipment should also be clearly lit, so that it can be clearly identified.

Cables installed for these systems have to withstand to fire for at least 60 minutes according to BS EN 50200.

BS 8519:2010- Selection and installation of fire resistant power and control cable systems for life safety and fire fighting applications. Code of practice.

BS 8519 was introduced specifically to apply only to large and complex buildings and has been widely welcomed within the industry. The new standard offers guidance for the selection of fire resistant power and control cables in life safety and firefighting systems such as smoke barriers, sprinkler systems, fire fighting and evacuation lift supplies. Consequently, BS 8519 should increase the protection of emergency and fire personnel, as well as evacuees who may be inside a large or complex building when fire breaks out.

CIRCUIT (INSULATION) INTEGRITY IN ACCORDANCE WITH DIFFERENT STANDARDS

Circuit (insulation) Integrity in accordance with IEC 60331

IEC 60331 specifies tests for electric cable for circuit integrity under fire conditions. It is divided in following parts that describe the test modes, the conditions, and the equipment to use. The test was originally carried out only in fire alone for a period of 180 minutes at a temperature of 750°C. To better simulate the real fire conditions, with mechanical stresses due to the fall of materials and with the presence of water, the testing conditions have been modified by changing the duration, increasing the temperature of the flame and by adding mechanical stresses and water spray.

IEC 60331-1 ed 1.0 (2009-05)- Part 1: Test method for fire with shock at a temperature of at least 830°C for cables of rated voltage up to and including 0.6/1KV and with an overall diameter exceeding 20mm.

IEC 60331-2 ed 1.0 (2009-05)- Part 2: Test method for fire with shock at a temperature of at least 830°C for cables of rated voltage up to and including 0.6/1KV and with an overall diameter not exceeding 20mm.

IEC 60331-3 ed 1.0 (2009-05)- Part 3: Test method for fire with shock at a temperature of at least 830°C for cables of rated voltage up to and including 0.6/1KV tested in a metal enclosure.

IEC 60331-11 ed1.01 Consol. with am1 (2009-07) – Part 11: Apparatus – Fire alone at a flame temperature of at least 750°C.

IEC 60331-12 ed1.01 Consol. with am1 (2009-07) – Part 12: Apparatus – Fire with shock at a flame temperature of at least 830°C.

IEC 60331-21 ed1.0 (1999-04) – Part 21: Procedures and requirements – Cables of rated voltage up to and including 0.6/1KV.

IEC 60331-23 ed1.0 (1999-04) – Part 23: Procedures and requirements – Electric Data Cables.

IEC 60331-25 ed1.0 (1999-04) – Part 25: Procedures and requirements – Optic Fiber Cables.

IEC 60331-31 ed1.0 (1999-04) – Part 31: Tests for electric cables for fire conditions and shock- Circuit integrity. Procedures and requirements for fire with shock – Cables of rated voltage up to and including 0.6/1KV.

IEC 60331-21/60331-23 A sample of the cable length of 1200mm sustained by two metal rings is mounted horizontally in a special ventilated cabin. During the test, to the wire cores of cable a voltage of the nominal value is applied (for telecommunication cables equal to 110 V), thereby creating a closed electric circuit.

The sample is subjected to an action of linear gas burner with a length of 500mm and the flame temperature equal to 750°C till 800°C. The time of the fire is 180 minutes. Result of the test is considered positive if at that time will not be considered a short circuit in the circuit being researched.

IEC 60331-25 details a method to assess the circuit integrity of optical fiber cables. The standard specifies a ribbon burner and the recommended flame temperature is 750°C. The optical power meter is zeroed and the changes in attenuation during the 180 minutes burner application period are monitored. The maximum change in attenuation (a change from zero) is recorded during the burner application period. In the 15 minutes period after the flame application, a maximum attenuation is also recorded. Result of the test is considered positive if at that time will not be considered a short circuit in the circuit being tested.

IEC 60331-31 applies to the cables with a diameter greater than 20mm, and introduces the standards and procedures for testing of cables exposed to fire and mechanical shock (equipment according to 60331-12). The test sample provides cable fragment length at least 1500mm. Bent wire on the U-shaped with a radius equal to the smallest permissible by the manufacturer, is mounted on a metal assay ladder. During the study, through all the cable wires is passed current with rated voltage and these cables are subjected to fire during 120min, where fire source is a gas burner set in conformity with standards, as well the mechanical shock of the 5 minutes interval. Result of the test is considered positive if at that time will not be considered a short circuit in the circuit being tested.

Circuit (insulation) Integrity in accordance with BS 6387:2013

BS 6387:2013 specifies the requirements for cables required to maintain circuit integrity under fire conditions. This is the first standard to include also mechanical stress and water stress in the fire resistance test of electric cables. BS 6387 standard is still used in many countries. Being different from EN 50200, Its limits is to require three different tests on three different cable samples.

The fire resistant cables are categorized by a letter symbol (e.g. A) or series of symbols (e.g. CWZ) according to the requirements for fire resistance characteristics which they meet, the test temperature selected and the duration of the test for resistance to fire alone in according to BS 6387 as below:

The test provides the basis for the following categories:

Test	Category
(1) Resistance to fire alone	
650°C for 3 hours (withdrawn in 2013 version)	A
750°C for 3 hours (withdrawn in 2013 version)	B
950°C for 3 hours	C
950°C for 20 minutes (short duration) (withdrawn in 2013 version)	S

Test	Category
(2) Resistance to fire with water Exposed to fire @ 650°C for 15 mins then exposed to fire @ 650°C with water for another 15 mins.	W
(3) Resistance to fire with mechanical shock Exposed to fire @ 650°C for 15 mins then exposed to fire @ 650°C with mechanical shock for 15 mins (withdrawn in 2013 version). Exposed to fire @ 750°C for 15 mins then exposed to fire @ 750°C with mechanical shock for 15 mins (withdrawn in 2013 version). Exposed to fire @ 950°C for 15 mins then exposed to fire @ 950°C with mechanical shock for 15 mins.	X Y Z

The most common test comprises the three categories C, W and Z.

–Category C is a fire resistance test in which the cable is exposed to a fire at a temperature of 950°C with a duration of 3 hours under realistic conditions.

– Category W is a fire and water resistance test in which the cable is exposed to a fire at a temperature of 650°C and then for another 15 minutes to fire with water that is poured over the area around the cable. This simulates effect of water from a sprinkler that is activated during the fire.

-Category Z is a fire and mechanical stroke test in which the cable is installed in a defined manner on a vertical wall with three cable clips and subject to heat from a gas burner; mechanical shock is simulated by striking the cable with a hammer. The cable is exposed to a fire at a temperature of 950°C and then for another 15 minutes to fire with mechanical shock at a frequency of 2 strikes per minute.

During testing in all three categories, the cable is connected to a 400V three-phase power supply protected with a 3 A fuse on each phase. The test is regarded as successful if none of the fuses blow during the test period.

Circuit (insulation) Integrity in accordance with EN 50200:2006

EN 50200:2006 defines method of test for resistance to fire of unprotected small cables (up to 20mm) for use in emergency circuits.

In the adapted chamber is mounted a cable sample with a length of 1200mm, to which wire cores during the test a nominal value voltage is applied, creating thereby a closed circuit. During the test the cable is subjected to actions of the fire at conventional temperature 842°C and mechanical stroke for a specified period of time. The measured time of proper functioning of the cable corresponds to the so-called cable fire resistance class PH, which is also mentioned in the standard PN-B-02851-1 - Fire resistance tests of elements of buildings (Test method for thin wires with an outside diameter not greater than 20mm).

The test duration is expressed in minutes and is recorded in the following classification:

Test	Category
Flame exposure for 15 minutes	PH 15

Test	Category
Flame exposure for 30 minutes	PH 30
Flame exposure for 60 minutes	PH 60
Flame exposure for 90 minutes	PH 90
Flame exposure for 120 minutes	PH 120

EN 50200 annex E also foresees the water stress (fire, mechanical shock & water spray), as previously provided by BS 8434-1 standard. EN 50200 is similar to IEC 60331-2. Being different from BS 6387, EN 50200 test the same samples simultaneously stressed by the flame action, by the mechanical shock and by water spray.

Circuit (insulation) Integrity in accordance with EN 50362:2003

EN 50362:2003 / BS EN 50362:2003 / DIN EN 50362:2003 / CEI EN 50362:2003 (CEI 20-36/5-0) defines method of test for resistance to fire of larger unprotected power and control cables for use in emergency circuits. This standard provides the same tests foreseen by IEC 60331-31 standards. (Flame Temperature of 830°C).

Circuit (insulation) Integrity in accordance with BS 5839-1:2002

The new edition of BS 5839-1:2013 (Fire detection and fire alarm systems for buildings. Code of practice for system design, installation, commissioning and maintenance) describes two level of fire performance for fire rated cabling for fire alarm system: Standard Grade and Enhanced Grade. In order to confirm the compliance of the cable to both categories, BS 5839-1 refers to EN 50200 and BS 8434-2003 Part 1 & 2. (Method of tests for the assessment of fire integrity of electricity cables). These tests are carried out to verify the circuit integrity of small cables exposed to flame, mechanical shock and water in accordance with the new fire alarm code of practice.

Standard Grade clause 26.2d
Maintenance of circuit integrity:
BS 8434-1:2003 at 830°C for 30 minutes,
15 minutes with fire and mechanical shock plus.
15 minutes with fire, mechanical shock and water.
BS EN 50200 PH30.
30 minutes at 830°C with fire and mechanical shock.

Enhanced Standard Grade clause 26.2e
Maintenance of circuit integrity:
BS 8434-2:2003 at 930°C for 60 minutes,
60 minutes with fire and mechanical shock plus.
60 minutes with fire, mechanical shock and water.
BS EN 50200 PH120 (improved).
120 minutes at 930°C with fire and mechanical shock.

Circuit (insulation) Integrity in accordance with BS 8434-1:2003 & BS 8434-2:2003 + A2:2009

BS 8434- Methods of test for assessment of the fire integrity of electric cables Part1: Test for unprotected small cables for use in emergency circuits - BS EN 50200 with the addition of water spray. Part 2: Test for unprotected small cables for use in emergency circuits- BS EN 50200 with a 930°C flame and with water spray.

BS 8434-1:2003 defines test which is equivalent to BS EN 50200 with a 830°C flame and water spray. The cable is stressed by the flame at 830°C with mechanical shocks for 15 minutes and further 15 minutes with the addition of water spray. BS 8434-2:2003 defines test which is equivalent to BS EN 50200 with a 930°C flame and water spray. The cable is stressed by the flame at 930°C with mechanical shocks for 60 minutes and further 60 minutes with the addition of water spray. The tests for BS 8434-2 have not been covered in the BS EN 50200 standard yet and are still in force. (BS 8434-1 was replaced by BS EN 50200).

Circuit (insulation) Integrity in accordance with BS 8491:2008

BS8491:2008 Method for assessment of fire integrity of large diameter power cables for use as components for smoke and heat control systems and certain other active fire safety systems. This standard is related to cables included in BS 7346-6 and certain other active fire safety systems. It is applicable to cables of rated voltage not exceeding 600/1000V and overall diameter greater than 20mm. The test method in BS 8491-2008 includes subjecting the cable under test to radiation via direct impingement corresponding to a constant temperature attack of 842°C, to direct mechanical impacts corresponding to a force of approximately 10N and to direct application of a water jet simulating a water fire fighting jet. The test method given in this standard includes three different test durations to allow testing of cables intended for different applications.

Circuit (insulation) Integrity in accordance with DIN VDE 0472-814

DIN VDE 0472-814:1991 - Testing of cables. wires and flexible cords; continuance of insulation effect under fire conditions.

A test fire is applied horizontally from a distance of 60cm to a single suspended cable during a specified time. The test is passed when there was continuous circuit integrity and no extremely increased attenuation values during and after the test respectively. For instance FE 90 cables can endure at least 90 minutes, “FE” stands for flame exposure. The fire test with circuit integrity shows how many minutes a mechanically unstressed connection at a flame exposure of minimum 750°C keeps minimum insulation efficiency (circuit integrity) in a dry environment.
Similar standard is IEC 60331 (FE) and BS 6387 Cat C. This is a fire test for insulation integrity without any mechanical and water stress.

Circuit (insulation) Integrity in accordance with NBN C30-004 (cat. F3)

NB N C30-004 – Fire Resistance of electric cables. Classification and test method.
The cable is stressed by the flame at 900°C with mechanical shocks every 30 seconds for a duration of 3 hours. The cable is deemed to pass the test if the current leakage does not exceed 1 amp per conductor. The test must be passed by 4 successive samples.

Circuit (insulation) Integrity in accordance with SS299-1

SS299-1 Fire resistant cables - Performance requirements for cables required to maintain circuit integrity under fire conditions.

Circuit (insulation) Integrity in accordance with CEI 20-36/2-1

CEI 20-36/2-1 Tests for electric cables under fire conditions-Circuit integrity - Part 21: Procedures and requirements- Cables of rated voltage up to and including 0.6/1KV.
This is equivalent to IEC 60331-21.

Circuit (insulation) Integrity in accordance with CEI 20-36/4-0

CEI 20-36/4-0 Method of test for fire resistance of small cables unprotected for use in emergency circuits. This is equivalent to CEI EN 50200.

Circuit (insulation) Integrity in accordance with NF C32-070-2.3(CR1)

The cable is installed in a stainless steel conduit and heated to 920°C ± 20°C according to a specified time curve. A voltage of 500 V AC or 1,000 V AC respectively is applied to the cable. To simulate mechanical shock, a small hammer strikes the pipe at a frequency of 2 strikes / min.

SYSTEM CIRCUIT (FUNCTIONAL) INTEGRITY IN ACCORDANCE WITH DIFFERENT STANDARDS

System Circuit (functional) Integrity in accordance with DIN 4102-12

Maintaining the function of electrical cable during the fire, defined as the concept of cable system is characterized by the German DIN 4102, part 12. DIN 4101-12 is a testing for functional integrity of entire electrical cable systems together with fastener components and shall be considered as the most rigorous, but on the other hand, as most closely simulating the real fire conditions,
DIN 4102-12 defines the requirements and testing method for fire resistance of electric cable system required to maintain circuit integrity. The standard defines testing for the functionality of so-called cable set, which consists of a group set of power cables, telecommunications, data cables etc. to be fixed to the support structure consisting of channels, ladders, cable tray ,items to hang, handles, etc. Cables attached to this structure are powered by their work voltage. Functional integrity will be tested for short-circuit of insulation or discontinuity of any wire core.

DIN 4102-12 is a realistic fire-chamber testing with minimum dimensions 2 x 3 x 2.5 m. (width/length/height). A complete cable installation is tested under realistic conditions. The effects of thermal expansion and mechanical load during a fire are taken into account. The temperature must follow the standard fire curve (ETK): At E 90, the system is tested for 90 minutes, with a flame temperatures reaching up to 1000°C during the test. The cable is installed in a furnace and mounted with cable trays and cable clips with guides. A voltage of 400 V AC is applied to the cable (or 110 V AC for telecommunications cables)

There are three categories of function maintenance as follows:
E30 - cable system function maintenance in case of fire for 30 minutes

E60 - cable system function maintenance in case of fire for 60 minutes
E90 - cable system function maintenance in case of fire for 90 minutes
The numbers in each case designate the period of time for which the integrity of the power circuit must be maintained.

It is worth noting that duration of the cable operation under test is determined not only by design and selection of used cable materials, but also and often primarily, the construction and selection of supporting structure materials, which is subject to deformation in high temperatures, and these deformations in turn tighten the cables attached to the structure.

System Circuit (functional) Integrity in accordance with NBN 713 020

The test specifies fire performance of building materials and products. The cables are installed in 3 x 3 testing room They are installed on cable trays and undergo the flame action up to 1000°C. The cables are then classified according to the maximum time for resistance to fire (denoted by Rf1, Rf 1 1/2, Rf2 in which the number represents the time duration).

FLAME RETARDANCE IN ACCORDANCE WITH DIFFERENT STANDARDS

The following standards specify a method for flame propagation test for single core cables. The single cable sample undergoes the flame action of a bunsen burner. The test only lasts few minutes.

The IEC 60332-1 standards are taken over as EN standards and transferred to national standards. Example: IEC 60332-1 becomes EN 60332-1 and introduced in Germany as DIN EN 60332-1.

Flame retardance in accordance with EN 60332:2004

EN 60332:2004 Tests on electrical and optical cables under fire conditions. The standard applies to single insulated wires (cables) and requires a vertical flame test with a maximum flame climb of 450mm. The test lasts between 1 and 8 minutes, depending on the cable diameter.

EN 60332-1-1:2004 / BS EN 60332-1-1:2004 / IEC 60332-1-1:2004 / DIN EN 60332-1-1:2004 / VDE 0482-1-1:2005-06 Test on electrical and optical cables under fire conditions. Test for a vertical flame propagation fo a single insulated wire or cables.

EN 60332-1-2:2004 / BS EN 60332-1-2:2004 / IEC 60332-1-2:2004 / DIN EN 60332-1-2:2004 / VDE 0482-1-2:2005-06 / CEI 60332-2-2 (CEI 20-35/2-2) Tests on electrical and optical fiber cables under fire conditions. Test for a verticalflame propagation for a single insulated wire or cable – Procedure for 1kW premixed flame.
This standard specifies a method of test for resistance to vertical flame propagation for a single insulated wire or cable. Part 1-1 specifies the test apparatus and Part 1-2 specifies the test procedure.

The cable sample is deemed to pass the test if the distance between the lower edge of the top support and the onset of charring is greater than 50mm. In addition, a failure shall be recorded if burning extends downward to a point greater than 540mm from the lower edge of the top support.

EN 60332-1-2:2004 specifies the use of 1kW premix flame and is for general use, except that the procedure may not be suitable for the testing of small insulated conductors or cables of less than 0.5mm sq cross section because the conductor melts before the test is completed, or for the testing of small optic fiber cables because the fiber will be broken before the test is completed. In this case, the procedure given by EN 60332-2-1/2 is recommended.

EN 60332-2-1:2004 / BS EN 60332-2-1:2004 / IEC 60332-2-1:2004 / DIN EN 60332-2-1:2004 / VDE 0482-2-1:2005-06 Tests on electrical and optical cables under fire conditions. Test for a vertical flame propagation for a single small insulated wire or cable.

EN 60332-2-2:2004 / BS EN 60332-2-2:2004 / IEC60332-2-2:2004 / DIN EN 60332-2-2:2004 / VDE 0482-2-2:2005-06 / CEI 60332-2-2 (CEI 20-35/2-2) Test on electric and optical fiber cables under fire conditions. Tests for vertical flame propagation for a single small insulated wire or cable. Procedure for diffusion flame.
This test applies to small dimensions cables.
This standard specifies a method of test for resistance to vertical flame propagation for a single insulated wire or cable. Part 2-1 specifies the test apparatus and Part 2-2 specifies the test procedure.

Flame retardance in accordance with NF C32-070-2.1(C2)

NF C32-070:2001 Insulated conductors and cables for installation - Classification tests on conductors and cables with regard to fire behavior.

NF C32-070 2.1 Procedure for 1 kW pre-mixed flame.

The NF F 32070 2.1 (Category C2) and IEC 60332-1-2 are very similar. The sole difference is the time during which the flame is applied.

Flame retardance in accordance with EN 50265-1:1999 (replaced by EN 60332)

EN 50265-1:1999 / BS EN 50265-1:1999 / DIN EN 50265-1:1999 / VDE 0482-265-1:1999-04– Common test methods for cables under fire conditions. Test for resistance to a vertical flame propagation for a single insulated conductor or cable. Apparatus (Replaced by EN 60332-1-1:2004 and EN 60332-2-1:2004).

EN 50265-2-1:1999 / BS EN 50265-2-1:1999 / DIN EN 50265-2-1:1999 / VDE 0482-265-2-1:1999-04 – Common test methods for cables under fire conditions. Test for resistance to a vertical flame propagation for a single insulated conductor or cable. Part 2-1: Procedure 1kW pre-mixed flame (Replaced by EN 60332-1-2:2004).

EN 50265-2-2:1999 / BS EN 50265-2-2:1999 / DIN EN 50265-2-2:1999 / VDE 0482-265-2-2:1999-04 – Common test methods for cables under fire conditions. Test for resistance to a vertical flame propagation for a single insulated conductor or cable. Part 2-2: Procedure Diffusion flame (Replaced by EN 60332-2-2:2004).

Flame retardance in accordance with BS 4066 Part 1 & 2 (replaced by EN 60332)

BS 4066-2:1980 (superseded) – Tests on electic cables under fire conditions. Method of test on a single vertical insulated wire or cable.

This standard is no longer in force and is replaced by BS EN 50265-2-1 which was also superseded by BS EN 60332-1:2009.

Flame retardance in accordance with NBN C 30-004 (cat. F1)

NBN C 32-004 specifies a method of test for measuring the vertical flame propagation characteristics of a single wire or cable. The cable specimen is deemed to have passed the test and categorized as F1 if after burning has ceased, the charred or affected portion does not reach within 50mm of the lower edge of the top clamp which is equivalent to 425mm above the point of flame application.

Flame retardance in accordance with IEEE 383

In the IEEE 383 test, cables are supported by a one foot wide vertical rack eight feet high. The cables are positioned in the centre six inches of the rack, spaced one-half diameter apart. The rack is centered in an eight foot enclosure. A ten inch ribbon burner ignites the cable with a 21kW (70000 BTU). The burner is positioned 2 feet above the floor and 9 to 12 inches of cables are exposed to direct flames for 20 minutes. Cables on which flame extends above the top of the 8 foot rack fail the test.

REDUCED FIRE PROPAGATION IN ACCORDANCE WITH DIFFERENT STANDARDS

These standards specify a method for fire propagation test for vertically mounted bunched cables. These tests simulate the chimney effect in vertical installation of bunch of cables. A certain number of cable sections with a length of 3.5m is fastened to a vertical ladder in an adapted chamber. The amount of combustible materials for cables and duration of flame application depends on the category the cable has to meet.

Resistance of the wires bundle arranged vertically to the spread of the flame should be such that after a certain time and stopping the source of ignition, flame is extinguished by itself and the length of charred fragments will not exceed 2.5m in height measured above the lower edge of the burner.

Reduced fire propagation in accordance with IEC 60332-3

This test is the most common one to verify the behaviour of a cables for the fire propagation. The cables are installed on a bunch of vertical ladder inside a metal cabinet and undergo the action of a ribbon flame at 750°C.The standard is subdivided in several parts that differ one from the other for the quantity of cable to be installed, the installation mode and the flame application time.

EN 60332-3-10:2009 / BS EN 60332-3-10:2009 / IEC 60332-3-10 ed1.1 / DIN EN 60332-3-10:2009 / VDE 0482-332-3-10:2010-08 – Common test methods for cables under fire conditions. Tests on electric and

optical fiber cables under fire conditions - Part 3-10: Test for vertical flame spread of vertically mounted bunched wires or cables.

EN 60332-3-21:2009 / BS EN 60332-3-21:2009 / IEC 60332-3-21 ed1.1 / DIN EN 60332-3-21 / VDE 0482-332-3-21:2010-08 / CEI EN 60332-3-21:2009 (CEI 20-22/3-1)– Procedures. Tests on electric and optical fiber cables under fire conditions - Part 3-21: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category A . F/R
-Installation in one layer (front).
-Installation in two layers (front and rear)
-The quantity of the Installed cable is equal to 7 litres/m of combustible materials for cables
-The time of application of the flame is 40 minutes

EN 60332-3-22:2009 / BS EN 60332-3-22:2009 / IEC 60332-3-22 ed1.1 / DIN EN 60332-3-22:2009 /VDE 0482-332-3-22:2010-08 / CEI EN 60332-3-22:2009 (CEI 20-22/3-2)– Procedures. Tests on electric and optical fiber cables under fire conditions - Part 3-22: Test for vertical flame spread of vertically-mounted bunched wires or cable - Category A

-Installation in one layer (front).
-The quantity of the installed cable is equal to 7 litres/m of combustible materials for cables
-The time of application of the flame is 40 minutes

EN 60332-3-23:2009 / BS EN 60332-3-23:2009 / IEC 60332-3-23 ed1.1 / DIN EN 60332-3-23:2009 / VDE 0482-332-3-23:2010-08 / CEI EN 60332-3-23:2009 (CEI 20-22/3-3)– Procedures. Tests on electric and optical fiber cables under fire conditions - Part 3-23: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category B

-Installation in one layer (front).
-The quantity of the installed cable is equal to 3.5 litres/m of combustible materials for cables
-The time of application of the flame is 40 minutes

EN 60332-3-24:2009 / BS EN 60332-3-24:2009 / IEC 60332-3-24 ed1.1 / DIN EN 60332-3-24:2009 / VDE 0482-332-3-24:2010-08 / CEI EN 60332-3-24:2009 (CEI 20-22/3-4) – Procedures. Tests on electric and optical fiber cables under fire conditions - Part 3-24: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category C
-Installation in one layer (front).
-The quantity of the installed cable is equal to 1.5 litres/m of combustible materials for cables
-The time of application of the flame is 20 minutes

EN 60332-3-25:2009 / BS EN 60332-3-25:2009 / IEC 60332-3-25 ed1.1 / DIN EN 60332-3-25: 2009 / VDE 0482-332-3-25:2010-08 / CEI EN 60332-3-25:2009 (CEI 20-22/3-5)– Procedures. Tests on electric and

optical fiber cables under fire conditions - Part 3-25: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category D

-Installation in one layer (front).

-The quantity of the installed cable is equal to 0.5 litres/m of combustible materials for cables

-The time of application of the flame is 20 minutes.

Summary of test condition:

IEC	60332-3-21	60332-3-22			60332-3-23		60332-3-24		60332-3-25	
BS EN 50266	50266-2-1	50266-2-2			50266-2-3		50266-2-4		50266-2-5	
CEI	20-22/3-1	20-22/3-2			20-22/3-3		20-22/3-4		20-22/3-5	
Category	AF/R	A			B		C		D	
Conductor cross-sectionsmm^2	>35	>35		≤35	>35	≤35	>35	≤35	>35	≤35
NMV (litres per metre of cable)	7	7			3.5		1.5		0.5	
Minimum length of test pieces(m)	3.5	3.5			3.5		3.5		3.5	
Standard ladder (500 mm wide): • number of layers • maximum width of test sample	1front+1rear 300mm	≥1front 300mm	1front 300mm	- -	≥1front 300mm	1front 300mm	≥1front 300mm	1front 300mm	≥1front 300mm	
Wide ladder (800 mm wide): • number of layers • maximum width of test sample	- -	- -	- -	1front 600mm	- -		- -		- -	
Positioning of test pieces	Spaced 0.5×Diameter cable (Max.20mm)	Touching	Spaced 0.5×Diameter cable (Max.20mm)		Touching	Spaced 0.5×Diameter cable (Max.20mm)	Touching	Spaced 0.5×Diameter cable (Max.20mm)	Touching	
Number of burners	1	1	1	2	1		1		1	
Ladder mounting	Front and rear	Front, Wider ladder for larger cables			Front		Front		Front	
Flame application time (min)	40	40	40		40		40		40	
Test conditions	Wind speed: <8 m/s; Ternperature: 5°C - +40°C									
Extent of the charred portion	≤2.5m above the bottom edge of the burner, neither at the front nor at the rear of the ladder.									

Reduced fire propagation in accordance with NF C32-070-2.2(C1)

NF C32-070 :2001 Insulated conductors and cables for installation.

-Classification tests on conductors and cables with regard to fire behavior.

A 1600mm vertically installed bundled of cable is exposed to the effects of a radiating oven (approx 830°C)

and forced ventilation. Pilot flames arranged above the oven burn off the emitted gases. The test duration is 30 minutes, with the ventilation stopped for every 10 minutes during the flame application period. The cable sample is classified under Category C1 according to NF F 32070-2.2 if the carbonised part of the cable sample does not extend more than 0.8m above the upper base of the oven.
Depending on the damaged length, they can be further classified into 4 classes A, B, C and D according to NF F 16-101 as follows:

Category	Test Result
A	No damaged length from top of the oven in upper position.
B	Damaged length from top of oven in upper position not extending more than 50mm.
C	Damaged length from top of oven in upper position not extending more than 300mm
D	Damaged length from top of oven in upper position not extending above the top of the chimney

Reduced fire propagation in accordance with EN 50266-1, EN 50266-2-2, EN 50266-2-3, EN 50266-2-4.

EN 50266-1:2001 / BS EN 50266-1:2001 / DIN EN 50266-1:2001 / VDE 0482-266-1:2001-09– Common test methods for cables under fire conditions. Test for vertical flame spread of vertically mounted bunched wires or cables - Part 1: Apparatus (Replaced by EN 60332-3-10:2009)

EN 50266-2-1:2001 / BS EN 50266-2-1:2001 / DIN EN 50266-2-1:2001 / VDE 0482-266-2-1:2001-09 / CEI EN 50266-2-1– Common test methods for cables under fire conditions. Test for vertical flame spread of vertically mounted bunched wires or cables - Part 2-1 : Procedures. Category A F/R (Replaced by EN 60332-3-21:2009)

EN 50266-2-2:2001 / BS EN 50266-2-2:2001 / DIN EN 50266-2-2:2001 / VDE 0482-266-2-2:2001-09 / CEI EN 50266-2-2– Common test methods for cables under fire conditions. Test for vertical flame spread of vertically mounted bunched wires or cables
- Part 2-2: Procedures. Category A (Replaced by EN 60332-3-22:2009)

EN 50266-2-3:2001 / BS EN 50266-2-3:2001 / DIN EN 50266-2-3:2001 / VDE 0482-266-2-3:2001-09 / CEI EN 50266-2-1– Common test methods for cables under fire conditions. Test for vertical flame spread of vertically mounted bunched wires or cables
- Part 2-3: Procedures. Category B (Replaced by EN 60332-3-23:2009)

EN 50266-2-4:2001 / BS EN 50266-2-4:2001 / DIN EN 50266-2-4:2001 / VDE 0482-266-2-4:2001-09 / CEI EN 50266-2-4:2001 – Common test methods for cables under fire conditions. Test for vertical flame spread of vertically mounted bunched wires or cables - Part 2-4: Procedures. Category C (Replaced by EN 60332-3-24:2009).

Reduced fire propagation in accordance with BS 4066-3

BS 4066-3:1994 (superseded) – Tests on electic cables under fire conditions. Tests on bunched wires or cables. This standard is no longer in force and is replaced by the BS EN 50266-1:2001

Reduced fire propagation in accordance with NBN C 32-004 (F2)

NBN C 32-004 specifies a method of test for measuring the vertical flame propagation characteristics of a bunch of cables. The cable specimen is deemed to have passed the test and categorized as F2 if after burning has ceased, the extent of charred or affected portion does not reach a height exceeding 2.5m above the bottom edge of the burner.

HALOGEN CONTENT TEST IN ACCORDANCE WITH DIFFERENT STANDARDS

In the event of a fire, many fumes are produced. This test is concerned with the possibilities of corrosive acid gases being released from halogen containing cables and the damage such cables can cause (to equipments). These standards specify a method for determination of the amount of halogen acid gas, evolved during combustion of compound.

Halogen content test in accordance with EN 50267-2-1

EN 50267-2-1:1998 / BS EN 50267-2-1:1999 / DIN EN 50267-2-1: 1999 / VDE 0482-267-2-1:1999-04 / CEI EN 50267-2-1:1999 (CEI 20-37/2-1) Common test methods for cables under fire conditions- Test on gases evolved during combustion of materials from cables- Part 2-1: Procedures. Determination of the amount of halogen acid gas. This part of the standard defines the method to measure the amount of halogen acid evolved and which should be expressed in hydrochloric acid. The amount of halogen acid contained in the test solution is determined by a titration method.

If the cables are described as zero halogen or halogen free, it is recommended that the hydrochoric acid yield should be less than 0.5%.

Halogen content test in accordance with IEC 60754-1

IEC 60754-1 ed 2.0 Common test methods for cables under fire conditions. Test on gases evolved during combustion of materials from cables. Part 1: Procedures. Determination of the amount of halogen acid gas. Basically, this is same as EN 50267-2-1.

Halogen content test in accordance with BS 6425-1

BS 6425-1:1990 (superseded): Test on gases evolved during the combustion of materials from cables. Method for determination of amount of halogen acid gas evolved during combustion of polymeric materials taken from cables.
This standard is no longer in force and is replaced by the EN 50267-2-1.

ACID GAS EMISSION TEST IN ACCORDANCE WITH DIFFERENT STANDARDS

The following standards specify a method for determination of acidity of gas evolved during combustion of cables by measuring PH and conductivity. This test allows to determine the corrosivity of the acid gases generally halogens, that develop during the electric cable combustion.

Acid gas emission test in accordance with EN 50267-2-2

EN 50267-2-2:1999 / BS EN 50267-2-2:1999 / DIN EN 50267-2-2:1999 / VDE 0482-267-2-2:1999- 04/ CEI EN 50267-2-2:1999 (CEI 20-37/2-2). Common test methods for cables under fire conditions- Test on gases evolved during combustion of materials from cables- Part 2-2: Procedures. Determination of degree of acidity of gases for materials by measuring PH and conductivity.
The standard states that the pH and the conductivity of a test solution should be measured, using calibrated PH and conductivity meters.

If the cables are described as zero halogen or halogen free, it is recommended that at least both of the following requirements should be met for each of the individual materials of a cable:

-The PH value should not be less than 4.3 when related to 1 litre of water
-The conductivity should not be less than 10us/mm when related to 1 litre of water

EN 50267-2-3:1999 / BS EN 50267-2-3:1999 / DIN EN 50267-2-3:1999 / VDE 0482-267-2-3:1999-04 / CEI EN 50267-2-3:1999 (CEI 20-37/2-3). Common test methods for cables under fire conditions- Test on gases evolved during combustion of materials from cables- Part 2-3:Procedures. Determination of degree of acidity of gases for cables by determination of the weighted average of pH and conductivity.

The standard states that the pH and the conductivity of a test solution should be measured, using calibrated pH and conductivity meters. The results from the different components of the cable are then weighted.

Acid gas emission test in accordance with IEC 60754-2

IEC 60754-2 ed1.0 Test on gases evolved during combustion of electric cables - Part 2 : Determination of degree of acidity of gases evolved during combustion of materials taken from electric cables by measuring pH and conductivity.

Acid gas emission test in accordance with NF C32-074

NF C32-074 Common test methods for cables under fire conditions - Test on gases evolved during combustion of materials from cables. This standard is equivalent to IEC 60754-2.

Acid gas emission test in accordance with BS 6425-2

BS 6425-2:1993 (superseded) test on gases evolved during the combustion of materials from cables.
Determination of degree of acidity (corrosivity) of gases by measuring pH and conductivity.
This standard is no longer in force and is replaced by the EN 50267-2-2:1999.

Acid gas emission test in accordance with DIN VDE 0472-813 / VDE 0472-813:1994

DIN VDE 0472-813 / VDE 0472-813:1994 Corrosivity of combustion gases.
The standards are no longer in force and are replaced by the EN 50267-2-2 & VDE 0482-267-2-2.

SMOKE DENSITY TEST IN ACCORDANCE WITH DIFFERENT STANDARDS

The smoke density measurement taken from a material under fire conditions gives an indication of the

visibility through the smoke. This is important as reduced visibility in a real fire situation makes it more difficult to escape from the fire thus increasing the threat to human life from the toxic gas, fumes and heat.
The following standards specify the method for measuring the generation of smoke from cables during fire.

Smoke density test in accordance with IEC 61034-1 & IEC 61034-2

IEC 61034-1:2005 / EN 61034-1:2005 / BS EN 61034-1:2005 / DIN EN 61034-1:2006 / VDE 0482-1034-1:2006 Measurement of smoke density of cables burning under defined conditions. Part 1: Test apparatus

IEC 61034-2:2005 / EN 61034-2:2005 / BS EN 61034-2:2005 / DIN EN 61034-2:2006 / VDE 0482-1034-2:2006 / CEI EN 61034-2:2006 (CEI 20-37/3-1) Measurement of smoke density of cables burning under defined conditions.
Part 2: Test procedure and requirements.

The standard specifies a method of measurement of smoke density of cables. Part 1 specifies the test apparatus and Part 2 specifies the test procedure.

The test is usually performed inside a chamber of 3mx3mx3m and the test is sometimes described as 3 metres cube test. The test is performed by monitoring the transmittance reduction of a white light beam, running from one side of the chamber to the other, at a set height, thus monitoring the build up of smoke inside the chamber. The minimum percentage of light transmittance is often used to determine if the cable has passed or failed the test , often a minimum light transmittance of 60% is applied in order to classify a cable as low smoke.

Smoke density test in accordance with NF C32- 073

NF C32 073 Common test methods for cables under fire conditions.
- Measurement of smoke density of cables burning under defined conditions.
This standard is equivalent to IEC 61034-2

Smoke density test in accordance with BS 7622-1 & BS 7622-2

BS 7622-1:1993 (superseded) – Measurement of smoke density of electric cables burning under defined conditions. Test apparatus.
BS 7622-2:1993 (superseded) – Measurement of smoke density of electric cables burning under defined conditions. Test procedure and requirements.
The standards are no longer in force and were replaced by the EN 50268-1:2000 and EN 50268-2:2000 even though they too were superseded by EN 61034-1:2005 and EN 61034-2:2005.

Smoke density test in accordance with EN 50268-1 & EN 50268-2

EN 50268-1:2000 / BS EN 50268-1:2000 / DIN EN 50268-1:2000 / VDE 0482-268-1:2000 (superseded) – Common test methods for cables under fire conditions. Measurement of smoke density of cable burning under defined conditions. Part 1: Apparatus.
EN 50268-2:2000 / BS EN 50268-2:2000 / DIN EN 50268-2:2000 / VDE 0482-268-2:2000 (superseded) – Common test methods for cables under fire conditions. Measurement of smoke density of cable burning under defined conditions. Part 2: Procedure.
The standards are no longer in force and are replaced by the EN 61034-1:2005 and EN 61034-2:2005.

Although these standards have been withdrawn, they are still called upon in some specification documents such as in the London Underground specification 1-085.

Smoke density test In accordance with DIN VDE 0472-816 / VDE 0472-816:1994

DIN VDE 0472-816/VDE 0472-816:1994 Testing of cables, wires and flexible cords. Smoke Density.

The standards are no longer in force and are replaced by the EN 50268-1, VDE 0482-268-1, EN 50268-2 & VDE 0482-268-2 which are also replaced by the EN 61034-1:2005 and EN 61034-2:2005.

OXYGEN INDEX TEST IN ACCORDANCE WITH DIFFERENT STANDARDS

The oxygen index is defined as the minimum concentration of oxygen, expressed as volume percentage, in a mixture of oxygen and nitrogen that will just support combustion of a material initially at room temperature under specified test conditions.

Oxygen Index test in accordance with ASTM D 2863

ASTM D 2863-10 Measuring the minimum oxygen concentration to support candle-like combustion of plastics (Oxygen Index).

The test is performed in accordance with the procedure specified in ASTM 2863-95 using test piece cut from the outer sheath of the cable. The apparatus holds a small specimen which is clamped vertically in a tube in an atmosphere where the relative concentration of oxygen and nitrogen can be changed. The aim is to test the flammability of the sample with a small pilot flame to find the minimum oxygen concentration required to just sustain combustion of the sample.

Oxygen index test in accordance with ISO 4589-2

ISO4589-2:1996 Determination of burning behaviour by oxygen index Part 2: Ambient temperature test. Specimens measuring 100mm long by 6mm wide are used for testing. The test is performed in accordance with the procedure specified in the standard.

TEMPERATURE INDEX TEST IN ACCORDANCE WITH DIFFERENT STANDARDS

This is a test for assessing the performance of a material when it is tested in accordance with BS2782: Part 1: Method 143a and 143b. The oxygen index of a material will drop when the temperature rises. When the temperature rises and the oxygen index drops to 21%, the material will burn automatically. This temperature is defined as temperature index. For example, the oxygen index of the coal at room temperature is 50% and when the temperature climbs to 150°C, it's oxygen index drops to 21°C and the coal will burn by itself automatically. The temperature index of the coal is defined as 150°C. In general, the temperature index of fire retardant cable exceeds 250°C.

Temperature index test in accordance with BS 2782

BS 2782: Part 1:1989 Method 143a and 143b Temperature of materials. Determination of flammability. Specimens measuring nominally 100mm long by 6.5mm wide by 3mm thick are used for testing. The specimens are then tested in accordance with the test procedure specified in the standard.

Temperature index test in accordance with ISO 4589-3

ISO4589-3:1996 Determination of burning behaviour by oxygen index Part 3: Elevated temperature test. Specimens measuring 100mm long by 6mm wide are used for testing. The test is performed in accordance with the procedure specified in the standard.

TOXICITY TEST IN ACCORDANCE WITH DIFFERENT STANDARDS

Toxicity test in accordance with NES 02-713

Measuring a fume from a material exposed to a controlled fire conditions gives an indication of the fumes which may be produced in a real fire situation. A standard method of test for determining the toxicity of materials under fire condition is Defense Standard NES 02-713- Toxicity. This method gives the level of toxicity of the fumes produced from the material under test. During the test, the test specimen is heated via direct flame application at 1150°C.

The flame is applied via a bunsen burner with a flame height of between 100m and 125mm formed with a methane gas and an external supply of compressed air. The specimen toxicity is determined from accurate pre-analysis weight (4pp) colorimetric tubes and ion chromatography.
The test may determine the following species: Hydrogen Bromide, Hydrochloric Acid, Hydrogen Fluoride, Formaldehyde, Nitrous gases, Carbon Monoxide, Carbon Dioxide, Acrylonitrile, Phenol,
Hydrogen Sulphide, Sulphur Dioxide, Hydrocyanic Acid, Ammonia. The concentration in ppm for each gas detected are provided. The toxicity index of the speciments summates the toxic gases, taking into account of their level of danger to humans. The smaller the toxicity index, the better the product. A limit of 5 is often applicable.

Toxicity test in accordance with NF C 20-454

NF C 20-454 base environmental testing procedures. Fire behaviour. Analysis and titration of gases evolved during pyrolysis or combustion of materials used in electrotechnics. Exposure to abnormal heat or fire. Tube furnace method.

The test defined by this standard serves to define the conventional toxicity index (cti) of the gases emitted by the insulating or sleeving materials during combustion at 800°C.

Toxicity test in accordance with NF X 70-100

NF X 70-100 Fire Tests; Analysis of gaseous effluents.

The test is conducted within a tube furnace where the temperature is set at either 400°C, 600°C, 800°C

(commonly 600°C is used for most of the materials or 800°C for some electrical products) for 40 minutes throughout the test by analysis of the toxicity index of the gases including CO, CO2, HCl, HBr, HCN, HF and SO2.

ADDISON

Address:

Marchants Industrial Centre, Mill Lane, Laughton, Lewes,

East Sussex, BN8 6AJ, UK

Tel: 44(0) 207 4195087

Fax: 44(0) 207 8319489

E-mail: sales@caledonian-cables.com

www.caledonian-cables.com