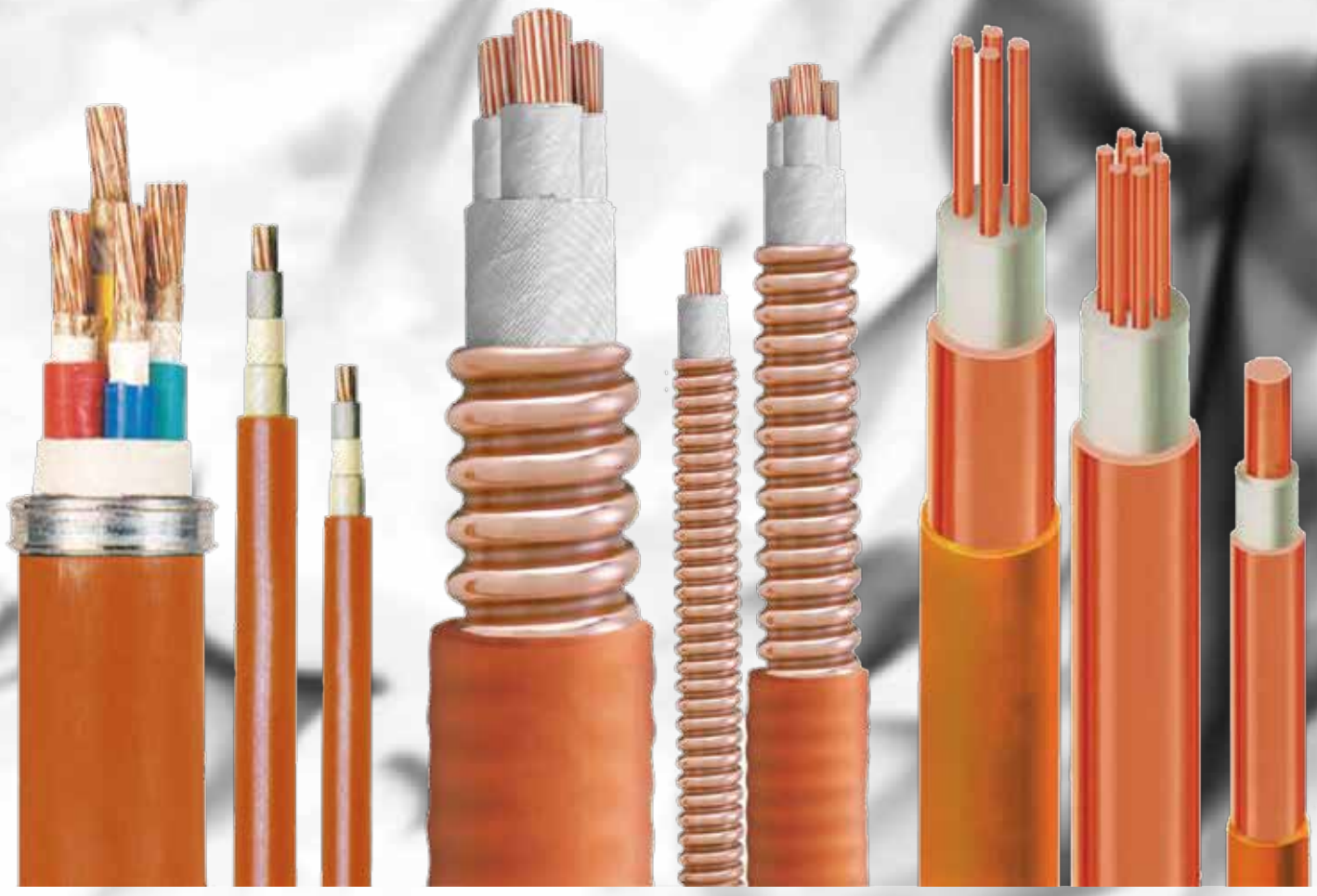
ISE Cable



Fire Resistant Cable (FRC)
Flexible Fireproof Cable (FFC)
Mineral Insulated Cable (MIC)

iSE Cable
Fire Resistant Cables

During fire disaster when you need critical circuits to work for life safety and a secure plant shutdown, it will require iSE Fire Resistant Cable (FRC) because not all cables are created equal, especially when it comes to critical circuit protection.

During fire disaster, fire smoke, heat, and toxic fumes are the main obstacles to safe evacuation of a building or area. A major contribution toward overcoming this hazards is the use of fire resistant and non-halogenated cables. These cables provided the following features:

- Fire resistance
- Long-term circuit integrity in a fire
- Low smoke and toxic gas emissions
- Fire retardant properties
- Zero halogen gases
- Ease and low cost of installation

iSE Fire Resistant Cable is committed to product quality and the products are being produced under strict quality assurance of ISO 9001:2008 in one of the biggest cable factory at Shanghai, China.

iSE Fire Resistant Cables manufactured by Shanghai Cable complied with either one or combination of the specifictation as below:

- Fire Resistant : EC 60331; BS 6387; SS 299
- Fire Retardant : IEC 60332; BS 4066; BS EN 50266; IEEE 383
- Smoke Emission : IEC 61034; BS 7622; BS EN 50268
- Acid Gas Emission : IEC 60754; BS 6425; BS EN 50267
- Oxygen Index : ASTM D 2863

In the Air:

1. As the single core cable laying in parallel, the distance between the cable:center is 2 times (for cable, which cross sectional area of conductor ≤ 185mm^2) and 90mm (for cables, which cross sectional area of conductor ≤240mm^2).
2. Ambient temperature: 40˚C
3. Max temperature of conductor 70˚C
4. Rating factors of current rating for ambient temperature

Air temperature	10°C	15°C	20°C	25°C	30°C	35°C	40°C	45°C	50°C
Rating factors	1.30	1.30	1.29	1.22	1.15	1.08	1.00	0.91	0.87

Direct in the Ground:

1. When single core cables are installed separately, the distance between the cable:center is 2 times of the cables diameter.
2. Ambient temperature: 25˚C
3. Max temperature of conductor 70˚C
4. Soil thermal resistivity: 1.0˚C.m/w
5. Depth: 0.7 meter
6. Rating factors of current rating for ambient temperature:

Air temperature	10°C	15°C	20°C	25°C	30°C	35°C
Rating factors	1.15	1.11	1.05	1	0.94	0.88

Current Rating Copper Conductor in the *Air*

0,6/1kV Copper (Cu) conductor PVC insulated / PVC sheathed fire resistant & non-fire resistant power cable installed **in the air** for long term continuous load

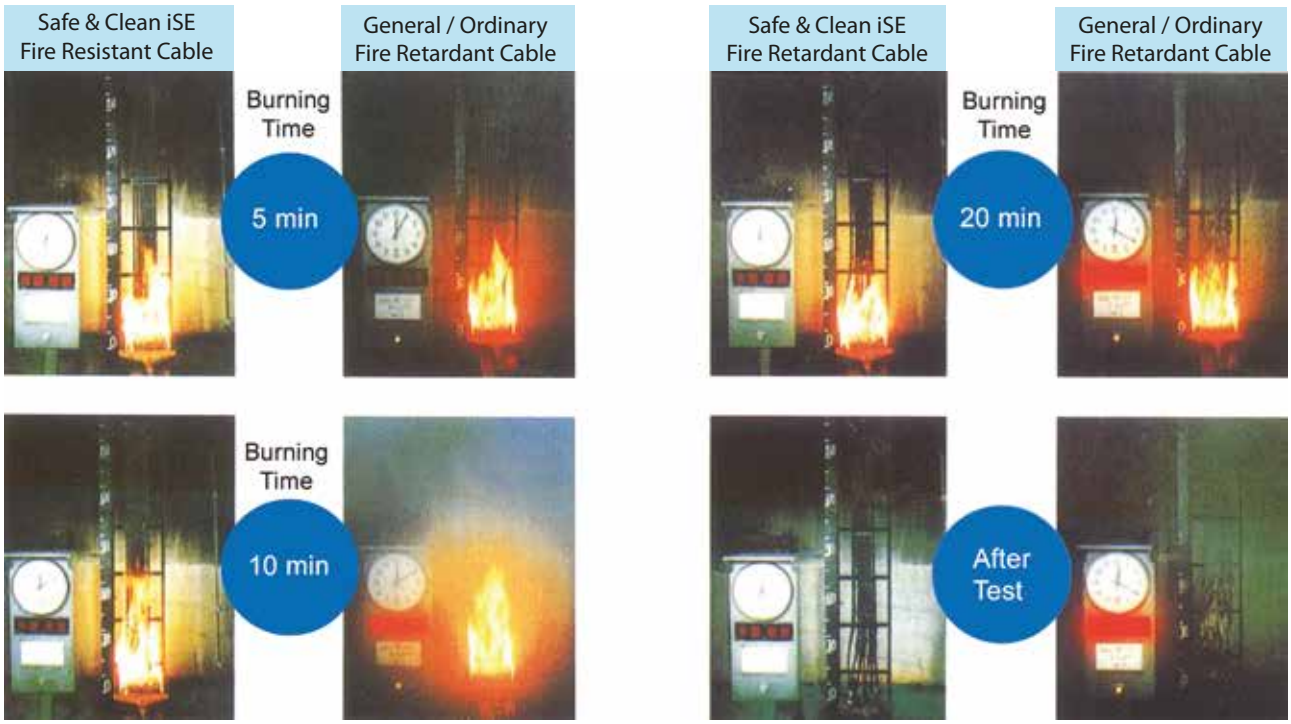
Nominal cross section areas of conductor	Current rating (A)								
	Unarmoured					Armoured			
	Single core		2 cores	3 cores	5 cores	Single core		2 cores	3 cores	5 cores
	3 lendthes			4 cores	(4+1)cores	3 lendthes			4 cores	(4+1)cores
				(3+1)cores	(3+2)cores				(3+1)cores	(3+2)cores
1.5	19	24	17	-		19	24	-	-	
2.5	25	31	23	-		25	31	-	-	
4	33	41	31	26		33	41	31	26	
6	41	52	38	32		41	52	38	32	
10	57	72	53	46		57	72	53	46	
16	76	95	71	60		76	95	71	60	
25	98	120	90	77		98	120	90	77	
35	115	150	110	95		115	150	110	95	
50	145	180	135	115		145	180	135	115	
70	180	230	165	145		180	230	165	145	
95	225	280	210	185		225	280	210	185	
120	260	325	245	210		260	325	245	210	
150	300	375	280	245		300	375	280	245	
185	345	430	320	280		345	430	320	280	
240	410	510	-	335		410	510	-	335	
300	475	585	-	375		475	585	-	375	
400	555	690	-	-		555	690	-	-	
500	640	800	-	-		640	800	-	-	
630	730	920	-	-		730	920	-	-	
800	830	1060	-	-		830	1060	-	-	

Current Rating Copper Conductor in the ***Ground***

0,6/1kV Copper (Cu) conductor PVC insulated / PVC sheathed fire resistant & non-fire resistant power cable installed direct **in the ground** for long term continuous load

Nominal cross section areas of conductor	Current rating (A)									
	Unarmoured					Armoured				
	Single core		2 cores	3 cores	5 cores	Single core		2 cores	3 cores	5 cores
	3 lendthes			4 cores	(4+1)cores	3 lendthes			4 cores	(4+1)cores
				(3+1)cores	(3+2)cores				(3+1)cores	(3+2)cores
1.5	27	29	26	22	22	27	29	26	22	22
2.5	36	38	34	29	30	36	38	34	29	30
4	47	49	44	38	39	47	49	44	38	39
6	58	61	56	47	48	58	61	56	47	48
10	78	83	76	65	66	78	83	76	65	66
16	100	105	100	84	86	100	105	100	84	86
25	130	135	125	110	112	130	135	125	110	112
35	155	160	155	130	133	155	160	155	130	133
50	185	195	185	155	158	185	195	185	155	158
70	225	240	230	195	199	225	240	230	195	199
95	270	285	275	230	235	270	285	275	230	235
120	310	325	310	260	265	310	325	310	260	265
150	350	365	350	300	306	350	365	350	300	306
185	395	415	395	335	341	395	415	395	335	341
240	455	480	-	390	398	455	480	-	390	398
300	515	545	-	435	444	515	545	-	435	444
400	585	625	-	-	-	585	625	-	-	-
500	660	710	-	-	-	660	710	-	-	-
630	740	810	-	-	-	740	810	-	-	-
800	820	910	-	-	-	820	910	-	-	-

Testing bunched Fire Resistant Cable with high fire retardancy



In fire burning test, iSE Fire Resistant Cable (FRC) shows superior results. iSE FRC produced much less smoke / fumes if it is being compared with regular fire retardant cable, and this is visible by naked eyes.

Moreover, the actual fumes form iSE FRC will produce non-halogen fumes, with less toxic content, and it will be self extingushed when the fire source extinct. This will safe life during fire disaster because toxic fumes kill more human than the fire itself.

Final burning test result will show iSE FRC will suffer less burning insulation and it still able to operate the electrical equipment through the cable during the burning test and still operate after the burning test finished.

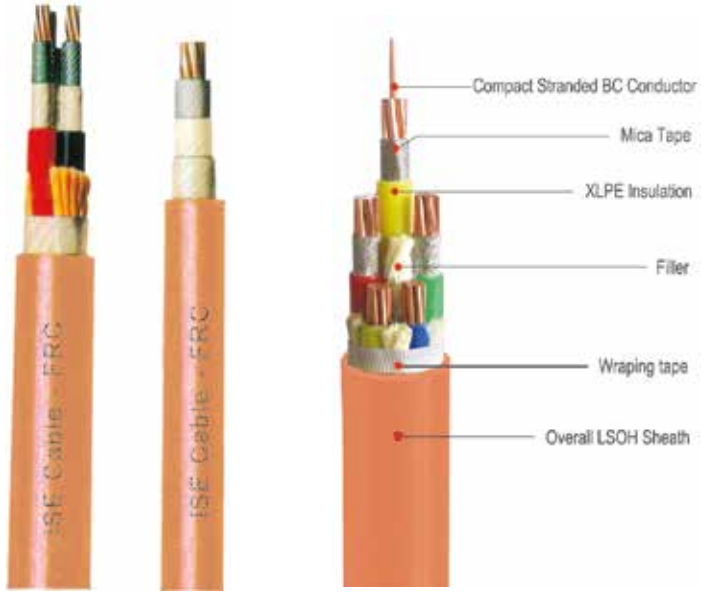
Fire Resistant Standard

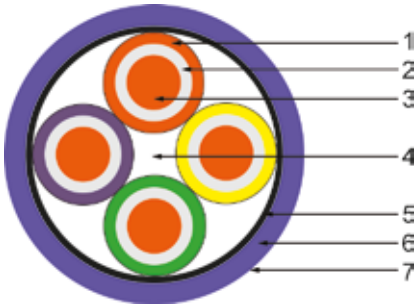
International : IEC 60502, IEC 60331
China : GB12706-2008, EB/T19216

Fire Resisting Characteristic (IEC 60331)

Step	Test Method	Performance Requirement
1st Step	Fire of 750˚C and test voltage of the rated voltage of the cable shall be applied for 2 hours.	No failure of any of the 3A fuses occurs, nor any lamp extinguished and capable of withstanding the rated voltage of the cable.
2nd Step	After extinguished and after 12 hours later, test voltage of the rated voltage of the cable shall be applied for 2 hours.	

600 / 1000V PVC/XLPE SHEATHED FIRE RESISTANT CABLE





1. XLPE / PE
2. Mica Tape as Fire Resistant Layer
3. Cable core (Copper)
4. Filler packing
5. Fire Retardant Protection Tape
6. Outer layer (low smoke, low toxic non-halogen, fire retardant)
7. Label indicator / marking

Fire Resistant Cable Properties

Voltage	Model No.	Cores	Section area (mm^2)	Voltage	Model No.	Cores	Section area (mm^2)
0.6 / 1 kV	SC_{1A}-CE and SC_1-FP_B-CE series	1	1.5 ~ 400	0.6 / 1 kV	SC_{1A}-CE_2 and SC_1-FP_B-CE_2 series	1	-
		2	1.5 ~ 240			2	2.5 ~ 240
		3	1.5 ~ 240			3	2.5 ~ 240
		4	1.5 ~ 240			4	2.5 ~ 240
		3 + 1	2.5 ~ 240			3 + 1	2.5 ~ 240
		5	2.5 ~ 240			5	2.5 ~ 240
		3 + 2	2.5 ~ 240			3 + 2	2.5 ~ 240
		4 + 1	2.5 ~ 240			4 + 1	2.5 ~ 240
		4 ~ 61	1 ~ 2.5			4 ~ 61	1 ~ 2.5

iSE Cable FRC - Technical Properties

(1 core)									
Core No.	Conductor Size						SC_3-FP_B-CV	SC_1-FP_B-CE	
	Nominal Diameter mm^2	No. of Structure n/diameter	Aprox. Outer Diameter mm	Insulation Thickness mm	Jacket Thickness mm	Aprox. Outer Diameter mm	Approx. Weight kg/km	Approx. Weight kg/km	20˚C Highest Resistance Ω/km
1	1.5	1/1,38	1.38	0.7	1.8	7.7	85	81	12.1000
1	2.5	1/1,78	1.78	0.7	1.8	8.1	100	95	7.4100
1	4	1/2,25	2.25	0.7	1.8	8.5	120	114	4.6100
1	6	1/2,76	2.76	0.7	1.8	9.1	145	137	3.0800
1	10	7/1,35	4.05	0.7	1.8	10.3	199	189	1.8300
1	16	7/1,70	5.1	0.7	1.8	11.4	268	254	1.1500
1	25	7/2,14	6.2	0.9	1.8	12.9	378	359	0.7270
1	35	7/2,252	7.2	0.9	1.8	13.9	485	460	0.5240
1	50	19/1,78	8.6	1.0	1.8	15.5	638	606	0.3870
1	70	19/2,14	10.4	1.1	1.8	17.5	651	808	0.2680
1	95	19/2,52	12.2	1.1	1.8	19.3	1103	1047	0.1930
1	120	37/2,03	13.6	1.2	1.8	20.9	1357	1289	0.1530
1	150	37/2,25	15.2	1.4	1.8	22.9	1666	1582	0.1240
1	185	37/2,52	17	1.6	1.8	25.2	2029	1927	0.0991
1	240	61/2,25	19.3	1.7	1.8	27.7	2588	2458	0.0754
1	300	61/2,52	22.4	1.8	1.9	31.2	3192	3096	0.0601
1	400	61/2,82	25.4	2.0	2.0	34.8	4190	4064	0.0470

(2 cores)									
Nominal Cross Section	Insulation Thickness			SC3-FPB-CV	SC1-FPB-CE			SC3-FPB-CV2	SC1-FPB-CE2
		Jacket Thickness	Aprox. Outer ø	Approx. Weight	Approx. Weight	Jacket Thickness	Aprox. Outer Diameter	Approx. Weight	Approx. Weight
mm2	mm	mm	mm	kg/km	kg/km	mm	mm	kg/km	kg/km
2 x 1,5	0.7	1.8	12.7	182	172				
2 x 2,5	0.7	1.8	13.5	215	204	1.8	16.7	446	423
2 x 4	0.7	1.8	14.6	260	247	1.8	17.7	525	498
2 x 6	0.7	1.8	15.5	316	300	1.8	18.7	597	567
2 x 10	0.7	1.8	18.1	440	418	1.8	21.3	762	723
2 x 16	0.7	1.8	20.2	593	563	1.8	23.4	950	902
2 x 25	0.9	1.8	23.2	843	800	1.8	26.4	1445	1372
2 x 35	0.9	1.8	25.2	1080	1026	1.8	28.4	1744	1656
2 x 50	1.0	1.8	28.4	1409	1338	1.9	31.6	2131	2024
2 x 70	1.1	1.9	32.6	1899	1804	2.0	37.2	2715	2579
2 x 95	1.1	2.0	36.4	2467	2343	2.2	40.0	3361	3260
2 x 120	1.2	2.1	39.8	3044	2891	2.3	44.6	4026	3905
2 x 150	1.4	2.3	44.2	3752	3639	2.4	47.8	4841	4695
2 x 185	1.6	2.4	49.0	4596	4458	2.6	54.2	5816	5641
2 x 240	1.7	2.6	54.4	5873	5696	2.7	59.6	7265	7047

(3 cores)									
Nominal Cross Section	Insulation Thickness			SC3-FPB-CV	SC1-FPB-CE			SC3-FPB-CV2	SC1-FPB-CE2
		Jacket Thickness	Aproximate Outer Dia.	Approximate Weight	Approximate Weight	Jacket Thickness	Aprox. Outer Diameter	Approximate Weight	Approximate Weight
mm2	mm	mm	mm	kg/km	kg/km	mm	mm	kg/km	kg/km
3 x 1,5	0.7	1.8	13.4	214	203				
3 x 2,5	0.7	1.8	14.2	259	246	1.8	17.4	521	494
3 x 4	0.7	1.8	15.2	320	304	1.8	18.5	598	568
3 x 6	0.7	1.8	16.4	396	376	1.8	19.6	692	657
3 x 10	0.7	1.8	19.1	563	534	1.8	22.3	904	858
3 x 16	0.7	1.8	21.4	776	737	1.8	24.6	1,153	1,095
3 x 25	0.9	1.8	24.7	1,119	1,063	1.8	27.9	1,763	1,674
3 x 35	0.9	1.8	26.9	1,453	1,380	1.8	30.1	2,166	2,057
3 x 50	1.0	1.9	30.5	1,934	1,837	2.0	35.1	2,703	2,567
3 x 70	1.1	2.0	35.0	2,622	2,490	2.1	39.6	3,491	3,386
3 x 95	1.1	2.1	39.1	3,428	3,325	2.3	43.9	4,391	4,259
3 x 120	1.2	2.3	42.8	4,247	4,120	2.4	47.8	5,308	5,148
3 x 150	1.4	2.4	47.5	5,250	5,092	2.5	52.5	6,428	6,235
3 x 185	1.6	2.6	52.9	6,439	6,245	2.7	58.1	7,760	7,527
3 x 240	1.7	2.7	58.5	8,244	7,996	2.9	64.1	9,753	9,557

(3 + 1 cores)									
Nominal Cross Section	Insulation Thickness			SC3-FPB-CV	SC1-FPB-CE			SC3-FPB-CV2	SC1-FPB-CE2
		Jacket Thickness	Aproximate Outer Dia.	Approximate Weight	Approximate Weight	Jacket Thickness	Aprox. Outer Diameter	Approximate Weight	Approximate Weight
mm2	mm	mm	mm	kg/km	kg/km	mm	mm	kg/km	kg/km
3 x 2,5 + 1,5	0.7	1.8	15.2	371	352	1.8	18.4	668	634
3 x 4 + 2,5	0.7	1.8	16.3	465	440	1.8	19.5	782	742
3 x 6 + 4	0.7	1.8	17.5	650	616	1.8	20.7	1,009	958
3 x 10 + 6	0.7	1.8	20.1	912	865	1.8	23.3	1,500	1,425
3 x 16 + 10	0.7	1.8	22.8	1,314	1,248	1.8	26.0	2,002	1,902
3 x 25 + 16	0.7	1.8	26.2	1,639	1,557	1.8	29.4	2,385	2,266
3 x 35 + 16	0.9	1.8	28.0	2,232	2,120	2.0	32.6	3,044	2,952
3 x 50 + 25	1.0	1.9	32.0	3,014	2,863	2.1	36.8	3,926	3,808
3 x 70 + 35	1.1	2.1	36.7	3,973	3,854	2.2	41.3	4,994	4,844
3 x 95 + 50	1.1	2.2	41.1	5,008	4,857	2.4	46.1	6,146	5,962
3 x 120 + 70	1.2	2.4	45.6	5,988	5,808	2.5	51.6	7,225	7,008
3 x 150 + 70	1.4	2.5	49.4	7,420	7,271	2.7	54.8	8,809	8,544
3 x 185 + 95	1.6	2.7	55.1	9,459	9,269	2.9	60.7	11,039	10,818
3 x 240 + 120	1.7	2.9	60.0	11,681	11,447	3.1	65.8	13,270	13,004

(3 + 2 cores)									
				SC3-FPB-CV	SC1-FPB-CE			SC3-FPB-CV2	SC1-FPB-CE2
Nominal Cross Section	Insulation Thickness	Jacket Thickness	Aproximate Outer Dia.	Approximate Weight	Approximate Weight	Jacket Thickness	Aprox. Outer Diameter	Approximate Weight	Approximate Weight
mm²	mm	mm	mm	kg/km	kg/km	mm	mm	kg/km	kg/km
3 x 2,5 + 2 x 1,5	0.7	1.8	18.8	315	299	1.8	19.6	618	587
3 x 4 + 2 x 2,5	0.7	1.8	20.0	427	405	1.8	20.8	746	708
3 x 6 + 2 x 4	0.7	1.8	21.5	540	513	1.8	22.1	880	836
3 x 10 + 2 x 6	0.7	1.8	24.0	746	708	1.8	24.8	1,306	1,240
3 x 16 + 2 x 10	0.7	1.8	27.1	1,059	1,006	1.8	27.9	1,692	1,607
3 x 25 + 2 x 16	0.7	1.8	30.8	1,525	1,448	1.9	31.8	2,269	2,155
3 x 35 + 2 x 16	0.9	1.9	32.6	1,853	1,760	2.1	35.0	2,643	2,510
3 x 50 + 2 x 25	1.0	2.1	37.3	2,555	2,427	2.2	39.5	3,424	3,321
3 x 70 + 2 x 35	1.1	2.2	42.1	3,442	3,338	2.3	44.3	4,423	4,290
3 x 95 + 2 x 50	1.1	2.4	47.8	4,563	4,426	2.5	49.6	5,664	5,494
3 x 120 + 2 x 70	1.2	2.5	52.6	5,820	5,645	2.7	55.0	7,058	6,846
3 x 150 + 2 x 70	1.4	2.7	56.5	6,791	6,587	2.9	58.9	8,120	7,876
3 x 185 + 2 x 95	1.6	2.9	62.9	8,480	8,225	3.0	65.1	9,976	9,676
3 x 240 + 2 x 120	1.7	3.1	69.3	10,777	10,453	3.3	71.7	12,473	12,223

(4 cores)									
				SC3-FPB-CV	SC1-FPB-CE			SC3-FPB-CV2	SC1-FPB-CE2
Nominal Cross Section	Insulation Thickness	Jacket Thickness	Aproximate Outer Dia.	Approximate Weight	Approximate Weight	Jacket Thickness	Aprox. Outer Diameter	Approximate Weight	Approximate Weight
mm²	mm	mm	mm	kg/km	kg/km	mm	mm	kg/km	kg/km
4 x 1,5	0.7	1.8	14.4	254	241				
4 x 2,5	0.7	1.8	15.4	311	295	1.8	18.6	595	565
4 x 4	0.7	1.8	16.5	389	369	1.8	19.7	691	656
4 x 6	0.7	1.8	17.8	488	463	1.8	21.0	810	769
4 x 10	0.7	1.8	20.9	703	667	1.8	24.1	1,074	1,020
4 x 16	0.7	1.8	23.4	979	930	1.8	26.6	1,392	1,322
4 x 25	0.9	1.8	27.1	1,423	1,351	1.8	30.3	2,140	2,033
4 x 35	0.9	1.8	29.5	1,866	1,772	2.0	34.3	2,656	2,523
4 x 50	1.0	1.9	38.4	2,506	2,380	2.1	43.2	3,352	3,251
4 x 70	1.1	2.1	43.2	3,405	3,302	2.2	47.8	4,374	4,243
4 x 95	1.1	2.2	47.3	4,464	4,330	2.4	52.3	5,547	5,381
4 x 120	1.2	2.4	52.5	5,540	5,374	2.5	56.3	6,735	6,532
4 x 150	1.4	2.5	58.3	6,861	6,655	2.7	63.7	8,195	8,031
4 x 185	1.6	2.7	64.7	8,415	8,246	2.9	70.3	9,912	9,713
4 x 240	1.7	2.9	73.1	10,785	10,569	3.1	78.9	12,500	12,250

(4 + 1 cores)									
				SC3-FPB-CV	SC1-FPB-CE			SC3-FPB-CV2	SC1-FPB-CE2
Nominal Cross Section	Insulation Thickness	Jacket Thickness	Aprox. Outer ø	Approx. Weight	Approx. Weight	Jacket Thickness	Aprox. Outer Diameter	Approx. Weight	Approx. Weight
mm²	mm	mm	mm	kg/km	kg/km	mm	mm	kg/km	kg/km
4 x 2,5 + 1,5	0.7	1.8	16.5	330	313	313	19.7	628	596
4 x 4 + 2,5	0.7	1.8	17.7	447	424	424	20.9	769	730
4 x 6 + 4	0.7	1.8	19.1	564	535	535	22.3	909	863
4 x 10 + 6	0.7	1.8	22.1	800	760	760	25.3	1,193	1,133
4 x 16 + 10	0.7	1.8	25.1	1,128	1,071	1,071	28.3	1,777	1,688
4 x 25 + 16	0.7	1.8	29.0	1,638	1,556	1,556	32.4	2,407	2,286
4 x 35 + 16	0.9	1.9	31.4	2,081	1,976	1,976	36.2	2,910	2,764
4 x 50 + 25	1.0	2.1	36.0	2,831	2,689	2,689	40.6	3,731	3,619
4 x 70 + 35	1.1	2.2	41.1	3,835	3,719	3,719	45.9	4,867	4,720
4 x 95 + 50	1.1	2.4	46.3	5,055	4,903	4,903	51.3	6,213	6,026
4 x 120 + 70	1.2	2.5	51.0	6,356	6,165	6,165	56.4	7,647	7,417
4 x 150 + 70	1.4	2.7	55.8	7,661	7,431	7,431	61.4	9,075	8,893
4 x 185 + 95	1.6	2.9	62.1	9,477	9,192	9,192	67.7	11,069	10,847
4 x 240 + 120	1.7	3.1	68.8	12,102	11,860	11,860	74.8	13,920	13,641

Fire Retardant vs Fire Rated / Fire Resistant - What's the Differences?

There is a vast difference between cables that are rated flame retardant and those that have earned the rating fire rated or fire resistant. Fire retardant cables resist the spread of fire into a new area, while fire rated cables maintain circuit integrity and continue to work for a specified time under defined conditions. Fire rated cables continue to operate in the presence of a fire and are commonly referred to as circuit integrity cables. The differences between the two ratings are significant for the critical circuits required for life safety or a safe and immediate plant shut down. Additionally, fire rated cables can be used to replace expensive fire rated structures, blankets or wraps and the difficult to install MI cable.
Fire retardant cables are not rated to continue to operate in a fire, and in all probability will not maintain circuit integrity during a fire. The differences between flame retardant and fire rated/fire resistant cables can be seen in the test descriptions shown below.

Cable Test	Fire Rated / Resistant
Definition	A cable that will continue to operate in the presence of a fire, also identified as Circuit Integrity Cable
UL - 2196 or ULC S-139	Large fire test, 10 x 10 foot wall, can use either the standard or rapid rise fire profile, cable energized at the utilization voltage, water spray used at conclusion of test to verify the cables can survive fire fighting efforts.
European Standard IEC 60331	Small scale circuit integrity test, uses 0.6 meter ribbon burner, standard temperature is 750˚C for one hour, other optional times and temperatures can be specified, cable energized at rated voltage of cable.

Cable Test	Fire Retardant
Definition	A cable that will not convey or propagate a fire as defined by the Fire Retardant or Propagation Tests indicated below.
VW1	Vertical wire test to measure fire propagation, small scale, uses Bunsen burner, maximum propagation 12 inches.
FT1	Similar to VW1.
FT2	Horizontal fire spread test, small scale, uses same burner as VW1, maximum propagation 2 inches
IEC 60332-1	Small scale vertical wire test.
IEC 60332-2	Small scale vertical cable test.
Vertical Tray Fire Tests	Medium scale tests, measure fire propagation only, does not maintain circuit integrity beyond several minutes.

Frequently Ask Questions :

Q: Is a flame retardant cable also / equal to fire rated (FRC)?
A: No. A flame retardant cable is not a fire rated cable (FRC). A flame retardant cable is designed to only restrict the spread of a fire by inhibiting combusting.

Q: Are flame retardant cable intended to maintain critical circuits during a fire?
A: NO !!!

Q: Is a flame retardant cable also /equal to fire rated?
A: When the need to maintain circuit integrity is essential, specify fire rated (fire resistant) cable for those critical circuits that need to work in order to assure life safety or a plant shut down.

Q: How does the iSE-Cable FRC protect conductors during fire?
A: iSE-Cable FRC utilizes electrical grade ceramified silicone rubber. The ceramified silicone technology is a hardening of standard ruber insulating material into an insulating glass-like structure which protects the conductors against attack by fire and water which may be present during fire fighting efforts.

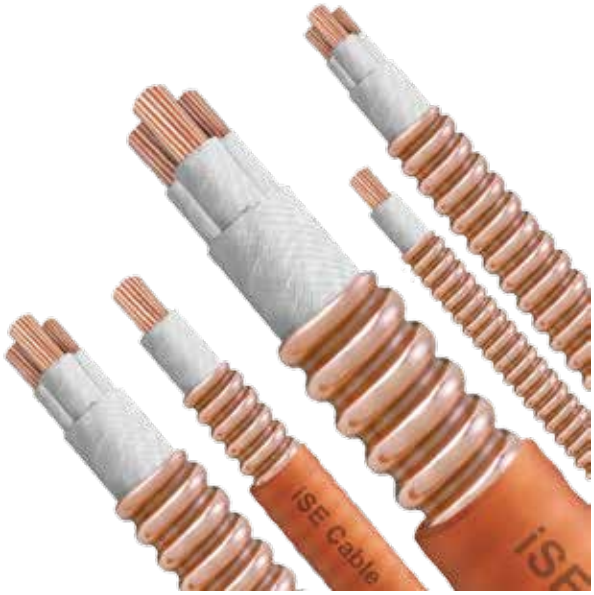
Q: How can I use iSE-Cable FRC for my critical applications?
A: iSE-Cable FRC can be designed into the type of cable you need for fire safety application to provide survivability that you require during fire disaster.

Flexible Fireproof Cable

Flexible fireproof cable excels in the properties of excellent fireproof and flexibility. Its fireproof rating not only satisfies the national standard GB12666.6 but also meets up with the UK standard BS6387-1994. Meanwhile, it is also able to withstand the water spraying or mechanical strike. As to its flexibility property, the cable can be wound on the cable reel, with the bending radius OD, (D is the outer diameter of cable).

Main performance of flexible fireproof cable:

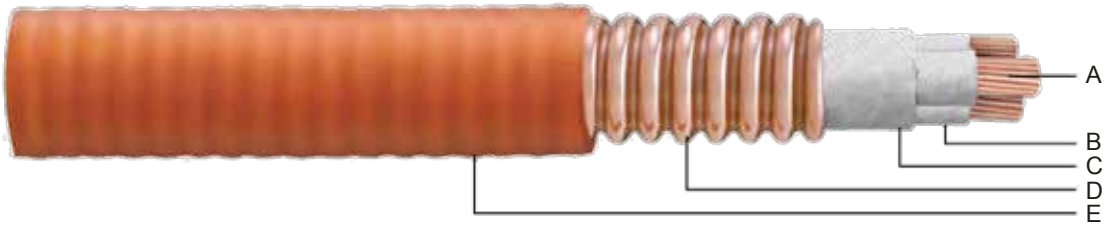
- Excellent fireproof property
- Long continuous length
- Large sectional area
- Property of flexibility
- High over-load capacity
- Stand up to 800 ˚C burning for 3 hours, without interuption on electricity power.
- Stand up to 1000 ˚C burning for 1 hours, without interuption on electricity power.



Structure of flexible fireproof cable:

1. Cable conductor is made up of stranded copper wires with favouratble flexural property.
2. Insulating layer adopts high temperature resistant inorganic insulating materials.
3. Copper sheath materials through special machining with favourable flexural property.
4. Outer sheath made of low-smoke non-toxic plastic materials, with favorable corrosion protection.

A. Stranded copper conductor
B. Mineral / inorganic insulation
C. Mineral / inorganic fiber packing materials
D. Copper sheath
E. Outer sheath (low smoke, non-toxic materials)



Fire-resistant property of flexible fireproof cable:

1. GB12666.6 Class A, burn in fire with temperature 950°C
2. BS6378, requirements:
   - Class A 650°C 3h
   - Class B 750°C 3h
   - Class C 950°C 3h
   - Class S 950°C 20min

Advantages of flexible fireproof cable

1. Excelent fireproof property: meet up with the U.K. standard BS6387-1994
2. Long continous length: continous length of each cable can be as long as 1,000m
3. Large sectional area: single core-630mm^2, multi core-70mm^2
4. Property of flexibility: bending radius 6 - 10D
5. Smoke-free-non-toxicity when burning
6. High overload capacity: long-term working temperature can reach 250°C
7. Property of corrosion proof & Free of elegtromagnetic interference
8. Favorable safeness & Long service life
9. Transportation and packaging of flexible fireproof cables are simple
10. Favorable economical efficiency

Specification and parameters of flexible fireproof cable (refer to table 1- table 9)

Table 1. Structural dimension of cable

Nominal section of conductor mm^2	Conductor structure pcs./dia.	Nominal diameter of conductor mm	Nominal insulation thickness mm	Thickness of metallic sheath mm				O.D. Of cable mm			
				1-core	2-cores	3-cores	4-cores	1-core	2-cores	3-cores	4-cores
1	1/1,13	1.13	0.80	0.4	0.5	0.5	0.5	3.53	5.66	5.96	6.46
1.5	1/1,38	1.38	0.80	0.4	0.5	0.5	0.5	3.78	6.16	6.50	7.06
2.5	1/1,78	1.78	0.80	0.4	0.5	0.6	0.6	4.18	6.96	7.56	8.23
4	1/2,25	2.25	0.80	0.5	0.6	0.6	0.6	4.85	8.10	8.57	9.36
6	1/2,76	2.76	0.80	0.5	0.6	0.6	0.6	5.36	9.12	9.67	10.59
10	7/1,34	4.02	1.00	0.5	0.7	0.7	0.7	7.02	12.44	13.22	14.52
16	7/1,68	5.04	1.00	0.6	0.7	0.7	0.8	8.24	14.48	15.42	17.18
25	7/2,12	6.36	1.00	0.6	0.8	0.8	0.9	9.56	17.32	18.46	20.57
35	7/2,50	7.50	1.00	0.6	0.8	0.9	1.0	10.90	19.90	21.43	23.86
50	19/1,76	8.80	1.20	0.7	0.9	0.9	1.0	12.60	23.00	24.55	27.34
70	19/2,12	10.60	1.20	0.7	1.0	1.0	1.0	14.40	26.80	28.63	31.69
95	19/2,50	12.50	1.20	0.8	1.0	1.0	-	16.50	30.60	32.72	-
120	37/2,02	14.14	1.20	0.8	1.0	-	-	18.14	33.88	-	-
150	37/2,25	15.75	1.40	0.8	-	-	-	20.15	-	-	-
185	37/2,50	17.50	1.40	0.9	-	-	-	22.10	-	-	-
240	37/2,87	20.09	1.40	0.9	-	-	-	24.69	-	-	-
300	61/2,50	22.50	1.60	1.0	-	-	-	27.70	-	-	-
400	61/2,80	25.20	1.60	1.0	-	-	-	30.40	-	-	-
500	91/2,60	29.20	1.80	1.1	-	-	-	37.40	-	-	-
630	91/2,88	33.00	1.80	1.1	-	-	-	43.50	-	-	-

1. *4-core conductor may adopt two different sectional areas and combine into special structured 3+1 -core cable, outer diameter of cable can be calculated based on the combination.
2. When the cable employs compressed cores, diameter of cable should be 95% of nominal diameter; outer diameter of metallic sheath should be adjusted correspondingly. When en - hancing the insulation, outer diameter of cable is increased for about 5%.
3. For special large-spec. 2-core or 3-core cables, it can adopt hemicycle or sector conductor core to reduce the outer diameter of cables.
4. Thickness of copper sheath after corrugation treatment will be thinner, but should be able to satisfy the electrical requirements of PE; if the copper sheath will not be used as PE wire, it will be only required to guarantee its mechanical strength.

Table 2. DC resistance of cable conductor and copper sheath at 20°C							
Nominal section of conductor mm²	Conductor structure Pcs./dia.	Calculation of conductor section mm	Ω/km Conductor resistence Ω/km at 20°C not more than	Calculation of resistence Ω/km of copper sheath at 20°C			
				1-core	2-cores	3-cores	4-cores
1	1/1,13	1.003	18.1	4.53	2.20	2.08	1.90
1.5	1/1,38	1.496	12.1	4.19	2.00	1.89	1.73
2.5	1/1,78	2.488	7.41	3.75	1.75	1.36	1.24
4	1/2,25	3.976	4.61	2.61	1.26	1.18	1.08
6	1/2,76	5.983	3.08	2.33	1.11	1.04	0.945
10	7/1,34	9.872	1.83	1.74	0.689	0.646	0.586
16	7/1,68	15.52	1.15	1.19	0.587	0.550	0.432
25	7/2,12	24.71	0.727	1.05	0.429	0.401	0.320
35	7/2,50	34.36	0.524	0.935	0.377	0.141	0.28
50	19/1,76	46.22	0.387	0.680	0.285	0.266	0.215
70	19/2,12	67.07	0.268	0.591	0.220	0.205	0.185
95	19/2,50	93.27	0.193	0.451	0.191	0.179	-
120	37/2,02	118.6	0.153	0.408	0.172	-	-
150	37/2,25	147.1	0.124	0.366	-	-	-
185	37/2,50	181.6	0.0991	0.297	-	-	-
240	61/2,25	242.5	0.0754	0.263	-	-	-
300	61/2,50	299.4	0.0601	0.212	-	-	-
400	61/2,80	375.6	0.0470	0.193	-	-	-
500	91/2,60	482.9	0.0366	0.149	-	-	-
630	91/2,88	592.5	0.0283	0.129	-	-	-

Note: *3 + 1-core cable is a special cable, resistance of copper sheath at 20°C can be gotten according to the following formula: $R20=0.0178 \div \pi * 4 \div [D^2-(D-2h)^2]*1000$
wherein: D-O.D. of cable; h-thickness of copper sheath

Table 3. DC resistance of cable conductor at 90°C and copper sheath at 70°C						
Nominal section of conductor mm²	Conductor structure pcs./dia.	Conductor resistance Ω/km at 90°C not more than	Resistence of copper sheath at 70°C Ω/km			
			1-core	2-cores	3-cores	4-cores
1	1/1,13	23.10	5.44	2.64	2.50	2.28
1.5	1/1,38	15.40	5.03	2.40	2.27	2.08
2.5	1/1,78	9.48	4.50	2.10	1.63	1.49
4	1/2,25	5.90	3.13	1.51	1.42	1.30
6	1/2,76	3.90	2.80	1.33	1.25	1.13
10	7/1,34	2.33	2.10	0.83	0.78	0.70
16	7/1,68	1.47	1.43	0.70	0.66	0.52
25	7/2,12	0.92	1.26	0.51	0.48	0.38
35	7/2,50	0.67	1.12	0.45	0.17	0.34
50	19/1,76	0.49	0.82	0.34	0.32	0.26
70	19/2,12	0.34	0.71	0.26	0.25	0.22
95	19/2,50	0.25	0.54	0.23	0.21	-
120	37/2,02	0.20	0.49	0.21	-	-
150	37/2,25	0.16	0.44	-	-	-
185	37/2,50	0.13	0.36	-	-	-
240	61/2,25	0.10	0.32	-	-	-
300	61/2,50	0.08	0.25	-	-	-
400	61/2,80	0.06	0.23	-	-	-
500	-	0.048	0.018	-	-	-
630	-	0.038	0.014	-	-	-

Table 4. Current carrying capacity and parameters of single-core cable at ambient temperature 40°C						
Nominal section mm^2	Copper sheath (PE wire) Sectional area (mm^2)	Insulation thickness (mm)	Approximate O.D. (mm)	90°C(Ω/km) Core resistance 90°C(W/km)	Rated current (A)	Rated current (A)
1	4 x 4,4	0.80	3.53	23.10	-	-
1.5	4 x 4,7	0.80	3.78	15.40	32	26
2.5	4 x 5,2	0.80	4.18	9.48	42	34
4	4 x 7,6	0.80	4.85	5.90	56	44
6	4 x 8,4	0.80	5.63	3.90	70	56
10	4 x 11,0	1.00	7.02	2.33	97	77
16	4 x 15,5	1.00	8.24	1.47	125	100
25	4 x 18,0	1.00	9.56	0.92	165	130
35	4 x 20,5	1.00	10.70	0.67	200	160
50	4 x 27,7	1.20	12.60	0.49	245	195
70	4 x 31,7	1.20	14.40	0.34	305	245
95	4 x 41,4	1.20	16.50	0.25	375	300
120	4 x 45,6	1.20	18.14	0.20	435	350
150	4 x 50,6	1.40	20.15	0.16	500	400
185	4 x 62,4	1.40	22.10	0.13	580	465
240	4 x 70,2	1.40	24.85	0.10	685	550
300	4 x 87,0	1.60	27.70	0.08	795	635
400	4 x 95,4	1.60	30.40	0.06	930	745
500	4 x 125,4	1.80	36.65	0.048	1050	855
630	4 x 146,5	1.80	42.63	0.038	1198	998

Table 5. Current carrying capacity and parameters of two-cores cable at ambient temperature 40°C					
Nominal section mm^2	Copper sheath (PE wire) Sectional area (mm^2)	Insulation thickness (mm)	Approximate O.D. (mm)	Core resistance 90°C(W/km)	Rated current (A)
2 x 2,5	10	0.80	6.96	9.48	33
2 x 4	15	0.80	8.10	5.90	44
2 x 6	17	0.80	9.12	3.90	57
2 x 10	39	1.0	12.44	2.33	78
2 x 16	45	1.0	14.48	1.43	104
2 x 25	54	1.0	17.32	1.26	135
2 x 35	67	1.10	19.90	1.12	168
2 x 50	82	1.20	23.00	0.82	204
2 x 70	96	1.20	26.80	0.71	263
2 x 95	110	1.20	30.60	0.54	320
2 x 120	126	1.20	33.88	0.49	373

Table 6. Current carrying capacity and parameters of three-cores cable at ambient temperature 40℃					
Nominal section mm^2	Copper sheath (PE wire) Sectional area (mm^2)	Insulation thickness (mm)	Approximate O.D. (mm)	90°C(Ω/km) Core resistance 90°C(W/km)	Rated current (A)
3 x 2,5	13.6	0.80	7.56	9.48	29
3 x 4	15.4	0.80	8.57	5.90	38
3 x 6	17.4	0.80	9.67	3.90	46
3 x 10	27.7	1.0	13.22	2.33	65
3 x 16	32.3	1.0	15.42	1.47	85
3 x 25	44.3	1.0	18.46	0.92	118
3 x 35	57.8	1.10	21.43	0.67	150
3 x 50	66.2	1.20	24.55	0.49	192
3 x 70	85.8	1.20	28.63	0.34	228
3 x 95	98.1	1.20	32.72	0.25	273

Table 7. Current carrying capacity and parameters of 3+1 cores cable at ambient temperature 40°C						
Cable Spec. mm^2	Copper sheath (PE wire) Sectional area (mm^2)	Insulation thickness (mm)	Approximate O.D. (mm)	90°C(/km) Core resistance 90°C(W/km)	70°C(/km) Resistance of copper sheath 70°C(W/km)	Rated current (A)
3 x 16 +1 x 10	41.6	1.00	16.56	1.47	0.449	85
3 x 25 +1 x 16	55.9	1.00	19.77	0.92	0.334	118
3 x 35 +1 x 16	69.6	1.10	22.18	0.67	0.296	150
3 x 50 +1 x 25	81.2	1.20	25.87	0.49	0.228	192
3 x 70 +1 x 35	93.6	1.20	29.81	0.34	0.197	228
3 x 95 +1 x 50	106.9	1.20	34.04	0.25	0.171	273

Table 8. Current carrying capacity and parameters of 4 - core constant section cable at ambient temperature 40°C					
Cable Spec. mm^2	Copper sheath (PE wire) Sectional area (mm^2)	Insulation thickness (mm)	Approximate O.D. (mm)	90°C(Ω/km) Core resistance 90°C(W/km)	Rated current (A)
4 x 6	20.0	0.80	10.59	3.90	46
4 x 10	31.9	1.00	14.52	2.33	65
4 x 16	43.2	1.00	17.18	1.47	85
4 x 25	58.1	1.00	20.57	0.92	118
4 x 35	74.9	1.10	23.86	0.67	150
4 x 50	85.8	1.20	27.34	0.49	192
4 x 70	99.5	1.20	31.69	0.34	228

Table 9. Correction factor of current carrying capacity at different ambient temperatures									
Working temperature of conductor (°C)	Ambient temperature (°C) (in air)								
	10	15	20	25	30	35	40	45	50
60	1.58	1.50	1.41	1.32	1.22	1.11	1.00	0.86	0.73
65	1.48	1.41	1.34	1.26	1.18	1.09	1.00	0.89	0.77
70	1.41	1.35	1.29	1.22	1.15	1.08	1.00	0.91	0.81
80	1.32	1.27	1.22	1.17	1.11	1.06	1.00	0.93	0.86
90	1.26	1.22	1.18	1.14	1.09	1.04	1.00	0.94	0.89
105	1.22	1.19	1.15	1.11	1.08	1.04	1.00	0.95	0.91

Matters needing attention for installation of YTTW cables

1. YTTW cables are installed as the ordinary cables without the need of professional or specially-trained operators
2. The cable is de-reeled from the reel previously transported to the work site.
3. Cable support and fixing
   a. permissible span for horizontal & vertical hangers
   b. for installation in cable tray, "a" or "b" may be referenced for the permissible span for fixing the cable.
   c. Natural snaking of cable is permissable during installation.
   d. It is strongly prohibited to bind and fix single-core cables with magnetic materials.
   e. A single single-core cable shall not pass through a tube

Straight-through connector

Right-angled bending of a multicore cable

4. Cable accessories: straight-through connector, Quarter bend, Termination.
5. Bending : The cable shall be bent against a wheel having a diameter not smaller than 0.5m
6. Cutting
   a. The cable can be cut to any length
   b. When strippng the copper sheath, it is strongly prohibited to let bits of copper penetrate into the insulation

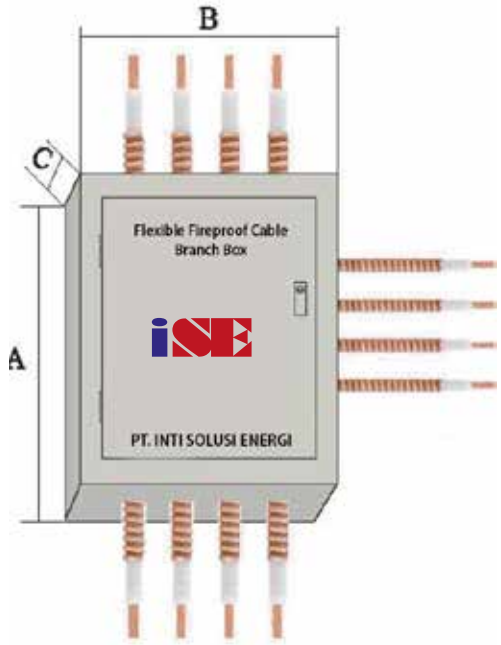
Termination

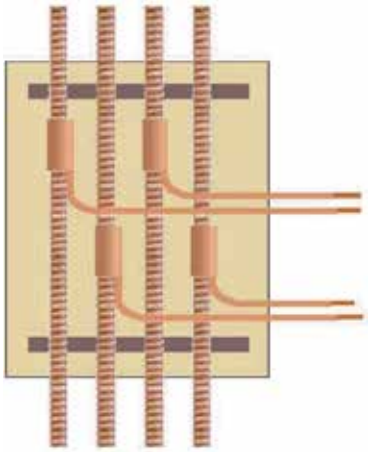
Single-core branched cable

Cable pipe bending machine

7. Earthing
   a. There are no special earthing requirements for multicore cables
   b. Single-core cables shall be earthed at both ends, may be earthed through a copper tape
8. Energization : the cable shall be terminated at both ends & connected to the electrical equipment.

Branch joint box





Matters needing attention for use of branch joint box

1. Tree-type distribution system shall be considered first due to large reduction in cost
2. When the branch joint box is used, the main cable shall be install directly on an open support instead of cable through
3. In a tree-type distribution system single-core cables are preferred for ease of branching.
4. The main cable won't be cut for branching, branch cable shall be not longer than 3m.
5. The branch joint shall be made by reliable compressed connection & pre-fabricated in factory.

Design guidlines

1. Should accord to the codes of GB50217 and DGJ08-93
2. In case of no special requirements, the fire-resistance standard is defaulted to category A
3. If the cable is laid in shaft or tray, the pipe inserting process is not needed
4. When the length of cable is calculated, it should be lengthended about 1-2m
5. The copper sheath may be used as the PE wire
6. If the cable is used in the badly corrosive area, the copper should be provided with anticorrosion sheath additionally.
7. Only the DC resistance of cable conductor and copper sheath is required
8. For 500A below, multi-core cable may be selected.

Transit and storage

1. In transit, the cable should be free of mechanical impact or the attack of rain and snow
2. The cable should be stored in the dry warehouse where the harmful matter or gas should not exist
3. In the construction site, the cable should be placed in the dry area
4. After ending the construction, the terminals of residual cables should be given the reliable seal.

iSE Cable

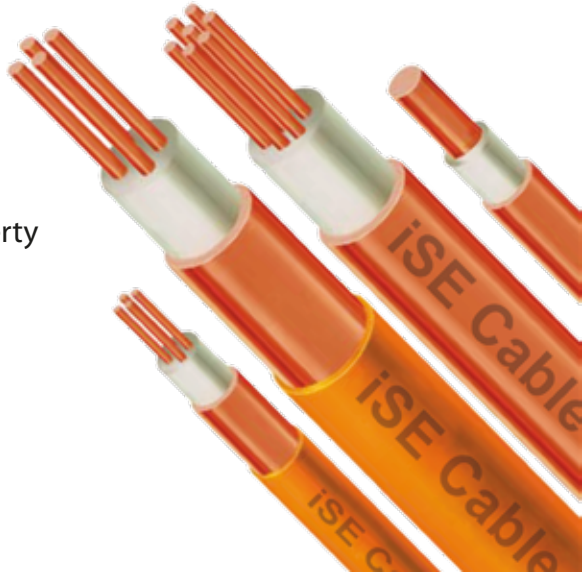
Fire Resistant Cables

MI Cable (Fireproof)

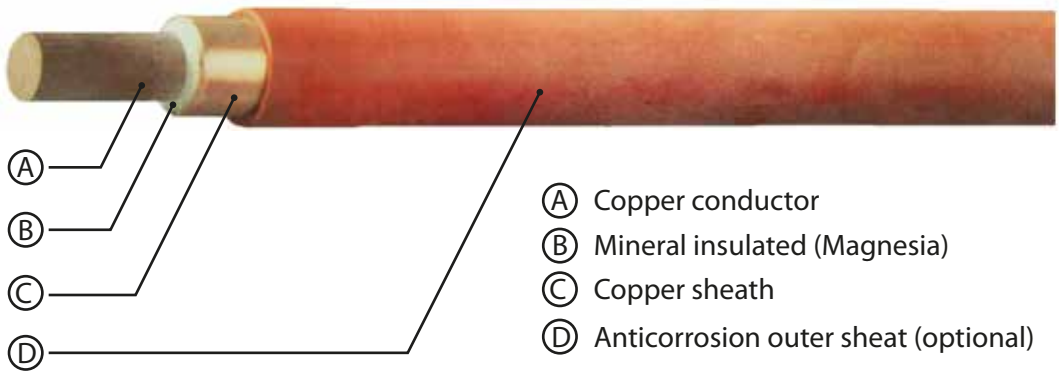
Mineral insulated cable is also called fireproof cable or copper-conductor copper sheathed magnesia insulated cable in China, known as MI cable abroad. Due to the particularity of product material and structure, it has high electric property, mechanical performance, environment resistance and environmental protection that the traditional organic insulation cable does not have. It has been widely applied to the basic industry and civil construction.

Main performance of mineral insulated cable:

- Fire-resistant performance
- Strong overload protection
- Large current carrying capacity
- High working temperature
- Waterproof, anticorrosion and explosion-proof property
- Highest standard for Fire Proof Cable
- Suitable for extreme fire safety measurement
- Continously transmitting electricity after 2 hours of fire disaster at 1000 °C.



MI cable structure diagram



MI cable is composed of high-conductivity copper conductor, mineral (magnesium-oxide) insulator and seamless coppertube sheath, if the cable is used in the locations where the copper will be eroded, it may be added with plastic sheath (optional) at the outermost layer. The continuous working temperature of bare cable reaches 250°C, it can supply the power for 3 hours continuously at 950°C -1,000°C, in addition. it can work at copper melting point of 1,083°C in short time or unusual time (melting point of magnesia: 2,800°C)

Test Item	GB/T19216	BS6387	IEC331
Fire-resistant test	750°C 90min	(Class A)650°C 180min (Class B)750°C 180min (Class C)950°C 180min (Class S)950°C 20min	750°C 180min
Water spray test	Without	(Class W)650°C 15min	Without
Impact test	Without	(Class X)650°C 15min (Class Y)750°C 15min (Class Z)950°C 15min	Without

Fire-resistant test

Water spray test

Impact test

Supplement: all the test requirements including S6387 are not strict enough, S6387 requires that 3 types of tests to be carried out on three new samples respectively. which is inconformity with the actual fire condition, cable fire safety test of British Underground Corporation requires that all the tests should be carried out on one sample, the test conditions are more rigorous, 950°C for 3 hours, use steel bar to impact once every 10min, spray with water for 15min (steel bar keeps striking), then bend the sample for 180° at the struck point, make further mechanical shock.

Fire-resistant test

Fire-proof capability

According to the forementioned contents, only the fire safety performance requirements for cables issued by British Underground Corporation can help the cable undergo the real fireresitive test. It is impossible that the same cable has no outside interference. it will be impacted constantly by the fire fighting water, falling material or other heavy objects.

Overload resistance

Test condition: The test adopts the cables that have the same rated current carrying capacity but different categories, all tested cables are connected in parallel, and connected to the adjustable transformer simultaneously.

Test methods: Increase the output voltage of current transformer gradually, to change the current passing the tested cable, and then, watch the cable status after the current overload occurs.

Test conclusion: As shown in following test efficiency diagram, we can know that after the over-current is applied to the cable, some tested cables produce the fire source by itself because its electric energy is converted into the thermal energy. Meanwhile, the test result shows that even if over load occurs, Ml cable hasn't the electric fault or doesn't cause the fire.

Cable overload test

Comparison of the performance

Comparing the performance		BTTZ Mineral Insulated Cable BTTZ type	ZN-YJV Common fire-retardant and fire resistant cable ZN-YJV type	WDZN-YJY LSZH fire resistant cable WDZN-Y JY type
Cable spec.		4 x 120	4x 150+1 x 70	4x150+1 x 70
Layout conditions		Surface wiring is available, without tray or pipeline	Need enclosed tray or pipeline protection	Need enclosed tray or pipeline protection
Service life		Over 100 years	20-40 years	20-40 years
Fire-retardant performance		Nocombustion	CAT - C fire retardance	CAT- A fire retardance
Fire-resistant performance		950°C 180min	Cable may be burned at 750°C for 90min, its price will be increased greatly.	
Fire-resistant capa-bility	Water spraying test	Meeting the test requirements	Fail to pass this test	
	Mechanical impact	Meeting the test requirements	Fail to pass this test	
Temperature resistance performance		Normal: 250°C ; max: 1,000°C	Max: 90°C ; short circuit: 250°C	
Environmental protection performance		No smoke, halogen or poison	Producing a great number of sm-oke and poisonous gas in burning	Producing little smoke or poison-ous gas in burning
Occupying the space		Φ34mm	Φ55mm	Φ65mm

Comparison of the price

Comparison of the item	Mineral Insulated Cable BTTZ type	Common Fire Retardant and Fire Resistant Cable ZN-YJV type	LSZH Fire Resistant Cable WDZN-YJY type
Cable spec.	4 x 120	4 x 150+1 x70	4x150+1x70
Current carrying capacity	380	360	365
Price per meter (percentage)	100%	95%	102%

Conclusion

a. Long service life, iSE MI Cable can avoid the secondary investment for project.
b. Small outer diameter, iSE MI Cable can save large of wiring space compared with the plastic cable.
c. Simple layout, iSE MI Cable can be installed without in pipeline, so it saves price for the project.
d. Good performance at high temperature resistant, it is far better than the plastic cable.
e. iSE MI Cable is the real green and safe product. Compared with LSZH plastic cable.
f. iSE MI Cable has passed this test BS6387 Class C, Class W, Class Z and IEC331
g. The performance/price ratio of iSE MI Cable surpasses any kind of cables.

Cable design, ordering model and expression

Class	Model	Name	Section (mm^2)	Core	Rated voltage (V)
Light-duty	BTTQ	Light-duty copper sheathed mineral insulated cable with copper conductor	1.0-4.0	2-7	500 (500/500)
	BTTVQ	Light-duty copper sheathed mineral insulated cable with copper conductor and anticorrosion sheath			
	BTTYQ	Light-duty copper sheathed mineral insulated cable with copper conductor and non-halogen low-smoke sheath			
Heavy-duty	BTTZ	Heavy-duty copper sheathed mineral insulated cable with copper conductor	1-400	1-19	750 (750/750)
	BTTVZ	Heavy-duty copper sheathed mineral insulated cable with copper conductor and anticorrosion sheath			
	BTTYZ	Heavy-duty copper sheathed mineral insulated cable with copper conductor and non-halogen low-smoke sheath			

Notices for application and design

1. When comparing with the general plastic cables, the MI cable is simpler in layout.
2. When the cables are exposed lay-out in buildings where should be look modern appearance, it can be designed into bare type without sheathing.
3. It can be designed into the one with the plastic outer sheath when it is intended for enviroment with ammonia and ammonia gas or other matters that would erode copper.
4. The cable with plastic sheath can be laid out with other plastic cables in the same bridge tray, cable duct, cable tunnel or other touchable occasions, but this bare cable should be laid out separately, otherwise, it would affect other plastic or other organic cables.
5. The cable need not to be set in metal pipe, single-core cable is not allowed to be set in pipe alone, when it must be set in metal pipe for special occasions.
6. As the cable has high current carrying capacity, it is advised to upgrade a sectional area class for designing and using, and that of exceeding and including $35mm^2$ can be used by upgrading two sectional area classes.
7. As the copper sheath of cable can be used as ground wire, it is advised to use four-core MI cable for three-phase five-wire systems.
8. When considering that the whole line should employ less intermediate connection, just design the multi-core cables whose sectional area is $25mm^2$ and below into single-core cables.
9. When a transmission route is long enough, and it requires both MI Cable and general plastic cable then transmitting box can be used for transition.
10. Cable branching box can be use to branch the mineral insulated cables.

Main application occasions

A. Public buildings

- Public entertainment places
- High-rise buildings
- Hotels
- Hospitals, schools, government units
- Department stores, warehouses
- National memorials and buildings of historic interest

B. High-temperature situations

- Metallurgical industry
- Coke industry
- Shipbuilding industry
- Iron and steel industry
- Glass industry
- Transmission and distribution lines in other high-temperature situations

C. Hazardous locations

- Petrochemical industry
- Refinery, filling station and oil house
- Paint making and pigment industry
- Chemical industry
- Nuclear power station
- Offshore oil platform

D. Underground buildings

- Underground railways
- Underground warehouses
- Tunnels
- Underground squares

E. Transportation and traffic junction

Notices for application and design

Attached table 1 Main enginnering data of copper-conductor copper sheathed mineral insulated cables of class 500V and 750V

Model	Core number of conductor and nominal sectional area	Overall diameter of cable		Overall diameter of cable		Cross section size of copper sheath	Max length of finished cables (only for reference)		Approximate weight	
		Bare cable	Cable with anticorrosion outer sheath	Bare cable	Cable with anticorrosion outer sheath				Bare cable	Cable with anticorrosion outer sheath
	mm^2	mm	mm	mm	mm	mm^2	m		kg/km	kg/km
BTTQ Light - duty cable	2 x 1,0	5.1	6.4	17.5	19.5	6.0	150	Please take the actual length as standard for delivery	104	125
	2 x 1,5	5.7	7.0	22.5	25	7.1	150		130	153
	2 x 2,5	6.6	7.9	30	33	9.4	150		179	205
	2 x 4,0	7.7	9.2	40	44	12.1	150		248	287
	3 x 1,0	5.8	7.1	15	16.5	7.6	150		135	159
	3 x 1,5	6.4	7.7	19	21	8.9	150		168	193
	3 x 2,5	7.3	8.8	25	28	10.7	150		224	261
	4 x 1,0	6.3	7.6	14.5	16	8.8	150		161	187
	4 x 1,5	7.0	8.3	19	21	10.2	150		202	230
	4 x 2,5	8.1	9.6	25	28	12.8	150		278	319
	7 x 1,0	7.6	9.1	10	11	11.6	250		233	271
	7 x 1,5	8.4	9.9	12.5	14	13.3	200		291	333
	7 x 2,5	9.7	11.2	17	19	17.4	160		407	455
BTTZ Heavy - duty cable	1 x 1,5	4.9	6.2	30	33	5.8	500		97	117
	1 x 2,5	5.3	6.6	39	43	6.4	500		116	137
	1 x 4,0	5.9	7.2	51	56	7.7	500		146	170
	1 x 6,0	6.4	7.7	63	69	8.9	500		180	206
	1 x 10	7.3	8.8	81	90	10.7	500		241	278
	1 x 16	8.3	9.8	107	119	13.2	400		329	371
	1 x 25	9.6	11.1	139	154	17.0	300		455	502
	1 x 35	10.7	12.2	168	187	20.2	250		584	637
	1 x 50	12.1	13.6	207	230	24.7	220		773	831
	1 x 70	13.7	15.2	251	279	30.9	220		1022	1088

Attached table 1

Model	Core number of conductor and nominal sectional area	Overall diameter of cable		Overall diameter of cable		Cross section size of copper sheath	Max length of finished cables (only for reference)		Approximate weight	
		Bare cable	Cable with anticorrosion outer sheath	Bare cable	Cable with anticorrosion outer sheath				Bare cable	Cable with anticorrosion outer sheath
	mm^2	mm	mm	mm	mm	mm^2	m		kg/km	kg/km
BTTZ Heavy-duty cable	1 x 95	15.4	17.4	300	333	36.7	170	Please take the actual length as standard for delivery	1315	1403
	1 x 120	16.8	18.8	344	382	42.6	140		1604	1701
	1 x 150	18.4	20.4	388	431	49.5	120		1950	2054
	1 x 185	20.4	22.9	434	482	58.1	100		2360	2496
	1 x 240	23.3	25.8	483	537	70.1	75		2993	347
	1 x 300	26.0	28.6	795	883	86.7	60		3680	3852
	1 x 400	30.0	32.8	948	1053	110.8	45		4805	5007
	2 x 1,5	7.9	9.4	23.5	26	12.5	280		230	270
	2 x 2,5	8.7	10.2	32	36	14.6	280		284	327
	2 x 4,0	9.8	11.3	42	47	17.6	220		365	413
	2 x 6,0	10.9	12.4	54	60	20.9	210		459	512
	2 x 10	12.7	14.2	74	82	26.7	150		634	695
	2 x 16	14.7	16.2	98	109	34.1	120		871	941
	2 x 25	17.1	19.1	128	142	43.4	120		1201	1299
	3 x 1,5	8.3	9.8	20	22	13.6	230		260	302
	3 x 2,5	9.3	10.8	27	30	16.1	230		332	378
	3 x 4,0	10.4	11.9	36	40	19.3	200		426	477
	3 x 6,0	11.5	13	46	51	23.1	180		537	593
	3 x 10	13.6	15.1	62	69	30.3	130		768	833
	3 x 16	15.6	17.6	83	92	38.1	110		1050	1140
	3 x 25	18.2	20.2	108	120	47.4	105		1460	1564
	4 x 1,5	9.1	10.6	20.5	23	15.8	200		312	358
	4 x 2,5	10.1	11.6	27	30	18.5	200		395	444
	4 x 4,0	11.4	12.9	36	40	22.9	200		519	574
	4 x 6,0	12.7	14.2	46	51	26.7	170		658	719
	4 x 10	14.8	16.3	61	68	34.4	160		927	997
	4 x 16	17.3	19.3	80	89	45.8	120		1353	1455
	4 x 25	20.1	22.6	104	116	56.0	90		1822	1956
	7 x 1,5	10.8	12.3	14	15.5	20.7	150		444	496
	7 x 2,5	12.1	13.6	19	21	24.7	180		562	620
	10 x 1,5	13.5	15	12.5	13.5	26.0	150		638	703
	10 x 2,5	15.2	17.2	17	19	29.7	120		836	924
	12 x 1,5	14.1	15.6	11.5	13	32.2	160		706	774
	12 x 2,5	15.6	17.6	15.5	17	38.1	150		907	997
	19 x 1,5	16.6	18.6	10	11	41.6	110		982	1077

Attached table 2 Copper-conductor copper sheathed mineral insulated bare cable or cable with anticorrosion sheath of class 500V and 750V, touchable temperature of copper sheath: 70°C/ambient temperature: 30°C (along the walls, floors, line ducts, pipes)

Nominal sectional area of conductor mm^2		A Current carrying capacity A		
		Two pieces of conductor (single-phase) two-core or single-core cable	Three pieces of conductor (three-phase)	
			Multi-core or single-core cable Triangle arrangement	Single-core cable Side-by-side arrangement
		1	2	3
500V Light-duty 500V	1.5	23	19	21
	2.5	31	26	29
	4	40	35	38
750 V Heavy-duty 750 V	1.5	25	21	23
	2.5	34	28	31
	4	45	37	41
	6	57	48	52
	10	77	65	70
	16	102	86	92
	25	133	112	120
	35	163	137	147
	50	202	169	181
	70	247	207	221
	95	296	249	264
	120	340	286	303
	150	388	328	346
	185	440	371	392
	240	514	434	457
	300	782	748	879
	400	940	893	1032

Attached table 3 Copper-conductor copper sheathed mineral insulated bare cable or class 500V and 750V, untouchable temperature of copper sheath: 105°C/ambient temperature: 30°C (along the walls,floors,line ducts,pipes)

Nominal sectional area of conductor mm²		A Current carrying capacity A		
		Two pieces of conductor (single-phase) two-core or single-core cable	Three pieces of conductor (three-phase)	
			Multi-core or single-core cable Triangle arrangement	Single-core cable Side-by-side arrangement
		1	2	3
500V Light-duty 500V	1.5	28	24	27
	2.5	38	33	36
	4	51	44	47
750 V Heavy-duty 750 V	1.5	31	26	30
	2.5	42	35	41
	4	55	47	53
	6	70	59	67
	10	96	81	91
	16	127	107	119
	25	166	140	154
	35	203	171	187
	50	251	212	230
	70	307	260	280
	95	369	312	334
	120	424	359	383
	150	485	410	435
	185	550	465	492
	240	643	544	572
	300	973	947	964
	400	1230	1136	1146

Attached table 4 Copper-conductor copper sheathed mineral insulated bare cable or cable with anticorrosion sheath of class 500V and 750V, touchable temperature of copper sheath: 70 °C/ambient temperature: 30 °C (Free air)

Nominal sectional area of conductor mm²		A Current carrying capacity A				
		Two pieces of conductor (single-phase) two-core or single-core cable	Three pieces of conductor (three-phase)			
			Multi-core or single-core cable Triangle arrangement	Single-core cable Side-by-side arrangement	Single-core cable Vertical with clearance	Single-core cable Horizontal with clearance
		1	2	3	4	5
500V Light-duty 500V	1.5	25	21	23	26	29
	2.5	33	28	31	34	39
	4	44	37	41	45	51
750 V Heavy-duty 750 V	1.5	26	22	26	28	32
	2.5	36	30	34	37	43
	4	47	40	45	49	56
	6	60	51	57	62	71
	10	82	69	77	84	95
	16	109	92	102	110	125
	25	142	120	132	142	162
	35	174	147	161	173	197
	50	215	182	198	213	242
	70	264	223	241	259	294
	95	317	267	289	309	351
	120	364	308	331	353	402
	150	416	352	377	400	454
	185	472	399	426	446	507
	240	552	466	496	497	565
	300	812	758	789	792	889
	400	965	913	933	938	1058

Attached table 5 Copper-conductor copper sheathed mineral insulated bare cable of class 500V and 750V, untouchable temperature of copper sheath: 105°C / ambient temperature: 30°C (Free air)

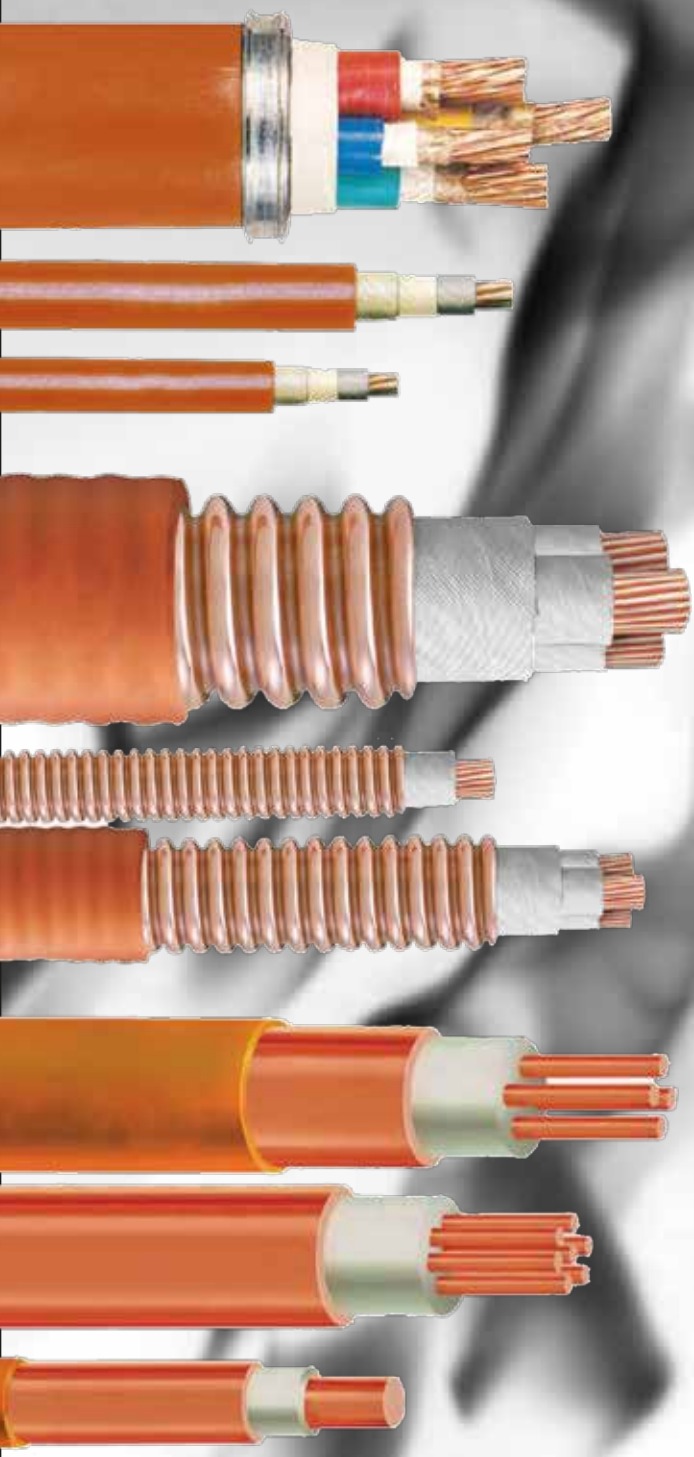
Nominal sectional area of conductor mm²		A Current carrying capacity A				
		Two pieces of conductor (single-phase) two-core or single-core cable	Three pieces of conductor (three-phase)			
			Multi-core or single-core cable Triangle arrangement	Single-core cable Side-by-side arrangement	Single-core cable Vertical with clearance	Single-core cable Horizontal with clearance
		1	2	3	4	5
500V Light-duty 500V	1.5	31	26	29	33	37
	2.5	41	35	39	43	49
	4	54	46	51	56	64
750 V Heavy-duty 750 V	1.5	33	28	32	35	40
	2.5	45	38	43	47	54
	4	60	50	56	61	70
	6	76	64	71	78	89
	10	104	87	96	105	120
	16	137	115	127	137	157
	25	179	150	164	178	204
	35	220	184	200	216	248
	50	272	228	247	266	304
	70	333	279	300	323	370
	95	400	335	359	385	441
	120	460	385	411	441	505
	150	526	441	469	498	565
	185	596	500	530	557	629
	240	697	584	617	624	704
	300	1012	945	973	1026	1098
	400	1197	1129	1161	1209	1312

Attached table 6 Correction coefficent of copper-conductur copper sheathed mineral insulated cable of class 500V and 750V in the air (ambient temperature not equal to 30°C), can be applied to the current-carrying capacity of cables laid out in the air

Environment temperature °C	Bare cable with anticorrosion sheath, touchable 70 °C	Bare cable Untouchable 105 °C
10	1.26	1.14
15	1.20	1.11
20	1.14	1.07
25	1.07	1.04
35	0.93	0.96
40	0.85	0.92
45	0.87	0.88
50	0.67	0.84
55	0.57	0.8
60	0.45	0.75
65	-	0.7
70	-	0.65
75	-	0.6
80	-	0.54
85	-	0.47
90	-	0.4
95	-	0.32

Attached table 7 When is applied to cables in line pipes or line ducts as well as exposed laying cable bunch, refer to the rated value for the group correction coefficent of multi circuits of copper-conductor copper sheathed mineral insulated of class 500V and 750V or multi-core cable

Item	Arrangement of cable	Correction coefficient											
		Quantity of circuit or multi-core cable											
		1	2	3	4	5	6	7	8	9	12	16	20
1	Exposed laying in bunch or enclosed in line pipe or line duct	1.00	0.80	0.70	0.65	0.60	0.57	0.54	0.52	0.50	0.45	0.41	0.38
2	Lay out single layer on wall,floor or hole-free tray	1.00	0.85	0.79	0.73	0.75	0.72	0.72	0.71	0.70	0.70	0.70	0.70
3	Lay out single layer on wooden floor directly	0.95	0.81	0.72	0.68	0.66	0.64	0.63	0.62	0.61	0.61	0.61	0.61
4	Lay out single layer on vertical or horizontal tray	1.0	0.88	0.82	0.77	0.75	0.73	0.73	0.72	0.72	0.72	0.72	0.72
5	Lay out single layer on ladder type support or plywood	1.0	0.87	0.82	0.80	0.80	0.79	0.79	0.78	0.78	0.78	0.78	0.78



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