

**GEMSCAB®**  
CABLES

THE RIGHT CONNECTION

# Fire Survival Cables



In today's world of regular upgradation of technology, cables are a vital organ of our working system. We are witnessing tremendous growth in industrial & commercial sectors. Due to rapid urbanization in our country, cities built with mortar are brought to life with current supplied by cables. May it be Airports, Hostels, Commercial Complexes, Metro Stations, Multiplexes, Power Plants, shopping malls, Universities, Oil Refineries, Schools, High Rise Buildings, Hospitals, On & Off Shore Installations, any other infrastructure gets its power from cables. Protection of said infrastructure & safe evacuation of residents/occupants in case of fire is the area of main concern.

The Major function of cables in the event of fire is to RETARD and RESIST it. Two important performances should be considered as -

- **FLAME RETARDANT**
- **FIRE RESISTANT/FIRE SURVIVABILITY**

#### **FLAME RETARDANT CABLES:**

These cables can retard the spread of fire. Usage of these cables is limited to small covered areas or in shaft or from floor to floor. In case of flame retardant cables when fire breaks out, they slow the speed of fire minimizing the destruction. All the systems connected to cables like fire alarm system, emergency lighting, voice alarm system, lifts, water pumps, water sprinklers become completely out of work.

#### **FIRE SURVIVAL CABLES:**

These cables have the quality to maintain circuit integrity in case of fire. All important systems connected to cables continue to work insuring safe evacuation of residents/occupants without any hindrance. Fire survival cables are always flame-retardant cables as well as they assure the highest level of security.

#### **STANDARDS AND SPECIFICATIONS**

To evaluate cable performance under fire condition various basic and enhanced test parameters have been developed during past years. International standards, specifications and tests where performance of cable is mentioned are as below-

#### **■ BS 7846:2015**

Specification for thermosetting insulated, armoured, fire resistant cables of rated voltage 600/1000 V, having low emission of smoke and corrosive gases when affected by fire.

Classes: CATEGORY F2	- Resistance to Fire With Mechanical Shock and Water spray as per tested in accordance with BS 8491.
CATEGORY F30	- Resistance to Fire With Mechanical Shock and Water spray as per tested in accordance with BS 8491 for 30 Minutes
CATEGORY F60	- Resistance to Fire With Mechanical Shock and Water spray as per tested in accordance with BS 8491 for 60 Minute
CATEGORY F120	- Resistance to Fire With Mechanical Shock and Water spray as per tested in accordance with BS 8491 for 120 Minute

#### **■ BS 6387**

Performance requirements for cables required to maintain circuit integrity under fire conditions.

Purpose of the Standard is to examine cable's ability to function under below conditions:

1. **Fire**
2. **Fire with water spray**
3. **Fire with mechanical shock**
1. **Resistance to fire alone – Protocol C**

Cable is tested by exposing to flame while passing current at its rated voltage.

- Flame Temperature: 950°C +/- 40°C for 3 hours
- Test Voltage: 1000 Volts Phase to Phase
- Test Requirement: No circuit breaker or fuses tripped nor any lamp extinguish during the period of test.





## 2. Resistance to fire with water sprinkle – Protocol W

Cable is tested by exposing to flame while passing current at its rated voltage. Duration of test is 30 minutes.

- Flame Temperature: 650°C +/- 40°C for initial 15 minutes.
- Exposure to both flame and water spray for further 15 minutes.
- Test Voltage : 1000 Volts Phase to Phase
- Test Requirement : No circuit breaker or fuses tripped nor any lamp extinguish during the period of test.



## 3. Resistance to fire with mechanical shock-Protocol Z

Test with mechanical shock is final requirement. Cable in S shape is monitored on a platform & exposed to flame.

- Flame Temperature: 950°C +/- 40°C for initial 15 minutes.
- Mechanical shocks – 30 times (one shock in every 30 second.)
- Test Voltage : 1000 Volts Phase to Phase
- Test Requirement : No circuit breaker or fuses tripped nor any lamp extinguish during the period of test.



### BS EN 50200:2015

Method of test for resistance to fire + mechanical shock of unprotected small cables for use in emergency circuits. Cable circuit integrity is verified by exposing it to fire at 830°C +/- 40°C & mechanical shock.

Classes:

- PH15 – Flame for 15 Minutes
- PH30 – Flame for 30 Minutes
- PH60 – Flame for 60 Minutes
- PH90 – Flame for 90 Minutes
- PH120 – Flame for 120 Minutes

### BSEN 50200+ Annex E: 2015

Method of test for resistance to fire + impact + water of unprotected small cables for use in emergency circuit.

Cable circuit integrity is verified by exposing to a flame at 830°C & mechanical shocks for 15 minutes & additional 15 minutes to flame, mechanical shocks & water spray

### BS 8434-2

Method of test for resistance to fire + impact + water of unprotected small cables for use in emergency circuits.

Test method :

Fire at 930°C + Mechanical shock (For 60 mins)

Fire at 930°C + Mechanical shock + Water sprinkling (for 60 mins)

Total test duration – 120 mins

### BS 8491:2008

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 test is carried out to verify circuit integrity of cables having diameter more than 20mm.

Flame Temperature: 830°C + 40°C / - 0°C for 120 minutes

Propane Flow Rate: 10.0 +/- 0.4 L/Min.

Air Flow Rate: 160 +/- 8 L/Min.

Water Flow Rate: 12.5 L/Min. Via on/off valve

Test Voltage: 1000 Volts Phase to Phase

Total Number of Impacts: 12 Nos in 120 Minutes (one shock in every 10 minutes)

Water sprinkle start by a strong jet of water 5 minute before (115.55 minutes start time during test) before the end of the test and 5 cycles of every 5 second duration each after one minute interval.

Test Requirement : No circuit breaker or fuses tripped nor any lamp extinguish during the period of test. .

**IEC 60331:** Circuit integrity test. Sample is held at 750°C flame for 90 minutes at rated voltage.

**IEC 60332-1, BS EN 60322-1:** Flame Propagation Test on a single cable

**IEC 60332-2, BS EN 60322-2**

**IEC 60332-3, BS EN 60332-3:** Fire Propagation/Flame spread test on bunched cables.

**IEC 60754-1, BS EN 50267-2-1:** Acid gas / HCL Emission test

**IEC 60754-2, BS EN 50267-2-2:** Gas Corrosivity / Acidity Determination Test

**IEC 61034-2, BS EN 61034-2:** Smoke Density test

**ASTM D 2863:** Limiting oxygen index



### **GEMSCAB “PRATIRODHI” FIRE SURVIVAL CABLES**

These are technologically advanced cables suitable for various applications, where maintaining circuit integrity is highly essential. These Cables are halogen free, resistant to chemicals, non -toxic and emits fewer corrosive gases which prevent the loss to machines, plants and human beings. No releases of dense smoke and excellent flame retardant properties that prevents spread of fire are added features.

These are intended for use in dense occupancy area like – Hospitals, Airports, Escalators, Shopping Complexes, High-rise buildings, Hotels, Metro Links, Oil Refineries, Petrochemical Outlets, Defence establishments, malls, Commercial Complexes, Road and Rail tunnels, Lifts, Cinema Theaters, Emergency Lightings, Car Parking, Nuclear Power Station, Industrial Areas, Power Generating Stations etc. where maintaining power supply is must for a required minimum period of time.

**GEMSCAB “PRATIRODHI”** cables are manufactured to meet all categories as per BS :7846 i.e., F2, F30, F60, F120 where F120 is the highest category of performance under fire conditions.

GEMSCAB “PRATIRODHI” cables also comply with following test parameters:

- EN 61034-2: Smoke Density
- IEC 60754-1: HCL Gas Emission
- IEC 60754-2: Gas Corrosivity
- IEC 60332-2: Flame Propagation
- IEC 60332-3: Fire Retardant
- ASTM 2863: Critical Oxygen Index

### **CONSTRUCTION**

- Stranded Annealed Copper / Aluminium Conductor as per BS EN 60228-2.
- Double layer of Glass Mica Tape applied helically.
- Thermosetting Extruded XLPE insulation.
- Cores laid up & assembled.
- Extruded layer of LSZH compound as inner sheath.
- Galvanized steel round wire armoured.
- Extruded layer of LSZH Compound as outer sheath.





## BS 7846:2015

### Two-core 600/1000 V cables with copper conductors

Nominal Cross Sectional area of conductor (sq.mm)	Radial thickness of insulation (mm)	Nominal thickness of extruded bedding (mm)	Nominal steel armour wire diameter (mm)	Nominal thickness of over sheath (mm)	Approximate overall diameter (mm)	Approximate weight of cable (kg/km)
1.5 A)	0.6	0.8	0.9	1.3	13.0	325
2.5 A)	0.7	0.8	0.9	1.4	14.5	420
4 A)	0.7	0.8	0.9	1.4	15.5	480
6 A)	0.7	0.8	0.9	1.4	16.5	540
10 A)	0.7	0.8	0.9	1.4	19.0	700
16 A)	0.7	0.8	1.25	1.5	21.5	1005
25 A)	0.9	0.8	1.25	1.6	25.5	1200
25 B)	0.9	0.8	1.25	1.6	22.5	1030
35 A)	0.9	1.0	1.6	1.7	29.0	1690
35 B)	0.9	1.0	1.6	1.7	25.0	1450
50 B)	1.0	1.0	1.6	1.8	27.5	1800
70 B)	1.1	1.0	1.6	1.9	30.0	2325
95 B)	1.1	1.2	2.0	2	34.0	3200
120 B)	1.2	1.2	2.0	2.1	37.0	3800
150 B)	1.4	1.2	2.0	2.2	40.0	4500
185 B)	1.6	1.4	2.5	2.4	46.0	5650
240 B)	1.7	1.4	2.5	2.5	50.0	6800
300 B)	1.8	1.6	2.5	2.6	55.0	8400
400 B)	2.0	1.6	2.5	2.8	60.0	10300

A) Circular or compacted circular stranded conductor (class - 2)

B) Shaped stranded conductor (class - 2)

## BS 7846:2015

### Three core 600/1000 V cables with copper conductors

Nominal Cross Sectional area of conductor (sq.mm)	Radial thickness of insulation (mm)	Nominal thickness of extruded bedding (mm)	Nominal steel armour wire diameter (mm)	Nominal thickness of over sheath (mm)	Approximate overall diameter (mm)	Approximate weight of cable (kg/km)
1.5 A)	0.6	0.8	0.9	1.3	13.5	310
2.5 A)	0.7	0.8	0.9	1.4	15.0	450
4 A)	0.7	0.8	0.9	1.4	16.0	550
6 A)	0.7	0.8	0.9	1.4	17.5	635
10 A)	0.7	0.8	1.25	1.5	20.5	940
16 A)	0.7	0.8	1.25	1.6	22.5	1115
25 A)	0.9	1.0	1.6	1.7	28.0	1870
25 B)	0.9	1.0	1.6	1.7	24.5	1680
35 A)	0.9	1.0	1.6	1.8	31.0	2280
35 B)	0.9	1.0	1.6	1.8	26.5	2050
50 B)	1.0	1.0	1.6	1.8	30.0	2525
70 B)	1.1	1.0	1.6	1.9	33.0	3280
95 B)	1.1	1.2	2.0	2.1	38.0	4480
120 B)	1.2	1.2	2.0	2.2	42.0	5220
150 B)	1.4	1.4	2.5	2.3	47.0	6620
185 B)	1.6	1.4	2.5	2.4	51.0	7600
240 B)	1.7	1.4	2.5	2.6	56.0	9500
300 B)	1.8	1.6	2.5	2.7	61.0	10200
400 B)	2.0	1.6	2.5	2.9	68.0	14000

A) Circular or compacted circular stranded conductor (class -2)

B) Shaped stranded conductor (class -2)

## BS 7846:2015

### Four-core 600/1000 V cables with copper conductors

Nominal Cross Sectional area of conductor (sq.mm)	Radial thickness of insulation (mm)	Nominal thickness of extruded bedding (mm)	Nominal steel armour wire diameter (mm)	Nominal thickness of over sheath (mm)	Approximate overall diameter (mm)	Approximate weight of cable (kg/km)
1.5A)	0.6	0.8	0.9	1.3	14.5	380
2.5A)	0.7	0.8	0.9	1.4	16.0	525
4A)	0.7	0.8	0.9	1.4	17.5	620
6A)	0.7	0.8	1.25	1.5	20.0	870
10A)	0.7	0.8	1.25	1.5	22.5	1105
16A)	0.7	0.8	1.25	1.6	24.5	1290
25A)	0.9	1.0	1.6	1.7	30.0	2190
25B)	0.9	1.0	1.6	1.7	27.5	2040
35A)	0.9	1.0	1.6	1.8	33.0	2740
35B)	0.9	1.0	1.6	1.8	30.0	2540
50B)	1.0	1.0	1.6	1.9	33.0	3150
70B)	1.1	1.2	2.0	2.1	39.0	4400
95B)	1.1	1.2	2.0	2.2	43.0	5600
120B)	1.2	1.4	2.5	2.3	48.0	7200
150B)	1.4	1.4	2.5	2.4	53.0	8400
185B)	1.6	1.4	2.5	2.6	58.0	10100
240B)	1.7	1.6	2.5	2.7	64.0	12600
300B)	1.8	1.6	2.5	2.9	70.0	15180
400B)	2.0	1.8	3.15	3.2	79.0	19500

A) Circular or compacted circular stranded conductor (class - 2)

B) Shaped stranded conductor (class - 2)

## BS 7846:2015

### Five core 600/1000 V cables with copper conductors

Nominal Cross Sectional area of conductor (sq.mm)	Radial thickness of insulation (mm)	Nominal thickness of extruded bedding (mm)	Nominal steel armour wire diameter (mm)	Nominal thickness of over sheath (mm)	Approximate overall diameter (mm)	Approximate weight of cable (kg/km)
1.5	0.6	0.8	0.9	1.4	15.5	495
2.5	0.7	0.8	0.9	1.4	17.5	600
4	0.7	0.8	0.9	1.5	19.0	720
6	0.7	0.8	1.25	1.5	21.5	1010
10	0.7	0.8	1.25	1.6	24.0	1270
16	0.7	1.0	1.6	1.7	27.5	1880
25	0.9	1.0	1.6	1.8	32.5	2620
35	0.9	1.0	1.6	1.9	36.0	3150
50	1.0	1.2	2.0	2.0	42.0	4580
70	1.1	1.2	2.0	2.2	48.0	5675

A) Circular or compacted circular stranded conductor (class - 2)



## BS 7846:2015

### Multicore auxiliary 600/1000 V cables with copper conductors

Number of Cores A)	Nominal Cross Sectional area of conductor B) (sq.mm)	Radial Thickness of insulation (mm)	Nominal Thickness of extruded bedding (mm)	Nominal steel armour wire diameter (mm)	Nominal Thickness of oversheath (mm)	Approximate overall diameter (mm)	Approximate overall diameter (mm)
7	1.5	0.6	0.8	0.9	1.4	16.5	570
12	1.5	0.6	0.8	1.25	1.5	21.5	980
19	1.5	0.6	0.8	1.25	1.6	24.5	1250
27	1.5	0.6	1.0	1.6	1.7	29.5	1880
37	1.5	0.6	1.0	1.6	1.7	33.0	2275
7	2.5	0.7	0.8	0.9	1.4	18.5	700
12	2.5	0.7	0.8	1.25	1.6	24.5	1190
19	2.5	0.7	1.0	1.6	1.7	29.0	1810
27	2.5	0.7	1.0	1.6	1.8	34.0	2350
37	2.5	0.7	1.0	1.6	1.8	36.0	2920
7	4	0.7	0.8	1.25	1.5	21.0	1000
12	4	0.7	1.0	1.6	1.6	27.5	1660
19	4	0.7	1.0	1.6	1.7	32.0	2240
27	4	0.7	1.0	1.6	1.9	38.0	2980
37	4	0.7	1.2	2.0	2.0	43.0	4000

A) the numbers of cores given here are preferred. Other numbers up to maximum of 37 are permitted subject to agreement between the purchaser and manufacturer and, where such numbers are manufactured, the dimensional details shall be as for the next highest preferred number of cores. Auxiliary cables with 2 to 5 cores shall be in accordance with table 4, 5, 6 or 7, as applicable

A) Circular or Compacted Circular Stranded Copper Conductors (class 2)

## BS 7846:2015

### Fire Survival Cable, 600/1000 V AC

ELECTRICAL CHARACTERISTICS								
Conductor Cross Sectional Area	Max. Conductor Resistance		Current carrying capacity (Amperes)					
							Air Ambient Temperature - 30°C	
							Ground Temperature - 20°C	
							Conductor operating Temperature - 90°C	
			Reference Method (Clipped direct)		Reference Method E (in free air or on a perforated cable tray etc. horizontal or vertical)		Reference Method D (Direct in ground or in ducting in ground, in or around buildings)	
	At 20°C	At 90°C	I two-core cable, Single phase AC or DC	I three- or I four-core cable, three-phase AC	I two-core cable, Single phase AC or DC	I three- or I four-core cable, three-phase AC	I two-core cable, Single phase AC or DC	I three- or I four-core cable, three-phase AC
1.5	12.1	15.5	27	23	29	25	25	21
2.5	7.41	9.50	36	31	39	33	33	28
4	4.61	5.91	49	42	52	44	43	36
6	3.08	3.95	62	53	66	56	53	44
10	1.83	2.35	85	73	90	78	71	58
16	1.15	1.47	110	94	115	99	91	75
25	0.727	0.932	146	124	152	131	116	96
35	0.524	0.672	180	154	188	162	139	115
50	0.387	0.496	219	187	228	197	164	135
70	0.268	0.343	279	238	291	251	203	167
95	0.193	0.247	338	289	354	304	239	197
120	0.153	0.196	392	335	410	353	271	223
150	0.124	0.159	451	386	472	406	306	251
185	0.0991	0.128	515	441	539	463	343	281
240	0.0754	0.0977	607	520	636	546	395	324
300	0.0601	0.0781	698	599	732	628	446	365
400	0.0470	0.0616	787	673	847	728	-	-

The above table is in accordance with Table 4E4A of BS 7671-2018

#### Current rating de-rating factor for other than 30°C ambient air temperature

Air Temperature	25	30	35	40	45	50	55	60	65	70	75	80
De-rating	1.02	1.00	0.96	0.91	0.87	0.82	0.76	0.71	0.65	0.58	0.50	0.41

#### Current rating de-rating factor for other than 20°C ground temperature

Air Temperature	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
De-rating	1.07	1.04	1.00	0.96	0.93	0.89	0.85	0.80	0.76	0.71	0.65	0.60	0.53	0.46	0.38

**GEMSCAB®**  
CABLES

THE RIGHT CONNECTION

## **GEMSCAB INDUSTRIES LIMITED**

An ISO 9001, ISO 14001, ISO 45001 Certified Company

### **WORKS**

#### *Unit-I*

SP-1192/L & K, Phase-IV, RIICO Industrial Area  
Bhiwadi, Distt. Alwar (Rajasthan) - 301 019  
Ph.: +91-7230085142, 7230085143, 7230085144  
Fax: +91-1493-222752

#### *Unit-II*

SP-4-868/869, RIICO Industrial Area  
Pathredi, (Near Bhiwadi), P.O. Tapukara  
Dist. Alwar (Rajasthan) - 301 707  
Ph.: +91-7230085145, 7230085146

### **CORPORATE OFFICE**

704-707, 7th Floor, Vikrant Tower, 4, Rajendra Place  
New Delhi - 110008  
Ph. 011-42151572 • Fax: 011-45136501  
E-Mail: delhi@gemscab.com

### **BRANCH OFFICES**

#### **Mumbai**

519, Laxmi Plaza, Laxmi Industrial Estate  
Andheri (West), Mumbai - 400 053  
Ph.: +91-22-26351354, 26351356  
Mobile: +91 9223170503, 9223171494  
E-Mail: mumbai@gemscab.com

#### **Chennai**

113, 1st Floor, Gee Gee Shroff Centre  
Poonamalle High Road, Chennai - 600 084  
Ph.: +91-44-43307098  
Mobile: +91 9282349620  
E-Mail: kkbhat@gemscab.com

#### **Kolkata**

5th Floor, 29, Ganesh Chandra Avenue  
Kolkata - 700 013  
Ph: +91-33-40037819  
Mobile: +91 9830125253  
E-Mail: vedantgupta@gemscab.com

### **Representatives**

Bangalore, Hyderabad, Coimbatore, Chandigarh, Ahmedabad, Nagpur, Lucknow, Bhubaneswar, Jaipur, Dehradun, Ludhiana, Indore, Vadodara, Raipur, Vizag

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