Materials Mag!c
Hitachi Metals

HITACHI

FLEXIBLE CABLE

Strong durability under harsh environment

For several decades, Hitachi Metals has supplied flexible cables for severe environmental conditions to the market, such as for ports, steel works and chemical plants.
“Robustness” is an essential requirement for these applications, where continuous manufacturing or operation is required.
Customers simultaneously desires “Flexibility” that is a property somewhat opposite to “Robustness”.
We have continuously supplied products meeting market requirements by taking advantage of our delivery experience and technological innovation for a long time. Please expect for the future flexible cables of Hitachi Metals Ltd.

Benefits for the customers and our advantages

- Assured quality proven by a long delivery history
- Applications through a wide-range of product lineup
- Short delivery time by extensively stocked products
- Wide choice of products adapted for various standards

Photos provided by Kawasaki City Port Authority
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FLEXIBLE CABLE

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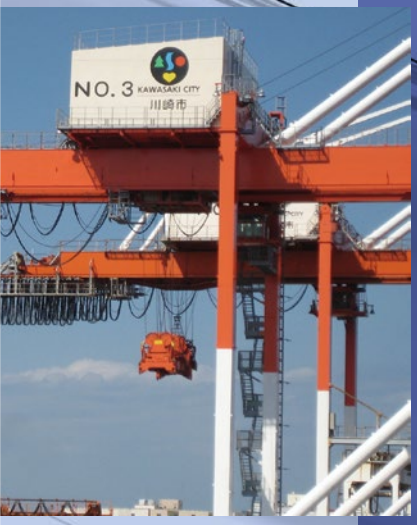
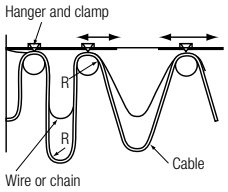
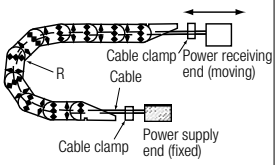
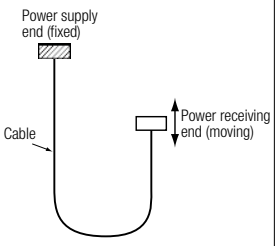
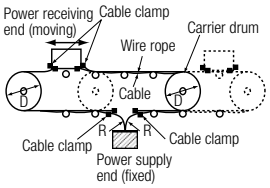


System Application and Recommended Cables

System Application / Type of Cable	Page	Festoon	Chain	Lift	Carrier Drum	
						
RELCT (MV) RELCT (LV)	6 7	—	■	■	■	
SPDCT SPDCT (Y)	9 10	—	—	—	—	
FTNCT FTNCT-SB / FTNCT-PSB	12 13	●	●	●	—	
FRCCT	14	●	●	●	—	
CARCT	15	■	■	—	●	
FFCT / FFCTB	17	●	●	●	—	

Meaning of marks in the Catalog

Squeeze resistance
Durability is superior in applications where squeeze stress is applied.

Flexibility
Superior flexibility

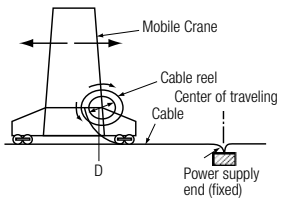
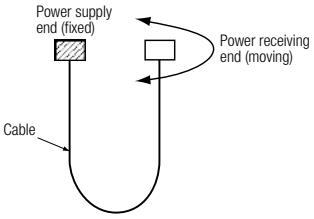
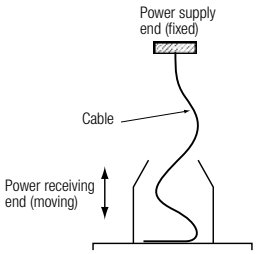
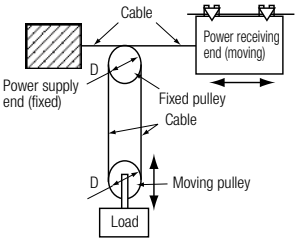
Bending resistance
Durability is superior in applications where bending is repetitively applied.
(D: Overall diameter of cable)

Tough sheath
Tear strength and wear resistance are enhanced over those of general chloroprene sheaths.

Torsion resistance
Durability is superior in applications where torsion is applied.

Smooth surface
Friction resistance is reduced to lower than that of general chloroprene sheaths.

● Main application ■ Suitable – Not applicable

	Reel (Traveling)	Torsion	Spreader (Basket)	Moving Pulley
				
	●	■	–	●
	–	–	●	–
	–	■	–	–
	–	●	–	–
	–	–	–	–
	–	■	–	–

–50°C
Conforms to -50°C as a result of the low-temperature embrittlement test specified in JIS C 3005.

Heat resistant up to 200°C
Maximum conductor temperature up to 200°C.

Oil resistance
Indicates having oil resistance.

Chemical resistance
Indicates having chemical resistance.

Reeling Cable

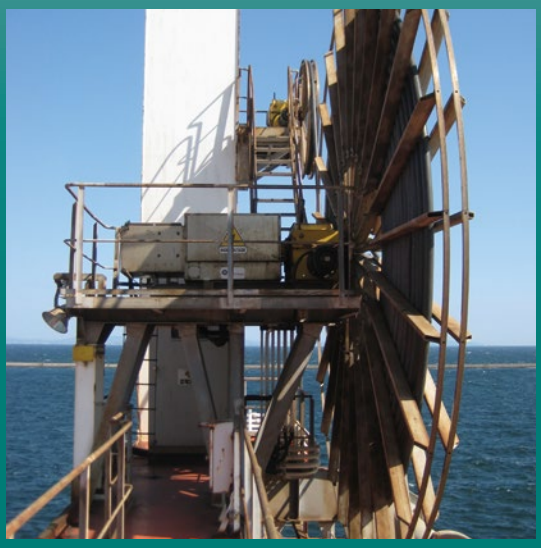


Photo provided by Kawasaki City Port Authority
This photo is for illustrative purposes only.

Reeling Cable

RELCT (MV)

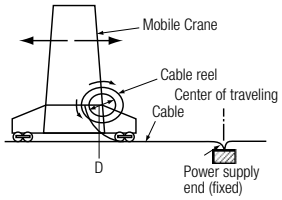
Squeeze resistance | 12D Bending resistance | Flexibility | Tough sheath | Smooth surface | -50°C | Oil resistance

Features

- Superior squeeze resistance
- Superior wear and tear resistance with tough sheath
- Superior wiring workability with smooth surface sheath

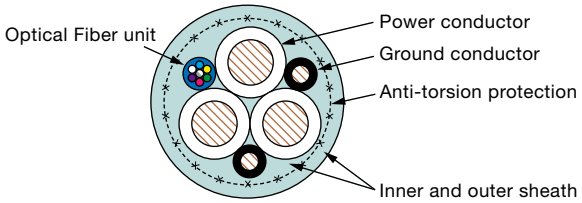
Application

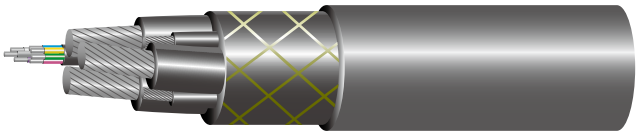
Reel (Traveling)



Rated Voltage	U_0/U : 6/10 kV
AC test voltage	17kV/5min
Max. permissible operation temperature of conductor	90℃
Short circuit temperature of conductor	250℃
Tensile load	Not more than 39 N/mm^2

Cable structure





RELCT (MV)

Specification

RELCT (MV)

Type	No. of cores X size (mm^2)	Power conductor diameter (mm)	Nominal overall diameter (mm)	Maximum overall diameter (mm)	Approx. Weight (kg/km)	Maximum permissible tensile force (N)	Maximum permissible compression force (kN/m)
RELCT (MV)	3X35+3X25/3	8.0	45	46.8	2,945	4,000	4.9
	3X50+3X25/3	10.3	51	52.6	4,020	5,800	4.9
	3X70+3X35/3	12.2	56	58.9	5,030	8,100	4.9
	3X95+3X50/3	14.4	59	62.0	5,520	11,100	4.9
	3X35+2X25/2+6TG624	8.0	45	46.8	3,170	4,000	4.9
	3X50+2X25/2+6TG624	10.3	51	52.6	4,020	5,800	4.9
	3X70+2X35/2+6TG624	12.2	56	58.9	5,010	8,100	4.9
	3X95+2X50/2+6TG624	14.4	59	62.0	5,750	11,100	4.9

* Compresstion force = Pulling tension / Bending radius

Reeling Cable

RELCT (LV)

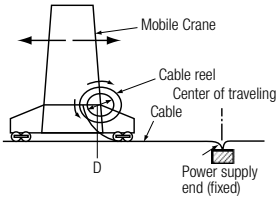
Squeeze resistance | 10D Bending resistance | Flexibility | Tough sheath | Smooth surface | -50℃ –50°C | Oil Oil resistance

Features

- Superior squeeze resistance
- Superior wear and tear resistance with tough sheath
- Superior wiring workability with smooth surface sheath

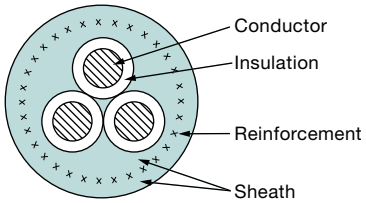
Application

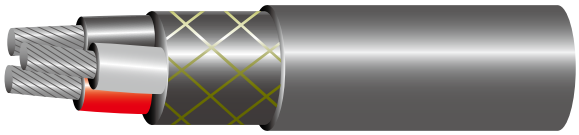
Reel (Traveling)



Rated Voltage	U_0/U : 0.6/1 kV
AC test voltage	2500V/5min
Max. permissible operation temperature of conductor	90℃
Short circuit temperature of conductor	250℃
Tensile load	Not more than 39 N/mm^2

Cable structure





RELCT (LV)

Specification

RELCT (LV)

Type	No. of cores X size (mm^2)	Power conductor diameter (mm)	Nominal overall diameter (mm)	Maximum overall diameter (mm)	Approx. Weight (kg/km)	Maximum permissible tensile force (N)	Maximum permissible compression force (kN/m)
RELCT (LV)	3X25	7.1	29	30.5	1,410	2,900	4.9
	3X35	8.3	32	33.6	1,810	4,000	4.9
	3X50	9.9	37	38.9	2,520	5,800	4.9
	3X70	11.8	42	44.1	3,330	8,100	4.9
	3X95	13.8	47	49.4	4,280	11,100	4.9
	4X25	7.1	32	33.6	1,730	3,900	4.9
	4X35	8.3	36	37.8	2,260	5,400	4.9
	4X50	9.9	41	43.1	3,150	7,800	4.9
	4X70	11.8	46	48.3	4,200	10,900	4.9
	4X95	13.8	53	55.7	5,440	14,800	4.9
	12X2.5	2.1	24	25.2	735	1,100	4.9
	12X4	3.0	28	29.4	1,050	1,800	4.9
	20X2.5	2.1	30	31.5	1,150	1,900	4.9
	20X4	3.0	34	35.7	1,670	3,100	4.9
	24X2.5	2.1	33	34.7	1,380	2,300	4.9
	24X4	3.0	38	39.9	2,010	3,700	4.9
	30X2.5	2.1	35	36.8	1,650	2,900	4.9
	30X4	3.0	40	42.0	2,410	4,600	4.9

* Compresstion force = Pulling tension / Bending radius

Spreadable

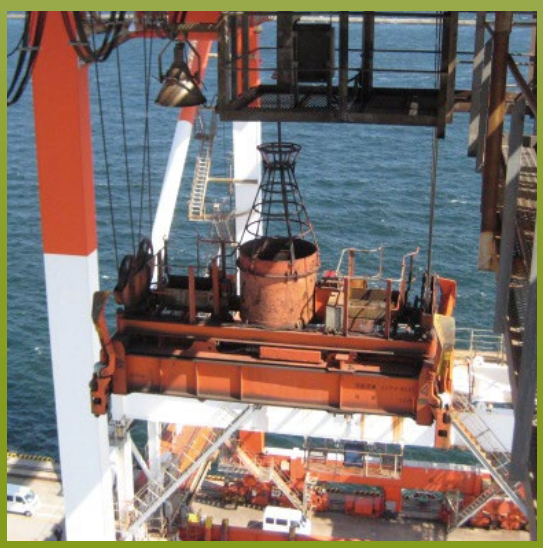


Photo provided by Kawasaki City Port Authority
This photo is for illustrative purposes only.

Spreader Cable

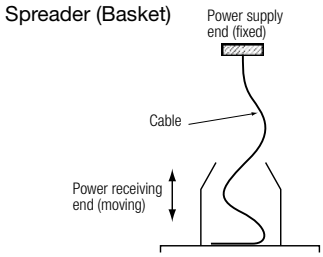
SPDCT

Squeeze resistance | Flexibility | Tough sheath | Oil resistance

Features

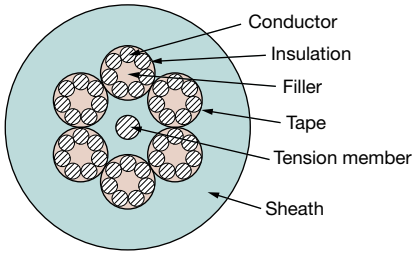
- Superior squeeze resistance
- Stable basket accommodation property

Application



Rated Voltage	600V
AC test voltage	3000V/min
Max. permissible operation temperature of conductor	80℃
Short circuit temperature of conductor	250℃

Cable structure



SPDCT

Specification

SPDCT

Type	No. of cores X size (mm²)	Conductor diameter (mm)	Nominal overall diameter (mm)	Approx. Weight (kg/km)
SPDCT	30X3.5	2.5	42	2,710
	36X3.5	2.5	46	3,090
	42X3.5	2.5	50	3,820
	30X2.5	2.1	38	2,100
	36X2.5	2.1	42	2,540
	42X2.5	2.1	46	3,020

Spreader Cable

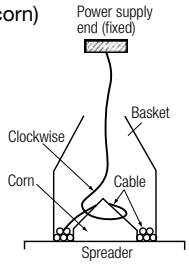
SPDCT (Y)

Features

- Stable basket accommodation property

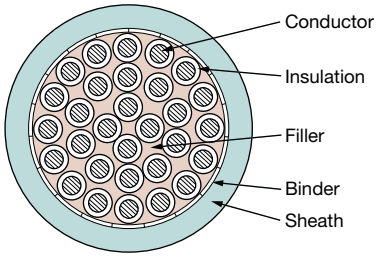
Application

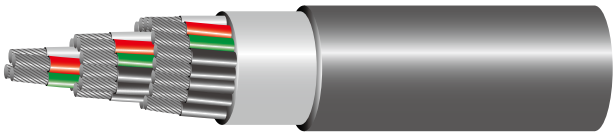
Spreader (Basket with corn)



Rated Voltage	600V
AC test voltage	3000V/min
Max. permissible operation temperature of conductor	80℃
Short circuit temperature of conductor	250℃
Max. hoisting stroke	30m
Max. hoisting speed	100m/min

Cable structure





SPDCT (Y)

Specification

SPDCT (Y)

Type	No. of cores X size (mm²)	Conductor diameter (mm)	Nominal overall diameter (mm)	Approx. Weight (kg/km)
SPDCT (Y)	30X3.5	2.6	37	2,130
	36X3.5	2.6	40	2,520
	42X3.5	2.6	43	2,930
	30X2.5	2.2	34	1,680
	36X2.5	2.2	37	1,990
	42X2.5	2.2	40	2,310

Festoon / Chain Cable

Photo provided by Kawasaki City Port Authority
This photo is for illustrative purposes only.

Festoon / Chain Cable

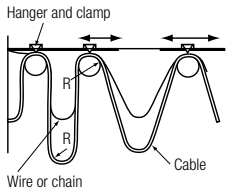
FTNCT

Features

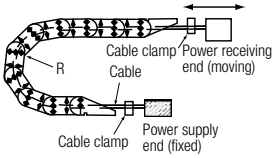
- Superior flexibility and bending resistance
- Superior wear and tear resistance with tough sheath
- Superior wiring workability with smooth surface sheath

Application

Festoon

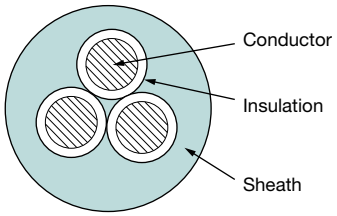


Chain

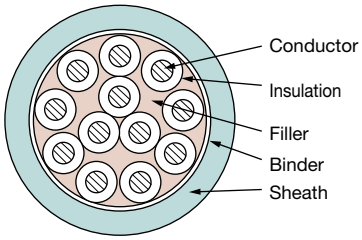


Rated Voltage	U_0/U : 0.6/1kV
AC test voltage	2500V/5min
Max. permissible operation temperature of conductor	90℃
Short circuit temperature of conductor	250℃

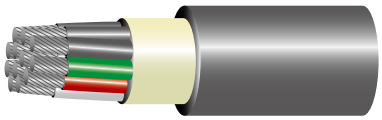
Cable structure



3-core



12-core



FTNCT

Specification

FTNCT

Type	No. of cores X size (mm²)	Conductor diameter (mm)	Nominal overall diameter (mm)	Maximum overall diameter (mm)	Approx. Weight (kg/km)
FTNCT	3X35+3X16/3	8.3*	31	32.6	1,890
	3X50+3X25/3	9.9*	35	36.8	2,480
	3X70+3X35/3	11.8*	42	44.1	3,550
	12X1.5	1.6	19	20.0	465
	12X2.5	2.1	22	23.1	660
	18X1.5	1.6	22	23.1	645
	18X2.5	2.1	26	27.3	915
	24X1.5	1.6	25	26.3	855
	24X2.5	2.1	30	31.5	1,210
	30X1.5	1.6	27	28.4	1,020
	30X2.5	2.1	32	33.6	1,480
	36X1.5	1.6	29	30.5	1,200
	36X2.5	2.1	35	36.8	1,760
	3X4	3.0	14	14.7	300
	3X6	3.2	16	16.8	400
	3X10	4.2	19	20.0	610
	3X16	5.7	23	24.2	900
	3X25	7.1	27	28.4	1,330
	3X35	8.3	31	32.6	1,760
	3X50	9.9	35	36.8	2,310
	4X4	3.0	16	16.8	360
	4X6	3.2	17	17.9	480
	4X10	4.2	21	22.1	760
	4X16	5.7	25	26.3	1,110
	4X25	7.1	30	31.5	1,650
	4X35	8.3	34	35.7	2,210
	4X50	9.9	39	41.0	2,920
	5X4	3.0	17	17.9	435
	5X6	3.2	19	20.0	575
	5X10	4.2	23	24.2	910
	5X16	5.7	28	29.4	1,350
	5X25	7.1	34	35.7	2,010

* Power conductor

Festoon / Chain Cable

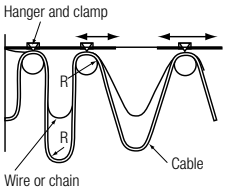
FTNCT-SB / FTNCT-PSB

Features

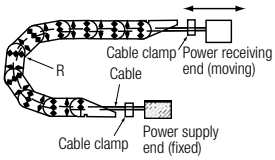
- Superior flexibility and bending resistance
- Superior wear and tear resistance with tough sheath
- Superior wiring workability with smooth surface sheath

Application

Festoon

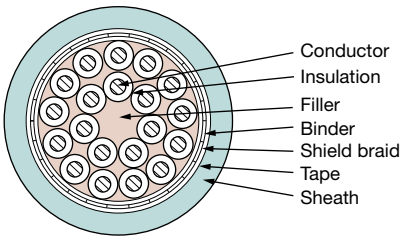


Chain

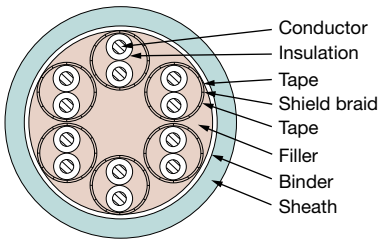


Rated Voltage	U_0/U : 0.6/1kV
AC test voltage	2500V/5min
Max. permissible operation temperature of conductor	90℃
Short circuit temperature of conductor	250℃

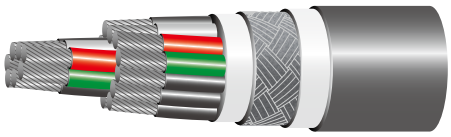
Cable structure



20-core



6-pair



FTNCT-SB

Specification

FTNCT-SB

Type	No. of cores X size (mm²)	Conductor diameter (mm)	Nominal overall diameter (mm)	Maximum overall diameter (mm)	Approx. Weight (kg/km)
FTNCT-SB	3X25	7.1	30	31.5	1,410
	4X4	3.0	18	18.9	425
	4X6	3.2	20	21.0	525
	4X10	4.2	24	25.2	835
	4X35	8.3	37	38.9	2,290
	3X35	8.3	34	35.7	1,820
	3X16+3X2.5	5.7*	26	27.3	1,050
	3X25+3X4	7.1*	30	31.5	1,530
	3X35+3X6	8.3*	34	35.7	1,950
	3X50+3X10	9.9*	38	39.9	2,750
	12X2.5	2.1	24	25.2	790
	20X2.5	2.1	29	30.5	1,160
	24X2.5	2.1	32	33.6	1,370
	30X2.5	2.1	34	35.7	1,640
	36X1.5	1.6	32	33.6	1,360

* Power conductor

FTNCT-PSB

Type	No. of cores X size (mm²)	Conductor diameter (mm)	Minimum overall diameter (mm)	Maximum overall diameter (mm)	Approx. Weight (kg/km)
FTNCT-PSB	6PX1	1.3	27	28.4	715
	6PX1.5	1.6	29	30.5	825
	6PX2.5	2.1	34	35.7	1,130
	9PX1	1.3	35	36.8	1,120
	9PX2.5	2.1	43	45.2	1,780

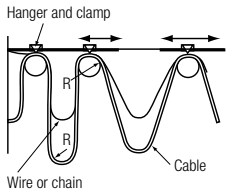
FRCCT

Features

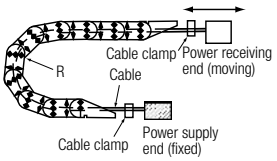
- Superior flexibility and bending resistance
- Deliverable with optical connectors

Application

Festoon

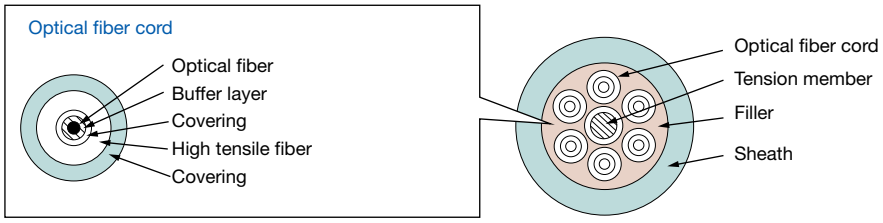


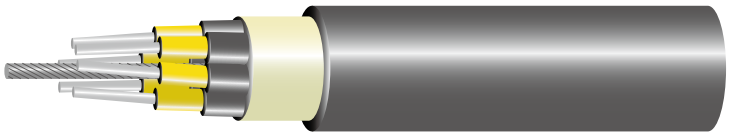
Chain



Optical Fiber	Transmission Loss at 0.85μm (dB/km)	Transmission Bandwidth at 0.85μm (MHz-km)
GI 50 / 125	3.0 or less	200 or over
GI 62.5 / 125	3.5 or less	160 or over

Cable structure





FRCCT

Specification

FRCCT

Type	No. of Cores	Optical Fiber Cord				Approx. Overall diameter (mm)	Approx. Weight (kg/km)	Permissible tension (N)
		Type	Core diameter (μm)	Clad diameter (μm)	Approx. Cord diameter (mm)			
FRCCT-6G5032-V	**6**	GI	50	125	2.8	15	220	490
FRCCT-8G5032-V	**8**					17	260	490
FRCCT-6G6242-V	**6**		62.5	125	2.8	15	220	490
FRCCT-8G6242-V	**8**					17	260	490

* Please contact us for any other information about number of cores or optical fibers.

Carrier Drum Cable

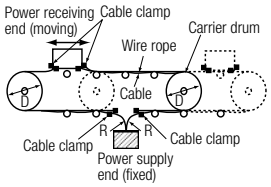
CARCT

Features

- Superior squeeze resistance
- Superior wear and tear resistance with tough sheath
- Superior wiring workability with smooth surface sheath

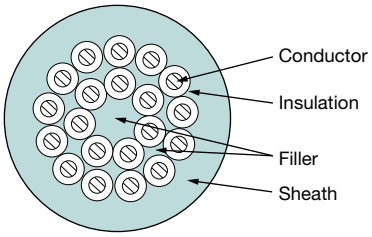
Application

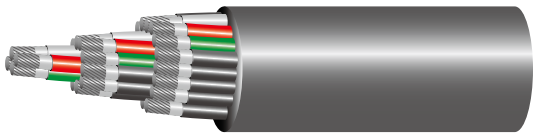
Carrier Drum



Rated Voltage	600V
AC test voltage	3000V/min
Max. permissible operation temperature of conductor	80℃
Short circuit temperature of conductor	250℃

Cable structure





CARCT

Specification

CARCT

Type	No. of cores X size (mm^2)	Conductor diameter (mm)	Nominal overall diameter (mm)	Maximum overall diameter (mm)	Approx. Weight (kg/km)
CARCT	3X8	3.7	17	17.9	475
	3X14	4.9	20	21.0	730
	3X22	7.0	26	27.3	1,180
	3X30	8.1	28	29.4	1,470
	3X38	9.1	31	32.6	1,790
	3X60	11.6	38	39.9	2,790
	4X38	9.1	34	35.7	2,280
	6X3.5	2.5	17	17.9	465
	6X8	3.7	22	23.1	890
	6X14	4.9	27	28.4	1,390
	6X22	7.0	34	35.7	2,220
	10X3.5	2.5	23	24.2	790
	12X3.5	2.5	24	25.2	815
	16X3.5	2.5	26	27.3	1,080
	20X3.5	2.5	29	30.5	1,330
	24X3.5	2.5	32	33.6	1,630
	30X3.5	2.5	36	37.8	2,080

Heat Resistant Flexible Cable

Heat Resistant Flexible Cable

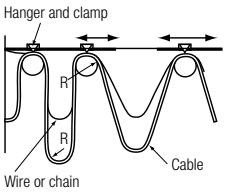
FFCT / FFCTB

Features

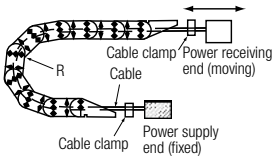
- Maximum conductor temperature up to 200°C
- Superior bending resistance
- Superior oil and chemical resistance

Application

Festoon

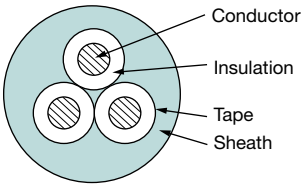


Chain

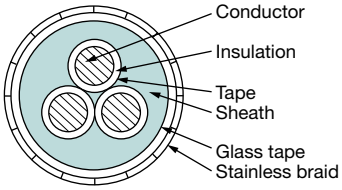


Rated Voltage	600V
AC test voltage	3000V/min
Max. permissible operation temperature of conductor	200℃

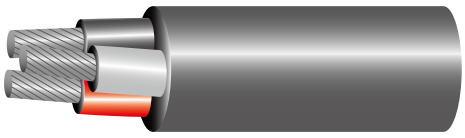
Cable structure



FFCT



FFCTB



FFCT

Specification

FFCT

Type	No. of cores X size (mm²)	Conductor diameter (mm)	Nominal overall diameter (mm)	Maximum overall diameter (mm)	Approx. Weight (kg/km)	Ampacities* (A)
FFCT	1X100	15.2	22	23.1	1,230	570
	1X200	21.2	29	30.5	2,270	880
	1X325	27.0	36	37.8	3,660	1,180
	2X2	1.8	10	10.5	140	38
	2X3.5	2.5	12	12.6	205	55
	3X2	1.8	10	10.5	165	32
	3X3.5	2.5	12	12.6	245	47
	4X2	1.8	11	11.6	200	29
	4X3.5	2.5	13	13.7	300	43
	6X2	1.8	13	13.7	290	25
	10X2	1.8	17	17.9	480	20
	20X2	1.8	22	23.1	825	16
	30X2	1.8	25	26.3	1,190	13

FFCTB

Type	No. of cores X size (mm²)	Conductor Diameter (mm)	Nominal overall diameter (mm)	Maximum overall diameter (mm)	Approx. Weight (kg/km)	Ampacities* (A)
FFCTB	1X100	15.2	27	28.3	1,560	510
	1X200	21.2	34	35.7	2,710	760
	1X325	27.0	40	42.0	4,180	1,000
	2X2	1.8	15	15.7	310	37
	2X3.5	2.5	16	16.8	395	53
	3X2	1.8	15	15.7	340	31
	3X3.5	2.5	17	17.8	445	47
	4X2	1.8	16	16.8	390	28
	4X3.5	2.5	18	18.9	515	44
	6X2	1.8	18	18.9	505	25
	10X2	1.8	22	23.1	760	20
	20X2	1.8	27	28.3	1,190	15
	30X2	1.8	31	32.5	1,610	13

* Indicated values are based on the ambient temperature of 30 degrees C, max. rated conductor temperature of 200 degrees C, and single cable installed in air.

Technical Data

Ampacities

Standard ampacities of the cable can be calculated using the tables below.
Please make a modification with the related correction factor when using the cable under different conditions, such as ambient temperature, multiple installation, reeling, or number of cable cores, etc.

IEC size (Standard structure of 0.6/1kV round flexible cable)

Nominal Cross-Section (mm^2)	Ampacities (A)		
	3-cores	4-cores	5-cores
1.5	21	19	18
2.5	29	26	24
4	38	35	33
6	49	44	41
10	69	62	58
16	92	83	77
25	120	109	101
35	148	133	-
50	183	165	-
70	227	202	-
95	265	239	-

* Cable structure is based on our standard of 0.6/1kV FTNCT.
  In case of different specification from this catalog, it is required to calculate ampacities for a special item.
* Indicated values are based on the ambient temperature of 30 degrees C, max. rated conductor temperature of 90 degree C, and single cable installed in air.
* For the reeling system, please calculate by multiplying the correction factor of the reeling system.

JIS size (Standard structure of 600V round flexible cable)

Nominal Cross-Section (mm^2)	Ampacities (A)				
	Single-core	2-cores	3-cores	4-cores	5-cores
0.75	19	15.5	13.5	12.5	11.5
1.25	25	21	18	16.5	15.5
2	32	27	23	21	19
3.5	47	39	33	30	28
5.5	62	51	44	40	37
8	77	63	54	49	46
14	109	89	76	69	64
22	149	121	103	93	86
30	180	145	123	111	103
38	209	166	142	128	118
50	245	194	165	149	140
60	281	221	188	171	161
80	340	268	231	211	198
100	393	311	269	244	229
125	449	-	306	-	-
150	493	-	338	-	-
200	592	-	411	-	-
250	675	-	469	-	-

* Cable structure is based on SP97-31-9001Rev.1 (JISC3327).
* Indicated values are based on the ambient temperature of 30 degrees C, max. rated conductor temperature of 80 degrees C, and single cable installed in air.
* Values for 6 or more cores can be obtained by multiplying the above indicated ampacity for the single-core cable by the correction factor of the actual multi-core cable.
* For the reeling system, please calculate by multiplying the correction factor of the reeling system.

Correction Factors for Ampacities

① Correction Factors for Multi-core Cables

No. of Cores	4	5	6	7	8	9	10	11	12
Correction factors	0.65	0.59	0.55	0.51	0.49	0.46	0.44	0.43	0.42

No. of Cores	13	14	15	16	17	18	19	20	21
Correction factors	0.41	0.40	0.39	0.38	0.37	0.36	0.36	0.35	0.34

No. of Cores	22	23	24	25	26	27	28	29	30
Correction factors	0.33	0.33	0.32	0.32	0.31	0.30	0.30	0.29	0.29

② Correction Factors(k) at Different Ambient Temperatures

Ambient Temperature (°C)		20	25	30	35	40	45	50	55	60	65	70
Correction factors	IEC size	1.08	1.04	1.00	0.96	0.91	0.87	0.82	0.76	0.71	0.65	0.58
	JIS size	1.10	1.05	1.00	0.95	0.89	0.84	0.77	0.71	0.63	0.55	0.45

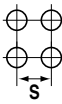
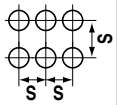
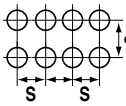
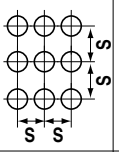
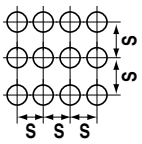
$$k = \sqrt{\frac{\text{Rated temperature - Actual ambient temperature}}{\text{Rated temperature - Given ambient temperature for given ampacity}}}$$

③ Correction Factors for Reel System

Cable Type	Round Type							
No. of Turns	Mono-spiral Reeling	1	2	3	4	5	8	10
Correction Factor	0.85	0.85	0.65	0.45	0.35	0.31	0.28	0.26

④ Correction Factors for Multiple Installation in Air

(1) 1~12 Cables

No. of Cables	1	2	3	6	4	6	8	9	12
Arrangement									
S=d	1.00	0.85	0.80	0.70	0.70	0.60	-	-	-
S=2d		0.95	0.95	0.90	0.90	0.90	0.85	0.80	0.80
S=3d		1.00	1.00	0.95	0.95	0.95	0.90	0.85	0.85

S: Distance between centers of the adjacent cables. d: Cable Diameter

* Excerpt from the JCS 0168-1 'Ampacities of Power Cables for Rated Voltages up to 33KV' of Japanese Cable Maker's Association Standard.

(2) For other installation

Distance between centers of the adjacent cables	Level (n)	1	2					3										
	Row (m)	7~20	4	5	6	7	8~20	3	4	5	6	7	8	9~10	11~12	13~15	16~19	20
S=d		0.70	0.60	0.56	0.53	0.51	0.50	0.48	0.41	0.37	0.34	0.32	0.31	0.30	0.30	0.30	0.30	0.30
S=2d		0.80	-	0.73	0.72	0.71	0.70	-	-	0.68	0.66	0.65	0.65	0.64	0.63	0.62	0.61	0.60

S: Distance between centers of the adjacent cables. d: Cable Diameter

* Excerpt from the JCS 0168-1 'Ampacities of Power Cables for Rated Voltages up to 33KV' of Japanese Cable Maker's Association Standard.

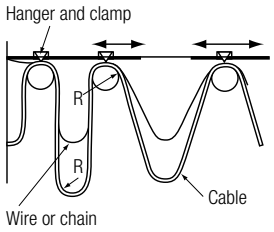
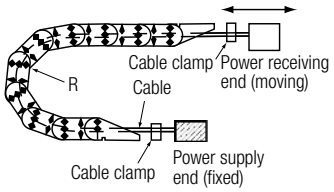
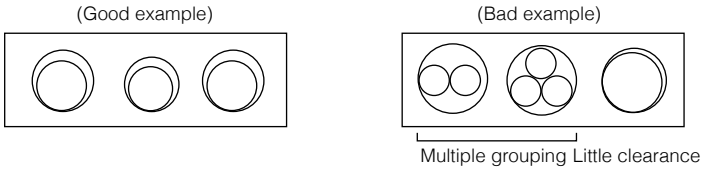
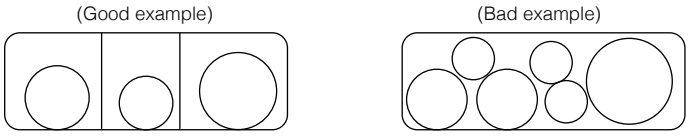
Ampacities at Short-Circuit

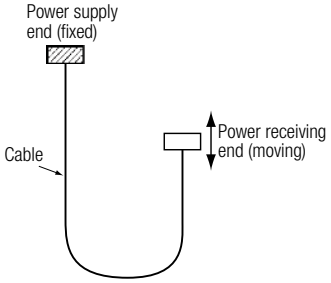
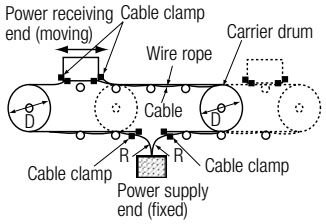
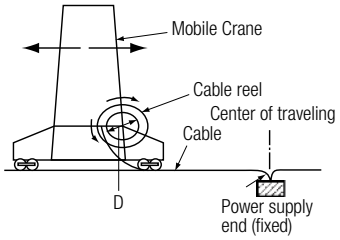
Approximate ampacity at short-circuit can be obtained by the following formula.

$$\text{Ampacities at Short-Circuit} = \frac{K \times S}{\sqrt{T}}$$

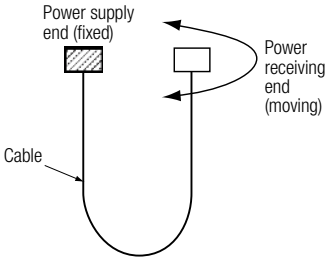
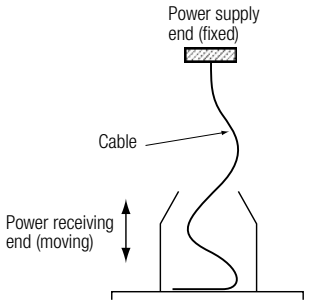
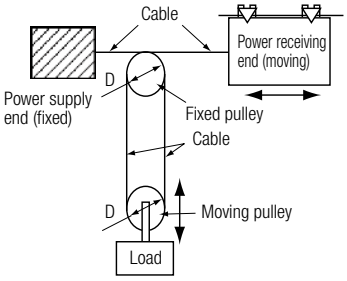
- K: Constant No. (copper conductor + EP rubber insulation: 139) (copper conductor + PVC insulation: 95)
- S: Cross-section of conductor (mm^2)
- T: Duration of short-circuit current (sec.)

Precautions of Use

System Application	Precautions
1. Festoon System 	(1) Permissible bending radius (R) of the cable shall be as follows. However, if specified in the individual specification, prioritize the indicated value. **Type** / **Low-voltage Cable** / **Remarks** **Round Cable** / R≧6d / d : Cable diameter Please attach a bar to each hanger in order to secure the min. bending radius of the cable when gathering the system. (2) Cable hangers (the first hanger to be connected to the structure) shall be connected with a wire rope or chain as a tension member and do not apply tension to the cables. (The length of the wire rope or chain shall be less than 0.9 time of the cable length.) (3) Cable hanger must be fixed so that it cannot be rotated. (4) Do not unfold the system while cables remain twisted. (5) For multiple installation, please clamp all conductors securely so that the cable becomes flat-shaped. (6) Fixed cable ends shall be installed by winding them around a drum or hanger with permissible bending radii or more so that any concentrative stress by bending or tension, etc. is not applied to the fixed ends when the cable is moved. (7) Hangers shall be in a rotatable state when cables are suspended spirally. In this case, cables shall be twisted when being pulled out. Therefore, the torsional direction of the cable must be in the direction where the twisting of cable cores becomes tight, and the torsional angle must be 70 degrees/m max. (recommended value: 35 degrees/m max).
2. Chain System 	(1) Permissible bending radius (R) of the cable shall be as follows. However, if specified in the individual specification, prioritize the indicated value. **Type** / **Low-voltage Cable** / **Remarks** **Round Cable** / R≧6d / d : Cable diameter (2) It is recommended to use the caterpillar system, which can support the cables so that their centers are located at the center of the tracks. In this case, the hole diameter for supports must be large enough to enable cables to move loosely within considerable clearance to prevent the cables from being subjected to unreasonable bending or force when the tracks are bent. **Targeted clearance amount: 10% or more of max. diameter of the cable (Min. of 2 mm)** (3) Only one cable must be routed into each support hole and no multiple cables shall be routed into one hole.  (4) When using a box-type guide, make sure that the cables shall not be overlapped inside the box. Please use dividers if necessary to prevent interference between cables.  (5) Make sure to fix the supply and receiving ends of the cable securely to prevent the internal cores from moving. It is recommended to fix them using a split clamp with a width of 100 mm or more (contact length to the cables). Targeted deformation ratio of the cable is approx. 15% for the low-voltage type cables and approx. 5% for the high-voltage type cables. Insufficient clamping may cause corkscrewing or kink to the cables, which may result in short-circuit. (6) The length of the straight-line portion from the fixed end to the radius curve end of the cable must be secured to the longest possible extent (targeted length: 20 times or more than the cable diameter).

System Application	Precautions
3. Lift System 	(1) Please remove the torsion of the cable before installation. (2) Make sure that the distance between adjacent suspensions shall be 12 times or more than the cable diameter (for low-voltage cables). (3) For hanging multiple cables, there shall not be any interference between adjacent cables. (4) When hanging multiple cables at the same position, it is recommended to change the height of each cable loop so that they are installed on different levels. (5) The length of straight-line portion from the fixed end to radius curve end of the cable must be secured to the longest possible extent (targeted length: 20 times or more than the cable diameter). (6) Using the cable attached with counter weight causes lateral pressure and corkscrewing, which may result in short-circuit. Please consult us for cable selection. (7) Please consult us when using the cable under severe conditions, such as stroke length, frequency, or speed, etc. (8) For a normal elevator, please use the specified lift control cables.
4. Carrier Drum System 	(1) Permissible bending radius (R) of the cable shall be as follows. However, if specified in the individual specification, please prioritize the indicated value. **Type** / **Low-voltage Cable** / **Remarks** **Round Cable** / R≧6d / d : Cable diameter (2) When installed, the cable shall not be twisted. (3) Carrier drums shall be transferred with wire ropes. There shall be no tension applied to the cable with enough slack. (4) Make sure to fix the supply and receiving ends of the cable securely to prevent the internal cores from moving. It is recommended to fix them using a split clamp with a width of 100 mm or more (contact length to the cables). Targeted deformation ratio of the cables is approx. 15% for the low-voltage type cables and approx. 5% for the high-voltage type cables. Insufficient clamping causes corkscrewing or kink to the cables, which may result in short-circuit.
5. Reel System (Traveling) 	(1) Permissible bending radius (R) of the cable shall be as follows. However, if specified in the individual specification, please prioritize the indicated value. **Type** / **Low-voltage Cable** / **Medium-Voltage Cable** / **Remarks** **Round Cable** / R≧10d / R≧12d / d : Cable diameter (2) Constant and instant tension applied to the cable must be less than the permissible level. (3) Lateral pressure applied to the cable shall be as follows. However, if specified in the individual specification, please prioritize the indicated value. **Type** / **Lateral pressure (tension/bending radius)** With reinforcement in the sheath / 4.9kN/m(500kgf/m) or less (4) Do not wind up the cables when they are in a twisted state. (5) When winding a round cable in a cylindrical reel, it is recommended to apply a traverser mechanism for array winding operation. Random winding into the reel results in the twisting of cables. (6) For applying a cable guide roller for the reel, the min. permissible bending radius must be secured. (7) Be sure that the cable is extended only in a straight line from the storage reel. Winding and unwinding the cable in a not straight line may cause twisting to the cable. (8) During operation, make sure that reel system (reel, guide roll, side roll, and pit, etc.) shall remain in a relative position without deviation. Especially when using a flat cable, no lateral pressure shall be applied to the cable in the direction of its shorter sides. (9) For terminal clamping at the fixed ends of the cable, they shall be clamped after winding more than one turn of the cable around the anchor drum, or clamped by two points inserting a wire saddle between the clamps and snaking the cable. In this case, make sure that the initial grip force is 2 times or more than the max. tension applied to the cable. Insufficient clamping may cause corkscrewing or kink to the cable.

Precautions of Use

System Application	Precautions
6. Torsion System 	(1) Permissible bending radii shall be 6 times or more than the cable diameter (for low-voltage cables). (2) Cable length must be secured to the longest possible extent and installed so that the torsional angle per unit length becomes as small as possible. (Make sure that the torsional angle is 70 degrees/m max. Recommended value: ±35 degrees/m max.) (3) For hanging multiple cables, there should not be any interference between adjacent cables. Do not bundle and fix the cables with the banding tie etc. (4) To prevent any concentrative torsional stress to the fixed ends of the cable, make sure to secure a longer length for the straight-line portions of the cable or to create sufficient bending radii at the fixed ends when installing the cable. (5) As the cable length varies when twisted, sufficient slack shall be obtained. (6) Please consult us when using the cable under a severe torsional condition, or for single-core or shielded type cables.
7. Spreader (Basket) System 	(1) Torsion may occur when pulling up the cable in a coiled state. After being pulled up, the cable shall be installed in the direction where the twisting of the cable becomes tight (that is, S-lay laid cables shall be collected in a clockwise direction). (2) Coiling diameter must be secured to the largest possible extent (20 times or more than the cable diameter). (3) Apply grease on the cable surface before installation. (4) Please contact us for the cable selection since it depends on the basket configuration, lifting height, or lifting speed, etc.
8. Moving Pulley System 	(1) Reel diameter (D) shall be 20d or more (d: cable diameter). (2) Make sure that reels can be rotated smoothly. (3) Weight and load of the moving reel shall be minimized so that the cable is not slacked, in order to reduce the tension applied to the cable. (4) For terminal clamping at the fixed ends of the cable, they shall be clamped by two points inserting a wire saddle between the clamps and snaking the cable. In this case, make sure that the initial grip force shall be two times more than the max. tension applied to the cable. (5) As the cable is applied with tension, bending, and lateral pressure at the same time, be aware that it is not suitable for applications with high frequency.

9. Other Common Safety Instructions

(1) For safety, be sure to follow the 'Safety Precautions' indicated on the back of the front cover.
(2) Be aware that the insulation resistance of sheath (cable armor) being used on flexible cables has been reduced in order to prioritize its mechanical strength.
(3) Insulation resistance between shields is not normally considered in case that cores or twisted pairs are electrostatically shielded. If any insulation resistance is needed between shields, please let us know in advance.
(4) Electrostatic shields shall be single-ended. Grounding both ends may result in picking up dark-current noise. It is also recommended that you actually check the respective end (terminal) and have the more effective side grounded.
(5) Cables may become harder at low temperature. Please contact us for any solution in case of using them constantly at low temperature, such as in refrigerated warehouse, etc.
(6) Chloroprene rubber used as a sheath material may absorb water and swell when being used underwater for a long period. Make sure that terminals shall be completely free from water intrusion and also measures shall be taken to prevent an electric leakage, when it is required to use the cable underwater.
(7) Cable cores may have been lubricated for smoother movement inside the cable. In order to prevent any surface leakage, please clean the insulation surface with alcohol before performing the terminal sealing.
(8) When winding the cable into the figure, 8, be sure to form as big loops as possible. Please also make sure not to create small loops when unwinding the cable since there is a risk that it may be twisted and kinked.
(9) During the cold season, drum coil winding habit may remain due to cable hardening. In such case, please warm the cable indoor in prior to use.
(10) Do not apply creosote treatment (preservative) to wooden cleats since the chloroprene rubber and vinyl can be negatively affected.
(11) As the colored EP rubber may be discolored by sunlight or ultraviolet ray, do not expose the insulation coated on cores of Flexible Cable to sunlight.
(12) Please handle the optical fiber cord and optical connector carefully (no twisting, stretching, nor excessive bending is permitted).
(13) Some cables may contain powder lubricant inside. When handling, make sure to wear protective gloves and mask, etc. as necessary to prevent particles from scattering. After operation, please wash away any adhered particles thoroughly.
(14) When performing a terminal sealing on the high-voltage (3300 V or over) flexible cables, some conductive material may remain on the EP rubber insulator after removing the tape from the outer semiconductive tape. In such case, please clean any residue completely using sandpaper.
(15) Durability for oil and chemical resistant properties depend on application, environment and types of oil and chemicals.

⚠ Safety Precautions

Make sure to read all the 'Safety Precautions' thoroughly before using the products indicated in this guide book.
If you have any other questions about the products, please contact us prior to use.
As the safety precautions indicated here provide very important points regarding safety, be sure to follow them.
Symbols used in the texts are as follows.

⚠ WARNINGS : Ignoring warnings and handling the products incorrectly may lead to serious injury or death.

⚠ CAUTIONS : Ignoring cautions and handling the products incorrectly may lead to injury or property damage.

⚠ WARNINGS

1. Risk of electric shock or fire.
- Do not perform connecting and wiring operation with the power switched ON.
- Do not disassemble or alter the products.
- Make sure to ground the shielding layer.
  Note: Single grounding results in induced voltage at the ungrounded end.
  Grounding both ends may cause a temperature increase to the shielding layer.

2. Risk of burn injury, burnout, or fire.
- Do not apply voltage or current exceeding the rated level.
- Do not use the cable exceeding the rated temperature in consideration of the operating environment.

⚠ CAUTIONS

1. Prohibited matters at wire/cable processing.
- When installing a terminal joint of the high-voltage cable, make sure to remove the outer semiconductive layer thoroughly without any residue, otherwise it may cause an insulation failure.
- Do not install the wire or cable with torsion remained, otherwise it may damage the products.
- Do not use the wire or cable for any purpose other than that which is provided for each product, otherwise it may damage the products.
- Be sure that no water, etc. enters the conductor when terminating the wire or cable, otherwise it may damage the products.

2. Handling Precautions
- Make sure that tension or bending radius does not exceed the permissible level, otherwise it may break or damage the conductor and result in shortening the product life.
- When the wire or cable is subjected to tension or vibration, be sure to clamp terminals securely to prevent the cores from being wrongly positioned. Otherwise, it may damage the products.
- Load the drums in a vertical state (on its flange side). Loading them sideways tangles the wire or cable and makes it difficult in unloading them.
- When unloading drums, make sure to use a forklift or crane. Also be aware that coils should be treated carefully.
  If dropped from the delivery vehicle, the drums or products may be damaged.
- When lifting a drum with a crane, be sure to use a long wire so that the wiring angle is 60 degrees or less.
  If being lifted with a short wire and the wiring angle becomes 60 degrees or more, the lateral pressure exerts on the drum flange and crushes the flange, resulting in product damage.

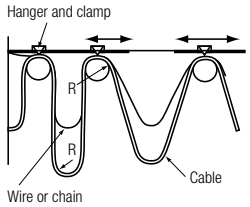
Confirmation Sheet for Specifications

In order to supply products which meet your need, please confirm the specifications below and inform us.

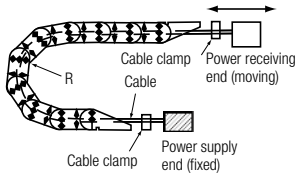
No.	Item		Details
1	Cable designation		
2	Configuration		·Round type ·Flat type
3	Voltage		·0.6/1kV ·6/10V ·600V ·3300V ·6600V ·(V)
4	No. of Cores x Size (please also indicate multi/pair types)		
5	Shield	(1) With / Without	·With ·Without
		(2) Material	·Copper braid ·Semiconductive rubber ·( )
		(3) Type	·Individually shielded ·Overall shielded ·Pair shielded ·( )
6	Equipments that use cables		
7	System Application		
8	Detailed Information		
9	(1)Bending radius mm (2)Tension N(kg) (3)Traveling stroke m (4)Traveling speed m/minute (5)Frequency of repeated use times/day		
10	Whether new installation or replacement (* For replacement, please also let us know of the specifications and name of manufacturer of the existing cables.)		·New installation ·Replacement

System Application

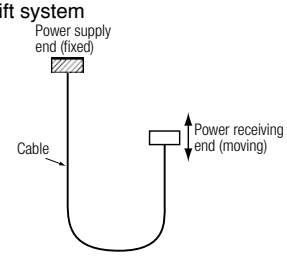
(1) Festoon System



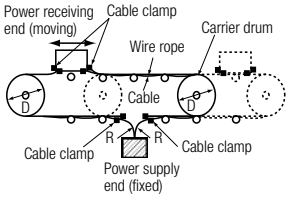
(2) Chian System



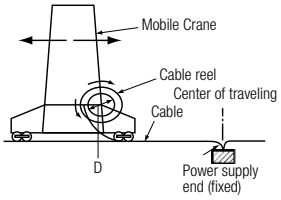
(3) Lift system



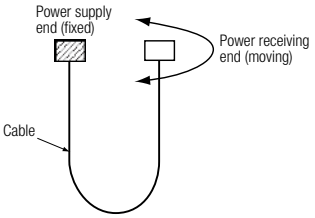
(4) Carrier Drum System



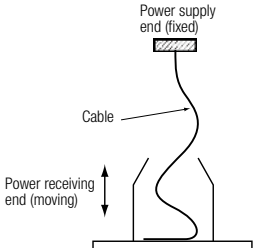
(5) Reel(Traveling) system



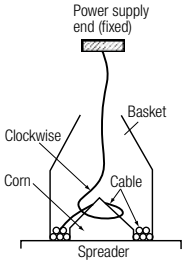
(6) Torsion System



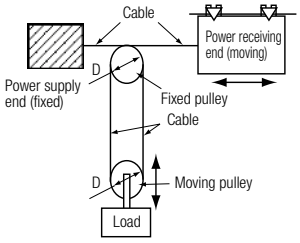
(7) Spreader (Basket) System



(8) Spreader(Basket with corn) System



(9) Moving Pulley System



(*Others)

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