

ITC CABLE

Wire & Cables for Railway and Applications



 **ITC** ITC CO., LTD.

Hard-drawn Copper Trolley Wire

There are three types of copper trolley wire that contact the pantograph and supply power to trolleys and electric locomotives.

They are round, grooved and deformed types depending on the cross-sectional shape. It is especially important for trolley wires to keep the best conductivity, tensile strength and abrasion resistance for railways.



Trolley Wire

1. Application

Scope applied

This standard is applied to Hard-drawn Copper Round Trolley Wire of overhead trolley line.

2. Classification

It is classified as per trolley wire table

Class	Standard
Round-type	CU 110mm ²
Round-type	CU 170mm ²
Grooved-type	CU 110mm ²
Grooved-type	CU 170mm ²
Deformed-type	CU 150mm ²

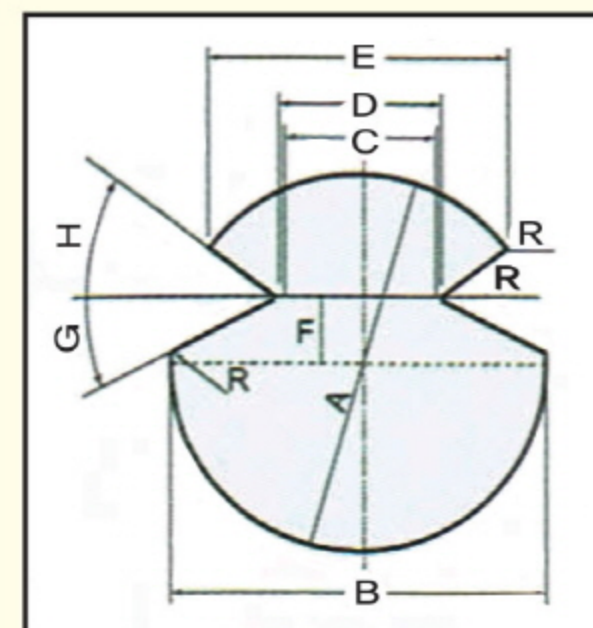
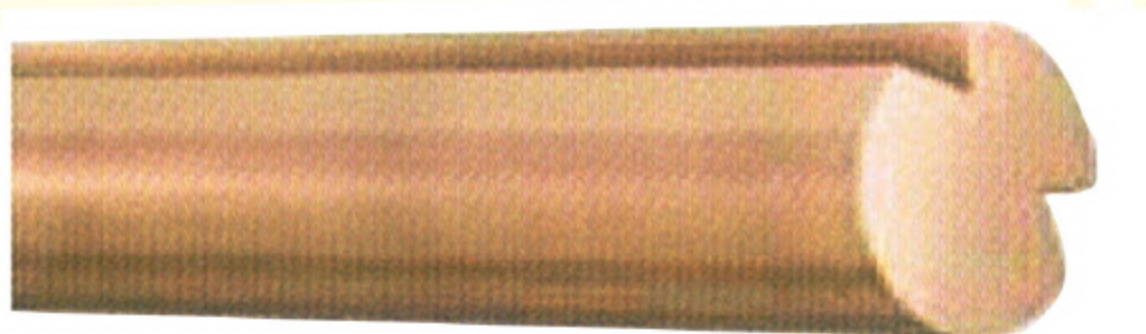
※ The above specifications are based on Korea Railways Standards.

Round-Type(Cu)

To be used for overhead power supply line of electric railways except the underground area.

Construction

- ♠ Material : Hard drawn Copper
- ♠ Standard : Korean Railway Standards



Normal Sectional Area	Calculated Sectional Area	A	B	C	D	E	F	G	H	R	Approx Weight	Min Breaking Force	Min Elongation
mm ²	mm ²	mm	mm	mm	mm	mm	mm	°	°	mm	kg/km	kg	%
170	170	15.49	15.49	7.32	7.74	11.43	2.4	27	51	0.38	1511.3	5900	3.4
110	111.1	12.34	12.34	6.85	7.27	9.75	1.7	27	51	0.38	987.7	3900	3.0

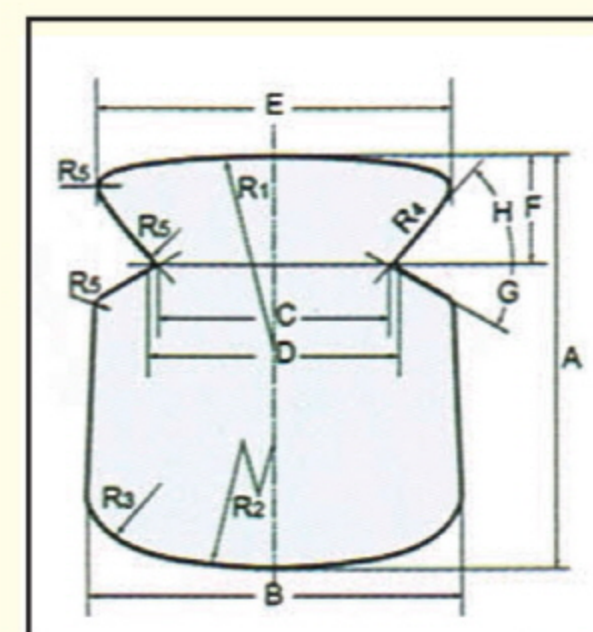
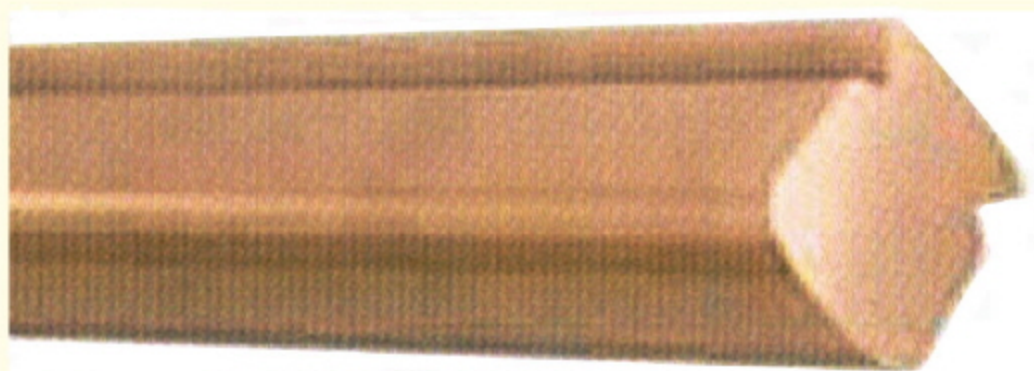
Tolerance A : $\pm 1\%$ B, D, E: $\pm 2\%$

Grooved-Type(Cu)

To be used for overhead power supply line of electric railways except the underground area.

Construction

- ♠ Material : Hard drawn Copper
- ♠ Standard : Korean Railway Standards



Normal Sectional Area	A	B	C	D	E	F	R ₁	R ₂	R ₃	R ₄	R ₅	G	H	Approx Weight	Min Breaking Force	Min Elongation
mm ²	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	°	°	kg/km	kg	%
110	11.7	10.9	6.85	7.27	9.6	3.0	30	20	2.5	0.75	0.38	27	51	987.7	3900	3.0
170	14.8	13	6.85	7.27	9.6	3.0	30	35	2.5	0.7	0.38	27	51	1511	5900	3.4

Tolerance A : $\pm 2\%$

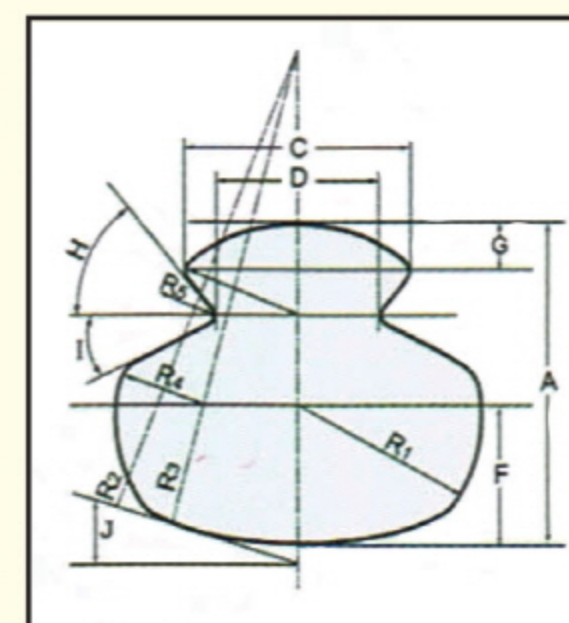
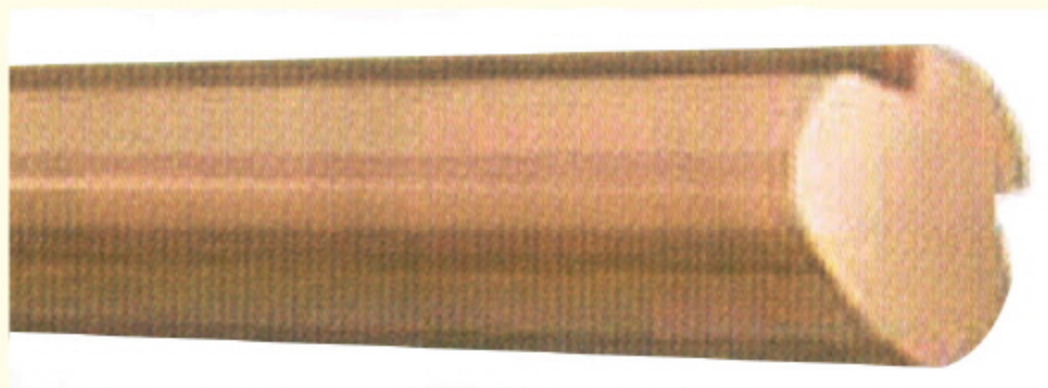
Deformed-Type(Cu)

To be used for overhead power supply line of electric high speed railways except the underground area.

Construction

♠ Material : Hard drawn Copper

♠ Standard : Korean Railway Standards



Normal Sectional Area mm ²	Calculated Sectional Area mm ²	A mm	C mm	E mm	G mm	H °	J °	R ₁ mm	R ₃ mm	R ₅ mm	Approx Weight kg/km	Min Breaking Force kg	Min Elongation %
		B mm	D mm	F mm		I °		R ₂ mm	R ₄ mm	R ₆ mm			
150	150.0	13.60 ± 2	9.852	5.18	3.9	51	15	7.55 ±0.1	1	0.38	1333.5	5300	3~8
		15.1 ±0.2	6.92 ±0.15	5.36		27		20 ±0.15	0.45	0.38			

Standard tension of trolley wire and messenger wire

The standard tension of trolley and messenger wire follow under each clause, the change of installing wire system or development may be applied separately.

1) General automatic adjustment of trolley and messenger wire

Trolley wire		Messenger wire		Remark
Wire (mm ²)	Tension (N)	Wire (mm ²)	Tension (N)	
Cu 110	9,800	CdCu 70	9,800	
		CWSR 65, CuMg65		
		St 90		
	11,760	Bz 65 CWSR 65, CuMg65	11,760	
	13,720	Bz 65, CuMg65	13,730	Cako250
Cu 170	14,700	CdCu 80	14,700	
Cu 150	13,720	Bz 65 CWSR 65, CuMg65	13,720	

2) Separate automatic adjustment of trolley and messenger wire

Trolley wire		Messenger wire		Remark
Wire (mm ²)	Tension (N)	Wire (mm ²)	Tension (N)	
Cu 150	19,600	Bz 65, CuMg 65	13,720	300km/h
Cu-Sn 150	25,400	Bz 116, CuMg 116	19,600	300km/h
Cu-Mg 150	33,320	CuMg 116	22,540	300km/h

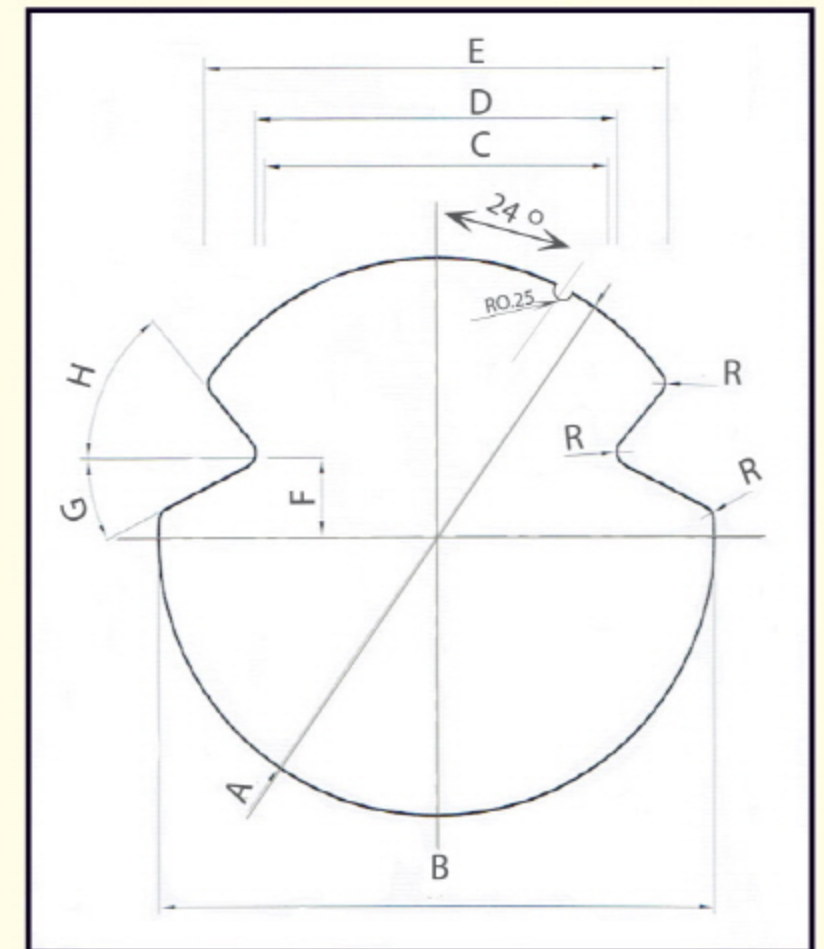
(Attached map 1) 350km/h level Tin-Copper Alloys Trolley wire 150mm²



Note. RO.25 means the curve line is not mentioned the groove of material classification.

Standard	A	B	C	D	E	F	G	H	R	Nominal Sectional Area (mm)	Approx Weight kg/km
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(.)	(.)	(mm)		
Round- type Cu-Su 150mm ²	14.5 ±0.2	14.5 ±0.25	(6.5)	6.94 ±0.15	9.55 ±0.2	(3.25)	27 -2	51 -2	(0.4)	150	1.338 ±3%

Construction



The value (C.F.R) without acceptable difference is standard and a refence for mold design.

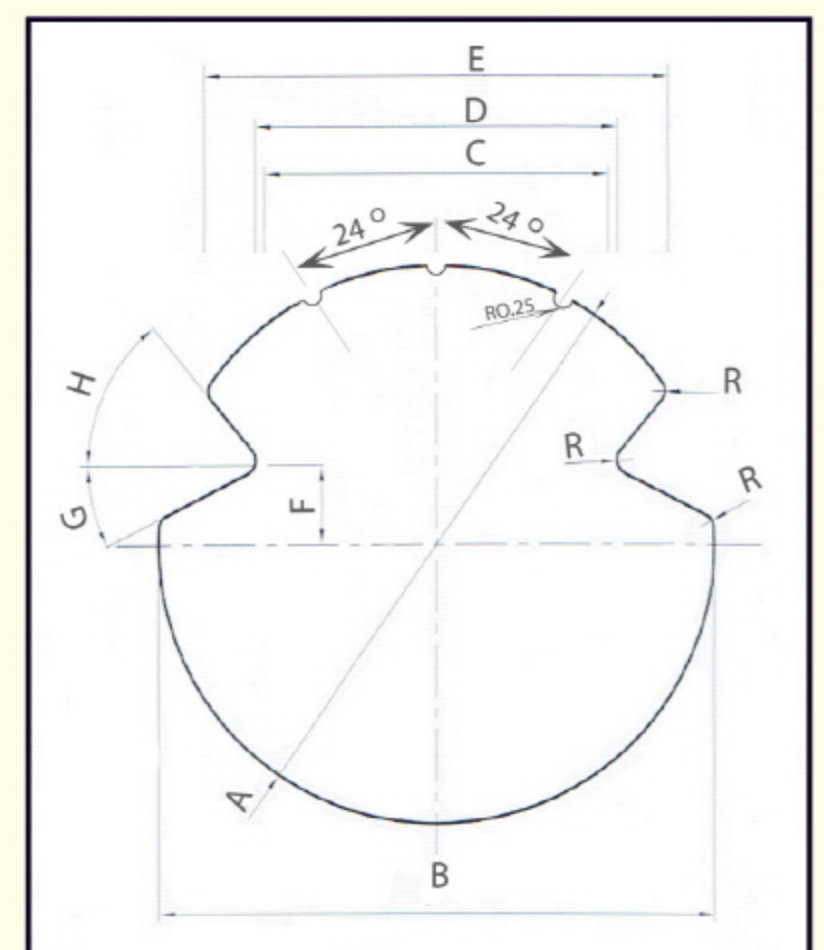
(Attached map 2) 400km/h level Mg-Copper Alloys Trolley wire 150mm²



Note. RO.25 means the curve line is not mentioned the groove of material classification.

Standard	A	B	C	D	E	F	G	H	R	Nominal Sectional Area (mm)	Approx Weight kg/km
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(.)	(.)	(mm)		
Round- type Cu-Su 150mm ²	14.5 ±0.2	14.5 ±0.25	(6.5)	6.94 ±0.15	9.55 ±0.2	(3.25)	27 -2	51 -2	(0.4)	150	1.335 ±3%

Construction



The value (C.F.R) without acceptable difference is standard and a refence for mold design.

ITC can supply three types of Bronze stranded wires for Messenger Wire and Dropper Wire.

Broze Stranded Wire (Bz)

◆. Application & Classification

1.Scope applied

This standard is applied to copper alloys, bronze stranded wire (Bz) for messenger wire and dropper wire of overhead trolley line.

2.Classification

This Bronze stranded wire (Bz) applied to the stranded is classified as per application under table 1.

(Table 1)

Class	Application	Remark
Bronze Stranded Wire (Bz 65mm ²)	Messenger wire	Calculated cross-sectional area 65.49mm ²
Bronze Stranded Wire with sheath (Bz 65mm ²)	Messenger wire	Calculated cross-sectional area 65.49mm ²
Bronze Stranded Wire (Bz 12mm ²)	Dropper wire	Calculated cross-sectional area 12mm ²

※ Name:The name of stranded wire is the name of goods and class.

ex)Bz 65mm²

※ The above specifications are based on Korea Railways Standards.

3. Necessary Condition

1. Construction

a) The chemical composition of Bz should be as table 2

(Table 2)

Class	IACS conductivity (%)	CuMg		
		Mg(%)	Zn(%)	others(%)
(Bz 65mm ²)	60	0.4~0.5	—	Max 0.03
(Bz 12mm ²)	72	0.3~0.4	—	Max 0.03

※ Footnote) IACS : International Annealed Copper Standard.

b) The feature of Bz is as table 3

(Table 3)

No	Item	Condition	Unit	Class		
				Bz 65mm ² / Bz 65mm ² with sheath, Cd alloy	Bz 65mm ² / Bz 65mm ² with sheath, Mg alloy	Bz 12mm ²
1	Name		mm ²	65		12
2	No of wire		strand /mm ²	37 x 1.5		(7 x 0.65) x 1 (7 x 0.54) x 6
3	Wire diameter	Nominal value	mm ²	1.5(± 1%)		0.65(± 1%) 0.54(± 1%)
4	Diameter	Nominal value	mm ²	10.5(±1%) / 26.3		5.0 (+0.2, -0.1)
5	Resistance per Km(20℃ basis)	Max value	mm ²	0.462		0.103
6	Unit weight	Reference value		0.605 / 1.00	0.602 / 1.00	0.103
7	Breaking Load of wire	Average value	N	1.206	1.230	—
8		Min value	N	1.118	1.140	—
9	Breaking Load of wires	Min value	N	42,198	45,500	7,650
10	Breaking Load (wire clamps)	Min value	N	43,228	41,900	0.103

※ The above specifications are based on Korea Railways Standards.

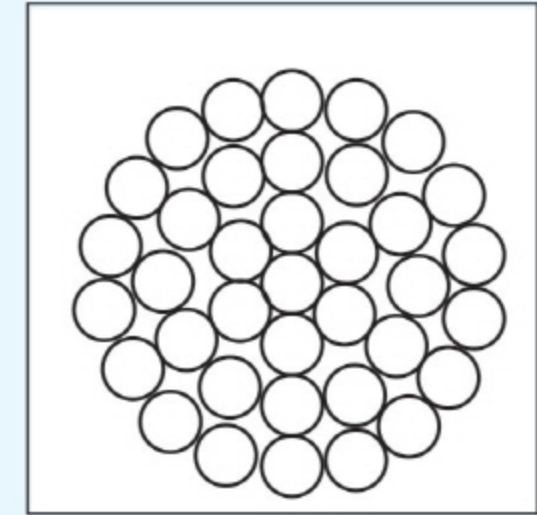
Messenger Wire(Bz 65_{mm²})

To be used for support to overhead power supply line of electric railways.

Construction

- ♠ Material : Copper Magnesium Alloy
- ♠ Standard : Korean Railway Standards

Purchasing Specification of Korea Rail Network Authority



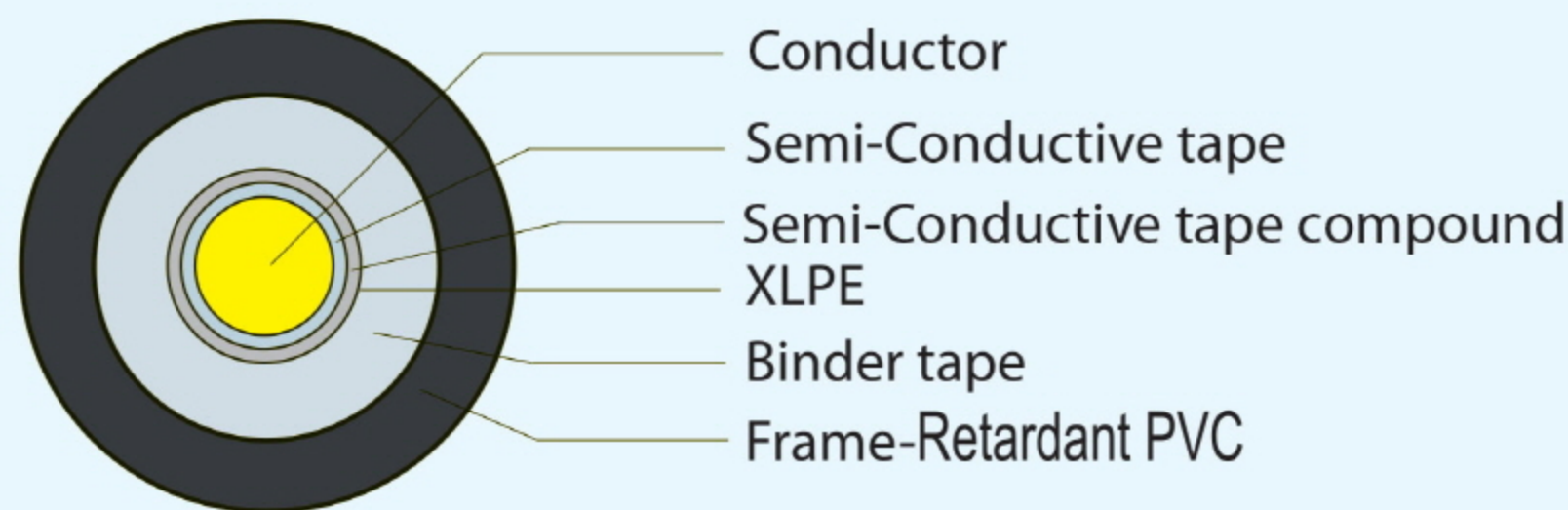
Normal Sectional Area	Number & Diameter of Wire	Approx Overall Diameter	Max Conductor Resistance at 20 °C	Approx Weight	Min. Breaking Force	Min. Conductivity	Magnesium Content
mm ²	No/mm	mm	Ω /km	kg/km	kN	%	wt %
65	37/15	10.5	0.462	602	45.5	60	0.4~0.5
116	37/2.0	14.0	0.216	1050	72.1	72	0.2~0.3

Sheathed Messenger Wire(Bz 65_{mm²})

To be used for support to overhead power supply line for railway station section and/or tunnel section of electric railways.

Construction

- ♠ Conductor : Copper Magnesium Alloy
- ♠ Insulation : XLPE
- ♠ Sheath : Flame-Retardant PVC
- ♠ Standard : Purchasing Specification of Korean Rail Network Authority



Conductor			Semi. Conductive Thickness	Insulation Thickness	Sheath Thickness	Overall Diameter	Approx Weight	Max. Conductor Resistance at 20 °C	Min. Breaking Force	Min. Conductivity
Norminal Sectional Area	Number & Diameter of Wire	Approx Overall Diameter								Magnesium
										Content W 1%
mm ²	No./mm	mm	Avg. mm	Avg. mm	Avg. mm	Max. mm	kg/km	Ω /km	kN	
			Min. mm	Min. mm	Min. mm	Min. mm				
65	37/1.5	10.5	0.5	4.80	1.70	26.3	108.5	0.462	45.5	60
			0.35	4.22	1.43	24.0				0.4~0.5

Dropper Wire(Bz 12_{mm²})

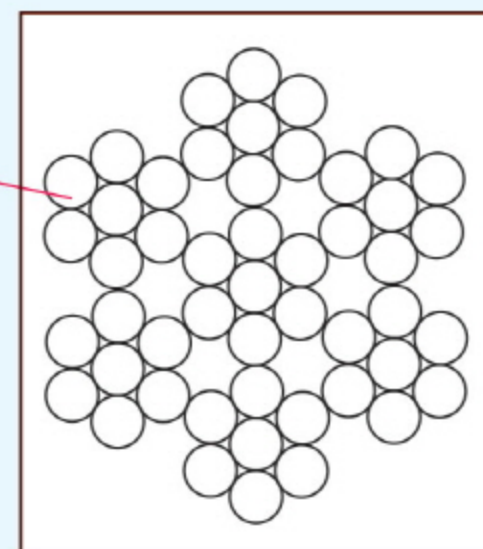
To be used for support between trolley wire and messenger wire of electric railways.

Construction

- ♠ Material : Copper Magnesium Alloy
- ♠ Standard : Korean Railway Standards



CuMg



Norminal Sectional Area	Number & Diameter of Wire	Overall Diameter	Max Conductor Resistance at 20 °C	Approx Weight	Min. Breaking Force	Min. Conductivity	Magnesium Content
mm ²	No/mm	mm	Ω /km	kg/km	kN	%	wt%
12	(7/0.65)x1 (7/0.54)x6	5.0	2.1	103	7.65	72	0.3~0.4

FR-BUFF-CABLE

1.Scope.

This cable is designed for using in power distribution line under 1.8/3.0kV, is PVC insulated flame retardant PVC sheathed power cable.

2.Description.

This cable shall be in accordance with the following table 1.

(Table 1)

Description	Cable symbol
1.8/3.0kV PVC insulated flame retardant (FR-PVC) PVCsheathed Power Cable	1.8/3.0kV FR-BUFF-CABLE

3.Construction.

1.Conductor.

The conductors shall assemble of annealed copper wire in accordance with KSC IEC 60228 D, 8(GRADE 5), and shall assemble with right-hand lay, comply as the following table 2

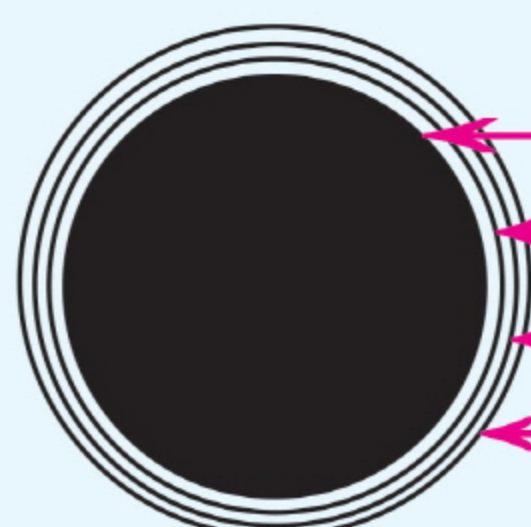
(Table 2)

Conductor Type	Cross Section of Conductor	No./ of assembly and Copper Wire Size
Circular assemble copper wire	300 SQMM 240 SQMM	37/51/0.45 37/41/0.45

2.Separate.

Conductor shall be separate (Semi-Conductive Swallowable Tape)

Construction



Conductor(Copper Alloys Stranded Wire)

P/S Tape

First Insulated Layer

Second Sheathed Layer



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