

# TOXFREE ZH ROZ1-K (AS) 0,6/1 kV EMC

## 1. Object

This document defines the design and manufacturing characteristics of the cable type ROZ1-K (AS) 0,6/1 kV EMC manufactured by Top Cable.

## 2. Design

This type of cable is basically designed, manufactured and tested according to IEC 60502-1.

## 3. Application

Flexible cable for fixed installations with three phase conductors and protective conductor. Suitable for transporting and distributing of electric power in installations where it's required low smoke and halogen free emissions under fire conditions.

In the last years has increased the use of variation engines of speed by means of variation of frequency, so much in the new industries like in the already installed ones, where gradually they are replacing to the systems with traditional engines.

This new technology presents big advantages, but brings some disadvantages; one of these disadvantages is the emission of electromagnetic waves of high frequency. A part of the solution is obtained by choosing cable with an appropriate electromagnetic shield. Also, the solution is obtained with a symmetrical distribution of the protective conductor in the interstices of the cable (for small sections, up to 10 mm<sup>2</sup>, the symmetrical distribution is not necessary).

This cable type, that incorporate a special screen and have a symmetrical distribution of the protective conductor, are adequate for facilities where is necessary avoid the interferences of electromagnetic waves of high frequency of nearby circuits, as variation engines of speed.

## 4. Characteristics

**Nominal voltage:** 0,6/1 (1,2) kV.

**Minimum service temperature:** -30 °C (fixed installation).

**Maximum conductor temperature:** 90 °C.

**Maximum short-circuit temperature:** 250 °C. (maximum 5 s.)

**Minimum bending radius (static):** 10 x cable Ø.

**No flame propagation:** according to EN 60332-1 / IEC 60332-1.

**No fire propagation:** according to EN 60332-3 / IEC 60332-3

**Halogen free:** according to EN 50267 / IEC 60754

HCl content < 0,5 %

pH > 4,3

conductivity < 10 µS/mm.

**Smoke density:** according to EN 61034 / IEC 61034

Light transmittance > 60 %

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## 5. General make-up of the cable

### 5.1 Conductor

Electrolytic annealed copper conductor, class 5 in accordance with IEC 60228.

### 5.2 Protective conductor

Electrolytic annealed copper conductor, class 5 in accordance with IEC 60228.

Until the section of 10 mm<sup>2</sup> the grounding conductor is of the same section as the phase conductors.

From 16 mm<sup>2</sup>, the ground conductor is divided into three conductors; the equivalent section of the three protective conductors together is over 50% of the section of the phase conductor.

### 5.3 Insulation

Cross-linked polyethylene insulation, type XLPE according to IEC 60502-1.

The standard identification is the following:

- 4 G.....grey + brown + black + Yellow/Green (until 10 mm<sup>2</sup>)
- 3x + 3x..... grey + brown + black + Yellow/Green (3x) (from 16 mm<sup>2</sup>)

### 5.4 Assembly of cores

Until the section 10 mm<sup>2</sup>, the three phase conductors and protection conductor are cabled helically.

From 16 mm<sup>2</sup>, the three phase conductors are cabled helically with the three protective conductors distributed in the interstices.

### 5.5 Separator / Screen

Aluminium-polyester tape, helically over the set of insulated conductor. The polyester is in contact with the insulated conductors and serves as the separator, while the aluminium is in contact with the braid of tinned copper wire that is placed directly above the aluminium-polyester tape, doing all a screen function.

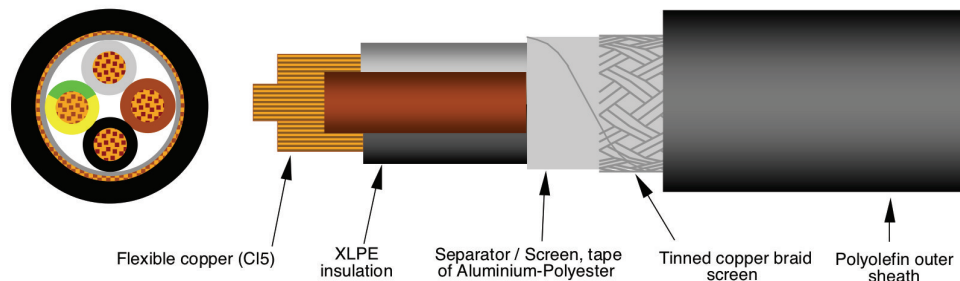
Screen has a lining of 100% and its total section is at least 10% of the section of the phase conductor in each cases.

### 5.6 Outer sheath

Polyolefin outer sheath with low smoke and halogen free, black colour, type ST<sub>8</sub> according to IEC 60502-1.

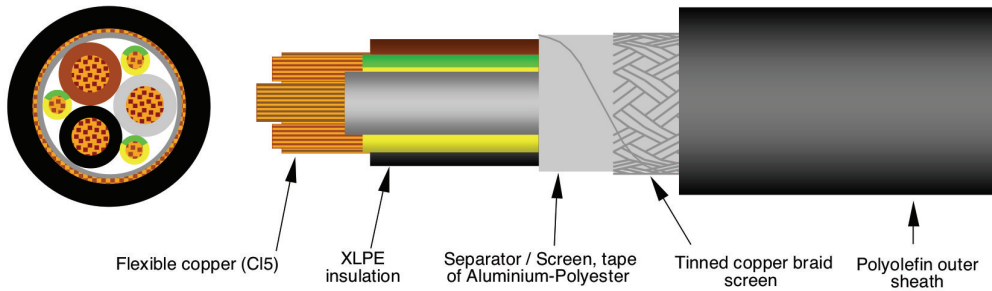
### 5.7 Diagram representation

- Cables 4G (until 10 mm<sup>2</sup>):



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- Cables 3x + 3x (from 16 mm<sup>2</sup>):



## 6. Current-carrying capacities

### 6.1 Nominal current-carrying capacities

Table 1 shows the current-carrying capacities and voltage drop detailed for every cable.

Current-carrying capacities, in amperes, are calculated according to IEC 60364-5-523 and for the following conditions:

- Open air installation: one cable with adequate ventilation and ambient temperature of 30 °C, supported by cleats and hangers or on perforated tray (reference method E).
- Buried installation: one cable in a duct buried at depth of 0,7 m, with soil thermal resistivity of 2,5 °K·m/W, and 20 °C of ground temperature (reference method D).
- It is supposed a three-phase circuit.

For conditions other than this apply the adequate correction factors (point 6.3).

The electrical resistance of conductor is indicated according to IEC 60228 for copper conductor class 5.

Voltage drop is the maximum that may occur. It is calculated for the maximum service temperature and for  $\cos \varphi = 1$ , supposed a three-phase circuit.

n° x Section (mm <sup>2</sup> )	Open Air Inst. (A)	Buried Inst. (A)	Conductor Resistant (Ω/Km)	Voltage drop (V/A·km)
4G1,5	23	22	13,3	29,4
4G2,5	32	29	7,98	17,6
4G4	42	37	4,95	10,9
4G6	54	46	3,30	7,29
4G10	75	61	1,91	4,22
3 x 16 + 3 x 2,5	100	79	1,21	2,67
3 x 25 + 3 x 4	127	101	0,780	1,72
3 x 35 + 3 x 6	158	122	0,554	1,22

n° x Section (mm <sup>2</sup> )	Open Air Inst. (A)	Buried Inst. (A)	Conductor Resistant (Ω/Km)	Voltage drop (V/A·km)
3 x 50 + 3 x 10	192	144	0,386	0,852
3 x 70 + 3 x 10	246	178	0,272	0,601
3 x 95 + 3 x 16	298	211	0,206	0,455
3 x 120 + 3 x 16	346	240	0,161	0,356
3 x 150 + 3 x 25	399	271	0,129	0,285
3 x 185 + 3 x 35	456	304	0,106	0,234
3 x 240 + 3 x 50	538	351	0,0801	0,177
3 x 300 + 3 x 50	621	396	0,0641	0,142

Tabla 1

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## 6.2 Short-circuit current-carrying capacities

The maximum short-circuit current that a cable can withstand depend on the time of reaction of the protection elements installed in the line. The maximum current-carrying capacity in a short-circuit accident, for a specific type of cable, is the result of multiplying the cross section of the cable for the values shown in table 2. These values are taken from IEC 949 with initial temperature 90°C and end temperature 250°C.

Time (s)	0,1	0,2	0,3	0,5	1	1,5	2	2,5	3
A/mm <sup>2</sup>	449	318	259	201	142	116	100	90	82

Table 2

## 6.3 Correction factors

The current-carrying capacities must be multiplied with the adequate correction factor when the installation conditions differs from point 6.1

Correction factors for air temperature other than 30°C.

Air T. (°C)	20	25	30	35	40	45	50	55	60
Factor	1,08	1,04	1	0,96	0,91	0,87	0,82	0,76	0,71

Table 3

Correction factors for ground temperature other than 20°C.

Ground T. (°C)	10	15	20	25	30	35	40	45	50
Factor	1,07	1,04	1	0,96	0,93	0,89	0,85	0,80	0,76

Table 4

Correction factors for soil thermal resistivity, other than 2,5 °K·m/W.

Moisture degree of soil	Damp	Slightly Damp	Slightly dry	Dry	Very dry
Thermal Resist, (° K · m / W)	1	1,5	2,0	2,5	3,0
Factor	1,18	1,1	1,05	1	0,96

Table 5

## 7. Dimensions

Table 6 shows diameter and weight detailed for every cable.

n° x Section (mm <sup>2</sup> )	Diameter under the braid (mm)	Exterior diameter (mm)	Weight (Kg/Km)	n° x Section (mm <sup>2</sup> )	Diameter under the braid (mm)	Exterior diameter (mm)	Weight (Kg/Km)
4G1,5	7,0	10,4	149	3 x 50 + 3 x 10	23,3	28,1	1.997
4G2,5	7,9	11,2	192	3 x 70 + 3 x 10	25,7	30,5	2.571
4G4	9,2	12,6	259	3 x 95 + 3 x 16	31,3	36,5	3.445
4G6	10,6	14,0	341	3 x 120 + 3 x 16	34,8	40,5	4.220
4G10	12,9	17,0	544	3 x 150 + 3 x 25	39,3	45,2	5.344
3 x 16 + 3 x 2,5	13,5	17,7	686	3 x 185 + 3 x 35	44,5	51,0	6.686
3 x 25 + 3 x 4	17,7	22,3	1.078	3 x 240 + 3 x 50	50,0	56,9	8.759
3 x 35 + 3 x 6	20,5	25,3	1.448	3 x 300 + 3 x 50	55,9	63,2	10.602

Table 6