

# TOXFREE Marine XZ1-K (AS) 0,6/1 kV

## 1. Object.

This document defines the design and manufacturing characteristics of the TOXFREE Marine XZ1-K (AS) 0,6/1 kV type manufactured by Top Cable.

## 2. Design.

This type of cable is designed, manufactured and tested according to IEC 60092-353.

Approvals: DNV and Bureau Veritas

Approvals in process: Lloyd's Register

## 3. Applications.

For fixed installations on ships and offshore units in all locations. All cable materials are free of halogens, with low fumes emission and fire retardant. These cables are especially suitable for the installation in ships in power, lighting and control circuits.

## 4. Characteristics.

**Nominal voltage:** 0,6/1 kV.

**Lowest installation temperature:** -15 °C.

**Lowest ambient temperature for fixed installation:** -40°C.

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

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

**Minimum bending radius:** Overall diameter of cable (D) ≤ 25 mm: 4D.

Overall diameter of cable (D) ≥ 25 mm: 6D.

**No flame propagation:** according to IEC 60332-1-2

**No fire propagation:** according to IEC 60332-3-22 (Category A).

**Halogen free:** Acid gas emission < 0,5 % according to IEC 60754-1.

pH > 4,3 according to IEC 60754-2.

conductivity < 10 μS/mm according to IEC 60754-2.

**Smoke emission:** according to IEC 61034-2.

light transmittance > 60 %

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## 5. General make-up of the cable.

### 5.1 Conductor.

Electrolytic annealed copper conductor, class 5 according to IEC 60228.

### 5.2 Insulation.

Cross-linked polyethylene insulation, type HF XLPE-90 °C according to IEC 60092-351.

The standard identification is the following:

- 1 cond.....natural
- 2 cond.....blue + brown
- 3 cond.....brown + black + grey
- 4 cond.....brown + black + grey + blue
- $\geq 5$  cond .....white numbered

Others colours under request.

### 5.3 Assembly of cores.

The cores are twisted together.

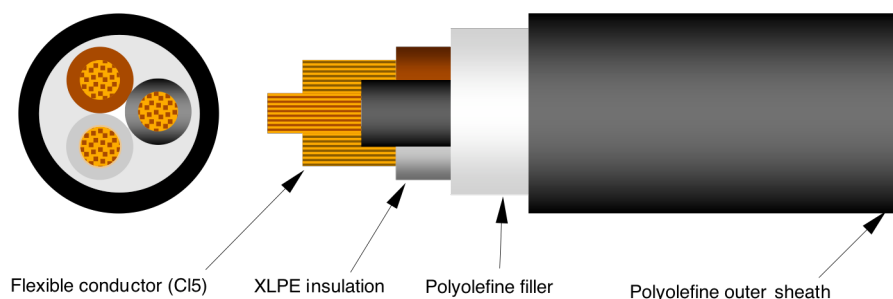
### 5.4 Filler

If needed, the filler is thermoplastic polyolefin of natural colour with low smoke and halogen free under fire conditions.

### 5.5 Outer sheath.

Thermoplastic polyolefin, black colour, with low smoke and halogen free under fire conditions, type SHF1 according to IEC 60092-359.

### 5.6 Diagram representation.



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### 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 ampere, are calculated according to IEC 60092-352 and for the following conditions:

- Open air installation: one cable with adequate ventilation and ambient temperature of 45°C, supported by cleats and hangers or on perforated tray. Reference method F (three conductors trefoil) for single-core and E for multi core cables.
- For cables having 2 conductors and 3 conductors up to 10 mm<sup>2</sup>, it is supposed a single-phase circuit. For cables having more of 5 conductors is supposed that all are loaded. For the rest of the cables it is supposed a three-phase circuit.

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

Voltage drop is the maximum that may occur. It is calculated for the maximum service temperature and for  $\cos \varphi = 1$ .

| n° x Section (mm <sup>2</sup> ) | Open Air Inst. (A) | Max. Conductor Resistance at 20°C (Ω/Km) | Voltage drop (V/A·km) | n° x Section (mm <sup>2</sup> ) | Open Air Inst. (A) | Max. Conductor Resistance at 20°C (Ω/Km) | Voltage drop (V/A·km) |
|---------------------------------|--------------------|------------------------------------------|-----------------------|---------------------------------|--------------------|------------------------------------------|-----------------------|
| 1 x 2,5                         | 25                 | 7,98                                     | 17,7                  | 1 x 240                         | 528                | 0,0801                                   | 0,178                 |
| 1 x 4                           | 35                 | 4,95                                     | 11,0                  | 1 x 300                         | 612                | 0,0641                                   | 0,142                 |
| 1 x 6                           | 46                 | 3,3                                      | 7,32                  | 2 x 1,5                         | 23                 | 13,3                                     | 34,0                  |
| 1 x 10                          | 64                 | 1,91                                     | 4,23                  | 2 x 2,5                         | 31                 | 7,98                                     | 20,4                  |
| 1 x 16                          | 88                 | 1,21                                     | 2,68                  | 2 x 4                           | 43                 | 4,95                                     | 12,7                  |
| 1 x 25                          | 117                | 0,78                                     | 1,73                  | 2 x 6                           | 55                 | 3,3                                      | 8,45                  |
| 1 x 35                          | 147                | 0,554                                    | 1,23                  | 2 x 10                          | 75                 | 1,91                                     | 4,89                  |
| 1 x 50                          | 180                | 0,386                                    | 0,860                 | 2 x 16                          | 100                | 1,21                                     | 3,10                  |
| 1 x 70                          | 233                | 0,272                                    | 0,603                 | 3 x 1,5                         | 23                 | 13,3                                     | 34,0                  |
| 1 x 95                          | 285                | 0,206                                    | 0,457                 | 3 x 2,5                         | 31                 | 7,98                                     | 20,4                  |
| 1 x 120                         | 333                | 0,161                                    | 0,357                 | 3 x 4                           | 43                 | 4,95                                     | 12,7                  |
| 1 x 150                         | 386                | 0,129                                    | 0,286                 | 3 x 6                           | 55                 | 3,3                                      | 8,45                  |
| 1 x 185                         | 444                | 0,106                                    | 0,235                 | 3 x 10                          | 75                 | 1,91                                     | 4,89                  |

Table 1 (continue)



## TOXFREE Marine XZ1-K (AS) 0,6/1 kV

| n° x Section (mm <sup>2</sup> ) | Open Air Inst. (A) | Max. Conductor Resistance at 20°C (Ω/Km) | Voltaje drop (V/A·km) | n° x Section (mm <sup>2</sup> ) | Open Air Inst. (A) | Max. Conductor Resistance at 20°C (Ω/Km) | Voltage drop (V/A·km) |
|---------------------------------|--------------------|------------------------------------------|-----------------------|---------------------------------|--------------------|------------------------------------------|-----------------------|
| 3 x 16                          | 87                 | 1,21                                     | 2,68                  | 4 x 185                         | 397                | 0,106                                    | 0,235                 |
| 3 x 25                          | 110                | 0,78                                     | 1,73                  | 4 x 240                         | 468                | 0,0801                                   | 0,178                 |
| 3 x 35                          | 137                | 0,554                                    | 1,23                  | 5 x 1,5                         | 20                 | 13,3                                     | 29,5                  |
| 3 x 50                          | 167                | 0,386                                    | 0,860                 | 5 x 2,5                         | 28                 | 7,98                                     | 17,7                  |
| 3 x 70                          | 214                | 0,272                                    | 0,603                 | 5 x 4                           | 37                 | 4,95                                     | 11,0                  |
| 3 x 95                          | 259                | 0,206                                    | 0,457                 | 5 x 6                           | 47                 | 3,3                                      | 7,32                  |
| 3 x 120                         | 301                | 0,161                                    | 0,357                 | 5 x 10                          | 65                 | 1,91                                     | 4,23                  |
| 3 x 150                         | 347                | 0,129                                    | 0,286                 | 5 x 16                          | 87                 | 1,21                                     | 2,68                  |
| 3 x 185                         | 397                | 0,106                                    | 0,235                 | 5 x 25                          | 110                | 0,78                                     | 1,73                  |
| 3 x 240                         | 468                | 0,0801                                   | 0,178                 | 5 x 35                          | 137                | 0,554                                    | 1,23                  |
| 4 x 1,5                         | 20                 | 13,3                                     | 29,5                  | 5 x 50                          | 167                | 0,386                                    | 0,860                 |
| 4 x 2,5                         | 28                 | 7,98                                     | 17,7                  | 7 x 1,5                         | 11                 | 13,3                                     | 29,5                  |
| 4 x 4                           | 37                 | 4,95                                     | 11,0                  | 7 x 2,5                         | 15                 | 7,98                                     | 17,7                  |
| 4 x 6                           | 47                 | 3,3                                      | 7,32                  | 10 x 1,5                        | 10                 | 13,3                                     | 29,5                  |
| 4 x 10                          | 65                 | 1,91                                     | 4,23                  | 12 x 1,5                        | 9                  | 13,3                                     | 29,5                  |
| 4 x 16                          | 87                 | 1,21                                     | 2,68                  | 12 x 2,5                        | 12,5               | 7,98                                     | 17,7                  |
| 4 x 25                          | 110                | 0,78                                     | 1,73                  | 14 x 1,5                        | 8,5                | 13,3                                     | 29,5                  |
| 4 x 35                          | 137                | 0,554                                    | 1,23                  | 16 x 1,5                        | 8                  | 13,3                                     | 29,5                  |
| 4 x 50                          | 167                | 0,386                                    | 0,860                 | 19 x 1,5                        | 7,5                | 13,3                                     | 29,5                  |
| 4 x 70                          | 214                | 0,272                                    | 0,603                 | 19 x 2,5                        | 11                 | 7,98                                     | 17,7                  |
| 4 x 95                          | 259                | 0,206                                    | 0,457                 | 24 x 1,5                        | 7                  | 13,3                                     | 29,5                  |
| 4 x 120                         | 301                | 0,161                                    | 0,357                 | 27 x 1,5                        | 6,5                | 13,3                                     | 29,5                  |
| 4 x 150                         | 347                | 0,129                                    | 0,286                 | 27 x 2,5                        | 9                  | 7,98                                     | 17,7                  |

Table 1 (end)

### 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.

| Time (s)          | 0,1 | 0,2 | 0,3 | 0,5 | 1   | 1,5 | 2   | 2,5 | 3  |
|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|----|
| A/mm <sup>2</sup> | 452 | 320 | 261 | 202 | 143 | 117 | 101 | 90  | 83 |

Table 2

# TOXFREE Marine XZ1-K (AS) 0,6/1 kV

## 6.3 Correction factors for air temperature other than 45 °C.

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

| Air T. (°C) | 35   | 40   | 45 | 50   | 55   | 60   | 65   | 70   | 75   | 80   |
|-------------|------|------|----|------|------|------|------|------|------|------|
| Factor      | 1,10 | 1,05 | 1  | 0,94 | 0,88 | 0,82 | 0,74 | 0,67 | 0,58 | 0,47 |

Table 3

Other correction factors are in IEC 60092-352.

## 7. Dimensions.

| n° x Section (mm <sup>2</sup> ) | Diameter (mm) | Weight (Kg/Km) | n° x Section (mm <sup>2</sup> ) | Diameter (mm) | Weight (Kg/Km) |
|---------------------------------|---------------|----------------|---------------------------------|---------------|----------------|
| 1 x 2,5                         | 5,4           | 45             | 3 x 6                           | 12,2          | 285            |
| 1 x 4                           | 5,9           | 61             | 3 x 10                          | 14,6          | 442            |
| 1 x 6                           | 6,5           | 81             | 3 x 16                          | 16,8          | 642            |
| 1 x 10                          | 7,4           | 122            | 3 x 25                          | 21,0          | 1.008          |
| 1 x 16                          | 8,6           | 181            | 3 x 35                          | 24,0          | 1.363          |
| 1 x 25                          | 10,4          | 271            | 3 x 50                          | 27,9          | 1.894          |
| 1 x 35                          | 11,7          | 370            | 3 x 70                          | 30,5          | 2.532          |
| 1 x 50                          | 13,4          | 510            | 3 x 95                          | 36,6          | 3.397          |
| 1 x 70                          | 15,3          | 704            | 3 x 120                         | 40,2          | 4.252          |
| 1 x 95                          | 17,4          | 923            | 3 x 150                         | 45,1          | 5.299          |
| 1 x 120                         | 19,0          | 1.157          | 3 x 185                         | 50,7          | 6.495          |
| 1 x 150                         | 21,3          | 1.438          | 3 x 240                         | 57,3          | 8.461          |
| 1 x 185                         | 23,9          | 1.750          | 4 x 1,5                         | 9,7           | 140            |
| 1 x 240                         | 26,9          | 2.283          | 4 x 2,5                         | 10,6          | 185            |
| 1 x 300                         | 29,6          | 2.864          | 4 x 4                           | 12,1          | 262            |
| 2 x 1,5                         | 8,0           | 97             | 4 x 6                           | 13,5          | 351            |
| 2 x 2,5                         | 9,1           | 131            | 4 x 10                          | 16,0          | 544            |
| 2 x 4                           | 10,2          | 176            | 4 x 16                          | 18,7          | 802            |
| 2 x 6                           | 11,4          | 234            | 4 x 25                          | 23,7          | 1.271          |
| 2 x 10                          | 13,3          | 348            | 4 x 35                          | 25,9          | 1.690          |
| 2 x 16                          | 15,1          | 493            | 4 x 50                          | 31,3          | 2.396          |
| 3 x 1,5                         | 8,9           | 118            | 4 x 70                          | 35,8          | 3.284          |
| 3 x 2,5                         | 9,8           | 156            | 4 x 95                          | 40,6          | 4.282          |
| 3 x 4                           | 10,9          | 211            | 4 x 120                         | 44,8          | 5.391          |

Table 4 (continue)

# TOXFREE Marine XZ1-K (AS) 0,6/1 kV

| n° x Section (mm <sup>2</sup> ) | Diameter (mm) | Weight (Kg/Km) |
|---------------------------------|---------------|----------------|
| 4 x 150                         | 50,2          | 6.748          |
| 4 x 185                         | 56,5          | 8.262          |
| 4 x 240                         | 63,7          | 10.763         |
| 5 x 1,5                         | 10,4          | 165            |
| 5 x 2,5                         | 11,8          | 229            |
| 5 x 4                           | 13,3          | 315            |
| 5 x 6                           | 15,0          | 431            |
| 5 x 10                          | 17,7          | 670            |
| 5 x 16                          | 20,8          | 991            |
| 5 x 25                          | 25,9          | 1.554          |
| 5 x 35                          | 29,1          | 2.095          |
| 5 x 50                          | 34,5          | 2.942          |

| n° x Section (mm <sup>2</sup> ) | Diameter (mm) | Weight (Kg/Km) |
|---------------------------------|---------------|----------------|
| 7 x 1,5                         | 11,4          | 204            |
| 7 x 2,5                         | 13,0          | 284            |
| 10 x 1,5                        | 13,4          | 277            |
| 12 x 1,5                        | 14,3          | 326            |
| 12 x 2,5                        | 17,2          | 477            |
| 14 x 1,5                        | 15,4          | 333            |
| 16 x 1,5                        | 16,6          | 384            |
| 19 x 1,5                        | 17,3          | 435            |
| 19 x 2,5                        | 20,3          | 632            |
| 24 x 1,5                        | 19,5          | 542            |
| 27 x 1,5                        | 20,7          | 601            |
| 27 x 2,5                        | 24,3          | 876            |

Table 6 (end)

Top Cable reserves the right to carry out any modification whatsoever without giving previous notice.