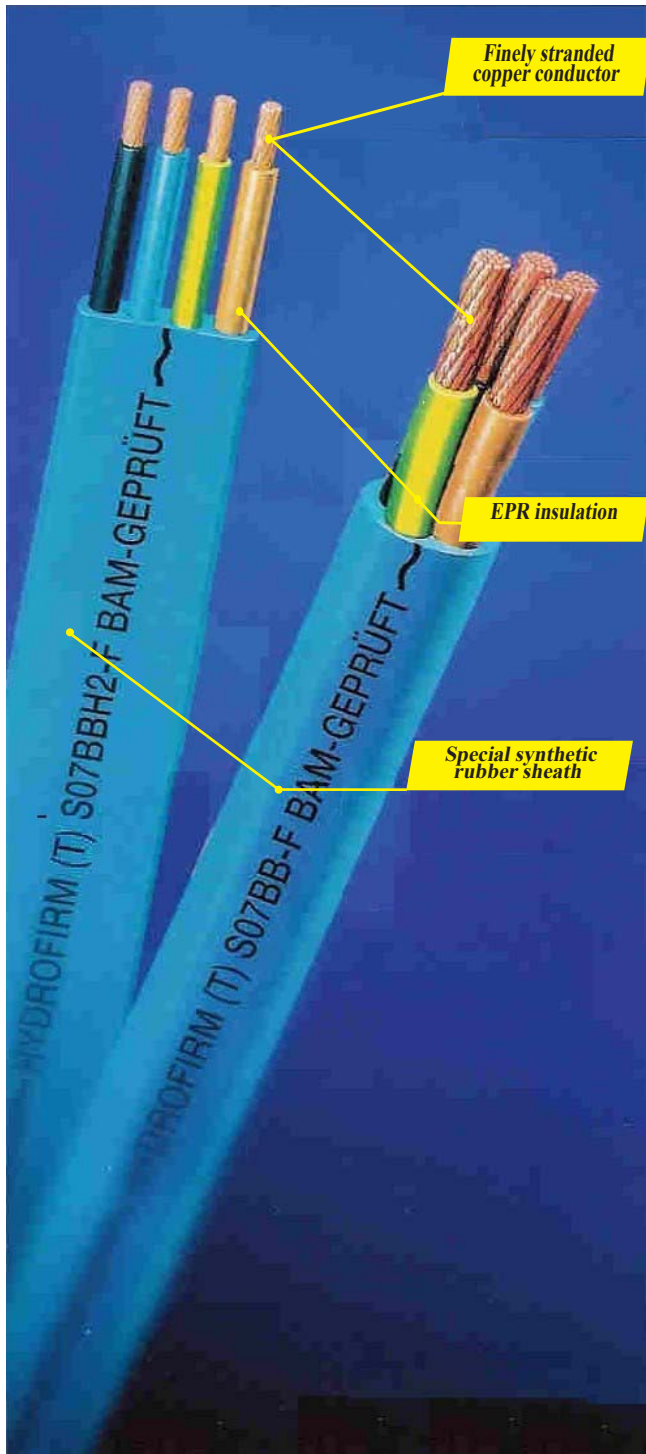




HYDROFIRM (T) Cables

for use in Ground Water
and Drinking Water



Until now, the renowned HYDROFIRM®TGK cables were available for use only in ground water at temperatures up to 40°C, while the TGW and TGFLW were suitable for ground water temperature up to 60°C. On the other hand, our HYDROFIRM(T) cable types TGKT and TGFLKT were designed for use in drinking water at temperatures up to 40°C (105°F). Consistent improvement of the sheathing materials has led to the development of a cable suitable for use in drinking water at temperatures up to 60°C (140°F). Just one type of cable is now available for the entire field of application. New type designations based on the harmonization code, S07BB-F and S07BBH2-F, have been established to clearly distinguish this new cable from former versions. In both instances, the letter B signifies the insulating and sheathing materials. As before, these materials are based on special ethylenepropylene rubber (EPR) compounds. Naturally, the insulating compound satisfies the rigorous electrical requirements even in the presence of moisture. The blue sheathing compound demonstrates the required mechanical properties along with an excellent resistance to water. It remains true that

these highly water-resistant materials do not offer the same degree of oil-resistance or burning behavior as harmonized 07RN rubber cables. Our OZOFLEX® (PLUS) is ideally suited for this combination of requirements. The new HYDROFIRM(T) cables have dimensions identical to their predecessors, which also correspond to the 07RN constructions. The flat versions, S07BBH2-F, employ the same wall thicknesses as their corresponding round types, S07BB-F. Therefore, apart from the obvious fact that flat cables may be flexed in only one plane, the flat versions are electrically and mechanically equivalent to their round counterparts. A light colored inner sheath is present within round constructions possessing conductor sizes above 16mm² or having more than 5 conductors.

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Application

HYDROFIRM(T) cables 07BB (round) and 07BBH2 (flat) are intended for continuous emersion in drinking or ground water to depths up to 500 m, for use under medium mechanical stresses, and for use as a connection cable for electrical equipment such as submersible pumps. They may also be submerged in rain, sea, or surface water, as well as in water employed for industrial processing or cooling purposes. However, the suitability of these cables for "mixed" water types, as defined by DIN 4045 and 4046, is limited.

They may not be used in water containing more than 0.5 mg/l of chlorine.

The cable's resistance to aggressive water or water of an atypical composition must be individually verified for each application.

The cable's suitability for continuous immersion in water is verified by a certificate that includes manufacturing supervision

from the VDE Test and Certification Institute (German Institute of Electrical Engineers). Whereas tests conducted by the Federal Authority of Materials Testing (BAM), based on the KTW recommendations (Area C, "Installation Materials"), prove the suitability of this cable's use in drinking water.

HYDROFIRM(T) cables, 07BB and 07BBH2, may be used indoors and outdoors, but not in areas exposed to explosion hazards. For protected, fixed installation within equipment, pipes or wells, as well as for rotor connections, these cables may be operated with an AC voltage to 1000V or a DC voltage to 750V with respect to earth.

The permissible AC voltages for motor tests is 3 kV for a maximum duration of 3 minutes.

In all other respects, DIN VDE 0298 Part 3000 applies.

Technical details

The design is based on DIN VDE 0282 Part 810. HYDROFIRM(T) cables are at least equivalent to type 07RN rubber-insulated flexible cables with respect to their electrical and mechanical properties. Flat type 07BBH2 cables have the same sheathe thicknesses as their round counterparts.



- Finely stranded conductor of bare copper wires, Class 5 to DIN VDE 0295 and IEC 228
- Insulation and sheath consist of special EPR-based materials, adapted for use in ground water and drinking water.
- Insulation: Special rubber compound, at least equivalent to compound type 3G13 in DIN VDE 0207, color coding to DIN VDE 0293.
- Inner sheath (for sizes >16mm² or more than 5 conductors): Special rubber compound at least equivalent to compound type GM1b to DIN VDE 0207.
- Outer sheath: Special rubber compound, mechanical and thermal properties same as compound type 5GM3 to DIN VDE 0207 colored blue.

Outer marking: There is a wavy line on the outer sheath, interrupted with the type designation, number of conductors and conductor cross-section, the trademark HYDROFIRM(T), the message “BAM-geprüft” (tested by the federal authority of materials testing and the VDE (German institute of electrical engineers) registered number 9832. For example:

~~~~~HYDROFIRM(T) S07BB-F 4G1.5  
BAM-GEPRÜFT VDE-REG-NR 9832 ~~~~~

|                                                                              |                |       |
|------------------------------------------------------------------------------|----------------|-------|
| <b>Permissible temperatures:</b>                                             |                |       |
| at conductor                                                                 | permanent load | 90°C  |
|                                                                              | short circuit  | 250°C |
| during transportation, storage, installation, handling and operation         |                |       |
|                                                                              | flexible       | -25°C |
|                                                                              | fixed          | -40°C |
| <b>Permissible water temperatures:</b>                                       |                | 60°C  |
| At higher water temperatures, a reduced cable service life must be expected. |                |       |

### Current-carrying capacity

The values apply to a cable during continuous operation at an ambient temperature of 30°C. For other ambient temperatures, the current-carrying capacities must be converted with the following factors.

|    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| °F | 50   | 59   | 68   | 77   | 86   | 95   | 104  | 113  | 122  | 131  | 140  | 149  | 158  | 167  | 176  |
| °C | 10   | 15   | 20   | 25   | 30   | 35   | 40   | 45   | 50   | 55   | 60   | 65   | 70   | 75   | 80   |
|    | 1.15 | 1.12 | 1.08 | 1.04 | 1.00 | 0.96 | 0.91 | 0.87 | 0.82 | 0.76 | 0.71 | 0.65 | 0.58 | 0.50 | 0.40 |

In all respects, the provisions of DIN VDE 0298 Part 4 apply.

### Continuous tensile stress

15 N/mm<sup>2</sup> with respect to the nominal conductor cross-section.

### Minimum bending radii

|                                    |      |              |               |         |
|------------------------------------|------|--------------|---------------|---------|
| Outer diameter of cable in mm      | to 8 | over 8 to 12 | over 12 to 20 | over 20 |
| For fixed installation             | 3 d  | 3 d          | 4 d           | 4 d     |
| For free movement and installation | 3 d  | 4 d          | 5 d           | 5 d     |

d = overall diameter of cable

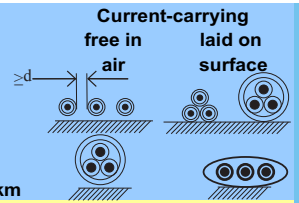
### Voltages

|                                                                                         |                      |
|-----------------------------------------------------------------------------------------|----------------------|
| Rated Voltage                                                                           | $U_0 / U$ 450/750 V  |
| Maximum permissible operation voltage for:<br>three-phase and single-phase AC operation | $U_0 / U$ 476/825 V  |
| DC operation                                                                            | $U_0 / U$ 619/1238 V |
| AC test voltage                                                                         | 2.5kV                |

# Selection data



| Number of Control Conductors                                        | Pirelli Part Number | Approximate Number of Strands x | max. strand diameter | Diameter approximate mm | Overall diameter of cable |             | Cable Weight |       | Current-carrying |                 |
|---------------------------------------------------------------------|---------------------|---------------------------------|----------------------|-------------------------|---------------------------|-------------|--------------|-------|------------------|-----------------|
|                                                                     |                     |                                 |                      |                         | min                       | max         | Lbs/1000 ft  | kg/km | free in air      | laid on surface |
| <b>HYDROFIRM(T) S07BB-F 1 X...round, with black core insulation</b> |                     |                                 |                      |                         |                           |             |              |       |                  |                 |
| 1 X 1.5                                                             | 5DH1 302            | 28                              | 0.26                 | 1.5                     | 5.5                       | 7.0         | 34           | 50    | 35               | 23              |
| 1 X 10                                                              | 5DH1 306            | 77                              | 0.41                 | 4.1                     | 9.5                       | 11.0        | 121          | 180   | 111              | 74              |
| 1 X 16                                                              | 5DH1 307            | 123                             | 0.41                 | 5.6                     | 11.5                      | 13.5        | 178          | 265   | 149              | 99              |
| 1 X 25                                                              | 5DH1 308            | 190                             | 0.41                 | 6.8                     | 13.5                      | 15.5        | 255          | 380   | 197              | 130             |
| 1 X 35                                                              | 5DH1 310            | 268                             | 0.41                 | 8.1                     | 15.0                      | 17.5        | 336          | 500   | 244              | 162             |
| 1 X 50                                                              | 5DH1 311            | 384                             | 0.41                 | 9.6                     | 17.5                      | 20.0        | 464          | 690   | 304              | 201             |
| 1 X 70                                                              | 5DH1 312            | 545                             | 0.41                 | 11.2                    | 20.0                      | 22.5        | 618          | 920   | 376              | 249             |
| 1 X 95                                                              | 5DH1 313            | 724                             | 0.41                 | 13.2                    | 22.5                      | 25.0        | 793          | 1180  | 453              | 300             |
| 1 X 120                                                             | 5DH1 314            | 926                             | 0.41                 | 14.9                    | 24.00                     | 26.5        | 988          | 1470  | 529              | 350             |
| <b>HYDROFIRM(T) S07BB-F 3 X...round, without ground conductor</b>   |                     |                                 |                      |                         |                           |             |              |       |                  |                 |
| 3 X 1.5                                                             | 5DH1 332            | 28                              | 0.26                 | 1.5                     | 9.5                       | 11.0        | 92           | 137   | 24               | 23              |
| 3 X 2.5                                                             | 5DH1 333            | 45                              | 0.26                 | 1.9                     | 11.0                      | 13.0        | 132          | 197   | 32               | 30              |
| 3 X 4.0                                                             | 5DH1 334            | 51                              | 0.31                 | 2.5                     | 13.0                      | 15.0        | 188          | 280   | 43               | 41              |
| 3 X 6.0                                                             | 5DH1 335            | 75                              | 0.31                 | 3.2                     | 14.5                      | 16.0        | 249          | 370   | 56               | 53              |
| 3 X 10.0                                                            | 5DH1 336            | 77                              | 0.41                 | 4.1                     | 19.0                      | 21.5        | 447          | 665   | 78               | 74              |
| 3 X 16.0                                                            | 5DH1 337            | 123                             | 0.41                 | 5.6                     | 23.5                      | 26.0        | 672          | 1000  | 104              | 99              |
| 3 X 25.0                                                            | 5DH1 338            | 190                             | 0.41                 | 6.8                     | 28.5                      | 31.0        | 968          | 1440  | 138              | 131             |
| 3 X 35.0                                                            | 5DH1 340            | 268                             | 0.41                 | 8.1                     | 32.0                      | 35.5        | 1257         | 1870  | 171              | 162             |
| 3 X 50.0                                                            | 5DH1 341            | 384                             | 0.41                 | 9.6                     | 37.0                      | 41.0        | 1720         | 2560  | 213              | 202             |
| 3 X 70.0                                                            | 5DH1 342            | 545                             | 0.41                 | 11.2                    | 42.0                      | 45.5        | 2265         | 3370  | 263              | 250             |
| <b>HYDROFIRM(T) S07BB-F 3 G...round, with ground conductor</b>      |                     |                                 |                      |                         |                           |             |              |       |                  |                 |
| 3 X 1.5                                                             | 5DH1 352            | 28                              | 0.26                 | 1.5                     | 1.5                       | 9.5         | 92           | 137   | 24               | 23              |
| 3 X 2.5                                                             | 5DH1 353            | 45                              | 0.26                 | 1.9                     | 1.9                       | 11.0        | 132          | 197   | 32               | 30              |
| 3 X 4.0                                                             | 5DH1 354            | 51                              | 0.31                 | 2.5                     | 2.5                       | 13.0        | 188          | 280   | 43               | 41              |
| <b>HYDROFIRM(T) S07BB-F 4 G...round, with ground conductor</b>      |                     |                                 |                      |                         |                           |             |              |       |                  |                 |
| 4 G 1.5                                                             | 5DH1 362            | 28                              | 0.26                 | 1.5                     | 10.0                      | 12.0        | 118          | 175   | 24               | 23              |
| 4 G 2.5                                                             | 5DH1 363            | 45                              | 0.26                 | 1.9                     | 12.0                      | 14.0        | 168          | 250   | 32               | 30              |
| 4 G 4.0                                                             | 5DH1 364            | 51                              | 0.31                 | 2.5                     | 14.0                      | 16.0        | 239          | 355   | 43               | 41              |
| 4 G 6.0                                                             | 5DH1 365            | 75                              | 0.31                 | 3.2                     | 15.5                      | 18.0        | 319          | 475   | 56               | 53              |
| 4 G 10.0                                                            | 5DH1 366            | 77                              | 0.41                 | 4.1                     | 21.0                      | 23.5        | 554          | 825   | 78               | 74              |
| 4 G 16.0                                                            | 5DH1 367            | 123                             | 0.41                 | 5.6                     | 25.5                      | 29.0        | 840          | 1250  | 104              | 99              |
| 4 G 25.0                                                            | 5DH1 368            | 190                             | 0.41                 | 6.8                     | 31.0                      | 34.0        | 1210         | 1800  | 138              | 131             |
| 4 G 35.0                                                            | 5DH1 370            | 268                             | 0.41                 | 8.1                     | 35.0                      | 39.0        | 1586         | 2360  | 171              | 162             |
| 4 G 50.0                                                            | 5DH1 371            | 384                             | 0.41                 | 9.6                     | 41.0                      | 45.0        | 2184         | 3250  | 213              | 202             |
| 4 G 70.0                                                            | 5DH1 372            | 545                             | 0.41                 | 11.2                    | 46.5                      | 50.0        | 2889         | 4300  | 263              | 250             |
| 4 G 95.0                                                            | 5DH1 373            | 724                             | 0.41                 | 13.2                    | 51.6                      | 55.6        | 3797         | 5650  | 317              | 301             |
| 4 G 120.0                                                           | 5DH1 374            | 926                             | 0.41                 | 14.9                    | 56.1                      | 60.1        | 4670         | 6950  | 370              | 352             |
| <b>HYDROFIRM(T) S07BBH2-F 3 X...flat, without ground conductor</b>  |                     |                                 |                      |                         |                           |             |              |       |                  |                 |
| 3 X 1.5                                                             | 5DH1 502            | 28                              | 0.26                 | 1.5                     | 6.0 x 12.5                | 7.5 x 14.0  | 81           | 120   | 24               | 23              |
| 3 X 2.5                                                             | 5DH1 503            | 45                              | 0.26                 | 1.9                     | 7.0 x 14.5                | 8.5 x 16.5  | 124          | 185   | 32               | 30              |
| 3 X 4.0                                                             | 5DH1 504            | 51                              | 0.31                 | 2.5                     | 8.0 x 17.0                | 9.5 x 19.0  | 175          | 260   | 43               | 41              |
| 3 X 6.0                                                             | 5DH1 505            | 75                              | 0.31                 | 3.2                     | 9.0 x 19.0                | 10.5 x 21.5 | 232          | 345   | 56               | 53              |
| 3 X 10.0                                                            | 5DH1 506            | 77                              | 0.41                 | 4.1                     | 12.5 x 25.0               | 14.5 x 28.0 | 417          | 620   | 78               | 74              |
| 3 X 16.0                                                            | 5DH1 507            | 123                             | 0.41                 | 5.6                     | 14.5 x 31.0               | 17.0 x 34.0 | 611          | 910   | 104              | 99              |
| 3 X 25.0                                                            | 5DH1 508            | 190                             | 0.41                 | 6.8                     | 17.0 x 36.5               | 19.0 x 40.0 | 874          | 1300  | 138              | 131             |
| 3 X 35.0                                                            | 5DH1 510            | 268                             | 0.41                 | 8.1                     | 19.0 x 42.0               | 21.5 x 45.5 | 1169         | 1740  | 171              | 162             |
| 3 X 50.0                                                            | 5DH1 511            | 384                             | 0.41                 | 9.6                     | 22.0 x 48.5               | 24.0 x 53.0 | 1599         | 2380  | 213              | 202             |
| 3 X 70.0                                                            | 5DH1 512            | 545                             | 0.41                 | 11.2                    | 24.0 x 54.5               | 26.5 x 59.0 | 2123         | 3160  | 263              | 250             |
| <b>HYDROFIRM(T) S07BBH2-F 4 G...flat, with ground conductor</b>     |                     |                                 |                      |                         |                           |             |              |       |                  |                 |
| 4 G 1.5                                                             | 5DH1 522            | 28                              | 0.26                 | 1.5                     | 6.0 x 16.0                | 7.5 x 18.5  | 118          | 175   | 24               | 23              |
| 4 G 2.5                                                             | 5DH1 523            | 45                              | 0.26                 | 1.9                     | 7.0 x 19.0                | 8.5 x 21.5  | 171          | 255   | 32               | 30              |
| 4 G 4.0                                                             | 5DH1 524            | 51                              | 0.31                 | 2.5                     | 8.0 x 22.5                | 9.5 x 21.5  | 242          | 360   | 43               | 41              |
| 4 G 6.0                                                             | 5DH1 525            | 75                              | 0.31                 | 3.2                     | 9.5 x 25.5                | 10.5 x 29.0 | 326          | 485   | 56               | 53              |
| 4 G 10.0                                                            | 5DH1 526            | 77                              | 0.41                 | 4.1                     | 12.5 x 33.0               | 14.5 x 36.5 | 642          | 955   | 78               | 74              |
| 4 G 16.0                                                            | 5DH1 527            | 123                             | 0.41                 | 5.6                     | 14.5 x 41.0               | 17.0 x 44.5 | 820          | 1220  | 104              | 99              |
| 4 G 25.0                                                            | 5DH1 528            | 190                             | 0.41                 | 6.8                     | 17.5 x 49.0               | 20.0 x 53.5 | 1210         | 1800  | 138              | 131             |
| 4 G 35.0                                                            | 5DH1 530            | 268                             | 0.41                 | 8.1                     | 19.5 x 56.5               | 22.0 x 60.5 | 1613         | 2400  | 171              | 162             |
| 4 G 50.0                                                            | 5DH1 531            | 384                             | 0.41                 | 9.6                     | 22.5 x 66.5               | 25.0 x 69.5 | 2197         | 3270  | 213              | 202             |
| 4 G 70.0                                                            | 5DH1 532            | 545                             | 0.41                 | 11.2                    | 25.0 x 73.0               | 28.0 x 77.5 | 2923         | 4350  | 263              | 250             |
| 4 G 95.0                                                            | 5DH1 533            | 724                             | 0.41                 | 13.2                    | 27.0 x 80.5               | 29.5 x 85.0 | 3897         | 5800  | 317              | 301             |
| 4 G 120.0                                                           | 5DH1 534            | 926                             | 0.41                 | 14.9                    | 29.5 x 85.5               | 32.5 x 70.0 | 4744         | 7060  | 370              | 352             |



# Data in Water

## Current rating

for continuous operation in air or underwater at 30 °C, or in the event of short-circuit conditions

The ampacity "in air on surfaces" is according to DIN VDE 0298-4:1998-1, table 13 and converted for installation "free in air" or "underwater"

| Type                                               | HYDROFIRM(T) 07BB, 07BBH      |     |                    |               |            |      |                                                       |                 |
|----------------------------------------------------|-------------------------------|-----|--------------------|---------------|------------|------|-------------------------------------------------------|-----------------|
| Permissible operating temperature at conductor     | 90 °C                         |     |                    |               |            |      |                                                       |                 |
| Permissible short-circuit temperature at conductor |                               |     |                    |               |            |      | 200 °C                                                | 250 °C          |
| Number of loaded conductors                        | 1                             | 3   | 3                  | 1             | 3          | -    | -                                                     |                 |
| Method of installation                             | free in air                   |     | in air on surfaces |               | underwater |      | tinned conductors                                     | bare conductors |
| Nominal cross-section, copper conductor            | Current Carrying Capacity (A) |     |                    |               |            |      | Permissible 1 s short-circuit current $I_{thr}$ in kA |                 |
| mm <sup>2</sup>                                    | in air                        |     |                    | underwater *) |            |      |                                                       |                 |
| 1                                                  | -                             | 19  | 18                 | -             | 23         | 0,12 | 0,14                                                  |                 |
| 1,5                                                | 35                            | 24  | 23                 | 42            | 29         | 0,18 | 0,21                                                  |                 |
| 2,5                                                | 45                            | 32  | 30                 | 54            | 38         | 0,31 | 0,36                                                  |                 |
| 4                                                  | 62                            | 43  | 41                 | 74            | 52         | 0,49 | 0,57                                                  |                 |
| 6                                                  | 80                            | 56  | 53                 | 96            | 67         | 0,73 | 0,86                                                  |                 |
| 10                                                 | 111                           | 78  | 74                 | 133           | 94         | 1,22 | 1,43                                                  |                 |
| 16                                                 | 149                           | 104 | 99                 | 179           | 125        | 1,95 | 2,29                                                  |                 |
| 25                                                 | 197                           | 138 | 131                | 236           | 166        | 3,05 | 3,58                                                  |                 |
| 35                                                 | 244                           | 171 | 162                | 293           | 205        | 4,27 | 5,01                                                  |                 |
| 50                                                 | 304                           | 213 | 202                | 365           | 256        | 6,10 | 7,15                                                  |                 |
| 70                                                 | 376                           | 263 | 250                | 451           | 316        | 8,54 | 10,0                                                  |                 |
| 95                                                 | 453                           | 317 | 301                | 544           | 380        | 11,6 | 13,6                                                  |                 |
| 120                                                | 529                           | 370 | 352                | 635           | 444        | 14,6 | 17,2                                                  |                 |
| 150                                                | 608                           | 425 | 404                | 730           | 510        | 18,3 | 21,5                                                  |                 |
| 185                                                | 693                           | 485 | 461                | 832           | 582        | 22,6 | 26,5                                                  |                 |
| 240                                                | 823                           | 576 | 547                | 988           | 691        | 29,3 | 34,3                                                  |                 |
| 300                                                | 952                           | 666 | 633                | 1142          | 799        | 36,6 | 42,9                                                  |                 |

\*) The underwater current rating is only valid, if the cable is completely submerged. The underwater ampacity is defined as 20 % higher than the ampacity in air.

At other ambient temperatures, the ampacities must be converted with the following factors f:

| °C | 10   | 15   | 20   | 25   | 30 | 35   | 40   | 45   | 50   | 55   | 60   | 65   | 70   | 75   | 80   |
|----|------|------|------|------|----|------|------|------|------|------|------|------|------|------|------|
| f  | 1,15 | 1,12 | 1,08 | 1,04 | 1  | 0,96 | 0,91 | 0,87 | 0,82 | 0,76 | 0,65 | 0,58 | 0,50 | 0,41 | 0,29 |

Permissible short-circuit currents  $I_{thz}$  for other break times  $t_k$  up to 5 s are calculated using the formula  $I_{thz} = I_{thr} \sqrt{\frac{1s}{t_k}}$

**Consero - Your North American Source for  
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