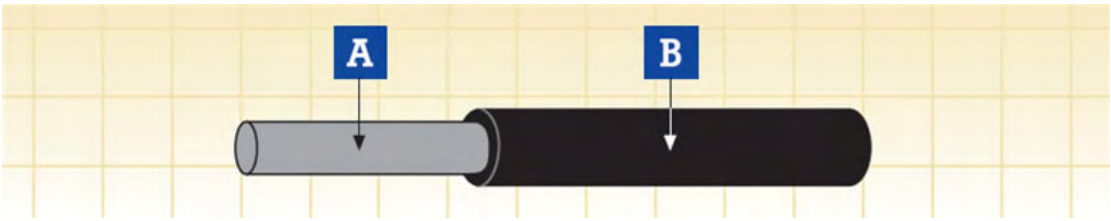
# FIREROL High Temperature
# Single Core Unsheathed cables
# 1.8/3 kV or 3.6/6 kV
# to EN 50382-2 (FRL-HT-3SU / FRL-HT-6SU)




A. Conductor B. Insulation

## Construction

**Conductor**
flexible tinned annealed copper wires (red copper only for 150° C core temperature) class 5 according to HD 383
**Insulation**
silicon rubber according to EN 50382-1 (EI 111)

## Electrical & Mechanical Properties

| | |
|---|---|
| Nominal Voltage | 1.8/3 kV or 3.6/6 kV |
| Maximum Conductor Temperature | +120/+150 °C (fixed installation) |
| Minimum Permissible Ambient Temperature | -25/-40 °C (fixed installation) |
| Bending Radius | 3 x Overall Diameter (D<12mm);<br>4 x Overall Diameter (D>12mm) |

## Chemical & Environmental Properties

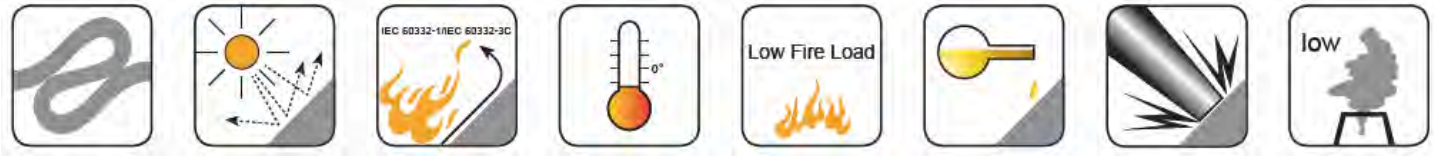
| | |
|---|---|
| EN 60684-2 | No fluorine |
| EN 50305; EN 60811-2-1 | Resistance to oil & fuel |
| EN 50305 | Resistance to ozone |

## Fire Performance for rolling stock application

| | |
|---|---|
| EN 50306-2 | Hazard levels HL1, HL2/HL3, HL4 |
| DIN 5510-2 | Protection level 1/2/3/4 |
| BS 6853 | Interior use 1a, 1b, II; Exterior use 1a, 1b, II |
| NF F 16-101 | FO |

## Fire Performance in general

| | |
|---|---|
| EN 50265-2-1; IEC 60332-1; BS 4066-1 | Vertical flame propogation for a single insulated wire or cable |
| EN 50266-2-4 + EN 50305; IEC 60332-3C; VDE 0472 Teil 804; BS 4066-3; NFC 32070 | Fire propagation of bunched wires and cables; |
| EN 50268-2; IEC 61034-2; VDE 0472 Teil 816 | Smoke density |
| EN 50267-2-1; IEC 60754-1; VDE 0472 Teil 815 | Halogen Free |
| EN 50267-2-2/3; IEC 60754-2; VDE 0472 Teil 813 | Corrosivity of gases (Acidity & Conductivity) |
| EN 50305; NFX 70-100; NFF 63808; TM1-04; BS6853 | Toxicity index |
| NFF 16101; NFF 63808; BS6853 | Smoke index |



**FRL-HT-3SU 1.8/3 kV**

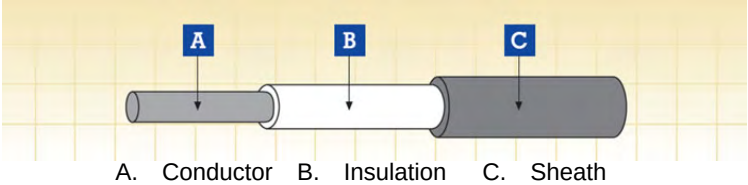
| NOMINAL CROSS-SECTIONAL AREA | CONDUCTOR DIAMETER (a) | MIN. MEAN THICKNESS OF INSULATION | OVERALL DIAMETER | | WEIGHT | RESISTANCE OF CONDUCTOR AT 20°C | | MIN. INSULATION RESISTANCE | |
|---|---|---|---|---|---|---|---|---|---|
| | | | min | max | | TINNED CONDUCTOR | PLAIN CONDUCTOR | AT +20℃ MIN. | AT +150℃ MIN. |
| $mm^2$ | mm | mm | mm | mm | kg/km | Ω/km | Ω/km | MΩ·km | MΩ·km |
| 1.5 | 1.5 | 2.5 | 6.3 | 7.3 | 50 | 13.7 | 13.3 | 970 | 1.90 |
| 2.5 | 1.95 | 2.5 | 6.7 | 7.8 | 70 | 8.21 | 7.98 | 840 | 1.60 |
| 4 | 2.5 | 2.5 | 7.2 | 8.4 | 80 | 5.09 | 4.95 | 720 | 1.40 |
| 6 | 3.0 | 2.5 | 7.7 | 9.0 | 100 | 3.39 | 3.30 | 650 | 1.30 |
| 10 | 3.9 | 2.5 | 8.5 | 10.0 | 160 | 1.95 | 1.91 | 540 | 1.00 |
| 16 | 5.0 | 2.5 | 9.6 | 11.2 | 210 | 1.24 | 1.21 | 460 | 0.90 |
| 25 | 6.4 | 2.5 | 10.9 | 12.7 | 290 | 0.795 | 0.780 | 380 | 0.70 |
| 35 | 7.7 | 2.5 | 12.1 | 14.1 | 380 | 0.565 | 0.554 | 330 | 0.60 |
| 50 | 9.2 | 2.5 | 13.5 | 15.8 | 520 | 0.393 | 0.386 | 290 | 0.50 |
| 70 | 11.0 | 2.5 | 15.2 | 17.8 | 720 | 0.277 | 0.272 | 250 | 0.50 |
| 95 | 12.5 | 2.7 | 17.0 | 19.9 | 930 | 0.210 | 0.206 | 230 | 0.40 |
| 120 | 14.2 | 2.7 | 18.6 | 21.7 | 1140 | 0.164 | 0.161 | 210 | 0.40 |
| 150 | 15.8 | 2.7 | 20.1 | 23.5 | 1430 | 0.132 | 0.129 | 190 | 0.30 |
| 185 | 17.5 | 2.7 | 21.7 | 25.4 | 1720 | 0.108 | 0.106 | 170 | 0.30 |
| 240 | 20.1 | 2.7 | 24.1 | 28.2 | 2270 | 0.0817 | 0.0801 | 150 | 0.30 |
| 300 | 22.5 | 2.7 | 26.4 | 30.9 | 2750 | 0.0654 | 0.0641 | 140 | 0.20 |
| 400 | 25.8 | 2.9 | 29.9 | 34.9 | 3730 | 0.0495 | 0.0486 | 130 | 0.20 |

**FRL-HT-6SU 3.6/6kV**

| NOMINAL CROSS-SECTIONAL AREA | CONDUCTOR DIAMETER (a) | MIN. MEAN THICKNESS OF INSULATION | OVERALL DIAMETER | | WEIGHT | RESISTANCE OF CONDUCTOR AT 20°C | | MIN. INSULATION RESISTANCE | |
|---|---|---|---|---|---|---|---|---|---|
| | | | min | max | | TINNED CONDUCTOR | PLAIN CONDUCTOR | AT +20℃ MIN. | AT +150℃ MIN. |
| $mm^2$ | mm | mm | mm | mm | kg/km | Ω/km | Ω/km | MΩ·km | MΩ·km |
| 2.5 | 1.95 | 3.0 | 7.6 | 8.9 | 80 | 8.21 | 7.98 | 920 | 1.80 |
| 4 | 2.5 | 3.0 | 8.1 | 9.5 | 100 | 5.09 | 4.95 | 800 | 1.60 |
| 6 | 3.0 | 3.0 | 9.0 | 10.6 | 120 | 3.39 | 3.30 | 750 | 1.50 |
| 10 | 3.9 | 3.0 | 9.5 | 11.1 | 180 | 1.95 | 1.91 | 610 | 1.20 |
| 16 | 5.0 | 3.0 | 10.5 | 12.3 | 230 | 1.24 | 1.21 | 520 | 1.00 |
| 25 | 6.4 | 3.0 | 11.8 | 13.8 | 310 | 0.795 | 0.780 | 430 | 0.80 |
| 35 | 7.7 | 3.0 | 13.0 | 15.2 | 410 | 0.565 | 0.554 | 380 | 0.70 |
| 50 | 9.2 | 3.0 | 14.4 | 16.9 | 550 | 0.393 | 0.386 | 330 | 0.60 |
| 70 | 11.0 | 3.0 | 16.1 | 18.9 | 740 | 0.277 | 0.272 | 280 | 0.50 |
| 95 | 12.5 | 3.0 | 17.5 | 20.5 | 940 | 0.210 | 0.206 | 260 | 0.50 |
| 120 | 14.2 | 3.1 | 19.3 | 22.6 | 1170 | 0.164 | 0.161 | 240 | 0.40 |
| 150 | 15.8 | 3.1 | 20.8 | 24.4 | 1460 | 0.132 | 0.129 | 220 | 0.40 |
| 185 | 17.5 | 3.2 | 22.6 | 26.5 | 1760 | 0.108 | 0.106 | 200 | 0.40 |
| 240 | 20.1 | 3.4 | 25.4 | 29.8 | 2340 | 0.0817 | 0.0801 | 190 | 0.30 |
| 300 | 22.5 | 3.4 | 27.7 | 32.4 | 2820 | 0.0654 | 0.0641 | 170 | 0.30 |
| 400 | 25.8 | 3.4 | 30.8 | 36.0 | 3780 | 0.0495 | 0.0486 | 150 | 0.30 |

(a)= For information,indicative only

# FIREROL High Temperature
# Single Core Sheathed cables
# 1.8/3kV or 3.6/6 kV
# to EN 50382-2 (FRL-HT-3S / FRL-HT-6S)




A. Conductor B. Insulation C. Sheath

## Construction

**Conductor**
flexible tinned annealed copper wires(red copper only for 150° C core temperature)class 5 according to HD 383
**Insulation**
silicon rubber according to EN 50382-1 (EI 112)
**Outer sheath**
LSZH elastomeric compound according to EN 50382-1 (EM 105. EM 106 or EM 107)

## Electrical & Mechanical Properties

| | |
|---|---|
| Nominal Voltage | 1.8/3kV or 3.6/6 kV |
| Maximum Conductor Temperature | +90 °C (fixed installation) |
| Minimum Permissible Ambient Temperature | -25/-40 °C (fixed installation) |
| Bending Radius | 3 x Overall Diameter (D<12mm);<br>4 x Overall Diameter (D>12mm) |

## Chemical & Environmental Properties

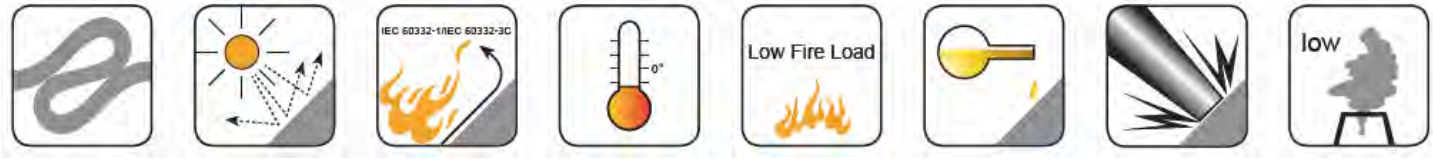
| | |
|---|---|
| EN 60684-2 | No fluorine |
| EN 50305; EN 60811-2-1 | Resistance to oil & fuel |
| EN 50305 | Resistance to ozone |

## Fire Performance for rolling stock application

| | |
|---|---|
| EN 50306-2 | Hazard levels HL1, HL2/HL3, HL4 |
| DIN 5510-2 | Protection level 1/2/3/4 |
| BS 6853 | Interior use 1a, 1b, II; Exterior use 1a, 1b, II |
| NF F 16-101 | FO |

## Fire Performance in general

| | |
|---|---|
| EN 50265-2-1; IEC 60332-1; BS 4066-1 | Vertical flame propogation for a single insulated wire or cable |
| EN 50266-2-4 + EN 50305; IEC 60332-3C; VDE 0472 Teil 804; BS 4066-3; NFC 32070 | Fire propagation of bunched wires and cables; |
| EN 50268-2; IEC 61034-2; VDE 0472 Teil 816 | Smoke density |
| EN 50267-2-1; IEC 60754-1; VDE 0472 Teil 815 | Halogen Free |
| EN 50267-2-2/3; IEC 60754-2; VDE 0472 Teil 813 | Corrosivity of gases (Acidity & Conductivity) |
| EN 50305; NFX 70-100; NFF 63808; TM1-04; BS6853 | Toxicity index |
| NFF 16101; NFF 63808; BS6853 | Smoke index |



**FRL-HT-3S 1.8/3 kV**

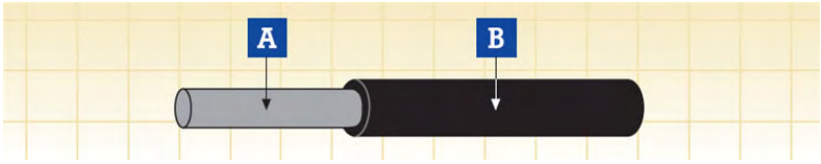
| NOMINAL CROSS-SECTIONAL AREA | CONDUCTOR DIAMETER (a) | MIN. MEAN THICKNESS OF INSULATION | MIN. AVERAGE SHEATH THICKNESS | OVERALL DIAMETER | | WEIGHT | RESISTANCE OF CONDUCTOR AT 20°C | | MIN. INSULATION RESISTANCE | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | min | max | | TINNED CONDUCTOR | PLAIN CONDUCTOR | AT 20℃ MIN. | AT 150℃ MIN. |
| $mm^2$ | mm | mm | mm | mm | mm | kg/km | Ω/km | Ω/km | MΩ·km | MΩ·km |
| 1.5 | 1.5 | 1.3 | 1.4 | 6.8 | 7.9 | 70 | 13.7 | 13.3 | 670 | 1.30 |
| 2.5 | 1.95 | 1.3 | 1.4 | 7.2 | 8.4 | 80 | 8.21 | 7.98 | 570 | 1.10 |
| 4 | 2.5 | 1.3 | 1.4 | 7.7 | 9.0 | 100 | 5.09 | 4.95 | 480 | 0.90 |
| 6 | 3.0 | 1.3 | 1.4 | 8.2 | 9.6 | 120 | 3.39 | 3.30 | 420 | 0.80 |
| 10 | 3.9 | 1.5 | 1.4 | 9.4 | 11.0 | 190 | 1.95 | 1.91 | 380 | 0.70 |
| 16 | 5.0 | 1.5 | 1.4 | 10.5 | 12.2 | 240 | 1.24 | 1.21 | 310 | 0.60 |
| 25 | 6.4 | 1.8 | 1.4 | 12.3 | 14.4 | 340 | 0.795 | 0.780 | 300 | 0.60 |
| 35 | 7.7 | 1.8 | 1.4 | 13.6 | 15.9 | 440 | 0.565 | 0.554 | 250 | 0.50 |
| 50 | 9.2 | 1.8 | 1.4 | 15.0 | 17.5 | 580 | 0.393 | 0.386 | 220 | 0.40 |
| 70 | 11.0 | 1.8 | 1.5 | 16.8 | 19.7 | 780 | 0.277 | 0.272 | 200 | 0.40 |
| 95 | 12.5 | 2.2 | 1.5 | 19.0 | 22.2 | 1020 | 0.210 | 0.206 | 190 | 0.40 |
| 120 | 14.2 | 2.2 | 1.6 | 20.8 | 24.3 | 1270 | 0.164 | 0.161 | 180 | 0.30 |
| 150 | 15.8 | 2.2 | 1.6 | 22.3 | 26.1 | 1560 | 0.132 | 0.129 | 160 | 0.30 |
| 185 | 17.5 | 2.4 | 1.7 | 24.5 | 28.6 | 1890 | 0.108 | 0.106 | 160 | 0.30 |
| 240 | 20.1 | 2.4 | 1.8 | 27.1 | 31.7 | 2480 | 0.0817 | 0.0801 | 140 | 0.20 |
| 300 | 22.5 | 2.4 | 1.9 | 29.5 | 34.6 | 2990 | 0.0654 | 0.0641 | 120 | 0.20 |
| 400 | 25.8 | 2.6 | 2.0 | 33.2 | 38.9 | 4010 | 0.0495 | 0.0486 | 120 | 0.20 |

**FRL-HT-6S 3.6/6 kV**

| NOMINAL CROSS-SECTIONAL AREA | CONDUCTOR DIAMETER (a) | MIN. MEAN THICKNESS OF INSULATION | MIN. AVERAGE SHEATH THICKNESS | OVERALL DIAMETER | | WEIGHT | RESISTANCE OF CONDUCTOR AT 20°C | | MIN. INSULATION RESISTANCE | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | min | max | | TINNED CONDUCTOR | PLAIN CONDUCTOR | AT 20℃ MIN. | AT 150℃ MIN. |
| $mm^2$ | mm | mm | mm | mm | mm | kg/km | Ω/km | Ω/km | MΩ·km | MΩ·km |
| 2.5 | 1.95 | 2.6 | 1.4 | 9.9 | 11.6 | 130 | 8.21 | 7.98 | 870 | 1.70 |
| 4 | 2.5 | 2.6 | 1.4 | 10.4 | 12.2 | 150 | 5.09 | 4.95 | 750 | 1.50 |
| 6 | 3.0 | 2.6 | 1.4 | 10.9 | 12.8 | 180 | 3.39 | 3.30 | 670 | 1.30 |
| 10 | 3.9 | 2.6 | 1.4 | 11.8 | 13.8 | 240 | 1.95 | 1.91 | 570 | 1.10 |
| 16 | 5.0 | 2.6 | 1.4 | 12.8 | 15.0 | 300 | 1.24 | 1.21 | 480 | 0.90 |
| 25 | 6.4 | 2.9 | 1.4 | 14.7 | 17.2 | 410 | 0.795 | 0.780 | 430 | 0.80 |
| 35 | 7.7 | 2.9 | 1.4 | 15.9 | 18.6 | 510 | 0.565 | 0.554 | 380 | 0.70 |
| 50 | 9.2 | 2.9 | 1.5 | 17.5 | 20.5 | 660 | 0.393 | 0.386 | 330 | 0.60 |
| 70 | 11.0 | 2.9 | 1.5 | 19.2 | 22.4 | 870 | 0.277 | 0.272 | 280 | 0.50 |
| 95 | 12.5 | 2.9 | 1.6 | 20.8 | 24.3 | 1100 | 0.210 | 0.206 | 250 | 0.50 |
| 120 | 14.2 | 2.9 | 1.6 | 22.4 | 26.2 | 1330 | 0.164 | 0.161 | 230 | 0.40 |
| 150 | 15.8 | 2.9 | 1.7 | 24.1 | 28.2 | 1640 | 0.132 | 0.129 | 210 | 0.40 |
| 185 | 17.5 | 3.2 | 1.8 | 26.4 | 30.9 | 1990 | 0.108 | 0.106 | 210 | 0.40 |
| 240 | 20.1 | 3.4 | 1.9 | 29.4 | 34.4 | 2620 | 0.0817 | 0.0801 | 190 | 0.30 |
| 300 | 22.5 | 3.4 | 1.9 | 31.7 | 37.1 | 3120 | 0.0654 | 0.0641 | 170 | 0.30 |
| 400 | 25.8 | 3.4 | 2.0 | 35.0 | 40.9 | 4150 | 0.0495 | 0.0486 | 150 | 0.30 |

**(a)= For information,indicative only**

# FIREROL High Temperature
# Single core cables with Reinforced Insulation
# 3.6/6 kV to EN 50382-2 (FRL-HT-6SURI)




A. Conductor B. Insulation

## Construction

**Conductor**
extra flexible tinned annealed copper wires(red copper only for 150° C core temperature)class 6 according to HD 383
**Insulation**
silicon rubber according to EN 50382-1 (EI 112)

## Electrical & Mechanical Properties

| | |
|---|---|
| Nominal Voltage | 3.6/6kV |
| Maximum Conductor Temperature | +120/+150 °C (fixed installation) |
| Minimum Permissible Ambient Temperature | -25/-40 °C (fixed installation) |
| Bending Radius | 3 x Overall Diameter (D<12mm);<br>4 x Overall Diameter (D>12mm) |

## Chemical & Environmental Properties

| | |
|---|---|
| EN 60684-2 | No fluorine |
| EN 50305; EN 60811-2-1 | Resistance to oil & fuel |
| EN 50305 | Resistance to ozone |

## Fire Performance for rolling stock application

| | |
|---|---|
| EN 50306-2 | Hazard levels HL1, HL2/HL3, HL4 |
| DIN 5510-2 | Protection level 1/2/3/4 |
| BS 6853 | Interior use 1a, 1b, II; Exterior use 1a, 1b, II |
| NF F 16-101 | FO |

## Fire Performance in general

| | |
|---|---|
| EN 50265-2-1; IEC 60332-1; BS 4066-1 | Vertical flame propogation for a single insulated wire or cable |
| EN 50266-2-4 + EN 50305; IEC 60332-3C; VDE 0472 Teil 804; BS 4066-3; NFC 32070 | Fire propagation of bunched wires and cables; |
| EN 50268-2; IEC 61034-2; VDE 0472 Teil 816 | Smoke density |
| EN 50267-2-1; IEC 60754-1; VDE 0472 Teil 815 | Halogen Free |
| EN 50267-2-2/3; IEC 60754-2; VDE 0472 Teil 813 | Corrosivity of gases (Acidity & Conductivity) |
| EN 50305; NFX 70-100; NFF 63808; TM1-04; BS6853 | Toxicity index |
| NFF 16101; NFF 63808; BS6853 | Smoke index |

**FRL-HT-6SURI 3.6/6 kV**

| NOMINAL CROSS-SECTIONAL AREA (a) | CONDUCTOR DIAMETER (a) | MIN. MEAN THICKNESS OF INSULATION | OVERALL DIAMETER | | WEIGHT | RESISTANCE OF CONDUCTOR AT 20°C | | MIN. INSULATION RESISTANCE | |
|---|---|---|---|---|---|---|---|---|---|
| | | | min | max | | TINNED CONDUCTOR | PLAIN CONDUCTOR | AT +20 ℃ MIN. | AT +150℃ MIN. |
| $mm^2$ | mm | mm | mm | mm | kg/km | Ω/km | Ω/km | MΩ·km | MΩ·km |
| 50 | 9.2 | 3.0 | 15.2 | 17.8 | 560 | 0.393 | 0.386 | 340 | 0.70 |
| 70 | 11.0 | 3.0 | 16.9 | 19.8 | 770 | 0.277 | 0.272 | 300 | 0.60 |
| 95 | 12.5 | 3.0 | 18.3 | 21.4 | 970 | 0.210 | 0.206 | 270 | 0.55 |
| 120 | 14.2 | 3.1 | 20.1 | 23.5 | 1200 | 0.164 | 0.161 | 250 | 0.50 |
| 150 | 15.8 | 3.1 | 21.6 | 25.3 | 1480 | 0.132 | 0.129 | 220 | 0.45 |
| 185 | 17.5 | 3.2 | 23.4 | 27.4 | 1800 | 0.108 | 0.106 | 210 | 0.40 |

**(a)= For information,indicative only**