



RAILWAY PRODUCTS



RAILWAY PRODUCTS

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**Quality is
Everything**

Chapter 1

ABHAR CABLE at a glance

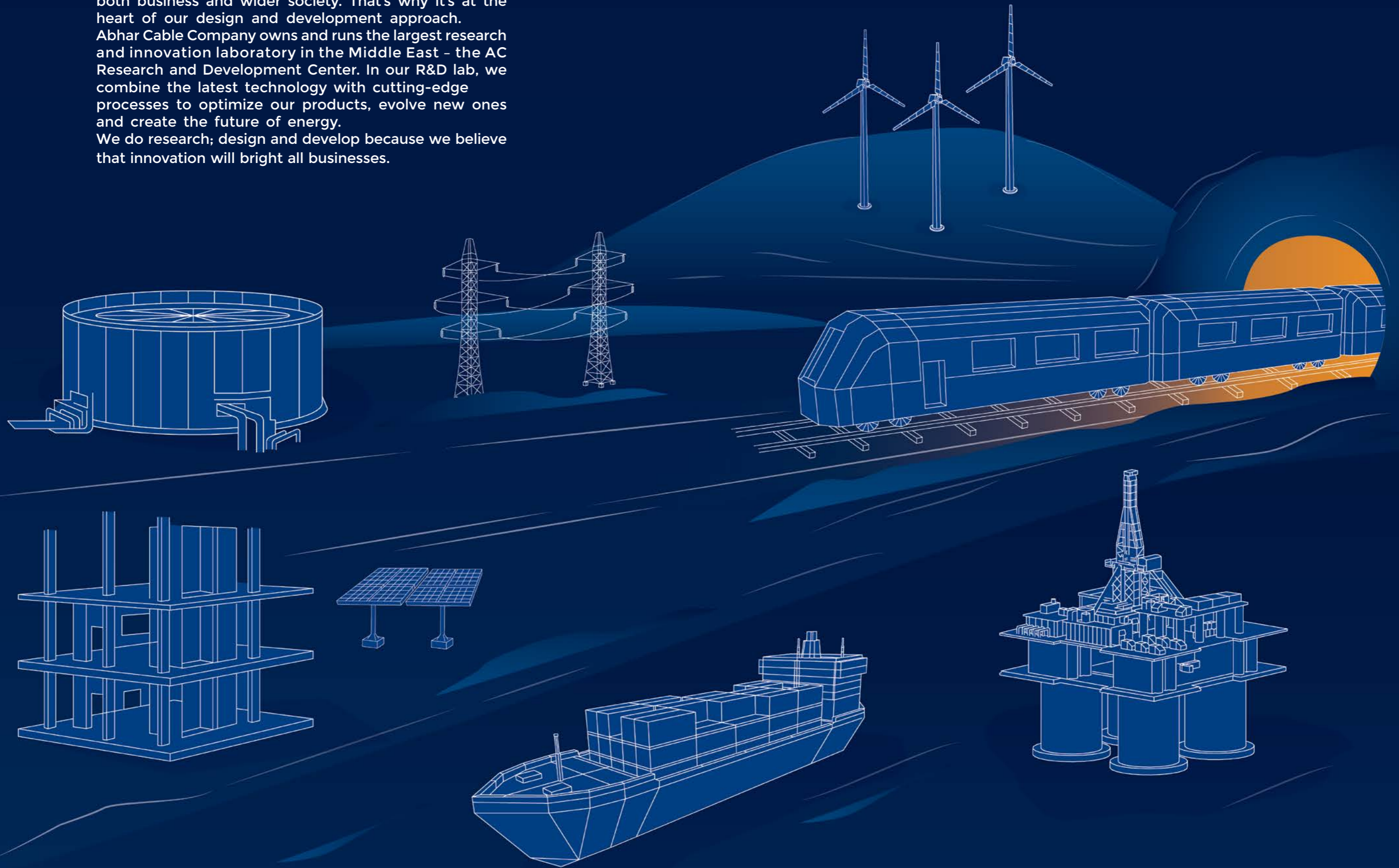
Our mission is to power technological, industrial and social development and to help lay the foundations for a brighter future for all.

Abhar Cable Company (AC) as a part of Noorin Industrial Complex (a private industrial park) has been established in 1992. AC is Iran's leading and most prestigious producer of high quality cables as per national and international standards.

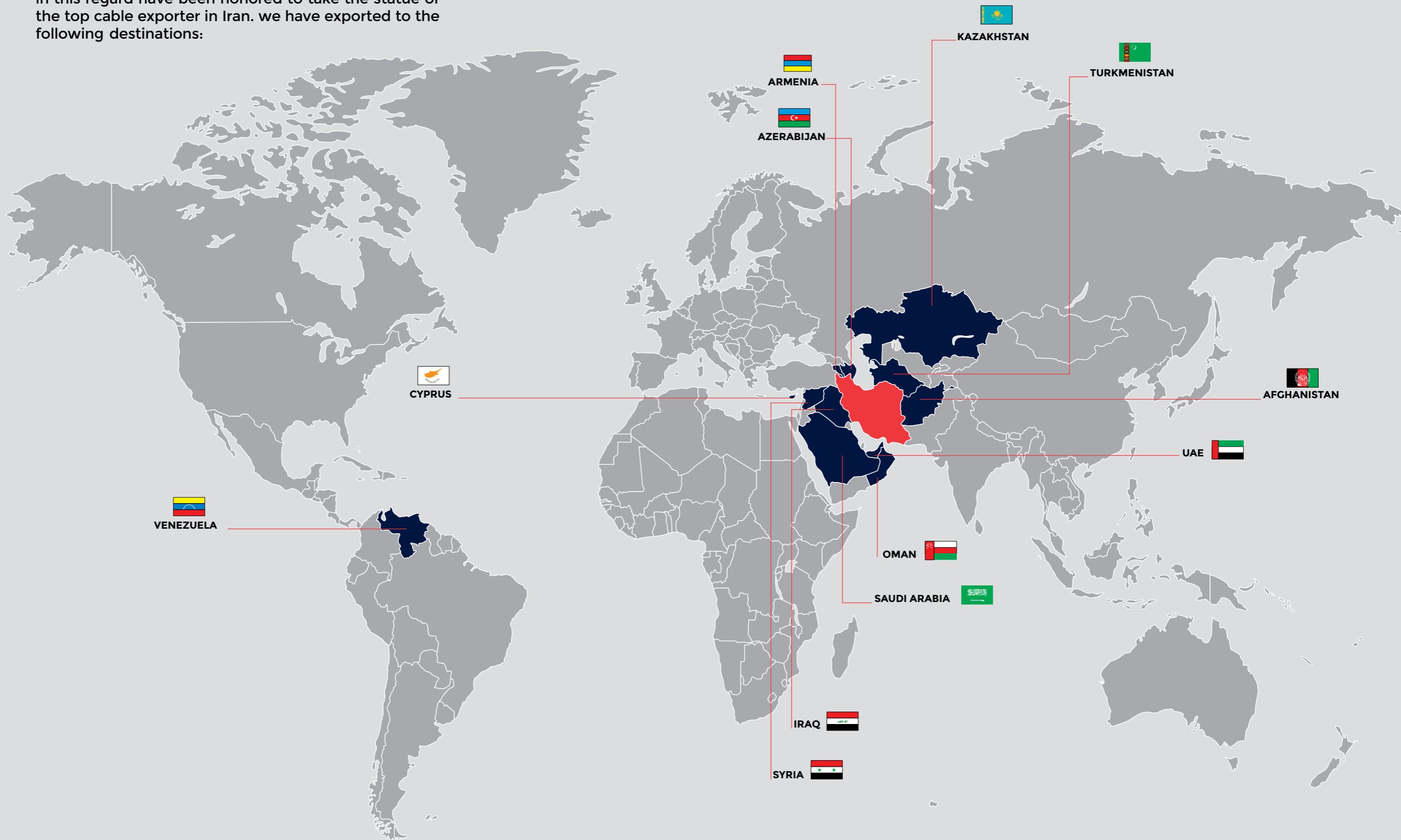
Our factory is based in over 20,000 m² covered spaces (land area: 54 Hectare) of production and services in Abhar city in western of Iran, is equipped with the latest machineries and modern testing equipment. We produce a wide range of products (up to 400 kV & 2000 mm²) with about 500 employees.

Since its establishment, AC has supplied various types of wires and cables to medium and large scale projects in Power, Infrastructure, Railways, Subways, Transportation, Oil, Gas and Petrochemical projects in Iran and some other countries including Afghanistan, Iraq, Azerbaijan, Turkmenistan, UAE, Saudi Arabia, Sri Lanka, Venezuela, Armenia, Kazakhstan, Oman, Cyprus. AC is ISO certified since 1995 and also has various type tests certificates for its products from famous independent testing laboratories like KEMA, CESI, Warrington fire, EPIL and ISIRI.

We believe that innovation drives positive changes for both business and wider society. That's why it's at the heart of our design and development approach. Abhar Cable Company owns and runs the largest research and innovation laboratory in the Middle East - the AC Research and Development Center. In our R&D lab, we combine the latest technology with cutting-edge processes to optimize our products, evolve new ones and create the future of energy. We do research; design and develop because we believe that innovation will bright all businesses.



We are the first and largest exporter of cable in Iran and in this regard have been honored to take the statue of the top cable exporter in Iran. we have exported to the following destinations:



Chapter 2

RAILWAY TRANSPORTATION

Today, the world is facing to rapid advances in rail transportation that can create a variety of experiences for humans.

Along with the growing population and urbanization, strategic planning and decisions, especially in the field of public transportation, must be adapted to meet this trend. In addition to the infrastructural challenges posed by the development of new cities, the railway industries must also consider customer expectations, competition and increasing advances in technology. This development process requires cables with high levels of performance, reliability and safety.

Today, the world is facing to rapid advances in rail transportation that can create a variety of experiences for humans.



COMMUNICATION

Transportation and communication are centre of development in every society and its economy and means or processes of overcoming distance.



TRANSPORTATION

Rail transportation is the solution for today, future and forever. AC offers a wide range of products which provide the platform to build modern rail transport system. These products are designed for specific applications.



RAILWAY SOLUTIONS:

AC offers rolling stock cables which have an excellent performance Under the fire condition. Moreover, cables have extremely low smoke values.



Chapter 3

ROLLING STOCK CABLES
RAILWAY CABLES &
PROFILE DESCRIPTION

Abhar cable relies on its unique combination of deep cable industry experience and rigorous testing to overcome the challenges of today, and power the innovations of the future.

The rolling stock cables including Power, Instrumentation and Control cables, have been offered acc. to EN 50264 and EN 50382 standards.

The cables have the following features:

- Low smoke
- Halogen free and flame retardant
- Hydrocarbon resistant
- High temperature
- Excellent flexibility
- UV resistant
- Vermin proof

List of Products

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ROLLING STOCK Cables

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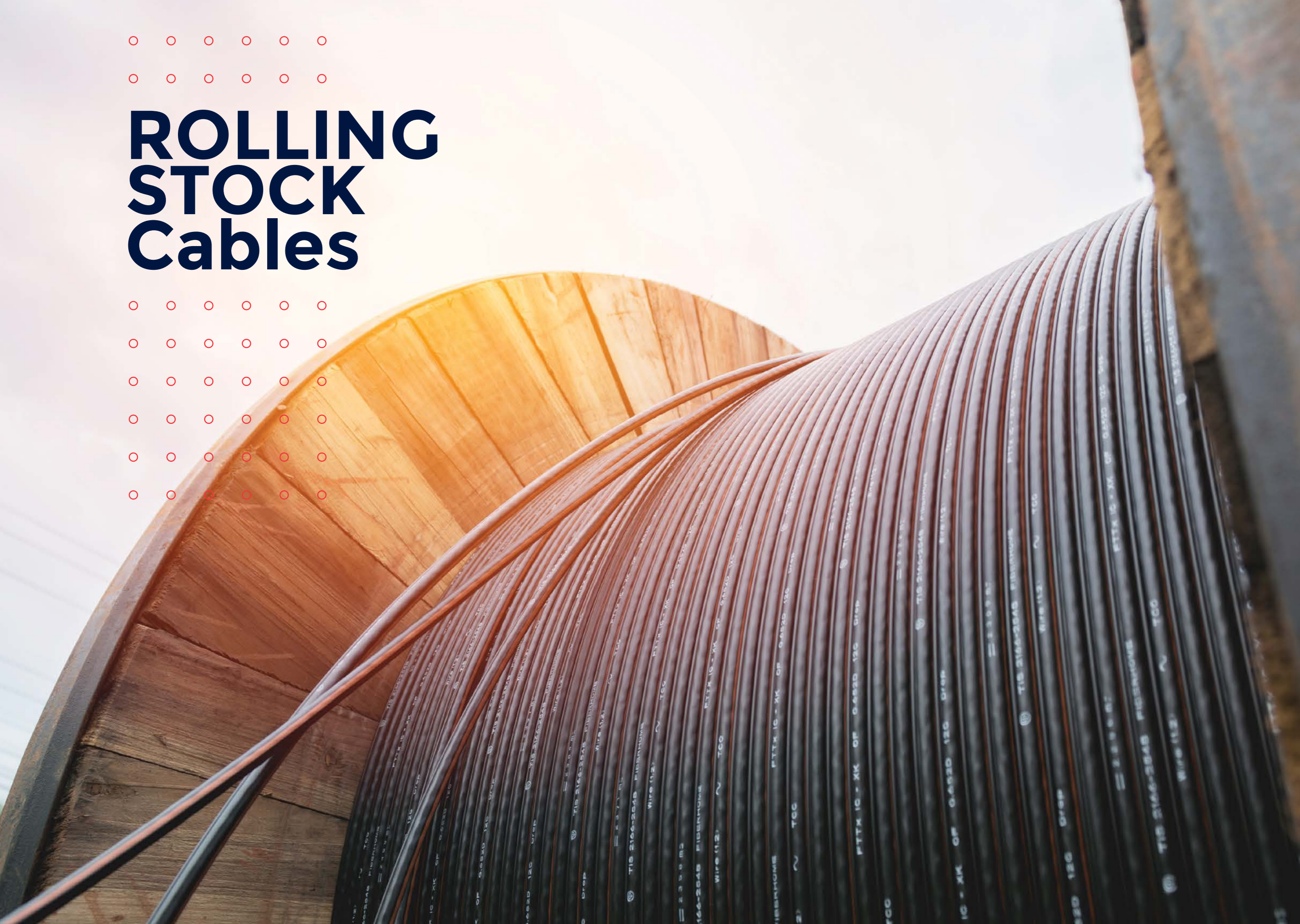
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Symbols



Ambient Temperature

Permissible minimum ambient temperature during laying and maximum conductor temperature in normal operation (+90 °C; +105 °C, +120 °C, +150 °C)
Compound resistance at low temperature (-25 °C; -40 °C)



Short Circuit Temperature

Maximum permissible short circuit temperature at conductor (+250 °C; ...)



Fire Behaviour

ACCORDING TO
EN/IEC 60332-1 flame retardant
EN/IEC 60332-3-24 + EN 50305 fire retardant



Smoke Emission

ACCORDING TO
EN/IEC 61034



Impact

Cable mechanical resistance to impacts (Good, Excellent, ...)



Toxicity

ACCORDING TO
EN/IEC 60754-1&2 + EN 50305



Bending radius - Fixed installation

Minimum bending radius for installed cables in fixed application
Value 1
Value 2



Chemicals

Outer sheath resistance to chemicals (Acid, alkaline, oil, extra oil and fuel resistance)



Bending radius - Flex installation

Minimum bending radius for installed cables in flexible application xx X OD
Value 1
Value 2

Abbreviations

RAC: Railway – ABHAR Cable Co.

MW: Medium Wall

SW: Standard Wall

T: Sheathed, for single core

power cables

M: Multi core

S: Screened

HT: High temperature

C: Screened

Flex: Multi core

3GKW: Voltage level of 0.6/1kV

4GKW: Voltage level of 1.8/kV

9GKW: Voltage level of 3.6/6kV



RAC MW

600/1000 V AC (900/1500V DC) or
1800/3000 V AC (2700/4500 V DC)

APPLICATION

Power cables with special fire performance used inboards safety circuits, lighting circuits, auxiliary circuits.
Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Tin-coated annealed copper conductor class 5 according to EN 60228

2 Insulation

LSZH elastomeric compound (Electron beam crosslinked -EI 109)

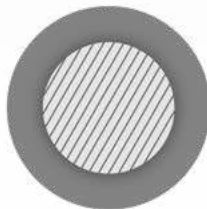
3 Marking

ABHAR CABLE RAC MW 1X35 RF SQMM 600V HALOGEN FREE EN 50264-3-1

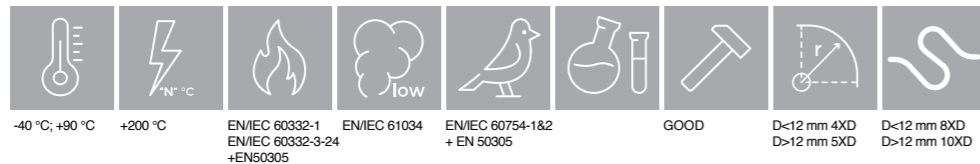
ABHAR CABLE RAC MW 1X35 RF SQMM 1800V HALOGEN FREE EN 50264-3-1

Notes

- All thicknesses are according to EN 50264-3-1
- White, grey and black colors available upon request



| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |



| RAC MW - 0.6/1kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1 x 1 | 1.32 | 2.52 | 20 | 20 | 0.12 |
| 1 x 1.5 | 1.6 | 3 | 20 | 25 | 0.18 |
| 1 x 2.5 | 2.1 | 3.5 | 30 | 33 | 0.31 |
| 1 x 4 | 2.46 | 3.86 | 50 | 46 | 0.49 |
| 1 x 6 | 3.01 | 4.41 | 60 | 60 | 0.73 |
| 1 x 10 | 3.96 | 5.36 | 100 | 85 | 1.22 |
| 1 x 16 | 5.1 | 6.5 | 160 | 110 | 1.95 |
| 1 x 25 | 6.5 | 8.3 | 270 | 150 | 3.05 |
| 1 x 35 | 7.7 | 9.5 | 370 | 190 | 4.27 |
| 1 x 50 | 9.2 | 11.2 | 520 | 240 | 6.1 |
| 1 x 70 | 11.1 | 13.3 | 730 | 300 | 8.54 |
| 1 x 95 | 12.7 | 14.9 | 950 | 360 | 11.59 |
| 1 x 120 | 14.4 | 16.8 | 1210 | 425 | 14.64 |
| 1 x 150 | 16.1 | 18.9 | 1520 | 490 | 18.3 |
| 1 x 185 | 17.7 | 20.9 | 1860 | 560 | 22.57 |
| 1 x 240 | 20.3 | 23.7 | 2430 | 675 | 29.28 |
| 1 x 300 | 22.7 | 26.3 | 3030 | 775 | 36.6 |
| 1 x 400 | 26.2 | 30.2 | 4030 | 950 | 48.8 |

| RAC MW - 1.8/3kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1 x 1.5 | 1.6 | 5.6 | 50 | 25 | 0.18 |
| 1 x 2.5 | 2.1 | 6.1 | 60 | 33 | 0.31 |
| 1 x 4 | 2.46 | 6.46 | 80 | 46 | 0.49 |
| 1 x 6 | 3.01 | 7.01 | 100 | 60 | 0.73 |
| 1 x 10 | 3.96 | 7.96 | 140 | 85 | 1.22 |
| 1 x 16 | 5.1 | 9.1 | 210 | 110 | 1.95 |
| 1 x 25 | 6.5 | 10.5 | 320 | 150 | 3.05 |
| 1 x 35 | 7.7 | 11.7 | 420 | 190 | 4.27 |
| 1 x 50 | 9.2 | 13.2 | 580 | 240 | 6.1 |
| 1 x 70 | 11.1 | 15.1 | 790 | 300 | 8.54 |
| 1 x 95 | 12.7 | 17.1 | 1030 | 360 | 11.59 |
| 1 x 120 | 14.4 | 18.8 | 1300 | 425 | 14.64 |
| 1 x 150 | 16.1 | 20.5 | 1590 | 490 | 18.3 |
| 1 x 185 | 17.7 | 22.5 | 1940 | 560 | 22.57 |
| 1 x 240 | 20.3 | 25.1 | 2510 | 675 | 29.28 |
| 1 x 300 | 22.7 | 27.5 | 3100 | 775 | 36.6 |
| 1 x 400 | 26.2 | 31.4 | 4110 | 950 | 48.8 |

RAC MW-T

1800/3000 V AC (2700/4500 V DC) or
3600/6000 V AC (5400/9000 V DC)



APPLICATION

Power cables with special fire performance used in medium voltage circuits. Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Tin-coated annealed copper conductor class 5 according to EN 60228

2 Insulation

LSZH elastomeric compound (Electron beam crosslinked -EI 109)

3 Sheath

LSZH elastomeric compound (EM 104)

4 Marking

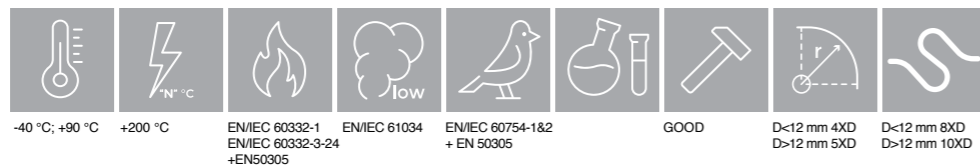
ABHAR CABLE RAC MW-T 1X95 RF SQMM CONTROL 1800V HALOGEN FREE EN 50264-3-1

ABHAR CABLE RAC MW-T 1X95 RF SQMM CONTROL 3600V HALOGEN FREE EN 50264-3-1

Notes

- All thicknesses are according to EN 50264-3-1
- White, grey and black colors available upon request

| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |

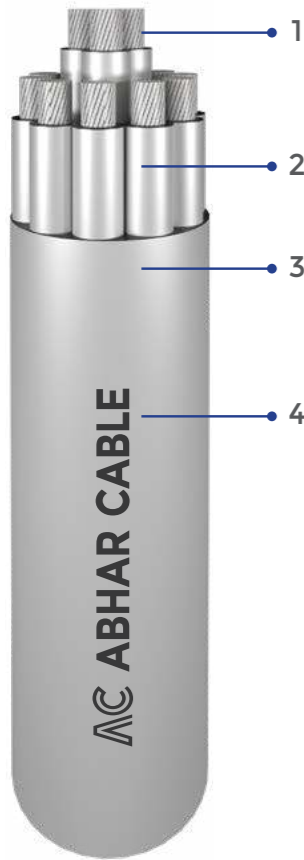


| RAC MW-T - 1.8/3kV | | | | | |
|-------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm2) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1x1.5 | 1.6 | 5.8 | 50 | 25 | 0.18 |
| 1 x 2.5 | 2.1 | 6.3 | 70 | 33 | 0.31 |
| 1 x 4 | 2.46 | 6.7 | 80 | 46 | 0.49 |
| 1 x 6 | 3.01 | 7.2 | 100 | 60 | 0.73 |
| 1 x 10 | 3.96 | 8.6 | 150 | 85 | 1.22 |
| 1 x 16 | 5.1 | 9.7 | 220 | 110 | 1.95 |
| 1 x 25 | 6.5 | 12.1 | 360 | 150 | 3.05 |
| 1 x 35 | 7.7 | 13.3 | 470 | 190 | 4.27 |
| 1 x 50 | 9.2 | 14.8 | 630 | 240 | 6.1 |
| 1 x 70 | 11.1 | 16.7 | 850 | 300 | 8.54 |
| 1 x 95 | 12.7 | 19.1 | 1120 | 360 | 11.59 |
| 1 x 120 | 14.4 | 20.8 | 1390 | 425 | 14.64 |
| 1 x 150 | 16.1 | 22.9 | 1710 | 490 | 18.3 |
| 1 x 185 | 17.7 | 24.9 | 2070 | 560 | 22.57 |
| 1 x 240 | 20.3 | 27.5 | 2650 | 675 | 29.28 |
| 1 x 300 | 22.7 | 29.9 | 3260 | 775 | 36.6 |
| 1 x 400 | 26.2 | 34.2 | 4330 | 950 | 48.8 |

| RAC MW-T - 3.6/Kv | | | | | |
|-------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm2) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1 x 2.5 | 2.1 | 8.9 | 110 | 33 | 0.31 |
| 1 x 4 | 2.46 | 9.3 | 130 | 46 | 0.49 |
| 1 x 6 | 3.01 | 9.8 | 150 | 60 | 0.73 |
| 1 x 10 | 3.96 | 10.8 | 200 | 85 | 1.22 |
| 1 x 16 | 5.1 | 11.9 | 270 | 110 | 1.95 |
| 1 x 25 | 6.5 | 14.3 | 430 | 150 | 3.05 |
| 1 x 35 | 7.7 | 15.5 | 540 | 190 | 4.27 |
| 1 x 50 | 9.2 | 17 | 710 | 240 | 6.1 |
| 1 x 70 | 11.1 | 18.9 | 940 | 300 | 8.54 |
| 1 x 95 | 12.7 | 20.5 | 1180 | 360 | 11.59 |
| 1 x 120 | 14.4 | 22.6 | 1480 | 425 | 14.64 |
| 1 x 150 | 16.1 | 24.3 | 1790 | 490 | 18.3 |
| 1 x 185 | 17.7 | 26.5 | 2160 | 560 | 22.57 |
| 1 x 240 | 20.3 | 29.9 | 2810 | 675 | 29.28 |
| 1 x 300 | 22.7 | 32.3 | 3430 | 775 | 36.6 |
| 1 x 400 | 26.2 | 35.8 | 4450 | 950 | 48.8 |

RAC MW-M

300/500 V or 600/1000 V AC
(900/1500V DC)



APPLICATION

Power cables with special fire performance used inboards safety circuits, lighting circuits, auxiliary circuits. Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Tin-coated annealed copper conductor class 5 according to EN 60228

2 Insulation

LSZH elastomeric compound (Electron beam crosslinked -EI 109)

3 Sheath

LSZH elastomeric compound (EM 104)

4 Marking

ABHAR CABLE RAC MW-M 5X1 RF SQMM CONTROL 300V HALOGEN FREE EN 50264-3-2

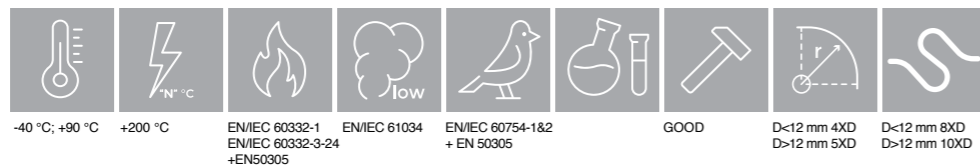
ABHAR CABLE RAC MW-M 5X1 RF SQMM CONTROL 600V HALOGEN FREE EN 50264-3-2

Notes

- All thicknesses are according to EN 50264-3-2
- Other constructions available upon request
- White, grey and black colors available upon request



| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |



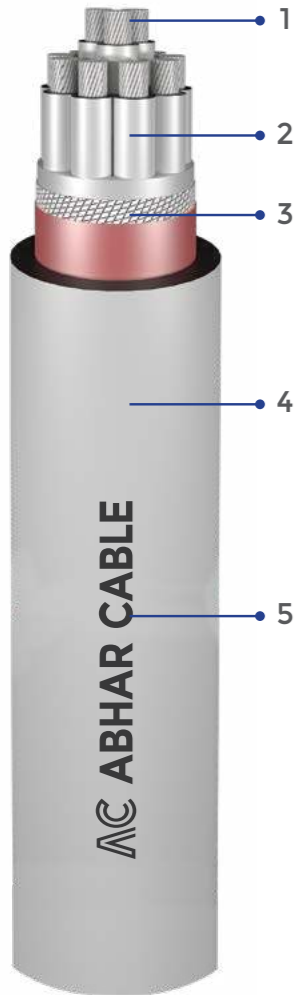
-40 °C, +90 °C +200 °C
EN/IEC 60332-1 EN/IEC 61034 EN/IEC 60754-1&2 + EN 50305
GOOD
D<12 mm 4XD D>12 mm 5XD
D<12 mm 8XD D>12 mm 10XD

| RAC MW-M - 300/500V | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 2 x 1 | 1.32 | 5.5 | 60 | 16 | 0.12 |
| 4 x 1 | 1.32 | 6.4 | 90 | 16 | 0.12 |
| 7 x 1 | 1.32 | 7.9 | 120 | 10.4 | 0.12 |
| 9 x 1 | 1.32 | 10 | 150 | 9.3 | 0.12 |
| 12 x 1 | 1.32 | 10.3 | 180 | 8.5 | 0.12 |
| 19 x 1 | 1.32 | 12.3 | 280 | 7.2 | 0.12 |
| 24 x 1 | 1.32 | 14.8 | 360 | 6.4 | 0.12 |
| 32 x 1 | 1.32 | 16.3 | 470 | 5.6 | 0.12 |
| 37 x 1 | 1.32 | 16.9 | 530 | 5.4 | 0.12 |
| 40 x 1 | 1.32 | 17.6 | 570 | 5.3 | 0.12 |
| 4 x 1.5 | 1.6 | 7.8 | 130 | 20 | 0.18 |
| 7 x 1.5 | 1.6 | 9.3 | 150 | 13 | 0.18 |
| 9 x 1.5 | 1.6 | 12.1 | 200 | 11.6 | 0.18 |
| 12 x 1.5 | 1.6 | 12.5 | 250 | 10.6 | 0.18 |
| 19 x 1.5 | 1.6 | 15.1 | 400 | 9 | 0.18 |
| 24 x 1.5 | 1.6 | 17.7 | 490 | 8 | 0.18 |
| 32 x 1.5 | 1.6 | 19.9 | 660 | 7 | 0.18 |
| 37 x 1.5 | 1.6 | 20.7 | 750 | 6.8 | 0.18 |
| 4 x 2.5 | 2.1 | 9 | 180 | 26.4 | 0.31 |
| 7 x 2.5 | 2.1 | 11 | 230 | 17.2 | 0.31 |
| 9 x 2.5 | 2.1 | 14.5 | 310 | 15.3 | 0.31 |
| 12 x 2.5 | 2.1 | 15 | 390 | 14 | 0.31 |
| 19 x 2.5 | 2.1 | 17.6 | 590 | 11.9 | 0.31 |
| 24 x 2.5 | 2.1 | 21.1 | 750 | 10.6 | 0.31 |

| RAC MW-M - 0.6/1kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 2 x 1.5 | 1.6 | 7.5 | 90 | 20 | 0.18 |
| 2 x 2.5 | 2.1 | 8.5 | 120 | 26 | 0.31 |
| 2 x 4 | 2.46 | 9.3 | 160 | 37 | 0.49 |
| 2 x 6 | 3.01 | 10.5 | 210 | 48 | 0.73 |
| 2 x 10 | 3.96 | 12.9 | 330 | 68 | 1.22 |
| 2 x 16 | 5.1 | 15.1 | 490 | 88 | 1.95 |
| 2 x 25 | 6.5 | 19.1 | 810 | 120 | 3.05 |
| 2 x 35 | 7.7 | 21.5 | 1070 | 152 | 4.27 |
| 2 x 50 | 9.2 | 25.3 | 1510 | 192 | 6.1 |
| 3 x 1.5 | 1.6 | 8 | 120 | 20 | 0.18 |
| 3 x 2.5 | 2.1 | 9 | 160 | 26 | 0.31 |
| 3 x 4 | 2.46 | 9.9 | 210 | 37 | 0.49 |
| 3 x 6 | 3.01 | 11.2 | 290 | 48 | 0.73 |
| 3 x 10 | 3.96 | 13.7 | 460 | 68 | 1.22 |
| 3 x 16 | 5.1 | 16.1 | 680 | 88 | 1.95 |
| 3 x 25 | 6.5 | 20.4 | 1140 | 120 | 3.05 |
| 3 x 35 | 7.7 | 23 | 1520 | 152 | 4.27 |
| 3 x 50 | 9.2 | 27.1 | 2140 | 192 | 6.1 |
| 4 x 1.5 | 1.6 | 8.7 | 150 | 20 | 0.18 |
| 4 x 2.5 | 2.1 | 9.9 | 210 | 26 | 0.31 |
| 4 x 4 | 2.46 | 11.1 | 280 | 37 | 0.49 |
| 4 x 6 | 3.01 | 12.7 | 390 | 48 | 0.73 |
| 4 x 10 | 3.96 | 15.1 | 600 | 68 | 1.22 |
| 4 x 16 | 5.1 | 18.2 | 920 | 88 | 1.95 |
| 4 x 25 | 6.5 | 22.9 | 1530 | 120 | 3.05 |

RAC MW-MS

300/500 V or 600/1000 V AC
(900/1500V DC)



APPLICATION

Power cables with special fire performance and with an overall screen made by a tin-plated copper braid, used inboards safety circuits, lighting circuits, auxiliary circuits.
Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Tin-coated annealed copper conductor class 5 according to EN 60228

2 Insulation

LSZH elastomeric compound (Electron beam crosslinked-EI 109)

3 Screen

Tinned annealed copper wire braid with 85% coverage (with separating layer below and above)

4 Sheath

LSZH elastomeric compound (EM 104)

5 Marking

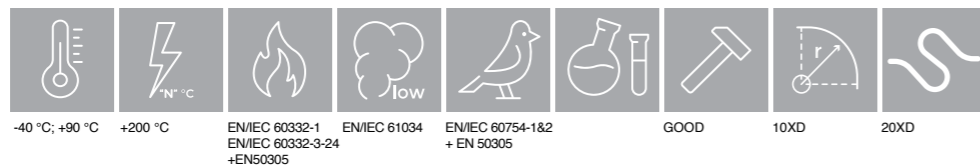
ABHAR CABLE RAC MW-MS 12X1 RF SQMM CONTROL 300V HALOGEN FREE EN 50264-3-2

ABHAR CABLE RAC MW-MS 12X1 RF SQMM CONTROL 600V HALOGEN FREE EN 50264-3-2

Notes

- All thicknesses are according to EN 50264-3-2
- Other constructions available upon request
- White, grey and black colors available upon request

| Standard | Fire protection on railway vehicles | |
|--------------|-------------------------------------|-------------------------------------|
| DIN 5510 -2 | hazard level | 1, 2, 3, 4 |
| NF F 16 -101 | class, category | C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | | |



| RAC MW-MS - 300/500V | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 2 x 1 | 1.32 | 6.4 | 90 | 16 | 0.12 |
| 4 x 1 | 1.32 | 7.5 | 140 | 16 | 0.12 |
| 7 x 1 | 1.32 | 8.8 | 150 | 10.4 | 0.12 |
| 9 x 1 | 1.32 | 11.1 | 200 | 9.3 | 0.12 |
| 12 x 1 | 1.32 | 11.4 | 240 | 8.5 | 0.12 |
| 19 x 1 | 1.32 | 13.6 | 350 | 7.2 | 0.12 |
| 24 x 1 | 1.32 | 15.7 | 440 | 6.4 | 0.12 |
| 32 x 1 | 1.32 | 17.2 | 550 | 5.6 | 0.12 |
| 37 x 1 | 1.32 | 17.8 | 610 | 5.4 | 0.12 |
| 40 x 1 | 1.32 | 18.9 | 670 | 5.3 | 0.12 |
| 4 x 1.5 | 1.6 | 8.7 | 180 | 20 | 0.18 |
| 7 x 1.5 | 1.6 | 10.2 | 200 | 13 | 0.18 |
| 9 x 1.5 | 1.6 | 13.4 | 270 | 11.6 | 0.18 |
| 12 x 1.5 | 1.6 | 13.8 | 330 | 10.6 | 0.18 |
| 19 x 1.5 | 1.6 | 16 | 470 | 9 | 0.18 |
| 24 x 1.5 | 1.6 | 19 | 600 | 8 | 0.18 |
| 32 x 1.5 | 1.6 | 20.8 | 750 | 7 | 0.18 |
| 37 x 1.5 | 1.6 | 21.6 | 850 | 6.8 | 0.18 |
| 4 x 2.5 | 2.1 | 9.9 | 250 | 26.4 | 0.31 |
| 7 x 2.5 | 2.1 | 11.9 | 280 | 17.2 | 0.31 |
| 9 x 2.5 | 2.1 | 15.4 | 380 | 15.3 | 0.31 |
| 12 x 2.5 | 2.1 | 15.9 | 460 | 14 | 0.31 |
| 19 x 2.5 | 2.1 | 18.9 | 690 | 11.9 | 0.31 |
| 24 x 2.5 | 2.1 | 22 | 850 | 10.6 | 0.31 |

| RAC MW-MS - 0.6/1kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 2 x 1.5 | 1.6 | 8.4 | 140 | 20 | 0.18 |
| 2 x 2.5 | 2.1 | 9.4 | 180 | 26 | 0.31 |
| 2 x 4 | 2.46 | 10.4 | 230 | 37 | 0.49 |
| 2 x 6 | 3.01 | 11.4 | 280 | 48 | 0.73 |
| 2 x 10 | 3.96 | 13.8 | 420 | 68 | 1.22 |
| 2 x 16 | 5.1 | 16 | 590 | 88 | 1.95 |
| 2 x 25 | 6.5 | 20 | 940 | 120 | 3.05 |
| 2 x 35 | 7.7 | 22.8 | 1240 | 152 | 4.27 |
| 2 x 50 | 9.2 | 26.2 | 1680 | 192 | 6.1 |
| 3 x 1.5 | 1.6 | 8.9 | 170 | 20 | 0.18 |
| 3 x 2.5 | 2.1 | 9.9 | 220 | 26 | 0.31 |
| 3 x 4 | 2.46 | 11 | 290 | 37 | 0.49 |
| 3 x 6 | 3.01 | 12.1 | 360 | 48 | 0.73 |
| 3 x 10 | 3.96 | 14.6 | 550 | 68 | 1.22 |
| 3 x 16 | 5.1 | 17.4 | 800 | 88 | 1.95 |
| 3 x 25 | 6.5 | 21.3 | 1280 | 120 | 3.05 |
| 3 x 35 | 7.7 | 24.3 | 1690 | 152 | 4.27 |
| 3 x 50 | 9.2 | 28.4 | 2350 | 192 | 6.1 |
| 4 x 1.5 | 1.6 | 9.6 | 210 | 20 | 0.18 |
| 4 x 2.5 | 2.1 | 11 | 280 | 26 | 0.31 |
| 4 x 4 | 2.46 | 12 | 360 | 37 | 0.49 |
| 4 x 6 | 3.01 | 13.6 | 470 | 48 | 0.73 |
| 4 x 10 | 3.96 | 16 | 700 | 68 | 1.22 |
| 4 x 16 | 5.1 | 19.1 | 1040 | 88 | 1.95 |
| 4 x 25 | 6.5 | 23.8 | 1690 | 120 | 3.05 |

RAC SW

600/1000 V AC (900/1500V DC) or
1800/3000 V AC (2700/4500 V DC)

APPLICATION

Power cables with special fire performance used inboards safety circuits, lighting circuits, auxiliary circuits. Usable on railway vehicles having the hazard level HL3 according to EN 45545

CONSTRUCTION

1 Conductor

Tin-coated annealed copper conductor class 5 according to EN 60228

2 Insulation

LSZH elastomeric compound (Electron beam crosslinked -EI 104)

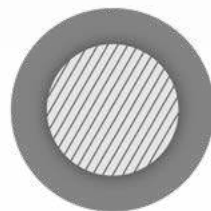
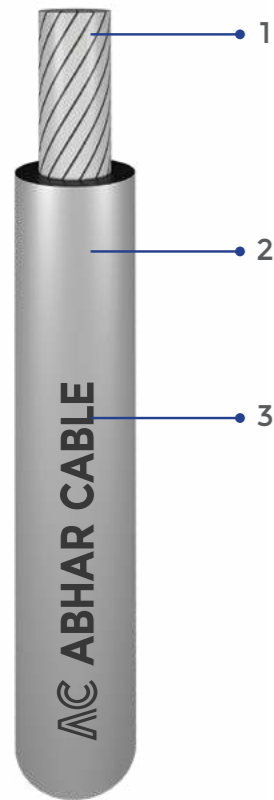
3 Marking

ABHAR CABLE RAC SW 1X25 RF SQMM 600V HALOGEN FREE EN 50264-2-1

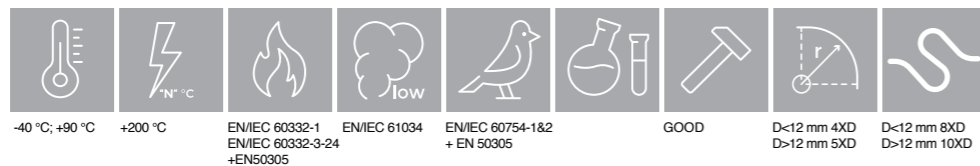
ABHAR CABLE RAC SW 1X25 RF SQMM 1800KV HALOGEN FREE EN 50264-2-1

Notes

- All thicknesses are according to EN 50264-2-1
- White, grey and black colors available upon request



| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |



| RAC SW - 0.6/1kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1 x 1 | 1.32 | 2.92 | 20 | 20 | 0.12 |
| 1 x 1.5 | 1.6 | 3.2 | 30 | 25 | 0.18 |
| 1 x 2.5 | 2.1 | 3.7 | 40 | 33 | 0.31 |
| 1 x 4 | 2.46 | 4.06 | 50 | 46 | 0.49 |
| 1 x 6 | 3.01 | 4.81 | 70 | 60 | 0.73 |
| 1 x 10 | 3.96 | 6.16 | 110 | 85 | 1.22 |
| 1 x 16 | 5.1 | 7.3 | 170 | 110 | 1.95 |
| 1 x 25 | 6.5 | 8.9 | 280 | 150 | 3.05 |
| 1 x 35 | 7.7 | 10.3 | 390 | 190 | 4.27 |
| 1 x 50 | 9.2 | 12.2 | 550 | 240 | 6.1 |
| 1 x 70 | 11.1 | 14.1 | 760 | 300 | 8.54 |
| 1 x 95 | 12.7 | 15.9 | 990 | 360 | 11.59 |
| 1 x 120 | 14.4 | 17.6 | 1250 | 425 | 14.64 |
| 1 x 150 | 16.1 | 19.9 | 1560 | 490 | 18.3 |
| 1 x 185 | 17.7 | 21.5 | 1880 | 560 | 22.57 |
| 1 x 240 | 20.3 | 24.5 | 2480 | 675 | 29.28 |
| 1 x 300 | 22.7 | 27.1 | 3070 | 775 | 36.6 |
| 1 x 400 | 26.2 | 30.8 | 4070 | 950 | 48.8 |

| RAC SW - 1.8/3kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1 x 1.5 | 1.6 | 6.6 | 60 | 25 | 0.18 |
| 1 x 2.5 | 2.1 | 7.1 | 80 | 33 | 0.31 |
| 1 x 4 | 2.46 | 7.46 | 90 | 46 | 0.49 |
| 1 x 6 | 3.01 | 8.01 | 120 | 60 | 0.73 |
| 1 x 10 | 3.96 | 8.96 | 160 | 85 | 1.22 |
| 1 x 16 | 5.1 | 10.1 | 230 | 110 | 1.95 |
| 1 x 25 | 6.5 | 11.5 | 340 | 150 | 3.05 |
| 1 x 35 | 7.7 | 12.7 | 450 | 190 | 4.27 |
| 1 x 50 | 9.2 | 14.2 | 610 | 240 | 6.1 |
| 1 x 70 | 11.1 | 16.1 | 830 | 300 | 8.54 |
| 1 x 95 | 12.7 | 18.1 | 1070 | 360 | 11.59 |
| 1 x 120 | 14.4 | 19.8 | 1340 | 425 | 14.64 |
| 1 x 150 | 16.1 | 21.5 | 1640 | 490 | 18.3 |
| 1 x 185 | 17.7 | 23.1 | 1970 | 560 | 22.57 |
| 1 x 240 | 20.3 | 25.7 | 2540 | 675 | 29.28 |
| 1 x 300 | 22.7 | 28.1 | 3140 | 775 | 36.6 |
| 1 x 400 | 26.2 | 32 | 4160 | 950 | 48.8 |

RAC SW-T

1800/3000 V AC (2700/4500 V DC) or
3600/6000 V AC (5400/9000 V DC)

APPLICATION

Power cables with special fire performance used in medium voltage circuits.

Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Tin-coated annealed copper conductor class 5 according to EN 60228

2 Insulation

LSZH elastomeric compound (Electron beam crosslinked -EI 104)

3 Sheath

LSZH elastomeric compound (EM 104)

4 Marking

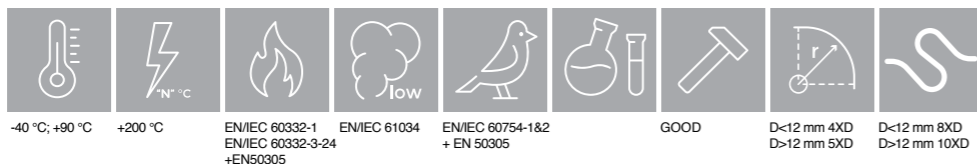
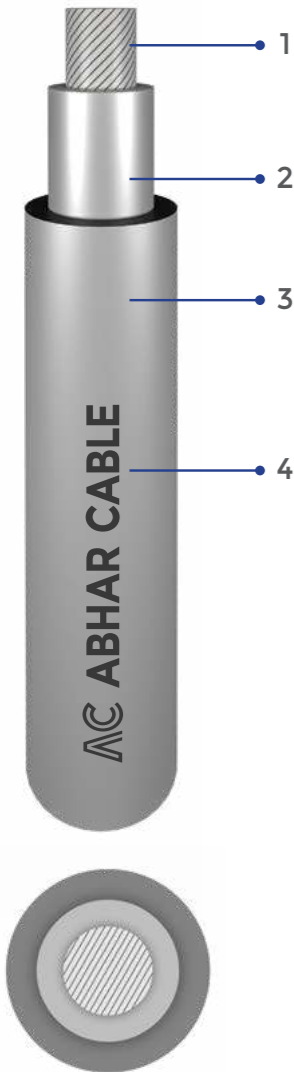
ABHAR CABLE RAC SW-T 1X150 RF SQMM POWER 1800V HALOGEN FREE EN 50264-2-1

ABHAR CABLE RAC SW-T 1X150 RF SQMM POWER 3600V HALOGEN FREE EN 50264-2-1

Notes

- All thicknesses are according to EN 50264-2-1
- White, grey and black colors available upon request

| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |

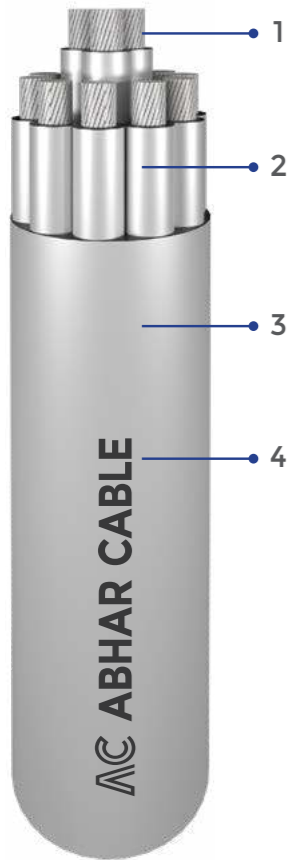


| RAC SW-T - 1.8/3kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1 x 1.5 | 1.6 | 7 | 70 | 25 | 0.18 |
| 1 x 2.5 | 2.1 | 7.5 | 80 | 33 | 0.31 |
| 1 x 4 | 2.46 | 7.9 | 100 | 46 | 0.49 |
| 1 x 6 | 3.01 | 8.4 | 120 | 60 | 0.73 |
| 1 x 10 | 3.96 | 11.2 | 210 | 85 | 1.22 |
| 1 x 16 | 5.1 | 12.3 | 280 | 110 | 1.95 |
| 1 x 25 | 6.5 | 13.7 | 410 | 150 | 3.05 |
| 1 x 35 | 7.7 | 14.9 | 520 | 190 | 4.27 |
| 1 x 50 | 9.2 | 16.4 | 690 | 240 | 6.1 |
| 1 x 70 | 11.1 | 18.5 | 920 | 300 | 8.54 |
| 1 x 95 | 12.7 | 20.7 | 1190 | 360 | 11.59 |
| 1 x 120 | 14.4 | 22.4 | 1470 | 425 | 14.64 |
| 1 x 150 | 16.1 | 24.3 | 1790 | 490 | 18.3 |
| 1 x 185 | 17.7 | 25.9 | 2120 | 560 | 22.57 |
| 1 x 240 | 20.3 | 28.7 | 2730 | 675 | 29.28 |
| 1 x 300 | 22.7 | 31.3 | 3360 | 775 | 36.6 |
| 1 x 400 | 26.2 | 35.4 | 4420 | 950 | 48.8 |

| RAC SW-T - 3.6/6kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1 x 2.5 | 2.1 | 10.9 | 160 | 33 | 0.31 |
| 1 x 4 | 2.46 | 11.3 | 180 | 46 | 0.49 |
| 1 x 6 | 3.01 | 11.8 | 200 | 60 | 0.73 |
| 1 x 10 | 3.96 | 12.8 | 260 | 85 | 1.22 |
| 1 x 16 | 5.1 | 13.9 | 330 | 110 | 1.95 |
| 1 x 25 | 6.5 | 15.3 | 460 | 150 | 3.05 |
| 1 x 35 | 7.7 | 16.5 | 580 | 190 | 4.27 |
| 1 x 50 | 9.2 | 18.2 | 760 | 240 | 6.1 |
| 1 x 70 | 11.1 | 20.1 | 990 | 300 | 8.54 |
| 1 x 95 | 12.7 | 21.9 | 1250 | 360 | 11.59 |
| 1 x 120 | 14.4 | 24 | 1550 | 425 | 14.64 |
| 1 x 150 | 16.1 | 25.7 | 1870 | 490 | 18.3 |
| 1 x 185 | 17.7 | 27.7 | 2240 | 560 | 22.57 |
| 1 x 240 | 20.3 | 30.9 | 2880 | 675 | 29.28 |
| 1 x 300 | 22.7 | 33.3 | 3500 | 775 | 36.6 |
| 1 x 400 | 26.2 | 37 | 4550 | 950 | 48.8 |

RAC SW-M

300/500 V or 600/1000 V AC
(900/1500V DC)



APPLICATION

Power cables with special fire performance used inboards safety circuits, lighting circuits, auxiliary circuits. Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Tin-coated annealed copper conductor class 5 according to EN 60228

2 Insulation

LSZH elastomeric compound (Electron beam crosslinked -EI 104)

3 Sheath

LSZH elastomeric compound (EM 104)

4 Marking

ABHAR CABLE RAC SW-M 5X1 RF SQMM CONTROL 300 V HALOGEN FREE EN 50264-2-2

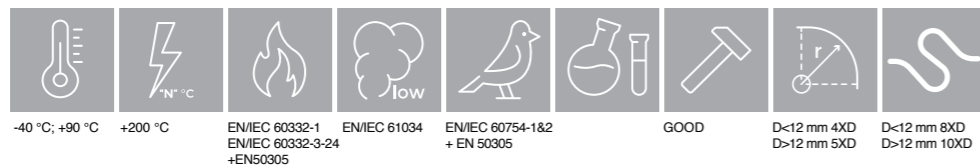
ABHAR CABLE RAC SW-M 5X1 RF SQMM CONTROL 600V HALOGEN FREE EN 50264-2-2

Notes

- All thicknesses are according to EN 50264-2-2
- Other constructions available upon request
- White, grey and black colors available upon request



| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |

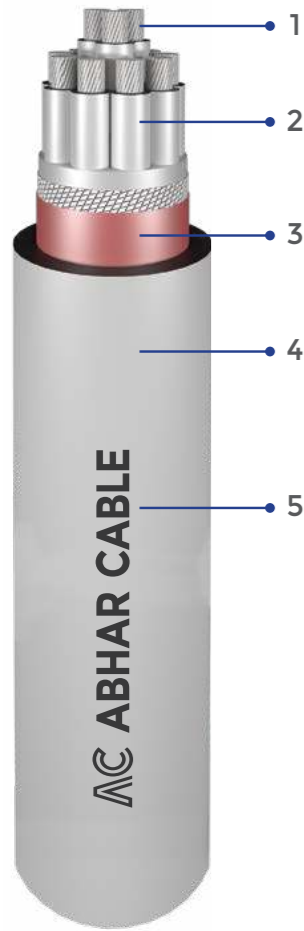


| RAC SW-M - 300/500V | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 2 x 1 | 1.32 | 7.9 | 90 | 16 | 0.12 |
| 4 x 1 | 1.32 | 9 | 140 | 16 | 0.12 |
| 7 x 1 | 1.32 | 10.5 | 170 | 10.4 | 0.12 |
| 9 x 1 | 1.32 | 13 | 210 | 9.3 | 0.12 |
| 12 x 1 | 1.32 | 13.4 | 260 | 8.5 | 0.12 |
| 19 x 1 | 1.32 | 15.5 | 370 | 7.2 | 0.12 |
| 24 x 1 | 1.32 | 18.2 | 470 | 6.4 | 0.12 |
| 32 x 1 | 1.32 | 20.2 | 600 | 5.6 | 0.12 |
| 37 x 1 | 1.32 | 20.9 | 680 | 5.4 | 0.12 |
| 40 x 1 | 1.32 | 21.8 | 730 | 5.3 | 0.12 |
| 7 x 1.5 | 1.6 | 11.9 | 210 | 13 | 0.18 |
| 9 x 1.5 | 1.6 | 14.9 | 270 | 11.6 | 0.18 |
| 12 x 1.5 | 1.6 | 15.4 | 330 | 10.6 | 0.18 |
| 19 x 1.5 | 1.6 | 18.1 | 490 | 9 | 0.18 |
| 24 x 1.5 | 1.6 | 21.3 | 620 | 8 | 0.18 |
| 32 x 1.5 | 1.6 | 23.6 | 810 | 7 | 0.18 |
| 37 x 1.5 | 1.6 | 24.5 | 910 | 6.8 | 0.18 |
| 4 x 2.5 | 2.1 | 11.9 | 260 | 26.4 | 0.31 |
| 7 x 2.5 | 2.1 | 14 | 310 | 17.2 | 0.31 |
| 9 x 2.5 | 2.1 | 17.9 | 400 | 15.3 | 0.31 |
| 12 x 2.5 | 2.1 | 18.5 | 500 | 14 | 0.31 |
| 19 x 2.5 | 2.1 | 21.8 | 750 | 11.9 | 0.31 |
| 24 x 2.5 | 2.1 | 25.9 | 960 | 10.6 | 0.31 |

| RAC SW-M - 0.6/1kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 2 x 1.5 | 1.6 | 9.3 | 130 | 20 | 0.18 |
| 2 x 2.5 | 2.1 | 10.3 | 160 | 26 | 0.31 |
| 2 x 4 | 2.46 | 11.1 | 200 | 37 | 0.49 |
| 2 x 6 | 3.01 | 12.5 | 260 | 48 | 0.73 |
| 2 x 10 | 3.96 | 15.3 | 410 | 68 | 1.22 |
| 2 x 16 | 5.1 | 17.7 | 580 | 88 | 1.95 |
| 2 x 25 | 6.5 | 21.5 | 920 | 120 | 3.05 |
| 2 x 35 | 7.7 | 24.1 | 1210 | 152 | 4.27 |
| 2 x 50 | 9.2 | 28.3 | 1690 | 192 | 6.1 |
| 3 x 1.5 | 1.6 | 9.8 | 160 | 20 | 0.18 |
| 3 x 2.5 | 2.1 | 10.9 | 210 | 26 | 0.31 |
| 3 x 4 | 2.46 | 11.7 | 260 | 37 | 0.49 |
| 3 x 6 | 3.01 | 13.2 | 350 | 48 | 0.73 |
| 3 x 10 | 3.96 | 16.5 | 560 | 68 | 1.22 |
| 3 x 16 | 5.1 | 19 | 810 | 88 | 1.95 |
| 3 x 25 | 6.5 | 23.1 | 1290 | 120 | 3.05 |
| 3 x 35 | 7.7 | 25.9 | 1700 | 152 | 4.27 |
| 3 x 50 | 9.2 | 30.2 | 2370 | 192 | 6.1 |
| 4 x 1.5 | 1.6 | 10.6 | 200 | 20 | 0.18 |
| 4 x 2.5 | 2.1 | 11.8 | 260 | 26 | 0.31 |
| 4 x 4 | 2.46 | 12.8 | 340 | 37 | 0.49 |
| 4 x 6 | 3.01 | 14.5 | 450 | 48 | 0.73 |
| 4 x 10 | 3.96 | 18 | 730 | 68 | 1.22 |
| 4 x 16 | 5.1 | 20.9 | 1060 | 88 | 1.95 |
| 4 x 25 | 6.5 | 25.6 | 1720 | 120 | 3.05 |

RAC SW-MS

300/500 V or 600/1000 V AC
(900/1500V DC)



APPLICATION

Power cables with special fire performance used inboards safety circuits, lighting circuits, auxiliary circuits, with tin-plated copper braid screen. Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Tin-coated annealed copper conductor class 5 according to EN 60228

2 Insulation

LSZH elastomeric compound (Electron beam crosslinked -EI 104)

3 Screen

Tinned annealed copper wire braid with 85% coverage (with separating layer below and above)

4 Sheath

LSZH elastomeric compound (EM 104)

5 Marking

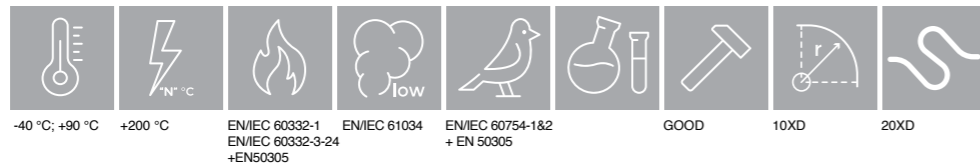
ABHAR CABLE RAC SW-MS 5X1 RF SQMM CONTROL 300V HALOGEN FREE EN 50264-2-2

ABHAR CABLE RAC SW-MS 5X1 RF SQMM CONTROL 600V HALOGEN FREE EN 50264-2-

Notes

- White, grey and black colors available upon request

| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |



| RAC SW-MS - 300/500V | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 2 x 1 | 1.32 | 8.8 | 140 | 16 | 0.12 |
| 4 x 1 | 1.32 | 9.9 | 200 | 16 | 0.12 |
| 7 x 1 | 1.32 | 11.4 | 210 | 10.4 | 0.12 |
| 9 x 1 | 1.32 | 13.9 | 270 | 9.3 | 0.12 |
| 12 x 1 | 1.32 | 14.3 | 310 | 8.5 | 0.12 |
| 19 x 1 | 1.32 | 16.6 | 440 | 7.2 | 0.12 |
| 24 x 1 | 1.32 | 19.3 | 550 | 6.4 | 0.12 |
| 32 x 1 | 1.32 | 21.1 | 680 | 5.6 | 0.12 |
| 37 x 1 | 1.32 | 22 | 770 | 5.4 | 0.12 |
| 40 x 1 | 1.32 | 22.9 | 820 | 5.3 | 0.12 |
| 7 x 1.5 | 1.6 | 12.8 | 260 | 13 | 0.18 |
| 9 x 1.5 | 1.6 | 15.8 | 340 | 11.6 | 0.18 |
| 12 x 1.5 | 1.6 | 16.5 | 410 | 10.6 | 0.18 |
| 19 x 1.5 | 1.6 | 19 | 570 | 9 | 0.18 |
| 24 x 1.5 | 1.6 | 22.2 | 710 | 8 | 0.18 |
| 32 x 1.5 | 1.6 | 24.5 | 900 | 7 | 0.18 |
| 37 x 1.5 | 1.6 | 25.4 | 1000 | 6.8 | 0.18 |
| 4 x 2.5 | 2.1 | 12.8 | 330 | 26.4 | 0.31 |
| 7 x 2.5 | 2.1 | 14.9 | 370 | 17.2 | 0.31 |
| 9 x 2.5 | 2.1 | 18.8 | 480 | 15.3 | 0.31 |
| 12 x 2.5 | 2.1 | 19.4 | 570 | 14 | 0.31 |
| 19 x 2.5 | 2.1 | 22.7 | 830 | 11.9 | 0.31 |
| 24 x 2.5 | 2.1 | 26.8 | 1050 | 10.6 | 0.31 |

| RAC SW-MS - 0.6/1kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 2 x 1.5 | 1.6 | 10.2 | 180 | 20 | 0.18 |
| 2 x 2.5 | 2.1 | 11.2 | 220 | 26 | 0.31 |
| 2 x 4 | 2.46 | 12 | 270 | 37 | 0.49 |
| 2 x 6 | 3.01 | 13.4 | 340 | 48 | 0.73 |
| 2 x 10 | 3.96 | 16.4 | 520 | 68 | 1.22 |
| 2 x 16 | 5.1 | 18.6 | 700 | 88 | 1.95 |
| 2 x 25 | 6.5 | 22.6 | 1070 | 120 | 3.05 |
| 2 x 35 | 7.7 | 25.2 | 1380 | 152 | 4.27 |
| 2 x 50 | 9.2 | 29.2 | 1880 | 192 | 6.1 |
| 3 x 1.5 | 1.6 | 10.7 | 220 | 20 | 0.18 |
| 3 x 2.5 | 2.1 | 11.8 | 270 | 26 | 0.31 |
| 3 x 4 | 2.46 | 12.6 | 330 | 37 | 0.49 |
| 3 x 6 | 3.01 | 14.1 | 430 | 48 | 0.73 |
| 3 x 10 | 3.96 | 17.4 | 670 | 68 | 1.22 |
| 3 x 16 | 5.1 | 19.9 | 930 | 88 | 1.95 |
| 3 x 25 | 6.5 | 24 | 1430 | 120 | 3.05 |
| 3 x 35 | 7.7 | 26.8 | 1860 | 152 | 4.27 |
| 3 x 50 | 9.2 | 31.3 | 2580 | 192 | 6.1 |
| 4 x 1.5 | 1.6 | 11.5 | 260 | 20 | 0.18 |
| 4 x 2.5 | 2.1 | 12.7 | 330 | 26 | 0.31 |
| 4 x 4 | 2.46 | 13.7 | 410 | 37 | 0.49 |
| 4 x 6 | 3.01 | 15.4 | 540 | 48 | 0.73 |
| 4 x 10 | 3.96 | 19.1 | 850 | 68 | 1.22 |
| 4 x 16 | 5.1 | 22 | 1200 | 88 | 1.95 |
| 4 x 25 | 6.5 | 26.5 | 1870 | 120 | 3.05 |

RAC HT

1800/3000 V AC (2700/4500 V DC) or
3600/6000 V AC (5400/9000 V DC)

APPLICATION

High temperature power cables with special fire performance for traction and power circuits. Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Flexible circular tin-coated annealed copper or plain copper conductor, class 5 according to EN 60228

2 Insulation

Silicone compound (SIR)

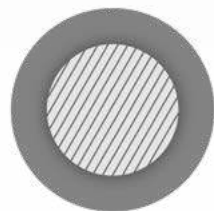
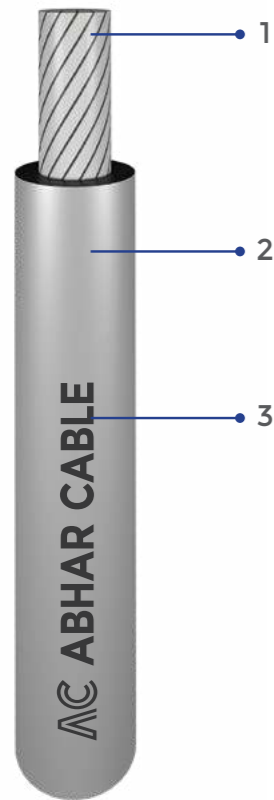
3 Marking

ABHAR CABLE RAC HT 1X95 RF SQMM 1800V HALOGEN FREE EN 50382-2

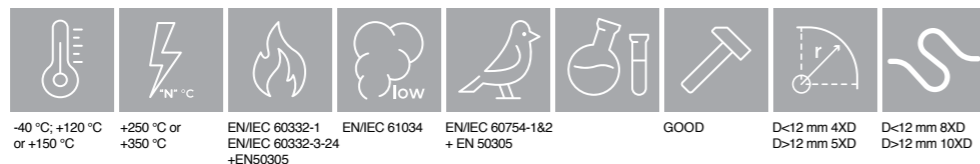
ABHAR CABLE RAC HT 1X95 RF SQMM 3600V HALOGEN FREE EN 50382-2

Notes

- All thicknesses are according to EN 50382-2
- for tinned conductors, the maximum operating temperature is limited to 120° C.



| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |



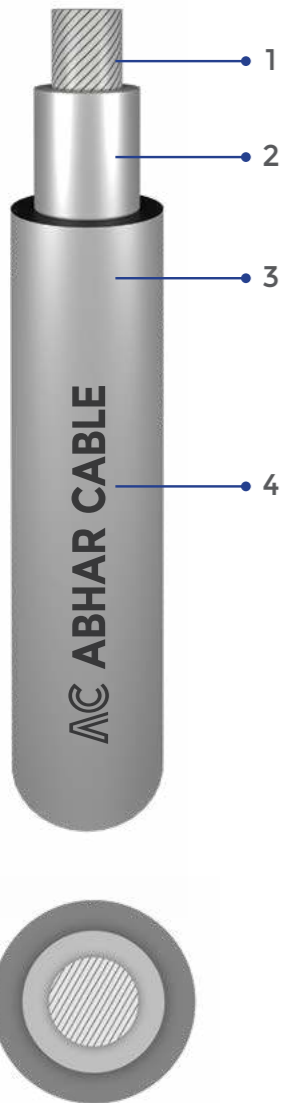
-40 °C; +120 °C or +150 °C +250 °C or +350 °C EN/IEC 60332-1 EN/IEC 60332-3-24 +EN50305 EN/IEC 61034 LOW EN/IEC 60754-1&2 + EN 50305 GOOD D<12 mm 4XD D>12 mm 5XD D<12 mm 8XD D>12 mm 10XD

| RAC HT - 3/1.8kV | | | | | |
|-------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm2) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1x1.5 | 1.6 | 6.6 | 70 | 35 | 0.19 |
| 1 x 2.5 | 2.1 | 7.1 | 80 | 46 | 0.32 |
| 1 x 4 | 2.46 | 7.46 | 100 | 64 | 0.51 |
| 1 x 6 | 3.01 | 8.01 | 120 | 84 | 0.76 |
| 1 x 10 | 3.96 | 8.96 | 170 | 119 | 1.26 |
| 1 x 16 | 5.1 | 10.1 | 240 | 154 | 2.02 |
| 1 x 25 | 6.5 | 11.5 | 350 | 210 | 3.15 |
| 1 x 35 | 7.7 | 12.7 | 460 | 266 | 4.42 |
| 1 x 50 | 9.2 | 14.2 | 620 | 336 | 6.31 |
| 1 x 70 | 11.1 | 16.1 | 840 | 420 | 8.83 |
| 1 x 95 | 12.7 | 18.1 | 1090 | 504 | 11.98 |
| 1 x 120 | 14.4 | 19.8 | 1360 | 595 | 15.14 |
| 1 x 150 | 16.1 | 21.5 | 1660 | 685 | 18.92 |
| 1 x 185 | 17.7 | 23.1 | 1990 | 783 | 23.34 |
| 1 x 240 | 20.3 | 25.7 | 2570 | 944 | 30.27 |
| 1 x 300 | 22.7 | 28.1 | 3170 | 1084 | 37.84 |
| 1 x 400 | 26.2 | 32 | 4200 | 1329 | 50.45 |

| RAC HT - 6/3.6kV | | | | | |
|-------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm2) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1x2.5 | 2.1 | 8.1 | 100 | 46 | 0.32 |
| 1 x 4 | 2.46 | 8.46 | 120 | 64 | 0.51 |
| 1 x 6 | 3.01 | 9.01 | 140 | 84 | 0.76 |
| 1 x 10 | 3.96 | 9.96 | 190 | 119 | 1.26 |
| 1 x 16 | 5.1 | 11.1 | 260 | 154 | 2.02 |
| 1 x 25 | 6.5 | 12.5 | 380 | 210 | 3.15 |
| 1 x 35 | 7.7 | 13.7 | 500 | 266 | 4.42 |
| 1 x 50 | 9.2 | 15.2 | 660 | 336 | 6.31 |
| 1 x 70 | 11.1 | 17.1 | 890 | 420 | 8.83 |
| 1 x 95 | 12.7 | 18.7 | 1120 | 504 | 11.98 |
| 1 x 120 | 14.4 | 20.6 | 1400 | 595 | 15.14 |
| 1 x 150 | 16.1 | 22.3 | 1710 | 685 | 18.92 |
| 1 x 185 | 17.7 | 24.1 | 2050 | 783 | 23.34 |
| 1 x 240 | 20.3 | 27.1 | 2670 | 944 | 30.27 |
| 1 x 300 | 22.7 | 29.5 | 3270 | 1084 | 37.84 |
| 1 x 400 | 26.2 | 33 | 4280 | 1329 | 50.45 |

RAC HT-T

1800/3000 V AC (2700/4500 V DC) or
3600/6000 V AC (5400/9000 V DC)



APPLICATION

High temperature power cables with special fire performance for traction and power circuits, with protective outer sheath and flexible class 5 tin-plated copper core.
Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Flexible circular tin-coated annealed copper or plain copper conductor, class 5 according to EN 60228

2 Insulation

Silicone compound (SIR)

3 Sheath

LSZH elastomeric compound

4 Marking

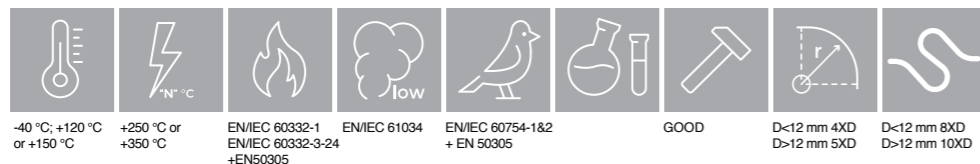
ABHAR CABLE RAC HT-T 1X95 RF SQMM POWER 1800V HALOGEN FREE EN 50382-2

ABHAR CABLE RAC HT-T 1X95 RF SQMM POWER 3600V HALOGEN FREE EN 50382-2

Notes

- All thicknesses are according to EN 50382-2
- For tinned conductors, the maximum operating temperature is limited to 120° C.

| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |



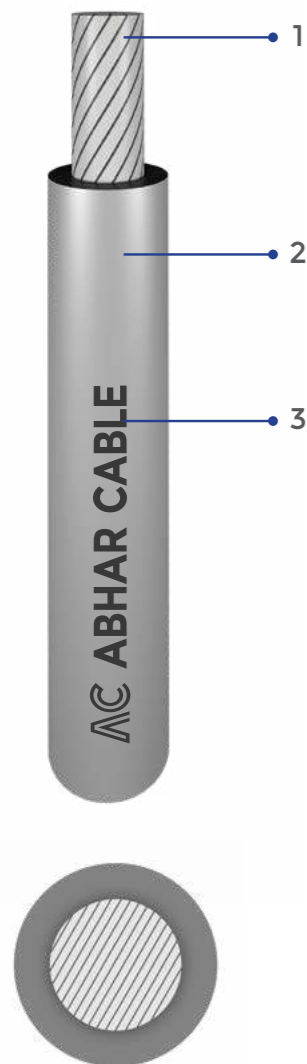
-40 °C; +120 °C or +150 °C | +250 °C or +350 °C | EN/IEC 60332-1 EN/IEC 60332-3-24 +EN50305 | EN/IEC 61034 | EN/IEC 60754-1&2 + EN 50305 | GOOD | D<12 mm 4XD D>12 mm 5XD | D<12 mm 8XD D>12 mm 10XD

| RAC v - 3/1.8kV | | | | | |
|-------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm2) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1x1.5 | 1.6 | 7 | 70 | 35 | 0.19 |
| 1 x 2.5 | 2.1 | 7.5 | 90 | 46 | 0.32 |
| 1 x 4 | 2.46 | 7.9 | 100 | 64 | 0.51 |
| 1 x 6 | 3.01 | 8.4 | 130 | 84 | 0.76 |
| 1 x 10 | 3.96 | 9.8 | 180 | 119 | 1.26 |
| 1 x 16 | 5.1 | 10.9 | 250 | 154 | 2.02 |
| 1 x 25 | 6.5 | 12.9 | 390 | 210 | 3.15 |
| 1 x 35 | 7.7 | 14.1 | 500 | 266 | 4.42 |
| 1 x 50 | 9.2 | 15.6 | 670 | 336 | 6.31 |
| 1 x 70 | 11.1 | 17.7 | 900 | 420 | 8.83 |
| 1 x 95 | 12.7 | 20.1 | 1180 | 504 | 11.98 |
| 1 x 120 | 14.4 | 22 | 1460 | 595 | 15.14 |
| 1 x 150 | 16.1 | 23.7 | 1770 | 685 | 18.92 |
| 1 x 185 | 17.7 | 25.9 | 2150 | 783 | 23.34 |
| 1 x 240 | 20.3 | 28.7 | 2760 | 944 | 30.27 |
| 1 x 300 | 22.7 | 31.3 | 3390 | 1084 | 37.84 |
| 1 x 400 | 26.2 | 35.4 | 4460 | 1329 | 50.45 |

| RAC HT-T - 6/3.6kV | | | | | |
|-------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm2) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1 x 2.5 | 2.1 | 10.1 | 140 | 33 | 0.32 |
| 1 x 4 | 2.46 | 10.5 | 160 | 46 | 0.51 |
| 1 x 6 | 3.01 | 11 | 190 | 60 | 0.76 |
| 1 x 10 | 3.96 | 12 | 240 | 85 | 1.26 |
| 1 x 16 | 5.1 | 13.1 | 320 | 110 | 2.02 |
| 1 x 25 | 6.5 | 15.1 | 470 | 150 | 3.15 |
| 1 x 35 | 7.7 | 16.3 | 580 | 190 | 4.42 |
| 1 x 50 | 9.2 | 18 | 770 | 240 | 6.31 |
| 1 x 70 | 11.1 | 19.9 | 1000 | 300 | 8.83 |
| 1 x 95 | 12.7 | 21.7 | 1260 | 360 | 11.98 |
| 1 x 120 | 14.4 | 23.4 | 1540 | 425 | 15.14 |
| 1 x 150 | 16.1 | 25.3 | 1870 | 490 | 18.92 |
| 1 x 185 | 17.7 | 27.7 | 2270 | 560 | 23.34 |
| 1 x 240 | 20.3 | 30.9 | 2920 | 675 | 30.27 |
| 1 x 300 | 22.7 | 33.3 | 3550 | 775 | 37.84 |
| 1 x 400 | 26.2 | 37 | 4600 | 950 | 50.45 |

RAC 3GKW

600/1000 V AC (900/1500V DC)



APPLICATION

Power cables used in carriage wiring, terminal boxes. Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Copper, tinned, finely stranded class 5 according to EN 60228

2 Insulation

LSZH, cross-linked elastomeric compound (Electron beam crosslinked -EI 109)

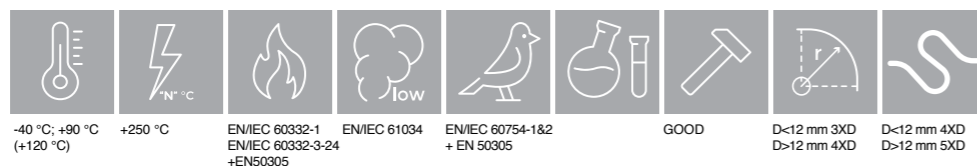
3 Marking

ABHAR CABLE RAC 3GKW 1X2.5 RF SQMM 600V HALOGEN FREE

Notes

-White, grey and black colors available upon request

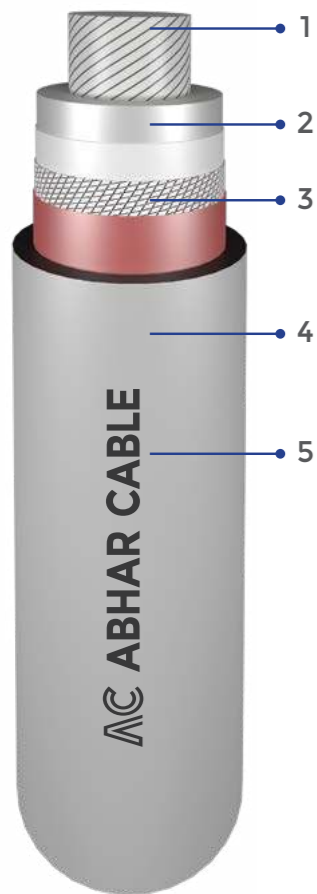
| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |



| RAC 3GKW - 0.6/1kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1 x 0.5 | 0.93 | 2.13 | 10 | 14 | 0.07 |
| 1 x 0.75 | 1.14 | 2.34 | 20 | 16 | 0.11 |
| 1 x 1 | 1.32 | 2.52 | 20 | 20 | 0.14 |
| 1 x 1.5 | 1.6 | 3 | 20 | 25 | 0.21 |
| 1 x 2.5 | 2.1 | 3.5 | 30 | 33 | 0.36 |
| 1 x 4 | 2.46 | 3.86 | 50 | 46 | 0.57 |
| 1 x 6 | 3.01 | 4.41 | 60 | 60 | 0.86 |
| 1 x 10 | 3.96 | 5.36 | 100 | 85 | 1.43 |
| 1 x 16 | 5.1 | 6.5 | 160 | 110 | 2.29 |
| 1 x 25 | 6.5 | 8.3 | 270 | 150 | 3.58 |
| 1 x 35 | 7.7 | 9.5 | 370 | 190 | 5.01 |
| 1 x 50 | 9.2 | 11.2 | 520 | 240 | 7.15 |
| 1 x 70 | 11.1 | 13.3 | 730 | 300 | 10.0 |
| 1 x 95 | 12.7 | 14.9 | 950 | 360 | 13.6 |
| 1 x 120 | 14.4 | 16.8 | 1210 | 425 | 17.2 |
| 1 x 150 | 16.1 | 18.9 | 1520 | 490 | 21.5 |
| 1 x 185 | 17.7 | 20.9 | 1860 | 560 | 26.5 |
| 1 x 240 | 20.3 | 23.7 | 2430 | 675 | 34.3 |
| 1 x 300 | 22.7 | 26.3 | 3030 | 775 | 42.9 |
| 1 x 400 | 26.2 | 30.2 | 4030 | 950 | 57.2 |

RAC 3GKW C

600/1000 V AC (900/1500V DC)



APPLICATION

Power cables used in carriage wiring, terminal boxes, with tin-plated copper braid screen. Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Copper, tinned, finely stranded class 5 according to EN 60228

2 Insulation

LSZH elastomeric compound (Electron beam crosslinked-EI 109)

3 Screen

Tinned annealed copper wire braid with 85% coverage (with separating layer below and above)

4 Sheath

LSZH, cross-linked elastomeric compound (EM 104)

5 Marking

ABHAR CABLE RAC 3GKW C 1X2.5 RF SQMM Control 600V HALOGEN FREE

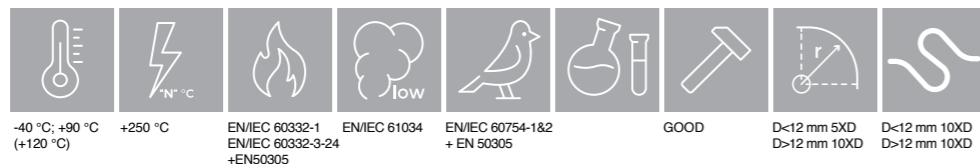
Notes

-White, grey and black colors available upon request



| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |

| RAC 3GKW C - 0.6/1kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1 x 1.5 | 1.6 | 5.4 | 60 | 25 | 0.21 |
| 1 x 2.5 | 2.1 | 5.9 | 80 | 33 | 0.36 |
| 1 x 4 | 2.46 | 6.3 | 90 | 46 | 0.57 |
| 1 x 6 | 3.01 | 6.8 | 110 | 60 | 0.86 |
| 1 x 10 | 3.96 | 7.8 | 160 | 85 | 1.43 |
| 1 x 16 | 5.1 | 8.9 | 230 | 110 | 2.29 |
| 1 x 25 | 6.5 | 10.9 | 360 | 150 | 3.58 |
| 1 x 35 | 7.7 | 12.5 | 480 | 190 | 5.01 |
| 1 x 50 | 9.2 | 14.2 | 650 | 240 | 7.15 |
| 1 x 70 | 11.1 | 16.3 | 880 | 300 | 10.0 |
| 1 x 95 | 12.7 | 18.3 | 1130 | 360 | 13.6 |
| 1 x 120 | 14.4 | 20.2 | 1410 | 425 | 17.2 |
| 1 x 150 | 16.1 | 22.7 | 1760 | 490 | 21.5 |
| 1 x 185 | 17.7 | 24.7 | 2120 | 560 | 26.5 |
| 1 x 240 | 20.3 | 27.9 | 2750 | 675 | 34.3 |
| 1 x 300 | 22.7 | 30.9 | 3410 | 775 | 42.9 |
| 1 x 400 | 26.2 | 34.8 | 4460 | 950 | 57.2 |



-40 °C, +90 °C (+120 °C) | +250 °C | EN/IEC 60332-1 EN/IEC 60332-3-24 +EN50305 | EN/IEC 61034 | EN/IEC 60754-1&2 + EN 50305 | GOOD | D<12 mm 5XD D>12 mm 10XD | D<12 mm 10XD D>12 mm 10XD

RAC 3GKW Flex

600/1000 V AC (900/1500V DC) (EN 50264)



APPLICATION

Power cables used in carriage wiring, terminal boxes. Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Copper, tinned, finely stranded class 5 according to EN 60228

2 Insulation

LSZH, cross-linked lastomeric compound (Electron beam crosslinked -EI 109)

3 Sheath

LSZH, cross-linked elastomeric compound (EM 104)

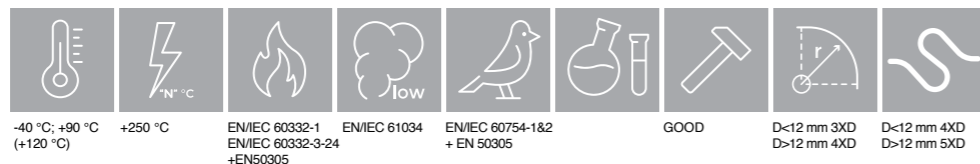
4 Marking

ABHAR CABLE RAC 3GKW Flex 3X1 RF SQMM Control 600V HALOGEN FREE

Notes

- Other constructions available upon request.
- White, grey and black colors available upon request

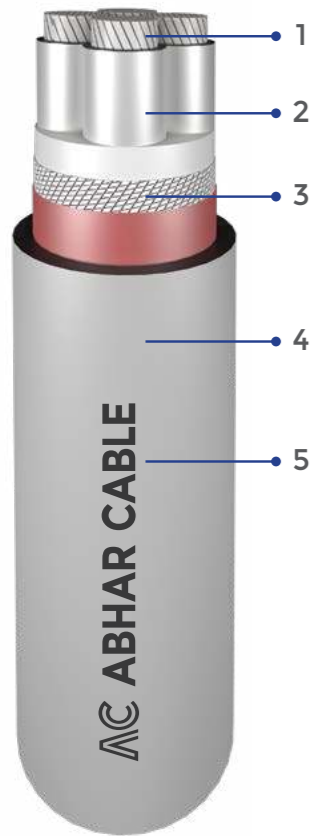
| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |



| RAC 3GKW Flex - 0.6/1kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 2 x 1.5 | 1.6 | 7.5 | 90 | 21 | 0.21 |
| 2 x 2.5 | 2.1 | 8.5 | 120 | 28 | 0.36 |
| 2 x 10 | 3.96 | 12.9 | 330 | 68 | 1.43 |
| 3 x 1.5 | 1.6 | 8 | 120 | 21 | 0.21 |
| 3 x 2.5 | 2.1 | 9 | 160 | 28 | 0.36 |
| 3 x 4 | 2.46 | 9.9 | 210 | 37 | 0.57 |
| 3 x 6 | 3.01 | 11.2 | 290 | 49 | 0.86 |
| 3 x 10 | 3.96 | 13.7 | 460 | 68 | 1.43 |
| 4 x 1.5 | 1.6 | 8.7 | 150 | 17 | 0.21 |
| 4 x 2.5 | 2.1 | 9.9 | 210 | 23 | 0.36 |
| 4 x 4 | 2.46 | 11.1 | 280 | 31 | 0.57 |
| 4 x 6 | 3.01 | 12.7 | 390 | 41 | 0.86 |
| 4 x 10 | 3.96 | 15.1 | 600 | 57 | 1.43 |
| 4 x 16 | 5.1 | 18.2 | 920 | 76 | 2.29 |
| 5 x 1.5 | 1.6 | 8.7 | 170 | 16 | 0.21 |
| 5 x 2.5 | 2.1 | 10.1 | 240 | 21 | 0.36 |
| 5 x 4 | 2.46 | 11.5 | 340 | 28 | 0.57 |
| 5 x 6 | 3.01 | 12.7 | 450 | 37 | 0.86 |
| 6 x 1.5 | 1.6 | 8.9 | 160 | 14 | 0.21 |
| 6 x 2.5 | 2.1 | 10.5 | 230 | 19 | 0.36 |
| 7 x 1.5 | 1.6 | 10.7 | 180 | 14 | 0.21 |
| 7 x 2.5 | 2.1 | 12.6 | 270 | 18 | 0.36 |

RAC 3GKW C Flex

600/1000 V AC (900/1500V DC) (EN 50264)



APPLICATION

Power cables used in carriage wiring, terminal boxes, with tin-plated copper braid screen. Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Copper, tinned, finely stranded class 5 according to EN 60228

2 Insulation

LSZH, cross-linked elastomeric compound (Electron beam crosslinked -EI 109)

3 Screen

Tinned annealed copper wire braid with 85% coverage (with separating layer below and above)

4 Sheath

LSZH, cross-linked elastomeric compound (EM 104)

5 Marking

ABHAR CABLE RAC 3GKW C Flex 4X1 RF SQMM Control 600V HALOGEN FREE

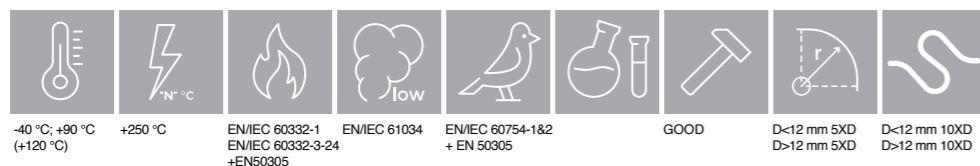
Notes

- Other constructions available upon request.
- White, grey and black colors available upon request

| RAC 3GKW C Flex - 0.6/1kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 2 x 10 | 3.96 | 13.7 | 410 | 68 | 1.43 |
| 2 x 16 | 5.1 | 16 | 590 | 90 | 2.29 |
| 3 x 1.5 | 1.6 | 8.9 | 170 | 21 | 0.21 |
| 3 x 2.5 | 2.1 | 9.9 | 220 | 28 | 0.36 |
| 3 x 4 | 2.46 | 10.9 | 280 | 37 | 0.57 |
| 4 x 1.5 | 1.6 | 9.6 | 210 | 17 | 0.21 |
| 4 x 2.5 | 2.1 | 11 | 280 | 23 | 0.36 |
| 4 x 4 | 2.46 | 11.9 | 360 | 31 | 0.57 |
| 4 x 6 | 3.01 | 13.6 | 470 | 41 | 0.86 |
| 4 x 10 | 3.96 | 15.9 | 700 | 57 | 1.43 |
| 5 x 1.5 | 1.6 | 10.7 | 260 | 16 | 0.21 |
| 5 x 2.5 | 2.1 | 12.1 | 350 | 21 | 0.36 |
| 5 x 4 | 2.46 | 13.4 | 450 | 28 | 0.57 |
| 5 x 6 | 3.01 | 14.9 | 580 | 37 | 0.86 |
| 7 x 1.5 | 1.6 | 11.6 | 230 | 14 | 0.21 |
| 7 x 2.5 | 2.1 | 13.5 | 330 | 18 | 0.36 |
| 7 x 4 | 2.46 | 14.6 | 430 | 24 | 0.57 |
| 12 x 1.5 | 1.6 | 15.5 | 380 | 11 | 0.21 |
| 12 x 2.5 | 2.1 | 18 | 530 | 15 | 0.36 |



| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |



RAC 4GKW

1800/3000 V AC (2700/4500 V DC) (EN 50264)

APPLICATION

Power cables used in protected connections, inside and outside of rolling stock. Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Copper, tinned, finely stranded class 5 according to EN 60228

2 Insulation

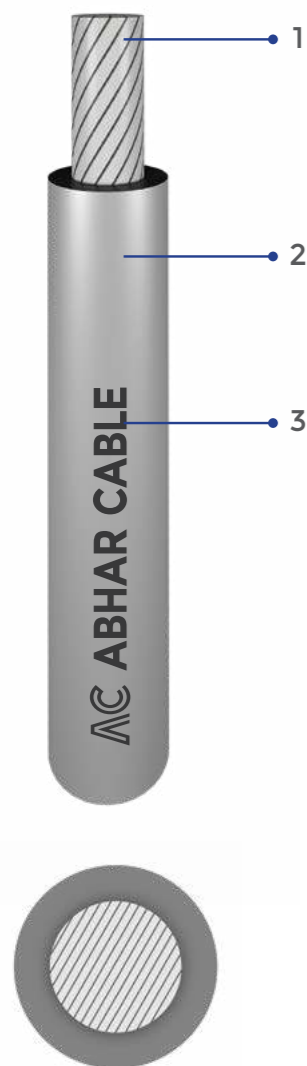
LSZH, cross-linked elastomeric compound (Electron beam crosslinked -EI 109)

3 Marking

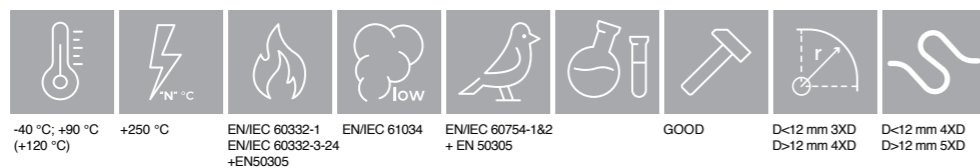
ABHAR CABLE RAC 4GKW 1x150 RF SQMM 1800V HALOGEN FREE

Notes

- White, grey and black colors available upon request



| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |



-40 °C; +90 °C (+120 °C) +250 °C EN/IEC 60332-1 EN/IEC 60332-3-24 +EN50305 EN/IEC 61034 EN/IEC 60754-1&2 + EN 50305 GOOD D<12 mm 3XD D>12 mm 4XD D<12 mm 4XD D>12 mm 5XD

| RAC 4GKW - 1.8/3kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1 x 1 | 1.32 | 5.32 | 40 | 20 | 0.14 |
| 1 x 1.5 | 1.6 | 5.6 | 50 | 25 | 0.21 |
| 1 x 2.5 | 2.1 | 6.1 | 60 | 33 | 0.36 |
| 1 x 4 | 2.46 | 6.46 | 80 | 46 | 0.57 |
| 1 x 6 | 3.01 | 7.01 | 100 | 60 | 0.86 |
| 1 x 10 | 3.96 | 7.96 | 140 | 85 | 1.43 |
| 1 x 16 | 5.1 | 9.1 | 210 | 110 | 2.29 |
| 1 x 25 | 6.5 | 10.5 | 320 | 150 | 3.58 |
| 1 x 35 | 7.7 | 11.7 | 420 | 190 | 5.01 |
| 1 x 50 | 9.2 | 13.2 | 580 | 240 | 7.15 |
| 1 x 70 | 11.1 | 15.1 | 790 | 300 | 10.0 |
| 1 x 95 | 12.7 | 17.1 | 1030 | 360 | 13.6 |
| 1 x 120 | 14.4 | 18.8 | 1300 | 425 | 17.2 |
| 1 x 150 | 16.1 | 20.5 | 1590 | 490 | 21.5 |
| 1 x 185 | 17.7 | 22.5 | 1940 | 560 | 26.5 |
| 1 x 240 | 20.3 | 25.1 | 2510 | 675 | 34.3 |
| 1 x 300 | 22.7 | 27.5 | 3100 | 775 | 42.9 |
| 1 x 400 | 26.2 | 31.4 | 4110 | 950 | 57.2 |

RAC 4GKW C

1800/3000 V AC (2700/4500 V DC) (EN 50264)



APPLICATION

Power cables used in protected connections, inside and outside of rolling stock, with tin-plated copper braid screen. Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Copper, tinned, finely stranded class 5 according to EN 60228

2 Insulation

LSZH, cross-linked elastomeric compound (Electron beam crosslinked -EI 109)

3 Screen

Tinned annealed copper wire braid with 85% coverage (with separating layer below and above)

4 Sheath

LSZH, cross-linked elastomeric compound (EM 104)

5 Marking

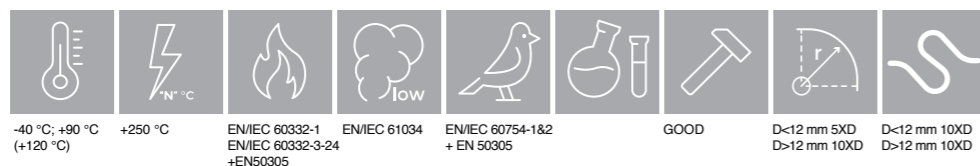
ABHAR CABLE RAC 4GKW C 1x70 RF SQMM Power 1800V HALOGEN FREE

Notes

- White, grey and black colors available upon request

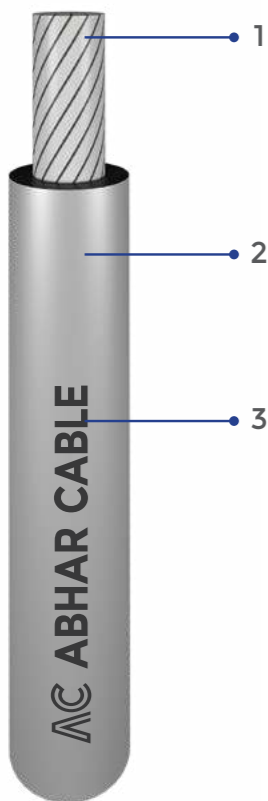
| RAC 4GKW C - 1.8/3kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1 x 1.5 | 1.6 | 6.8 | 80 | 25 | 0.21 |
| 1 x 2.5 | 2.1 | 7.3 | 100 | 33 | 0.36 |
| 1 x 4 | 2.46 | 7.7 | 120 | 46 | 0.57 |
| 1 x 6 | 3.01 | 8.2 | 140 | 60 | 0.86 |
| 1 x 10 | 3.96 | 9.6 | 200 | 85 | 1.43 |
| 1 x 16 | 5.1 | 10.7 | 270 | 110 | 2.29 |
| 1 x 25 | 6.5 | 13.1 | 420 | 150 | 3.58 |
| 1 x 35 | 7.7 | 14.3 | 540 | 190 | 5.01 |
| 1 x 50 | 9.2 | 15.8 | 710 | 240 | 7.15 |
| 1 x 70 | 11.1 | 17.7 | 940 | 300 | 10.0 |
| 1 x 95 | 12.7 | 20.1 | 1210 | 360 | 13.6 |
| 1 x 120 | 14.4 | 21.8 | 1490 | 425 | 17.2 |
| 1 x 150 | 16.1 | 23.9 | 1830 | 490 | 21.5 |
| 1 x 185 | 17.7 | 25.9 | 2190 | 560 | 26.5 |
| 1 x 240 | 20.3 | 28.5 | 2790 | 675 | 34.3 |
| 1 x 300 | 22.7 | 30.9 | 3410 | 775 | 42.9 |
| 1 x 400 | 26.2 | 35.2 | 4500 | 950 | 57.2 |

| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |



RAC 9GKW

3600/6000 V AC (5400/9000 V DC) (EN 50264)



APPLICATION

Power cables used in protected connections, inside and outside of rolling stock. Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Copper, tinned, finely stranded class 5 according to EN 60228

2 Insulation

LSZH, cross-linked elastomeric compound (Electron beam crosslinked -EI 109)

3 Marking

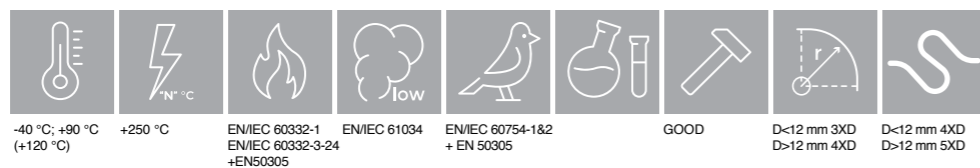
ABHAR CABLE RAC 9GKW 1x240 RF SQMM 3600V HALOGEN FREE

Notes

- White, grey and black colors available upon request

| RAC 9GKW - 3.6/6kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1 x 1.5 | 1.6 | 4.8 | 40 | 25 | 0.21 |
| 1 x 2.5 | 2.1 | 5.3 | 50 | 33 | 0.36 |
| 1 x 4 | 2.46 | 5.86 | 70 | 46 | 0.57 |
| 1 x 6 | 3.01 | 6.61 | 90 | 60 | 0.86 |
| 1 x 10 | 3.96 | 8.36 | 150 | 85 | 1.43 |
| 1 x 16 | 5.1 | 9.5 | 210 | 110 | 2.29 |
| 1 x 25 | 6.5 | 11.3 | 340 | 150 | 3.58 |
| 1 x 35 | 7.7 | 12.9 | 460 | 190 | 5.01 |
| 1 x 50 | 9.2 | 14.8 | 630 | 240 | 7.15 |
| 1 x 70 | 11.1 | 16.9 | 860 | 300 | 10.0 |
| 1 x 95 | 12.7 | 19.3 | 1120 | 360 | 13.6 |
| 1 x 120 | 14.4 | 21 | 1400 | 425 | 17.2 |
| 1 x 150 | 16.1 | 22.7 | 1700 | 490 | 21.5 |
| 1 x 185 | 17.7 | 24.9 | 2060 | 560 | 26.5 |
| 1 x 240 | 20.3 | 28.1 | 2690 | 675 | 34.3 |
| 1 x 300 | 22.7 | 30.5 | 3300 | 775 | 42.9 |
| 1 x 400 | 26.2 | 34 | 4310 | 950 | 57.2 |

| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |



RAC 9GKW C

3600/6000 V AC (5400/9000 V DC) (EN 50264)V



APPLICATION

1 Power cables used in protected connections, inside and outside of rolling stock, with tin-plated copper braid screen.
2 Usable on railway vehicles having the hazard level HL3 according to EN 45545.

CONSTRUCTION

1 Conductor

Copper, tinned, finely stranded class 5 according to EN 60228

2 Insulation

LSZH, cross-linked elastomeric compound (Electron beam crosslinked -EI 109)

3 Screen

Tinned annealed copper wire braid with 85% coverage (with separating layer below and above)

4 Sheath

LSZH, cross-linked elastomeric compound (EM 104)

5 Marking

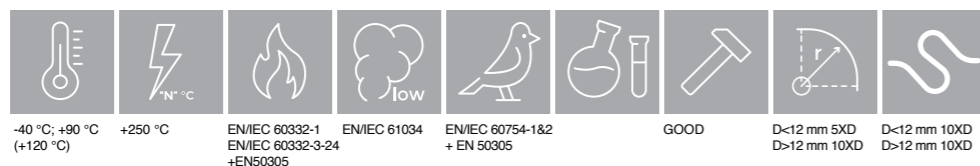
ABHAR CABLE RAC 9GKW C 1x150 RF SQMM Power 3600V HALOGEN FREE

Notes

- White, grey and black colors available upon request

| RAC - 3.6/6kV | | | | | |
|--------------------------------------------|-------------------------|--------------------------|----------------|-------------------------------------|----------------------------------|
| Construction (nr cond. X mm ²) | Conductor diameter (mm) | Nom. Outer diameter (mm) | Weight (kg/km) | Permissible current at free air (A) | Short circuit current at 1s (kA) |
| 1 x 1.5 | 1.6 | 9.4 | 140 | 25 | 0.21 |
| 1 x 2.5 | 2.1 | 9.9 | 160 | 33 | 0.36 |
| 1 x 4 | 2.46 | 10.3 | 180 | 46 | 0.57 |
| 1 x 6 | 3.01 | 10.8 | 200 | 60 | 0.86 |
| 1 x 10 | 3.96 | 11.8 | 260 | 85 | 1.43 |
| 1 x 16 | 5.1 | 12.9 | 340 | 110 | 2.29 |
| 1 x 25 | 6.5 | 15.3 | 500 | 150 | 3.58 |
| 1 x 35 | 7.7 | 16.5 | 620 | 190 | 5.01 |
| 1 x 50 | 9.2 | 18 | 800 | 240 | 7.15 |
| 1 x 70 | 11.1 | 19.9 | 1040 | 300 | 10.0 |
| 1 x 95 | 12.7 | 21.5 | 1280 | 360 | 13.6 |
| 1 x 120 | 14.4 | 23.6 | 1590 | 425 | 17.2 |
| 1 x 150 | 16.1 | 25.3 | 1910 | 490 | 21.5 |
| 1 x 185 | 17.7 | 27.5 | 2290 | 560 | 26.5 |
| 1 x 240 | 20.3 | 30.9 | 2960 | 675 | 34.3 |
| 1 x 300 | 22.7 | 33.3 | 3590 | 775 | 42.9 |
| 1 x 400 | 26.2 | 36.8 | 4630 | 950 | 57.2 |

| Standard | Fire protection on railway vehicles |
|--------------|-----------------------------------------------------|
| DIN 5510 -2 | hazard level 1, 2, 3, 4 |
| NF F 16 -101 | class, category C/F0, int. A1, A2, B/ext. A1, A2, B |
| EN 45545-2 | |



Chapter 4

PHYSICAL CROSS-LINKING
TESTS
DELIVERY SPOOLS

In the last few years, the development of rolling stock technology has been largely driven by the implementation of high speed train networks. The increasing need to reduce both volume and weight has led to the development of miniaturized cables, as well as high temperature cables with enhanced performance.

Based on decades of experience as a complete supplier of electrical cables, ABHAR cable co. has systematically expanded and enhanced its knowledge in the railway technology sector.

Cables in trains must be resistant to a wide range of conditions, e.g. aggressive fluids, oils, etc., as well as harsh environmental conditions.

“RAC” Rolling Stock cables are suitable in the most critical conditions (e.g. tunnels, metro lines, etc.) and are fully environmentally friendly (LSFOH and recyclable).

Physical cross-linking

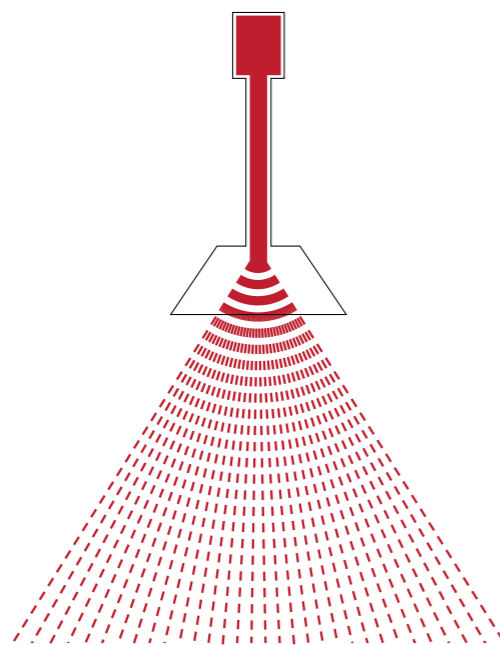
We cross-link our insulations with high energy electrons (E-beam) in our own state-of-the-art irradiation center. These electrons cede their kinetic energy when slowed down in the polymer. Through the impact of the electrons radicals are built, which with chemical reaction interlink the molecules.

Cross-linked insulating materials

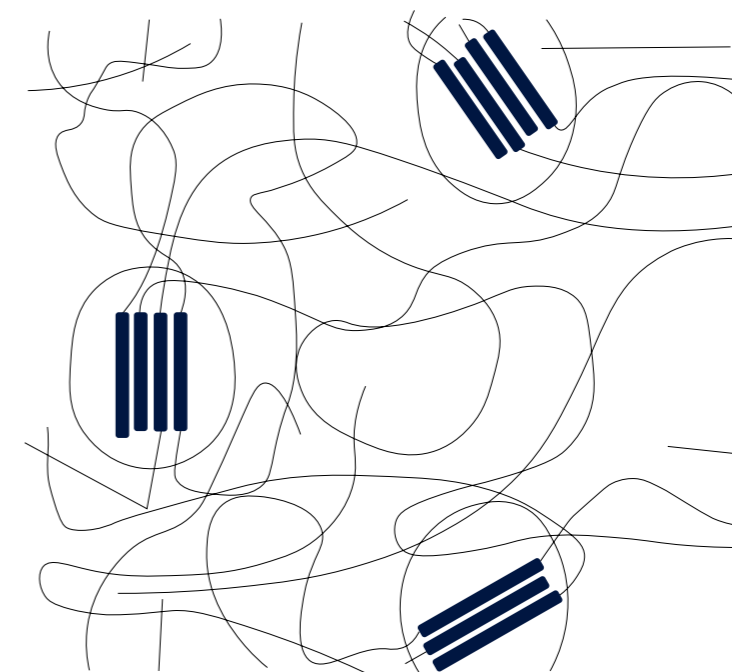
Cross-linking binds together the filiform molecules by means of a chemical linking (in the amorphous phase). This leads to a three-dimensional network. The filiform molecules can no longer move freely (irrespective of temperature). Above the melting temperature the material can no longer flow but it goes into a rubber-like elastic state.

Advantages of cross-linked insulation materials:

- Increased shear and compressive strength
- Improved integrity in case of electrical failures (overload, short circuit)
- Improved resistance to chemicals
- Infusible, soldering iron resistance
- Improved impact strength and crack resistance
- Better weather and abrasion resistance

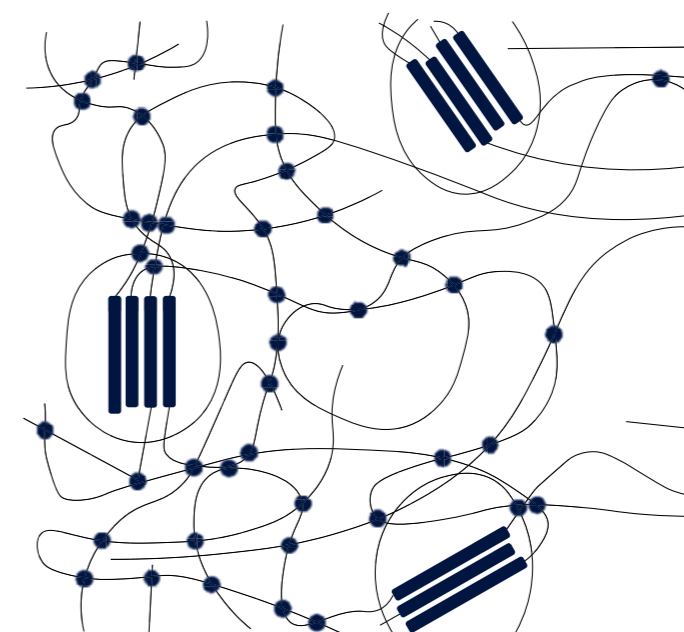


With the electron-beam accelerators the insulation materials can be cross-linked within a few seconds. The homogenous irradiation and implicit the homogenous cross-linking are ensured by therefore especially adopted handling systems. Other than in the chemical cross-linking in the irradiation cross-linking no peroxides or hydro-silicones are incorporated into the synthetic mixtures.



Before cross-linking

Chart of the aliphatic macromolecules before cross-linking. Free movement of the polymer chain (within the melt and the dilution).



After cross-linking

Chart of the aliphatic macromolecules after cross-linking. -3D cross-linking of the polymer chain (strongly limited freedom of movement).

Halogen free

The halogens are the elements of the 7th group in the Periodic Table of Elements:

Chlorine (Cl), fluorine (F), bromine (Br), iodine (I).

Halogen free cables must be free of chlorine, fluorine and bromine (PVC cables contain halogen, PVC = Polyvinylchloride).

The halogens are an integrated component of many acids

- HCl =Salt acid (hydrochloric acid)
- HF =Hydrogenfluorid
- HBr = hydrogenbromid

The most popular plastic containing halogens is PVC (polyvinylchloride). In case of fire or at high temperature PVC starts to degrade. Hydrochloric acid and other fission products are generated and leads to extremely aggressive corrosion. Therefore, the current trend is to replace the halogen containing plastics with halogen free ones. For instance, PVC is currently being replaced at a large scale with polyolefin i.e. polyethylene. Thanks to halogen free cables the formation of corrosive and toxic gases can be prevented.

Test procedures

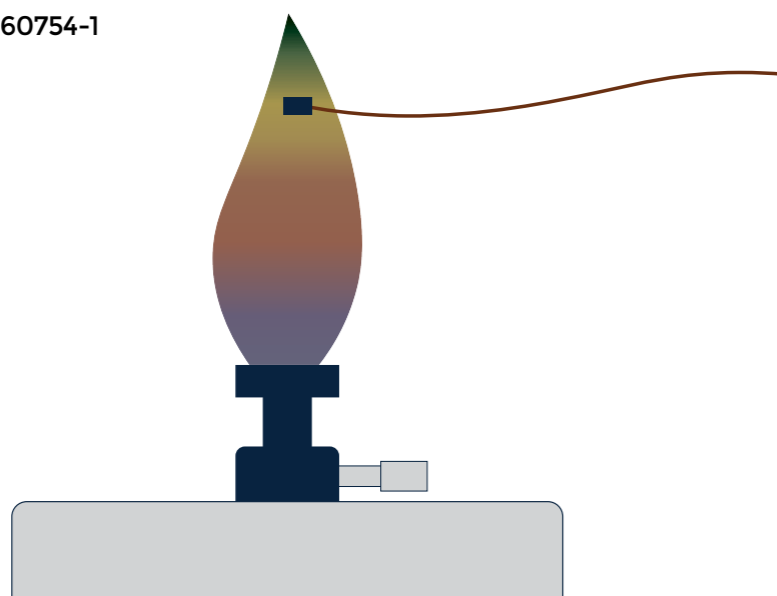
1000 mg of the testing material must be hold at one termination of an pre-annealed copper wire in a gas flame.

Requirements

The material is considered to be halogen free if no green to blue-green flame discolorations occurs. The chlorine and the bromine would cause such a discoloration; however, the existence of fluorine cannot be proven like that.

Test standards

IEC 60754-1



Degree of acidity of combustion gases

Corrosive gases act with moisture to produce aggressive acids which corrode metal parts and cause extensive long-term damage, even though the fire damage may only be limited; this is because corrosive gases often spread throughout a building through the ventilation system or within whole installations. The damage may not be limited to the area immediately affected by the fire. Electronic units and electronic contacts are particularly vulnerable, as are free-standing or concrete steel constructions.

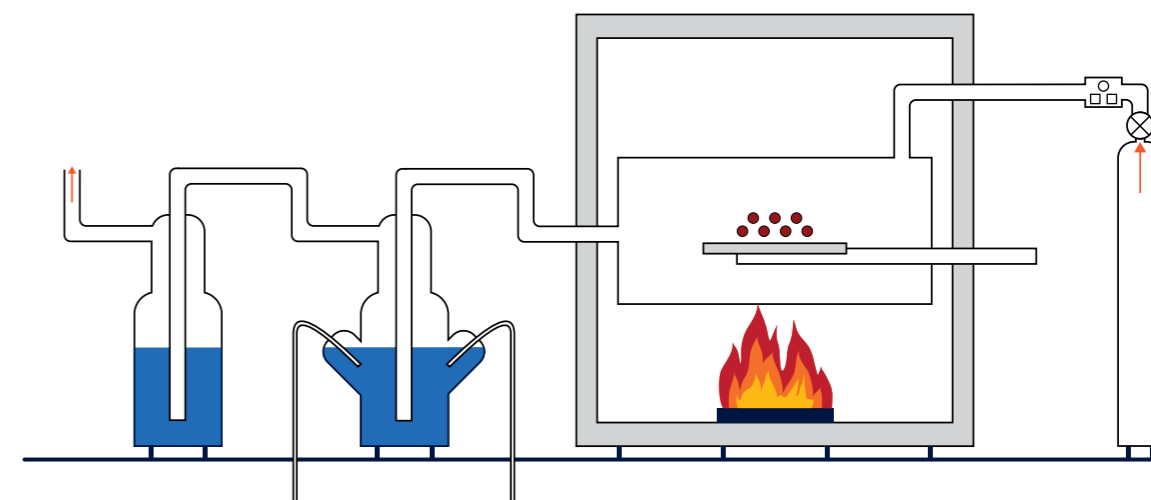
Test procedures

1000 mg insulation material is burned combustion furnace at ≥ 935 oc with pre-defined air supply for over 30 minutes. By means of two gas washing containers, held in the air flow the conductivity and the PH-value are measured. Like that even small quantities of halogen containing substances can be detected and proven.

The test is considered to be passed when
the ph-value >4.3
the conductivity $< 10 \mu\text{S}/\text{mm}$

Test standards

IEC 60754-2
and toxic gases can be prevented.



Smoke density

The formation of smoke has several unpleasant consequences. On one hand it considerably lowers the visibility in a fire event, thus impeding the people trapped inside closed rooms escape of and the efforts of the fireman to carry on their rescue and firefighting actions. On the other hand, it produces smoke poisoning because of the carbon monoxide. Regarding the formation of the combustion gases the PVC comes off quite badly.

Test procedures

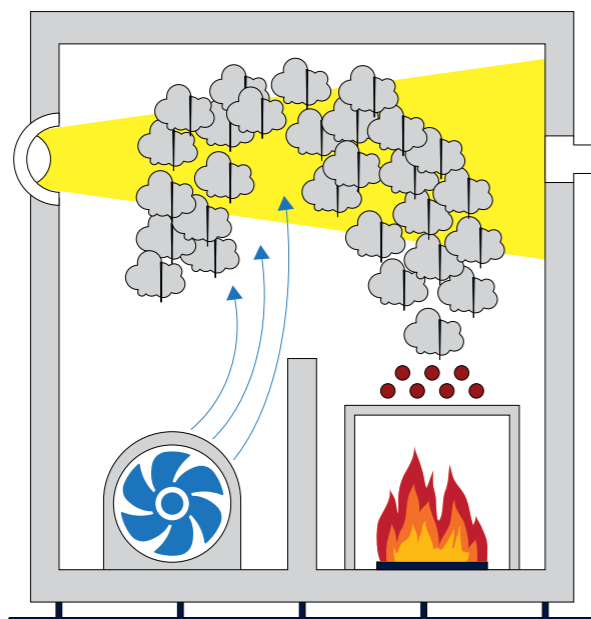
The density of smoke emission can be determined by measuring of the light penetrability. Cable samples are lit with alcohol in a test chamber (cubical with an edge length of 3 m). The so formed smoke is uniformly spread by a ventilator and influences the light measuring section.

The test is considered to be passed when the following light penetrability is reached:

| Dangerous level | Requirements |
|-----------------|--------------|
| HL 1 | - |
| HL 2 and HL 3 | 60% |
| HL 4 | 70% |

Test standards

IEC 61034, EN 61034



Flame retardant

Flame retardant cables are cables which, when installed as a single cable, although ignitable on exposure to flame source, will greatly reduce flame spread and self-extinguish once the flame source is removed.

However, in vertical risers, fire can spread along the cables (chimney effect). In order to avoid this danger, this so-called »non-flame propagating« cables should be used.

Test procedure

This test procedure describes the minimum requirements for flame retardant cables and it is valid for lead wires or on single cables only.

A lead wire or a cable is being aflamed with a propane-air-burner (1 kW Flame).

Test duration

| | |
|---------------------------|------|
| $\varnothing \leq 25$ | 60s |
| $\varnothing 25 \dots 50$ | 120s |
| $\varnothing 50 \dots 75$ | 240s |
| $\varnothing > 75$ | 480s |

The burning cable should self-extinguish as soon as the fire source has been removed. The fire damage may not be higher than 60 cm.

The test is considered to be passed if:

The sample has not burned and the damage (carbonization) has not reached any off terminations of the sample (> 50 mm).

Test standards

IEC 60332-1, EN 60332-1



No Flame propagation

No flame propagation cables are those cables which can be ignited by a flame source, however they don't allow the fire to spread even if the cable bundle is placed vertically; they are self-extinguishing once the fire source is removed.

Test procedures

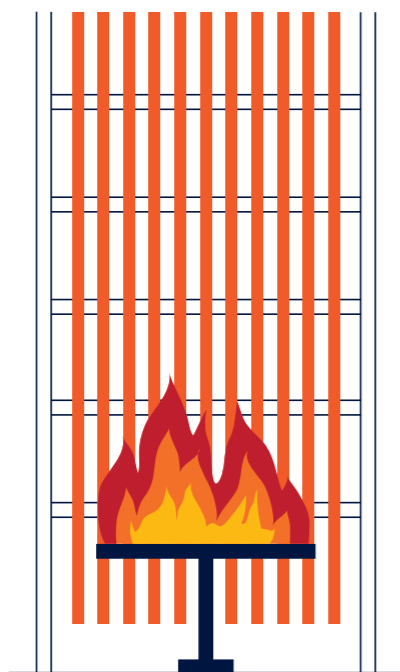
This test simulates the chimney effect in the vertical cable installations. In a standardized cabinet the cable bundle is kept in a burner fire for 20- 40 minutes (gas burner 75 ± 5 MJ/h). Thereby the temperature is kept constant to 750 oc. Depending on the volume of the non-metal (combustible) materials per running meter it can be differentiated in the categories A F/R, A, B C and D

| Category | A F/R | A | B | C | D |
|----------------------------------------------------------------|-------|----|-----|-----|-----|
| Liter (dm ³) of insulation material per 1 m sample | 70 | 7 | 3.5 | 1.5 | 0.5 |
| Aflame time (min) | 40 | 40 | 40 | 20 | 20 |

The cables must self-extinguish after removing the fire source. The fire may not have propagated any further than 2.5 m from the burner.

Test standards

IEC 24-3-60332



| Topic | | Abhar Cable Co. |
|--------------------------------------------------------------------------|--------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Minimum Service Life | | 30 years at normal condition |
| Operating Temperature | Maximum permissible operating temperature for 100,000 hrs Lifetime | 90°C |
| | Maximum permissible operating temperature for 20,000 hrs Lifetime | 120°C |
| Multi-core Identifier | | Numbered |
| Marking Interval | | In accordance with EN 50264-2-1 |
| Elongation Test for conductor | | In accordance with EN 10002-1 Minimum elongation value for an individual wire: 10% |
| Temperature at which the resistance shall be in accordance with EN 60228 | | 20°C |

Table 9. Schedule of tests for single core cables

| No. | Tests | Category | Test Method | | Reuirements | |
|----------|--------------------------------------------------------------------------|----------|------------------------------------|--------|--------------|--------------------|
| | | | EN | Clause | Reference ° | Clause |
| 1 | Electrical tesy | | | | | |
| 1.1 | Conductor resistance | T, S | 50305 | 6.1 | EN 50264-3-1 | 7.2 |
| 1.2 | Voltage test on cable | T, S | 50305 | 6.2.1 | EN 50264-3-2 | 7.3 |
| 1.3 | Dielectric strength on sample | T | 50305 | 6.8 | EN 50264-3-3 | 7.5 |
| 1.4 | Surface resistance | T | 50305 | 6.6 | EN 50264-3-4 | 7.8 |
| 1.5 | Spark test on insulation | R | 50305 | 6.5 | EN 50264-3-5 | 7.6 |
| 1.6 | Insulation resistance (20 °C) | T, S | 50305 | 6.4.1 | EN 50264-3-6 | 7.4 |
| 1.7 | Insulation resistance (90 °C) | T | 50305 | 6.4.2 | EN 50264-3-7 | 7.4 |
| 1.8 | D.C. stability | T | 50305 | 6.7 | EN 50264-3-8 | 7.7 |
| 2 | Provision covering constructional and dimensional charactersitics | | | | | |
| 2.1 | Checking of compliance with constructional provisions | T, S | Inspection and manual tests | | | Table 1 to Table 5 |
| 2.2 | Conductor material and construction | T, S | Visual examination 50264-1 | 6.1 | EN 50254-3-1 | 6.2 |
| 2.3 | Insulation: | | | | | |
| | a) application | S | Visual examination | | | 4.3 |
| | b) thickness | T, S | 60811-1-1 | 8.1 | | Table 1 to Table 5 |
| 2.4 | Core identification | S | Visual examination and measurement | | | 4.9 |
| 2.5 | Sheath: | | | | | |
| | a) application | S | Visual examination | | | 4.4 |
| | b) thickness | T, S | 60811-1-1 | 8.2 | | Table 1 to Table 5 |
| 2.6 | Overall diameter | T, S | 60811-1-1 | 8.3 | | Table 1 to Table 5 |
| 2.7 | Metallic screen | | | | | |
| | a) diameter of wire | T, S | Measurement | | EN 50264-1 | 6.4 |
| | a) filling factor | T, S | Measurement | | EN 50264-1 | 6.4 |
| 2.8 | Cable marking and Identification | T, S | Visual examination and measurement | | | 4.10 |
| 2.9 | Durability | T, S | 50305 | 10.1 | EN 50264-1 | 5.4 |

Table 9. Schedule of tests for single core cables (continued)

| No. | Tests | Category | Test Method | | Reuirements | |
|----------|----------------------------------------------------|----------|-------------------------------------------------------------|--------|--------------|----------|
| | | | EN | Clause | Reference ° | Clause |
| 3 | Tests for Insulating and sheating materials | | | | | |
| 3.1 | Non-electrical tests | | | | | |
| 3.1.1 | Tensile test in the state as delivery | T, S | | | | |
| | a) insulation | | 60811-1-1 | 9.1 | EN 50264-1 | Table 2b |
| | b) sheath | | 60811-1-1 | 9.2 | EN 50264-1 | Table 4 |
| 3.1.2 | Tensile test before and after ageing in air oven | T | 60811-1-2 | 8.1 | | |
| | a) insulation | | 60811-1-1 | 9.1 | EN 50264-1 | Table 2b |
| | b) sheath | | 60811-1-1 | 9.2 | EN 50264-1 | Table 4 |
| 3.1.3 | Hot set test | T, S | 60811-2-1 | 9 | | |
| | a) insulation | | | | EN 50254-3-1 | 7.10 |
| | b) sheath | | | | EN 50254-3-1 | 7.10 |
| 3.1.4 | Water absorption on sheath (gravimetric) | T | 60811-1-3 | 9.2 | EN 50254-3-1 | 7.12 |
| 3.1.5 | Ozone resistance | T | 50305 | 7.4.2 | | |
| | a) insulation | | | | EN 50254-3-1 | 7.13 |
| | b) sheath | | | | EN 50254-3-1 | 7.13 |
| 3.1.6 | Mineral oil resistance | T | 60811-2-1 | 10 | | |
| | a) insulation | | | | EN 50254-3-1 | 7.14 |
| | b) sheath | | | | EN 50254-3-1 | 7.14 |
| 3.1.7 | Fuel resistance | T | 60811-2-1 | 10 | | |
| | a) insulation | | | | EN 50254-3-1 | 7.15 |
| | b) sheath | | | | EN 50254-3-1 | 7.15 |
| 3.1.8 | Acid and alkaline resistance | T | 60811-2-1 | 10 | | |
| | a) insulation | | | | EN 50254-3-1 | 7.16 |
| | b) sheath | | | | EN 50254-3-1 | 7.16 |
| 3.1.9 | Assessment of halogens | T, S | 50264-1, Annexes A & B 50267-2-2 50267-2-1 60684-2 | | EN 50264-1 | 9.1 |
| | a) insulation | | | | | |
| | b) non-metallic components | | | | | |
| | c) sheath | | | | | |
| 3.1.10 | Toxicity | T | 50305 | 9.2 | EN 50264-1 | 9.2 |

| Schedule of tests for single core cables (continued) | | | | | | |
|------------------------------------------------------|---------------------------------------------------------|----------|----------------------|------------|------------------------|--------|
| No. | Tests | Category | Test Method | | Reuirements | |
| | | | EN | Clause | Reference ^a | Clause |
| 4 | Tests on complete cable | | | | | |
| 4.1 | Bending test at low temperature (cable OD < 12.5 mm) | | 60811-1-4 | 8.1 or 8.2 | EN 50264-3-1 | 7.17 |
| 4.2 | Elongation test at low temperature (cable OD > 12.5 mm) | T | 60811-1-4 | 8.3 or 8.4 | EN 50264-3-1 | 7.18 |
| 4.3 | Impact test at low temperature | T | 50305 | 5.1 | EN 50264-3-1 | 7.19 |
| 4.4 | compatibility | T | 60811-1-2 | 7.1 | EN 50264-3-1 | 7.11 |
| 4.5 | Flame propagation | | | | | |
| 4.5.1 | Single vertical cable | T, S | 60332-1-2 | | EN 50264-1 | 8.1 |
| 4.5.2 | Bunched cables | | | | | |
| | ≥ 12 mm | T | 50266-2-4 NMV 1.5 /m | | EN 50264-1 | 8.2.1 |
| | > 6 mm and < 12 mm | T | 50266-2-5 NMV .5 /m | | EN 50264-1 | 8.2.2 |
| | ≤ 6 mm | T | 50305 | 9.1.2 | EN 50264-1 | 8.2.3 |
| 4.6 | Smoke emission | T | 61034-2 | | EN 50264-1 | 8.3 |
| 4.7 | Banding radius | T, S | | 4.8 | | 4.8 |

^a According to current specification, unless otherwise stated.

| Table 10. Schedule of tests for multi core cables | | | | | | |
|---------------------------------------------------|--------------------------------------------------------------------------|----------|------------------------------------|--------|------------------------|--------------------|
| No. | Tests | Category | Test Method | | Reuirements | |
| | | | EN | Clause | Reference ^a | Clause |
| 1 | Electrical tesy | | | | | |
| 1.1 | Conductor resistance | T, S | 50305 | 6.1 | EN 50264-3-2 | 7.2 |
| 1.2 | Voltage test on cable | T, S | 50305 | 6.2.1 | EN 50264-3-2 | 7.3 |
| 1.3 | Dielectric strength on sample | T | 50305 | 6.8 | EN 50264-3-2 | 7.5 |
| 1.4 | Surface resistance | T | 50305 | 6.6 | EN 50264-3-2 | 7.8 |
| 1.5 | Spark test on insulation | R | 50305 | 6.5 | EN 50264-3-2 | 7.6 |
| 1.6 | Insulation resistance (20 °C) | T, S | 50305 | 6.4.1 | EN 50264-3-2 | 7.4 |
| 2 | Provision covering constructional and dimensional charactersitics | | | | | |
| 2.1 | Checking of compliance with constructional provisions | T, S | Inspection and manual tests | | EN 50264-3-2 | 6.1 and 6.7 |
| 2.2 | Conductor material and construction | T, S | Visual examination 50264-1 | 6.1 | EN 50264-3-2 | 6.2 |
| | Insulation: | | | | | |
| | a) application | S | Visual examination | | | 4.3 |
| | b) thickness | T, S | 60811-1-1 | 8.1 | | Table 1 to Table 5 |
| 2.4 | Core identification | S | Visual examination and measurement | | | 4.9 |
| | Metallic screen | | | | | |
| | a) diameter of wire | T, S | Measurement | | EN 50264-1 | 6.4 |
| | a) filling factor | T, S | Measurement | | EN 50264-1 | 6.4 |
| | Sheath: | | | | | |
| | a) application | S | Visual examination | | | 4.4 |
| | b) thickness | T, S | 60811-1-1 | 8.2 | | Table 1 to Table 5 |
| 2.6 | Overall diameter | T, S | 60811-1-1 | 8.3 | | Table 1 to Table 5 |
| 2.8 | Cable marking and Identification | T, S | Visual examination and measurement | | | 4.1 |
| 2.9 | Durability | T, S | 50305 | 10.1 | EN 50264-1 | 5.4 |

Table 10. Schedule of tests for multi core cables (continued)

| No. | Tests | Category | Test Method | | Reuirements | |
|----------|-----------------------------------------------------|----------|----------------------------------------------------------------|--------|------------------------|----------|
| | | | EN | Clause | Reference ^a | Clause |
| 3 | Tests for Insulating and sheathing materials | | | | | |
| 3.1 | Non-electrical tests | | | | | |
| 3.1.1 | Tensile test in the state as delivered | T, S | | | | |
| | a) insulation | | 60811-1-1 | 9.1 | EN 50264-1 | Table 2b |
| | b) sheath | | 60811-1-1 | 9.2 | EN 50264-1 | Table 4 |
| 3.1.2 | Tensile test before and after ageing in air oven | T | 60811-1-2 and: | 8.1 | | |
| | a) insulation | | 60811-1-1 | 9.1 | EN 50264-1 | Table 2b |
| | b) sheath | | 60811-1-1 | 9.2 | EN 50264-1 | Table 4 |
| 3.1.3 | Hot set test | T, S | 60811-2-1 | 9 | EN 50254-3-1 | 7.9 |
| | a) insulation | | | | EN 50254-3-1 | 7.9 |
| | b) sheath | | | | | |
| 3.1.4 | Water absorption on sheath | T | 60811-1-3 | 9.2 | EN 50254-3-1 | 7.11 |
| 3.1.5 | Ozone resistance | T | 50305 | 7.4.2 | EN 50254-3-1 | 7.12 |
| | a) insulation | | | | EN 50254-3-1 | 7.12 |
| | b) sheath | | | | | |
| 3.1.6 | Mineral oil resistance | T | 60811-2-1 | 10 | EN 50254-3-1 | 7.13 |
| | a) insulation | | | | EN 50254-3-1 | 7.13 |
| | b) sheath | | | | | |
| 3.1.7 | Fuel resistance | T | 60811-2-1 | 10 | EN 50254-3-1 | 7.14 |
| | a) insulation | | | | EN 50254-3-1 | 7.14 |
| | b) sheath | | | | | |
| 3.1.8 | Acid and alkaline resistance | T | 60811-2-1 | 10 | EN 50254-3-1 | 7.15 |
| | a) insulation | | | | EN 50254-3-1 | 7.15 |
| | b) sheath | | | | | |
| 3.1.9 | Assessment of halogens | T, S | 50264-1, Annexes A & B 50267-2-2 50267-2-1 60684-2 | | EN 50264-1 | 9.1 |
| | a) insulation | | | | | |
| | b) non-metallic components | | | | | |
| | c) sheath | | | | | |
| 3.1.10 | Toxicity | T | 50305 | 9.2 | EN 50264-1 | 9.2 |

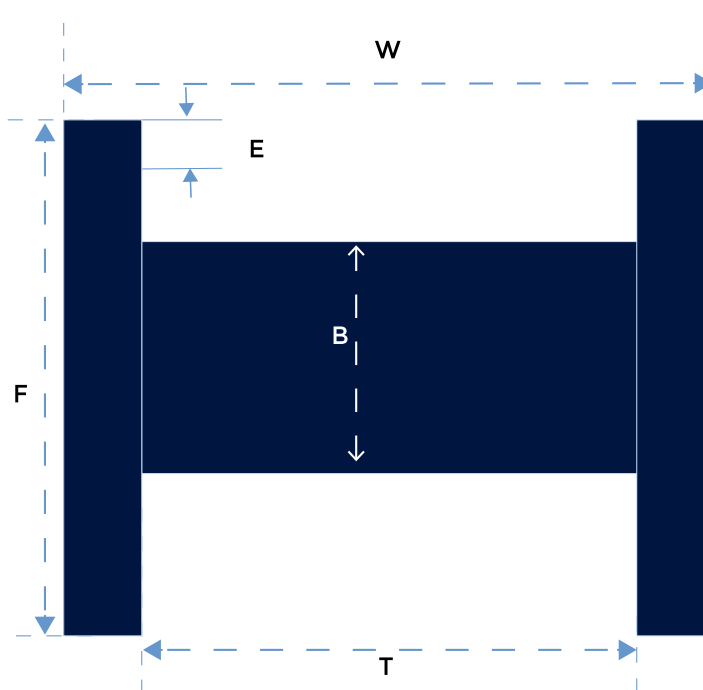
Table 10. Schedule of tests for multi core cables (continued)

| No. | Tests | Category | Test Method | | Reuirements | |
|----------|---------------------------------------------------------|----------|--------------------------|------------|------------------------|--------|
| | | | EN | Clause | Reference ^a | Clause |
| 4 | Tests on complete cable | | | | | |
| 4.1 | Bending test at low temperature (cable OD < 12.5 mm) | | 60811-1-4 | 8.1 or 8.2 | EN 50264-3-2 | 7.16 |
| 4.2 | Elongation test at low temperature (cable OD > 12.5 mm) | T | 60811-1-4 | 8.3 or 8.4 | EN 50264-3-2 | 7.17 |
| 4.3 | Impact test at low temperature | T | 50305 | 5.1 | EN 50264-3-2 | 7.18 |
| 4.4 | compatibility | T | 60811-1-2 | 7.1 | EN 50264-3-2 | 7.10 |
| 4.5 | Flame propagation | | | | | |
| 4.5.1 | Single vertical cable | T, S | 60332-1-2 | | EN 50264-1 | 8.1 |
| 4.5.2 | Bunched cables | | | | | |
| | ≥ 12 mm | T | 50266-2-4 NMV 1.5 l/m | | EN 50264-1 | 8.2.1 |
| | > 6 mm and < 12 mm | T | 50266-2-5 NMV 0.5 l/m | | EN 50264-1 | 8.2.2 |
| | ≤ 6 mm | T | 50305 | 9.1.2 | EN 50264-1 | 8.2.3 |
| 4.6 | Smoke emission | T | 61034-2 | | EN 50264-1 | 8.3 |
| 4.7 | Banding radius | T, S | | 4.8 | | 4.8 |

^a According to current specification, unless otherwise stated.

| Drum size | Flange Dia. F | Barrel Dia. B | Traverse T | Width overall W | Drum weight Kg |
|-----------|------------------|------------------|---------------|--------------------|-------------------|
| 4' | 400 | 160 | 400 | 380 | - |
| 7' | 700 | 320 | 510 | 620 | - |
| 6 | 600 | 300 | 500 | 430 | 27 |
| 8 | 800 | 350 | 500 | 600 | 50 |
| 10 | 1000 | 450 | 630 | 700 | 700 |
| 12 | 1200 | 600 | 630 | 820 | 70 |
| 14 | 1400 | 700 | 820 | 920 | 125 |
| 16 | 1600 | 900 | 820 | 1028 | 175 |
| 18 | 1800 | 1100 | 1250 | 1248 | 290 |

Plastic drum *



$$L_T = \frac{\pi NP(B+PD)}{1000} \quad p = \frac{F-B-2E}{2D} \quad N = 0.95 \frac{T}{D}$$

L_T = Length of Cable (m)

F = Flange Dia. (mm)

B = Barrel Dia. (mm)

D = Cable Dia. (mm)

T = Traverse (mm)

E = Empty Space (mm)