



# Technical Standard

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**Mondi AG.**  
**Mondi Standard Harmonization**

## CABLE STANDARD

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## 1 GENERAL

This cable standard specifies the cables to be used in all Mondi projects. All the used cables shall be approved to use in local country in the circumstances of the mill. The cables can be exposed to direct sunlight and shall be UV-resistant when installed outdoors. Ambient temperature in process areas and outdoors are shown on appendix of General Mill Specifications Summary MG0001. When temperature is higher, heat resistant cables are used. Mainly cables will be installed on cable ladders.

The cable specifications specify the main construction of the cables. Every full meter of cable length shall be marked with meter readings to enable the easy checking of lengths after cable pulling.

If the standard does not include cable that is necessary to use, the missing cable shall be agreed with Purchaser and will be added to the standard after the approval.

20 kV distribution system is unearthed - first earth fault trips within 1 s. 10 kV and 6 kV systems are low resistance earthed - first earth fault trips within 1 s. 690 V and 400 V systems are solidly earthed (TN-S). 690 V sectional drives are realized with IT-system. Distribution system shall be taken into account when selecting cables.

Earthing of supply grids, conditions are only applicable to green field installations.

CPR (European Construction Products Regulation) classified cables shall be used when required by local Norms, Regulation, Statutory Order or Law. In this standard CPR classes are according to German recommendations: halogen free cables with minimum fire class  $C_{ca-s1}$ ,  $d2$ ,  $a1$ ,  $B_{ca-s1}$ ,  $d1$ ,  $a1$  in server rooms and  $B_{ca-s1}$ ,  $d1$ ,  $a1$  in escape routes shall be used, when available for the application. Lower classified cables can be used only with Purchaser approval.

There is no CPR class according to standard EN50575 for fire-resistant cables yet. Underground cables are also outside the CPR classification.

## 2 FIRE CLASS

New co-ordinated EU standard EN50575 was published in 2014 that became mandatory on 1 July 2017. The new standard is included in the CPR (European Construction Products Regulation) and concerns fire classification and test methods for cables used in buildings.

Cables are classified in seven main classes according to their contribution to fire:  $A_{ca}$ ,  $B1_{ca}$ ,  $B2_{ca}$ ,  $C_{ca}$ ,  $D_{ca}$ ,  $E_{ca}$  and  $F_{ca}$ . Three addition criteria are smoke production, flaming droplets and acidity of the combustion gasses.

Class	Addition criteria			AVCP System	Duties of notified body	Test Method	Security
A <sub>ca</sub>				1+	- type testing - regular plant auditing - regular sampling from ongoing production	EN ISO 1716	Very high
B1 <sub>ca</sub>	<b>Smoke production</b> S1a, S1b, S2, S3 EN50399 / EN61034-2	<b>Flaming droplets</b> d0, d1, d2 EN 50399	<b>Acidity</b> a1, a2, a3 EN 60754-2			EN 50399 EN 60332-1-2	Very high
B2 <sub>ca</sub>							Very high
C <sub>ca</sub>							High
D <sub>ca</sub>							3
E <sub>ca</sub>		EN 60332-1-2	Low				
F <sub>ca</sub>				4	- none		None

### 3 ATEX

Cables in ATEX (**at**mosphere **exp**losive) areas shall be specified according to standard IEC 60079-14 (Explosive atmospheres - Part 14: Electrical installations design, selection and erection).

Cables in ATEX areas shall be:

- a) sheathed with thermoplastic, thermosetting, or elastomeric material. They shall be circular and compact. Any bedding or sheath shall be extruded. Fillers, if any, shall be non-hygroscopic; or
- b) mineral insulated metal sheathed; or
- c) special, e.g. flat cables with appropriate cable glands. They shall be compact and any bedding or sheath shall be extruded. Fillers, if any, shall be non-hygroscopic.

Cables of Exi circuits (intrinsically safety circuits) shall be blue.

### 4 CABLE SUPPORTS

Cable supports are specified in Instrument and Automation Installation Standard MEIA0007 and Electrical Installation Standard MEIA0008.

### 5 REFERENCES

250/2021 Sb. „Zákon o bezpečnosti práce v souvislosti s provozem vyhrazeným technických zařízení a o změně souvisejících zákonů“

NV 190/2022 Sb. „Nařízení vlády o vyhrazených technických elektrických zařízeních a požadavcích na zajištění jejich bezpečnosti“

NV 194/2022 Sb. „Nařízení vlády o požadavcích na odbornou způsobilost k výkonu činnosti na elektrických zařízeních a na odbornou způsobilost v elektrotechnice“

MG0001	General Mill Specifications Summary
MEIA0007	Instrument and Automation Installation Standard
MEIA0008	Electrical Installation Standard
EN 50399	Common test methods for cables under fire conditions - Heat release and smoke production measurement on cables during flame spread test - Test apparatus, procedures, results
EN 50525	Electric cables low voltage energy cables of rated voltage up to and including 450/750 V (Uo/U)
EN 50575	Power, control and communication cables. Cables for general applications in construction works subject to reaction to fire requirements
EN 60332-1-2	Tests on electric and optical fibre cables under fire conditions - Part 1-2: Test for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame
EN 60754-2	Test on gases evolved during combustion of materials from cables - Part 2: Determination of acidity (by pH measurement) and conductivity
EN 61034-2	Measurement of smoke density of cables burning under defined conditions - Part 2: Test procedure and requirements
IEC 11801:2017	Information technology - Generic cabling for customer premises
IEC 60079-14:2013	Explosive atmospheres - Part 14: Electrical installations design, selection and erection
IEC 60331:2018	Tests for electric cables under fire conditions - Circuit integrity
IEC 60331-21:1999	Tests for electric cables under fire conditions - Circuit integrity - Part 21: Procedures and requirements - Cables of rated voltage up to and including 0,6/1,0 kV
IEC 60332-1-2:2004	Tests on electric and optical fibre cables under fire conditions - Part 1-2: Test for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame

IEC 60332-3-22:2018	Tests on electric and optical fibre cables under fire conditions - Part 3-22: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category A
IEC 60502:2021	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV)
IEC 60840:2020	Power cables with extruded insulation and their accessories for rated voltages above 30 kV (Um= 36 kV) up to 150 kV (Um = 170 kV) - Test methods and requirements
IEC 61158	Industrial communication networks - Fieldbus specifications
IEC 61784	Industrial communication networks
ISO 1716:2018	Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)

## 6 STANDARD CABLE TYPES

### 6.1 Medium voltage cables

#### 6.1.1 Medium Voltage (20 kV) Cables

For cables installed on indoors, the CPR classification requirement is C<sub>ca</sub>-s1, d2, a1. Testing according to IEC 60332-1-2

Type	Conductor size	Conductor marking	Note
<b>20 kV single core cables</b>  Rated voltage: U <sub>o</sub> /U = 11.5/20 kV U <sub>m</sub> = 24 kV	1 x 35		Conductor: Copper (Cu) acceptable aluminium preferred. Conductor insulation: XLPE Cu screen Standard: IEC 60502 Suitable also for underground installations
	1 x 50		
	1 x 70		
	1 x 95		
	1 x 120		
	1 x 150		
	1 x 185		
	1 x 240		
	1 x 300		
	1 x 400		
	1 x 500		
	1 x 630		
	1 x 800		
<b>20 kV three core cables</b>  Rated voltage: U <sub>o</sub> /U = 11.5/20 kV U <sub>m</sub> = 24 kV	3 x 35	1 Brown 2 Black 3 Gray	Conductor: Copper (Cu) acceptable aluminium preferred. Conductor insulation: XLPE Cu screen over each individual core Extruded filler Standard: IEC 60502 Suitable also for underground installations
	3 x 50		
	3 x 70		
	3 x 95		
	3 x 120		
	3 x 150		
	3 x 185		
	3 x 240		

### 6.1.2 Medium voltage (10 and 6 kV) Cables

For cables installed on indoors, the CPR classification requirement is C<sub>ca</sub>-s1, d2, a1.  
Testing according to IEC 60332-1-2

Type	Conductor size	Conductor marking	Note
<b>10 kV single core cables</b>  Rated voltage: U <sub>o</sub> /U = 6/10 kV U <sub>m</sub> = 12 kV	1 x 35		Conductor: Copper (Cu) acceptable aluminium preferred. Conductor insulation: XLPE Cu screen Standard: IEC 60502  Suitable also for underground installations
	1 x 50		
	1 x 70		
	1 x 95		
	1 x 120		
	1 x 150		
	1 x 185		
	1 x 240		
	1 x 300		
	1 x 400		
<b>10 kV three core cables 10 kV motors</b>  Rated voltage: U <sub>o</sub> /U = 6/10 kV U <sub>m</sub> = 12 kV	3 x 35	1 Brown 2 Black 3 Grey	Conductor: Copper (Cu) acceptable aluminium preferred. Conductor insulation: XLPE Cu screen over each individual core Extruded filler Standard: IEC 60502  Suitable also for underground installations
	3 x 50		
	3 x 70		
	3 x 95		
	3 x 120		
	3 x 185		
	3 x 240		
<b>6 kV single core cables</b>  Rated voltage: U <sub>o</sub> /U = 3.5/6 kV U <sub>m</sub> = 7.2 kV	1 x 35		Conductor: Copper (Cu) acceptable aluminium preferred. Conductor insulation: XLPE Cu screen Standard: IEC 60502 Suitable also for underground installations
	1 x 50		
	1 x 70		
	1 x 95		
	1 x 120		
	1 x 150		
	1 x 185		
	1 x 240		
	1 x 300		
	1 x 400		
	1 x 500		
<b>6 kV three core cables</b>  Rated voltage: U <sub>o</sub> /U = 3.5/6 kV U <sub>m</sub> = 7.2 kV	3 x 35	1 Brown 2 Black 3 Grey	Conductor: Copper (Cu) acceptable aluminium preferred. Conductor insulation: XLPE Cu screen over each individual core Extruded filler Standard: IEC 60502 Suitable also for underground installations
	3 x 50		
	3 x 70		
	3 x 95		
	3 x 120		
	3 x 185		
	3 x 240		

## 6.2 Power Cables

### 6.2.1 General Power Cables

CPR class: C<sub>ca</sub>-s1, d2, a1.

Testing according to IEC 60332-1-2

Type	Conductor size	Conductor marking	Note
<b>400/690 V single core power cables</b>  Rated voltage U <sub>o</sub> /U = 0.6/1 kV	1 x 150	Black	Conductor: Stranded copper (Cu) Conductor insulation: XLPE (PVC not allowed) Outer sheath: black Standard: IEC 60502
	1 x 240		
	1 x 300		
<b>400/690 V three core power cables</b>  Rated voltage U <sub>o</sub> /U = 0.6/1 kV	3 G 2.5	1 Black	Conductor: Stranded copper (Cu) Conductor insulation: XLPE (PVC not allowed) Tape or extruded filler Outer sheath: black Standard: IEC 60502 (Solid copper acceptable for 2.5, 4 and 6 mm <sup>2</sup> )
	3 G 4		
	3 G 6		
	3 G 10		
	3 G 16		
	3 G 25		
	3 G 35		
	3 G 50		
	3 G 70		
	3 G 95		
	3 G 120		
	3 G 150		
	3 G 185		
<b>400/690 V four core power cables</b>  Rated voltage U <sub>o</sub> /U = 0.6/1 kV	4 G 2.5	1 Brown/Black	<b>For standard motors (DOL)</b>  Conductor: Stranded copper (Cu) Conductor insulation: XLPE (PVC not allowed) Tape or extruded filler Outer sheath: black Standard: IEC 60502 (Solid copper acceptable for 2.5, 4 and 6 mm <sup>2</sup> )
	4 G 4		
	4 G 6		
	4 G 10		
	4 G 16		
	3 x 25 + 16		
	3 x 35 + 16		
	3 x 50 + 25		
	3 x 70 + 35		
	3 x 95 + 50		
	3 x 120 + 70		
	3 x 150 + 70		
	3 x 185 + 95		
	3 x 240 + 120		
<b>400/690 V five core power cables</b>  Rated voltage U <sub>o</sub> /U = 0.6/1 kV	5 G 2.5	1 Brown	Conductor: Stranded copper (Cu) Conductor insulation: XLPE (PVC not allowed) Tape or extruded filler Outer sheath: black Standard: IEC 60502 (Solid copper acceptable for 2.5, 4 and 6 mm <sup>2</sup> )
	5 G 4	2 Black	
	5 G 6	3 Grey	
	5 G 10	4 Blue	
	5 G 16	5 Green/Yellow	
	4 x 25 + 16		
	4 x 35 + 16		
	4 x 50 + 25		
	4 x 70 + 35		
	4 x 95 + 50		
	4 x 120 + 70		
	4 x 150 + 70		
	4 x 185 + 95		
	4 x 240 + 120		

Type	Conductor size	Conductor marking	Note
<b>400/690 V three core screened power cables</b>  Rated voltage $U_o/U = 0.6/1 \text{ kV}$	3 x 2.5 + 2.5	1 Brown/Black	<b>For variable speed motors</b>  Conductor: Stranded copper (Cu) Conductor insulation: XLPE (PVC not allowed) Tape or extruded filler Concentric conductor (PE), a layer of copper wires and an closed helix of copper tape Cable has to be shielded Interference protected (EMC) Outer sheath: black Symmetrical construction Standard: IEC 60502 (Solid copper acceptable for 2.5 and 6 mm <sup>2</sup> ) Longer cables than 150m need motor choke
	3 x 6 + 6		
	3 x 10 + 10		
	3 x 16 + 16		
	3 x 25 + 16		
	3 x 35 + 16		
	3 x 50 + 25		
	3 x 70 + 35		
	3 x 95 + 50		
	3 x 120 + 70		
	3 x 150 + 70		
	3 x 185 + 95		
	3 x 240 + 120		
<b>400/690 V four core screened power cables</b>  Rated voltage $U_o/U = 0.6/1 \text{ kV}$	4 x 2.5 + 2.5	1 Brown 2 Black 3 Grey 4 Blue	<b>For feeders, when screened cables needed</b>  Conductor: Stranded copper (Cu) Conductor insulation: XLPE (PVC not allowed) Tape or extruded filler Concentric conductor (PE), a layer of copper wires and an open helix of copper tape Outer sheath: black Standard: IEC 60502 (Solid copper acceptable for 2.5 and 6 mm <sup>2</sup> )
	4 x 6 + 6		
	4 x 10 + 10		
	4 x 16 + 16		
	4 x 25 + 16		
	4 x 35 + 16		
	4 x 50 + 25		
	4 x 70 + 35		
	4 x 95 + 50		
	4 x 120 + 70		
	4 x 150 + 70		
	4 x 185 + 95		
	4 x 240 + 120		

## 6.2.2 Fire Resistant Cables

CPR class: There is no fire class according to EN50575 for fire-resistant cables yet.

Type	Conductor size	Conductor marking	Note
<b>Three/five core fire resistant power cables</b>  Rated voltage U <sub>o</sub> /U = 0.6/1 kV	3 G 2.5	1 Brown	Fire resistant  Conductor: Stranded copper (Cu) Conductor insulation: XLPE Standard: IEC 60331
	3 G 4	2 Blue	
	3 G 6	3 Green/Yellow	
	3 G 10		
	3 G 16		
	5 G 2.5	1 Brown 2 Black 3 Grey 4 Blue 5 Green/Yellow	
	5 G 6		
	5 G 10		
	5 G 16		
	5 G 25		
	5 G 35		
	5 G 50		
	5 G 70		
	5 G 95		
	5 G120		

### 6.2.3 Heat Resistant Cables 125°C

CPR class: C<sub>ca</sub>-s1, d2, a1

Type	Conductor size	Conductor marking	Note
<b>Heat resistant lighting fitting cables</b>  Rated voltage U <sub>o</sub> /U =450/750V	3 G 1.5	1 Brown	Heat resistant  Conductor: Stranded copper (Cu) Conductor insulation: for 125°C service temp. Over all sheath: steam resistant Standard: EN 50525
	3 G 2.5	2 Blue	
	3 G 4	3 Green/Yellow	
	3 G 6		
	5 G 1.5	1 Brown	
	5 G 2.5	2 Black	
	5 G 6	3 Grey 4 Blue 5 Green/Yellow	

### 6.2.4 Heat Resistant Cables 180°C

Cable is not tested according to CPR C<sub>ca</sub>. Cable to be used only locally machine frame and special cases.

Type	Conductor size	Conductor marking	Note
<b>Tree core heat resistant power cables</b>  Rated voltage U <sub>o</sub> /U =450/750 V	3 G 1.5	1 Brown	Heat resistant  Conductor: Stranded copper (Cu) Conductor insulation: for 180°C service temp. Over all sheath: steam resistant Standard: EN 50525
	3 G 2.5	2 Blue	
	3 G 4	3 Green/Yellow	
	3 G 6		
<b>Four core heat resistant power cables</b>  Rated voltage U <sub>o</sub> /U =450/750 V	5 G 1.5	1 Brown	Heat resistant  Conductor: Stranded copper (Cu) Conductor insulation: for 180°C service temp. Over all sheath: steam resistant Standard: EN 50525
	5 G 2.5	2 Black	
	5G 4	3 Grey	
	5 G 6	4 Blue 4 Green/Yellow	

### 6.2.5 Cables for underground installation

For cables installed on indoors, the CPR classification requirement is C<sub>ca</sub>-s1, d2, a1.  
Testing according to IEC 60332-1-2

Type	Conductor size	Conductor marking	Note
<b>Three core armoured power cables</b>  Rated voltage U <sub>o</sub> /U = 0.6/1 kV	3 G 2.5	1 Brown	For underground installation  Conductor: Stranded copper (Cu) Conductor insulation: XLPE Tape or extruded filler Steel wire or steel tape armoured Outer sheath: black Standard: IEC 60502 (Solid copper acceptable for 2.5 and 6 mm <sup>2</sup> )
	3 G 6	2 Blue	
	3 G 10	3 Green/Yellow	
	3 G 16		
	3 G 25		
	3 G 35		
	3 G 50		
	3 G 70		
	3 G 95		
	3 G 120		
	3 G 150		
	3 G 185		

Type	Conductor size	Conductor marking	Note
<b>Four core armoured power cables</b>  Rated voltage $U_o/U=0.6/1$ kV	4 G 2.5	1 Brown	For underground installation  Conductor: Stranded copper (Cu) Conductor insulation: XLPE Tape or extruded filler Steel wire or steel tape armoured Outer sheath: black Standard: IEC 60502 (Solid copper acceptable for 2.5 and 6 mm <sup>2</sup> )
	4 G 6	2 Black	
	4 G 10	3 Blue	
	4 G 16	4 Green/Yellow	
	3 x 25 + 16		
	3 x 35 + 16		
	3 x 50 + 25		
	3 x 70 + 35		
	3 x 95 + 50		
	3 x 120 + 70		
<b>Five core armoured power cables</b>  Rated voltage $U_o/U=0.6/1$ kV	5 G 2.5	1 Brown	For underground installation  Conductor: Stranded copper (Cu) Conductor insulation: XLPE Tape or extruded filler Steel wire or steel tape armoured Outer sheath: black Standard: IEC 60502 (Solid copper acceptable for 2.5 and 6 mm <sup>2</sup> )
	5 G 6	2 Black	
	5 G 10	3 Grey	
	5 G 16	4 Blue	
	5 G 25	5 Green/Yellow	
	4 x 35 + 16		
	4 x 50 + 25		
	4 x 70 + 35		
	4 x 95 + 50		
	4 x 120 + 70		

### 6.2.6 Special Power Cables

Cable is not tested according to CPR C<sub>ca</sub>. Cable to be used only locally special cases.

Type	Conductor size	Conductor marking	Note
<b>400/690 V Flexible power cables</b>  Rated voltage $U_o/U=0.6/1$ kV	4 G 2.5	1 Brown	<b>Special cases</b>  Conductor: Class 5 high flexible stranded copper (Cu) Conductor insulation: Halogen free Standard: IEC 60502
	4 G 6	2 Black	
	4 G 10	3 Grey	
	4 G 16	4 Green/Yellow	
	4 G 25		
	4 G 35		

### 6.2.7 Lighting Fitting Cables

CPR class: C<sub>ca</sub>-s1, d2, a1. For cables installed on escape routes, the CPR classification requirement is B<sub>ca</sub>-s1, d1, a1.

Testing according to IEC 60332-1-2

Type	Conductor size	Conductor marking	Note
<b>Lighting fitting cables</b>  Rated voltage $U_o/U=450/750$ V	3 G 1.5	1 Brown	<b>For building electrification</b> Conductor: Flexible stranded copper (Cu) Conductor insulation: XLPE Standard: EN50525
	3 G 2.5	2 Blue 3 Green/Yellow	

## 6.3 Control Cables

### 6.3.1 General Control Cables

CPR class: C<sub>ca</sub>-s1, d2, a1

Testing according to IEC 60332-1-2

Type	Conductor size	Conductor marking	Note
<b>24-230 V multicore control cables</b>  Rated voltage U <sub>o</sub> /U=300/300 V	3 G 0.75	<u>Preferred:</u> -Cores with sequential numbering or colour -Last core GN/YE	Conductor: Solid copper (Cu) Conductor insulation: Halogen free Outer sheath: black Standard: EN 50525
	3 G 1		
	3 G 1.5		
	4 G 0.75		
	4 G 1		
	4 G 1.5		
	5 G 1.5		
	7 G 1.5		
	12 G 1.5		
	19 G 1.5		
	24 G 1.5		
	3 G 2.5		
	4 G 2.5		
	5 G 2.5		
	7 G 2.5		
	12 G 2.5		
	19 G 2.5		
	24 G 2,5		
<b>24-230 V multicore control cables</b>  Rated voltage U <sub>o</sub> /U=300/300 V	3 G 1.5	<u>Preferred:</u> -Cores with sequential numbering or colour -Last core GN/YE	<b>For variable speed motor installations</b>  Conductor: Solid copper (Cu) Conductor insulation: Halogen free Overall screen: an closed helix of metal tape with drain wire Outer sheath: black Standard: EN 50525 Interference protected (EMC)
	5 G 1.5		
	3 G 2.5		
	5 G 2.5		

### 6.3.2 Heat Resistant Control Cables

CPR class: C<sub>ca</sub>-s1, d2, a1

Type	Conductor size	Conductor marking	Note
<b>24-230 V Heat resistant flexible control cables</b>  Rated voltage U <sub>o</sub> /U=300/300 V	3 G 0,75	<u>Preferred:</u> -Cores with sequential numbering or colour -Last core GN/YE	<b>Heat resistant</b>  Conductor: Stranded copper (Cu) Conductor insulation: for 125°C service temperature. Halogen free Outer sheath: steam resistant Standard: EN 50525
	3 G 1		
	3 G 1.5		
	4 G 0,75		
	4 G 1		
	4 G 1.5		
	5 G 1.5		
	7 G 1.5		
	12 G 1.5		
	19 G 1.5		
	24 G 1.5		

Type	Conductor size	Conductor marking	Note
<b>Heat resistant, low capacitance computer cable</b>  Rated voltage 75 V	2x12 x 0.23		<b>Heat resistant, low capacitance</b>  Conductor: Stranded tinned copper (Cu) Conductor insulation: for 125°C service temperature. Halogen free Twisted pairs with shield and drain wire Outer sheath: steam resistant Standard: EN 50525

### 6.3.3 Fire Resistant Control Cables

CPR class: There is no fire class according to EN50575 for fire-resistant cables yet.

Type	Conductor size	Conductor marking	Note
<b>24-230 V Fire resistant control cables</b>  Rated voltage U <sub>o</sub> /U=300/300V	3 G 0,75	<u>Preferred:</u> -Cores with sequential numbering or colour -Last core GN/YE	<b>Fire resistant</b>  Conductor: Stranded copper (Cu) Conductor insulation: Halogen free Standards: IEC 60331
	3 G 1		
	3 G 1.5		
	4 G 0,75		
	4 G 1		
	4 G 1.5		
	5 G 1.5		
	7 G 1.5		
	12 G 1.5		
	19 G 1.5		
	24 G 1.5		

### 6.3.4 Flexible Control Cables

CPR class: C<sub>ca</sub>-s1, d2, a1

Testing according to IEC 60332-1-2

Type	Conductor size	Conductor marking	Note
<b>24-230 V Flexible control cables</b>  Rated voltage U <sub>o</sub> /U=300/300V	3 G 1.0	<u>Preferred:</u> -Cores with sequential numbering or colour -Last core GN/YE	<b>Special cases</b>  Conductor: Class 5 high flexible stranded copper (Cu) Conductor insulation: Halogen free Standard: EN 50525
	4 G 1.0		
	5 G 1.0		
	7 G 1.0		
	12 G 1.0		
	19 G 1.0		
	24 G 1.0		
	3 G 1.5		
	4 G 1.5		
	5 G 1.5		
	7 G 1.5		
	12 G 1.5		
	19 G 1.5		
	24 G 1.5		
	3 G 2.5		
	4 G 2.5		
	5 G 2.5		
	7 G 2.5		
	12 G 2.5		
	19 G 2.5		
	24 G 2,5		

Type	Conductor size	Conductor marking	Note
<b>24-230 V Flexible overall screened control cables</b>  Rated voltage $U_o/U=300/300V$	3 G 1.0	<u>Preferred:</u>  -Cores with sequential numbering or colour  -Last core GN/YE	<b>Special cases</b>  Conductor: Class 5 high flexible stranded copper (Cu) Overall screen: braid of tinned copper wire Conductor insulation: Halogen free Standard: EN 50525
	4 G 1.0		
	5 G 1.0		
	7 G 1.0		
	12 G 1.0		
	19 G 1.0		
	24 G 1.0		
	3 G 1.5		
	4 G 1.5		
	5 G 1.5		
	7 G 1.5		
	12 G 1.5		
	19 G 1.5		
	24 G 1.5		
	3 G 2.5		
	4 G 2.5		
	5 G 2.5		
	7 G 2.5		
	12 G 2.5		
	19 G 2.5		
	24 G 2,5		

## 6.4 Signal Cables

### 6.4.1 General Signal Cables

CPR class: C<sub>ca</sub>-s1, d2, a1

Testing according to IEC 60332-1-2

Type	Conductor size	Conductor marking	Note
<b>24V Individually pair screened armoured instrumentation cables</b>  Rated voltage: 75 V	1 x (2 + 1) x 0.5 + 0.5	<u>Preferred:</u>  - Cores with sequential numbering or colour  - Pairs numbering: 1,2,3,4, etc.	Conductor: Stranded, tinned copper (Cu) Unit: Twisted pairs with screen and drain wire Overall screen Steel wire or steel tape armoured Outer sheath: grey, blue (ATEX/Exi), orange (SIS)
	2 x (2 + 1) x 0.5 + 0.5		
	4 x (2 + 1) x 0.5 + 0.5		
	8 x (2 + 1) x 0.5 + 0.5		
	12 x (2 + 1) x 0.5 + 0.5		
	24 x (2 + 1) x 0.5 + 0.5		
	48 x (2 + 1) x 0.5 + 0.5		
<b>24V Individually pair screened instrumentation cables</b>  Rated voltage: 75 V	1 x (2 + 1) x 0.5 + 0.5	<u>Preferred:</u>  - Cores with sequential numbering or colour  - Pairs numbering: 1,2,3,4, etc.	Conductor: Stranded, tinned copper (Cu) Unit: Twisted pairs with screen and drain wire Overall screen with drain wire Outer sheath: grey, blue (ATEX/Exi), orange (SIS)  Conductor size can be alternatively 0.5 mm <sup>2</sup> or 0.75 mm <sup>2</sup>
	2 x (2 + 1) x 0.5 + 0.5		
	4 x (2 + 1) x 0.5 + 0.5		
	8 x (2 + 1) x 0.5 + 0.5		
	12 x (2 + 1) x 0.5 + 0.5		
	24 x (2 + 1) x 0.5 + 0.5		
	48 x (2 + 1) x 0.5 + 0.5		
	1 x (2 + 1) x 0.75 + 0.75		
	2 x (2 + 1) x 0.75 + 0.75		
	4 x (2 + 1) x 0.75 + 0.75		
	8 x (2 + 1) x 0.75 + 0.75		
	12 x (2 + 1) x 0.75 + 0.75		
	24 x (2 + 1) x 0.75 + 0.75		
	48 x (2 + 1) x 0.75 + 0.75		

Type	Conductor size	Conductor marking	Note
<b>24V Overall screened instrumentation cables</b>  Rated voltage: 75 V	1 x (2 x 0.5) + 0.5	<u>Preferred:</u> - Cores with sequential numbering or colour - Pairs numbering: 1,2,3,4, etc.	Conductor: Stranded, tinned copper (Cu) Unit: Twisted pairs Overall screen with drain wire Outer sheath: grey
	2 x (2 x 0.5) + 0.5		
	4 x (2 x 0.5) + 0.5		
	8 x (2 x 0.5) + 0.5		
	12 x (2 x 0.5) + 0.5		
	24 x (2 x 0.5) + 0.5		
	48 x (2 x 0.5) + 0.5		
<b>24V Individually pair screened instrumentation cables</b>  Rated voltage: 75 V	1 x (2+1) x 0.5 + 0.5	<u>Preferred:</u> - Cores with sequential numbering or colour - Pairs numbering: 1,2,3,4, etc.	<b>For variable speed motor installations</b>  Conductor: Stranded, tinned copper (Cu) Unit: Twisted pairs with screen and drain wire Overall screen: an closed helix of metal tape with drain wire Outer sheath: grey, blue (ATEX/Exi), orange (SIS) Interference protected (EMC)
	2 x (2+1) x 0.5 + 0.5		
	4 x (2+1) x 0.5 + 0.5		
	8 x (2+1) x 0.5 + 0.5		
	12 x (2+1) x 0.5 + 0.5		
	24 x (2+1) x 0.5 + 0.5		
	48 x (2+1) x 0.5 + 0.5		

## 6.4.2 Fire Resistant Signal Cables

CPR class: There is no fire class according to EN50575 for fire-resistant cables yet.

Type	Conductor size	Conductor marking	Note
<b>24V Individually pair screened instrumentation cables</b>  Rated voltage U <sub>o</sub> /U=300/300V	2 x (2 + 1) x 0.5 + 0.5	<u>Preferred:</u> - Cores with sequential numbering or colour - Pairs numbering: 1,2,3,4, etc.	<b>Fire Resistant</b> Conductor: Stranded, tinned copper (Cu) Twisted pairs with screen and drain wire Overall screen Outer sheath: Halogen free, grey, blue (ATEX/Exi), orange (SIS)
	4 x (2 + 1) x 0.5 + 0.5		
	8 x (2 + 1) x 0.5 + 0.5		
	12 x (2 + 1) x 0.5 + 0.5		
	24 x (2 + 1) x 0.5 + 0.5		
	2 x (2+1) x 0.5 + 0.5		
	4 x (2+1) x 0.5 + 0.5		
	8 x (2+1) x 0.5 + 0.5		
	12 x (2+1) x 0.5 + 0.5		
	24 x (2+1) x 0.5 + 0.5		

## 6.4.3 Combined Cables and Tubes

Type	Conductor size	Conductor marking	Note
<b>Tube + signal cable</b>	1 x 6/4 + 2 x (2+1) x 0.5+0.5	According to manufacturer specification	Signal cable: 2 x (2+1) x 0,5+0,5 Tube(s): pressure min 10 bar Tube material: PA, PE, XLPE, PES or PU Outer sheath of combined cable: XLPE CPR class for outer sheath and for the signal cable: C <sub>ca</sub> -s1, d2, a1 Standard: IEC 60332-1
	1 x 10/7 + 2 x (2+1) x 0.5+0.5		
	1 x 10/8 + 2 x (2+1) x 0.5+0.5		
	2 x 6/4 + 2 x (2+1) x 0.5+0.5		
	2 x 10/7 + 2 x (2+1) x 0.5+0.5		
	2 x 10/8 + 2 x (2+1) x 0.5+0.5		
	2 x 10/8 + 2 x (2+1) x 0.5+0.5		
	2 x 10/8 + 2 x (2+1) x 0.5+0.5		

Type	Conductor size	Conductor marking	Note
<b>Pneumatic tubes</b>	1 x 6/4	According to manufacturer specification	Tube(s): pressure min 10 bar Tube material: PA, PE, XLPE, PES or PU; hot places: PTFE Standard: IEC 60332-1
	1 x 10/7		
	1 x 10/8		
	2 x 6/4		
	2 x 10/7		
	2 x 10/8		

## 6.5 Earthing Cables Cu

CPR class: C<sub>ca</sub>-s1, d2, a1

Testing according to IEC 60332-1-2

Type	Conductor size	Conductor marking	Note
<b>PE – single core cables</b>  Rated voltage U <sub>o</sub> /U =450/750 V	1 x 4		<b>For protective earthing</b>  Conductor: Stranded copper (Cu) Sheath color: Green/Yellow Standard: EN 50525
	1 x 6		
	1 x 10		
	1 x 16		
	1 x 35		
	1 x 50		
	1 x 70		
	1 x 120		
<b>FE – single core cables</b>  Rated voltage U <sub>o</sub> /U =450/750 V	1 x 4		<b>For signal earthing</b>  Conductor: Stranded copper (Cu) Sheath color: Black Standard: EN 50525
	1 x 6		
	1 x 10		
	1 x 16		
	1 x 35		
	1 x 50		
	1 x 70		
	1 x 120		

## 6.6 Bare earthing cables

Type	Conductor size	Conductor marking	Note
<b>Bare earthing cables</b>	1 x 70 mm		<b>For earthing electrode</b>  Conductor: Stranded copper (Cu)
<b>Bare earthing lead (Zn/Fe)</b>	4 x 50 mm		<b>For earthing electrode</b>  Conductor: Zinc coated flat bar iron (Zn/Fe)
<b>Painted earthing lead (Zn/Fe)</b>	4 x 50 mm		<b>For earthing bonding conductor (in main cable trays)</b>  Conductor: Zinc coated flat bar iron (Zn/Fe), painted with green/yellow
	1 x 6		
	1 x 10		
	1 x 16		
	1 x 35		
	1 x 50		
	1 x 70		
	1 x 120		

## 6.7 Bus and Network Cables

### 6.7.1 Copper Cables

CPR class: C<sub>ca</sub>-s1, d2, a1, in server rooms: B2<sub>ca</sub>-s1, d1, a1  
Testing according to IEC 60332-1-2

Type	Conductor size	Note
<b>Profibus PA cable</b>	Standard Profibus PA	<b>For process automation</b>  Shielded twisted pair, stranded copper Halogen free Standard: IEC 61158-2, IEC 61784
<b>Profibus DP cable</b>	Standard Profibus DP cable (type A)	<b>For electrical and automation rooms</b>  Shielded twisted pair Halogen free CPR class: B2 <sub>ca</sub> -s1, d1, a1 Standard: IEC 61158, IEC 61784
<b>Robust Profibus DP cable</b>	Robust Profibus DP cable (type A)	<b>For process areas</b>  Shielded twisted pair Halogen free Standard: IEC 61158, IEC 61784
<b>Profinet cable</b>	Industrial Ethernet Cat 5e or better 4x0.64 (AWG22)	<b>For electrical and automation rooms</b>  Standard shielded 4-wire quad cable Suitable for Fast Connect technology Halogen free CPR class: B2 <sub>ca</sub> -s1, d1, a1 Standard: IEC 61158, IEC 61784
<b>Robust Profinet cable</b>	Industrial Ethernet Cat 5e or better 4x0.64 (AWG22)	<b>For process areas</b>  Robust shielded 4-wire quad cable Suitable for Fast Connect technology Halogen free Standard: IEC 61158, IEC 61784
<b>Horizontal twisted pair cable</b>	Cat 6A or better	<b>For indoor &amp; non-process areas</b>  Shielded twisted pair Shielding (min U/FTP or F/UTP) Halogen free Standard: IEC 11801
<b>Horizontal twisted pair cable</b>	Cat 6 or better	<b>For indoor/outdoor</b>  Shielded twisted pair Shielding (min U/FTP or F/UTP) Halogen free UV protected Standard: IEC 11801
<b>Horizontal twisted pair cable</b>	Cat 6A or better	<b>For process areas</b>  Shielded twisted pair Shielding (S/FTP or F/FTP) Halogen free Standard: IEC 11801

## 6.7.2 Fibre Optic (FO) Cables

CPR class: C<sub>ca</sub>-s1, d2, a1

Testing according to IEC 60332-1-2

Type	Conductor size	Note
Multimode Fibre Optic Cable	4x50/125µm 12x50/125µm 24x50/125µm 48x50/125µm 96x50/125µm	<b>For indoor/outdoor</b>  OM3 or better Rodent protected Halogen free
Multimode Fibre Optic Cable	4x50/125µm 12x50/125µm 24x50/125µm 48x50/125µm 96x50/125µm	<b>For direct burial, outdoor</b>  OM3 or better Rodent protected Halogen free Dielectric armour
Singlemode Fibre Optic Cable	4x9/125µm 12x9/125µm 24x9/125µm 48x9/125µm 96x9/125µm	<b>For indoor/outdoor</b>  OS2 or better Rodent protected Halogen free
Singlemode Fibre Optic Cable	4x9/125µm 12x9/125µm 24x9/125µm 48x9/125µm 96x9/125µm	<b>For direct burial, outdoor</b>  OS2 or better Rodent protected Halogen free Dielectric armour