

Standards and Directives

The particular requirements of the user's device regulations are binding for the use of connectors. The essential standards and regulations for the manufacture and testing of Turck products are stated below.

DIN VDE 0627: 2012-03 – Connectors and Plug Devices

After lengthy revision this standard will soon be valid as an international standard. The standard applies to connectors and plug devices for rated voltages up to 1000 V~ and 1500 V– and rated currents up to 125 A per contact for connecting modules or components in or on equipment in or on measurement and instrumentation circuits, taking safety aspects into account. The standard also applies to connectors and plug devices for household devices as well as for devices used in IT.

IEC 60664-1: 2008-01 – Insulation Coordination

This international standard, which complies with the German standard DIN VDE 0110-1, edition April 97, is a generic safety standard for insulation coordination. It contains the information required for specifying clearances, creepage distances and fixed insulation for electrical equipment (e.g. connectors). This takes into account the micro ambient conditions and other factors to which they will probably be exposed during their expected lifespan. This includes procedures for voltage testing in relation to insulation coordination.

IEC 60512: 2001-01 – Measurement and Test Procedures

This international standard complies with the European standard EN 60512 and has replaced the previous German standard DIN 41640. It defines the measuring and test procedures for electromechanical components (e.g. connectors). The standard is very comprehensive and consists in all of nine sections, containing descriptions of all electrical, mechanical and climatic tests. The standard also contains tests on the solderability, sealing, shielding and cable strain relief.

IEC 60529: 2000-09 – Protection Classes by Housing (IP Code)

This international standard corresponds to the European standard DIN EN 60529 and complies with the previous German standard DIN VDE 0470-1, edition Nov. 92. The standard defines the designations, requirements and tests for the classification of protection types by housings for electrical equipment (e.g. connectors). It also covers the evaluation of protection from access to hazardous parts, protection from foreign bodies and protection from water. The protection class is stated by means of an IP code.

IEC 60068-1: 1995-03 – Environmental Tests

This international standard, which complies with the German standard DIN EN 60068-1, is a fundamental specification of environmental tests and test levels of severity. These test procedures are used to test the resistance of components to expected environmental influences under operating conditions. Typical tests include: Cold, dry and damp heat, impact, vibration, temperature change etc.

Notes on the technical information

Turck reserves the right to make design changes due to quality improvements, further developments or production requirements without previous notice. The technical information stated in the catalog refers to connectors, i.e. components that must not be plugged or disconnected under live conditions. The technical data is provided to ensure correct use of the products.

The information enables the correct selection of products. Although the products are described with the data, their particular features are not guaranteed. The devices are designed for use in large industrial plants and equipment and also for use in industrial automation.

Information on the properties and sealing is based on tightening torques of 0.8...1.0 Nm for M12 × 1 round connectors and 0.4...0.6 Nm for M8 × 1 round connectors. The IP protection classes stated are only guaranteed for the connections of Turck products.

Notes on the Technical Information in the Catalog:

Characteristic values	Standard	Remark
Housing protection class	IEC 60529	When fitted. Further information on IP protection types overleaf
Mechan. lifespan	IEC 60512-5/9a	Test completed without electrical load
Rated voltage	IEC 60664-1	The stated value is defined in conjunction with the pollution degree and the operating voltage category
Pollution degree	IEC 60664-1	
Ampacity	IEC 60512-3/5b	
Forward resistance	IEC 60512-2/2a	Contact resistance of contact pin/contact socket when fitted over a defined range.

Note: The technical data represents initial values that may change after load conditions apply. When installing electrically conductive receptacle housings, these must be included in the device protection measures. The cables to be connected must only be stripped so that the clearances to the electrically conductive parts are not reduced. When soldering cables it must be ensured that no individual wires stick out and thus may cause short circuits.

Protection types to IEC/EN 60529 and DIN 40050 Part 9

The IEC/EN 60529 and DIN 40050-9 standards define the classification of protection types for electrical equipment. The following properties are defined:

- Contact protection: Protection of persons from contact with fixed or moving live parts inside enclosures
- Protection from foreign objects: Protection of the equipment from the ingress of solid particles, including dust
- Liquid ingress protection: Protection of the equipment from the ingress of liquids

The IP code is used for rating the protection class. This code consists of the two letters "IP" and a two-digit code, e.g. "IP67". The tables below explain the meaning of the two digits (refer to the respective standards for further information):

First digit of the IP code

1st digit		Meaning of the IP code: Protection from foreign bodies	Meaning of the IP code: Protection from contact
DIN 40050-9	IEC/EN 60529		
0	0	No protection	No protection
1	1	Protection from solid foreign bodies with $\varnothing > 50$ mm	Protection from back of hand contact
2	2	Protection from solid foreign bodies with $\varnothing > 12.5$ mm	Protection from finger contact
3	3	Protection from solid foreign bodies with $\varnothing > 2.5$ mm	Protection from contact with tool
4	4	Protection from solid foreign bodies with $\varnothing > 1.0$ mm	Protection from contact with wire
5K	5	Protection from dust in a harmful quantity	Complete protection from contact
6K	6	Dust-tight	Complete protection from contact

Second digit of the IP code

2nd digit		Meaning of the IP code: Protection from water
DIN 40 050-9	IEC/EN 60529	
0	0	No protection
1	1	Protection from vertically dripping water
2	2	Protection from dripping water when housing tilted up to 15°
3	3	Protection against vertical spray water up to 60° from vertical
4	4	Protection from spray water on all sides
4K		Protection from pressurized spray water on all sides
5	5	Protection from water jets from any angle
6	6	Protection from strong water jets
6K		Protection from strong powerful water jets with increased pressure, specifically for road vehicles
7	7	Protection from intermittent immersion
8	8	Protection from continuous immersion
9K		Protection from water with high pressure/ steam cleaning, specifically for road vehicles

PG thread and metric thread

The transition period for DIN 46320 "Cable Glands for cables and conductors with PG standard threads" expired on 31.12.1999. Since then, glands for cables and conductors had first to comply with the national standard 46319 before this was replaced by EN 50262 on 01.03.2001.

PG thread and metric thread

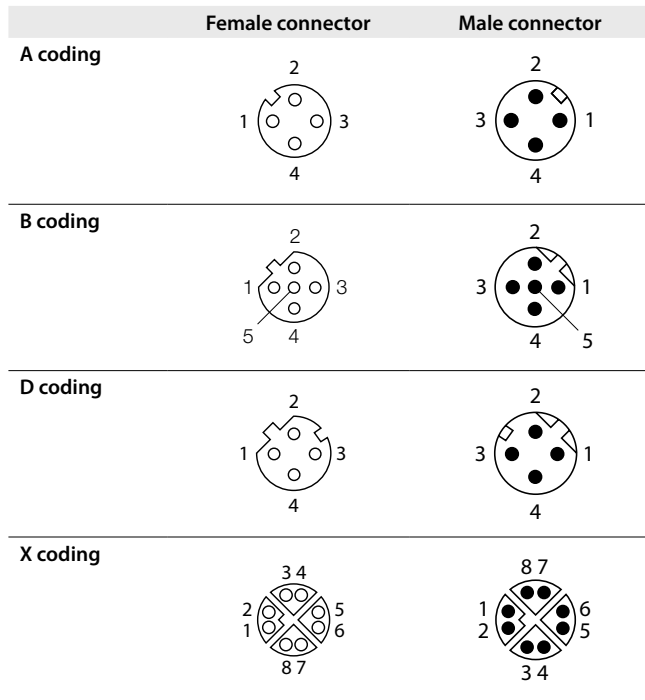
PG	metric [mm]
PG7	M12 x 1.5/ M10 x 1.5
PG9	M16 x 1.5
PG11	M16 x 1.5
PG13.5	M20 x 1.5

Wrench width for cable glands acc. to EN 50262

Thread	max. wrench size [mm]	max. across flats [mm]
M12 x 1.5	16	18
M16 x 1.5	21	23
M20 x 1.5	25	28

M12 × 1 Connector – Coding

Connectors are coded in order to ensure a fault-free connection. This coding is set using a pin and slot on the contact carrier. Different codings are used:



Note: B-coded female and male connectors from Turck are marked with a W (see type code).

Approvals and Certificates

UL (Underwriter Laboratories Inc.)

UL approvals are primarily required for the US and Canadian market. Certification by the Underwriter Laboratories Inc. verifies that the tested products, components or materials meet the specific safety requirements.

UL component approvals (UL Recognized Component), which identify these products as UL-approved components for mounting in UL-approved systems, apply to a number of Turck products. This component approval also applies to suitably used cable qualities. Individual cable qualities carry the UL Listing test mark (so-called device approval), which guarantees compliance with the applicable UL safety requirements.



GOST-R (ГОСТ - Государственный Стандарт)

Certification by the Federal Agency for Technical Regulation and Metrology is required for the import of goods to the Russian Federation. The Federal Agency verifies compliance of the products with Russian requirements, standards and quality standards.



Directive 2002/95/EU (RoHS - Restriction of [the use of certain] hazardous substances)

The EU Directive for restricting the use of certain hazardous substances in electrical and electronic devices prohibits hazardous substances in devices and components above the specified limits. These include lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB), and polybrominated diphenyl ethers (PBDE). For Turck products, this means the lead-free soldering and avoidance of toxic flame retardants in plastics and cables.



General Technical Features

Rated voltage

Specifies the maximum value of the electrical voltage in normal operation. The information on the operating characteristics of the connector are based on the rated voltage.

Insulation resistance

The insulation capacity of a material according to IEC 60512-2, 3a and DIN EN 60512-2 is defined as the ability to isolate adjacent contacts or a contact against ground at as high-impedance as possible.

Current load

The ampacity of a connector according to DIN ISO IEC 60512-3 defines the maximum power which may constantly flow across all contacts at the same time at an ambient temperature of 40 °C. The sum of the current-dependent self heating of the contacts and the ambient temperature must not exceed the maximum limit temperature of a connector - defined by the thermal properties of the materials used. The so-called derating curve shows the interrelationship between the current load of a connector and its ambient temperature. In practice higher currents per contact are permissible in certain circumstances since not all contacts are energized permanently at the same time at the maximum current. The precise values must be determined by testing in individual cases. Extract of the current load table for the cables of industrial machines according to DIN VDE 0113, EN 60204T1.

Nominal Ø Cable [mm ²]	Ampacity for cables with machines...			
	for normal use		for large series production	
	in cable duct	in air	in cable duct	in air
0.10	1.20	1.3	1.0	1.1
0.14 ¹	1.50	2.0	1.5	2.0
0.25 ¹	3.00	4.0	3.0	4.0
0.34 ¹	4.50	6.0	4.5	6.0
0.50	6.00	6.5	5.0	5.5
0.75	9.00	10.0	7.5	8.5
1.00	12.00	13.5	10.0	11.5
1.50	15.50	17.5	13.0	15.0
2.50	21.00	24.0	18.0	20.0
4.00	28.00	32.0	24.0	27.0
6.00	36.00	41.0	31.0	34.0
10.00	50.00	57.0	43.0	48.0

¹ These nominal cross sections are not covered by the standard. The ampacity is selected in compliance with VDE 0891.

Nominal Ø Cable [mm ²]	Nominal currents of fuses according to IEC 269-2 and IEC 269-3		
	gll	gl	aM
0.10	–	–	–
0.14	–	–	–
0.25	–	–	–
0.34	–	–	–
0.50	12	10	8
0.75	16	12	12
1.00	25	20	16
1.50	32	25	20
2.50	40	40	32
4.00	50	50	40
6.00	80	80	63
10.00	100	100	100

Insulation Coordination (Clearance and Creepage Distances)

For electrical equipment in low-voltage installations (< 1kV), DIN EN 60664 (DIN VDE 0110) describes the procedure for measuring the isolating clearance and creepage distances. The standard defines the minimum clearances (minimum distance between live parts in air) and minimum creepage distances (minimum distance between live parts along an insulating surface) to prevent electrical arcing. Minimum creepage distances depend on insulation material and degree of pollution.

Pollution degree

The degree of pollution (value 1 to 4) states the amount of pollution (solid, liquid or gaseous foreign bodies) in which the dielectric strength and/or surface resistance are reduced. For industrial applications degree of pollution 3 typical: conductive or dry, non-conductive pollution is present. This becomes conductive due to expected condensation.

Mechanical lifespan

States the number of mating cycles (mechanical plugging and removal of a connector), in which the wear of contact surfaces and thus the increase of the contact resistance does not occur.

Cable structure

Cable structure data

Only the maximum single wire diameter for the particular cable and the assigned maximum permissible electrical resistance cross section are specified in the VDE standard 0295. Other cable cross sections and designs on request.

Cable cross section [mm]	Cable from bare or tinned copper wire – number of wires × diameter [mm] – VDE 0295			
	solid Class 1 Column 2	stranded Class 2 Column 1	fine wire ¹ Class 5	extra fine wire ¹ Class 6
0.10			14 × 0.10 26 × 0.07	50 × 0.05
0.14			18 × 0.10 36 × 0.07	72 × 0.05
0.25			14 × 0.15 32 × 0.10 65 × 0.07	128 × 0.05
0.34		7 × 0.25	19 × 0.15 43 × 0.10 88 × 0.07	180 × 0.05
0.50	1 × 0.80	7 × 0.30	16 × 0.20 28 × 0.15 63 × 0.10 129 × 0.07	258 × 0.05
0.75	1 × 1.00	7 × 0.37	24 × 0.20 42 × 0.15 95 × 0.10 196 × 0.07	384 × 0.05
1.00	1 × 1.13	7 × 0.43	32 × 0.20 56 × 0.15 127 × 0.10 258 × 0.07	512 × 0.05
1.50	1 × 1.38	7 × 0.52	30 × 0.25 84 × 0.15 191 × 0.10 385 × 0.07	768 × 0.05
2.50	1 × 1.78	7 × 0.67	50 × 0.25 140 × 0.15 320 × 0.10 651 × 0.07	1281 × 0.05
4.00	1 × 2.26	7 × 0.85	56 × 0.30 224 × 0.15 512 × 0.10 1036 × 0.07	
6.00	1 × 2.77	7 × 1.05	84 × 0.30 192 × 0.20 765 × 0.10 1561 × 0.07	
10.00	1 × 3.57	7 × 1.35	80 × 0.40 320 × 0.20 1275 × 0.10	

¹ The number of wires in fine wire and extra fine wire conductor designs are preferred numbers.

Conversion: US cable designations AWG in mm²

IAWG (American Wire Gauge) cables are used in some industrial areas. The following table is used for the conversion from AWG to mm². Cables with the same AWG number and a different cable structure have slightly different cross sections!

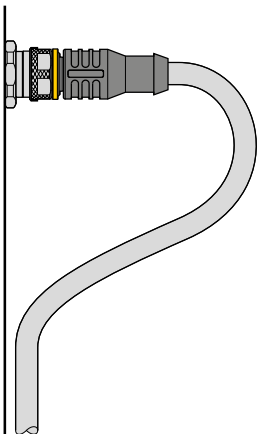
AWG	Conductor design [mm]	Conductor diameter [mm]	Conductor cross section [mm ²]
30	1 × 0.25	0.25	0.05
	7 × 0.10	0.36	0.06
28	1 × 0.32	0.32	0.08
	7 × 0.13	0.38	0.09
26	1 × 0.4	0.40	0.13
	7 × 0.16	0.48	0.14
	19 × 0.10	0.51	0.15
24	1 × 0.51	0.51	0.21
	17 × 0.20	0.61	0.22
	19 × 0.13	0.64	0.25
22	1 × 0.64	0.64	0.33
	7 × 0.25	0.76	0.34
	19 × 0.16	0.81	0.38
20	1 × 0.81	0.81	0.52
	7 × 0.32	0.97	0.56
	19 × 0.20	1.02	0.60
18	1 × 1.02	1.02	0.82
	19 × 0.25	1.27	0.93
16	19 × 0.29	1.44	1.25
14	19 × 0.36	1.80	1.93
12	19 × 0.46	2.29	3.16
10	37 × 0.40	3.10	4.65

Mounting

Wiring Instructions

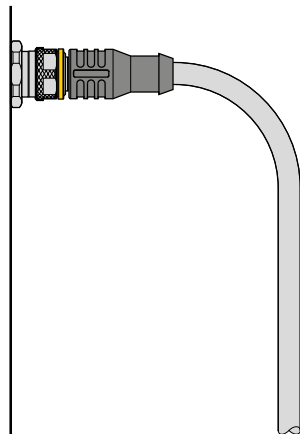
Use of fixed cable

Minimum 5 x cable diameter



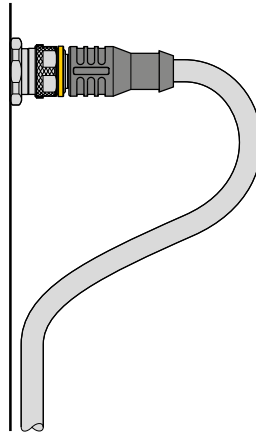
Use of free cable

Minimum 10 x cable diameter

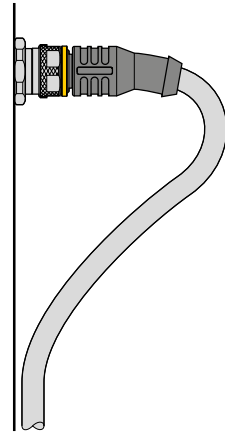


Bending radius of cable

Bending radius correct:

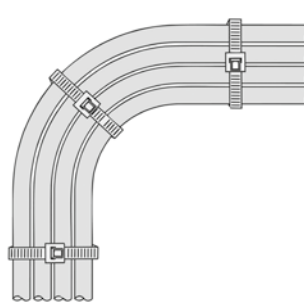


Bending radius incorrect:

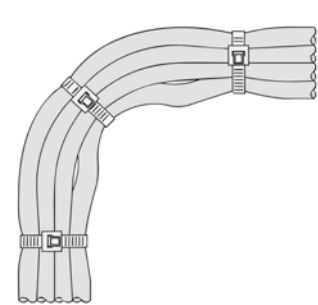


Bundling of multiple cables

Bundling correct:

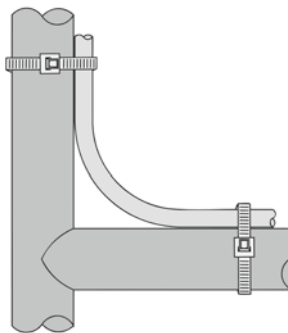


Bundling incorrect:

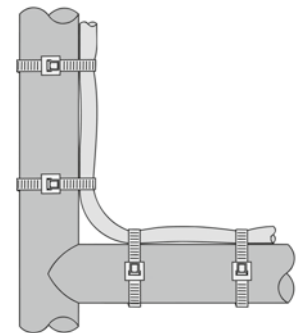


Fixed cabling

Fixed cable correct:



Fixed cable incorrect:



Note: The properties guaranteed by the manufacturer with regard to the correctly sealed and reliable electrical connection require the correct mounting of connectors and proper connection of cables. The use of a torque wrench is recommended for tightening and loosening round connectors.

Tightening torques:

- 0.4...0.6 Nm for M8 × 1 round connectors
- 0.8...1.0 Nm for M12 × 1 round connectors

To prevent damage to connectors and cables, the minimum bending radius (r_{min}) of the cable must be observed during wiring.

To avoid short circuits, cable breaks or a reduction in dielectric strength, cable ties used for bundling cables or fixed

wiring must not cut or deform the cable. A sufficient cable length between the terminals of cables must be observed in order to absorb the applied energy during movement. The use of cable loops, spiral cables or cable carriers guarantees the greater lifespan of the connector system.

Material Information

The connectors described in the catalog consist of two material groups:

- Metals for contacts and housings
- Plastics for connector inserts and housings

Materials for Contacts

The properties of the contacts are largely determined by the materials used. Key features include

- Strength and spring properties
- Electrical conductivity
- Max. operating temperature

In line with these requirements, Turck uses tried and tested copper alloys for the manufacture of contacts (CuZn). CuZn combines optimum strength with conductivity and temperature resistance.

Materials for Metal Housings

Brass, die-cast zinc or stainless steel housings are used depending on the application area. Brass is primarily used for round housing components due its easy machining properties and strength.

Plastics for Connector Inserts

Thermoplastic polyurethane is primarily used for connector inserts and contact carriers on Turck connectors.

Surface Treatment

The surfaces of contacts and housings are optimally designed for protection against corrosive environmental influences and to improve conductivity. The contacts are gold-plated or silver-plated and thus highly conductive and resistant to corrosion.

For applications in the mA range as well as for extra low voltages, the use of gold-plated contacts is recommended in order to improve the electrical properties and increase corrosion resistance. Housings are nickel-plated, chrome-plated, PTFE coated or made from stainless steel for improved corrosion resistance and visual appearance.

Materials for Seals

To ensure the required protection types all Turck round connectors are fitted with elastomer seal rings. Depending on the application area, these are nitrile butadiene rubber (NBR) or fluoro rubber (FPM, Viton).

Plastics for Housings

Glass fiber reinforced polyamide PA (polyamide) is primarily used for plastic housings. This long-proven plastic is very tough, abrasion-resistant, resistant to solvents, oils and fats and can be used up to continuous temperatures of +100 °C...+120 °C. Other benefits of this material are:

- high mechanical strength
- high rigidity
- high thermal resistance
- good electrical insulation properties
- good resistance to some chemicals

Characteristics of Materials Used

Surfaces

Material	Symbol	Conductivity [mm/Ω × mm ²]	Tensile strength [N/mm ²]	Limit temperature [°C]	Corrosion resistance
Gold	Au	44	–	–	very good
Silver	Ag	62	–	–	good
Nickel	Ni	10	–	–	very good

Surfaces Basic material

Material	Symbol	Conductivity [mm/Ω × mm ²]	Tensile strength [N/mm ²]	Limit temperature [°C]	Corrosion resistance
Copper	Cu	55	approx. 400	90	limited resistance, surface treatment recommended
Brass	CuZn	15	approx. 500	90	limited resistance, surface treatment recommended
Tin bronze	CuSn	9	approx. 700	120	good
Die-cast zinc	GD-Zn	16	approx. 300	–	no resistance, surface treatment required

Chemical resistance of plastics and elastomers used

		Thermoplastic polyurethane (TPU)	Polyamide (PA)	Nitrile butadiene rubber (NBR)	Fluoro rubber (FPM)
Hydrocarbons					
Gasoline, normal		+	+	+	+
Heating oil, diesel oil		+	+	+	+
Benzene		-	+	-	+
Naphthalene		-	+	+	+
Alcohols					
Ethyl alcohol			○	+	+
Isopropanol		○	○	+	+
Glycol		+	-	+	+
Glycerine		+	+	+	○
Ketone		-	+	-	-
Acetone		-	+	-	-
Acids					
Hydrochloric acid	20 %	+ 3 %	-	○	+
Nitric acid	10 %	+ 3 %	-	○	+
Phosphoric acid	30 %	+ 3 %	-	+	+
Sulphuric acid	30 %	+ 3 %	-	+	+
Citric acid		+ 3 %	+	+	+
Lactic acid	10 %	+ 3 %	+	○	+
Acetic acid	10 %	+ 3 %	○	+	+
Bases					
Soda lye	10 %	+ 3 %	+	○	○
Ammonia solution, diluted		+ 3 %	+	+	+
Oils, lubricants					
Mineral oils		+	+	+	○
ASTM oil 1		+	-	-	-
ASTM oil 2		+	-	-	-
ASTM oil 3		+	-	-	-
Hydraulic oils		+	+	-	-
Detergents					
Washing agents		-	+	+	+
Detergents		-	+	+	+
Sea water		+	+	+	+
+ resistant ○ conditionally resistant - not resistant					

Cable qualities







Chemical resistance of the outer jacket

Outer jacket Chemical	Soft PVC	PUR elastomer
++ resistant + largely resistant ○ conditionally resistant – not resistant		
Acetone	–	–
Aluminum chloride 10 %	++	+
Formic acid	–	–
Ammoniac	○	
Ammonium chloride	++	+
Aniline	–	–
ASTM oil I	++	++
ASTM oil II	++	++
ASTM oil III	++	++
ASTM fuel no. 1	++	++
ASTM fuel II	+	○
ASTM fuel III	+	○
Benzene	–	–
Brake fluid ATE	+	
Butanol	–	–
Butyl acetate	–	–
Calcium chloride 40 %	++	+
Chlorobenzene	–	–
Chloroform	–	–
Chromic acid	–	–
Cyclohexane	–	○
Cyclohexanone	–	–
Diesel oil	–	+
Dimethyl formamide	–	–
Iron II chloride 10 %	++	+
Acetic acid 10 %	+	+
Ethanol	–	–
Ethyl ether	–	○
Ethyl acetate	–	○
Ethylene chloride	–	+
Freon 12	+	○
Freon 22	+	○
Gear oil SAE90	+	–
Glycerine	++	++








Outer jacket Chemical	Soft PVC	PUR elastomer
++ resistant + largely resistant ○ conditionally resistant – not resistant		
Glycol	○	++
Isopropanol	–	○
Lye 10 %	++	++
Potassium dichromate	++	++
Potassium nitrate	++	++
Potassium permanganate	○	–
Magnesium chloride 30 %	++	+
Methanol	–	○
Methyl acetate	–	–
Methylene chloride	–	–
Methyl ethyl ketone	–	○
Methyl glycol	–	–
Methyl glycol acetate	–	–
Lactic acid 10 %	++	○
Sodium chloride 10 %	++	+
Sodium hypochlorite solution	○	++
Soda lye 10 %	++	++
Ozone	++	++
Perchloroethylene	++	–
Petrol ether	–	++
Petroleum	–	+
Phosphoric acid	++	–
Nitric acid	–	–
Hydrochloric acid	++	++
Carbon disulfide	–	–
Sulphuric acid 30 %	++	++
Tetrachloroethylene	–	–
Carbon tetrachloride	–	–
Tetrahydrofuran	–	–
Trichloroethylene	–	–
Hydrogen peroxide 3 %	++	++
Xylene	–	–

The suitability for certain applications must always be examined through appropriate testing by the user. The specified chemical resistance is only applicable in non-pressurized storage and unless otherwise stated, at room temperature.





Cables – Application and Features

	Food and Beverage			PUR, free of halogen		
	TFG	TFE	TFW	TXL	TXG	TXO
						
Machine and plant building	+	+	+	++++	++++	++++
Automotive industry	+	+	+	++++	++++	++++
Robot applications	+	+	+	++++	++++	++++
Food industry	++++	++++	++++	+	+	+
Packaging machines	++++	++++	++++	+	+	+
Jacket material	TPE	PVC	TPE	PUR	PUR	PUR
Jacket color	Gray (GY)	GY	White (WH)	BK	GY	OR
Conductor insulation	PP	PVC	PP	PP	PP	PP
IP67	yes	yes	yes	yes	yes	yes
IP69K	yes	yes	yes	yes	yes	yes
ecolab	yes	yes	yes	-	-	-
FDA	yes	-	yes	-	-	-
Temperature range						
...at rest [°C]	-40...105	-25...105	-40...105	-50...80	-50...80	-50...80
...in motion [°C]	-25...105	-25...105	-25...105	-25...80	-25...80	-25...80
...in drag chain operation [°C]	-25...60	-	-	-25...60	-25...60	-25...60
Shielded versions	-	-	optional	optional	optional	optional
Free of halogen, silicone, PVC	-	-	-	yes	yes	yes
Qualified for drag chain use	+++	-	-	++++	++++	++++
Torsion resistant	-	-	-	++++	++++	++++
Flame-retardant	-	yes	-	++++	++++	++++
Resistant to welding sparks	-	-	-	++++	++++	++++
Resistant to chemicals (detergents)	++++	++++	++++	+	+	+
Oil-resistant	+	+	+	++++	++++	++++
Resistant to acids/alkaline solutions	++	++++	++++	+	+	+
Resistant to sea water	++++	++++	++++	++++	++++	++++
UV and ozone resistant	++++	++	++++	++++	+++	+++
Resistant to hydrolysis	++++	++	++++	++++	++++	++++
Microbe resistant	++++	++	++++	++++	++++	++++
Directives/approvals						
cULus	-	-	-	AWM STYLE 20549 80C 300V UL# OR AWM I/II A/B 80C 300V FT2		
RoHS/Reach compliant	yes	yes	yes	yes	yes	yes








++++ very good +++ very good to good ++ good + conditionally resistant

			PVC			
TXY	TXB	TXN	TEL	TEG	TEY	TEB
						
++++	++++	++++	++++	++++	++++	++++
++++	++++	++++	++	++	++	++
++++	++++	++++	+	+	+	+
+	+	+	++++	++++	++++	++++
+	+	+	++++	++++	++++	++++
PUR	PUR	PUR	PVC	PVC	PVC	PVC
YE	BU	GN	BK	GY	YE	BU
PP	PP	PP	PVC	PVC	PVC	PVC
yes	yes	yes	yes	yes	yes	yes
yes	yes	yes	yes	yes	yes	yes
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-50...80	-50...80	-50...80	-40...105	-40...105	-40...105	-40...105
-25...80	-25...80	-25...80	-30...80	-30...80	-30...80	-30...80
-25...60	-25...60	-25...60	-	-	-	-
optional	optional	optional	optional	optional	optional	optional
yes	yes	yes	-	-	-	-
++++	++++	++++	-	-	-	-
++++	++++	++++	-	-	-	-
++++	++++	++++	++++	++++	++++	++++
++++	++++	++++	+	+	+	+
+	+	+	++	++	++	++
++++	++++	++++	++	++	++	++
+	+	+	+	+	+	+
++++	++++	++++	++	++	++	++
+++	+++	+++	+	+	+	+
++++	++++	++++	++	++	++	++
++++	++++	++++	++	++	++	++
AWM STYLE 20549 80C 300V UL# OR AWM I/II A/B 80C 300V FT2			AWM STYLE 2517 105C 300V UL# OR AWM I/II A/B 105C 300V FT1			
yes	yes	yes	yes	yes	yes	yes

Fieldbus Cables – Application and Features

	PROFIBUS-DP			
	451	451B	452	458
				
Machine and plant building	++++	++++	++++	++++
Automotive industry	++++	++++	++++	++++
Robot applications	++	++	++	++
Food industry	+	+	+	+
Packaging machines	+	+	+	+
Jacket material	PUR	PUR	PVC	PUR
Jacket color	VT	BU	VT	VT
Conductor insulation	PP	PP	PVC	PP
IP67	yes	yes	yes	yes
IP69K	-	-	-	-
ecolab	-	-	-	-
FDA	-	-	-	-
Temperature range				
...at rest [°C]	-40...+80	-40...+80	-40...+100	-40...+100
...in motion [°C]	0...+80	0...+80	-30...+80	-30...+80
...in drag chain operation [°C]	0...+60	0...+60	-	0...+60
Shielded versions	shielded	shielded	shielded	shielded
Free of halogen, silicone, PVC	yes	yes	-	yes
Qualified for drag chain use	+++	+++	-	++++
Torsion resistant	++	++	-	+++
Flame-retardant	++++	++++	++++	++++
Resistant to welding sparks	++	++	+	++
Resistant to chemicals (detergents)	+	+	++	+
Oil-resistant	++++	++++	++	++++
Resistant to acids/alkaline solutions	+	+	+	+
Resistant to sea water	++++	++++	++	++++
UV and ozone resistant	+++	+++	+	+++
Resistant to hydrolysis	++++	++++	++	++++
Microbe resistant	++++	++++	++	++++
Directives/approvals				
cULus	yes	yes	-	AWM20233
RoHS/Reach compliant	yes	yes	yes	yes

++++ very good +++ very good to good ++ good + conditionally resistant

	DeviceNet™/CANopen			Ethernet			
	Thin Cable 5701	Thin Cable 572	Thick Cable 5723	4414	4416	441	841
							
	++++	++++	++++	++++	++++	++++	++++
	++++	++++	++++	++++	++++	++++	++++
	++	++	++	++	++	++	++
	+	+	+	+	+	+	+
	+	+	+	+	+	+	+
	PUR	PVC	PVC	PUR	PUR	PVC	PVC
	SW	GY	GY	GN	GN	GN	GN
	PP	PP	PP	PP	PP	PP	PP
	yes	yes	yes	yes	yes	yes	yes
	yes	yes	yes	yes	yes	yes	yes
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-40...+80	-40...+100	-40...+100	-40...+100	-40...+100	-40...+100	-40...+100
	0...+80	-30...+80	-30...+80	-30...+80	-30...+80	-30...+80	-30...+80
	0...+60	-	-	-	-	-	-
	shielded	shielded	shielded	shielded	shielded	shielded	shielded
	yes	-	-	yes	yes	yes	-
	+++	-	++++	+++	+++	+++	-
	++	-	++++	++	++	++	-
	++++	++++	++++	++++	++++	++++	++++
	++	+	+	++	++	++	+
	+	++	++	+	+	+	++
	++++	++	++	++++	++++	++++	++
	+	+	+	+	+	+	+
	++++	++	++	++++	++++	++++	++
	+++	+	+	+++	+++	+++	+
	++++	++	++	++++	++++	++++	++
	++++	++	++	++++	++++	++++	++
	yes	AWM 246475°C 300V		yes	yes	AWM75°C 300V	
	yes	yes	yes	yes	yes	yes	yes

Contact Assignments and Color Codes

Number of pins	Note	Contacts/Wires							
		1	2	3	4	5	6	7	8
3	Actuator-sensor cable	BN		BU	BK				
4	Actuator-sensor cable	BN	WH	BU	BK				
5	Actuator-sensor cable	BN	WH	BU	BK	GNYE			
5	Power cable	BK1	BK2	BK3	BK4	GNYE			
5	Type 4.5	BN	WH	BU	BK	GY			
8	DIN EN 60947-5-2	BN	WH	BU	BK	GY	PK	VT	OG ¹
8	DIN 47100 ²	WH	BN	GN	YE	GY	PK	BU	RD
12	DIN EN 60947-5-2	BN	WH	BU	BK	GY	PK	VT	OG ¹
12	DIN 47100 ²	BN	BU	WH	GN	PK	YE	BK	GY
14	Multicore cables	VT	RD	GY	GN	BK	WH	PK	YE
19	e.g. passive boxes	VT	RD	GY	GN	BK	WH	PK	YE

1 alternatively GNYE, if PE required

2 The DIN 47100 telecommunications standard is no longer used in automation

Number of pins	Note	Contacts/Wires							
		1	2	3	4	5	6	7	8
PROFINET									
4	M12, D-coded	YE	WH	OG	BU				
8	RJ45	YE	OG	WH	n.c.	n.c.	BU	n.c.	n.c.
EtherNet/IP									
4	M12, A-coded	WH/OG	WH/BU	OG	BU				
8	RJ45	WH/OG	OG	WH/BU	n.c.	n.c.	BU	n.c.	n.c.
Industrial Ethernet									
8	M12	WH/BU	WH/BN	BN	OG	WH/GN	WH/OG	BU	GN
8	M12, X-coded	WH/OG	OG	WH/GN	BU	WH/BU	GN	WH/BN	BN

Number of pins	Note	Contacts/Wires				
		1	2	3	4	5
PROFIBUS-DP						
5	M12, B-coded	n.c.	GN	n.c.	RD	n.c.
DeviceNet™						
5	7/8"	Drain wire	RD	BK	WH	BU
5	M12	Drain wire	RD	BK	WH	BU