SCHALTBAU

Connect · Contact · Control

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Connectors

M Series

Circular Modular Connectors

Manual A10-M.en

Inhalt

1. Important Basic Information

1.1 Legal Notes

Without prior written consent of Schaltbau GmbH, the installation and maintenance instructions is not allowed to be electronically or mechanically reproduced – as a whole or in parts – be distributed, changed, transmitted, translated into another language or used in any other way. Schaltbau GmbH cannot be held liable for damage caused by not observing (or only partly observing) the Installation and maintenance instructions.

1.2 Conventions for this Installation and Maintenance Instructions

This instructions describe the installation and maintenance of the M series connectors.

Cross references are presented in ***bold italics***.

To highlight particularly important safety instructions and other information, the following symbols are used in this instructions:

DANGER

Indicates a hazardous situation with a high level of risk which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation with a medium level of risk which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation with a low level of risk which, if not avoided, may result in minor or moderate injury.

NOTICE

Indicates a hazardous situation which, if not avoided, may result in property damage, such as service interruption or damage to equipment or other materials.

Refers to technical features and methods aimed at facilitating work or to particularly important information.

2. General and Security Information

The connectors which are presented in this document are parts of low-voltage installations for special applications. They have been designed and checked in accordance with approved engineering regulations. Electrical appliances can generally cause severe harm to one's health and also material damage if used or operated improperly, or if not maintained sufficiently. The operation, maintenance and installation instructions for the connectors must therefore be strictly followed.

Any uncertainties must be clarified and all queries must include details of the type of device and the serial number. The planning and carrying out of mechanical and electrical installations, transportations, assemblies and commissioning as well as maintenance and repair work during installation, operation and maintenance, must therefore only be carried out by responsible experts with the appropriate expertise.

This is not only important when observing the general construction regulations and safety instructions on work with low-voltage installations, but also regarding the professional use of approved tools. Electrical devices are to be protected, as much as possible, from dust and moisture during installation or storage.

2.1 Observing the Installation and Maintenance Instructions

- All staff must read and understand the instructions and adhere to them when working with the device.
- **Always carefully observe all safety warnings!**

2.2 User Obligations

- Observe all applicable national regulations, all safety, injury and environmental precautions as well as the recognised technical regulations with regards to safe and professional work.
- The proper functioning of all available protection and safety devices is to be checked regularly.
- Work on electrical devices must only be carried out by experts or by instructed persons under the guidance and supervision of an expert according to the electro-technical regulations.
- An expert is a person who can judge and recognise the possible dangers of the jobs commended to him based on his training, knowledge and experience and by knowledge of the appropriate regulations.
- Staff must be informed clearly about who is responsible for the maintenance of the connectors.

2.3 Intended Use

- The connectors are intended exclusively for plug-in and releasable connections between components, devices and systems. They are used for the transmission of electrical energy and signals.
- According to DIN EN IEC 61984 it has to be ensured that the live side of plugs and receptacles respectively will always be equipped with socket contacts.
- A symmetrical assembly of the contact insert is not permitted. Please refer to the section ***"6. Manufacture and processing"***.
- None of the operating conditions defined in our catalogue "A10.en" in section "Specifications", such as voltages, currents, ambient conditions, etc. may be changed. The same applies for the operating conditions indicated in our catalogue "A101.en".
- Work on the connectors must only be carried out by staff who meets the requirements set out in these installation and maintenance instructions.
- According to DIN EN IEC 61984 the connectors are components which must not be plugged or unplugged when voltage is present during intended use.
- Stiffness of the connection indicates a problem (e.g. dirt, twisted contacts, etc.) the cause of which must be removed without delay. The plugging of plug and receptacle with increased force or violence is not permitted.
- In order to fulfill the requirements of the protection class as well as for protection against the entry of dirt or moisture, plugs and receptacles must always be locked with protection caps when not mated.
- When releasing the connection, always pull on the plug, never on the cable.
- Only use the connectors for the described scope of application and only with original parts. Any other use or an alteration of the connectors is considered as not in accordance with regulations. We assume no liability for damages caused by not intended use or incorrect use.

2.4 Ambient Conditions

NOTICE

The connectors are constructed for specific ambient conditions.

- Use the connectors only under the ambient conditions as defined in our catalogue ***A10.en*** in section ***„Specifications"***, and accordingly in ***A101.en***.

3. Dangers and Security Measures

3.1 Electrical Dangers

DANGER

The connectors contain components that carry voltage.
Deadly hazard!
Always consider the following safety rules before carrying out work on the connectors:

- Disconnect
- Ensure that it is not possible to reconnect unintentionally
- Make sure that there is no voltage present

DANGER

An incorrect pin configuration of the contact inserts may cause a deathly electric shock.

- Make sure that associated pin contacts and socket contacts are always plugged in the corresponding contact cavities with identical pin configuration!
- Make sure that contacts with phase configuration may not be plugged on a protection contact (PE)!
- Refer to the section ***"6. Manufacture and processing"***.

3.2 Measures for avoiding damages

NOTICE

Inappropriate handling of the connectors, e.g. a hard impact on the ground, may cause breaks, cracks and distortions.

- Make sure that the connectors are handled appropriately.
- Visually check the connectors on a regular basis to detect possible damages.
- Replace damaged parts immediately.

3.3 Measures for avoiding failures

NOTICE

When the connector elements are worn and/or soiled, the functional safety of the connection is no longer guaranteed.

- Visually check the connectors on a regular basis to detect wear and tear and dirt.
- Immediately replace damaged parts.
- Immediately remove dirt without leaving residues.
- Immediately replace parts with persistent dirt.

NOTICE

Inappropriate handling when plugging or disconnecting may damage the connectors. The functional safety of the connectors is no longer guaranteed when parts are damaged.

- Make sure when plugging that grooves and guideways of plug and receptacle always interlock!
- Take care that plug and receptacle do not tilt and that they are plugged without force.
- Make sure before the plugging procedure that plug and receptacle as well as the protection caps are not soiled. Remove existent dirt without leaving any residue.
- Make sure that in the not mated condition the protection caps are always attached according to regulations.

4. Description

Connectors of the M series are universal industry connectors and offer highest reliability.

M1 and M3 connectors are dust-proof and water pressure tight (protection class IP67 when mated and IP69K when not mated with screwed on protection cap). Moreover, they are largely resistant to acids and alkalines as well as to heat and cold.

The M 1 Plus series connectors are in addition to that equipped with O-rings between plug shell and contact insert as well as between contacts and contact insert and they are therefore sealed to protection class IP67 (immersion protected) even when not mated.

There is a large application range. Typical applications are systems and components where reliability under difficult circumstances is important, e.g. in mining, shipbuilding, power plant construction, mechanical and traffic engineering, environmental technology or in food processing.

Connectors of the M series have a modular design which offers a wide range of applications.

4.1 Features

Common features of M1, M1 Plus and M3 series connectors:

- **Modular design:** Customized and cost-effective realisation of your application.
- **Shells:** Various kinds of assembly, e.g. plug and receptacle shells with and without strain relief, with flange, for use with heat shrink boots or backshells with thread and cable gland, also flange-mount angled receptacle. Materials used:
  - Fibre glass reinforced polyamide: impact resistant
  - Non-halogen, UL listed
- **Design flexibility:** Plug and receptacle shell can be fitted with either pin or socket insert, i.e. fully insulated socket inserts can be mounted on the live part.
- **Orientation:** Pin and socket inserts can be located in the shell in two different positions, thus preventing mismating. It also allows for the unmistakable connection of for example two connectors with different voltages to one and the same piece of equipment.
- **Contacts:**
  - High-quality screw machine contacts
  - Silver or gold plated
  - Crimp connection depending on series and contact arrangement from 0.5 … 6 mm².

Special features of M1 series:

- Number of contacts: 4 and 6 + PE
- 5.000 mating cycles at constant low contact resistance
- Current rating:16 A max

Special features of M1 Plus series:

- Number of contacts: 6 + PE
- The features of the M1 series remain valid.
- Complete compatibility and intermateability with all M1 series connectors.
- Connector shells and contacts are delivered with pre-assembled seals.
- A red colour marking on the shell distinguishes the connector as sealed to IP67 (immersion protected).
- Water tight filler plugs for unused contact cavities.

Special features of M3 series:

- Number of contacts: 6 + PE, 8 + PE, 12 +PE and 7+7 + PE
- 5.000 mating cycles at constant low contact resistance
- Current rating: 50 A max

4.2 Varieties of configuration

On the next pages you can find a survey of the extensive varieties of configuration of the different connector components for the M1, M1 Plus and M3 series. The survey shows how the components listed below may be combined with each other:

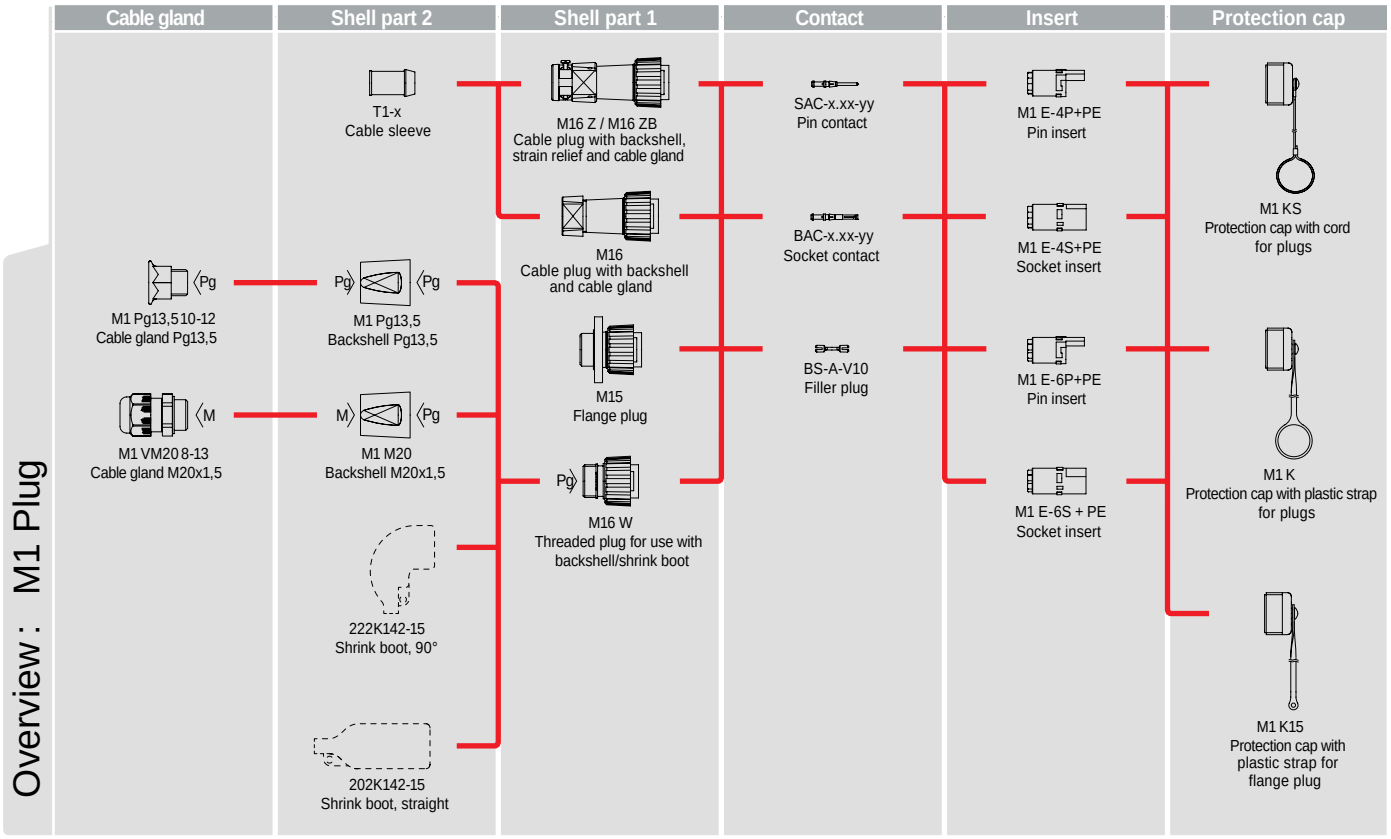
- Plug shells
- Receptacle shells
- Inserts and types of contacts
- Cable sleeves, shrink boots
- Backshells
- Cable glands
- Protection caps

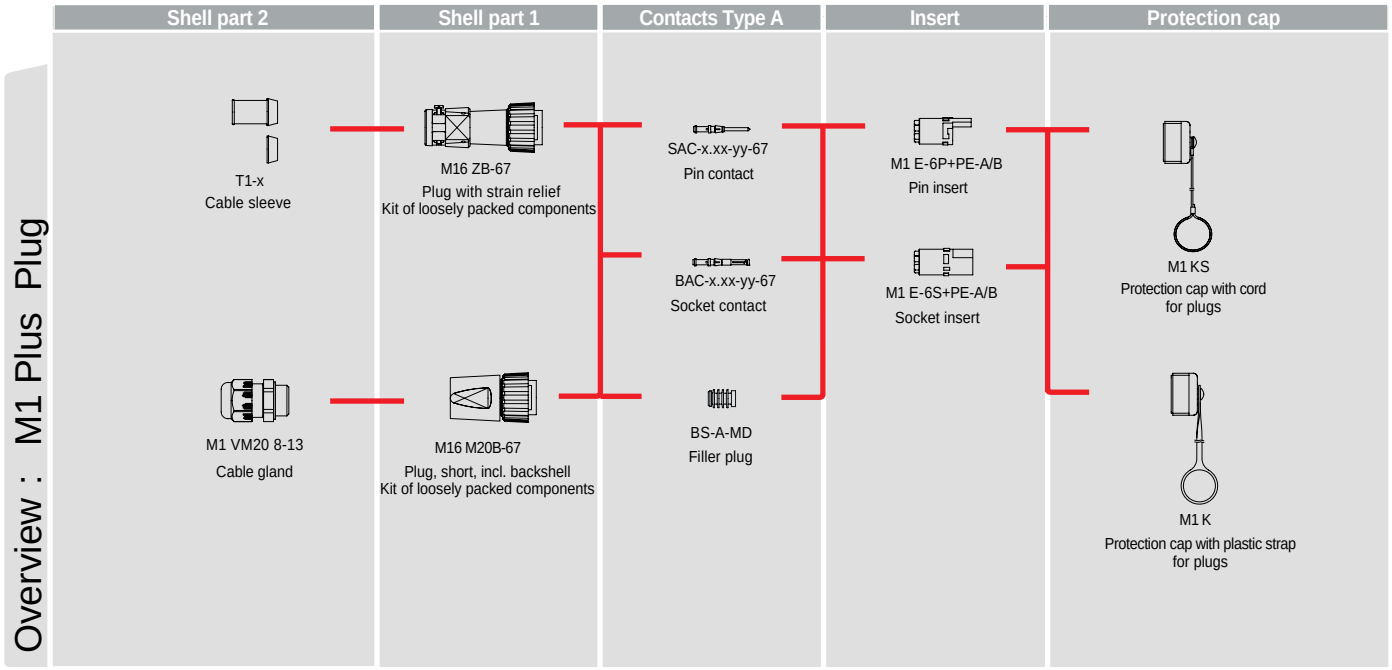
Under the following link on our homepage you can moreover find a configurator with the help of which you can assemble the various connector components in a comfortable way:

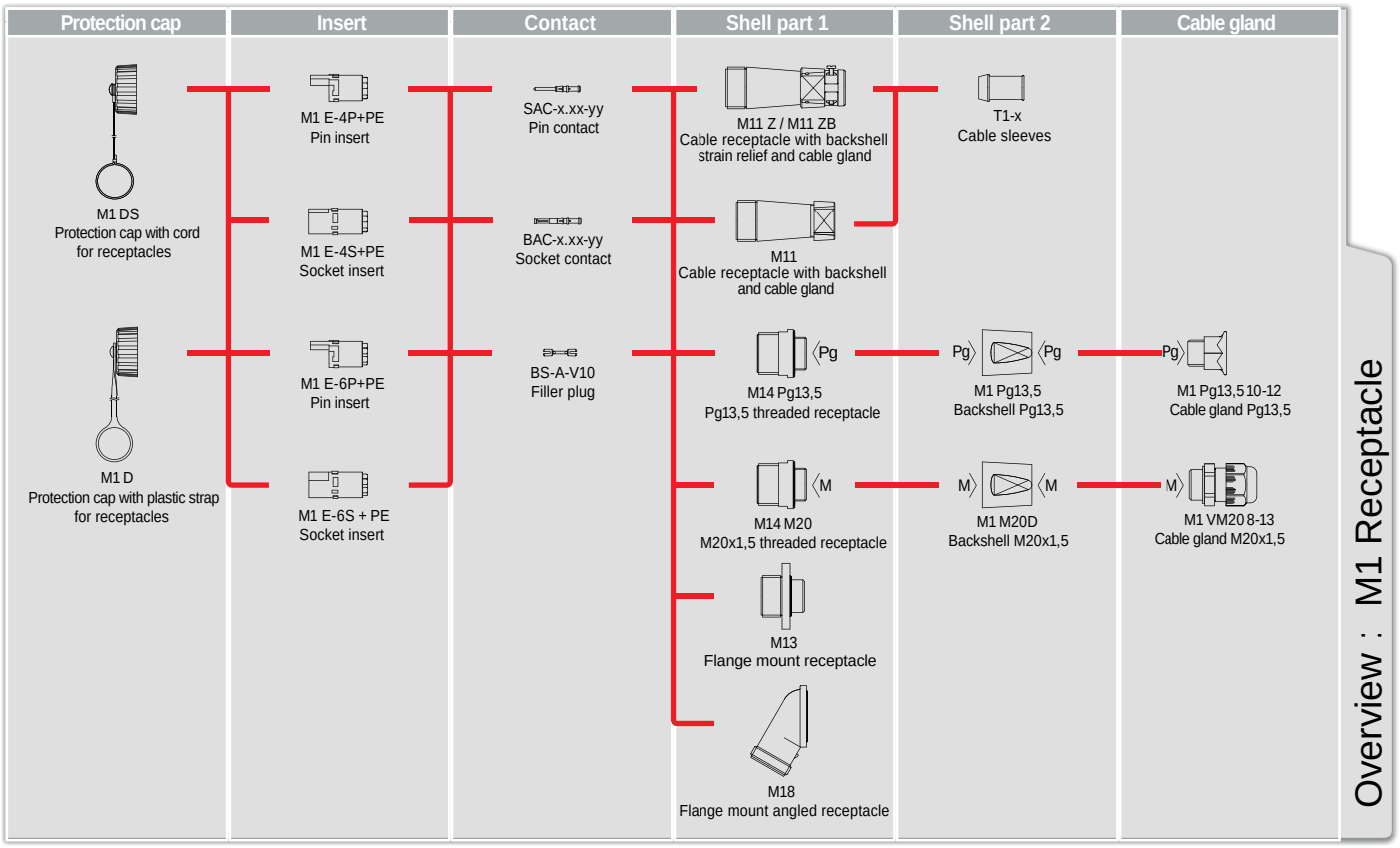
www.schaltbau-gmbh.com/en/Products/Connectors/M-series/

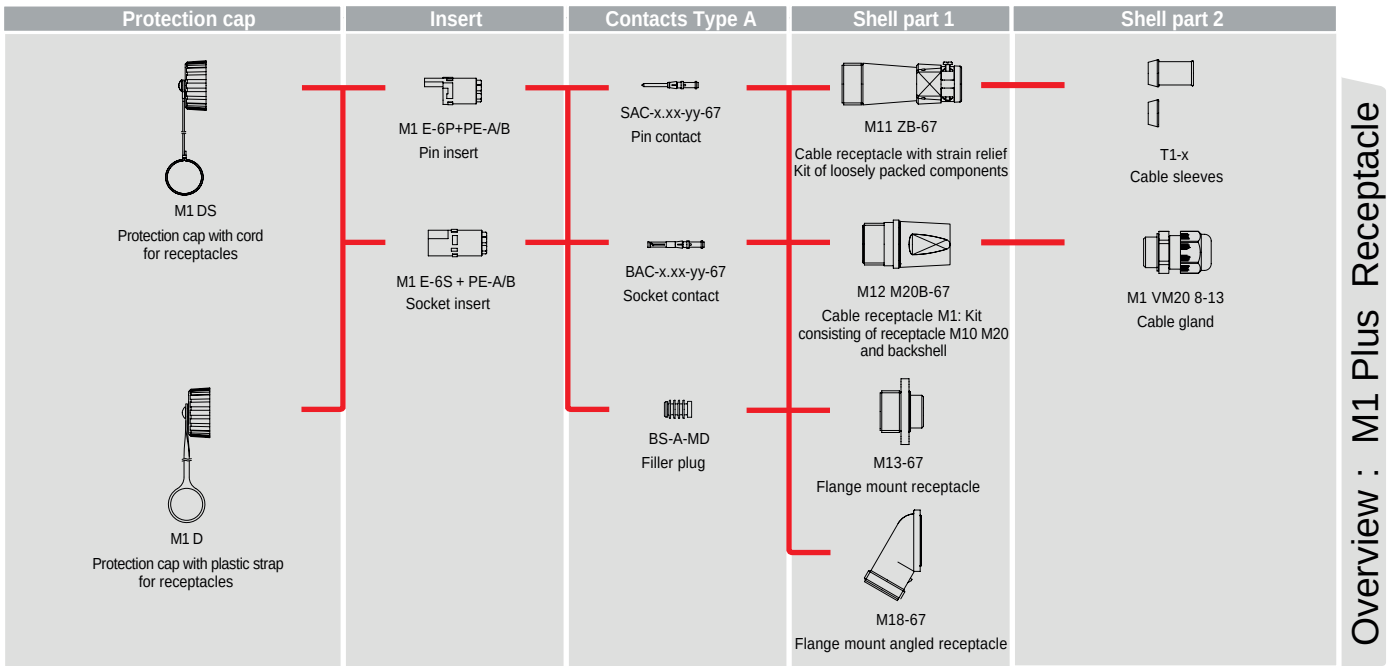
In order to find the configurator, click on the symbol with the two gears under the desired series on our homepage:

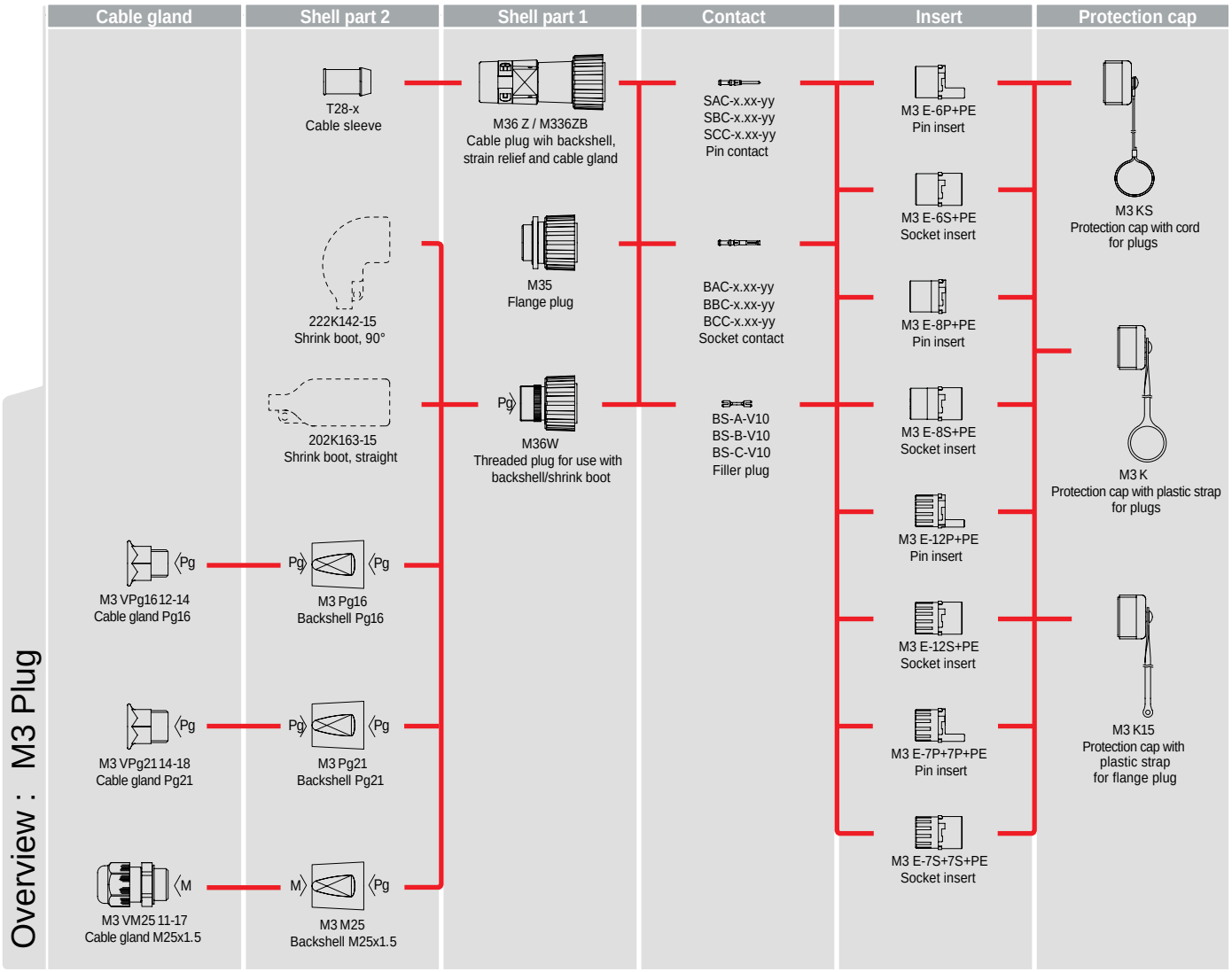
4.3 Survey of the components

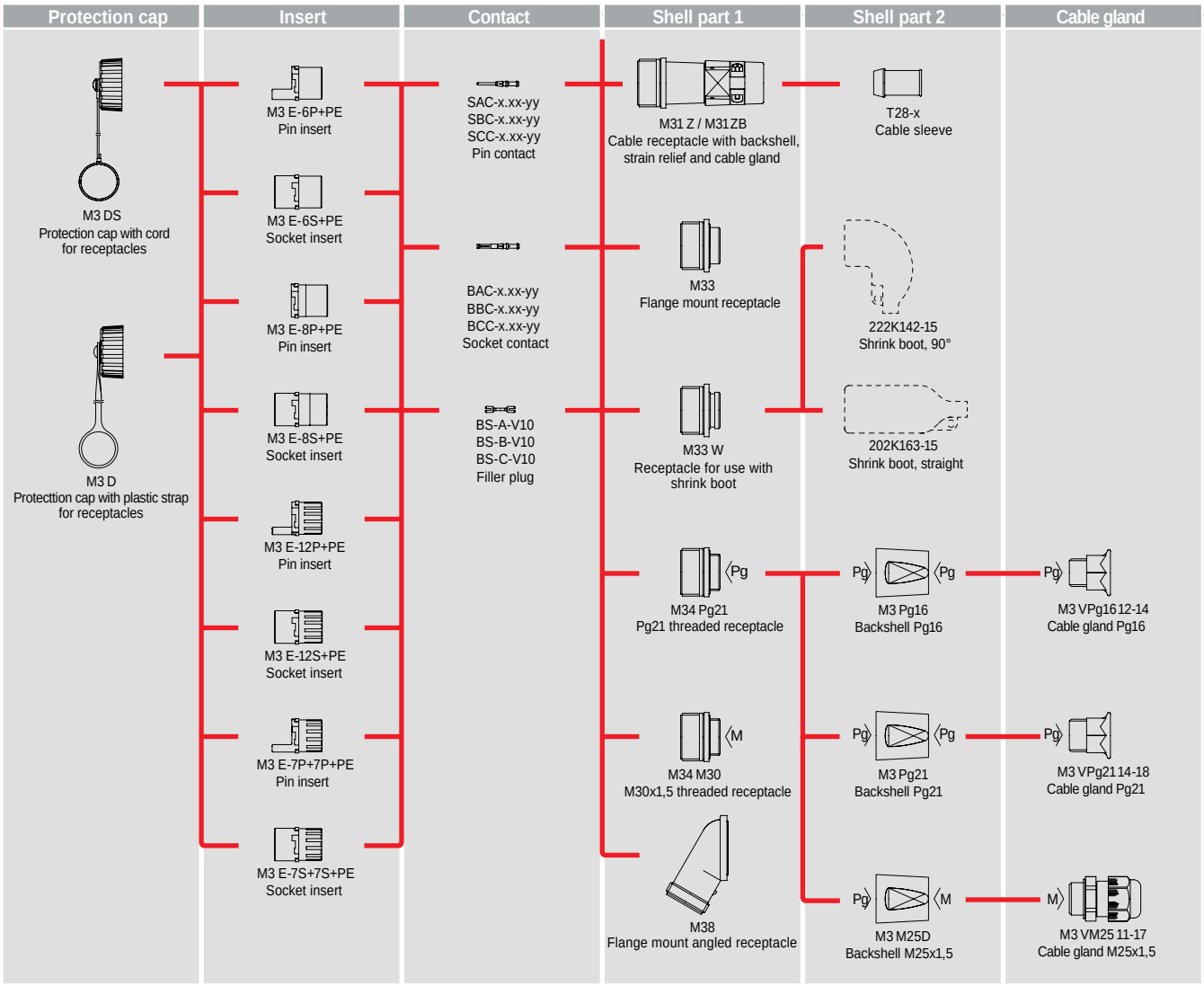





Protection cap
Insert
Contact
Shell part 1
Shell part 2
Cable gland
M1 DS
Protection cap with cord for receptacles
M1 D
Protection cap with plastic strap for receptacles
M1 E-4P+PE
Pin insert
M1 E-4S+PE
Socket insert
M1 E-6P+PE
Pin insert
M1 E-6S + PE
Socket insert
SAC-x.xx-yy
Pin contact
BAC-x.xx-yy
Socket contact
BS-A-V10
Filler plug
M11 Z / M11 ZB
Cable receptacle with backshell strain relief and cable gland
M11
Cable receptacle with backshell and cable gland
M14 Pg13,5
Pg13,5 threaded receptacle
M14 M20
M20x1,5 threaded receptacle
M13
Flange mount receptacle
M18
Flange mount angled receptacle
T1-x
Cable sleeves
M1 Pg13,5
Backshell Pg13,5
M1 M20D
Backshell M20x1,5
M1 Pg13,5 10-12
Cable gland Pg13,5
M1 VM20 8-13
Cable gland M20x1,5
Overview : M1 Receptacle


Protection cap
Insert
Contacts Type A
Shell part 1
Shell part 2
M1 DS
Protection cap with cord for receptacles
M1 D
Protection cap with plastic strap for receptacles
M1 E-6P+PE-A/B
Pin insert
M1 E-6S + PE-A/B
Socket insert
SAC-x.xx-yy-67
Pin contact
BAC-x.xx-yy-67
Socket contact
BS-A-MD
Filler plug
M11 ZB-67
Cable receptacle with strain relief Kit of loosely packed components
M12 M20B-67
Cable receptacle M1: Kit consisting of receptacle M10 M20 and backshell
M13-67
Flange mount receptacle
M18-67
Flange mount angled receptacle
T1-x
Cable sleeves
M1 VM20 8-13
Cable gland
Overview : M1 Plus Receptacle


Overview : M3 Plug
Cable gland
Shell part 2
Shell part 1
Contact
Insert
Protection cap
T28-x
Cable sleeve
222K142-15
Shrink boot, 90°
202K163-15
Shrink boot, straight
M3 VPg16 12-14
Cable gland Pg16
M3 VPg21 14-18
Cable gland Pg21
M3 VM25 11-17
Cable gland M25x1.5
M3 Pg16
Backshell Pg16
M3 Pg21
Backshell Pg21
M3 M25
Backshell M25x1.5
M36 Z / M336ZB
Cable plug wih backshell, strain relief and cable gland
M35
Flange plug
M36W
Threaded plug for use with backshell/shrink boot
SAC-x.xx-yy
SBC-x.xx-yy
SCC-x.xx-yy
Pin contact
BAC-x.xx-yy
BBC-x.xx-yy
BCC-x.xx-yy
Socket contact
BS-A-V10
BS-B-V10
BS-C-V10
Filler plug
M3 E-6P+PE
Pin insert
M3 E-6S+PE
Socket insert
M3 E-8P+PE
Pin insert
M3 E-8S+PE
Socket insert
M3 E-12P+PE
Pin insert
M3 E-12S+PE
Socket insert
M3 E-7P+7P+PE
Pin insert
M3 E-7S+7S+PE
Socket insert
M3 KS
Protection cap with cord for plugs
M3 K
Protection cap with plastic strap for plugs
M3 K15
Protection cap with plastic strap for flange plug


Protection cap
Insert
Contact
Shell part 1
Shell part 2
Cable gland
M3 DS
Protection cap with cord for receptacles
M3 D
Protecttion cap with plastic strap for receptacles
M3 E-6P+PE
Pin insert
M3 E-6S+PE
Socket insert
M3 E-8P+PE
Pin insert
M3 E-8S+PE
Socket insert
M3 E-12P+PE
Pin insert
M3 E-12S+PE
Socket insert
M3 E-7P+7P+PE
Pin insert
M3 E-7S+7S+PE
Socket insert
SAC-x.xx-yy
SBC-x.xx-yy
SCC-x.xx-yy
Pin contact
BAC-x.xx-yy
BBC-x.xx-yy
BCC-x.xx-yy
Socket contact
BS-A-V10
BS-B-V10
BS-C-V10
Filler plug
M31 Z / M31ZB
Cable receptacle with backshell, strain relief and cable gland
M33
Flange mount receptacle
M33 W
Receptacle for use with shrink boot
M34 Pg21
Pg21 threaded receptacle
M34 M30
M30x1,5 threaded receptacle
M38
Flange mount angled receptacle
T28-x
Cable sleeve
222K142-15
Shrink boot, 90°
202K163-15
Shrink boot, straight
M3 Pg16
Backshell Pg16
M3 Pg21
Backshell Pg21
M3 M25D
Backshell M25x1,5
M3 VPg16 12-14
Cable gland Pg16
M3 VPg21 14-18
Cable gland Pg21
M3 VM25 11-17
Cable gland M25x1,5

5. Assembly

DANGER

The connectors contain components that carry voltage.
Deadly hazard!
Always consider the following safety rules before carrying out work on the connectors:

- Disconnect
- Ensure that it is not possible to reconnect unintentionally
- Make sure that there is no voltage present

NOTICE

During installation, ensure that dirt caused by surrounding construction activities does not get into the connectors.

5.1 Check Parts for Transport Damage

NOTICE

If parts are damaged, the functional reliability of the connectors is no longer given.

- Before installing, check all parts for any possible transport damage.
- Do not install any damaged parts.

5.2 Assembly of receptacles / plugs into a mounting wall

Preparing measures

Appropriate mounting holes have to be prepared depending on the model for the mounting of receptacles and plugs with flange or thread into a mounting wall (refer to section ***Mounting holes / thread***).
In order to relieve the contacts from strain when assembled, a strain relief has to be provided on the mounting wall.

Fastening of receptacles / plugs with flange
For the fastening of receptacles and plugs with flange you need screws according to the following table:

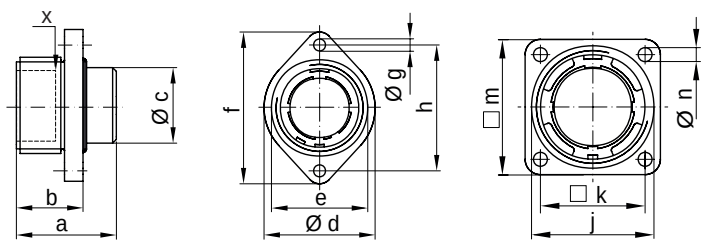
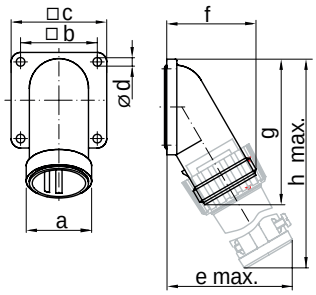
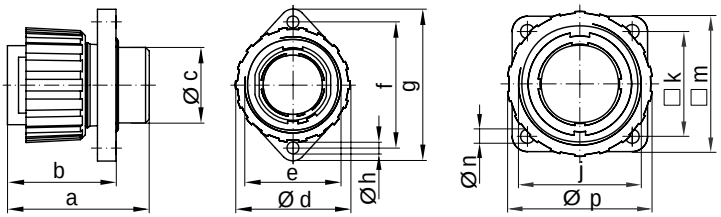
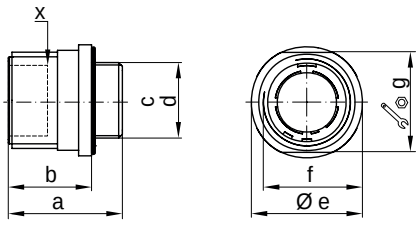
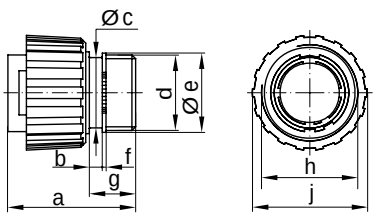
Series	Model of receptacle / plug	Size of screw (number)
M1, M1 Plus	Receptacle/plug with flange	M3 (2x)
	Angle receptacle with flange	M3 (4x)
M3	Receptacle/plug with flange and angle receptacle with flange	M4 (4x)

The length of the fastening screws as well as appropriate loctite thread locker elements have to be determined according to the assembly situation.
The torque has to be determined according to the screws used and to the materials existing on the site of the assembly.

Fastening of receptacles / plugs with thread
For the fastening of receptacles with thread, corresponding threads have to be prepared in the mounting wall.
Torque for all receptacles with thread: 2.5 Nm.

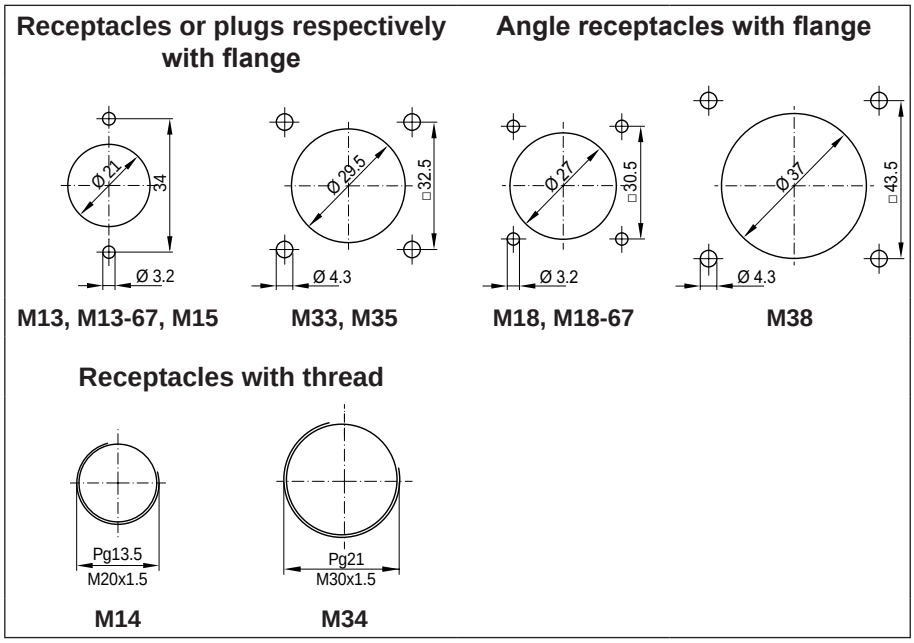
Dimensions

The measures for the different receptacles and plugs with flange or thread may be taken from the following table:

Model of receptacle / plug (diagrams not true to scale)		**Dimensions [mm]**	
		M1, M1 Plus	**M3**
Receptacles with flange	**M1, M1 Plus, M3** / **M1, M1 Plus** / **M3** 	**M13, M13-67** a = 27 b = 18 c = Ø 20.4 d = Ø 30 e = Tr26x2 f = 41 g = Ø 3.2 h = 34 x = Immersion depth 13.5	**M33** a = 31.5 b = 22.7 c = Ø 29 j = Tr38x6 P3 k = □ 32.5 m = □ 42 n = Ø 4.3 x = Immersion depth 15
Angle receptacles with flange	**M1, M1 Plus, M3** 	**M18, M18-67** a = Tr26x2 b = □ 30.5 c = □ 38.5 d = Ø 3.4 e = 65 max. f = 35.5 g = 58 h = 115 max	**M38** a = Tr38x6 P3 b = □ 43.5 c = □ 51.5 d = Ø 4.3 e = 95 max. f = 53.5 g = 87 h = 150 max
Plugs with flange	**M1, M3** / **M1** / **M3** 	**M15** a = 37.5 b = 28.5 c = Ø 20.4 d = Ø 31 e = Tr26x2 f = 34 g = 41 h = Ø 3.2	**M35** a = 43.5 b = 34.5 c = Ø 29 j = Tr38x6 P3 k = □ 32.5 m = □ 42 n = Ø 4.3 p = Ø 45
Receptacles with thread	**M1, M3** 	**M14** a = 31.5 b = 22.5 c/d = Pg13.5/M20x1.5 e = Ø 30 f = Tr26x2 g = SW 27 x = Immersion depth 13.5	**M34** a = 31.5 b = 22.7 c/d = Pg21/M30x1.5 e = Ø 40 f = Tr38x6 P3 g = SW 38 x = Immersion depth 15
Plugs with thread	**M1, M3** 	**M16W** a = 35.8 b = 3.5 c = Ø 19 d = Pg 13.5 e = Ø 21.4 f = 1 g = 12.5 h = Tr26x2 j = Ø 31	**M36W** a = 46.5 b = 3.5 c = Ø 27 d = Pg 21 e = Ø 29 f = 5.5 g = 26.5 h = Tr38x6 P3 j = Ø 45

Mounting holes / thread

You may take the measures for the mounting holes for the assembly of the different receptacles and plugs with flange or thread into a mountung wall from the following diagram.



Dimensions and arrangements of the mounting holes and threads (measures in mm)

6. Manufacture and processing

6.1 Required tools

Insertion tools for socket inserts

► Insertion tools for socket inserts

Ordering code	Insertion tools for
VW-M1 E-4S	contact insert M1 E-4S+PE
VW-M1 E-6S	contact insert M1 E-6S+PE
VW-M3 E-6S	contact insert M3 E-6S+PE
VW-M3 E-8S	contact insert M3 E-8S+PE
VW-M3 E-12S	contact insert M3 E-12S+PE, M3 7+7S+PE

Insertion tools for pin inserts

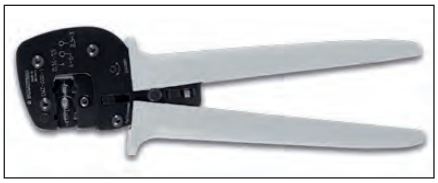
► Insertion tools for pin inserts

Ordering code	Insertion tools for
VW-M1 E-4P	contact insert M1 E-4P+PE
VW-M1 E-6P	contact insert M1 E-6P+PE
VW-M3 E-6P	contact insert M3 E-6P+PE
VW-M3 E-8P	contact insert M3 E-8P+PE
VW-M3 E-12P	contact insert M3 E-12P+PE, M3 7+7P+PE

Extraction tool

► Extraction tools for disassembly of contacts

Ordering code	Extraction tools for
AWZ-A	contact type SAC-x, SAC-x -67, BAC-x, BAC-x-67
AWZ-B	contact type SBC-x, BBC-x
AWZ-C/H	contact type SCC-x, BCC-x



Crimping pliers

► Crimping pliers

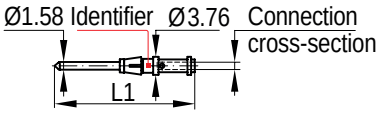
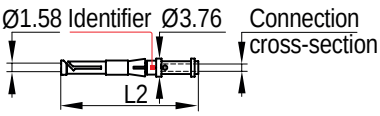
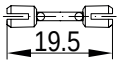
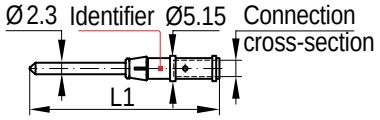
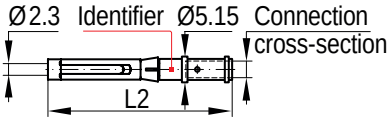
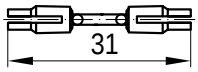
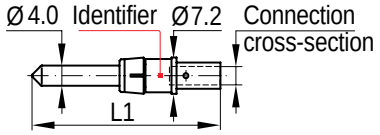
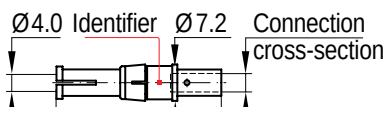
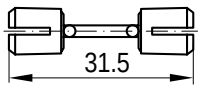
Ordering code	Crimping pliers for
CWZ-600-1	SAC-x, SAC-x-67, BAC-x, BAC-x-67, SBC-x, BBC-x, SCC-x and BCC-x, (not appropriate for the contact types SAC-2.50-xx and BAC-2.50-xx)
Pliers M22520/1-01 and insert M22520/1-02 (without illustration)	Only for contact types SAC-2.50-xx and BAC-2.50-xx.xx. Crimping pliers and insert from the company DMC or the company Buchanan. Order directly from the manufacturer.

► Wire stripping tools, commercially available

► Tweezers, commercially available (for inserting filler plugs)

6.2 Crimp contacts (pin / socket) and filler plugs

Series M1 / M3

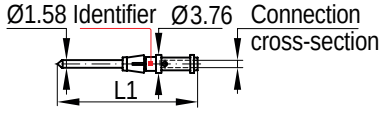
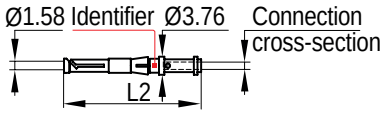
Contact type	Contact model	L1 [mm]	L2 [mm]	Identifier	Ordering code [1]	Connection cross-section
Pin contact SAC-x Ø 1.58 mm		28.6	-	without groove 1 groove 2 grooves 3 grooves	SAC-0.50-Ag SAC-1.00-Ag SAC-1.50-Ag SAC-2.50-Ag	0.5 mm² 0.75…1 mm² 1.5 mm² 2.5 mm²
Socket contact BAC-x Ø 1.58 mm		-	28.6	without groove 1 groove 2 grooves 3 grooves	BAC-0.50-Ag BAC-1.00-Ag BAC-1.50-Ag BAC-2.50-Ag	0.5 mm² 0.75…1 mm² 1.5 mm² 2.5 mm²
Filler plug [2] BS-A-V10		-	-	-	BS-A-V10	-
Pin contact SBC-x Ø 2.3 mm		40.4 40.4 40.4 39.0 39.0 39.0	-	without groove 1 groove 2 grooves 3 grooves 1 broad groove 2 broad grooves	SBC-0.50-Ag SBC-1.00-Ag SBC-1.50-Ag SBC-2.50-Ag SBC-4.00-Ag SBC-6.00-Ag	0.5 mm² 1.0 mm² 1.5 mm² 2.5 mm² 4.0 mm² 6.0 mm²
Socket contact BBC-x Ø 2.3 mm		-	37.0 37.0 37.0 35.6 35.6 35.6	without groove 1 groove 2 grooves 3 grooves 1 broad groove 2 broad grooves	BBC-0.50-Ag BBC-1.00-Ag BBC-1.50-Ag BBC-2.50-Ag BBC-4.00-Ag BBC-6.00-Ag	0.5 mm² 1.0 mm² 1.5 mm² 2.5 mm² 4.0 mm² 6.0 mm²
Filler plug [2] BS-B-V10		-	-	-	BS-B-V10	-
Pin contact SCC-x Ø 4.0 mm		37.5 37.5 37.5	-	3 grooves 1 broad groove 2 broad grooves	SCC-2.50-Ag SCC-4.00-Ag SCC-6.00-Ag	2.5 mm² 4.0 mm² 6.0 mm²
Socket contact BCC-x Ø 4.0 mm		-	32.6 32.6 32.6	3 grooves 1 broad groove 2 broad grooves	BCC-2.50-Ag BCC-4.00-Ag BCC-6.00-Ag	2.5 mm² 4.0 mm² 6.0 mm²
Filler plug [2] BS-C-V10		-	-	-	BS-C-V10	-

1) The standard contact surface for pin and socket contacts is silver (AG). For gold plated contacts (AU) please change the contact surface from “AG” to “AU” in the ordering code.

2) Filler plugs serve as an equipment of not configurated contact cavities in the contact inserts:
- For socket inserts: A whole filler plug is inserted into every not configurated contact cavity.
- For pin inserts: A whole filler plug is cutted in the middle and only half a filler plug is inserted into every not configurated contact cavity.

Series M1 Plus

The contacts of the series M1 Plus are delivered with pre-assembled sealing elements (immersion protected, sealed to IP67).

Contact type	Contact model	L1 [mm]	L2 [mm]	Identifier	Ordering code [1]	Connection cross-section
Pin contact SAC-x-67 Ø 1.58 mm		28.6	-	without groove 1 groove 2 grooves 3 grooves	SAC-0.50-Ag-67 SAC-1.00-Ag-67 SAC-1.50-Ag-67 SAC-2.50-Ag-67	0.5 mm² 0.75 ... 1 mm² 1.5 mm² 2.5 mm²
Socket contact BAC-x-67 Ø 1.58 mm		-	28.6	without groove 1 groove 2 grooves 3 grooves	BAC-0.50-Ag-67 BAC-1.00-Ag-67 BAC-1.50-Ag-67 BAC-2.50-Ag-67	0.5 mm² 0.75 ... 1 mm² 1.5 mm² 2.5 mm²
Filler plug BS-A-MD [2]		-	-	-	BS-A-MD	-

1) The standard contact surface for pin and socket contacts is silver (AG). For gold plated contacts (AU) please change the contact surface from “AG” to “AU” in the ordering code.

2) Filler plugs serve as an equipment of not configurated contact cavities in the contact inserts:

6.3 Ordering code for contacts

Example: SAC-1.00-AG-67

Contact type
S Pin contact
B Socket contact

Contact diameter
A 1.58 mm
B 2.30 mm
C 4.00 mm

Terminal Type
C Crimp

67 = identification only for series M1 Plus

Contact surface
AG Silver
AU Gold

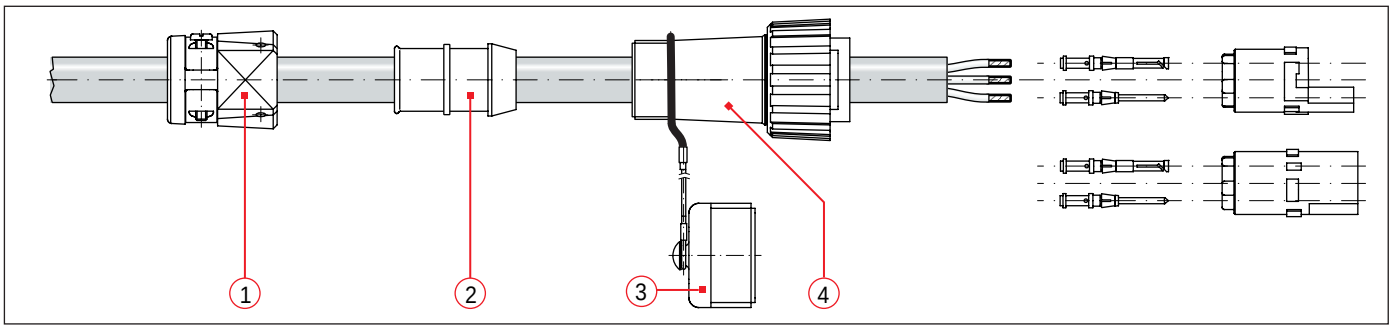
Connection cross section
0.5 mm²
0.75 ...1.00 mm²
1.50 mm²
2.50 mm²
4.00 mm²
6.00 mm²

6.4 Threading parts on cables

The following illustrations show for some examples of use how the connector parts have to be threaded on the cables.

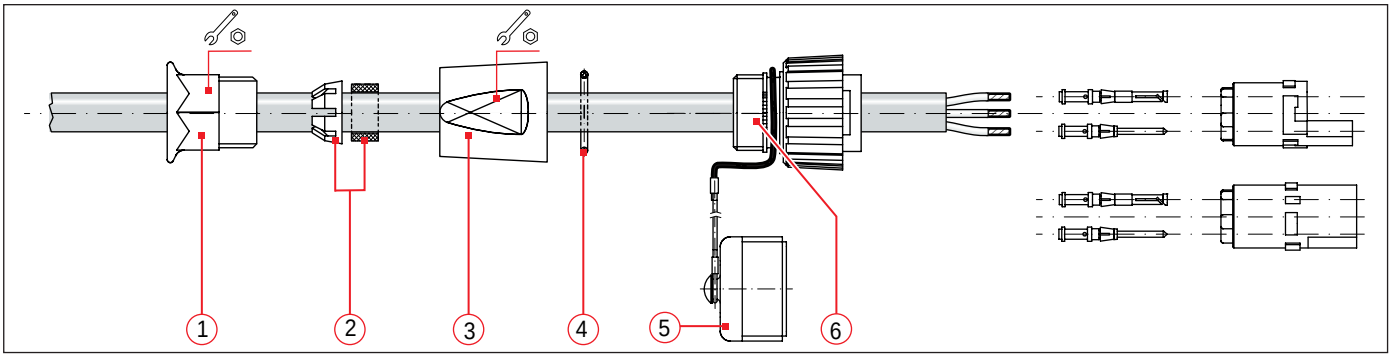
Receptacles / plugs for cables

► Depending on the application, at first thread all parts (1 to 6) on the cable.



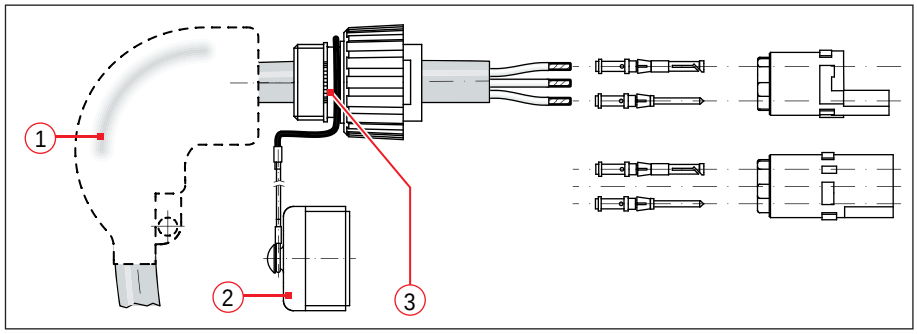
Example for cable plug with back shell, strain relief and screwing (applies analoguely also for cable receptacles)

1 Back shell with strain relief and cable gland
2 Cable sleeve with pre-assembled pressure disc
3 Protection cap for plugs or receptacles respectively
4 Plug or receptacle shell respectively



Example for plug with thread, back shell and cable gland (applies analoguely also for receptacles with thread)

1 Cable gland
2 Strain relief with rubber ring
3 Back shell
4 O-ring
5 Protection cap for plugs or receptacles respectively
6 Plug or receptacle shell respectively



Example for plug with thread and 90° shrink boot (applies analoguely also for receptacles with thread)

1 Shrink boot 90°
2 Protection cap for plugs or receptacles respectively
3 Plug or receptacle shell respectively

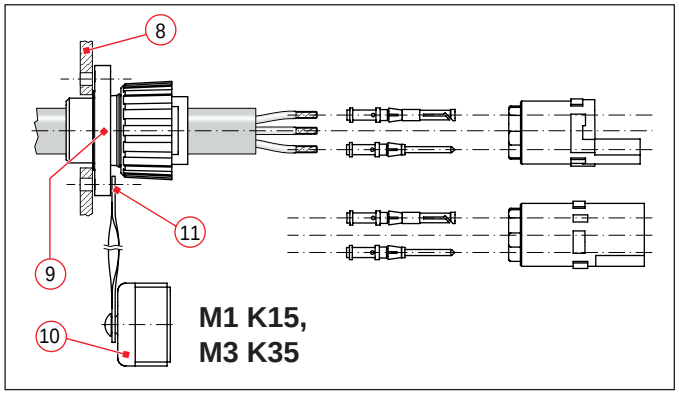
Receptacles / plugs with flange for wall assembly

- Slide cable from the rear through the mounting wall (8).
- Thread plug / receptacle with flange (9) on the cable and mount with the fixing screws on the mounting wall (8) with the pre-fabricated mounting holes.
- In doing so, also screw on protection cap (10) with one of the fixing screws on the flange (11).
  The torque for the fixing screws has to be determined according to the screws used and to the materials existent on the site of assembly.

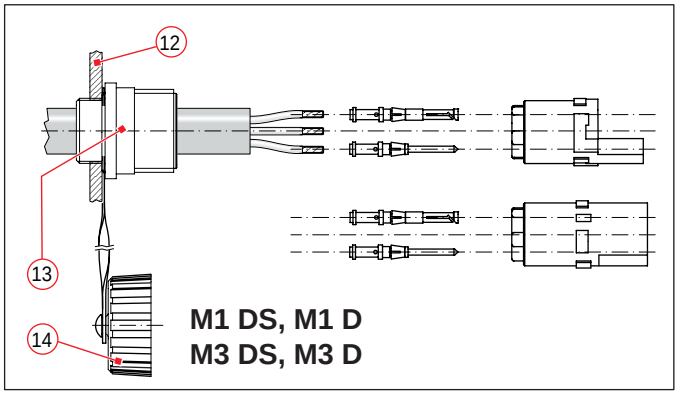
Receptacles with thread for wall assembly

- Slide cable from the rear through the mounting wall (12).
- Thread protection cap (14) on the thread side of the receptacle (13).
- Thread receptacle with thread (13) on the cable and screw into the mounting wall provided with the same thread.

For the assembly of the contacts and contact inserts refer to chapter **"6. *Manufacture and processing*"**.



Example of assembly for plugs with flange on a mounting wall



Example of assembly for receptacles with thread on a mounting wall

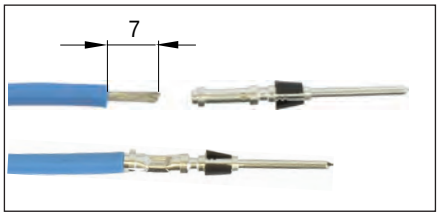
6.5 Make crimp connections

The connection of the crimp contacts has to be made according to DIN EN 60352-2 – solderless connections.

According to DIN EN IEC 61984 it has to be ensured that the live side of plugs and receptacles respectively will always be equipped with socket contacts.

Only for contact inserts M3 E-8P+PE and M3 E-8S+PE all contacts are equipped equally.
For all other contact inserts please observe the following:
- for pin inserts a socket contact must be used for the protective contact (PE),
- for socket inserts a pin contact must be used for the protective contact (PE).

Assembly



- Disengage cable at the connection end from the coating and strip cable strands approx. 7 mm.
- Push cable strands into the contacts.
- Crimp cable strands to contacts with the crimping pliers.
  - In doing so, observe connection cross-section of contacts depending on the model of the crimp contacts (refer to section ***"6.2 Crimp contacts (pin / socket) and filler plugs"***).
  - Crimping must be made in centre between inspection drill holes and the end of the contact.

Check

- Check if crimp contacts are firmly and correctly connected.
  - Make sure that no single wires stick out.
  - Check extraction forces according to DIN EN 61238-1.

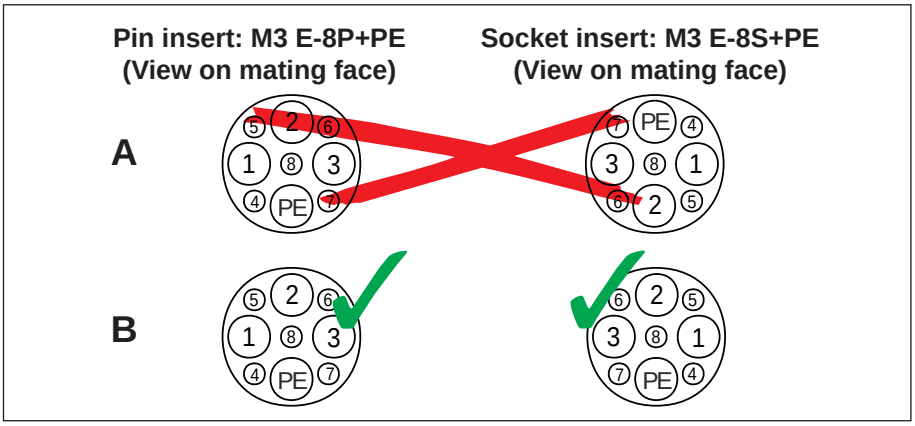
6.6 Assemble contacts into contact inserts

After all the cable strands have been crimped with the contacts and have been checked for firm and correct connection, the contacts may be assembled into the contact inserts.

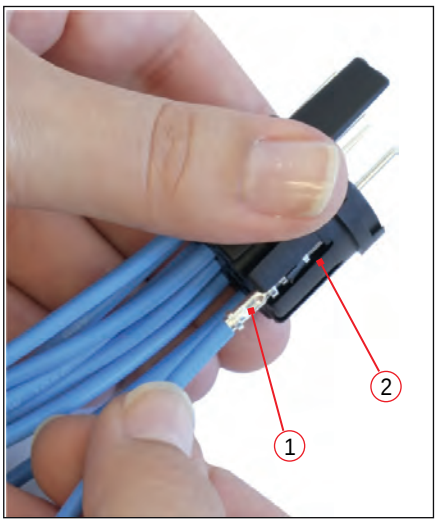
DANGER

A wrong pin configuration of the contact inserts may cause a deathly electric shock.

- Make sure that associated pin and socket contacts are always plugged into the corresponding contact cavities with identical pin configuration!
- Make sure that contacts with phase pin configuration cannot be plugged onto a protective contact (PE)!
- An equipment of the contact inserts with pin insert and socket insert rotated by 180° as shown for example in the following illustration (A) is not permitted!



Example for incorrect (A) and correct (B) configuration of the contact inserts



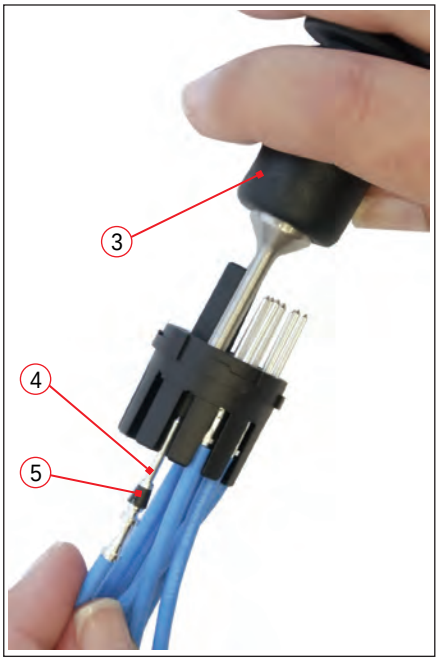
Pushing contacts (1) into contact inserts (2)

Assembly

- Inserting of the contacts (1) into the contact insert (2) is made starting from the middle outwards:
  In doing so, push every single contact to limit stop into the contact insert until the contact locks audibly.
- Insert filler plugs from the plug side into the contact insert of not configurated contact cavities, refer to section ***"6.7 Assembling filler plugs"***.

Check

- Check if all contacts are firmly in place: test force 40 N.



Disassembly of contacts

Disassembly

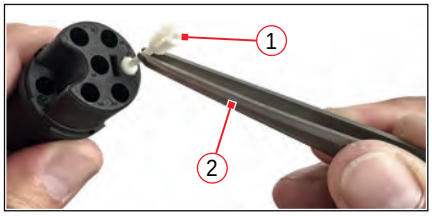
- In order to remove contacts from the contact inserts, adequate extraction tools are needed, refer to section ***"6.1 Required tools"***.
- Attach extraction tool (3) to contact (4) and extract contact from the contact insert.

NOTICE

After a contact has been extracted, the interlock function of the plastic clip (5) is no longer guaranteed. Therefore a new plastic clip – fitting for the type of contact – must be used when the contact is reused (refer to chapter ***"9. Special tools and spare parts"***)

6.7 Assemble filler plugs

Filler plugs have to be inserted into not configurated contact cavities of the contact inserts. Depending on the contact insert, filler plugs of different models and with corresponding diameters are available, refer to section ***"6.2 Crimp contacts (pin / socket) and filler plugs"***.
The following illustrations show for different examples of application how filler plugs have to be assembled into the contact inserts.



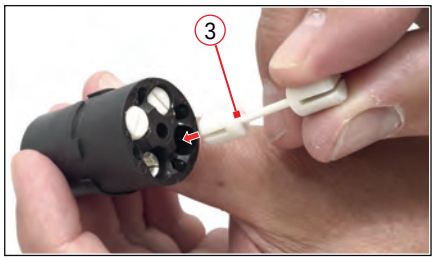
Insert of small filler plugs (e.g. BS-A/ BS-B) with forceps

Series M1 and M3:

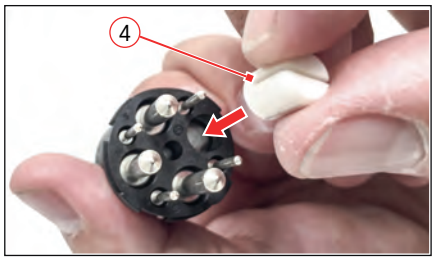
- For socket inserts: Insert one whole filler plug (1/3) per not configurated contact cavity.
- For pin inserts: Cut through one whole filler plug in the middle and only insert half a filler plug (4) per not configurated contact cavity.

► Insert filler plug from the plug side into the contact insert and push until limit stop.

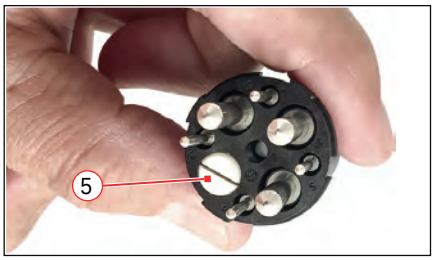
► Use tweezers (2) for easier insert of small filler plugs (1).



Assembly of whole filler plugs (3) for socket inserts



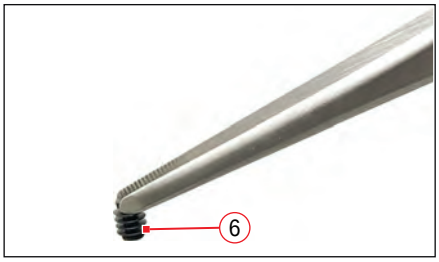
Assembly of half filler plugs (4) for pin inserts



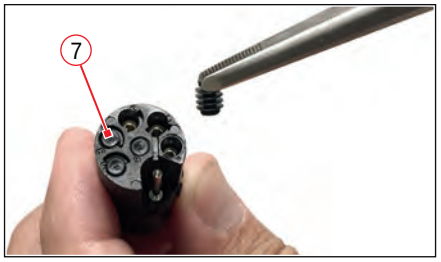
Final position of the assembled filler plug (5)

Series M1 Plus:

For the series M1 Plus, special sealed filler plugs (type BS-A-MD) are required. The same filler plugs are used respectively for socket inserts and pin inserts.



Sealed filler plugs (6) for the series M1 Plus



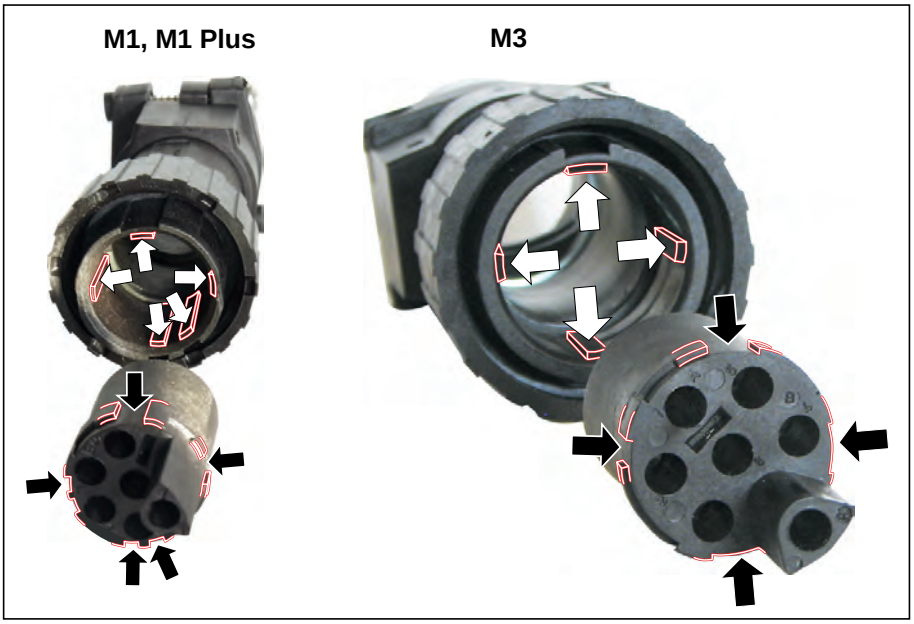
Final position of the assembled filler plugs (7)

6.8 Assemble contact inserts into receptacle / plug shells

After all the contacts have been made and the contacts and the filler plugs, if necessary, have been assembled into the contact insert, the contact insert must be inserted into the shell and locked with the help of adequate insertion tools (refer to section ***"6.1 Required tools"***).

Codings

The receptacle and plug shells as well as the corresponding contact inserts are equipped with codings in the form of grooves and guideways.



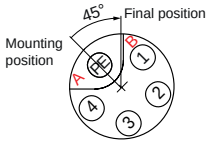
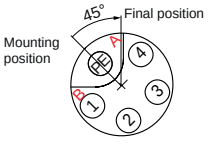
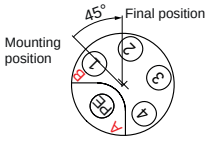
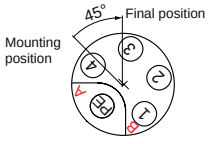
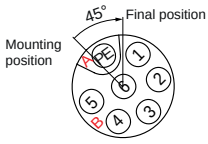
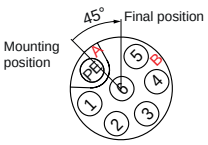
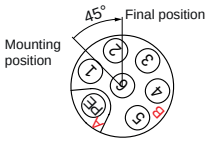
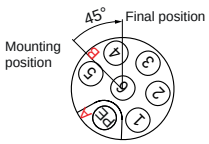
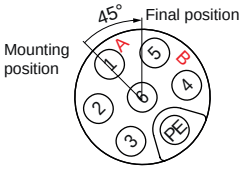
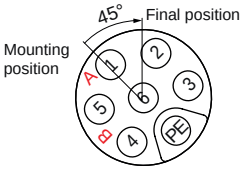
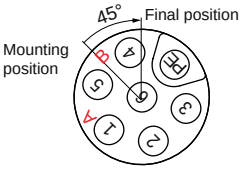
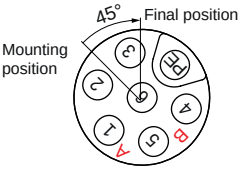
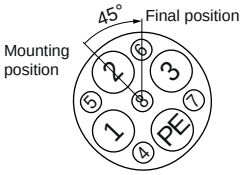
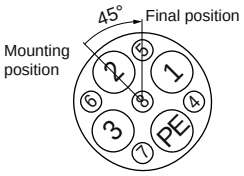
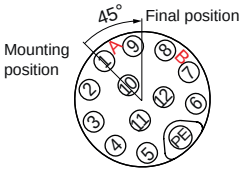
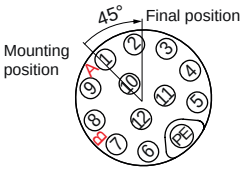
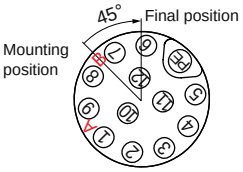
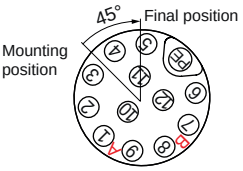
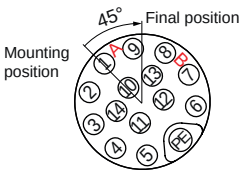
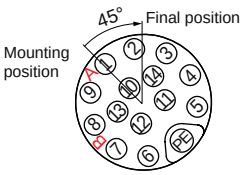
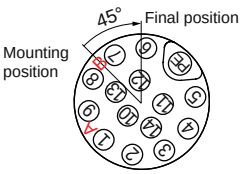
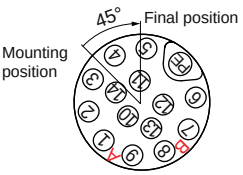
Examples for codings: Grooves on the contact inserts, guideways on the inner sides of the shells

WARNING

The connector with the contact insert M3 E-8P+PE / M3 E-8S+PE may be disproportionately worn due to frequent use (above the 5000 plugging cycles indicated in the catalogue) and especially due to a strongly soiled environment. This may cause a twisting of the connector by 180 degrees.

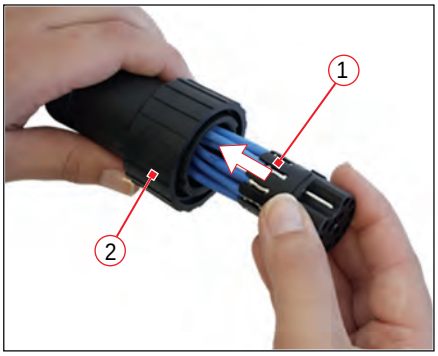
With the exception of the contact inserts M3 E-8P+PE and M3 E-8S+PE, all contact inserts have 2 coding positions (A, B). This allows for the unmistakable connection of for example two connectors with different voltages to one and the same piece of equipment.

In the following table, the coding positions A and B are illustrated for the different contact inserts. The illustrations refer respectively to the mounting position of the corresponding contact insert. When the contact inserts are assembled, they are brought into their final position by a clockwise rotation of 45° with the fitting insertion tool.

	Coding position A		Coding position B (rotated by 90° from coding position A)	
	Pin inserts	**Socket inserts**	**Pin inserts**	**Socket inserts**
Series M1, M1 Plus	 **M1 E-4P+PE**	 **M1 E-4S+PE**	 **M1 E-4P+PE**	 **M1 E-4S+PE**
	 **M1 E-6P+PE**	 **M1 E-6S+PE**	 **M1 E-6P+PE**	 **M1 E-6S+PE**
Series M3	 **M3 E-6P+PE**	 **M3 E-6S+PE**	 **M3 E-6P+PE**	 **M3 E-6S+PE**
	 **M3 E-8P+PE**	 **M3 E-8S+PE**	- - -	- - -
	 **M3 E-12P+PE**	 **M3 E-12S+PE**	 **M3 E-12P+PE**	 **M3 E-12S+PE**
	 **M3 E-7P+7P+PE**	 **M3 E-7S+7S+PE**	 **M3 E-7P+7P+PE**	 **M3 E-7S+7S+PE**

Assembly

- Insert the completely wired contact insert (1) in desired coding position (A or B) with the grooves into the guideways of the shell (2) and push the contact insert into the shell.
- Attach the fitting insertion tool (3) and lock the contact insert by a clockwise rotation of 45° (4). (Max. torque 2 Nm).



Assemble contact inserts into the shell using the insertion tool

Check

- Check if all contact inserts are locked correctly and are properly in place.

Disassembly

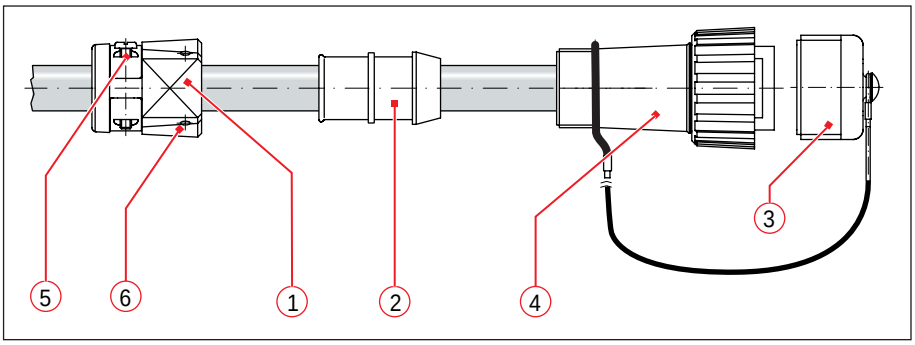
- Attach the fitting insertion tool (3) and unlock the contact insert by a 45° anti-clockwise rotation
- Take the contact insert out of the shell.

6.9 Final assembly of the connectors

After the completely wired contact inserts have been assembled into the receptacle / plug shell and have been checked whether they are locked correctly and properly in place, the final assembly of the connectors may be made.
The following illustrations show for some examples of application how the final assembly of the connector parts is made.

Final assembly of cable plugs / cable receptacles

- Push the cable sleeve (2) into the shell (4).
- Screw together the strain relief (1) with the plug / receptacle shell (4).
- Accomplish the strain relief by tightening the two screws (5). Torque: 2.5 Nm
- Attach the protection cap (3) to the plug / receptacle shell (4) and screw together.



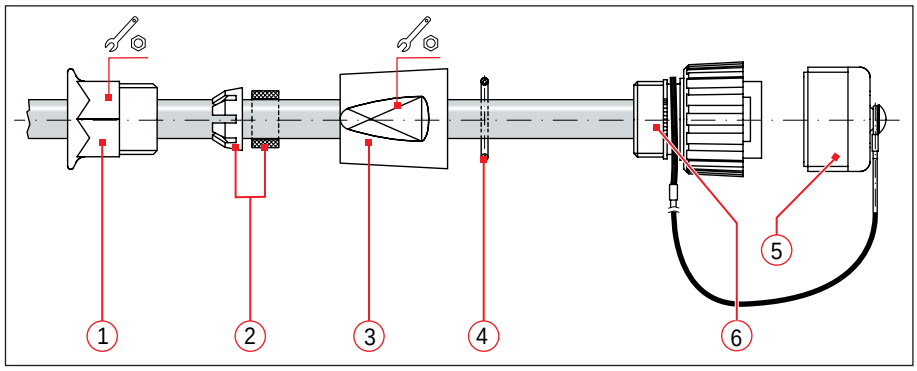
Example for cable plugs with back shell, strain relief and cable gland (applies analoguely also for cable receptacles)

Only for shells M11 Z, M11 ZB-67, M16 Z, M16 ZB-67, M31 Z, M36 Z:
In order to achieve an additional protection against twisting for the strain relief (1), 2 self-tapping screws may be screwed into the prepared drill holes (6) (the screws are not part of the shipment):

- for shells M11 Z, M11 ZB-67, M16 Z, M16 ZB-67 two self-tapping screws with cylinder head 2.2 x 9.5 are needed for this.
- for shells M31 Z, M36 Z two self-tapping screws with cylinder head 2.9 x 13.
  Torque for the self-tapping screws is 2.5 Nm.

Final assembly of plugs / receptacles with thread

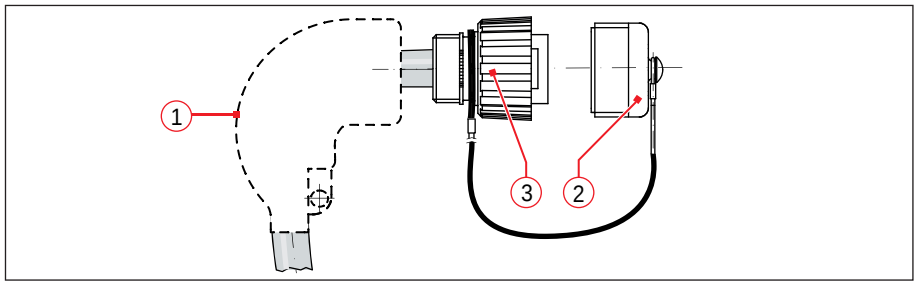
- Insert the O-ring (4) into the back shell (3).
- Screw the back shell (3) with the plug / receptacle shell (6).
- Push the strain relief with the rubber ring (2) into the back shell (3).
- Screw the cable gland (1) with the back shell (3).
- Attach the protection cap (5) to the plug / receptacle shell (6) and screw together.



Example for plug with thread, back shell and cable gland (applies analoguely also for receptacles with thread)

Final assembly of plugs / receptacles with thread and 90° shrink boot

- Push the shrink boot (1) onto the plug / receptacle shell (3) and shrink with the shaft of the shell.
- Attach the protection cap (2) to the plug / receptacle shell (3) and screw together.



Example for plug with thread and 90° shrink boot (applies analoguely also for receptacles with thread)

7. Plugging procedure

NOTICE

Inappropriate handling when plugging or disconnecting may damage the connectors. The functional safety of the connectors is no longer guaranteed when parts are damaged.

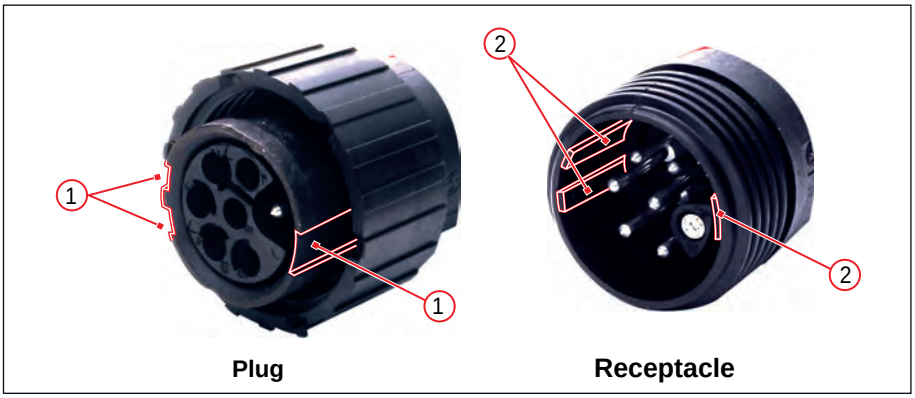
- Make sure when plugging that grooves (1) and guideways (2) of plug and receptacle always interlock!
- Take care that plug and receptacle do not tilt and that they are plugged without force.
- Make sure before the plugging procedure that plug and receptacle as well as the protection caps are not soiled. Remove existent dirt without leaving any residue.
- Make sure that in the not mated condition the protection caps are always attached according to regulations.

WARNING

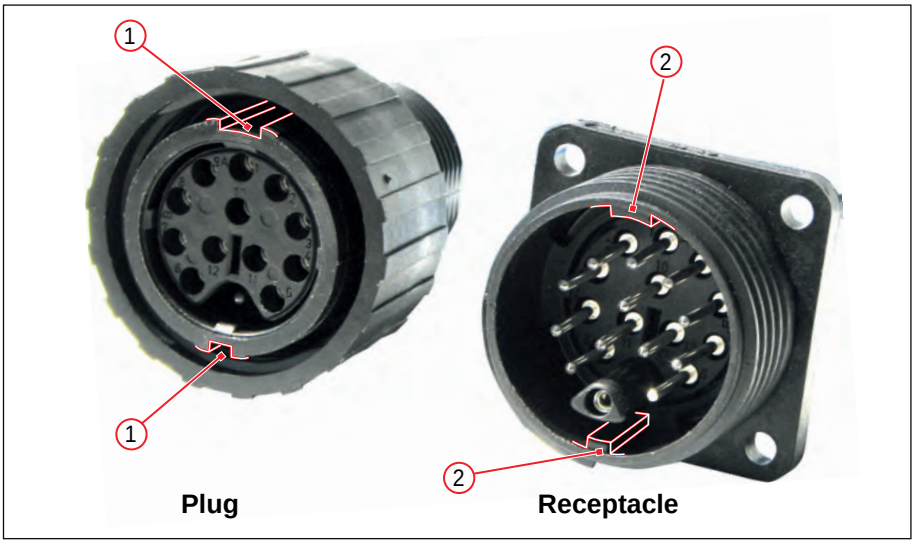
For the connector with the contact insert M3 E-8P+PE / M3 E-8S+PE the following has to be observed:
Under certain circumstances a twisting of the plug by 180 degrees is possible. The twisting of the plug may occur when the guideways of the receptacle and / or the plug are disproportionately worn due to frequent use (catalogue value 5000 plugging cycles) and especially due to a strongly soiled environment and when the included protection caps are not used in the not mated condition.

Critical operating conditions:
The twisting by 180 degrees may have critical consequences in such areas of application where there is a higher voltage on PIN 2 than safety extra-low voltage and where the protective contact on PIN PE is configurated. When in this case there is no fault current circuit braker installed in the power supply, a dangerous voltage may rest against the exposed metallic parts of a device.

Recommendation on the part of Schaltbau:
Due to these realisations we recommend to our clients a corresponding check in the form of a visual check of the connectors M3 E-8P+PE / M3 E-8S+PE for damages or signs of wear and tear, especially of the guideways as well as of the guide grooves and we recommend the replacement with a new pair of connectors, if necessary.



Series M1 and M1 Plus: Grooves (1) on plug and guideways (2) on receptacle



Series M3: Grooves (1) on plug and guideways (2) on receptacle

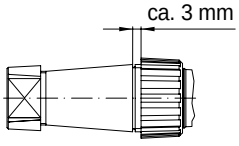
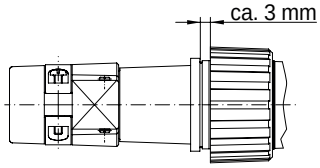
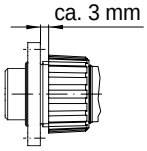
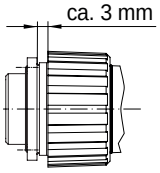
7.1 Plugging

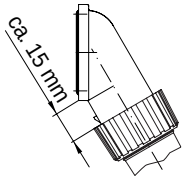
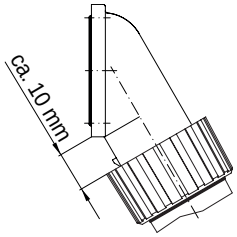
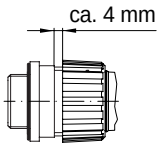
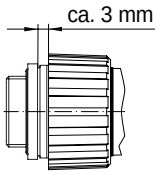
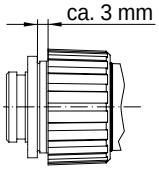
- Screw off the protection caps and slide off the plug or receptacle respectively.
- Attach the plug (3) in such a way to the receptacle (4) that the different grooves (1) in the plug lie superposable to the guideways (2) of the receptacle.
  For this purpose turn the plug slightly to and fro, if necessary, until the grooves and guideways interlock without force.
- Screw the cap nut (5) of the plug on the receptacle. In doing so, take care not to tilt the thread and that the cap nut can be screwed easily.
- Screw down the cap nut (5) of the plug hand-tight.

Connect plug (3) and receptacle (4) in such a way that grooves and guideways interlock easily

Screw cap nut on thread of receptacle

- Check that the connector is connected correctly. For this purpose, control the gap between cap nut and receptacle shell on the basis of the nominal sizes indicated in the following table.

Type of receptacle	**Nominal sizes for the gap between cap nut and receptacle shell when the connection is correctly screwed**	
	M1, M1 Plus	**M3**
Cable receptacles		
Receptacles with flange		

Type of receptacle	Nominal sizes for the gap between cap nut and receptacle shell when the connection is correctly screwed	
	M1, M1 Plus	M3
Flange mount angled receptacles		
Receptacles with thread		
Receptacles for shrink boot	---	

7.2 Disconnecting

- ► Screw off the cap nut (5) of the plug (3) from the receptacle (4) and take off the plug.
- ► Lock plug and receptacle with the protection caps, refer to ***"7.3 Attach protection caps"***.

Screw off cap nut (5)

Slide off plug (3) from receptacle (4)

7.3 Attach protection caps

In order to meet the requirements of the protection class as well as a protection against the intrusion of dirt and moisture, plugs and receptacles must always be locked with protection caps when not mated.

- ► Make sure that the protection caps are free of dirt and deposits.

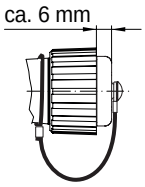
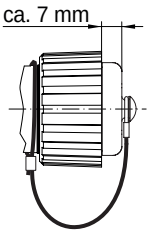
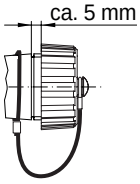
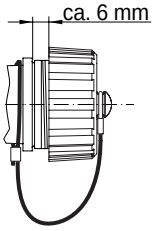
Lock plug:

- Attach protection cap (6) to the plug in such a way that the grooves and guideways interlock without force. For this purpose twist the cap slightly, if necessary.
- Screw down cap nut (5) of the plug hand-tight.
- Check that the protection cap has been screwed correctly. For this purpose, control the gap between cap nut and cap on the basis of the nominal sizes indicated in the following table.

Lock plug with protection cap

Lock receptacle:

- Attach protection cap to the receptacle and screw down hand-tight.
- Check that the protection cap has been screwed correctly. For this purpose, control the gap between cap and receptacle shell on the basis of the nominal sizes indicated in the following table.

Type of cap	Nominal sizes for protection caps when cap has been screwed correctly	
	M1, M1 Plus	M3
Protection cap (for plugs)		
Protection cap (for receptacles)		

8. Regular visual checks / functional checks

Please observe the expert knowledge absolutely required for maintenance under chapter ***"2. General and safety information"***.

DANGER

The connectors contain components that carry voltage.
Deadly hazard!
Always consider the following safety rules before carrying out work on the connectors:

- Disconnect
- Ensure that it is not possible to reconnect unintentionally
- Make sure that there is no voltage present

8.1 Checking intervals

The condition of the connectors depends on the ambient conditions. In order to safeguard the correct functioning and a prolonged operational life span of the connectors, the following visual and functional checks have to be performed regularly.

Visual check / functional check	Interval
Check of - Plugs - Wire - Receptacles - Cap nut - Contacts - Contact insert - Shrink boot - Backshell - Cable gland/Strain relief - Protection caps - Guideways / grooves of the coding in plug and receptacle shells	► With every plugging procedure

8.2 Visual and functional check with every plugging procedure

All elements of the connectors have to undergo a visual and functional check with every plugging procedure.

CAUTION

If you can see damages on wire, plug, receptacle, contacts, contact inserts or on other elements of the connectors when checking, the functional safety of the connectors is no longer guaranteed.

- Immediately replace all damaged parts.

Connector element	Visual and functional check	Measures
Plug	Check for: ► ease of movement when plugging ► dirt ► damage or wear and tear on shell, contacts, contact insert ► damage or wear and tear on grooves / guide-ways (e.g. round edges) ► bent contacts ► loose or missing fastening elements ► cracks and ruptured patches	In the case of defects: ► remove existent dirt with-out leaving any residue (abrasion of the contact surface) ► immediately replace damaged parts
Cap nut on plug	Check for: ► ease of movement when unscrewing and screw-ing down ► dirt ► damage or wear and tear of the thread ► cracks and ruptured patches	In the case of defects: ► remove existent dirt with-out leaving any residue ► when the cap nut is damaged, immediately replace the complete plug shell
Receptacle	Check for: ► ease of movement when plugging ► dirt ► damage or wear and tear on shell, contacts, contact insert ► twisted contacts ► damage or wear and tear on grooves / guide-ways (e.g. round edges) ► loose or missing fastening elements ► damage or wear and tear of the thread ► cracks and ruptured patches	In the case of defects: ► remove existent dirt with-out leaving any residue (abrasion of the contact surface) ► immediately replace damaged parts
Backshell/strain re-lief, shrink boot, cable gland	Check for: ► dirt ► damage or cracks on shell, shrink boot, cable gland ► loose or missing fastening elements ► check if properly in place ► correct functioning of strain relief	In the case of defects: ► remove existent dirt with-out leaving any residue ► immediately replace damaged parts
Protection caps	Check for: ► ease of movement when unscrewing and screw-ing down ► dirt ► damage or wear and tear on the thread ► damage or wear and tear on grooves / guide-ways (e.g. round edges) ► worn out fastening cord or damaged plastic clip ► cracks and ruptured patches ► damaged sealing ring	In the case of defects: ► remove existent dirt with-out leaving any residue ► immediately replace damaged parts

9. Special tools and spare parts

Special tools	Ordering code
Extraction tools for disassembling of contacts: - for contact type SAC-x, SAC-x-67, BAC-x, BAC-x-67 - for contact type SBC-x, BBC-x - for contact type SCC-x, BCC-x	 AWZ-A AWZ-B AWZ-C/H
Insertion tools for socket inserts: - for contact insert M1 E-4S+PE - for contact insert M1 E-6S+PE - for contact insert M3 E-6S+PE - for contact insert M3 E-8S+PE - for contact insert M3 E-12S+PE, M3 7+7S+PE	 VW-M1 E-4S VW-M1 E-6S VW-M3 E-6S VW-M3 E-8S VW-M3 E-12S
Insertion tools for pin inserts: - for contact insert M1 E-4P+PE - for contact insert M1 E-6P+PE - for contact insert M3 E-6P+PE - for contact insert M3 E-8P+PE - for contact insert M3 E-12P+PE, M3 7+7P+PE	 VW-M1 E-4P VW-M1 E-6P VW-M3 E-6P VW-M3 E-8P VW-M3 E-12P

Spare parts	Ordering code
Plastic clips: - for contact type SAC-x, SAC-x-67, BAC-x, BAC-x-67 - for contact type SBC-x, BBC-x - for contact type SCC-x, BCC-x	 Clip for contact type A Clip for contact type B Clip for contact type C

10. Technical Data

Specifications and information on the material characteristics for the connectors of the M series are given in our catalogues ***A10.en*** and accordingly ***A101en***.

Schaltbau GmbH

For detailed information on our products and services visit our website – or give us a call!

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The production facilities of Schaltbau GmbH have been IRIS certified since 2008.

Schaltbau GmbH ISO 14001 certified since 2002

Certified to DIN EN ISO 14001 since 2002. For the most recent certificate visit our website.

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