AK 24 | AK 36

The new compact small distribution boards

REDUCED TO THE **MAX.**

PRODUCT MANUAL

Table of Contents

About this product manual

This product manual is a project planning and installation guide and is written for skilled trades professionals. Read this product manual to select, safely mount, operate the AK-distribution board and make use of the permissible applications it offers.

AK-distribution board

The AK-distribution board is part of a product series of small distribution boards in various sizes and designs. The different equipment variants are reflected in the respective name extensions. It meets the requirements of the standards specified below, considering this product manual:

- EN 60670-24
- EN 61439-2
- EN 61439-3

Regardless of the information in this product manual, the installer is responsible for applying the currently valid standard and the procedures described therein.

Intended use

The AK-distribution board is suitable for the installation of:

- Rail-mounted devices, especially protective and control devices
- Low-voltage and switchgear assemblies

The usage limits stated in this product manual and the limit values specified by the product properties must be observed.

The specifications made in this product manual regarding the installation of the AK-distribution board, the wiring and the installation of the equipment must be observed.

Project planning aids according to standard

Spelsberg supports the professional installation of AK-distribution boards according to the standards below:

- EN 60670-24
- EN 61439-2
- EN 61439-3

Within the framework of standards EN 60670-24 and EN 61439-3 the AK-distribution board is suitable for operation by laypersons.

Safety instructions

- The AK-distribution board may only be installed and commissioned by electrotechnical specialists. Depending on the use of the AK-distribution board, operation of the installed devices by laypersons or authorized personnel is permitted.
- In case of damage to the enclosure where the original protection level is no longer given, a qualified electrotechnical specialist must assess whether the AK-distribution board must be taken out of service.
- If the distribution board is accessible to laypersons and the enclosure protection against contact with hazardous parts and ingress of solid bodies is less than IP3x (protection against contact with tools, wires, foreign bodies, etc. > Ø 2.5 mm), the distribution must be taken out of operation!
- The AK-distribution board without hinged window has a protection rating of IP30. Unused modules must be closed with cover strips.
- Regardless of the information in this product manual, standards and regulations apply in their most recent valid version.

Meaning of symbols

D

Danger
Ignoring leads to death or serious injury.
Escape from danger.

!

Warning
Ignoring can lead to death or serious injuries.
Escape from danger.

!

Caution
Ignoring can lead to injuries.
Escape from danger.

h

Note
Note explanation
Important additional information about the AK-distribution board.

Areas of application

The AK-distribution board is approved for surface mounting. It is suitable for indoor installation, as well as for unheated rooms or buildings.

Limits of use

The AK-distribution board can be used within the following limits without consulting Spelsberg, observing the applicable standards.

Ambient temperatures according to EN 61439-1

Minimum ambient temperature: – 5 °C
maximum ambient temperature: + 40 °C
Lowest temperature for use according to EN 60670-24: -25 °C
The average temperature over 24 hours must not exceed 35 °C.

Note
Special operating conditions
When used outdoors, at freezing temperatures, the seals on the top or hinged window may freeze. Careless opening may then cause damage to the seal.

Note
Special Operating Conditions
If the AK-distribution board is to be used outside the temperature limits stated above you should consult the technical sales department of Spelsberg.
Phone: 0 23 55 / 892-155

Air humidity

Permissible air humidity depends on the maximum ambient temperature.
It is 50% at a maximum ambient temperature of 40 °C.
It is 100% at a maximum ambient temperature of 25 °C.

Maximum installation altitude

The maximum altitude of the installation site is limited to 2000 m above sea level due to the reduction of insulation strength and cooling effect of ambient temperature at higher altitudes.

Note
Special operating conditions
If the AK-distribution board is to be used above 2000 m above sea level, you should consult the technical sales department of Spelsberg.
Phone: 0 23 55 / 892-155

Technical Data

Insulating material enclosure

The AK-distribution board is made of thermoplastics (type-tested branded product).
It is an insulating material enclosure and therefore has no provision for grounding.

Degree of pollution

The AK-distribution board is designed for use in application areas with pollution degree 3.

Electrical characteristics

The AK-distribution board may be operated in electrical networks with rated voltage up to 400 V, where the prospective short-circuit current (Icp) does not exceed 10 kA. If a higher Icp is expected at the power supply, a current-limiting protective device with a maximum cut-off current of 17 kA must be provided (e.g. AKi-T 201, order no. 786 201 01 from Spelsberg). The AK-distribution board is suitable for a rated insulation voltage of up to 1000V AC / 1500V DC. The maximum input current must not exceed 125 A.

Protection ratings

IP protection rating

The AK-distribution board has a protection rating of IP65 with closed hinged windows. When the hinged windows are open, the IP protection rating is reduced from IP65 to IP30. Depending on the cable insertion used, the IP protection rating is further reduced.

IK protection rating

The IK protection rating measures the resistance of enclosures to harmful mechanical stresses, especially impact stresses.

Upper part	IK08
Side walls	IK08
End faces	IK07

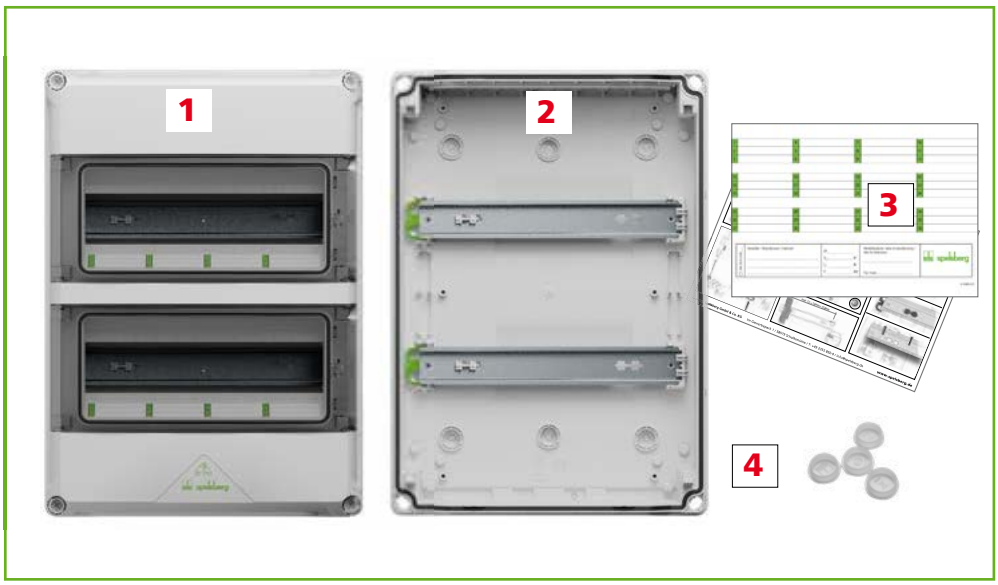
Impact energy:
IK07 ≙ 2 Joules
IK08 ≙ 5 Joules

The IK protection rating was tested at -5 °C.
The IK protection rating does not apply to knockout openings.

Scope of delivery

The AK-distribution board is delivered with:

- Top part with hinged windows
- Box
- Installation instructions with labelling strips
- Insulating plugs



1	Top part with hinged windows
2	Box with membrane flange
3	Assembly instructions with labelling strips Download: **www.spelsberg.de**
4	Accessory set

Figure 1: Scope of delivery AK-distribution board

Note

Disposal of packaging materials

Packaging materials must be recycled.

Condensation formation

When using non-airtight enclosures in environments with varying temperature and air humidity condensation problems may occur.

The physical basis is that air at a certain temperature and pressure can only hold a certain maximum amount of water vapor. The higher the temperature and the air pressure, the greater the maximum possible water content. Compared to a temperature of 55°C, air at 20°C can only hold 20% of the water content.

Due to power loss from installed devices, the air inside the enclosure usually warms up to about 55 °C. Warm air inside the enclosure gradually absorbs water vapor from the ambient air. When the outside temperature drops, the enclosure's outer walls cool down. Upon reaching the dew point temperature, water vapor in the air condenses on the enclosure's inside as condensate. The water collects in the enclosure base and can cause damage there.
See section "Drainage opening" **page 20**.

Box

The enclosure consists of enclosure base, two side walls, two end faces, and interior.

Enclosure base

The enclosure base of all AK-distribution boards is equipped with:

- Knockouts for wall mounting
- Knockouts for cable insertion
- Screw bosses for fixing the cover
- Fixing points within the sealing range
- Drainage openings
- Mounting for connection terminals (WAGO 221 / 6 mm²)

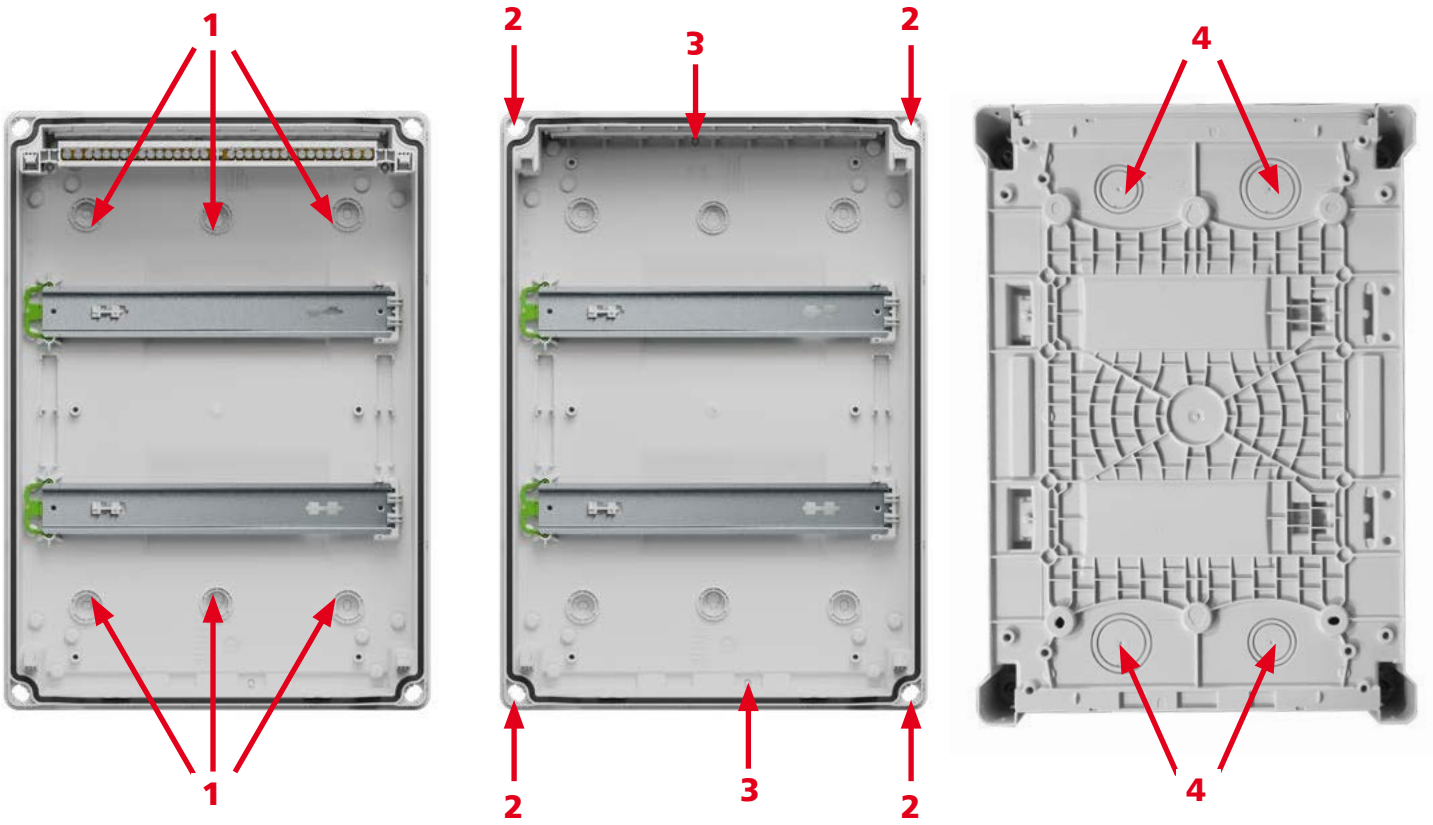


Figure 2: Box bottom front side, back side

1	Fixing points within the sealing range
2	Screw bosses for cover mounting
3	Drainage openings
4	Knockouts for cable insertions

Drainage openings

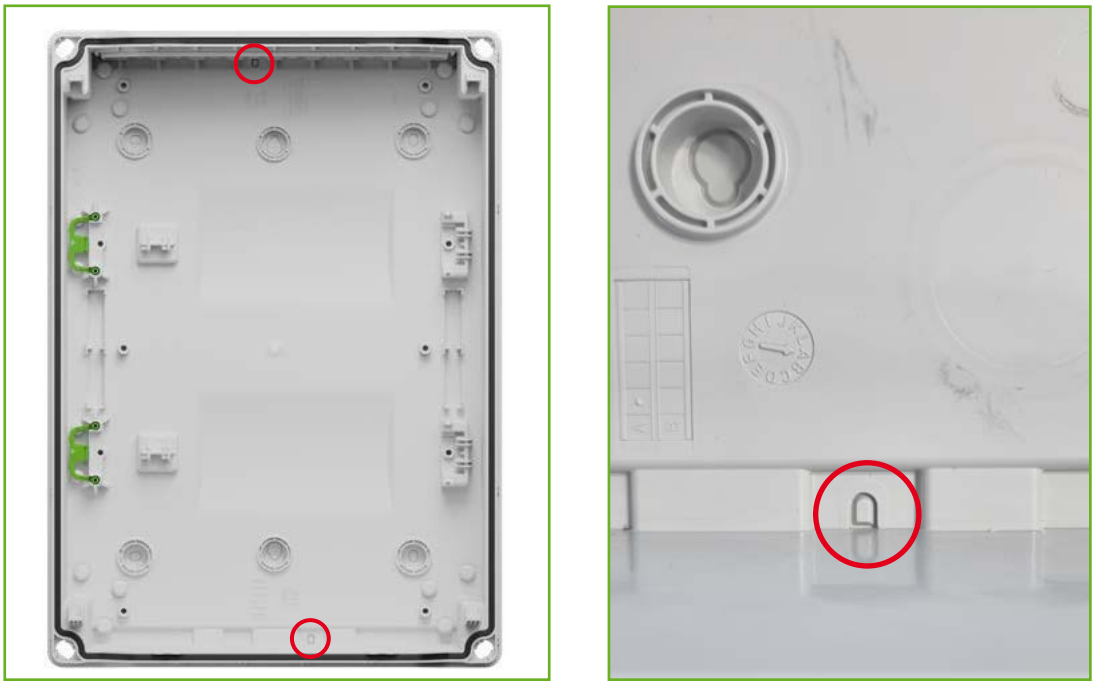


Figure 3: Drainage openings

Under exceptional environmental conditions, drainage openings in the enclosure can be opened.

Side walls

The two side walls are equipped with:

1) Knockouts for cable insertion M23/32
2) Knockouts for cable insertion M32
3) Knockouts for combination connector
4) Drilling points for optional attachment of Schuko sockets AK STD in combination with the knockout for combination fittings

Figure 4: Side walls AK 24/36

Each side panel has two combination entries M32/Ø44.5 mm with four drilling points each. They serve for lateral cable entry via cable glands M32 or for mounting the combination fittings as well as the Schuko sockets (AK STD).

End faces

The two end faces differ.

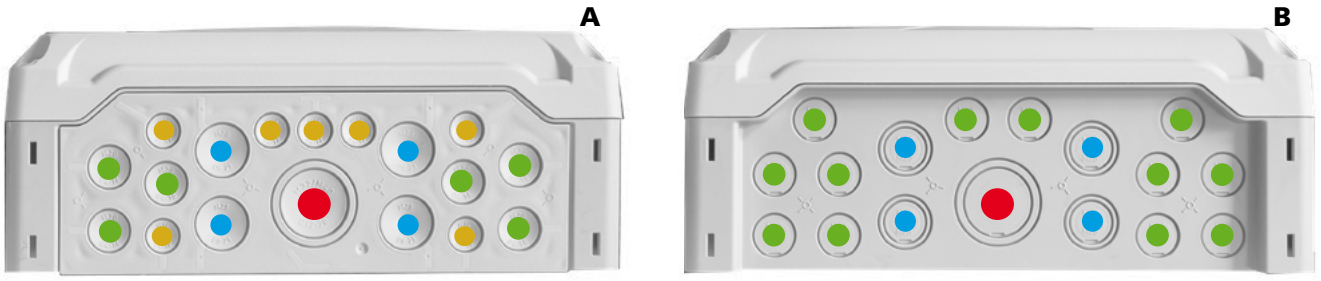


Figure 5: Top/bottom end above (A) and top/bottom end below (B)

Top end face (flange):

The AK-distribution boards are equipped on the top end faces with self-sealing soft entry membranes for:

- 7 x entry **Sealing range 4 – 12 mm (M16)**
- 4 x entry **Sealing range 8 – 21 mm (M25),** suitable for cable glands (KVR M25)
- 6 x entry **Sealing range 4 – 16 mm (M20),** suitable for cable glands (KVR M20)
- 1 x combination entry **Sealing range 12 – 28 mm (M32) and knockout membrane M40,** suitable for cable glands (KVR M32 and KVR M40)

For mounting the cable glands, the soft membrane must be removed with a knife.
Once-opened membranes can be resealed using a double membrane seal (DMS) in the corresponding size
.

Top/bottom End below:

The AK-distribution boards are equipped on the bottom end faces with knockouts for:

- 4 x combination entry **M25/20**
- 12 x entry **M20**
- 1 x combination entry **M32/40**

Figure 6: Marking suitable for cable glandsappropriate entry membranes

Interior

The interior of the AK-distribution boards is intended to accommodate equipment and is equipped with various mounting options.

Standard rail on standard rail holder

Figure 7: Standard rail on standard rail holder

The standard rail measuring 7.5 x 35 mm is used to accommodate rail-mounted devices.
The standard rails provide space for 12 modules (TE). (1 TE 18 mm)

Number of standard rails per 12 TE

AK 24	AK 36
2	3

Standard rail holder

Figure 8: Standard rail locking (A) / standard rail holder (B)

The standard rail holder (integrated in the enclosure base) in conjunction with the standard rail locking device (green component) allows the standard rails to be inserted without tools. This is also possible with fully equipped standard rails.

The short-circuit withstand capacity of a standard rail corresponds to an E-Cu conductor of 16 mm².

PE/N Rail

AK-distribution boards are delivered with a pre-assembled VDE-certified PE/N rail. Depending on the size of the AK-distribution board, different numbers of clamping points are provided. The following connection options are available:

AK 24 PE/N screw terminals

N		PE	
2x	2.5 mm² to 10 mm² fine-stranded	**2x**	2.5 mm² to 10 mm² fine-stranded
	2.5 mm² to 16 mm² solid		2.5 mm² to 16 mm² solid
14x	1.5 mm² to 4 mm² fine-stranded	**14x**	1.5 mm² to 4 mm² fine-stranded
	1.5 mm² to 6 mm² solid		1.5 mm² to 6 mm² solid

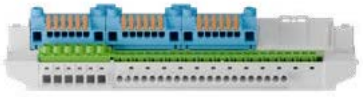
AK 36 PE/N screw terminals

N		PE	
2x 2x	2.5 mm² to 10 mm² fine-stranded	**4x**	2.5 mm² to 10 mm² fine-stranded
	2.5 mm² to 16 mm² solid		2.5 mm² to 16 mm² solid
2x 10x	1.5 mm² to 4 mm² fine-stranded	**30x**	1.5 mm² to 4 mm² fine-stranded
	1.5 mm² to 6 mm² solid		1.5 mm² to 6 mm² solid

AK 24 PE/N screwless terminals

N		PE	
2x 2x	2.5 mm² to 16 mm² fine-stranded	**3x**	2.5 mm² to 16 mm² fine-stranded
	2.5 mm² to 16 mm² solid		2.5 mm² to 16 mm² solid
2x 5x	0.75 mm² to 4 mm² fine-stranded without ferrule	**14x**	0.75 mm² to 4 mm² finely stranded without ferrule
	0.75 mm² to 2.5 mm² finely stranded with ferrule		0.75 mm² to 4 mm² finely stranded with ferrule
	0.75 mm² to 4 mm² solid		0.75 mm² to 4 mm² solid

AK 36 PE/N screwless terminals



N		PE	
3x 2x	2.5 mm² to 16 mm² fine-stranded	**6x**	2.5 mm² to 16 mm² fine-stranded
	2.5 mm² to 16 mm² solid		2.5 mm² to 16 mm² solid
3x 5x	0.75 mm² to 4 mm² fine-stranded without ferrule	**21x**	0.75 mm² to 4 mm² finely stranded without ferrule
	0.75 mm² to 2.5 mm² fine-stranded with ferrule		0.75 mm² to 4 mm² finely stranded with ferrule
	0.75 mm² to 4 mm² solid		0.75 mm² to 4 mm² solid

Screw terminals: Stripping length: 13 mm; conductor types: solid single wire, rigid, flexible; torque: 2 Nm (PZ2)
Screwless terminals: Stripping length: 12 mm; conductor types: solid single wire, rigid, flexible
Corresponding terminals are available as accessories for the connection of conductors with larger cross-sections.

Upper part

The top part is screwed to the screw bosses of the box using quick closures. The top part varies depending on the design of the AK-distribution board.

Figure 9: Top part

The top part with the overlapping, all-round edge optimally protects the seal. The cover can be placed on the box easily and without jamming. The combination of box and top part creates a creepage distance which achieves a rated insulation voltage of 1000 V AC or 1500 V DC at pollution degree 3 (EN 61439). The top part can be secured with a sealing wire if required.

Figure 10: Sealed top part

Device cut-out

The AK-distribution boards have device cut-outs in the top part to allow safe operation of rail mounted devices
.

Each device cut-out is designed for a maximum of 12 modules (1 TE ≙ 18 mm).

Figure 11: Device cut-out:

Hinged window

The device cut-outs are closed with a hinged window each.
The hinged windows have an opening angle of 180°.

Figure 12: Hinged window

Each hinged window is securely locked with two snap-in hooks.
The hinged windows open by gently pulling the handle.

The hinged windows can be secured if necessary with the AK SGA lock (same locking AK SGA-1 or different locking AK SGA-2) or with a sealing wire.

Accessories

The following assemblies are not part of the AK-distribution board.

Combi connector

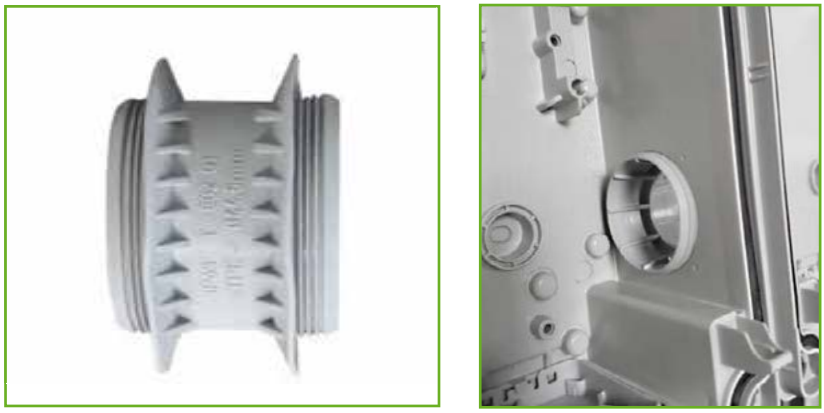


Figure 13: Combi connector

The combi connector connects two AK-distribution boards via the side walls and may only be used in the position shown in the illustration. The protection rating IP65 is maintained.

External fixing lugs

Figure 14: External fixing lug

Installation

The installation of the AK-distribution board must be carried out with suitable fastening elements. The necessary fastening materials are to be selected by the installer according to the fastening surface. If the wall is uneven, compensation under the fastening points may be necessary to avoid twisting the AK-distribution board.

Position of use

The AK-distribution board is designed for vertical wall mounting and horizontal floor mounting. Overhead mounting is not permitted.

Figure 15: Position of use

Note

Position of use of equipment

The permissible positions of use of the equipment must be observed.

Fastening material

Spelsberg advises against the use of countersunk screws.

Installation of box

Required fastening material: screws, dowels, etc.
The box of the AK-distribution board can be mounted in three different ways:

- 3-point keyhole installation
- Installation with external fixing lugs

Work preparation

The AK-distribution board has a variety of cable insertions. All cable insertions with pre-cutouts are designed for both DMS double membrane seals and KVR cable glands. The cable insertions of the flange are marked with regard to suitability for cable glands. See section "Top/bottom end" **page 11**.
Spelsberg recommends the use of cable glands for flexible cables.

Cable insertions

Overview of sealing options for cable insertions with membrane seal and the associated sealing ranges.

	Cable gland KVR, IP68		Double membrane seals DMS, IP66	Stepped nipples SNI, IP55	Attachment bushes AST, IP54
Size	**Sealing range [mm]**	**Nominal torque [mm]**	**Sealing range [mm]**	**Sealing range [mm]**	**Sealing range [mm]**
M16	4 – 10	2.5	5 – 9	–	6 – 10
M20	6 – 12	4	7 – 12	5 – 16	8 – 13.5
M25	9 – 16	6	9 – 16	5 – 21	9 – 18.5
M32	11 – 21	7	14 – 21	13 – 26.5	13 – 23
M40	16 – 28	7.5	–	13 – 24	17 – 30
M50	32 – 44.5	9	–	–	–

Note
IP protection class
Depending on the cable glands used, the IP protection class of the AK-distribution board reduces to the IP protection class of the cable insertion.

Pre-cutouts

All cable insertions are factory-closed and provided with pre-cutouts for opening.

The pre-cutouts are divided into:
- Pre-cutout with a nominal diameter and
- Combination pre-cutouts for two nominal diameters

Some of the pre-cutouts have a marking for knocking out.

Note
Box bottom
The pre-cutouts of the box bottom must be knocked out before installation.
When using double membrane seals to seal the cable insertions no additional spacer is required for wall mounting.

Required tools: hammer, flat screwdriver.

Pre-cutout with marking

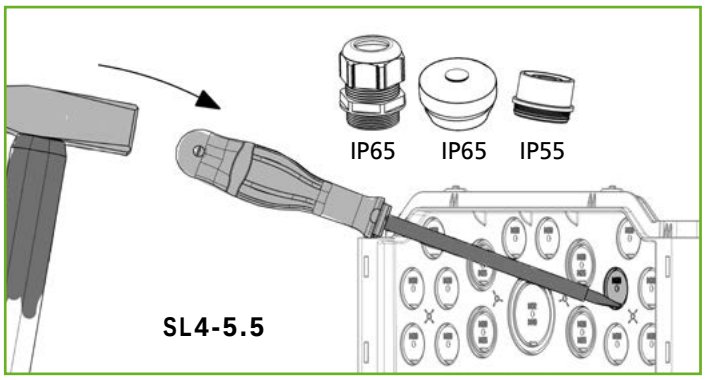
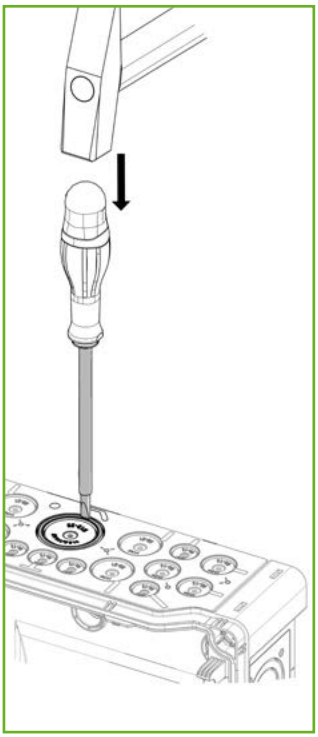
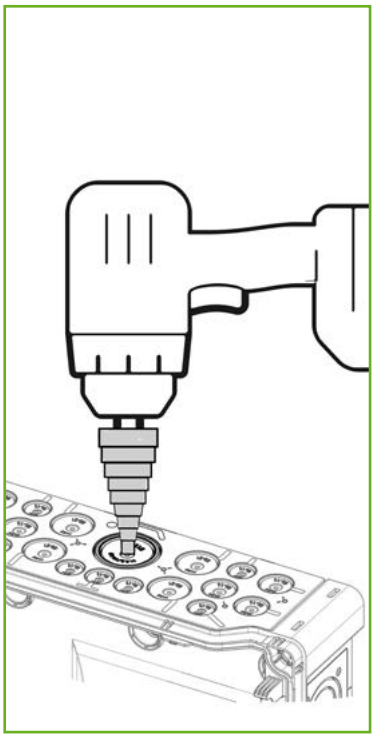
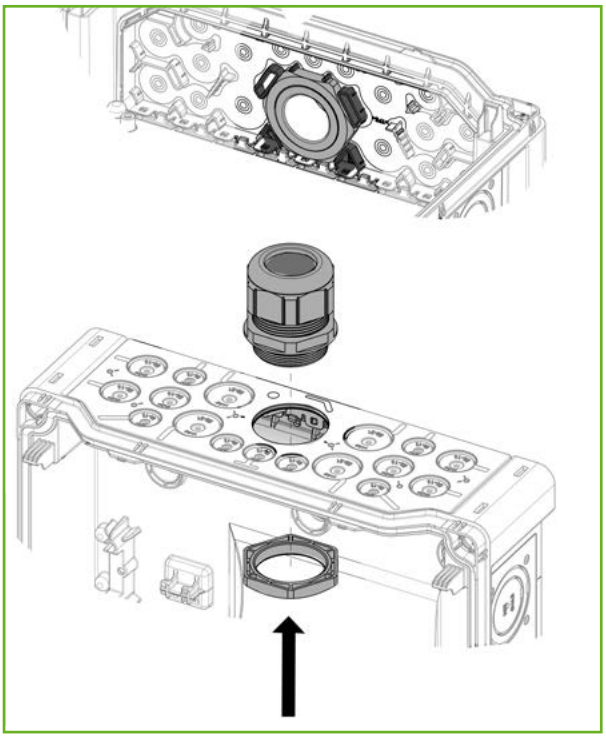


Figure 16: Combination pre-cutout with marking

- Insert the flat screwdriver into the marking.
- Strike the marking with the hammer to knock it out.







Cable entry

- Insert the desired cable insertion.

Drainage openings

The enclosure has pre-cutouts for drainage in the box bottom at the:

- Top/bottom Ends
- Side walls in the area of the standard rail mounts.
  The drainage openings can be knocked out before or after installation of the box, if necessary.

Note

IP protection class

Opening the drainage openings reduces the enclosure's protection class.
When mounted on a wall with a 20 mm covering: IP43.
When mounted on a support frame: IP23.
The air and creepage distances must be reassessed if necessary.

If necessary, all lower drainage openings must always be opened.
In horizontal position, all drainage openings must be opened.

Required tools: hammer, screwdriver

- Place the screwdriver inside the box on the pre-cutout of the drainage opening
- Knock out the pre-cutout with the hammer

Figure 18: Drainage opening

3-point keyhole installation

The installation of the box is carried out via the upper keyhole and the two lower elongated holes.

Suitable fastening material:

- Elongated holes: screws up to max. M6 or screws with a diameter of 5.5 mm.
  The screw head may have a diameter of max. 12 mm.

- Keyhole: screws up to max. M5 or screws with a diameter of 5 mm.
  The screw head may have a diameter of max. 10 mm to use the keyhole.

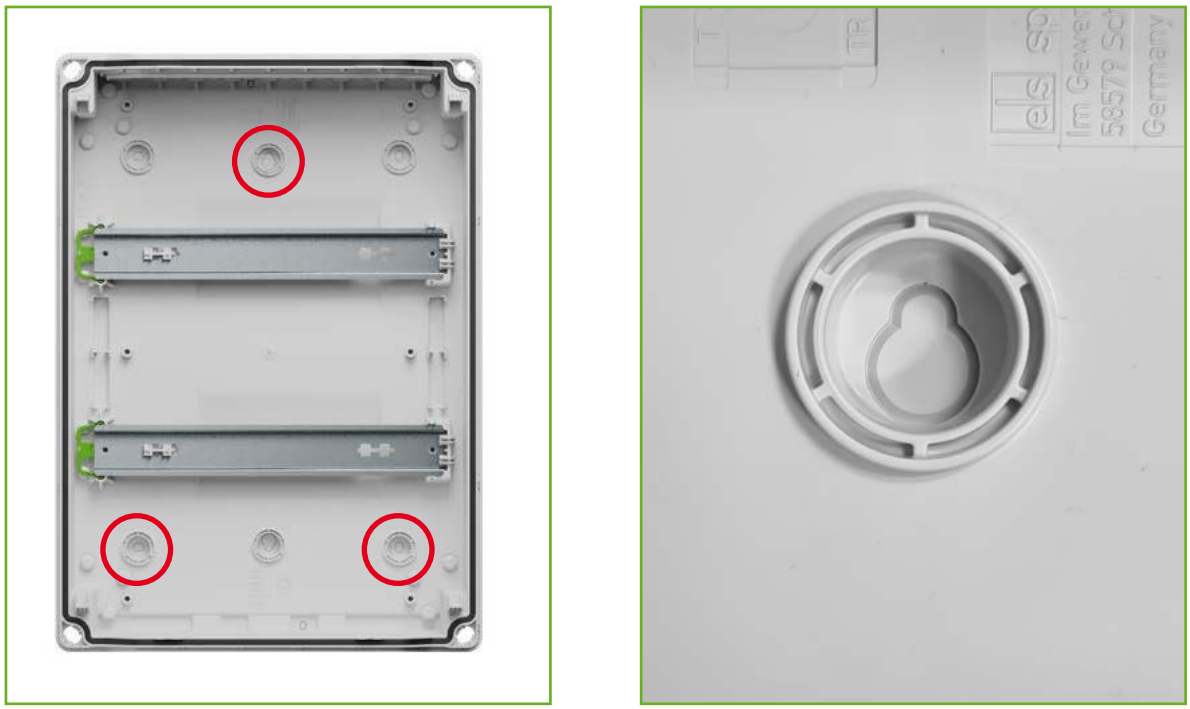


Figure 23: Fastening points 3-point installation, keyhole fastening

Required tools: hammer, screwdriver.

- Knock out the fastening holes
- Screw the upper screw into the desired position on the fastening wall
- Hang the box on the pre-mounted upper screw with the keyhole
- Align the box
- Mark the lower fastening points.
- Screw screws into the lower elongated holes
- Close all fastening holes with insulating plugs
- Installation is complete

If necessary, additional fastening points can also be used.

Installation with external fixing lugs

Note
External fixing lugs
The external fixing lugs are not included in the scope of delivery.

The installation of the box is carried out via the external fixing lugs with the enclosed stainless steel screws via the four internal fastenings. The external fixing lugs can be arranged vertically, diagonally or horizontally.

Suitable fastening material:

- Screws up to max. M8 or screws with a diameter of 8 mm.

When using the keyhole in the external fixing lug, the screw head may have a maximum diameter of 15 mm.

Figure 20: Fixing points external lugs

Required tools: hammer, screwdriver

- Knock out the fastening holes.
- Mount the fixing lugs with the supplied screws to the fastening holes.
  The keyholes of the fixing lugs point in the desired position.
- Close the fastening holes with the sealing plugs.
- Screw the box with the fixing lugs to the desired position on the fastening wall.
  Installation is complete.

Standard rail

The standard rail can be equipped with rail mounted devices inside and outside the box.

Figure 21: Standard rail

Removal of the standard rail

- Gently press the standard rail lock (green component) of the standard rail holder towards the box bottom
- Push the standard rail in a horizontal position towards the operated standard rail lock
- Remove the standard rail upwards from the standard rail holder (integrated in the box bottom) of the box

Insertion of the standard rail

- Place the standard rail, equipped or unequipped, on the standard rail holder mounting of the box
- Slide the standard rail horizontally until it clicks into place

Mounting the standard rail

To equip the standard rail precisely according to the device cut-out, the markings on the standard rail can be used as positioning aid. On the opposite side, the stops can be used as positioning aids.

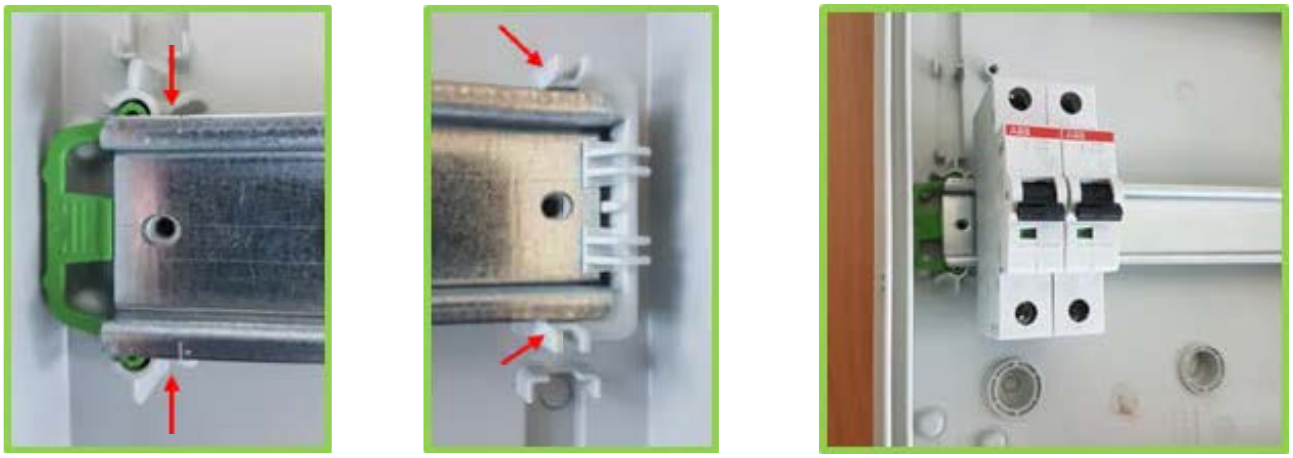


Figure 22: Standard rail with marking

Combi connector

The combi connector allows two AK-distribution boards to be connected sideways.

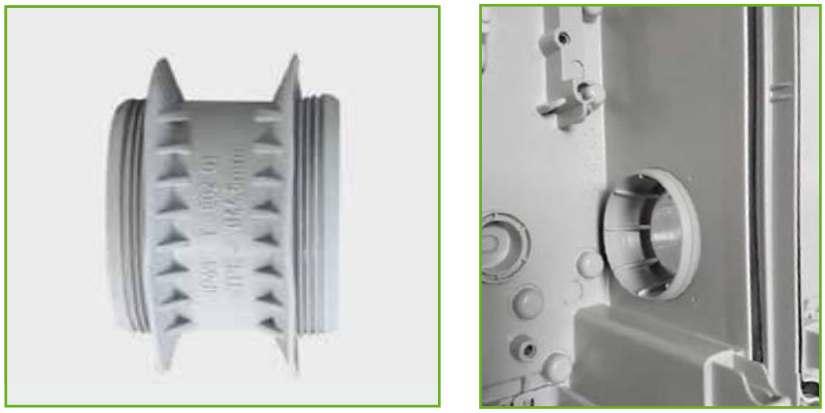


Figure 23: Combi connector

- Knock out the combination pre-cutout Ø 44.5 mm in both boxes
- Insert the combi connector from the outside through the openings of the first box
- Place the second box onto the combi connector
- The two distribution boards are connected (not mechanically stable connection)

Schuko socket AK STD

The Schuko socket is supplied with mounting screws.

- Knock out the pre-cutout Ø 44.5 mm on the box
- Knock out the fastening points in the side panel (Ø 6 mm)
- Attach the socket to the box with the enclosed mounting material

Assembly of the top part

Change window hinge

The window is supplied with hinged windows hinged on the left by default. The hinge can be changed.

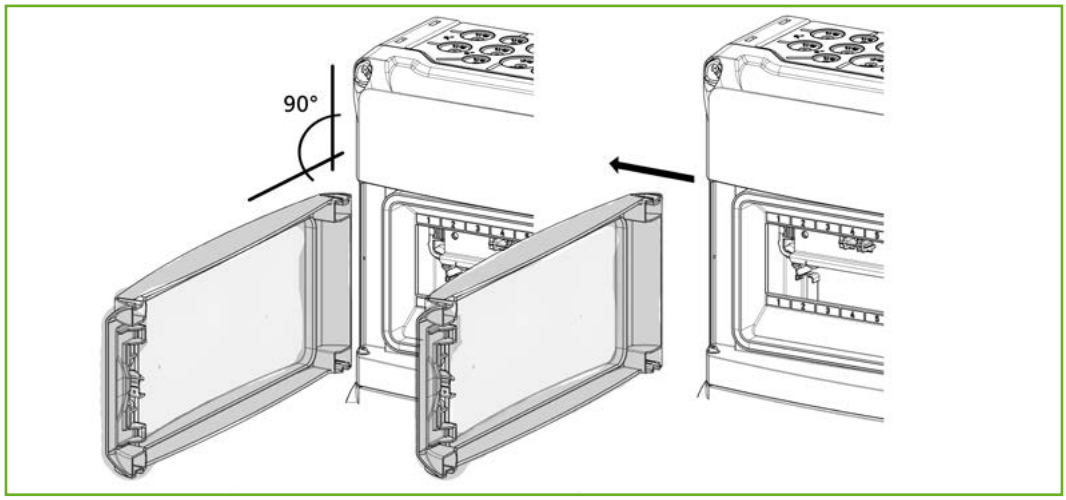


Figure 24: Change window hinge

- Open the window to an angle of 90°
- Remove the hinged window by unlocking it outwards from the hinge holders
- Insert the hinged window on the opposite side of the top part, also at a 90° angle into the hinge holder
- The hinges snap into place

Lock / seal window

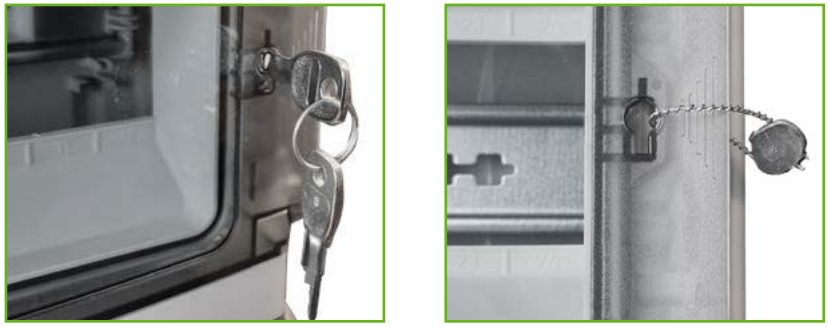


Figure 25: Locking and sealing the hinged window
Required tools: screwdriver, hammer

- Insert the AK SGA lock
- Secure the lock with the supplied pin

Alternatively, the hinged window can be secured with a sealing wire.

Secure top part

Suitable tool: screwdriver

Note

Opening and closing the top part should be done with a flat screwdriver (blade width 4 – 6.5 mm).

- Place the top part on the box
- By a 45° rotation, the quick closure locks the top part firmly to the box.

Warning

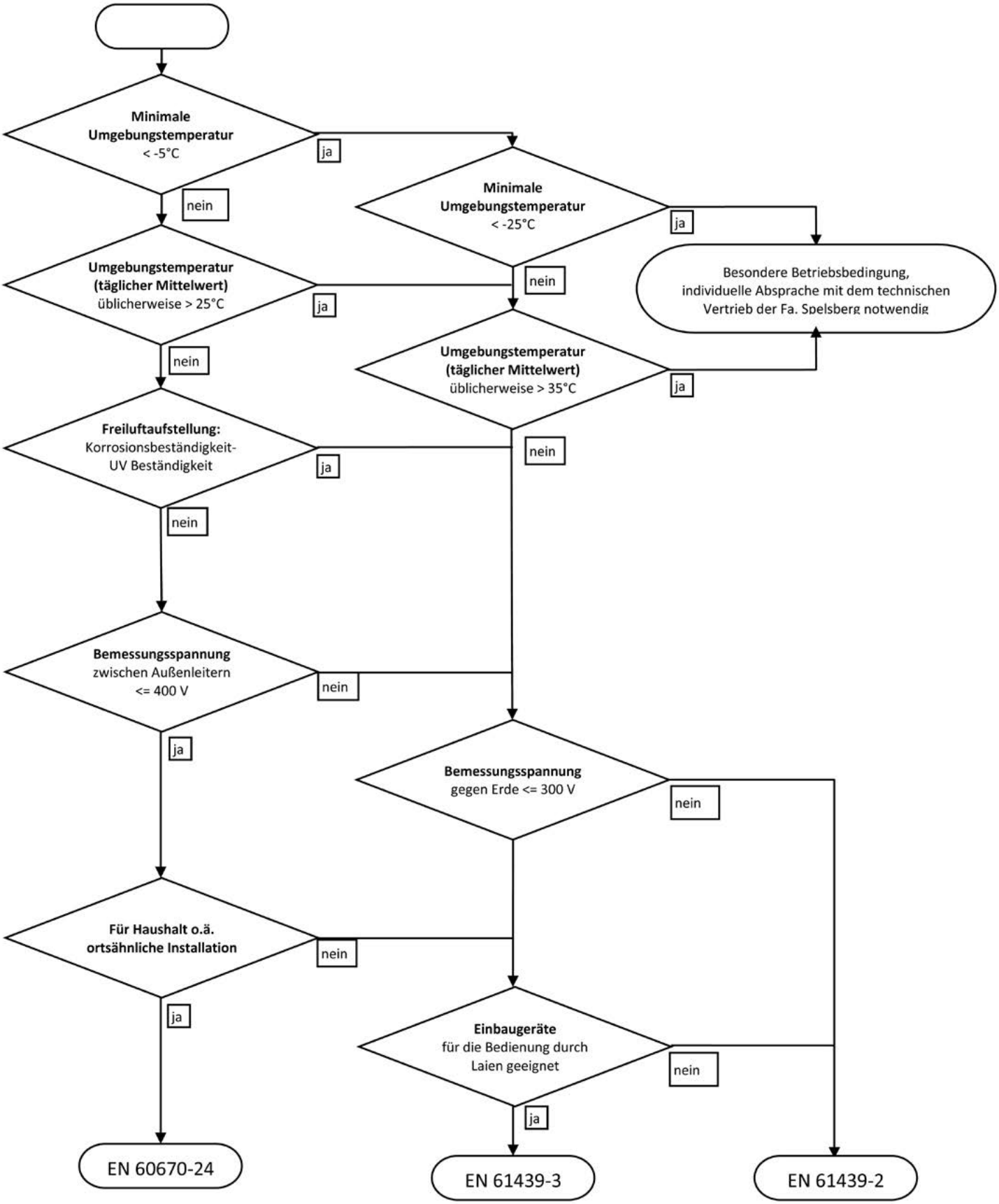
Electric shock due to exposed live parts.

After installation of the equipment, the remaining openings in the device cut-out must be closed with the cover strips (AK AS). The cover strip must not shift within the device cut-out to allow openings > 2 mm.

- Close the openings in the device cut-out

Planning

When is which standard to be applied



Planning according to EN 60670-24

Title of the standard

Boxes and enclosures for electrical accessories for household and similar fixed electrical installations Part 24: Special requirements for enclosures intended to contain protective devices and similar energy-consuming equipment.

Areas of application according to standard

Note
Electrical characteristics
Observe the feed-in limits in chapter "Electrical properties", **page 6**

Ambient temperature

- Usually +25 °C
- Occasionally +35 °C over a period of 24 h, max. 40 °C
- Installation temperature: minimum -5 °C
- Minimum permissible temperature for use: -25 °C

Classification of the AK-distribution board

Enclosures are classified according to EN 60670-24 based on their characteristics in various criteria:

Classification criteria according to chapter 7 of EN 60670-24

The following chapter information in brackets refers to chapter 7 of standard EN 60670-24.
Only the subchapters relevant for the AK-distribution board are mentioned.
Type of material (chapter 7.1)

The AK-distribution board is an insulating material enclosure. It can be used as:

- **Empty enclosure** (divided into)
  - GP enclosures (universal enclosures)
  - PD enclosures (enclosures for pre-determined equipment)

- **Basic enclosure** (divided into)
  - GP enclosures (universal enclosures)
  - PD enclosures (enclosures for pre-determined equipment).

Type of installation (chapter 7.2) The AK-distribution board is suitable as a surface-mounted enclosure on:

- Flammable walls
- Flammable ceilings
- Flammable floors
- Flammable furniture

Note
Installation
Observe the instructions from chapter "Installation", **page 17**.

Types of introductions (chapter 7.3)

All cable insertions and the sealing materials of the AK-distribution board specified in chapter "Cable insertions", **page 19** are suitable for:

- Sheath cables for fixed installations
- Flexible conductors

Note
Cable screw glands
Spelsberg recommends the use of cable glands IP65 for flexible cables.

Fastening elements (chapter 7.4)

The AK-distribution board is delivered without fastening elements for cables, wires or pipes.

Minimum and maximum temperature during installation (chapter 9.5)

The ambient temperature during installation of the AK-distribution board should be in the range From -5 °C to +40 °C.

Note
Installation
Observe the instructions from chapter "Installation", **page 17**.

Protection against electric shock

When the device cut-out is correctly closed, the normatively required protection type IPXXC is complied with (protected against access with tools).

Warning
Electric shock due to exposed live parts.
After installation of the equipment, the remaining openings in the device cut-out must be closed with the cover strips (AK AS). It must be ensured that shifting the cover strip in the device cutout does not create an opening > 2 mm.

Earthing device

As an insulated enclosure, the AK-distribution board does not have an earthing device.
The electrical continuity of the protective conductor connections inside the enclosure must be checked.

Surface mounting

The AK-distribution board meets the requirements of the standard.

Insulation resistance and voltage resistance

The enclosure of the AK-distribution board has a rated insulation voltage of 1000 V AC / 1500 V DC.

Creepage distances, clearances

The AK-distribution board meets the requirements of the standard.

Proof of maximum power dissipation capacity (P_{de})

The heating test was performed on AK-distribution boards with replacement resistors for:

- Empty enclosure as universal enclosure (GP enclosure),
- Basic enclosure as universal enclosure (GP enclosure)

In this case, the outer surface and the touch protection covers warmed up by not more than 30 K.
Generated power losses per standard rail, see "Technical data", **page 49**.

Note

Temperature rise in the enclosure

The temperature increase inside the enclosure is higher than the temperature increase on the outer surface and may, if applicable, exceed the allowable operating temperature of the installed operating equipment.

Proof of heating

The heating test was performed on AK-distribution boards with combinations of equipment for:

- Empty enclosure as enclosure for pre-determined equipment (PD enclosure),
- Basic enclosure as enclosure for pre-determined equipment (PD enclosure).

In this case, the outer surface and the touch protection covers warmed up by not more than 40 K.
Generated power losses per standard rail, see "Technical data", **page 49**.

Note

Temperature rise in the enclosure

The temperature increase inside the enclosure is higher than the temperature increase on the outer surface and may, if applicable, exceed the allowable operating temperature of the installed operating equipment.

Construction rules for use as GP enclosure

Note national conditions EN 60670-24

The AK-distribution board cannot be used as GP enclosure in:
Germany, Greece, Belgium, France.
Use in the countries mentioned above the design rules
for use as PD enclosure.

The construction rules for use as universal (GP) enclosure apply for empty and basic enclosures.
When observing the construction rules during installation, the AK-distribution board meets the requirements of the standard.

The installation of mechanical or electrical devices in empty or basic enclosures has been verified by Spelsberg in accordance with this standard.

The installer must provide proof for the installed devices according to the information given in this chapter.

Limit temperature rises

Note

Suitable AK-distribution board
To select the suitable AK-distribution board, the installer must demonstrate that the temperature rise caused by the power loss of the installed operating means at the hottest touchable part of the equipped small distribution board is not greater than 30 K.

$$P_{tot} \leq P_{de}$$

Where
P_{de} is the maximum power dissipation capacity of the enclosure, in W, specified by the manufacturer for the intended use;
P_{tot} is the total power loss of the electrical installation devices and protective devices to be installed in the GP enclosure and their wiring, calculated as follows:

$$P_{tot} = P_{dp} + 0.2\ P_{dp} + P_{au} + P_{el} + 0.2\ P_{el}$$

Here,
P_{dp} the power loss of the protective devices;
$0.2\ P_{dp}$ the increase of Pdp, to consider the power loss due to wiring, sockets, relays, time switches, small devices;
P_{au} the power loss of installation devices other than those mentioned above (for example transformers, socket outlets, signal lamps, …);
P_{dp} is calculated as follows: $P_{dp} = \sum p_e \cdot P_e \cdot K_e^2 + \sum p_n \cdot P_n \cdot K^2$
P_{el} the power loss of electronic installation devices, in watts, considering the load factor (K_e) for multi-use devices;
$0.2\ P_{el}$ the increase in P_{el} to consider the power loss due to the connections of the electronic devices' power circuit.

Here,
p_e the number of poles of devices of the input circuits;
P_e the power loss for each pole of the device of the input circuits;
K_e = 0.85;
p_n the number of poles of devices in the enclosure except for the input circuits;
P_n the power loss for each pole of the devices in the enclosure except for those of the input circuits;
K the value (≤ 1) depending on the simultaneous use of connected loads.

If no information on the actual currents and simultaneity factors is available,
the factors from the table may be used

Number of main circuits	Load factor K
2 and 3	0.8
4 and 5	0.7
6 to 9	0.6
10 and more	0.5

Table AA.1 of the standard

Tests and evidences to be carried out by the installer

The operating means installed in the AK-distribution board must comply with their product standard.
The installation instructions of the operating means manufacturer must be observed.

Labeling

The following inscriptions must be applied:

- Name or identifier of the installer,
- Type identifier or other means used by the installer,
  to identify the equipped GP enclosure,
- Rated current (I_n) (A),
- Rated voltage (V),
- Symbol for the type of power supply,
- Degree of protection of the equipped GP enclosure,
- Symbol for protective insulation
- Letter N for terminals intended exclusively for the neutral conductor,
- Symbol ⏚ for grounding terminals for the protective conductor connection.

The inscriptions may also be affixed behind the cover or doors of the equipped GP enclosure.
The inscriptions must be easily and permanently legible. For the AK-distribution boards with PE/N rail the required marking for neutral and protective conductor terminals is already embossed,
the symbol for protective insulation is already printed on the top part of the AK-distribution boards.

Protection by protective insulation

When devices that penetrate the enclosure are installed, the installer must ensure, that no-fault voltage is transferred from the enclosure. The devices must be suitable in the mounted state for the rated insulation voltage and, if applicable, the maximum rated impulse voltage. Parts inside the equipped enclosure must not be connected to the protective conductor circuit.
The test is carried out by visual inspection.

Continuity of the protective conductor connection

The electrical continuity of the protective conductor connections must be verified for each properly equipped, wired, and mounted enclosure.
The test is carried out by visual inspection and, if necessary, by testing the continuity of the protective conductor connection.

Wiring, mechanical function, and, if necessary, electrical function

The correct positioning of the conductors, effectiveness of connection means, and proper assembly of protective devices and other operating means must be checked.
The effectiveness of mechanical actuating elements, interlocks, etc., if present, must be checked.
Depending on the complexity of the wired enclosure, an electrical function test may be necessary.
The test is carried out by visual inspection and, if necessary, by electrical function testing.

Aging resistance, protection against ingress of solid foreign objects And harmful ingress of water

A test according to IEC 60529 is only to be performed if:

- the enclosure has been modified by the installer such that its electrical shock protection grade, as specified by the manufacturer, is compromised
- the enclosure was not installed according to the manufacturer's specifications

Insulation resistance

The proof is carried out with a test device at a test voltage of at least 500 V.
The measurement is made between each live conductor and the enclosure and each other live conductor.

The measured insulation resistance must be greater than 1000 Ω/V, related to the rated voltage against earth.

This proof can be omitted for single-phase equipped enclosures with a rated current $I_n \leq 32$ A.
During the test, operating means in the enclosure may be disconnected to avoid damage.

Design rules for use as PD enclosure

Note national conditions EN 60670-24
The AK-distribution board cannot be used as PD enclosure in:
Denmark, Italy.
Use in the countries mentioned above the design rules
for use as GP enclosure.

The design rules for use as enclosures for predetermined device assemblies (PD enclosures) apply to empty and base enclosures.

Enclosures for predetermined device assemblies are empty or base enclosures for which the accommodation capacity of mechanical and electrical devices according to design rules and tests according to EN 60670-24 by Spelsberg has been demonstrated.

The AK-distribution board must be installed so that the risk to the environment due to the heating of the equipped AK-distribution board is minimized and a proper combination of electrical operating means for the intended use is ensured.

The following design rules are instructions for the installer.

The accommodation capacity of predetermined mechanical or electrical devices in empty or base enclosures has been demonstrated by Spelsberg according to design rules and testing in accordance with this standard. The installer must provide evidence for the installed devices according to the information provided in this chapter.

Rated current and main features

Note
Electrical properties
Observe the input limits given in the chapter "Electrical Properties", **page 6**.

The operating means must be suitable according to their technical data for the intended application with regard to their rated values.

The maximum operating current of the devices shall be less than or equal to the maximum rated current Of the enclosure.

The rated current of the operating means may be higher if necessary to comply with a derating.

The maximum operating temperatures of the installed operating means and cables must be considered.

The operating means shall be arranged such that the power loss is distributed approximately evenly within the AK-distribution board.

Calculation

For correct design, calculation of the power loss emitted by the installed switching and protective devices is required.

The necessary electrical data of the operating means are part of the technical data provided by the manufacturer.

The rated load factors for outgoing circuits can be taken from the table for calculation purposes, unless application stipulates otherwise.

Number of main circuits	Load factor K
2 and 3	0.8
4 and 5	0.7
6 to 9	0.6
10 and more	0.5

Table 102 of the EN 60670-24 standard

There are operating means whose power loss is:

a) independent of current
b) substantially proportional to I
c) substantially proportional to I^2

The actual power loss is calculated for operating means according to the formula:

$\mathbf{P_{nc}} = P_n$
$\mathbf{P_{nc}} = P_n (I_{nc} / I_n)$
$\mathbf{P_{nc}} = P_n (I_{nc} / I_n)^2$

Here:

$\mathbf{P_{nc}}$ power loss at the rated current of the circuit,

Recommendation
Power loss per standard rail
Observe the power losses per standard rail listed in the chapter "Technical Data", **page 49**
.

$\mathbf{I_{nc}}$ rated current of the circuit,
$\mathbf{P_n}$ power loss at rated current of the operating means,
$\mathbf{I_n}$ rated current of the operating means.

For outgoing circuits, the load factor (K) must also be considered.
For outgoing circuits, the actual power loss of the operating means is calculated as follows:

a) $P_{nc} = P_n * K^2$
b) $P_{nc} = P_n (I_{nc} / I_n) * K^2$
c) $P_{nc} = P_n (I_{nc} / I_n)^2 * K^2$

Example:
A miniature circuit breaker B10A, which outputs a power loss of 1.5 W at a load of 10 A, according to the above formula outputs only 0.96 W at an actual rated current of 8 A of the circuit.

$$\mathbf{P_{nc} = 1{,}5\ W\ (8\ A / 10\ A)^2 = 0{,}96\ W}$$

If 10 miniature circuit breakers are used for the protection of the outgoing circuits, then according to Table 101 the EN 60670-24, a load factor of 0.5 can be assumed. A single miniature circuit breaker is 0.24 W. the power loss of a single miniature circuit breaker is 0.24 W.

$$\mathbf{P_{nc} = 1.5\ W\ (8\ A / 10\ A)^2 = 0.96\ W * 0.5^2 = 0.24\ W}$$

With 10 miniature circuit breakers, this results in a total power loss of 2.4 W.
The power loss for the wiring must be added, which can be estimated at 20% based on experience.

If a residual current circuit breaker (RCD) is used in the outgoing current circuit, the same load factor must not be assumed. 10 miniature circuit breakers B10A, load factor 0.5

10 miniature circuit breakers B10A, load factor 0.5
$I_{RCD} = 10 * 10\ A * 0.5$
$I_{RCD} = 10 * 10\ A * 0.5$
$I_{RCD} = 50\ A$

The actual power loss of the RCCB at the operating current of 50 A would be calculated analogously to the power loss of the miniature circuit breaker:

The actual power loss of the RCD at an operating current of 50 A would be calculated analogously to the power loss of the circuit breaker:

$$\mathbf{P_{nc} = P_n\ (50\ A / 63\ A)^2}$$

The operating means installed in the AK-distribution board must comply with their product standard, e.g.:

The equipment installed in the AK-distribution board must comply with their product standard, e.g.:

- RCCB according to IEC 61008-2-1
- RCBO according to IEC 61009-2-1, if available
- RCBO according to IEC 61009-2-1, if available

The mounting instructions of the equipment manufacturer must be observed.

Dimensions

The dimensions of the AK-distribution boards differ depending on the design, see Technical Data.

The distance between the standard rails is 135 mm.

The distance between the standard rail and the protective cover in the upper part is factory-set to 50 mm.

The distance between the standard rail and the hinged window is factory-set to 86 mm.

The distance between the standard rail and the top/bottom end is 125 mm for the AK 24 and 135 mm for the AK 36.

The distance between the standard rail and the PE/N rail is 87 mm for the AK 24 and 76.5 mm for the AK 36.

Connections

The external conductors are to be connected directly to the installation built-in device

Protection against electric shock

Devices must be installed and wired in the PD enclosure as specified by the device manufacturer so that their proper function during intended operation is not affected by:

- Heat
- Switching emissions
- Vibrations
- Magnetic fields

For PD enclosures with electronic operating means, separate routing or shielding of all electronic, signal-processing circuits may be necessary.
Conductors must be selected and routed throughout their entire length in the PD enclosure so that no short circuit is expected.

IP degree of protection and IK code

The AK-distribution board meets the requirements of the standards, see chapter "Degrees of Protection", **page 6**.

Wiring

When installing devices and wiring, a minimum creepage distance of 3 mm between live parts and metallic touchable or non-touchable parts must be maintained.
The conductor cross-sections must comply with the installation regulations and at least meet the manufacturer's requirements. Heat generated in the enclosure must be taken into account.

Planning according to EN 61439-3

Title of the standard

Low-voltage switchgear assemblies – Part 3: Distribution boards intended to be operated by ordinary persons (DBO)

Original manufacturer / Manufacturer of the switchgear assembly

The standards of EN 61439 distinguish the terms “original manufacturer” and “manufacturer of the switchgear assembly”.

Original manufacturer

Spelsberg is responsible as “original manufacturer” for the original design of the AK-distribution board and has provided the relevant evidence according to standard EN 61439-3.

Manufacturer of the switchgear assembly

Manufacturer of the switchgear assembly is the organization that takes responsibility for the finished switchgear assembly. This includes the standard-compliant design and wiring of the small distribution board, taking into account the electrical framework conditions, installation environment and usability, documented by type and unit verification.

Type verification

Spelsberg supports the creation of the type verification below. The requirements made in this product manual regarding assembly of the small distribution board, wiring, and installation of the operating means must be observed. The manufacturer of the switchgear assembly is responsible, regardless of the information in this product manual, for applying the currently valid standard and the described procedures. The electrical framework conditions, installation environment and usability must be defined by the user.

Applications according to standard Operating conditions

The AK-distribution board is intended for use under the following operating conditions:

Indoor installation

- Ambient temperatures from –5 °C to +40 °C
- But over a duration of 24 hours not higher than +35 °C
- Relative air humidity less than 50% at a maximum temperature of 40 °C,

At lower temperatures, higher air humidity is also allowed

Corrosion resistance /

The corrosion resistance of the metal parts in the enclosure was verified according to 10.2.2 of the standard

Degree of pollution

The AK-distribution board was designed for pollution degree 3.

Maximum installation height

The maximum installation altitude is 2000 m above sea level.

Note
Electrical properties
Observe the feed-in limits given in the chapter "Electrical Characteristics" **page 6**.

Verification according to section 10 of EN 61439-1/-3

The chapter references in parentheses relate to chapter 10 of the standard EN 61439-1/-3.

Evidence provided by the original manufacturer

Corrosion resistance (chapter 10.2.2)

The metal parts inside the AK-distribution board pass the tests according to Sharpness A and are suitable for outdoor installation.

Properties of insulating materials (chapter 10.2.3)

- The tests to verify the heat resistance of enclosures were passed,
- The verification of the resistance of insulating materials to exceptional heat and fire due to internal electrical effects, tests were performed on extracted samples with a Temperature of the glow wire tip of 850 °C delivered.

Resistance to ultraviolet (UV) radiation (chapter 10.2.4)

The AK distribution board is designed exclusively for indoor installation.

Lifting (chapter 10.2.5)

The AK-distribution board is designed for vertical and horizontal wall mounting and lying floor mounting for the following loads:

Maximum load per standard rail: 3 kg,
Maximum load on mounting plates: 3 kg, with 4 fastening screws

Impact tests (chapter 10.2.6)

The AK-distribution board meets the requirements of the impact tests, see chapter "IK protection grade, page 8".

Inscriptions (chapter 10.2.7)

The inscriptions applied in the Spelsberg-Delta are successfully abrasion resistant.
The labelling strips supplied with the AK-distribution boards and the type plate also included on the sheet Are not abrasion- and water-resistant.

Protection class of enclosures (chapter 10.3)

The AK-distribution board meets the requirements for outdoor installation according to EN 61439 as well as the requirements for "Wet and damp areas and rooms" and "Outdoor installations" of DIN VDE 0100-737.
The AK-distribution board achieves the IP protection degree IP65 with closed hinged windows, see chapter "IP protection degree", **page 6**.

Note

IP rating IP65

Changes, e.g., Installation of command and signaling devices in AK-Plus enclosures must be reassessed for the IP rating.
Spelsberg recommends protected installation under a roof or similar!

Creepage distances (chapter 10.4.2)

Due to the high rated insulation voltage of the AK-distribution board, no additional measures (e.g., cable fixing) are necessary. Cable fixing) are necessary. Rated insulation voltage,
See chapter "Installation", **page 17**.

Protection against electric shock and continuity of protective conductor circuits (chapter 10.5)

The basic protection is intended to prevent direct contact with dangerous active parts. With the given IP protection degree, the AK-distribution board provides the required protection when correctly installed.

Warning

Electric shock due to exposed live parts

After installation of operating equipment, the remaining openings in the device cutout must be closed with the cover strips (AK AS). The cover strip must not be shifted
In the device cutout so that an opening > 2 mm is exposed.

Continuity of the connection between bodies of the switchgear assembly And protective conductor circuit (chapter 10.5.2)

The AK-distribution board, as protective-insulated enclosure, has no connection for protective conductor. Therefore, the test does not need to be carried out. Protection against consequences of a fault in the switchgear assembly is given by the protective measure "protective insulation".

Short-circuit strength of the protective conductor (chapter 10.5.3)

The AK-distribution board is intended for use in electrical networks where the prospective short-circuit current Icp does not exceed 10 kA. Alternatively, the AK-distribution board may be operated with a current-limiting protective device with a switching current of max. 17 kA. A test of the short-circuit strength of the protective conductor is not required in this case.

Test of enclosures made of insulating material (chapter 10.5.4)

The AK-distribution board is suitable for rated insulation voltages of 1,000V AC and 1,500V DC. The corresponding tests have been successfully passed.
Combinations of AK-distribution boards using the combination gland KVR M50 or the connection flange AK KFL are also suitable for these rated insulation voltages.

External operating handles made of insulating material (Chapter 10.5.5)

The test point does not apply because the AK-distribution board does not have any external operating handles.

Short-circuit withstand strength (Chapter 10.11)

The AK-distribution board is intended for use in electrical networks where the prospective short-circuit current I_{cp} does not exceed 10 kA. Alternatively, the AK-distribution board may be operated with a current-limiting protective device with a cutoff current of max. 17 kA.
Therefore, proof of short-circuit withstand strength is not required for type verification.

Electromagnetic compatibility (Chapter 10.12)

The AK-distribution board as a bare enclosure behaves passively in terms of EMC. No protection of the components against electromagnetic interference occurring in the environment nor protection of the environment against electromagnetic interference generated inside the enclosure by the operating equipment is provided.

General (Chapter 10.12 – J.9.4.1/2)

Two types of environments are distinguished in the area of EMC.

- **Environment A:**
  This mainly includes industrial environments, where the power supply network is fed via its own transformer.
- **Environment B:**
  Residential, commercial, and business areas as well as small businesses are included in this environment, which are directly connected to the public low-voltage network.
  Further details can be found in EN 61439-1, Annex J.
  For completed switchgear assemblies, EMC immunity and
  EMC emission testing are not required if the following two conditions are met:
- The installed operating equipment is listed for the specified environment (A or B) in accordance with the relevant EMC product or generic standards.
- The internal structure and wiring is carried out according to the specifications of the equipment manufacturers.

Mechanical function (Chapter 10.13)

The enclosure and the hinged doors with hinges and handles have been tested for flawless mechanical function.

Proofs to be provided by the manufacturer of the switchgear assembly

Clearances (Chapter 10.4.1)

The clearance between active parts depends on the rated impulse withstand voltage (U_{imp}).
This in turn depends on the installation category and the network voltage as well as the network form of the electrical network.

Protection against electric shock and continuity of protective conductor circuits (Chapter 10.5)

Devices and circuits must be arranged so that their operation and maintenance are facilitated and the required protection is simultaneously ensured.

Effectiveness of the protective conductor (Chapter 10.5.1)

The effectiveness of the protective conductor must be demonstrated to protect against the consequences of a fault in the switchgear assembly according to 10.5.2.

The effectiveness of the protective conductor must be demonstrated to protect against the consequences of a fault in external circuits supplied by the AK-distribution board according to 10.5.3.

Installation of operating equipment (Chapter 10.6)

AK-distribution boards are not suitable for "inserts" and "removable parts" according to standard EN 61439.
The AK-distribution board is suitable for rail-mounted devices of sizes 1-3 according to DIN 43871. By changing the position of the standard rail in the standard rail holder, it is also possible to install devices with different heights (see chapter "Standard Rail Holder, page 30").

In AK-Plus distribution boards, other operating equipment can also be installed in areas without device cutouts, e.g.:

- Terminal blocks
- Transformers
- Contactors

The operating equipment must comply with the applicable standards and must be suitable for the respective application case.

The following should be especially noted:

- Rated voltage
- Rated currents
- Rated frequency
- Service life
- Making and breaking capacity
- Short-circuit withstand strength

If the short-circuit withstand strength and/or the breaking capacity of the installed operating equipment is not sufficient for the stresses occurring at the installation site, the equipment must be protected by current-limiting devices. Attention must be paid to proper coordination of the
Operating equipment to prevent unwanted disconnections.

The installation of the operating equipment must be carried out according to the manufacturer's instructions.

The power loss emitted by the devices causes the air inside the enclosure to heat up. Temperature-sensitive operating equipment should therefore always be installed in the lower part of the enclosure.

The operating equipment must be easily accessible to the user. Unless otherwise agreed, the standard EN 61439 provides the following specifications:

- Connections, except protective conductor connections, must be at least 0.2 m above the floor and arranged so that cables and wires can be easily connected,
- Readout displays must be arranged in an area from 0.2 to 2.2 m above the operator's standing surface,
- Emergency stop actuators must be arranged in an area from 0.8 to 1.6 m above the operator's
Standing surface.

Unoccupied modules in the device cutout must be closed with cover strips.

Internal electrical circuits and connections (Chapter 10.7)

The cables laid inside the AK-distribution board must be suitable for the respective application. Use of bare conductors is not permitted in the AK-distribution board. The conductors must be suitable for the rated insulation voltage, the rated current, and the connection to the operating equipment.
When laying the cables, care must be taken that they are not routed over sharp edges.
The installed standard rails and optionally available mounting plates are uncritical in this respect.
The conductor cross-section must be selected depending on the rated current of the respective circuit (I_{nc}).
The higher temperature in the enclosure can potentially negatively affect the current-carrying capacity of the conductors.

Connections for externally introduced conductors (Chapter 10.8)

The AK-distribution boards are equipped with PE and N terminals. From 28 modules onwards, the N-rail can be separated for two N-potentials. Connection options, see chapter "Top/bottom ends", **page 11**.

Insulation properties (Chapter 10.9)
General (Chapter 10.9.1)

Each circuit of the switchgear assembly must withstand temporary and transient overvoltages. This must be ensured by testing the voltage withstand capability. Devices consuming current in the switchgear assembly (e.g., Windings, measuring devices, surge protection devices) that would cause current flow when the test voltage is applied must be disconnected. Similarly, devices not designed for the test voltage must be disconnected. All other operating equipment must be connected.

Operating frequency dielectric strength (Chapter 10.9.2)

Main circuits as well as auxiliary and control circuits connected to the main circuit must be tested with the following test voltages.

Rated insulation voltage Ui (conductor to conductor, AC or DC)			Test voltage (AC effective value)	Test voltage (DC)
	Ui ≤	60	1,000	1,415
60	< Ui ≤	300	1,500	2,120
300	< Ui ≤	690	1,890	2,670
690	< Ui ≤	800	2,000	2,830
800	< Ui ≤	1,000	2,200	3,110
1000	< Ui ≤	1,500	-	3,820

Table 8: Table 8 of the standard

AC or DC auxiliary circuits and control circuits not connected to the main circuit must be tested with the following test voltages.

Rated insulation voltage Ui (conductor to conductor, AC or DC)			Test voltage (AC effective value)
	< Ui ≤	12	250
12	< Ui ≤	60	500
60	< Ui		See EN 61439-1, Table 8

Table 9: Table 9 of the standard

Further details on testing can be found in the EN 61439-1 standard.

Impulse voltage withstand strength (Chapter 10.9.3)

The standard offers two options for verification:

- Testing
- Assessment

The assessment according to 10.9.3.5 is carried out by measuring or checking the dimensions in the design drawings. Clearances must be at least 1.5 times the values specified in the following table.

Rated impulse with stand voltage Uimp [kV]	Minimum air clearance [mm]	Minimum clearance x 1.5 [mm]
≤ 2.5	1.5	2.25
4.0	3.0	4.50
6.0	5.5	8.25
8.0	8.0	12.00
12.0	14.0	21.00

By evaluating data from the manufacturers of the operating equipment, it must be shown that all installed operating equipment is suitable for the rated impulse withstand voltage Uimp.
The possibilities for verification by testing can be found in the standard, if necessary.

Verification of heating (Chapter 10.10)

The AK-distribution board offers the possibility to use rail-mounted devices from various manufacturers.
As a result, a wide variety of assembly variants arise. A restriction on equipping imposed on the manufacturer of the switchgear assembly and the user is not desired by Spelsberg as the original manufacturer of the switchgear assembly. For this reason, the proof of heating for the AK-distribution boards must be carried out by assessment of a switchgear assembly with a single compartment.

Verification by assessment (chapter 10.10.4)

The procedure may be applied to AK-distribution boards in networks with a frequency of max. 60 Hz if the following conditions according to 10.10.4.2.1 are met:

a) The data on power loss of all installed devices is available from the device manufacturers,
b) The power loss is approximately evenly distributed within the AK-distribution board.
We recommend not exceeding the power losses specified in the chapter "Technical Data, page 63",
It must not be exceeded per standard rail,
c) The rated currents of the circuit breakers of the switching device assembly shall be allowed up to 80% of the conventional thermal currents in free air (I_{th}) or the rated currents of the operating equipment (I_n) in the circuit
Not be exceeded. Depending on the operating equipment, the designation of the continuous operating current that can be carried without overheating may vary. For example, for contactors the rated operating current I_e AC1, for circuit breakers In. The reduced rated current can lead to lower power loss dissipation.

Example
A B16A miniature circuit breaker may only be loaded with a maximum of 12.8 A.
If a rated current (I_{nc}) of 16 A is required for the outgoing circuit, this circuit must be equipped with a B20A miniature circuit breaker (20 A * 0.8 = 16 A).

There are operating equipment whose power loss is:
a) independent of current,
b) essentially proportional to I,
c) essentially proportional to I².

The actual power loss is calculated as follows for:
a) $P_{nc} = P_n$
b) $P_{nc} = P_n (I_{nc} / I_n)$
c) $P_{nc} = P_n (I_{nc} / I_n)^2$

Where:

P_{nc} Power loss at the rated current of the circuit

I_{nc} Rated current of the circuit

P_n Power loss at the rated current of the operating equipment

I_n Rated current of the operating equipment

For outgoing circuits, the load factor (RDF) must also be taken into account.
For outgoing circuits, the actual power loss of the operating equipment is calculated by the formula:

a) $P_{nc} = P_n * K^2$
b) $P_{nc} = P_n (I_{nc} / I_n) * K^2$
c) $P_{nc} = P_n (I_{nc} / I_n)^2 * K^2$

Example:
A B10A miniature circuit breaker, which at a load of 10 A emits a power loss of 1.5 W,
Emits only 0.96 W at a rated current of 8 A of the circuit determined by the above formula.

P_{nc} = 1.5 W (8 A / 10 A)² = 0.96 W

If 10 miniature circuit breakers are now used in an AK-distribution board for protection of the outgoing circuits, according to EN 61439-3 Table 101 a RDF of 0.5 can be assumed, resulting in the actual power loss for a single miniature circuit breaker:

P_{nc} = 1.5 W (8 A / 10 A)² = 0.96 W * 0.5² = 0.24 W

Table 101 of EN 61439-3

If there is no agreement between the manufacturer of the DBO and the user for the respective load currents, the assumed load of the outgoing circuits of the DBO or a group of outgoing circuits may be determined using the values in Table 101 of EN 61439-3.

Number of main circuits	Assumed load factor
2 and 3	0.8
4 and 5	0.7
6 to 9	0.6
10 and more	0.5

d) The mechanical parts and the installed operating resources must be arranged so that the air circulation is not significantly impaired
e) This point is disregarded because the rated current of the switchgear assembly is less than 200 A
f) All conductors must have a minimum cross-section corresponding to 125% of the permissible rated current of the associated circuit have

From the example:
miniature circuit breaker B16A, rated current (I_{nc}) 12.8 A
Minimum cross-section for 12.8 A * 125 % = 16 A
miniature circuit breaker B20A, rated current ($_{Inc}$) 16 A
Minimum cross-section for 16 A * 125% = 20 A

g) The information about the heating depending on the power loss generated in the enclosure for surface mounting of the AK small distributor has been determined by testing according to 10.10.4.2.2 of EN 61439-1 and is listed in the chapter "Technical data", **page 49** .

The occurring power loss of all circuits including internal wiring (calculation see Annex H of EN 61439-1) must be calculated based on the rated current of the circuits. The total installed power loss of the distribution board is calculated by adding the individual outgoing and incoming circuits. It must be taken into account
That the sum of the outgoing currents is limited to the rated current of the distribution board.

The heating inside the distribution board depending on the installed power loss
Is printed in the technical appendix.

Application example:

1x D02 fuse element I_n = 63 A, 3-pole, fuse elements 50 A, incoming feed

1x RCD I_n = 63 A, 30 mA, 4-pole

10 miniature circuit breakers I_n = 10 A, single-pole, outputs, max. rated current of each
Circuit I_{nc} = 8 A, assumed load factor according to EN 61439-3, Table 101: 0.5

Additionally, wiring and connection cables inside the enclosure must be considered
(see also Annex H of EN 61439). Assumed exemplarily as a total of 5 W.

No.	Operating equipment	I_n	Pn at I_n	I	P at I	RDF	Number	P total
1	D02 fuse element 63A, 3-pole	63 A	1.5 W	50 A	0.9 W	1	1	0.9 W
2	D02 fuse unit 50A	50 A	5 W	50 A	5 W	1.	3	15 W
3	RCD 63A, 30mA, 4-pole	63 A	12 W	50 A	7.6 W	1.	1	7.6 W
4	Miniature circuit breaker 10A, 1-pole	10 A	1.5 W	8 A	0.96 W	0.5	10	2.4 W
5	Conductor							5 W
								30.9 W

Thus, a power of 30.9 W is introduced into the enclosure in total. In an AK 28, the temperature would increase by 30 K in the upper third part, in an AK 42 by 25 K. Together with the ambient temperature of the distribution board, the total internal temperature is obtained. The suitability of the installed devices for this temperature must be ensured.

Electromagnetic compatibility (Chapter 10.12)

Immunity (Chapter 10.12 – J.9.4.4)
Under normal operating conditions, the AK-distribution board which contains no electronic operating equipment is not sensitive to electromagnetic interference. An immunity test is not required in this case according to EN 61439-1. In other cases, EMC testing may be necessary according to EN 61439-1, Annex J.10.12.

Emissions (Chapter 10.12 – J.9.4.4)
For AK-distribution boards containing no electronic circuits, proof is not necessary according to EN 61439-1. In other cases, EMC testing may be necessary according to EN 61439-1, Annex J.10.12.

Verification according to section 11 of EN 61439-1/-3

Verification must be carried out on every switchgear assembly and serves to detect material and manufacturing defects as well as to ensure correct functioning.

Template verification according to EN 61439-3
The following sample verification is based on an unchanged enclosure and the use of cable insertions with a minimum protection class of IP65. The specifications for minimum dimensions of air and creepage distances as well as insulation properties are based on the following data:

- Overvoltage category: II (load level)
- Power supply system: 4-wire 3-phase system, neutral point grounded
- Rated voltage of the power supply system U_n [V]: 400V AC
- Rated insulation voltage U_i [V]: 400V AC
- Rated current of switchgear assembly I_n [A]: max. 125 A

Verification according to EN 61439-3				
No.	**Type of test**	**Tests**	**yes**	**n.p.***
11.2	S	**Degree of protection of enclosures**		
		IP65		
11.3	S / E	**Air and creepage distances**		
		Air clearance tested by impulse voltage test with 5.1 kV ACeff (1.2/50 µs) when air clearance < 4.5 mm, otherwise electrical. Creepage distance inspection by visual examination: 6.3 mm		
11.4	S / E	**Protection against electric shock and continuity of protective conductor circuits**		
		Protection against direct contact with live parts, continuity of protective conductor (resistance measurement with min. 10 A, max. 0.1 Ω)		
11.5	V	**Installation of equipment**		
		Compliance with circuit documentation and other documents, labelling and inscriptions, completeness of operating and service documents 11.6		
11.6	M	**Internal connections**		
		Check screwed connections by random sampling for correct torque		
	E	**Internal electrical circuits**		
		Faultless wiring in accordance with the circuit diagrams		
11.7	V	**Connections for conductors introduced from outside**		
		Connection, type and labelling of connections must correspond to manufacturing documentation		
11.8	M	**Mechanical functions**		
		Mechanical operating elements, interlocks and locks must be checked		
11.9	E	**Insulation properties**		
		Measurement of insulation resistance with 500V DC between circuits and bodies: R > 400 kOhm		
11.10	S / E	**Wiring, operational behavior, function**		
		Check marking, wiring welectrical functional test		

* n.a. = not verifiable

Types of tests: S= Visual inspection
M = Mechanical test
E = Electrical test
V = Comparison with manufacturing documentation

Verification according to
EN 61439-3

Design according to EN 61439-2

Title of the standard

Low-voltage switchgear assemblies

The use of the AK-distribution board as a power switchgear assembly can be necessary when the application requires voltages up to 1000 V AC or 1500 V DC.

Design and verification must be conducted analogously to chapter „Design according to EN 61439-3, page 52“. Different points must be observed, such as:

Installation of equipment (chapter 10.6)
Only devices that can be operated by laypersons are permitted. If devices that may only be operated by qualified personnel are used, access to these devices must be excluded by suitable measures (e.g. for example by installing the AK-SGA lock in the hinged window or sealing the hinged window).

Verification of heating (chapter 10.10)
The assumed load factors in table 101 in EN 61439-2 differ from table 101
To EN 61439-3.

Table 101 of EN 61439-2
If there is no agreement between the switchgear assembly manufacturer and the user on the respective load currents, the assumed loading of outgoing circuits of the DBO or a group of outgoing circuits may be determined based on the values in table 101 of EN 61439-2.

Type of load	Assumed load factor
Power distribution 2 and 3 circuits	0.9
Power distribution 4 and 5 circuits	0.8
Power distribution 6 to 9 circuits	0.7
Power distribution 10 or more circuits	0.6
Actuator	0.2
Motors ≤100 kW	0.8
Motors > 100 kW	1.0

Table 101 of EN 61439-2

Appendix

Technical data

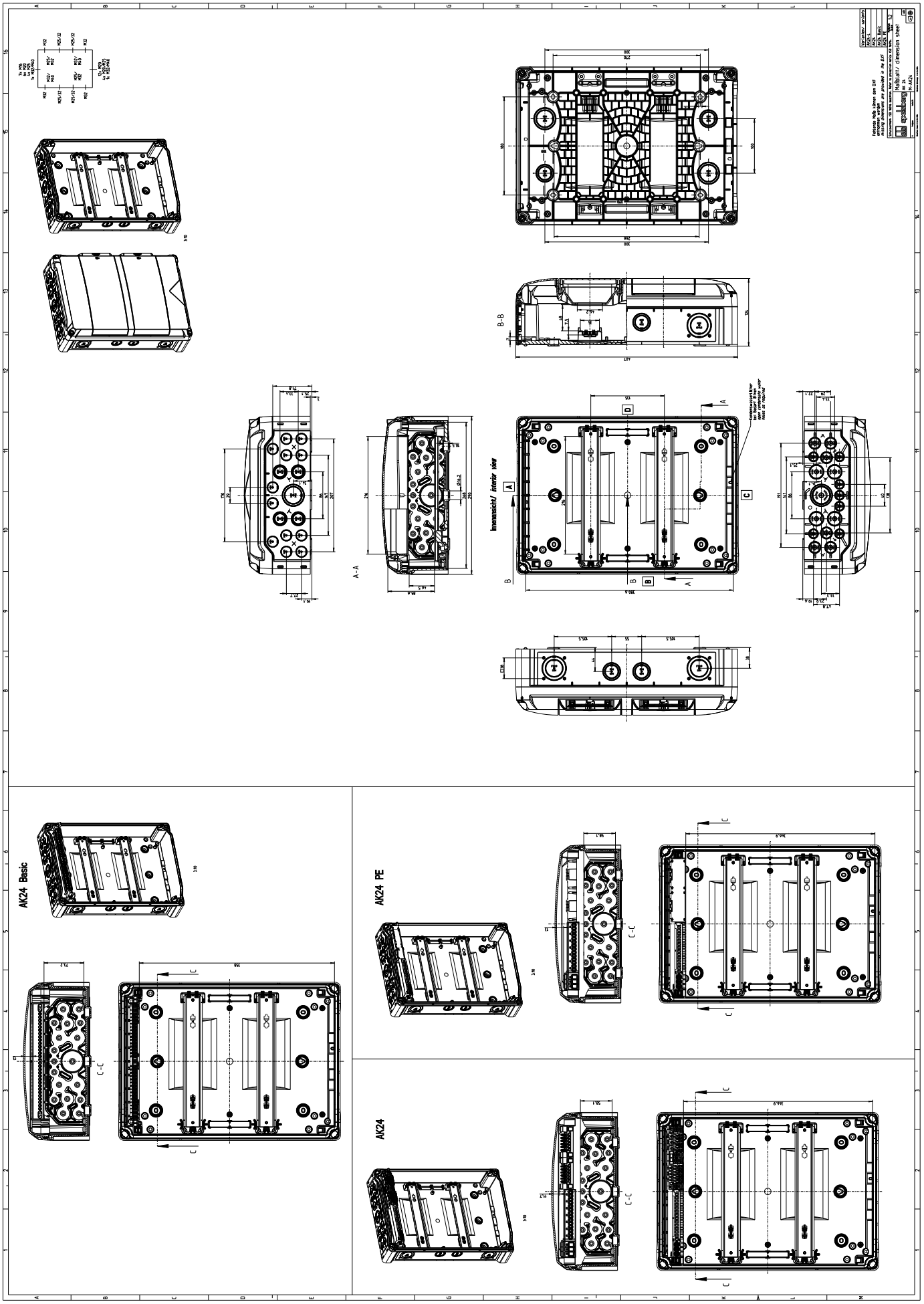
The data refer to the enclosure without PE-/N-terminal.

AK-distribution board

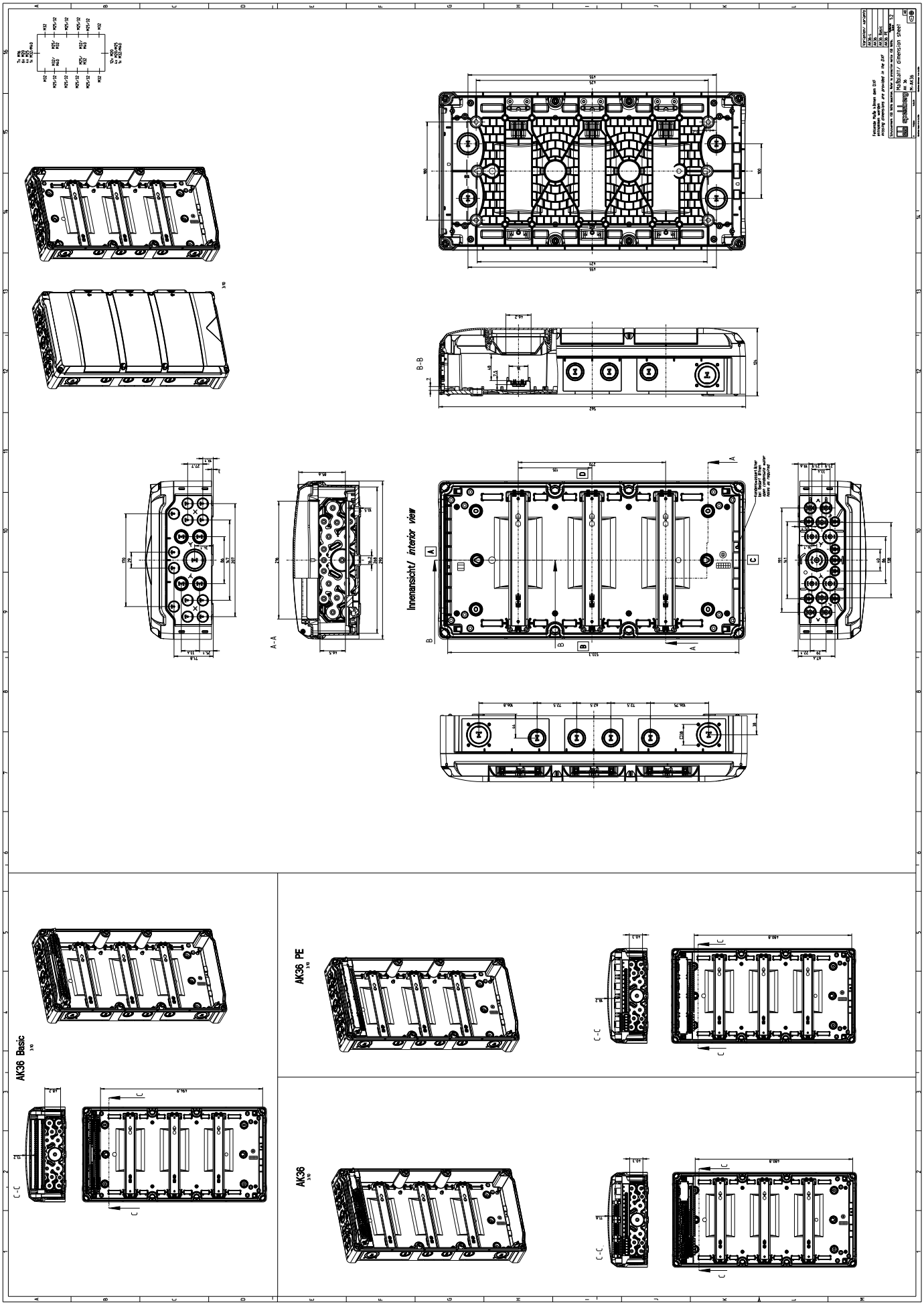
Product name	AK 24	AK 36
Order number	734 324 01, 734 424 01, 734 424 05, 734 424 03	734 336 01, 734 436 01, 734 436 05, 734 436 03
Rated voltage [V]	400	400
Rated current [A]	125	125
Weight / piece [kg]	1.96	2.76
Length [mm]	407	562
Width [mm]	290	290
Height [mm]	124	124
Inner height [mm]	86	86
Inner width [mm]	268	268
Inner length [mm]	385	385
Material of enclosure box	PS	PS
Material of enclosure cover	PP	PP
Material of hinged window	PC transparent	PC transparent
Material of seal	PU	PU
Material of quick closing	PA6GF	PA6GF
Type of protection	IP65	IP65
IK*	08	08
IK* (rear side)	07	07
Colour	Gray, similar to RAL7035	Gray, similar to RAL7035
Stackable	Yes	Yes
Minimum ambient temperature [°C]	-25	-25
Maximum ambient temperature [°C]	40	40
24h ambient temperature [°C]	34	34
Max. Rel. Humidity 25 °C	100%	100%
Max. Rel. Humidity 40 °C	50%	50%
Halogen free	Yes	Yes
Heavy metal free	Yes	Yes
PVC free	Yes	Yes
Silicone free	Yes	Yes
Sealable	Yes	Yes
Standards	EN 60670-24, EN 61439-2/3	EN 60670-24, EN 61439-2/3
Max. Power dissipation capacity [W] (Pde) For GP enclosure according to EN 60670-24 [per standard rail]* ΔT 30K	27.8 [13.9]	32.2 [10.7]
Allowable power dissipation [W] in PD enclosure according to EN 60670-24 [per standard rail]* ΔT 30K	31.0 [15.5]	37.5 [12.5]
Power dissipation capacity [W] according to EN 61439-1, 10.10.4.2.2 [per standard rail]* ΔT 30K	31.6 [15.8]	39.9 [13.3]

*** Note: Data applies for vertical mounting position**

AK 24 dimensional drawing



AK 36 dimensional drawing



Template verification for low-voltage switchgear assemblies according to EN 61439-3
With a rated voltage Un= 230/400V and a rated current of max. 125A.
Degree of protection of enclosure unchanged IP65

els spelsberg

Stücknachweis nach DIN EN 61439-3

Hersteller: _____ **Kunde:** _____

Straße: _____ **Straße:** _____

PLZ/Ort: _____ **PLZ/Ort:** _____

Auftrag / Pos.: _____

Nr.	*Prüfart*	*Prüfungen*	*ja*	*n.A.*
11.5	V	**Einbau von Betriebsmitteln** Übereinstimmung mit den Schaltungsunterlagen und anderen Unterlagen, Kennzeichnung und Aufschriften, Vollständigkeit der Gebrauchs- und Serviceunterlagen	☐	☐
11.7	V	**Anschlüsse für von außen eingeführte Leiter** Anschluss, Typ und Kennzeichnung von Anschlüssen müssen mit den Fertigungsunterlagen übereinstimmen	☐	☐
11.8	M	**Mechanische Funktion** Mechanische Betätigungselemente, Verriegelungen und Verschlüsse überprüfen	☐	☐
11.3	S / E	**Luft- und Kriechstrecken** Luftstrecke durch Stoßspannungsprüfung mit 5,1kV ACeff (1,2/50µs) wenn Luftstrecken < 4,5mm, sonst elektr. Prüfung **Kriechstrecke durch Sichtprüfung: 6,3mm**	☐	☐
11.6	M	**Innere Verbindungen** Geschraubte Verbindungen stichprobenartig auf korrektes Drehmoment prüfen	☐	☐
	E	**Innere elektrische Stromkreise** Einwandfreie Verdrahtung in Übereinstimmung mit den Schaltungsunterlagen	☐	☐
11.4	S / E	**Schutz gegen elektrischen Schlag und Durchgängigkeit der** Schutz gegen direktes Berühren aktiver Teile, Durchgängigkeit des Schutzleiters (Widerstandsmessung mit min. 10A, max. 0,1 Ω)	☐	☐
11.10	S / E	**Verdrahtung, Betriebsverhalten, Funktion** Überprüfung Kennzeichnung, Verdrahtung elektrische Funktionsprüfung	☐	☐
11.9	E	**Isolationseigenschaften** Messung Isolationswiderstand mit 500V DC zwischen Stromkreisen und Körpern: R > 400 k Ohm	☐	☐
11.2	S	**Schutzart von Umhüllungen** IP 65	☐	☐
	S	**Verpackung**	☐	☐

S= Sichtprüfung, M= mechanische Prüfung, E= elektrische Prüfung, V= Vergleich mit Fertigungsunterlagen

n.A. =nicht abprüfbar

Datum: _____ **Prüfer:** _____

Changes serving technical progress reserved

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