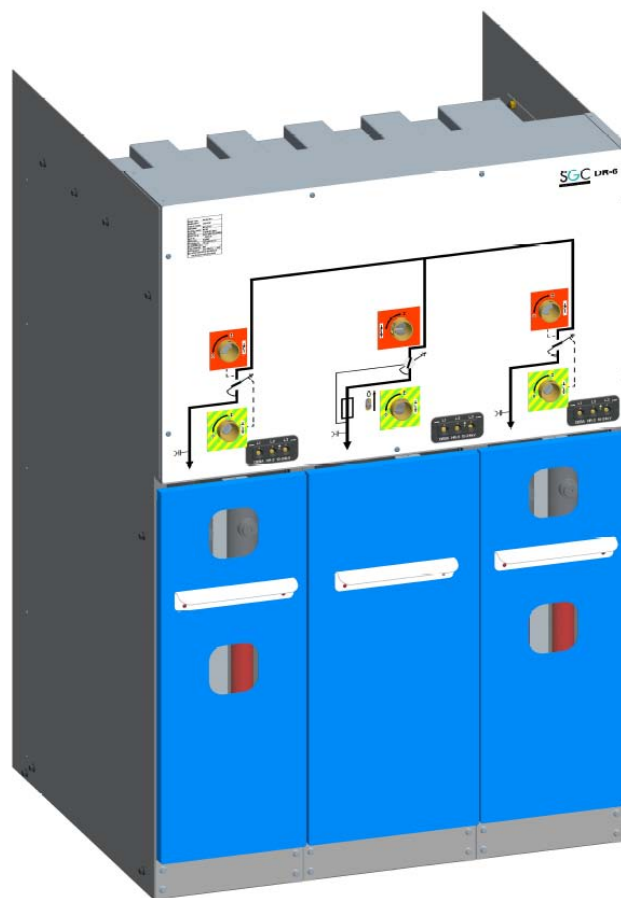


DR-6C

MEDIUM VOLTAGE SWITCHGEAR COMPACT RING MAIN UNIT



Installation Manual: DR-6C / DR-6+ C



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PREFACE

About this manual

This document is intended as a reference for qualified and trained operators to install the medium voltage switchgear in a safe and economical way.

This document uses the term “medium voltage switchgear” to denote a random, but in actual practice, existing combination of DR6 cubicles that, mutually coupled and connected, constitute a client-specific transformation or distribution station. See: “General description”.

The chapters and sections are numbered. The page numbers (consisting of the chapter number and the page number) and the document code can be found at the bottom of every page.

In the documentation the words “left”, “right”, “front” and “behind” are used to indicate a specific part of the medium voltage switchgear. The starting point is always the position of the operator, standing in front of the medium voltage switchgear, facing the switchgear.

Pictograms and safety symbols in and on the medium voltage switchgear

Depending on the version, the following pictograms are used on the medium voltage switchgear:



WARNING

High Voltage Danger

Access to this cubicle is only allowed after this cubicle and both the directly adjacent cubicles (previous and next one) are voltage-free.



WARNING

Drilling prohibited.

Drilling is strictly prohibited on surfaces equipped with this pictogram.

Pictograms used in this manual

The following pictograms apply to the medium voltage switchgear user documents:



CAUTION!

A procedure that can, if not carried out with the proper care, result in damage to the medium voltage switchgear, the surrounding area or the environment.



WARNING

High Voltage Danger



CAUTION!

Clamping danger



Notes, suggestions and advice.



Make this cubicle, the next one and the previous cubicle, voltage-free, before carrying out the work described.



Open the load break switch and the earthing switch before carrying out the work described in the manual.



Consult the indicated information sources first.



Protect the medium voltage switchgear from water and damp.

Related documentation

The following technical documentation for medium voltage switchgear is available:

- Transport manual DR-6C
- User manual DR-6C

Service and technical assistance

For information concerning specific settings, maintenance or repair work that is not mentioned here, please contact SGC - SwitchGear Company nv.

- When contacting SGC – Switchgear Company nv, always provide the following information:
 - Cubicle type and voltage
 - Serial number of the cubicles

General safety directions and instructions

SGC – SwitchGear Company nv does not accept any liability for damage or injury caused by not (strictly) following the safety directions and instructions, or by negligence during the installation, the use, the maintenance, or the repair of the medium voltage switchgear and its (possibly) additional options.

In case of any specific user circumstances, or in case of any additional, fitted options, extra safety instructions may be required. Please contact SGC – SwitchGear Company nv immediately if you encounter a potential danger during the operation of the medium voltage switchgear.

The owner/operator of the medium voltage switchgear is fully responsible at all times for observing the locally applicable safety instructions and guidelines.

User manual

- Anyone who uses or operates the medium voltage switchgear, must be familiar with the contents of the user manual, and follow the directions contained within very closely. The owner/operator must educate the users in accordance with the user manual and he or she must obey all directions and instructions.
- Never change the order of the required actions.
- Always keep the user manual close to the medium voltage switchgear.

Pictograms and safety symbols

The pictograms, symbols and instructions applied to the medium voltage switchgear are a part of the safety equipment. They may therefore not be covered or removed, and must be present and clearly readable throughout the entire life cycle of the medium voltage switchgear.

- Replace or repair unreadable or damaged pictograms, symbols and instruction immediately. Contact SGC – SwitchGear Company nv for replacements.

Operators

The execution of the work detailed herein (transport, installation, use and maintenance) is strictly reserved for trained and qualified operators, who are familiar with the dangers that may arise from operating the material. Temporary employees and personnel in training cannot operate the medium voltage switchgear under any circumstances.

Technical specifications

- Technical specifications must not be changed.
- Modification of the medium voltage switchgear (or parts thereof) is not permitted.

Transport, storage, installation, operation and maintenance

- See corresponding documents:
 - “Safety guidelines – transport”
 - “Safety guidelines – storage”
 - “Safety guidelines – installation”
 - “Safety guidelines – operation”
 - “Safety guidelines – maintenance”

Intended use

The medium voltage switchgear is designed exclusively for use as transformation and distribution stations, according to the guidelines and conditions provided by SGC – SwitchGear Company nv. Every other different or extended use, does comply with the intended use.¹

SGC – SwitchGear Company nv does not accept any liability for damage(s) or injuries resulting from deviation(s) of the intended use.

The medium voltage switchgear complies with the current norms and guidelines. See: Technical Brochure

- Operate the medium voltage switchgear strictly in a technically perfect condition, in accordance with the intended use outlined above.



Leave the sealed connections entirely intact, at all times. Breaking the sealed connections irrevocably voids any guarantee claims.

¹ The “Intended use” as defined in EN 292-1 “is the use for which the technical product is suited as specified by the manufacturer including his directions in the sales brochure.” In case of doubt, it is the use that can be deduced from the construction, the model and the function of the technical product that is considered normal use. Operating the product within the limits of its intended use also involves observing the instructions in the user manual.

1 INSTALLATION

1.1 Safety guidelines – installation

1.1.1 General



Installation of the medium voltage switchgear is reserved strictly for trained and authorized operators, who respect the locally applicable safety prescriptions & guidelines.

The actual connection and first start-up is to be performed by trained and authorized personnel in service of the power supply company.

- See also: "General safety prescriptions and instructions".
- Never leave tools or equipment behind in, or on, the medium voltage switchgear.
- Install the medium voltage switchgear exclusively in spaces that fully comply with the following recommendations (according to IEC 60298):

1.1.2 Recommendations – installation room parameters

Recommendations regarding the installation room parameters are subdivided in recommendations concerning:

- floor surface
- environmental conditions
- air circulation
- free height of the installation area
- dimensions of the access doors to the installation area
- free space in front of the cubicles
- internal arc resistance

1.1.2.1 *Floor surface*

The surface fit for the medium voltage switchgear placement, needs to be sufficiently strong and perfectly flat. The maximum allowed difference in level is **2 mm/m**.

1.1.2.2 Environmental conditions

DR-6C cubicles have been designed for **indoor** installation, provided that the following environmental conditions are met:

description	values
environmental temperature	min. -15 °C - max. +45 °C
relative air humidity (%)	min. 10% - max. 70% (without condensation)
installation altitude (m.a.s.l.)	max. 1.000 m above sea level

Table 1: Environmental conditions

Consequently:

- Avoid storage in dusty areas.
- Avoid storage in areas with a high level of relative air humidity.
- Avoid storage in areas sensible to lightning.
- Avoid storage in areas where cubicles may be exposed to corrosive gases or fluids.



Contact SGC – SwitchGear Company nv if the cubicles need to be stored or installed in places where the required environmental conditions cannot be guaranteed.

1.1.2.3 Air circulation

- Ensure proper air circulation in the installation area.
- Secure the air circulation openings to prevent small animals or rodents from gaining access to the installation area.

Particularly when the medium voltage switchgear contains one or more transformer cubicles, special attention needs to be placed on air circulation. Consult the table below to calculate the corresponding values. The table displays capacity losses with regard to the capacity of the cast resin transformers.

Transformer Capacity (KVA)	P (W)
100	1.605
160	2.175
250	2.850
315	3.412
400	4.012
500	4.837
630	5.745
800	6.787
1.000	7.875
1.250	10.350
1.600	12.450
2.000	16.125

Table 2: Overview of capacity losses in cast resin transformers

1.1.2.4 Free height of the installation area

The free height of the installation room has to be **at least 2.200 mm**. Depending on the distribution network manager however, a larger minimum free height may be required. An ideal free height, universally accepted by all distribution network managers, is 2500 mm.



Dry transformers with a capacity of ≥ 1.250 KVA require a minimal height of at least **2.500 mm**.

1.1.2.5 Dimensions of the access doors to the installation area

The provided height and width measurements apply to all doors that offer access to the installation room. These minimum requirements also apply if the installation room is not directly accessible from the outside.

description	value
Height of the access door	min. 2200 mm
Width of the access door	min. 100 mm + width of the widest cubicle

Table 3: Dimensions of the access doors



If the medium voltage switchgear does not contain any transformer cubicle(s), a minimal door height of **2.000 mm** suffices. If a transformer cubicle has been included, the dimensions of the transformer always need to be taken into account. For the correct dimensions of the different cubicles, please see: "Dimensions & Weights".

If the medium voltage switchgear is to be installed in basements, an access hatch is required, with a length and width of at least 400 mm larger than the dimensions of the largest cubicle or transformer.

1.1.2.6 Free space in front of the cubicles

The free space in front of the cubicles depends on the composition of the medium voltage switchgear.



If the medium voltage switchgear does not contain any transformer cubicle(s), the minimum free passage is **800 mm**. Medium voltage switchgear with a transformer cubicle with a capacity of ≥ 1.000 KVA requires a free passage of at least **2000 mm**.

1.1.2.7 Internal arc resistance

To prevent major material damage, serious physical injury or electrocution in the (unlikely) event of an internal arc, the following installation guidelines apply:

- Between the rear side of the cubicles and the wall of the installation room, ample free space needs to be provided, as displayed in Figure 1. This layout corresponds with an assembly where the side plates of the cubicles reach the rear side of the installation room. As a result, the free space behind the cubicles is entirely closed off.

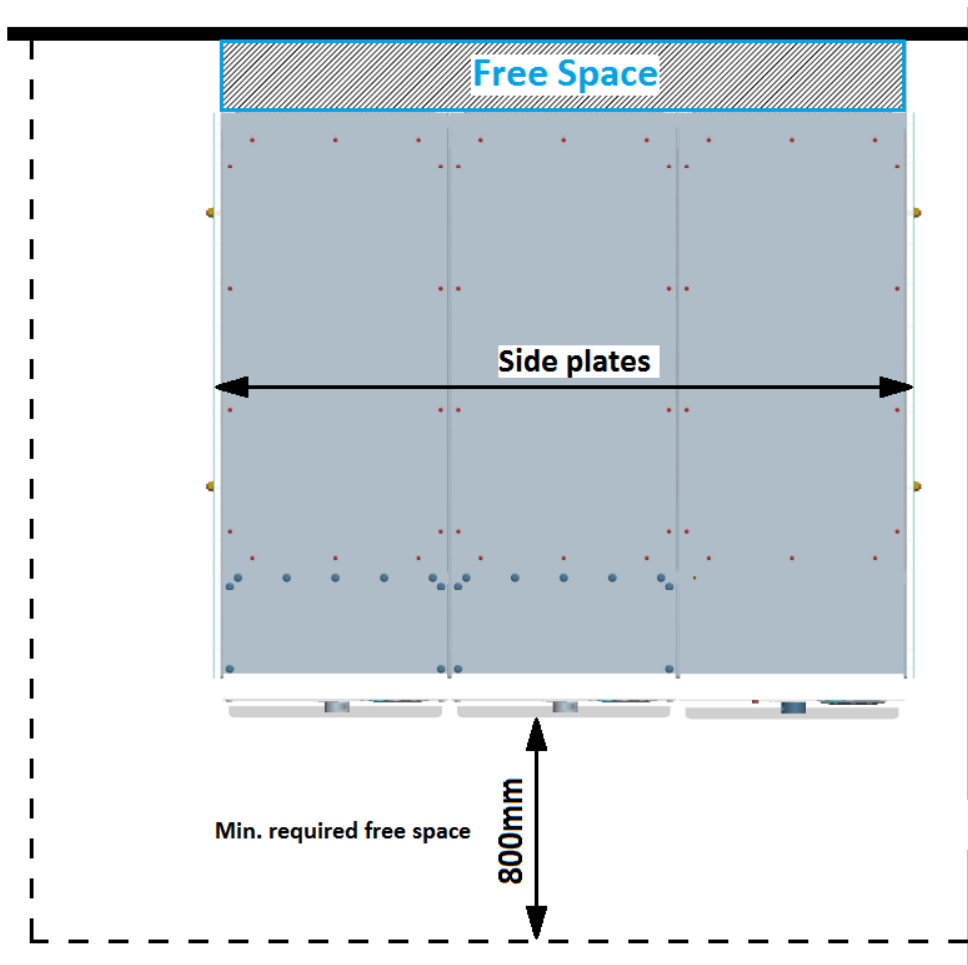
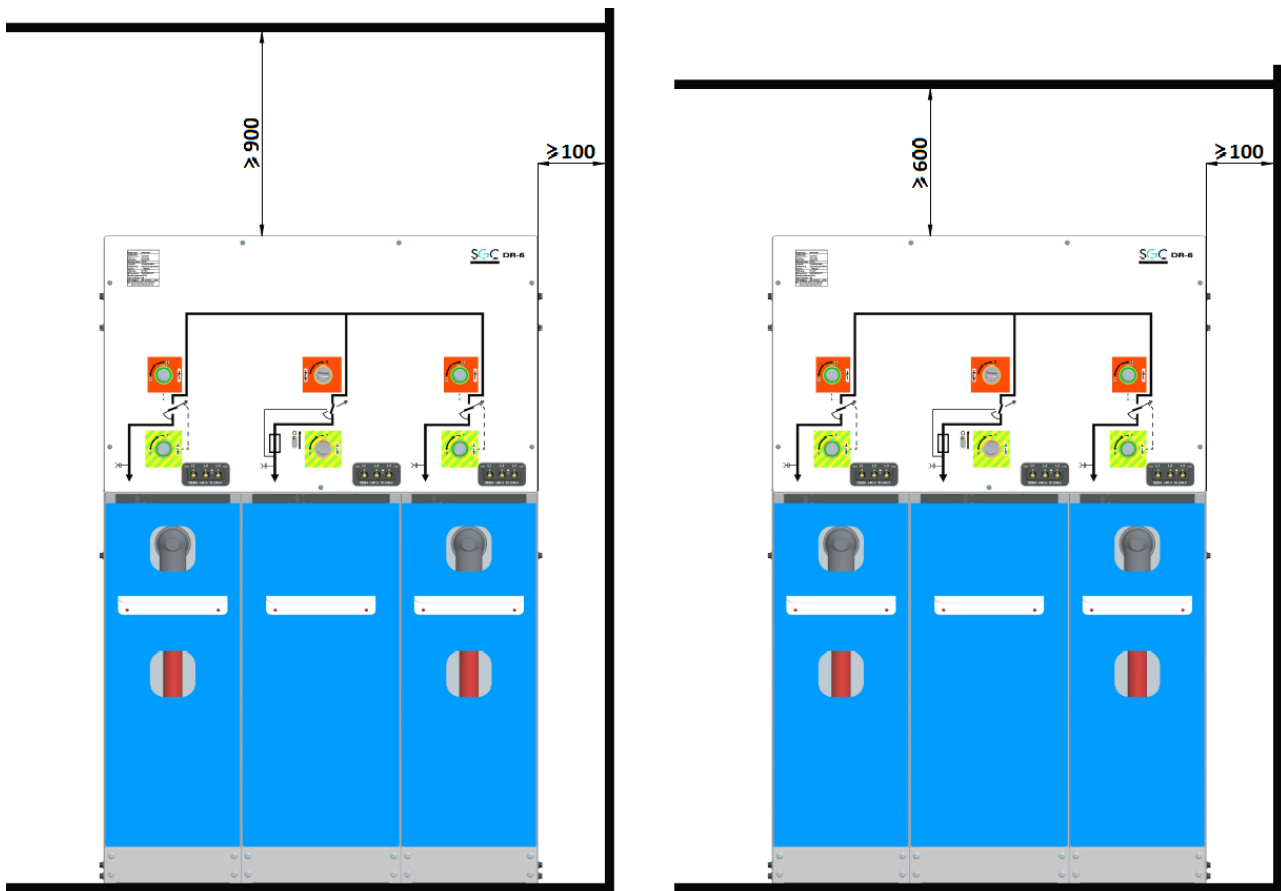


Figure 1: Top view of installed cubicles



A transformer cubicle can always be placed with its rear side against the wall.



**Figure 2: Minimal free height ≥ 900 for DR-6C installation (Left),
Minimal free height ≥ 600 for DR-6C+ installation (Right)**



Anchor each cubicle of the medium voltage switchgear to the floor as described in §4.1 Anchoring the DR-6C medium voltage switchgear.

Medium voltage cubicles installed according to the aforementioned guidelines always restrict an internal arc to its compartment of origin.

2 DR-6C INSTALLATION GUIDELINES

2.1 Installation with a cable cellar available

2.1.1 General

The installation of the DR-6C RMU guarantees the highest possible degree of protection in the event of an internal error, by routing the gas to the expansion volume in the cellar. It drastically reduces the consequences of an internal arc.

2.1.2 Required conditions

- Cellar's expansion volume $\geq 0.7 \text{ m}^3$
- Routing diameter $\geq 0.04 \text{ m}^2$, in a safe place
- Sealing off all other openings

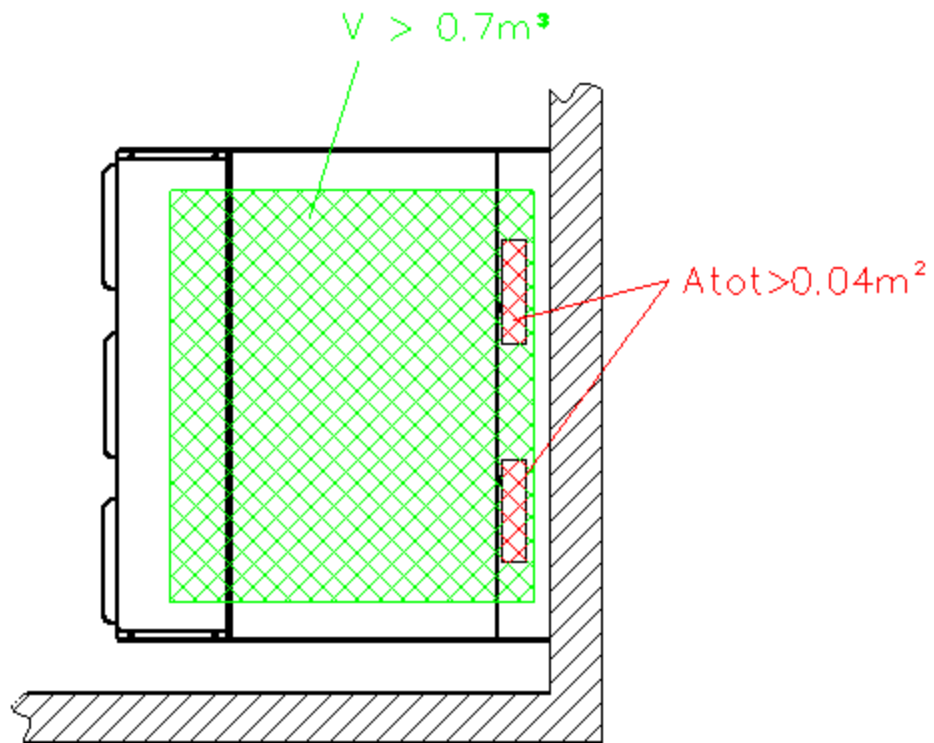


Figure 3: Top View of the installation

2.1.3 Gas escape route

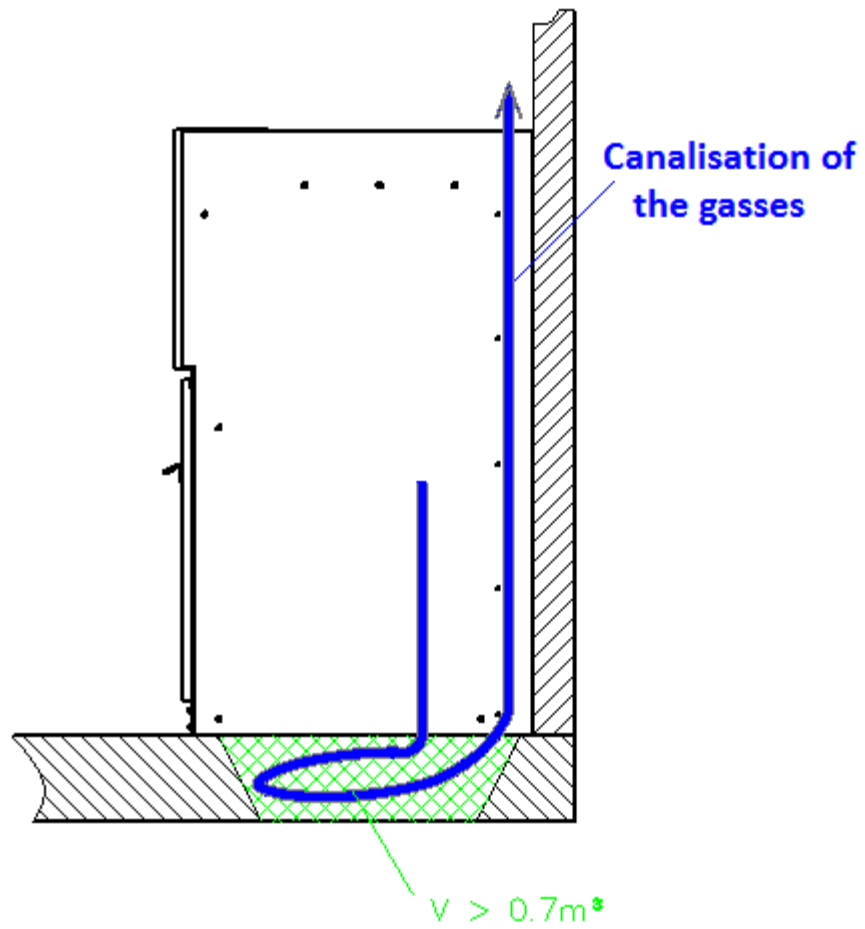


Figure 4: Gas escape route when placing the switchgear with a cable cellar available (Lateral view of installation)

2.2 With an expansion room available behind the switchgear

2.2.1 General

The installation of the DR-6C RMU guarantees the highest possible degree of protection in the event of an internal error, by routing the gas to an expansion volume behind the switchgear (transformer compartment). This drastically reduces the consequences of an internal arc in order to create safe operator conditions.

2.2.2 Required conditions

- Room's expansion volume $\geq 0.7 \text{ m}^3$
- Routing diameter $\geq 0.04 \text{ m}^2$, in a safe place
- Sealing off all other openings

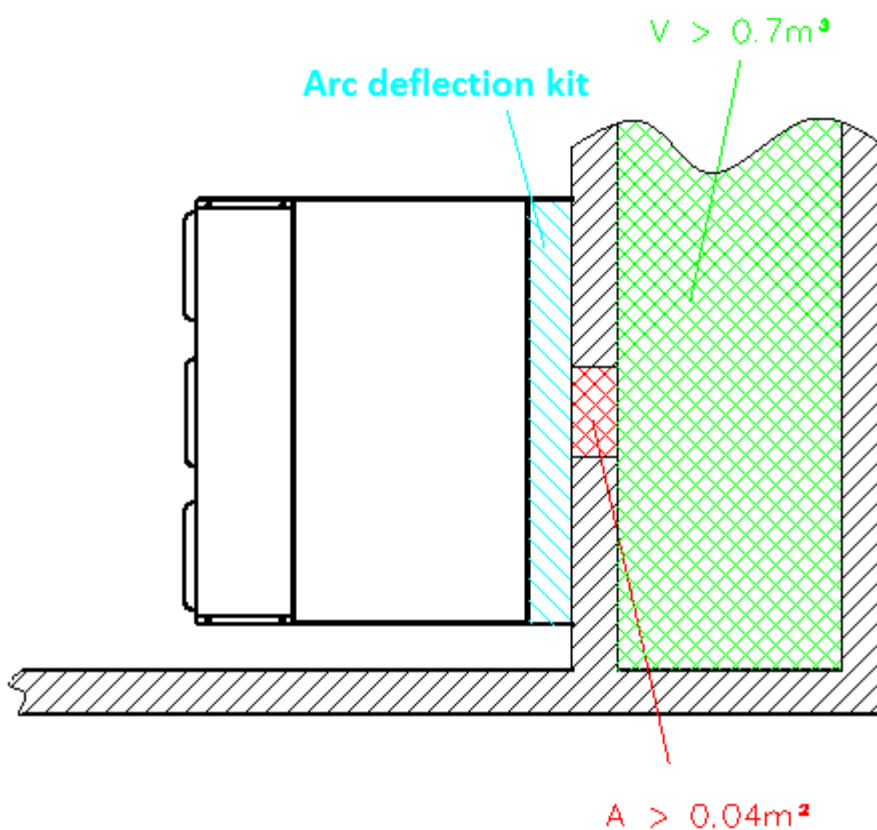


Figure 5: Top view of switchgear

2.2.3 Required Materials

- DR-6C Ring Main Unit
- Arc diversion kit, sealing of the top side (DR029670)

2.2.4 Gas escape route

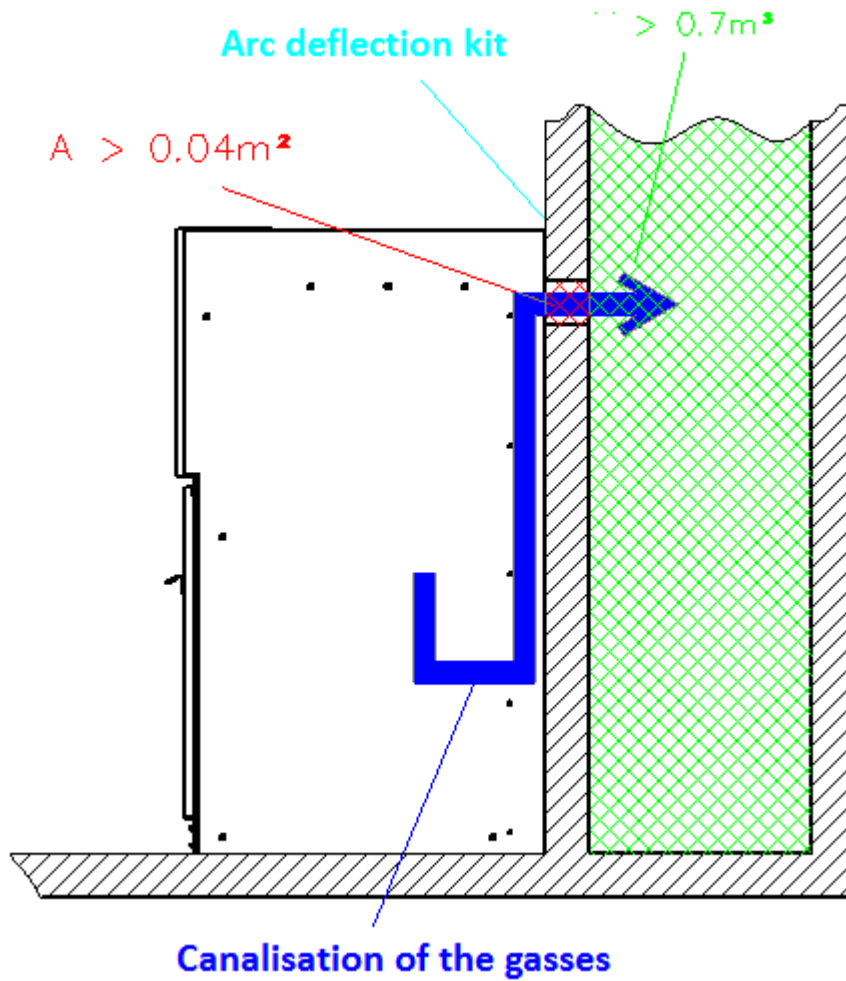


Figure 6: Gas escape route when placing the switchgear with an expansion room available behind the switchgear (Lateral view of installation)

2.3 Installation without a cable cellar or transformer room

2.3.1 General

The installation of a DR-6C RMU, without a cable cellar or a transformer room, guarantees the highest possible degree of protection in the event of an internal error, by routing the gas to a certified DR-6C cooling stand. The cooling stand acts as a buffer volume. This drastically reduces the consequences of an internal arc in order to create safe operator conditions.

2.3.2 Required conditions

The installation cannot in any way limit the function of the overpressure vents in the cooling stand.

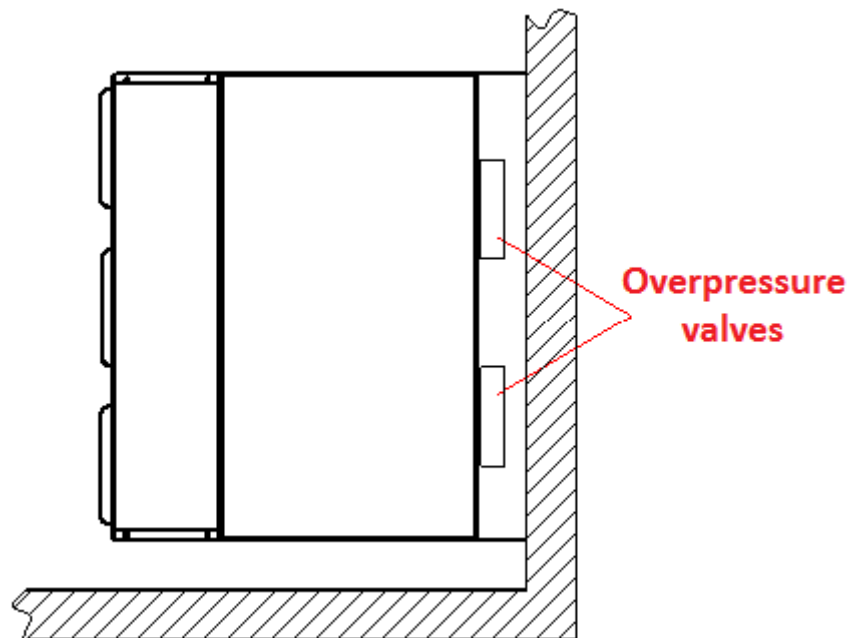
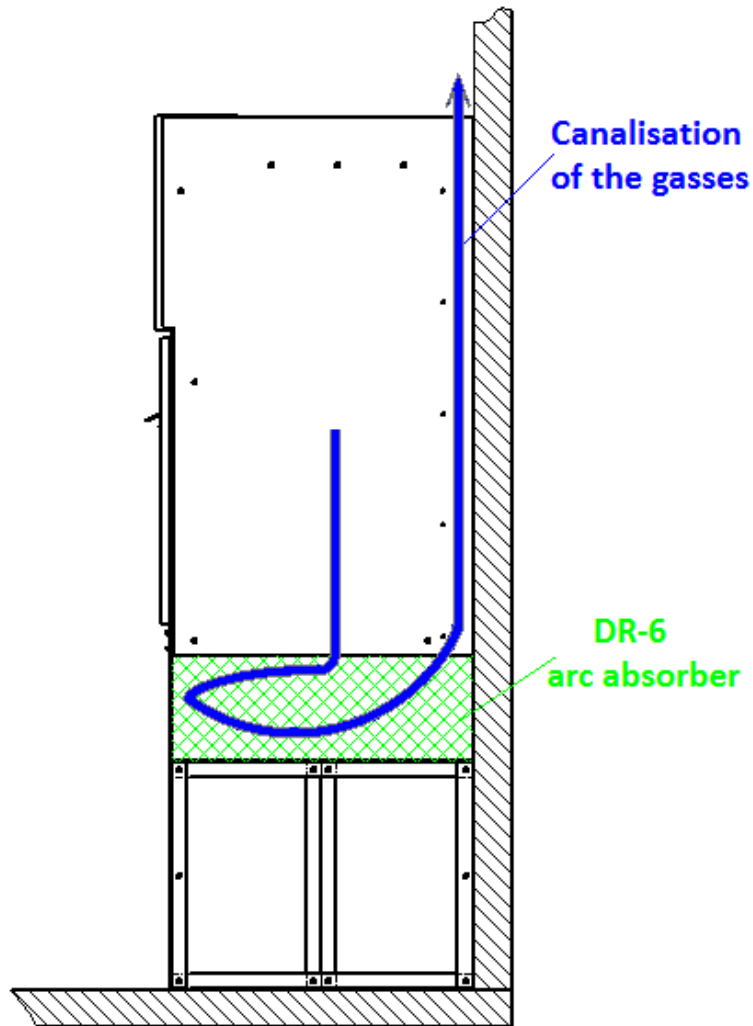


Figure 7: Top view of switchgear

2.3.3 Required materials

- DR-6C Ring Main Unit
- DR-6C cooling stand (DR029670)

2.3.4 Gas escape route



**Figure 8: Gas escape route when placing the switchgear on a DR-6C cooling stand
(Lateral view of installation)**

The height of the support attached to the cooling stand, needs to correspond with the regulations for bending cables.

3 DR-6+ C INSTALLATION GUIDELINES

3.1 Installation with a cable cellar

3.1.1 General

The installation of the DR-6C RMU guarantees the highest possible degree of protection in the event of an internal arc, by extinguishing it in less than 50 ms. The rapid arc extinction limits the internal pressure build-up, which in turn prevents the escape of gas.

3.1.2 Required conditions

To provide the highest possible degree of protection in the unlikely case of a malfunction of the arc extinction system (SV-50), an emergency overpressure vent is provided. To guarantee the perfect functioning of the overpressure vent, the free space between the rear side of the cubicles and the wall of the installation area needs to be respected. The installation cannot in any way limit the functioning of the overpressure vents.

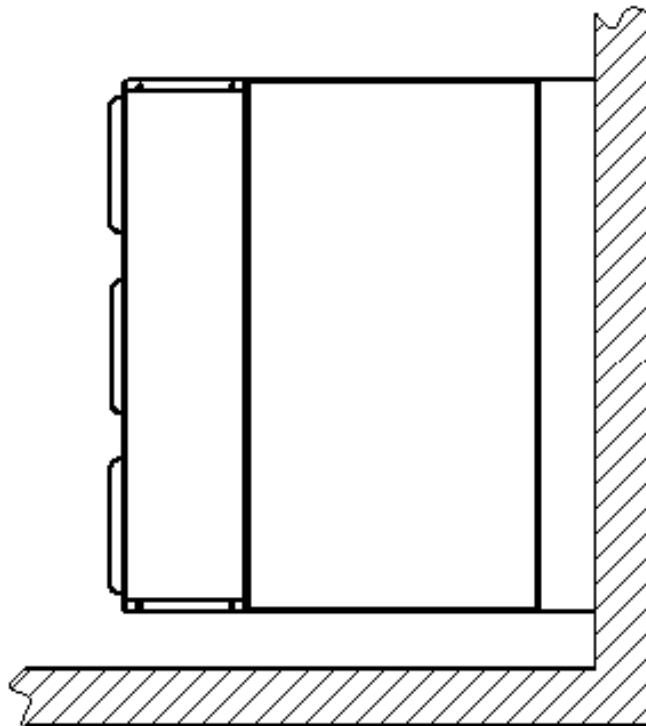


Figure 9: Top view of switchgear

3.1.3 Required Material

- DR-6+ C Ring Main Unit

3.1.4 Gas escape route

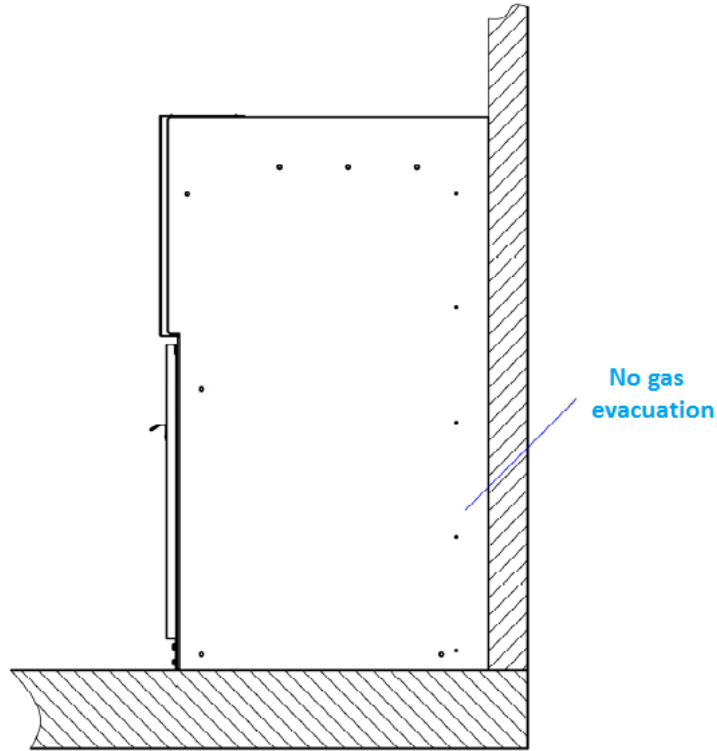


Figure 10: Gas escape route when placing the switchgear DR-6+ C with a cable cellar available (Lateral view of installation)

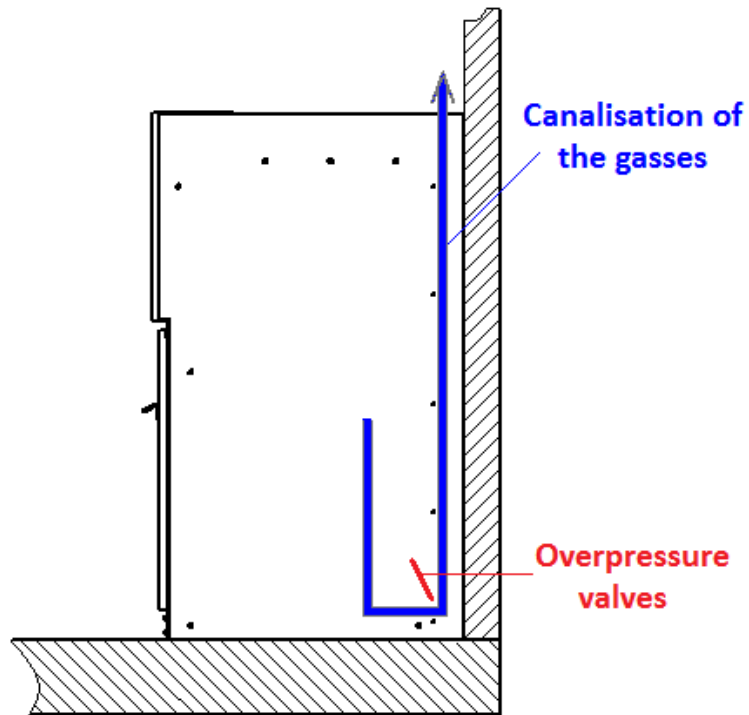


Figure 11: Gas escape route in the unlikely event of the arc extinguishing system's malfunction

3.2 Installation without a cable cellar

3.2.1 General

The installation of the DR-6+ C RMU guarantees the highest possible degree of protection in the event of an internal arc, by extinguishing it in less than 50 ms. The rapid arc extinction limits the internal pressure build-up, which in turn prevents the escape of gas.

3.2.2 Required conditions

To provide the highest possible degree of protection in the unlikely case of malfunction of the arc extinction system (SV-50) an emergency overpressure vent is provided. To guarantee the perfect functioning of the overpressure vent, the free space between the rear side of the cubicles and the wall of the installation area needs to be respected. The installation cannot in any way limit the functioning of the overpressure vents.

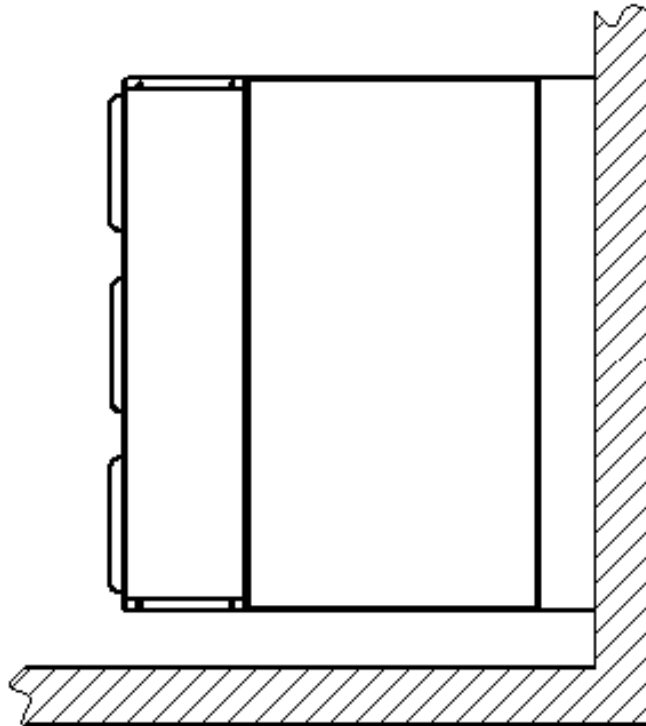


Figure 12: Top view of switchgear

3.2.3 Required material

- DR-6+ C Ring Main Unit

3.2.4 Gas escape route

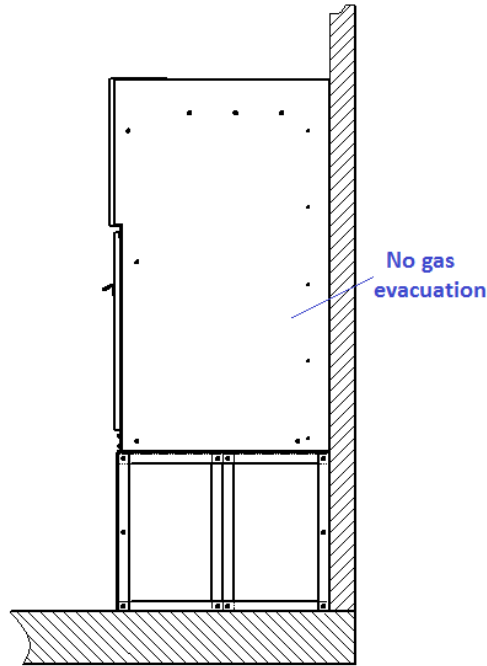


Figure 13: Gas escape route when placing DR-6+ C switchgear without a cable cellar (Lateral view of installation)

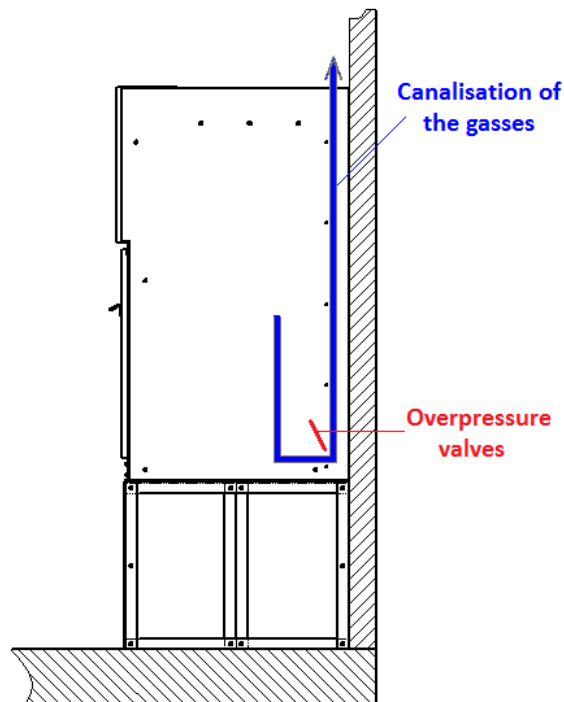


Figure 14: Gas escape route in the unlikely event of malfunction of the arc extinction system, positioning in the absence of a cable cellar

The height of the support attached to the cooling stand, needs to correspond with the regulations for bending cables.

4 POSITIONING

4.1 Anchoring the DR-6C medium-voltage cubicle

4.1.1 Installing the fixation clips

Before positioning the DR-6C switchgear in its definitive place, install a fixation clip (see Figure 15) for every functional unit.

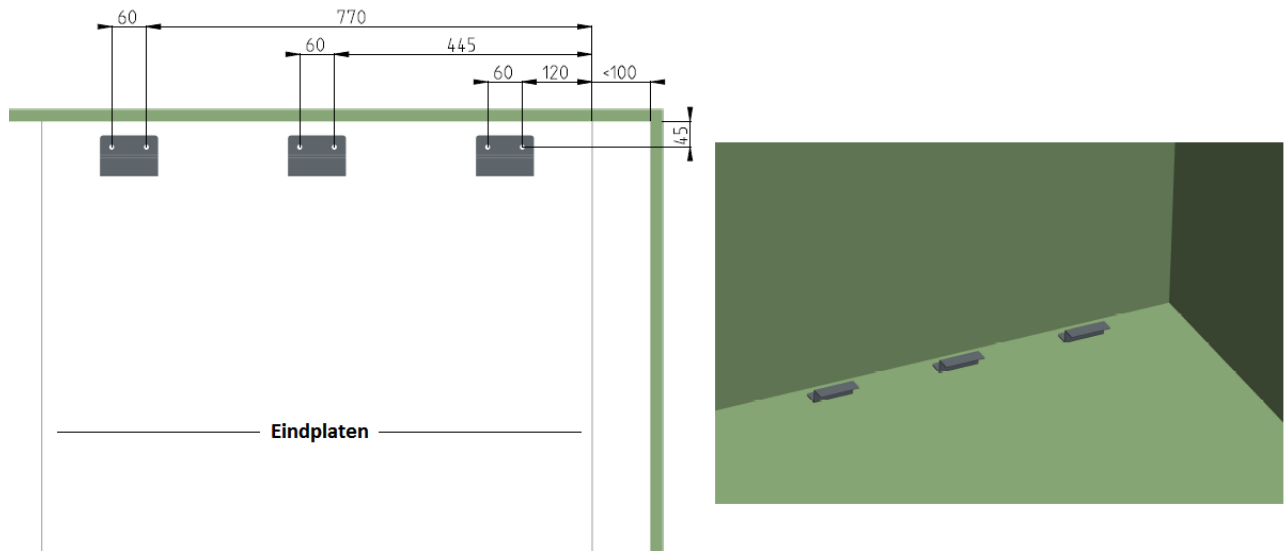


Figure 15: Positioning: Installing fixation clips

After installing the fixation clips, the DR-6C medium-voltage cubicle can be positioned in its definitive place. The rear side of the DR-6C medium-voltage cubicle is now fixed into place.

4.1.2 Anchoring front side of DR-6C medium-voltage switchgear

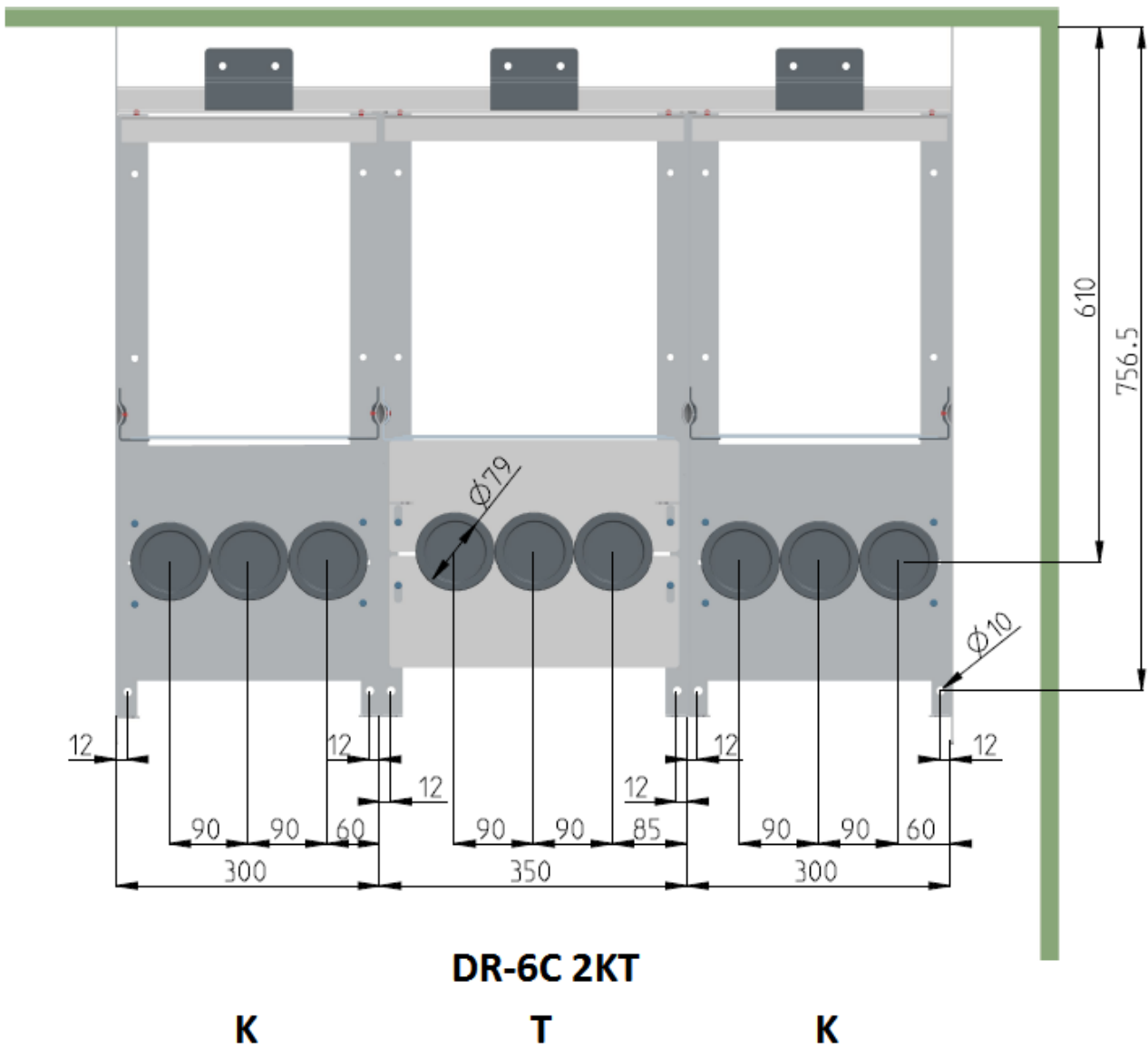


Figure 16: Positioning: Fastening DR-6C medium-voltage switchgear



Consult the installation drawing(s), the electrical schematics, and the floor plans before starting with the actual positioning of the medium-voltage switchgear.



Leave the indicated free space between the rear side of the cubicle and the wall of the installation room. This allows the overpressure system to function correctly in the event of an internal arc. A transformer cubicle can be placed with its rear side against the wall.

- Position the medium-voltage switchgear perfectly level, after fastening the fixation clips, in its definitive place in the installation room. The rear side of the DR-6C medium-voltage switchgear is now fixed into place.

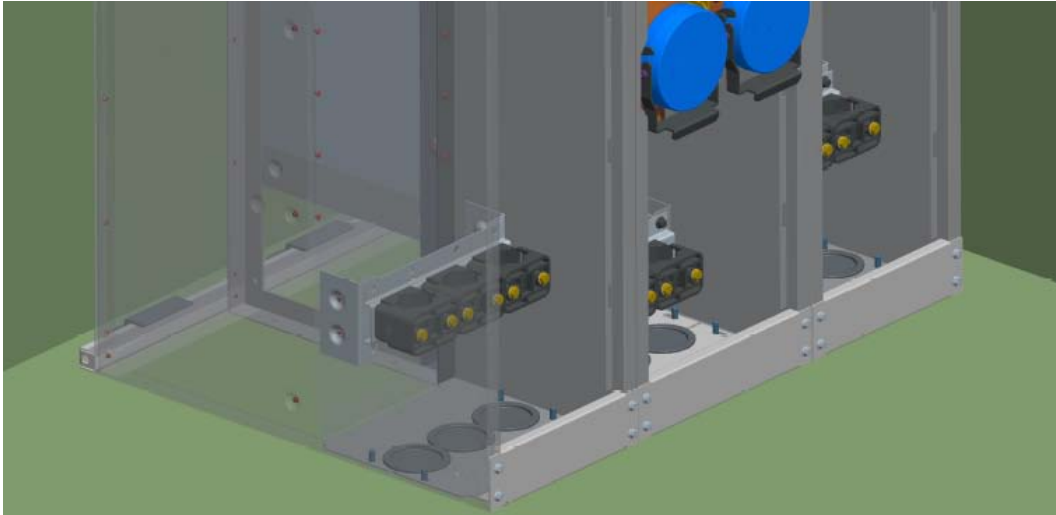


Figure 17: DR-6C medium-voltage switchgear installed in its definitive installation room

- Anchor each functional unit to the floor using two bolts (A). Use the provided openings as seen in Figure 18. If required, the anchoring can happen after disassembling the floor panels (B) and the front panel of the cable compartment (C).

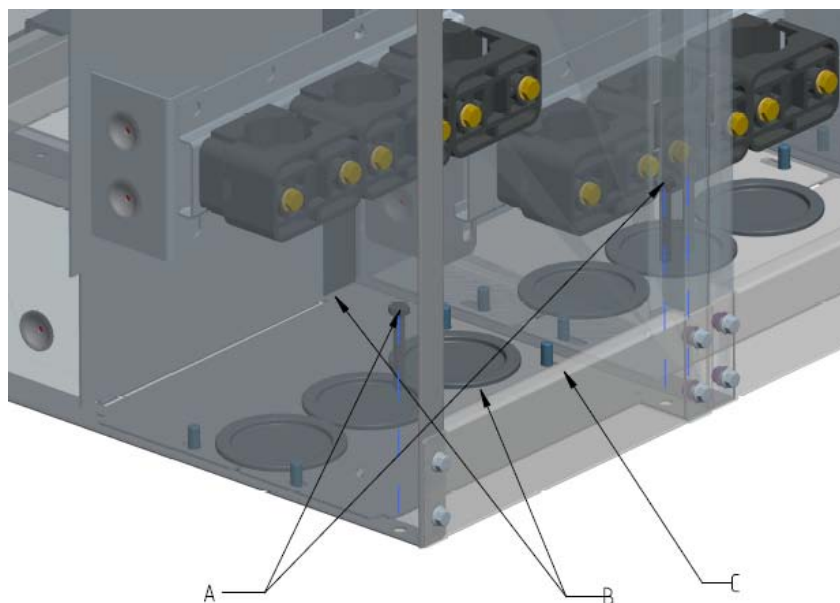


Figure 18: Positioning: Anchoring a DR-6C medium-voltage cubicle



Ensure that the cubicles remain exactly aligned and perfectly level to enable a torque-free assembly of the frame.

Optional cubicle bases are factory-included and are provided individually. Install the cubicles in the correct order according to the installation drawings and the electrical schematics.

4.2 Connecting cables, assembling floor panels

Since, during the installation of the medium-voltage switchgear, the assembly of the floor panels happens simultaneously with the connection of the cables, both activities are here described simultaneously, as well.

The following applies in all circumstances:



Connecting the cables must be performed exclusively by trained and authorized professionals in service of the power supply company, using only fixing materials provided by SGC – SwitchGear Company nv. Cables must never cross each other.

4.2.1 Preparations



Ensure that the cubicle, the next one, and the previous one are voltage-free and earthed

4.2.2 Optimal access to the cable compartment

To allow for the most comfortable way to connect the cables, the DR-6 medium-voltage cubicle is designed in such a way that the front panel of the cable compartment (C) can be disassembled easily (Figure 19). The front panel of the cable compartment (C) is fixed with four self-securing hexagonal flange bolts (A) and four self-securing flange nuts (B).

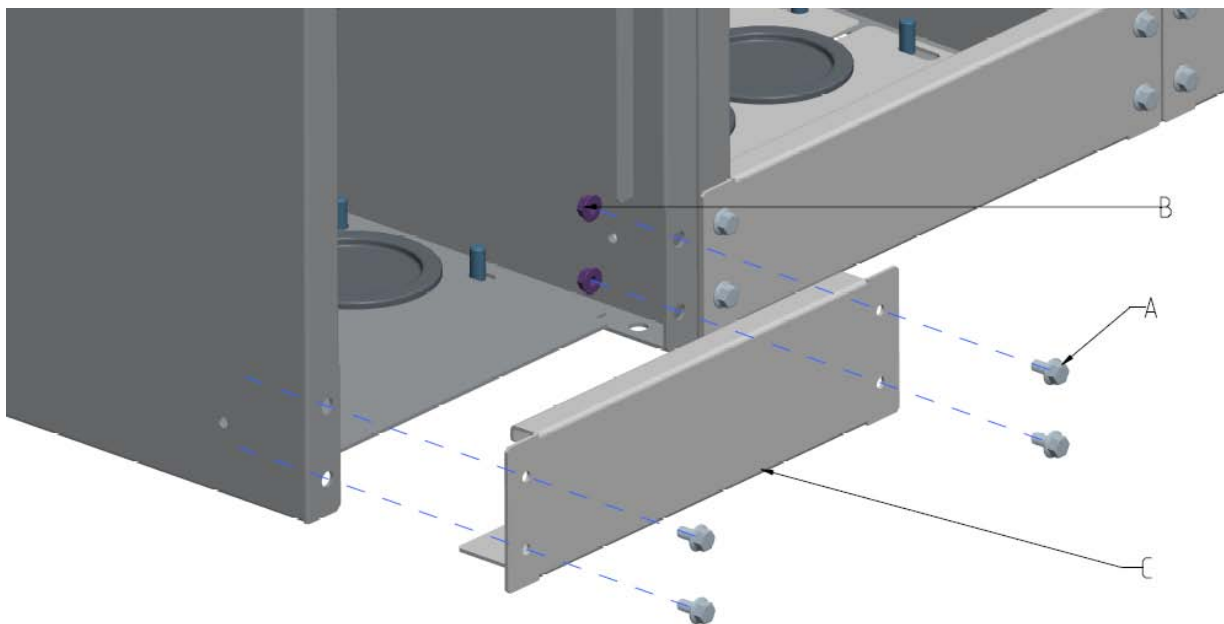


Figure 19: Disassembling the front panel of the cable compartment

After disassembling the front panel of the cable compartment, the front-most bottom panel (D) can be removed from the cable compartment, after disassembling the self-locking hexagonal flange nuts (E). Now the transit rubbers (F) can be removed from the cable compartment.

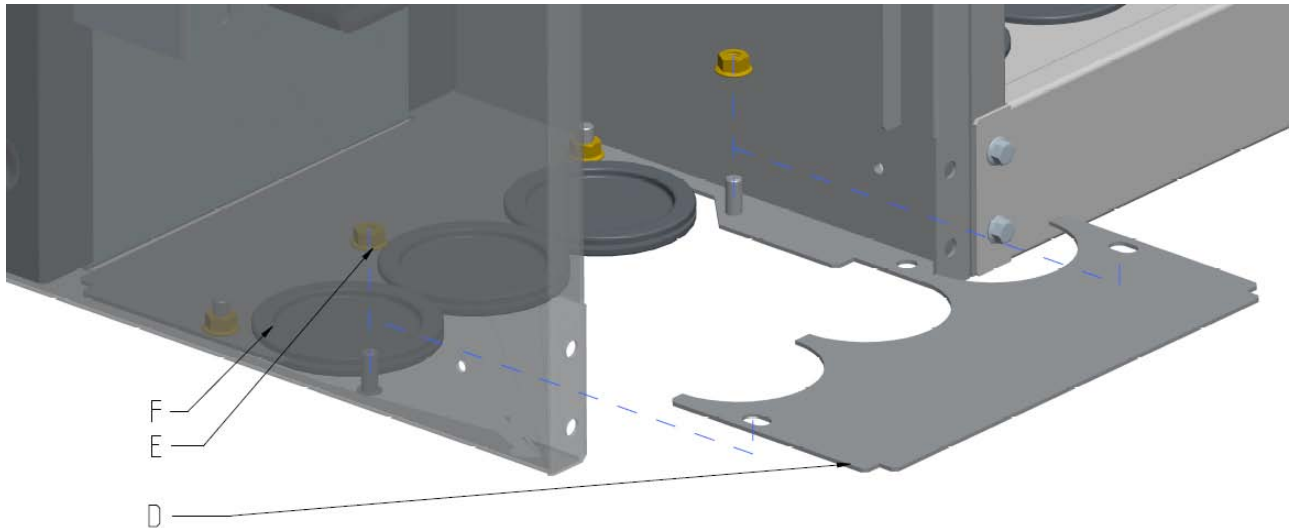


Figure 20: Disassembling the front-most bottom panel

The rear bottom panel (G) is to be installed according to Figure 21, after disassembling the two self-securing hexagonal flange nuts (H).

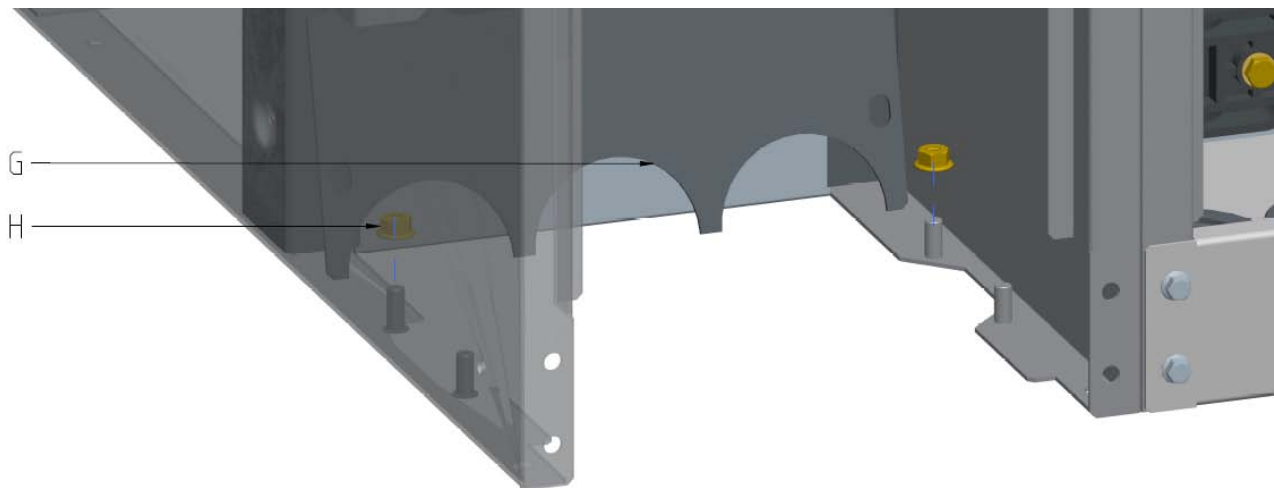


Figure 21: Disassembling the rear bottom plate

4.2.3 Assembly guidelines for cable connection

- Unscrew, for every cable support (Figure 22 B+C), the hexagonal tap bolts (Figure 22 A) to allow disassembly of the two-piece cable support.



Depending on the size of the diameter of the cable, it might be necessary to disassemble the cable support entirely (Figure 22 D.)

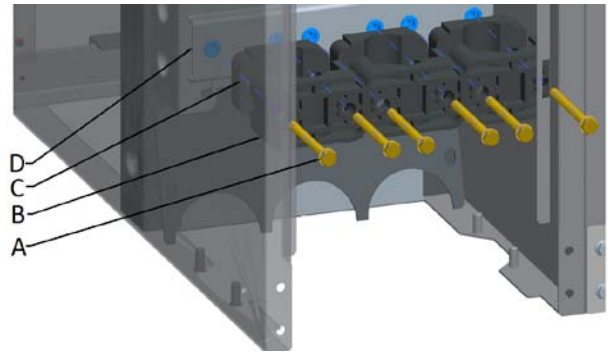


Figure 22: Assembly of the bottom panel

- Use a sharp knife to make a number of cuts in the transit rubber (Figure 23 F.)
- Slide the transit rubber over the cable socket.
- Connect the cable to the cable transit:
 - Assemble the cable connection (Figure 23 E) according to the supplier's installation instructions.



The entire cable transit / bushing needs to be carefully coated with a layer of silicone grease, which can be found in the cable connection kit.

- Slide the transit rubber (Figure 23 F) over the cable at the proper height.

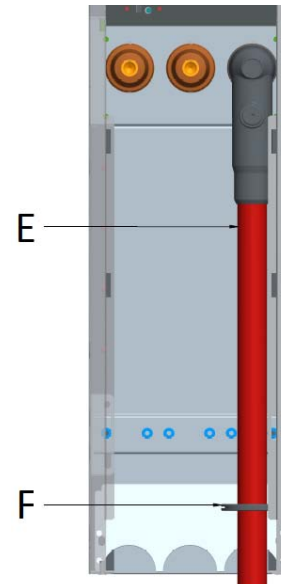


Figure 23: Assembly of the cable connection

- Place the first part of the cable clamp (Figure 24 C) between the cable (Figure 24 E) and the cable support (Figure 24 D).
- Now place the second part of the cable support (Figure 24 B) over the cable and fix the cable support by screwing in the hexagonal tap bolts (Figure 24A) on both sides.

Torque M_A equals **40Nm**.

- Continue work on the remaining two phases according to the instructions detailed above.

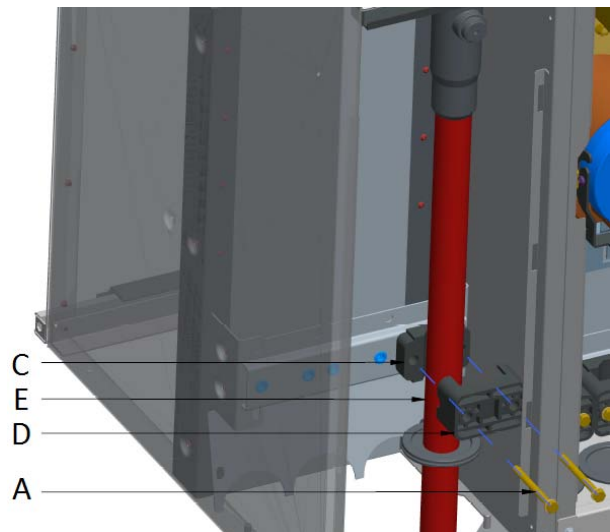


Figure 24: Assembly of the cable supports

- Connect the three earthing cables (Figure 26 G) to the cable support using two self-securing hexagonal flange bolts (Figure 26 H) and two self-securing hexagonal flange nuts (Figure 26I). Torque M_A equals **40Nm**.
- Install the bottom plate (Figure 27 J) right in the cable compartment and position the transit rubbers (Figure 27 K) in such a way that the bottom panels are fixed into place.
- Connect the front bottom panel (Figure 28 L) in such a way that the transit rubbers are fixed by both bottom panels. Screw in both bottom panels using four self-securing hexagonal flange nuts (Figure 28 M).
- Finally, the front panel (Figure 25 N) of the cable compartment needs to be put back using four self-securing hexagonal flange bolts (Figure 25 O) and two self-securing hexagonal flange nuts (Figure 25 P).

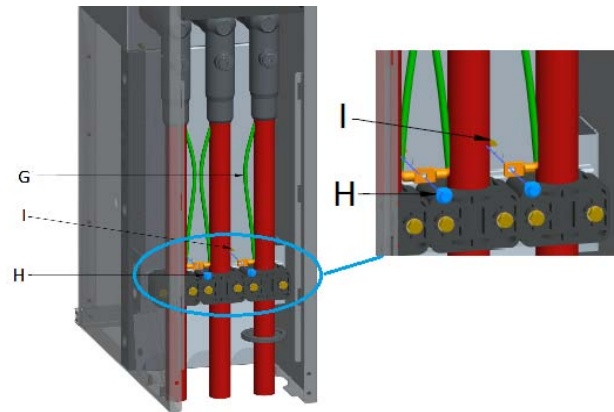


Figure 26: Assembly of the earthing cables

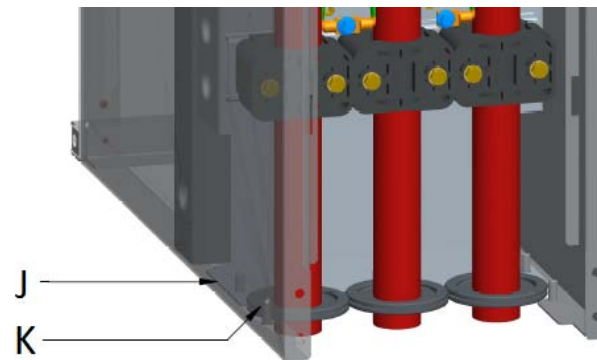


Figure 27: Positioning of the rear bottom panels

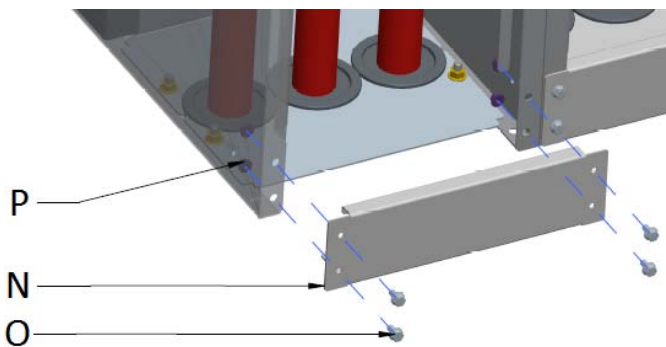


Figure 25: Assembly of the front panel of cable compartment

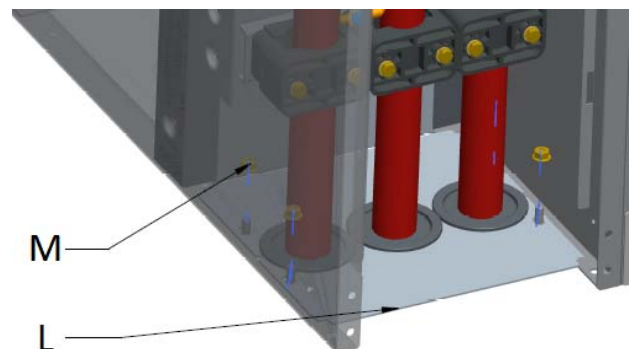


Figure 28: Putting back bottom panels

After assembly of the bottom panels (and connection of the cables), the doors can be put back onto the cubicles.



In functional units where the cable connection has not (yet) occurred, the earthing switch needs to be locked in the closed position, or the cable transits need to be equipped with a proper socket.

4.2.4 Possible cable transits

The DR-6C medium-voltage switchgear is equipped with cable transits in compliance with Cenelec EN50181 and IEC 60137 for cable connections.

- Interface C (screw connection M16x2) 400 series, $I_n = 630A$
Type K functional units default.
- Interface A with plug 200 series, $I_n = 250A$
Type K functional units default.

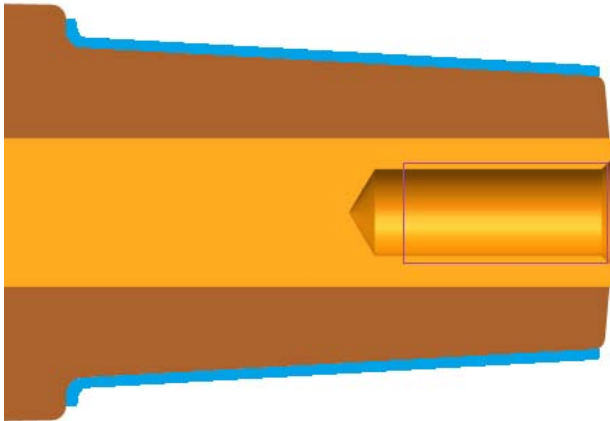


Figure 29: Cable transit type Interface C

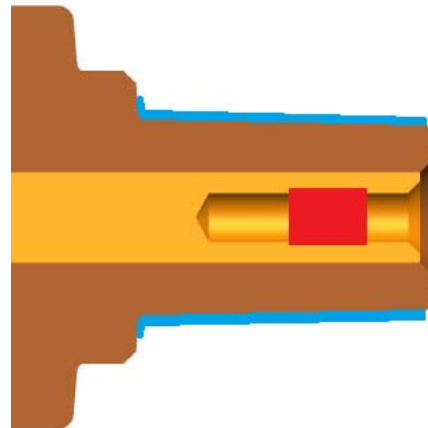


Figure 30: Cable transit type Interface A

Plug/cable supply manufacturer's installation instructions need to be followed strictly.

The following rules need to be taken into account at all times:



- **Thorough cleaning of the transit cables and cable connection**
- **The entire cable transit (bushing) needs to be carefully coated with a layer of silicon grease over the entire surface (denoted in blue). The grease is available in the cable connection kit.**
- **When connecting the cables, the prescribed torque needs to be respected.**

Examples of proper cable connections:

Manufacturer	Name of cable support	Diameter conductor [mm ²]	I_n [A]	Type of cable transit
Euromold	K400TB/G	35-300	630A	Interface C
Euromold	K158LR/G	16-70	250A	Interface A

The following manufacturers of cable connections are recommended:

- Euromold/Elastimold
- Tyco Electronics

4.3 Putting the door back in



Before placing the door back, the load break switch must be in the OPEN position and the earthing switch in the CLOSED position.

- Carefully check whether there are still tools or fixing materials in the cable compartment and remove them if necessary.
- Check all connections.
- Attach the door (B) to the cable compartment:
 - Take hold of the door with both hands using the grip (D).
 - Carefully place the door onto the support points.
 - Press the door downward.
- Lock the door using a sturdy padlock (C) and the locking clip (A).

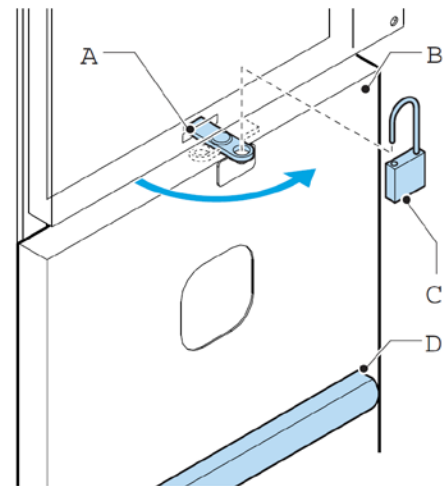


Figure 31: Placing the door back



The keys can only be stored by specially designated, authorized operators.

4.4 Measuring phases sequence



The phase sequence is frequently measured between K fields.

Using voltage indicators (A) on the front panel, the phase sequence can be measured easily.

- Measure using a voltage meter/phase sequence indicator (B) between the **corresponding** phases. A phase sequence indicator (RM086000) is optionally available.



If no voltage can be measured, the phase sequence is correct. To double check, the voltage between **different** phases can be measured. Obviously voltage does need to be measured in this case.

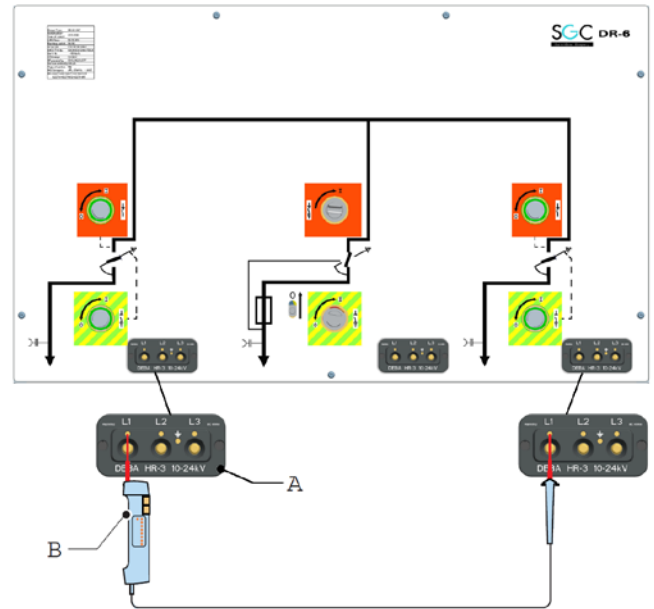


Figure 32: Measuring phase sequence

5 PUTTING INTO SERVICE

The actual connection to the distribution grid and the first putting into service of the medium voltage switchgear can only be carried out by authorized and trained personnel in service of the power supply company, and by strictly obeying the locally applicable safety guidelines.

Notes:
