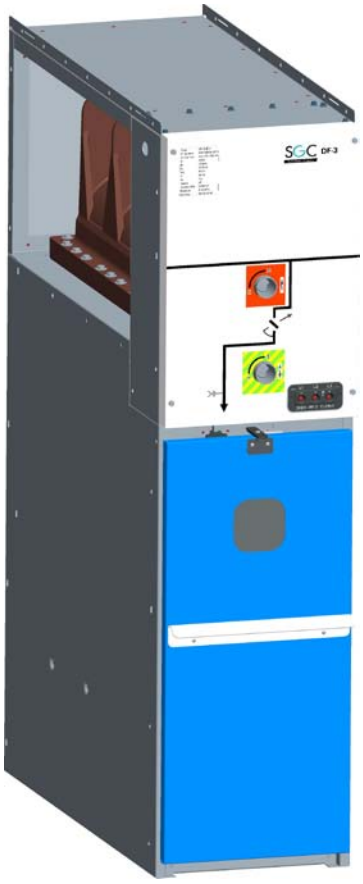
DF-2 / DF-3

MEDIUM VOLTAGE SWITCHGEAR

THE MODULAR CONCEPT



User manual:
Coupling of a DF-2 cubicle to a DF-3 cubicle

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PREFACE

This document

This document is intended as a reference with which qualified and trained operators can transport, install, use and maintain the medium voltage switchgear in a safe and economic way.

In this document the definition “medium voltage switchgear” is used to indicate a random – but occurring in practice – combination of DF-3 cubicles that, connected, from a customer-specific transformation or distribution switchgear. For details, see “General description”.

The chapters and sections are numbered. The page numbering (consisting of the chapter number and the page number) and the document code can be found at the bottom of each 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 for this is always the position of the operator, standing at the front side of the switchgear.

Pictograms and safety symbols in and on the medium voltage switchgear.

Depending on the version, the following pictogram is used on the medium voltage switchgear:

WARNING
Danger of high voltage.
Access to the particular cubicle is only allowed after the cubicle itself, the directly following and the previous cubicles are voltage free.

Pictograms in the documentation

In the user's manual of the medium voltage switchgear, the following pictograms are used:

CAUTION
Procedures that can – when not carried out with the necessary care – result in damage to the medium voltage switchgear, the surrounding area or the environment.

WARNING
Danger of high voltage

CAUTION
Entrapment danger

Notes, suggestions and advices

Make the cubicle in question, the immediately following one and the previous cubicle voltage free, before carrying out the work described.

Open the load break switch as well as the earthing switch before carrying out the work described.

Consult the indicated information source first.

Protect the medium voltage switchgear from water and damp.

Related documentation.

The following technical documentation is available for the medium voltage switchgear:

- User's manual DF-2 (AG602101)
- User's manual DF-3 (AG602101)

Service and technical support.

For information concerning specific settings, maintenance or repair work that is not mentioned here, please contact SGC Switchgear Company n.v.

- In this case, always mention the following data:
  - Cubicle type and voltage
  - Serial number of the cubicle(s)

General safety directions and instructions.

SGC Switchgear Company n.v. 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 any accompanying options.
Depending on the specific user circumstances or options fitted, extra safety instructions may be necessary. Please contact SGC Switchgear Company n.v. immediately if you encounter a potential danger when using the medium voltage switchgear.

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

User's manual

- Anyone who uses or operates the medium voltage switchgear, must known the contents of the user's manual and follow the directions contained in it very closely.
  The owner/operator must teach the users in accordance with the user's manual and obey all directions and instructions.
- Never change the order of the actions to be taken.
- Always keep the user's manual in the vicinity of the medium voltage switchgear.

Pictograms and safety symbols

Pictograms, symbols and instructions fitted to the medium voltage switchgear are a part of the safety equipment. They may not therefore be covered or removed and must be present and clearly readable throughout the entire lifetime of the medium voltage switchgear.

- Replace or repair unreadable or damaged pictograms, symbols and instructions immediately. Therefore, contact SGC Switchgear Company n.v.

Operators

The performance of the work described (transport, installation, use and maintenance) is strictly reserved for operators trained and qualified to do who are familiar with the danger that can occur when using medium voltage switchgears. Temporary staff and personnel in training may not operate the medium voltage switchgear in any way.

Technical specifications

- The technical specifications may not be changed.
- Modification of (parts of) the medium voltage switchgear is not permitted.

Transport, storage, installation, use and maintenance

- See:
  - "Safety instructions – transport"
  - "Safety instructions – storage"
  - "Safety instructions – installation"
  - "Safety instructions – use"
  - "Safety instructions – maintenance"

Intended use

The medium voltage switchgear is exclusively designed to be used as transformation or distribution switchgear, in accordance with the specifications and conditions provided by SGC Switchgear Company nv. Any other or further use is not in conformity with the purpose[1].
SGC Switchgear Company n.v. accepts no liability for any damage or injury resulting from this.

The medium voltage switchgear is in accordance with the applicable standards and guidelines. See the technical brochure (order number: DW601109 (DF-2)/ DW610111 (DF-3)).

- Only use the medium voltage switchgear in technically perfect condition, in accordance with the intended use described above.

Always keep sealed connections intact at all time. Breaking the sealed connections irrevocably voids any claims under guarantee.

[1] « intended use » as laid down 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 deducted 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's manual.

1 INSTALLATION

1.1 Safety instructions – installation

1.1.1 General

Installation of the medium voltage switchgear is restricted to qualified and trained operators with strictly observance of the locally applicable safety instructions and guidelines.
The connection and the putting into service must be done by qualified and authorized staff who are employed by the power supply company.

- Also see “General safety directions and instructions".
- Never leave tools or other material in or on top of the medium voltage switchgear.
- Install the medium voltage switchgear only in areas that are fully in compliance with the following recommendations. (according to IEC 60298)

1.1.2 Recommendations – installation area

The recommendation concerning the installation area are divided into :

- The floor surface
- The surrounding conditions
- The ventilation
- The free height of the installation area
- The dimensions of the entrance doors in the installation area
- The free passage in front of the cubicles
- The internal arc withstand.

1.1.2.1 Floor surface

The surface on which the medium voltage switchgear must be installed must be sufficiently strong and completely leveled. The maximum permissible difference in level is **2 mm/m**.

1.1.2.2 The surrounding conditions

The DF-3 cubicles have been designed for indoor installation in the following surrounding conditions:

description	value
Surrounding temperature	min. -15 °C - max. +45 °C
Relative air humidity	min. 10% - max. 70% (without condensation)
Installation altitude	max. 1.000 m above sea level

Table 1: Surrounding conditions

This means practically:

- Avoid installation in dusty areas.
- Avoid installation in areas with high relative humidity.
- Avoid installation in areas subject to lightning strikes.
- Avoid installation in surroundings where the cubicles can come into contact with aggressive gases or fluids.

Contact SGC Switchgear Company n.v. when cubicles must be installed in areas where the surrounding conditions cannot be guaranteed.

1.1.2.3 Ventilation

- Ensure that there is a good ventilation of the installation area.
- Protect the ventilation openings so that little animals or vermin do not have access to the installation area.

In particular, when the medium voltage switchgear contains one or more transformer cubicles, special attention should be given to the ventilation. Consult the following table when calculating the ventilation value. The table indicates the power of cast resin transformers.

Transformer power (in KVA)	P tot (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 power losses epoxy casted transformers

1.1.2.4 Free height of the installation area

The free height of the installation area must be at least **2.200 mm**.
Local power supply companies may, however, require more free height. Always observe these requirements. An ideal, and generally accepted, value is 2.500 mm.

With dry type transformers with a capacity of ≥ 1.250 KVA the free height must be at least **2.500 mm**.

1.1.2.5 The sizes of the entrance doors of the installation area

The dimensions given apply for all doors accessing the installation area. These minimum door sizes therefore also apply when the installation area is not directly accessible from the outside.

description	value
Height of the entrance door	min. 2.200 mm
Width of the entrance door	min. 100 mm + width of the widest cubicle

Table 3: Dimensions of the entrance doors

If the medium voltage switchgear does not contain transformer cubicle(s), a minimum door height of **2,000 mm** will be sufficient. If a transformer cubicle is included, refer to the transformer dimensions. For the correct dimensions of the various cubicles, see “Dimensions and weights".

If the medium voltage switchgear must be installed in basements or storage basements, an entrance hatch must be supplied whose length as well as width is at least 400 mm larger than the dimensions of the largest cubicle of the transformer.

1.1.2.6 Free passage in front of the cubicles

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

If the medium voltage switchgear does not contain transformer cubicle(s), the minimum free passage is **800 mm**. With medium voltage switchgears with a transformer cubicle with a power ≥ 1.000 KVA the free passage must a minimum of **2.000 mm**.

1.1.2.7 Internal arc protection

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

- Between the rear of the cubicle and the wall of the installation area a free space of 150 mm is required, as shown in Figure 1. This implantation is in accordance with an installation in which the side plates of the cubicles are joining the rear wall of the installation area. As such the free space behind the cubicles is totally closed. By this, the overpressure system of the rear plates will be able to move freely in the event of an eventual internal arc.

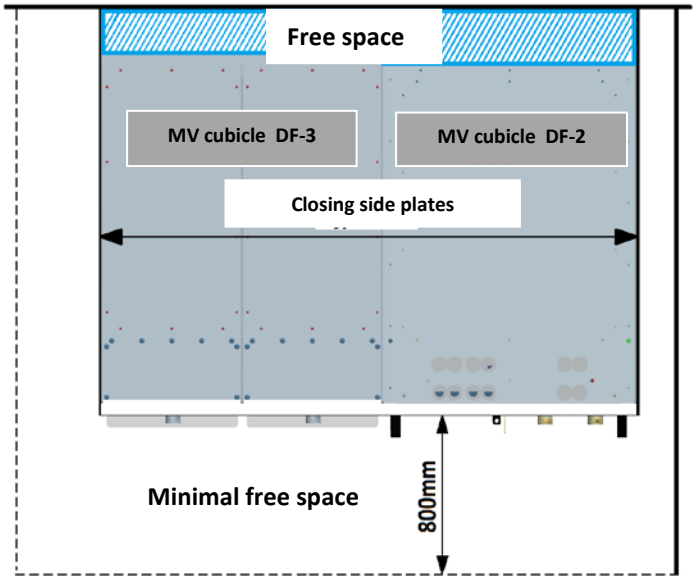


Figure 1: Top view of installed cubicles

A transformer cubicle can always be positioned wit hits rear side against the wall.

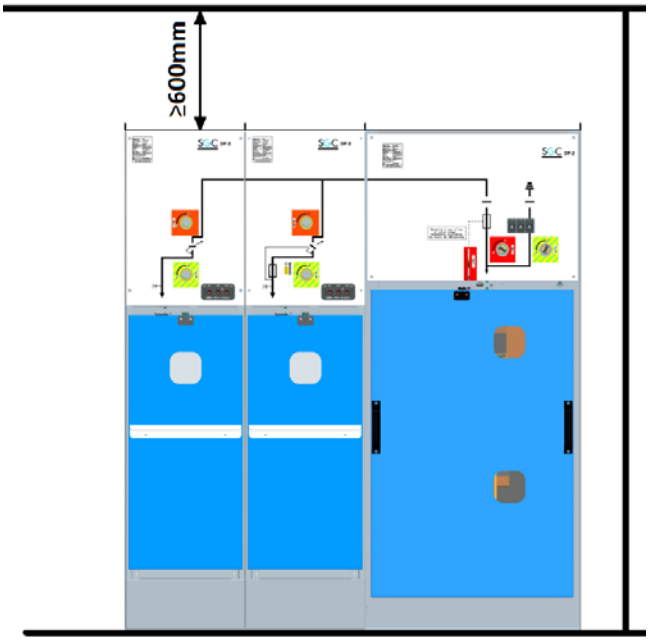


Figure 2: Minimal free height

- Anchor each cubicle of the medium voltage switchgear using four bolts in the floor. See 2.1 Anchoring of the cubicles.
- Connect the cubicles together using the fixing material supplied. See 2.2 Coupling of the cubicles.

In a medium voltage switchgear installed in accordance with the above-described installation procedure, the internal arc will always be restricted to the compartment in which it occurred.

2 ERECTION

2.1 Anchoring of the cubicles

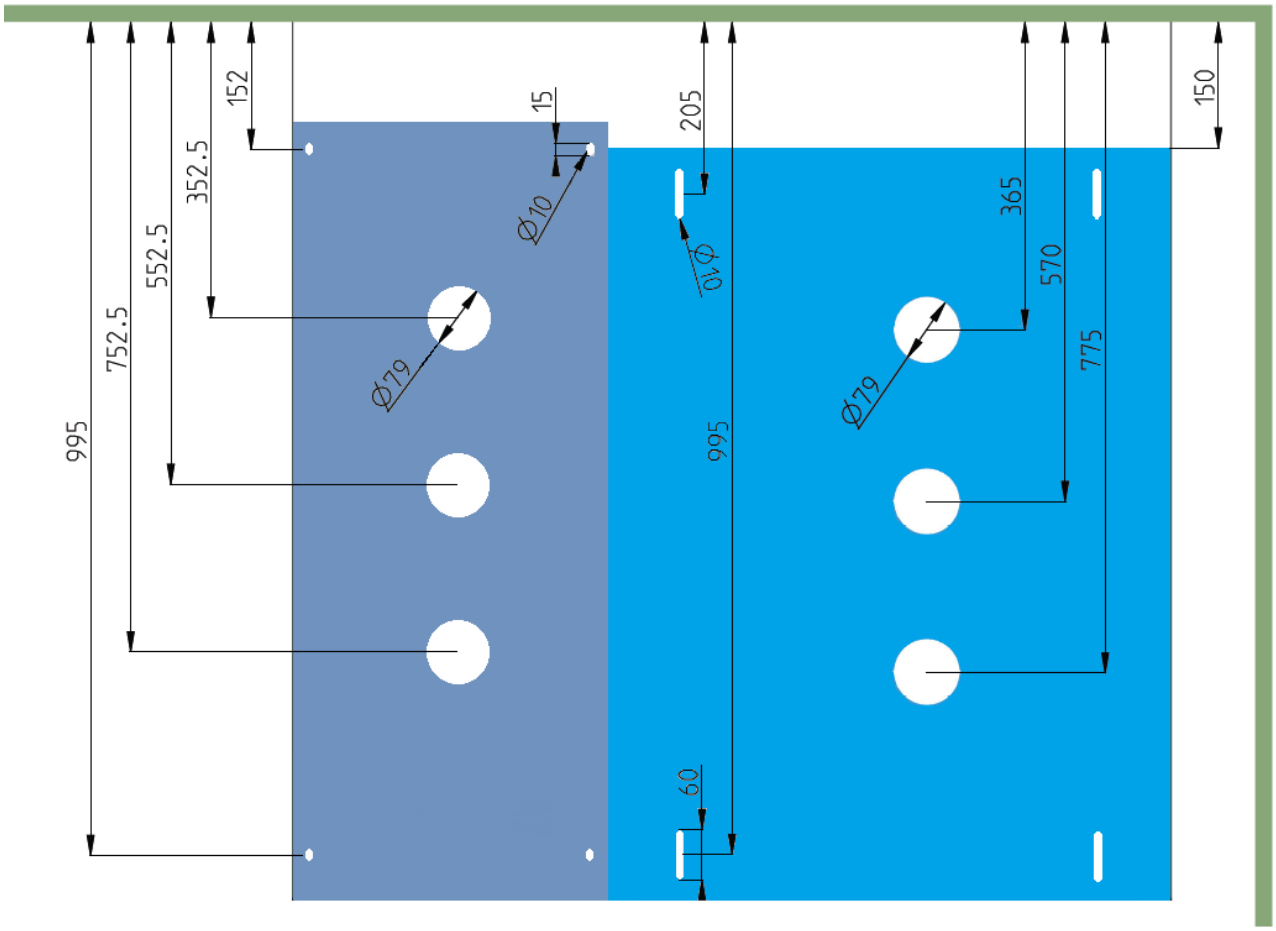


Figure 3: Erection: Coupling a DF-3 to a DF-2 cubicle

Consult the installation diagram, the electrical diagram and the ground plans before starting the actual installation of the medium voltage switchgear.
For the horizontal dimensions of the different types of cubicles, refer to the general user's manual of the concerned cubicle, as these are dependant of the cubicle type.

Leave the indicated distance free between the rear wall of the cubicle and the wall of the installation area. In this way the overpressure valves of the back plate can operate freely in case on an internal arc. A transformer cubicle can be positioned wit hits rear side against the wall.

- Place the first cubicle level in its definitive position in the installation area.
- Anchor this first cubicle using the 4 bolts to the floor. Use therefore the holes intended for this purpose, as shown in Figure 4.

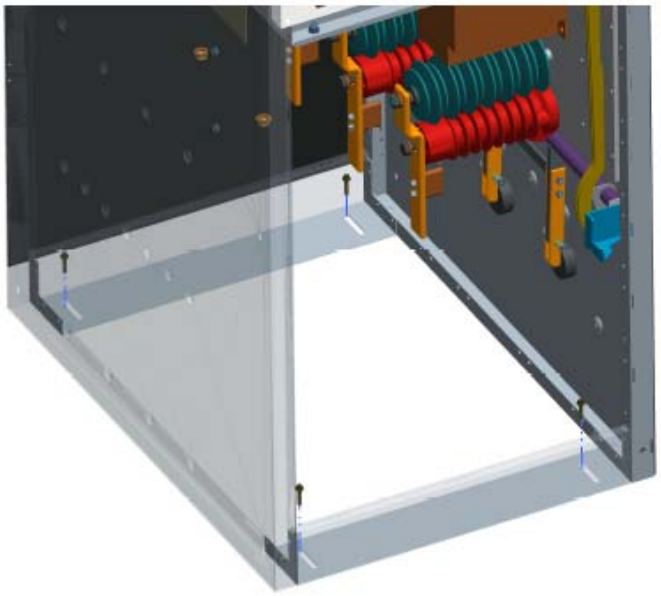


Figure 4: Erection: Anchoring of a DF-2 cubicle

- Disassemble the front panel (Figure 5):
  Loose the 4 hexagonal tap bolts (C).
  Remove the 4 washers (B)
  Remove the front panel (A).
  The driving mechanism and low voltage compartment are accessible.
- Position the second cubicle against the first one.

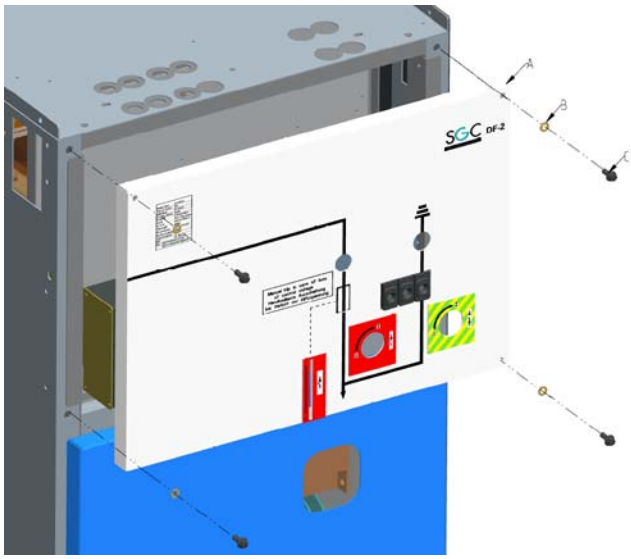


Figure 5: Disassembling of the front panel DF-2

Ensure that the cubicles are exactly in line and stay accurately level in order to enable a torsion free mounting of the housing, earthing copper connection pieces and bus bars.
Eventual plinths are provided ex factory and will be supplied separately.
Position the cubicles in the order indicated on the installation and the electrical diagram.

- Remove the front panel of the second cubicle (Figure 6):
  Loosen the 4 hexagonal tap bolts (C).
  Remove the 4 washers (B).
  Remove the front panel (A).
- The driving mechanism and low voltage compartment is accessible.

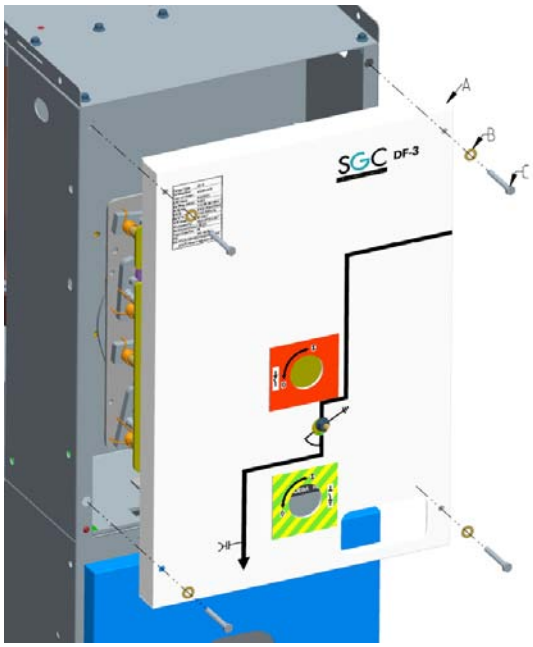


Figure 6: Disassembling of the front panel of the DF-3 cubicle

- Anchor this second cubicle using the 4 bolts to the floor. Use therefore the holes intended for this purpose, as shown in Figure 7

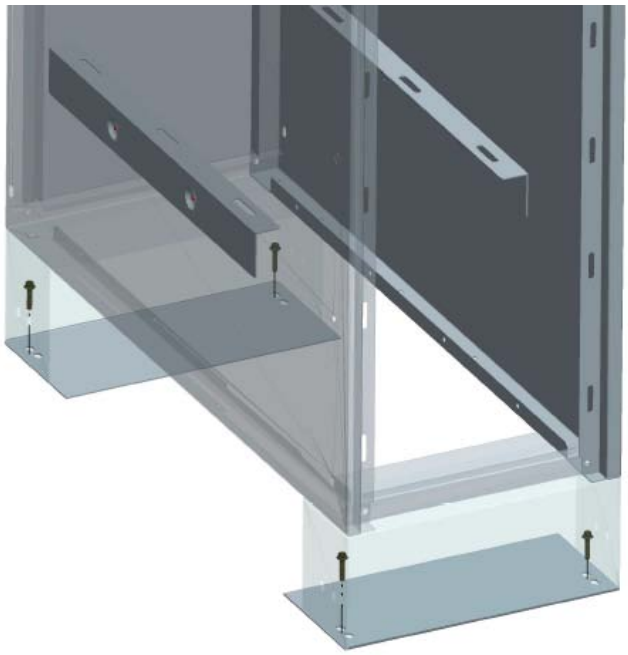


Figure 7: Erection: Anchoring of a DF-3 cubicle

- Position all other cubicles in the same way and ensure that all front panels have been removed.
- Remove the lifting eyes (if any) from the cubicles. To do so, loosen the bolts.
  The cubicles are ,now ready to be assembled. See 2.2 Cubicle assembly.

2.2 Cubicle assembly

When assembling the cubicles, the following important steps apply:

- Fixing the coupling part DF-3 / DF-2
- Coupling of the cubicles
- Assembly of the bus bar

2.2.1 Coupling of the cubicles

For the connecting of the cubicles, as special kit, per cubicle is available

2.2.1.1 Kit DD903620 (General extension kit DF-3: coupling part)

The coupling part should be fixed on the side of the DF-3 cubicle where the coupling will be done with a DF-2 cubicle. The over pleat should always be oriented to the outer side of the cubicle.

Figure 8 is illustrating a coupling to the right side of a DF-3 cubicle.

Order number	description	qty	pos.nr.
DE422809	Coupling part DF-3 / DF-2	1	A
GR040986	M8x16 RIPP self locking hexagonal tap bolt	2	B
GR041308	M8 RIPP self locking nut with collar	2	C

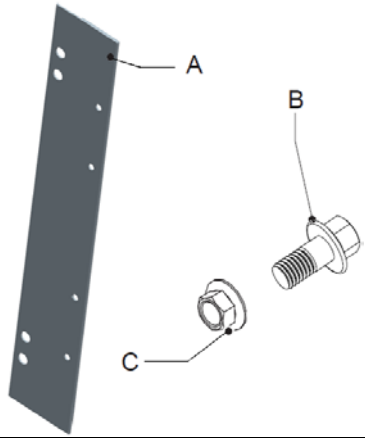


Table 4: Content of the kit DD903620

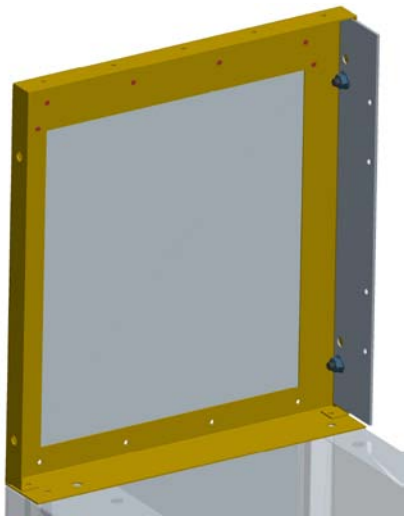


Figure 8: Fixing of the extension kit to the right side of a DF-3 cubicle

2.2.1.2 Kit DD903621 (coupling of a DF-3 cubicle with a DF-2 cubicle)

Order number	description	qty	pos. nr
GR040977	M6x12 RIPP self locking hexagonal tap bolt	2	A
GR040986	M8x16 RIPP self locking hexagonal tap bolt	11	B
GR040855	DIN 933 M8x55 hexagonal tap bolt	1	C
GR041306	M6 RIPP self locking hexagonal nut with collar	2	D
GR041608	DIN 6798A M8 lock washer	1	E
GR041308	M8 RIPP self locking nut with collar	12	F

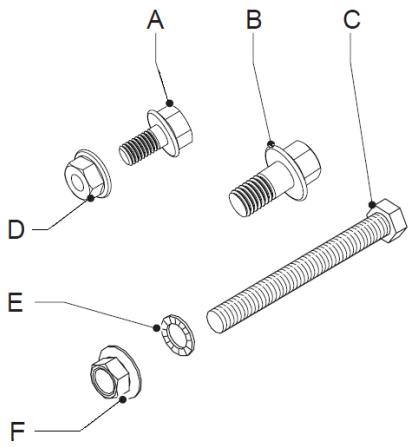


Table 5: Content of kit DD903621

2.2.1.2.1 Preparation

Ensure that the cubicle itself, the immediately following and the previous cubicle are voltage free and earthed.

Ensure that the surface is even and flat, so that the cubicles stay exactly in line and level. Only than, a torsion free fitting is possible.

2.2.1.2.2 Assembly procedure

The letters referring to the bolts and nuts, …… are in accordance with Table 5.

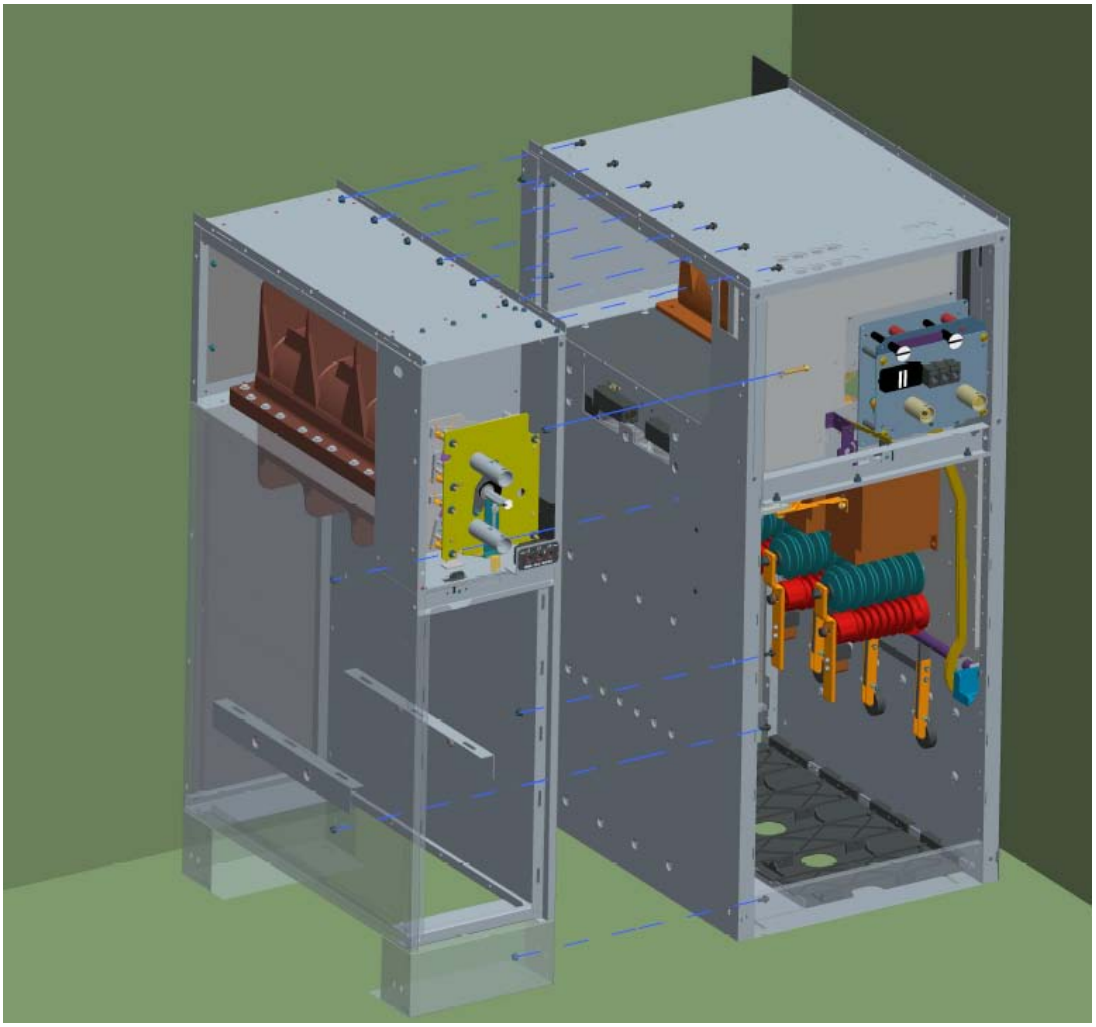


Figure 9: Coupling DF-3 and DF-2: General overview

- At the height of the bus bar compartment, the cubicles have to be connected by means of two M6x12 RIPP self locking hexagonal tap bolts (A) and two M6 RIPP self locking hexagonal nuts with collar (D). The torque M_A must be equal to 19Nm
- In the mechanical drive and low voltage compartment, the cubicles have to be connected by means of one DIN 933 M8x55 hexagonal tap bolt (C), one DIN 6798A M8 flat lock washer (E) and one M8 RIPP self locking hexagonal nut with collar (F). The torque M_A must be equal to 42 Nm.
- With four M8x16 RIPP self locking hexagonal tap bolts (B) and four M8 RIPP self locking hexagonal nuts with collar (F), the cubicles are connected in the cable compartment. The torque M_A must be equal to 42 Nm
- Before to connect the cubicles on the height of the roof panels with help of seven M8x16 RIPP self locking hexagonal tap bolts (B) and seven M8 RIPP self locking hexagonal nuts with collar (F) and fix them with a torque M_A equal to 42 Nm, the bus bars should be installed.

2.2.1.2.2.1 Coupling of the bus bar compartment

Fixing on 2 positions, see Figure 10.

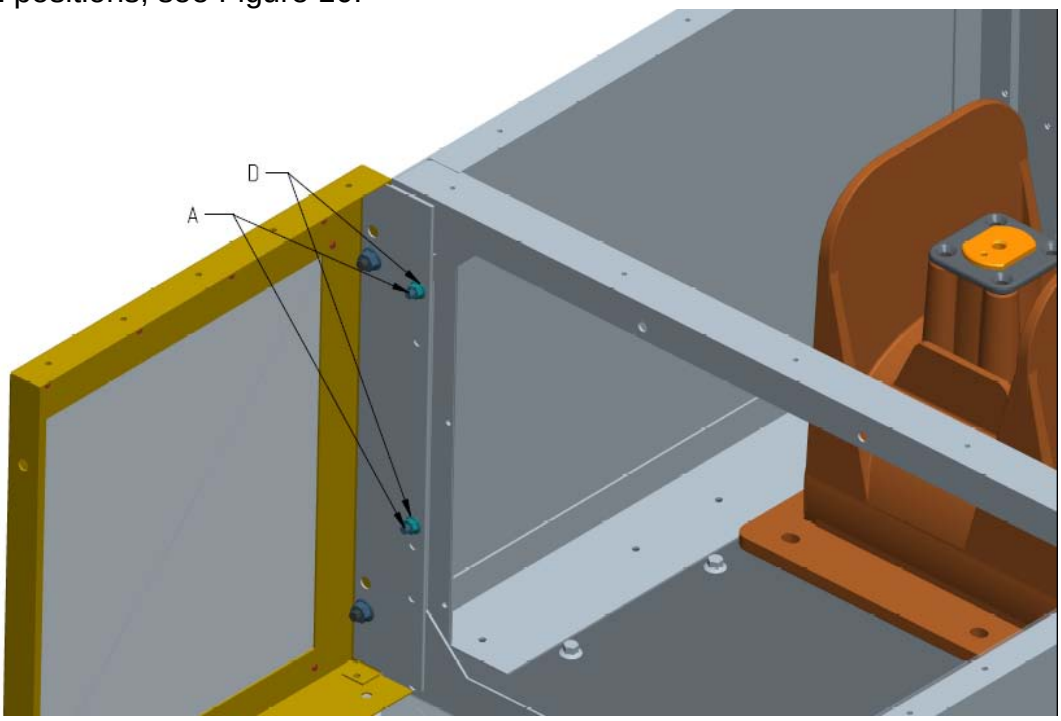


Figure 10: Coupling of a DF-3 to a DF-2: Bus bar compartment

2.2.1.2.2.2 Coupling of the low voltage compartment

Fixing on 2 positions, see Figure 11.

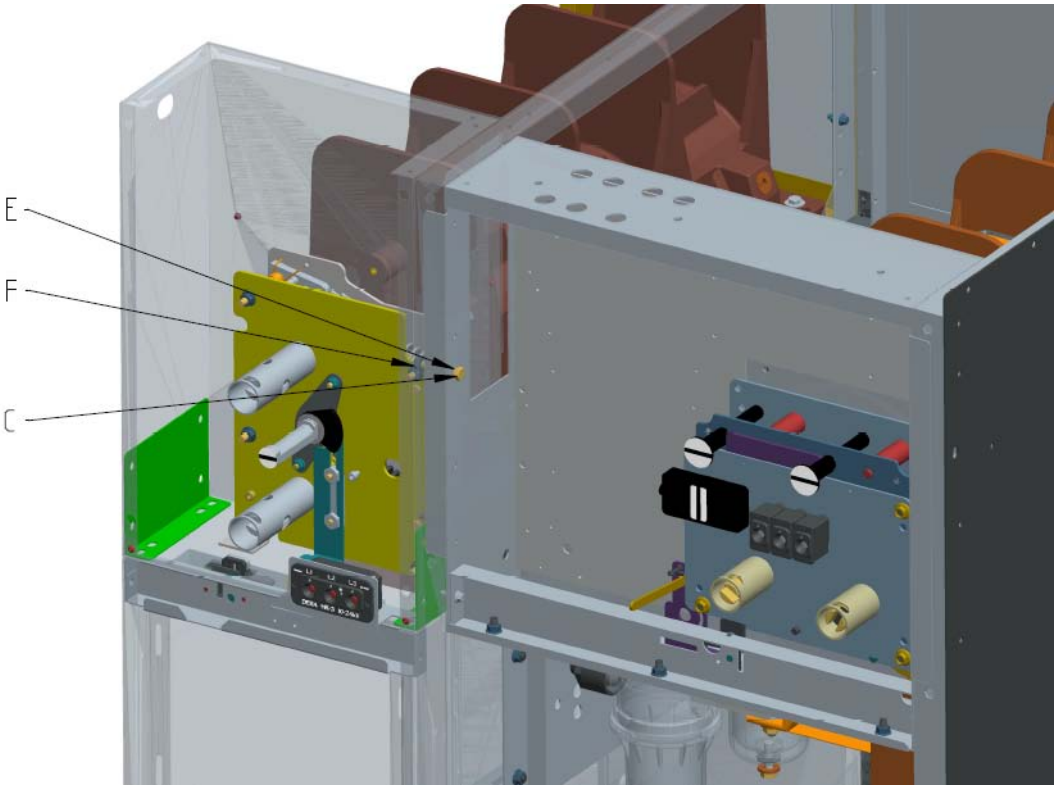


Figure 11: Coupling of a DF-3 to a DF-2: Low voltage compartment

2.2.1.2.2.3 Coupling of the cable compartment

Fixing on 4 positions, see Figure 12.

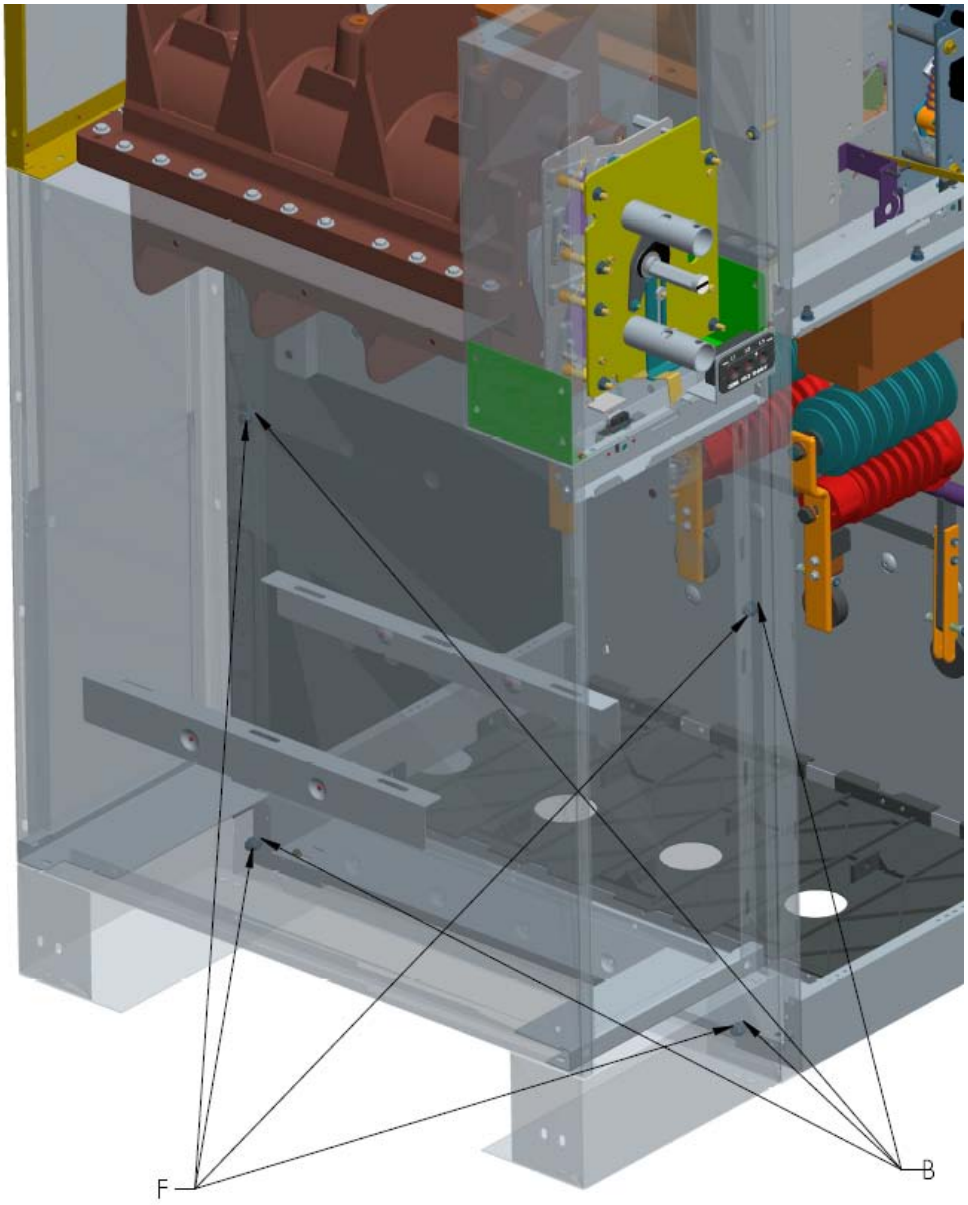


Figure 12: Coupling of a DF-3 to a DF-2: Cable compartment

The coupling of the cubicles on the height of the roof panels should be done after de fixing of the bus bars, see 2.3 Fitting of the bus bars

2.3 Fitting of the bus bars

If there is sufficient room at the sides of the cubicles, the bus bars can be fitted through the opening in the side walls. If there is insufficient room the roof panel must be removed from the relevant cubicles,

The method of assembly of the bus bars depends on the number of cubicles that must be connected together.

In all cases, the bus bars must always be assembled so that they are **torsion free**. Sideways tensional forces on the drill holes in the bars, or those of the load break switch as a result of incorrectly assembled cubicles are completely unacceptable.

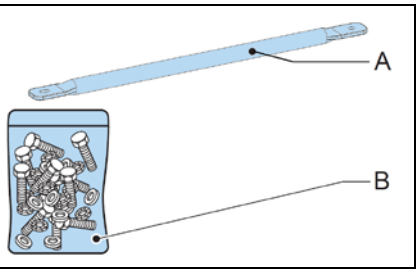
2.3.1 Medium voltage switchgear 630 A – available kits for bus bars

The content of the mounting kits for bus bars may vary, depending on factors such as the current of the medium voltage switchgear and the number of cubicles that must be connected using the bus bars.
Each mounting kits is delivered separatly and solidly packed.

The hexagonal tap bolts used for the coupling of the bus bars have to be fixed with a **torque of 35 Nm**.

2.3.1.1 Kit DD903630 (DF-3 A/P 375 to DF-DT 675)

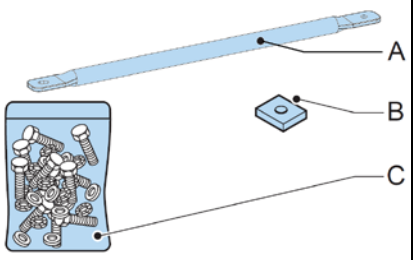
KIT COMPOSITION			
Order number	**Description**	**Qty**	**pos.nr**
CU127354	Bus bar DF-3 DF-DT-675 L=597 12 kV	3	A
GR017806	Set of fixing material DF-3	1	C



For the mounting of the bus bar see “Mounting prescription bus bar” of the concerned cubicle.

2.3.1.2 Kit DD903631 (DF-3 A/P 375 to DF-DT 675)

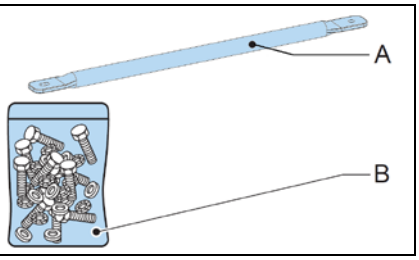
KIT COMPOSITION			
Order number	**Description**	**Qty**	**pos.nr**
CU127354	Bus bar DF-3 DF-DT-675 L=597 12 kV	3	A
CU127351	Closing piece bus bar, DF-3	3	B
GR017806	Set fixing material DF-3	2	C



For the mounting of the bus bar see “Mounting prescription bus bar” of the concerned cubicle.

2.3.1.3 Kit DD905630 (DF-3 A/P 500 to DF-DT 675)

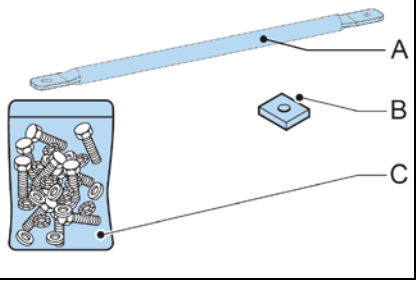
KIT COMPOSITION			
Order number	**Description**	**Qty**	**pos.nr**
CU127355	Bus bar DF-3 DF-DT-675 L=597 12 kV	3	A
GR017806	Set fixing material DF-3	1	C



For the mounting of the bus bar see “Mounting prescription bus bar” of the concerned cubicle.

2.3.1.4 Kit DD905631 (DF-3 A/P 500 to DF-DT 675)

KIT COMPOSITION			
Order number	**Description**	**Qty**	**pos.nr**
CU127356	Bus bar DF-3 DF-DT-675 L=597 12 kV	3	A
CU127351	Closing piece bus bar, DF-3	3	B
GR017806	Set fixing material DF-3	2	C



For the mounting of the bus bar see “Mounting prescription bus bar” of the concerned cubicle.

3 PUTTING INTO SERVICE

The final connection to the distribution network and the first putting into service of the medium voltage switchgear is restricted to qualified and trained personnel employed by power distribution company, observing the locally applicable safety instructions and guidelines.

Notes: