



DW-2

AIR-INSULATED METAL-CLAD, ARC PROOF

MEDIUM-VOLTAGE SWITCHGEAR



Technical Manual




MEDIUM VOLTAGE SWITCHGEAR, BUILT TO LAST

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This Technical Manual contains information necessary for the installation, commissioning and operation of DW-2. It is mandatory to adhere to the instructions and the relevant regulations for the proper use of this switchgear. The Technical Manual must be read carefully before any work on the panel commences.

Safety first

- Check whether the installation position (distances, spatial separation, and the surroundings) is suitable for the switching devices.
- Installation, operation and maintenance shall only be carried out by trained and experienced personnel who are familiar with the equipment and the electrical safety requirements.
- During installation, commissioning, operation and maintenance of the equipment the relevant legal regulations (such as DIN/VDE/IEC), accident prevention regulations and the relevant conditions of the electric utilities shall be relevant followed.
- Take note that during operation of the switchgear certain parts are subject to dangerous voltages. Mechanical parts, also remote-controlled, can move quickly. Failure to comply may result in death, severe personal injury or damage to equipment.
- Pay attention to the hazard statements located throughout this manual. 
- The operating conditions of the switchgear shall comply with the technical data specified in this manual.
- Personnel installing, operating and maintaining the equipment shall be familiar with this manual and its contents.

For special configurations please contact SGC - SwitchGear Company

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INTRODUCTION

Applicability

This Technical Manual applies to a range of air-insulated medium voltage switchgear DW-2 for indoor installations manufactured by SGC - SwitchGear Company.

The following products are covered by this manual: DW-2 range 630...1250A

Note:

Every care has been taken in the preparation of this manual. However, please note that not all the details or variations in the described equipment or represented procedures have been covered in this manual. Neither is it expected to address all contingencies connected with the installation and operation of this equipment. For any further information please contact your nearest SGC - SwitchGear Company office or Distributor.

Hazard statements

This manual contains three types of hazard statements, as follows:



DANGER

Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.



WARNING

Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.



CAUTION

Indicates a potentially hazardous situation that, if not avoided, could result in personal injury or equipment damage.

Safety instructions

General hazard statements applying to this equipment are described in this section. Statements relating to specific tasks or procedures are located throughout this manual.



DANGER

Contact with hazardous voltage will cause death or severe personal injury.



WARNING

This equipment is not intended to protect human life. Follow all locally approved safety procedures when installing or operating this equipment. Failure to comply may result in death or severe personal injury.



WARNING

Before working with equipment described in this manual carefully, read and understand the contents of this manual. Improper handling, installation, operation or maintenance can result in death, severe personal injury or damage to equipment.



WARNING

Power distribution equipment must be properly selected for the intended operation. It must be installed, used and understand all relevant safety procedures. Failure to comply can result in death, personal injury or equipment damage.

Abbreviations and definitions

BR	Bus-riser cabinet
BT	Bus-tie feeder
CM	Control module
CT	Current transformer
DIF	Direct incoming/outgoing feeder
DIS	Disconnect
DOU	Draw-out unit
ES	Earthing switch
FC	Fuse contactor
HD ISM	High duty ISM
IAC	International arc classification
IEC	International Electrotechnical Commission
IF/OF	Incoming/outgoing feeder
IP	International protection
ISM	Indoor switching module
ISMD	Withdrawable unit with vacuum circuit breaker
LD ISM	Low duty ISM
M	Measurement cabinet
NC	Normal closed contact
NO	Normal open contact
SA	Surge arrester
SP	Switchgear panel
SGC	SGC - SwitchGear Company (registered TM)
VCB	Vacuum circuit breaker
VS	Voltage sensor
VT	Voltage transformer
WVT	Withdrawable voltage transformer
LV compartment	Low-voltage compartment of panel
HV compartment	High-voltage compartment of panel
CB compartment	Circuit breaker compartment of panel
Zero sequence CT	Zero sequence current transformer

General

DW-2 is a family of air-insulated medium voltage switchgear solutions for indoor installations. It is designed for worldwide applications of primary power distribution and provides high operating safety.

The switchboards are fully type tested and designated for voltages up to 12kV and operating currents up to 1250A.

Standards and regulations

Standards

IEC 62271-102	High-voltage alternating current disconnectors and earthing switches
IEC 62271-200	AC metal-enclosed switchgear and controlgear for rated voltages above 1kV and up to and including 52kV
IEC 62271-105	Alternating current switch-fuse combinations
IEC 62271-1	High-voltage switchgear and controlgear

Service instructions

Standard service conditions according to IEC 62271-1:

The ambient air temperature does not exceed 40 °C and its average value, measured over a period of 24 h, does not exceed 35 °C. The minimum ambient air temperature is –5 °C. The altitude does not exceed 1 000 m.

The ambient air is not significantly polluted by dust, smoke, corrosive and/or flammable gases, vapours or salt.

The conditions of humidity are as follows:

The average value of the relative humidity, measured over a period of 24 h, does not exceed 95 %;

The average value of the relative humidity, over a period of one month, does not exceed 90 %;

For these conditions, condensation may occasionally occur. Condensation may be prevented by a special design of the building or housing, by suitable ventilation and heating of the station or by the use of dehumidifying equipment.

Special operating conditions

When special environmental conditions prevail at the location where the switchgear is to be put in service, the user must ask the manufacturer in advance. The conditions must be specified by the user in reference to IEC 60721.

Type Tests

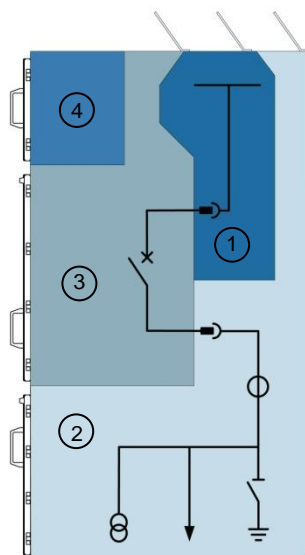
DW-2 switchgear has successfully passed all the tests required by the IEC (International Standard). As noted within the regulations of the standard, the tests were carried out on the switchgear units considered to be the most sensitive to stresses applied within the tests and therefore assigned to be valid on the whole range. The complete list of type tests is given in Table 1.

Type test		Applicable standard (sub-clause, Where applicable)	Tests station
Power frequency voltage test	42 kV, 1 min	IEC62271-200, 6.2.6.1	KEMA (the Netherlands)
Lightning and switching impulse voltage test	75 kV	IEC62271-200, 6.2.6.2	KEMA (the Netherlands)
Temperature rise test at normal working current	1250 A	IEC62271-200, 6.4; 6.5	KEMA (the Netherlands)
Short-time withstand current test, peak withstand current test	31.5kA, 4s 82 kA	IEC62271-200, 4.5; 4.6	KEMA (the Netherlands)
Short-time and peak withstand current test of earthing circuits	31.5kA, 4s 82 kA	IEC62271-200, 4.5; 4.6	KEMA (the Netherlands)
Internal arc fault test	31.5kA, 1s AFLR	IEC62271-200	FGH (Germany)
Verification of degree of protection	IP4X	IEC62271-200, 6.7.1	SGC – SwitchGear Company
Measurement of resistance of main circuits		IEC62271-200, 6.4.1	KEMA (the Netherlands)
Mechanical operation test with the removable parts		IEC62271-200, 6.102.1	KEMA (the Netherlands)
Circuit breaker type test certificate		IEC62271-100	KEMA (the Netherlands)



1 DESIGN

1.1 General arrangement



1. busbar compartment,
2. cable compartment (or bottom compartment for BT, BR panels),
3. circuit breaker compartment (for installation of ISMD, DIS or WVT),
4. low voltage compartment.

Figure 1

Busbar compartment

The busbar compartment houses the main busbar system connected to the fixed upper isolating contacts of the circuit breaker by means of branch connections. The main busbars are made of electrolytic copper. The busbar compartment of each panel is segregated from the busbar compartments of the neighbouring panels.

Cable compartment

The cable compartment houses the connection of the power cables to the busbar. On the rear side of the panel three current transformers can be installed. Additionally it is possible to mount capacitive postinsulators. There is also space on the rear side for a make-proof earth switch. On the front bottom plate three voltage transformers can be fitted. If necessary, surge arresters can also be placed in the cable compartment. The compartment is closed with a splitted metallic bottom plate.

Circuit breaker compartment

The circuit breaker compartment houses the bushing insulators containing the fixed contacts for the connection of the circuit breaker with the busbar and the cable compartment. The bushings are single-pole type and are made of cast resin. They are covered by metallic shutters. The metallic shutters operate automatically during movement of the circuit breaker from the racked-out position to the service position and vice versa. The position of the circuit breaker can be seen from the front of the panel through an inspection window. At the top of the circuit breaker compartment is a socket for the connection of the circuit breaker to the low voltage compartment.

Low voltage compartment

A space is provided in the low voltage compartment for protection and measuring instruments. Holes on each side of the panel allow a convenient panel to panel wiring

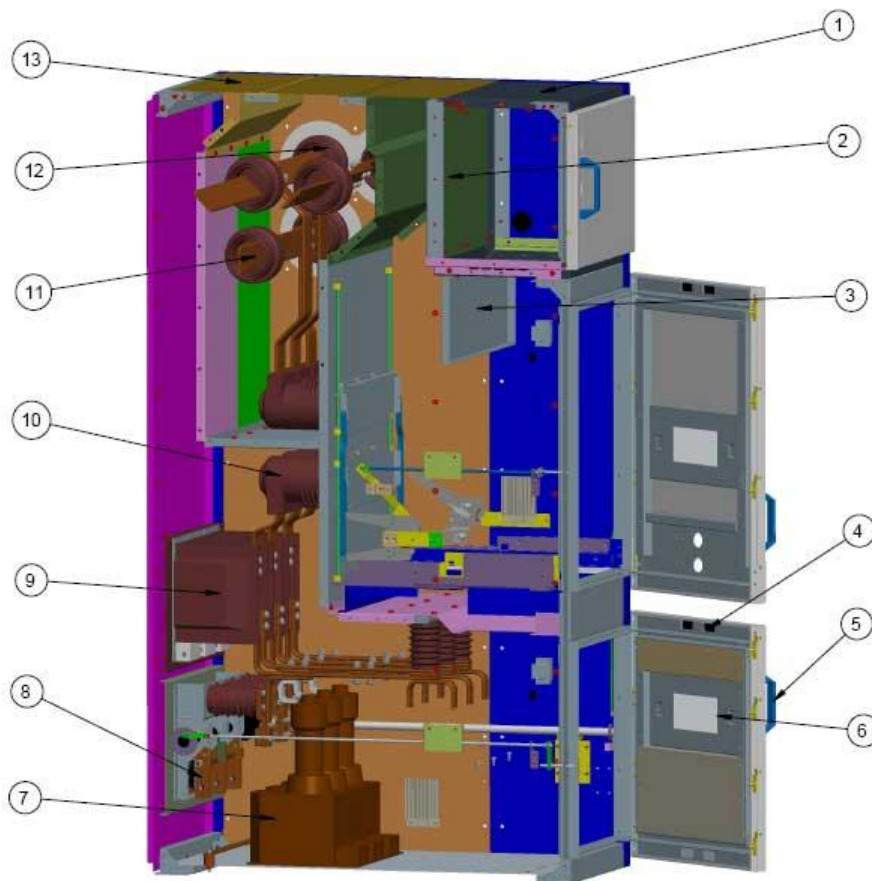
connection. The cable duct installed in the lower part of the panel provides a safe guide up to the low voltage compartment.

Availability and partition

DW-2 switchgear is designed in compliance to availability classes LSC2B and partition class PM according to IEC 62271-200. The switchgear compartments do not need any tools for opening. Interlocks allow access only when the corresponding high voltage parts are dead and earthed. Metallic shutters and partitions segregate the compartments from each other. When a compartment is opened all other panels in the installation and all cable termination compartments (including that in the panel concerned) remain in operation.

1.2 Components

The general SP view presented below is based on IF.



- | | |
|--------------------------------|-----------------------------|
| 1. Enclosure | 7. Cable compartment |
| 2. Low voltage compartment | 8. Earthing switch |
| 3. Circuit breaker compartment | 9. Current transformer |
| 4. Door lock | 10. Fixed contact insulator |
| 5. Door handle | 11. Busbar system |
| 6. Inspection window | 12. Bushing |
| | 13. Overpressure flap |

Figure 2
General view of IF

1.3 Dimensions and weight

All types of SP have the same depth, height and width. Overall dimensions are presented below.

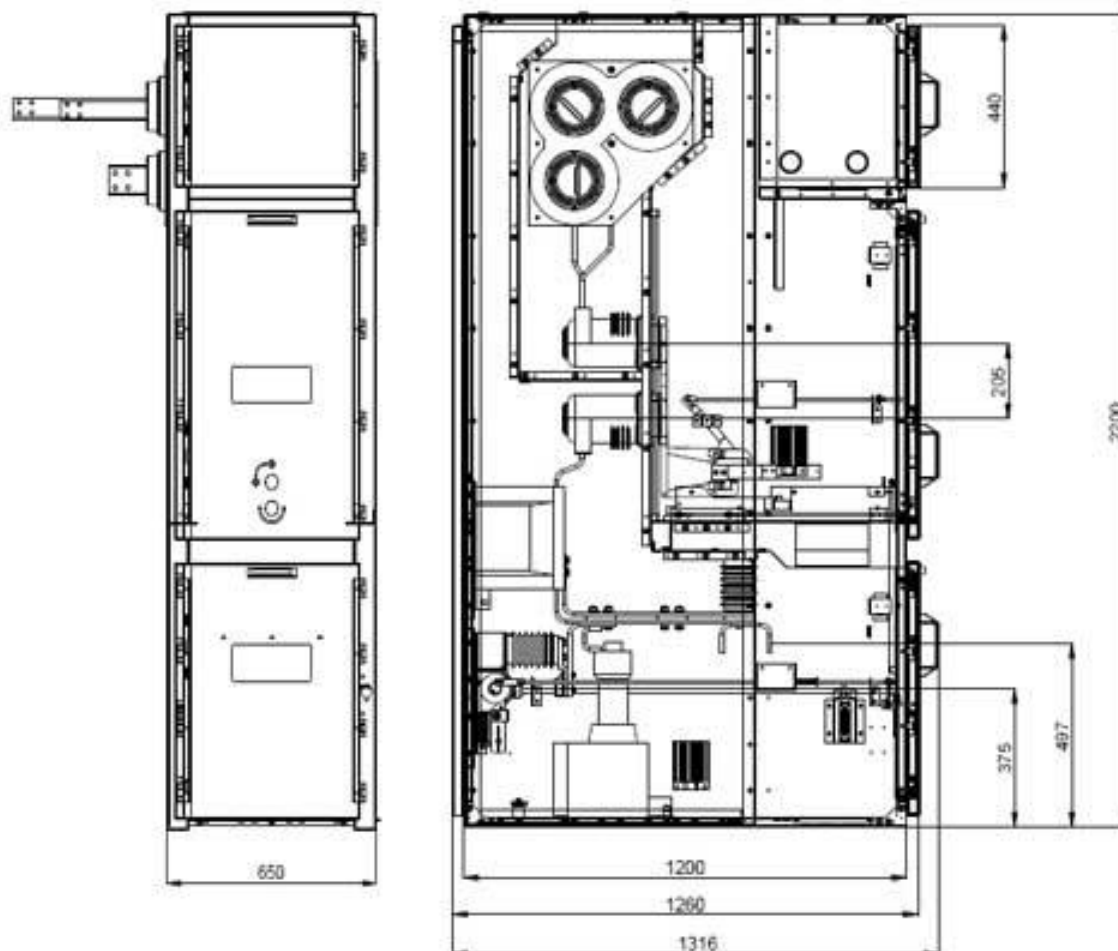


Figure 3
SP DW-2 dimensions

Table 2 SP dimensions and weight

Parameter	Value for SP framework	Total maximum value
Height, mm	2200	2260
Width, mm	650	680 (with lateral wall)
Depth, mm	1200	1316
Weight, kg	-	760 *

* Approximately, the maximum value. The weight of every particular panel depends on components installed

1.4 Typical units

1.4.1 Incoming/Outgoing Feeder

The IF/OF SP provides the basic functions, as follows:

- switching of incoming and outgoing feeders in both normal and fault modes;
- isolation and earthing of incoming and outgoing feeders.

In the Figure 5 single-line diagrams show different options regarding installed equipment. DIN size block-type CTs with up to 4 cores/phase and DIN size VTs with or without fuses can be installed. Additional devices such as zero sequence current transformers, heaters and thermostats can be installed as well.

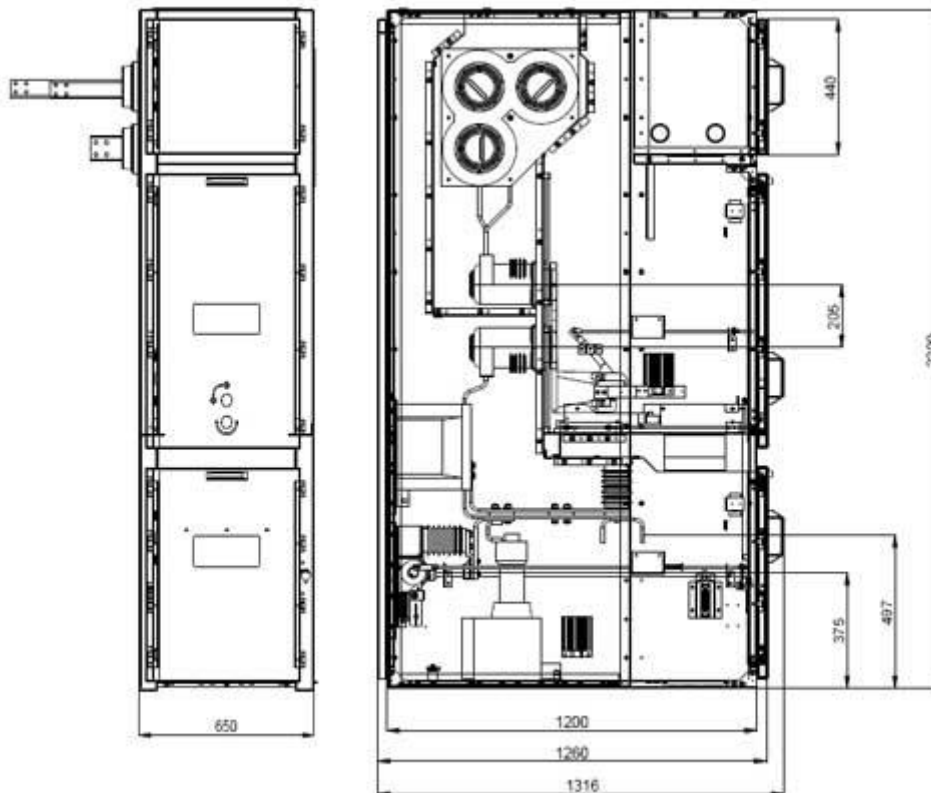


Figure 4
Dimensional drawing of IF/OF SP

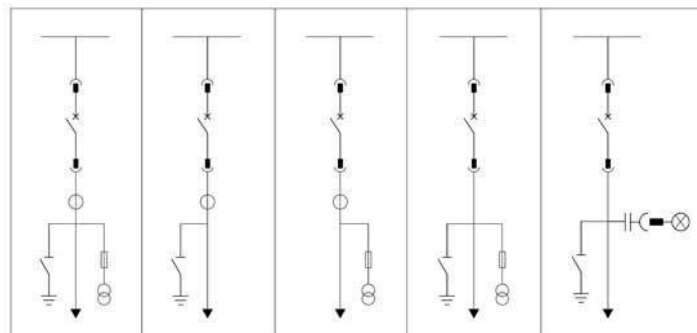


Figure 5
IF/OF SP single-line circuit diagrams

1.4.2 Bus-tie

BT SP is designed for sectionalization. An earth switch can also be installed. BT should be installed on the right from the BR.

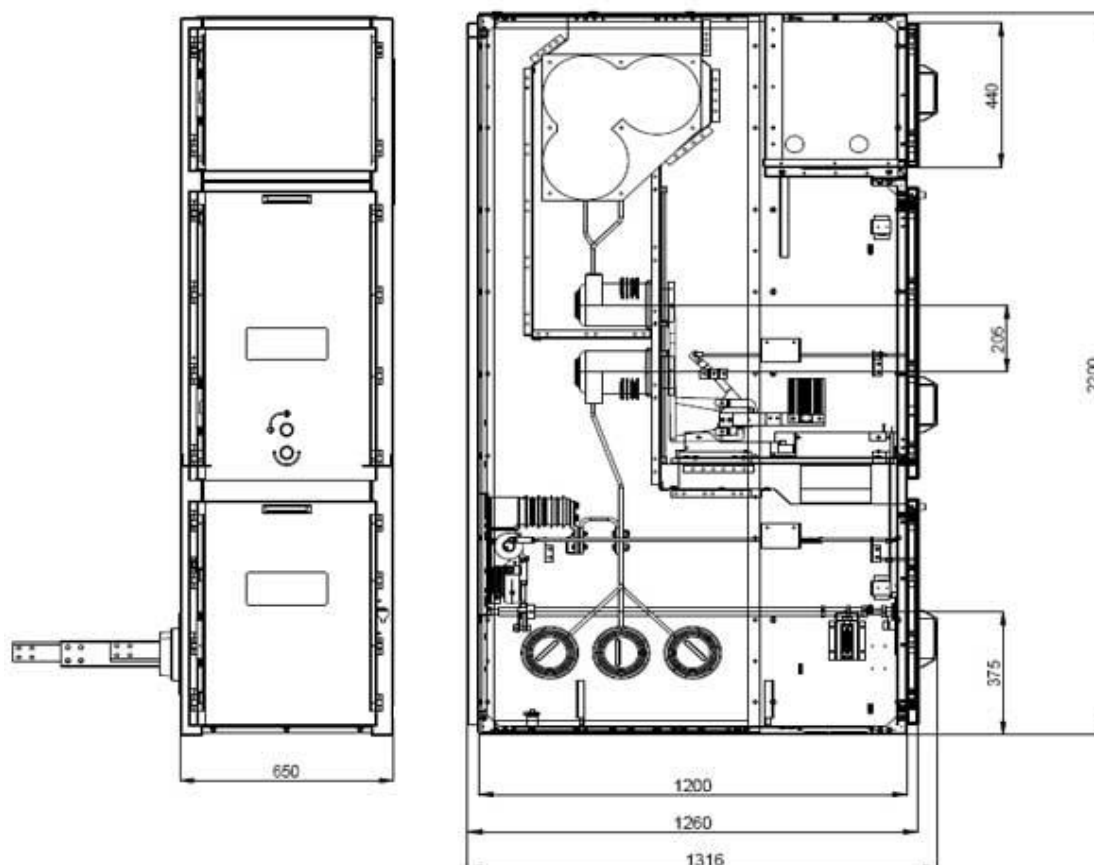


Figure 6
Dimensional drawings of BT SP

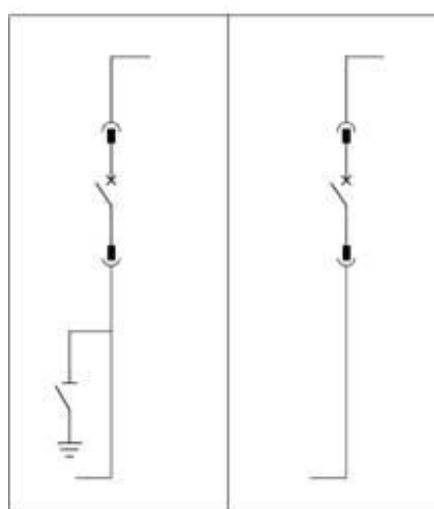


Figure 7
BT SP single-line circuit diagrams

1.4.3 Bus-riser

The BR SP is designed as the second part for sectionalization and is the neighbor of the BT. BR SP may be combined with M SP. In this case the withdrawable VT should be installed.

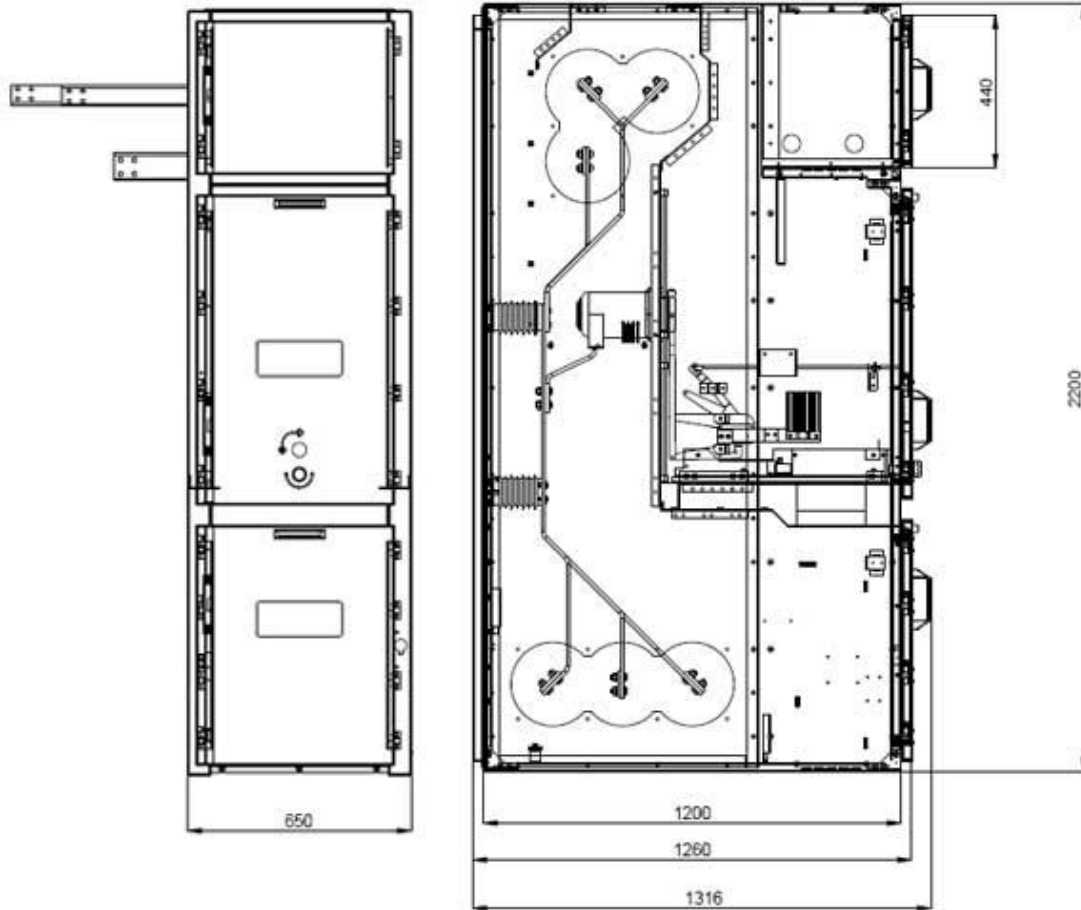


Figure 8
Dimensional drawings of BR SP

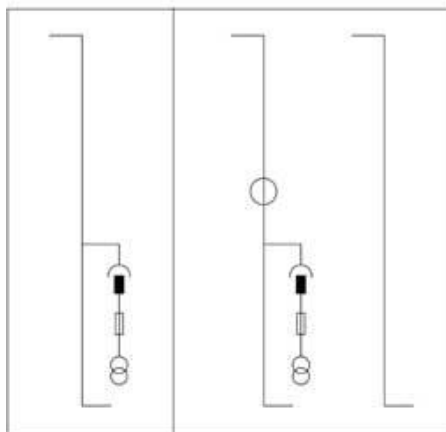


Figure 9
BR SP single-line circuit diagrams

1.4.4 Metering

The M SP provides measurements. An earth switch can also be installed.

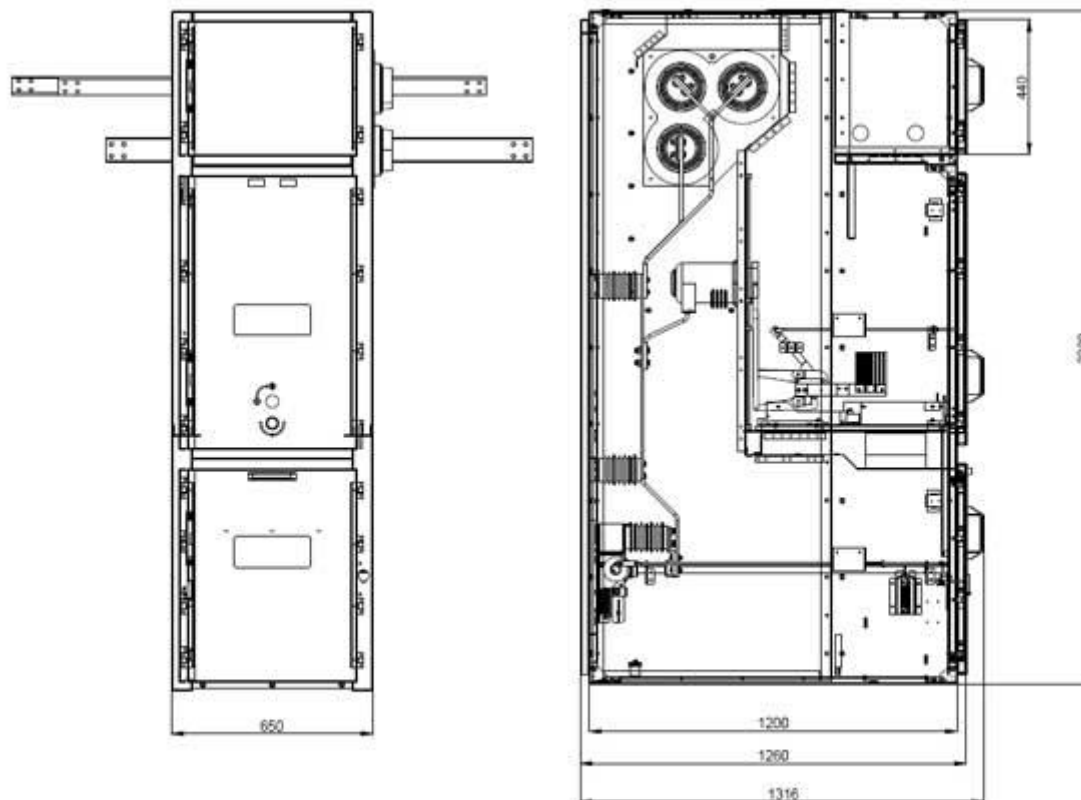


Figure 10
Dimensional drawings of M SP

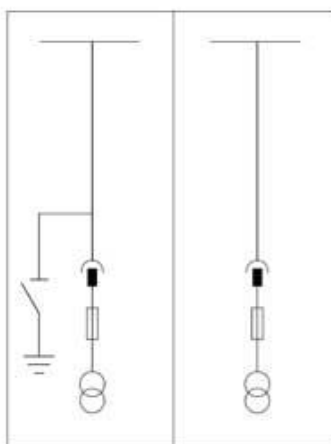


Figure 11
M SP single-line circuit diagrams

1.4.5 Direct Incoming Feeder

The DIF SP is designed for direct connection with busbars. In addition instrument current transformers, earthing switch, surge arresters can be installed. DIF SP can perform with a WVT, fixed VT or without a VT.

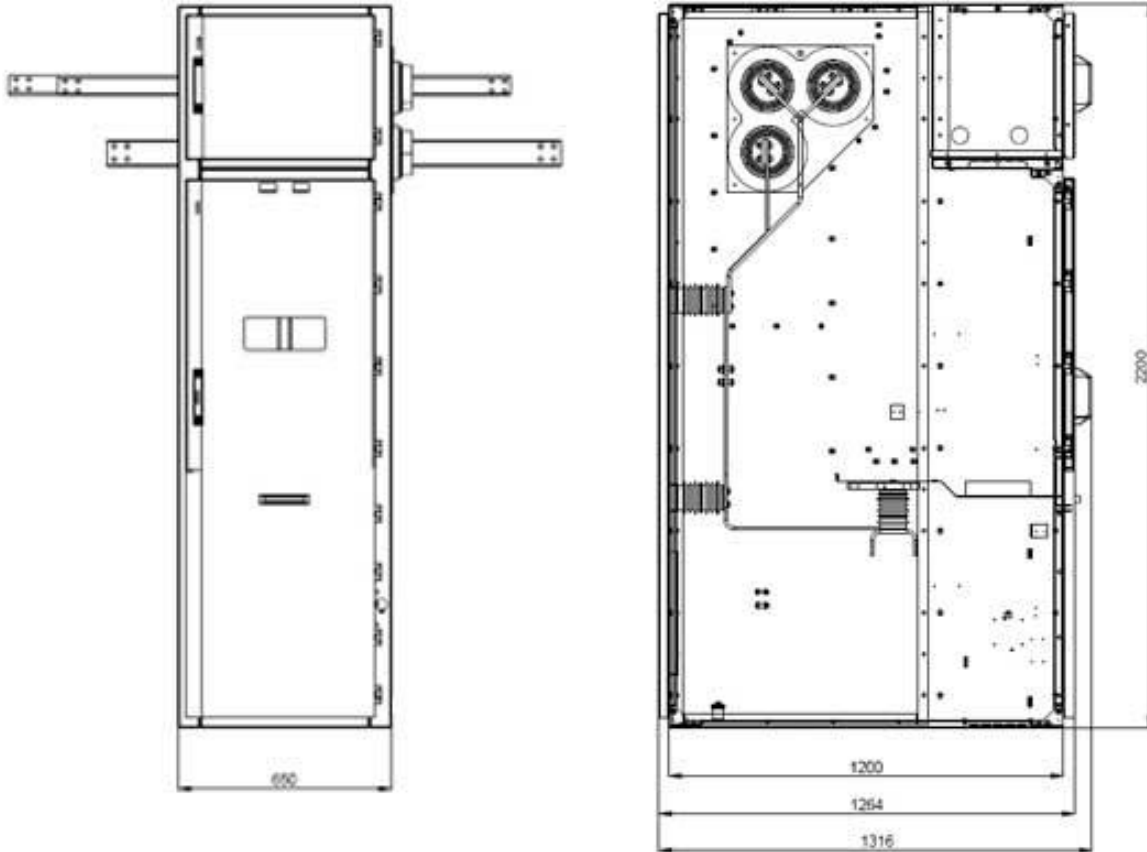


Figure 12
Dimensional drawings of DIF SP

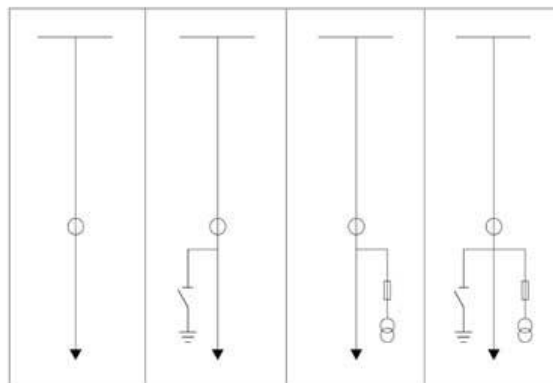


Figure 13
DIF SP single-line circuit diagrams

2 MAIN COMPONENTS

2.1 Complete list of main components

Table 3 Type designation and product range

Type designation	Main components									
	ISMD	DIS	CT	VT	WVT	ES	SA	Zero Sequence CT*	VS	Heater
IF	b	o	b	o	-	o	o	o	b	o
OF	b	o	b	o	-	o	o	o	b	o
BT	b	-	-	-	-	o	-	-	b	o
BR	-	-	o	-	o	o	-	-	o	o
M	-	-	-	o	b	o	-	-	b	o
DIF	-	-	o	o	o	o	o	o	b	o

* Installation of zero sequence current transformers inside of the SP or outside (in the cable channel) depends on cables cross-section.

Note: Designation in table means: b – basic configuration; o – optional configuration; - – not available.

2.2 Withdrawable units

2.2.1 Withdrawable unit with circuit breaker

The draw-out plate with its racking mechanism allows the ISMD to be racked into or out of the switchgear. See Table 4 or definition of applicability of ISMD.

Table 4 Variants of applicability of the ISMD in the SP

Draw-out unit		Dimensions of SP (WxD), mm / Distance between poles, mm			
		650x1260/150			
Type	Figure	Short-circuit current / Rated current			
		20 kA		25 kA; 31.5 kA	
		630 A	1250 A	630 A	1250 A
VCB15_LD_CDU	Figure 14	+			
VCB15_Shell_CDU	Figure 16		+	+	+

The main position indicating device is mechanically joined with the synchronizing shaft of the ISM for reliable indication of the status.

The manual tripping and locking device provides electromechanical tripping and locking of the ISM in its OPEN position.

Insulated contact arms with spring charged contact system create electrical connection between the ISM main terminals and fixed contacts of the switchgear when the draw out unit is in service position.

A series of interlocks are provided to avoid incorrect operation and to ensure maximum operator safety. Function of interlocks is described in the clause “Operations”.

The auxiliary circuit connection box provides CM auxiliary circuit wires, accessories installation and their connection to the switchgear relay protection and control system via a cable with a multi-pole control wiring plug. More detailed information can be found in “ISMD Technical manual”.

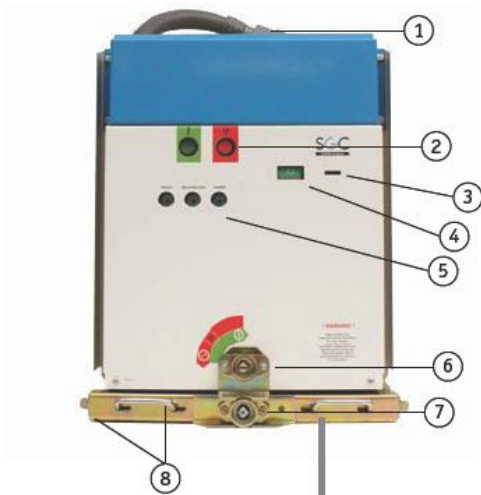


Figure 15.1



Figure 14
VCB15_LD_CDU

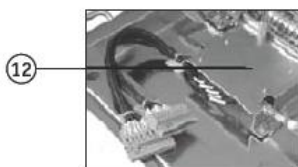


Figure 15.2
Auxiliary switches SQ1, SQ2

1. Control wiring plug (see Figure 17);
2. Electrical trip/close button;
3. Operating counter;
4. Main contacts position indication;
5. CM signaling and indication;
6. Mechanical trip and interlocking device
1. integrated in the interlocking system;
7. Racking mechanism of draw-out plate;
8. Fixing mechanism of draw-out plate;
9. Main contact terminals;
10. Vacuum circuit breaker, ISM;
11. Draw-out plate;
12. Auxiliary switches SQ1, SQ2 (see Figure 15.2)

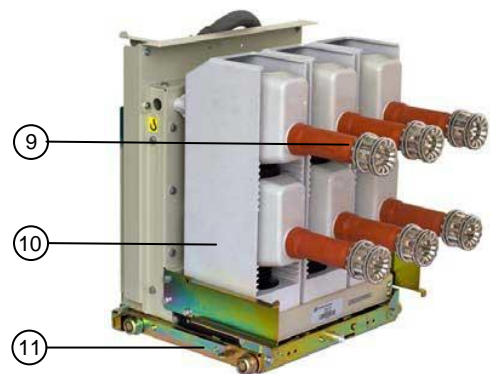


Figure 16
VCB15_Shell_CDU

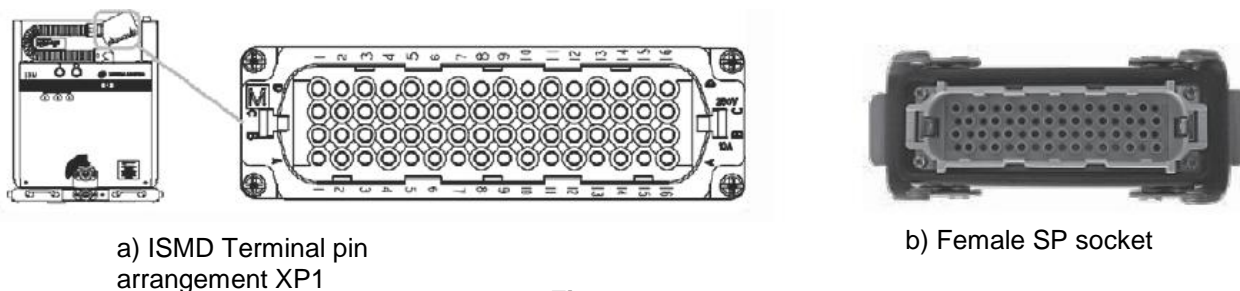


Figure 17

The female socket is installed in the upper part of the CB compartment for connection with the secondary circuit in the LV compartment of the SP (see Figure 17, b).

Table 5 ISMD Terminal arrangement

A		B	
Terminal No.	Connection	Terminal No.	Connection
1	CM: X1.3	1	Auxiliary switch (S4) XT1.8
2	CM: X1.4	2	Auxiliary switch (S5) XT1.9
3	CM: X1.9	3	Auxiliary switch (S5) XT1.10
4	CM: X1.10	4	Auxiliary switch (S6) XT1.11
5	CM: X1.12	5	Auxiliary switch (S6) XT1.12
6	CM: X2.1	6	Auxiliary switch (S1) XT1.17
7	CM: X2.2	7	Auxiliary switch (S1) XT1.18
8	CM: X2.4	8	Auxiliary switch (S8) XT1.19
9	CM: X2.5	9	Auxiliary switch (S8) XT1.20
10	FREE	10	Auxiliary switch (S9) XT1.21
11	FREE	11	Auxiliary switch (S9) XT1.22
12	Auxiliary switch (S2) XT1.3	12	Auxiliary switch (S10) XT1.23
13	Auxiliary switch (S2) XT1.4	13	Auxiliary switch (S10) XT1.24
14	Auxiliary switch (S3) XT1.5	14	Auxiliary switch (S11) XT1.25
15	Auxiliary switch (S3) XT1.6	15	Auxiliary switch (S11) XT1.26
16	Auxiliary switch (S4) XT1.7	16	FREE

C		D	
Terminal No.	Connection	Terminal No.	Connection
1	FREE	1	Test position (SQ2.3) XS3.6
2	Service position (SQ1.1) XS2.1	2	Test position (SQ2.4) XS3.7
3	Service position (SQ1.1) XS2.2	3	Test position (SQ2.4) XS3.8
4	Service position (SQ1.2) XS2.3	4	Test position (SQ2.5) XS3.9
5	Service position (SQ1.2) XS2.4	5	Test position (SQ2.5) XS3.10
6	Service position (SQ1.3) XS2.5	6	FREE
7	Service position (SQ1.3) XS2.6	7	FREE
8	Service position (SQ1.4) XS2.7	8	Auxiliary switch (S12) XT2.27
9	Service position (SQ1.4) XS2.8	9	Auxiliary switch (S12) XT2.28
10	Service position (SQ1.5) XS2.9	10	Auxiliary switch (S7) XT1.1
11	Service position (SQ1.5) XS2.10	11	Auxiliary switch (S7) XT1.2
12	Test position (SQ2.1) XS3.1	12	FREE

13	Test position (SQ2.1) XS3.2	13	FREE
14	Test position (SQ2.2) XS3.3	14	FREE
15	Test position (SQ2.2) XS3.4	15	FREE
16	Test position (SQ2.3) XS3.5	16	FREE

2.2.2 Withdrawable unit with disconnecter

There are two variants of Disconnecter (630A and 800A rated current) applicable for DW-2 panel.

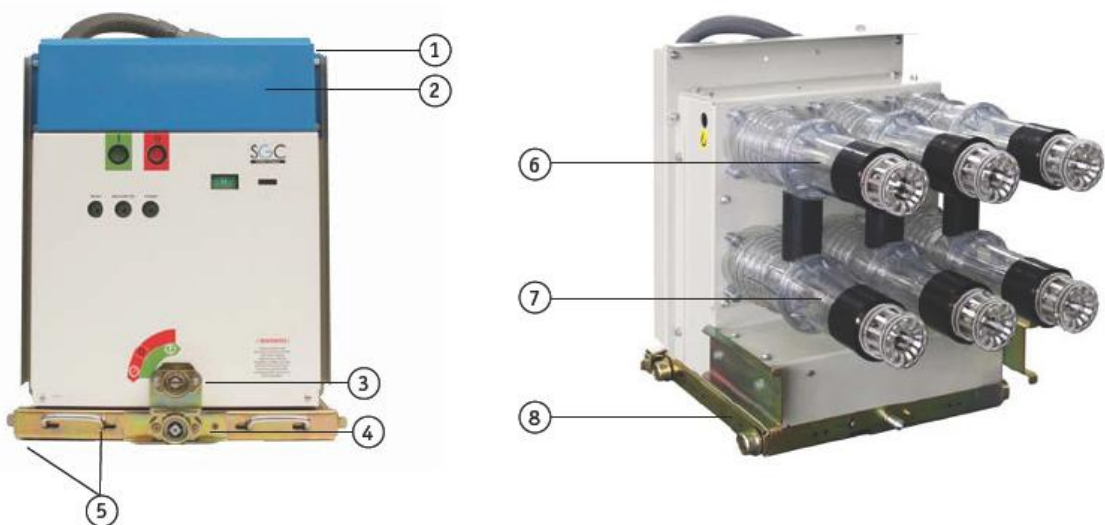


Figure 18
DIS15_CDU_1

1. Actuator for secondary plug blocking;
2. Control wiring plug (see Figure 17 and Table 6);
3. Interlocking device integrated in the interlocking system;
4. Racking mechanism of draw-out plate;
5. Fixing mechanism of draw-out plate;
6. Upper main contact terminals;
7. Lower main contact terminals;
8. Draw-out plate;

Table 6 Disconnecter Terminal arrangement

A		B	
Terminal No.	Connection	Terminal No.	Connection
1	FREE	1	FREE
2	FREE	2	FREE
3	FREE	3	FREE
4	Auxiliary switch (S14) XS5	4	FREE
5	FREE	5	FREE
6	FREE	6	FREE
7	FREE	7	FREE
8	FREE	8	FREE
9	FREE	9	FREE
10	Auxiliary switch (S14) XS4	10	FREE
11	FREE	11	FREE
12	FREE	12	FREE
13	FREE	13	FREE
14	FREE	14	FREE
15	FREE	15	FREE
16	FREE	16	FREE

C		D	
Terminal No.	Connection	Terminal No.	Connection
1	FREE	1	Test position (SQ2.3) XS3.6
2	Service position (SQ1.1) XS2.1	2	Test position (SQ2.4) XS3.7
3	Service position (SQ1.1) XS2.2	3	Test position (SQ2.4) XS3.8
4	Service position (SQ1.2) XS2.3	4	Test position (SQ2.5) XS3.9
5	Service position (SQ1.2) XS2.4	5	Test position (SQ2.5) XS3.10
6	Service position (SQ1.3) XS2.5	6	FREE
7	Service position (SQ1.3) XS2.6	7	FREE
8	Service position (SQ1.4) XS2.7	8	FREE
9	Service position (SQ1.4) XS2.8	9	FREE
10	Service position (SQ1.5) XS2.9	10	FREE
11	Service position (SQ1.5) XS2.10	11	FREE
12	Test position (SQ2.1) XS3.1	12	FREE
13	Test position (SQ2.1) XS3.2	13	FREE
14	Test position (SQ2.2) XS3.3	14	FREE
15	Test position (SQ2.2) XS3.4	15	FREE
16	Test position (SQ2.3) XS3.5	16	FREE

More detail information can be found in “ISMD Technical manual”.

2.2.3 Withdrawable unit with voltage transformer

WVT provides a LV source for power metering and voltage protection. See Figure 19.

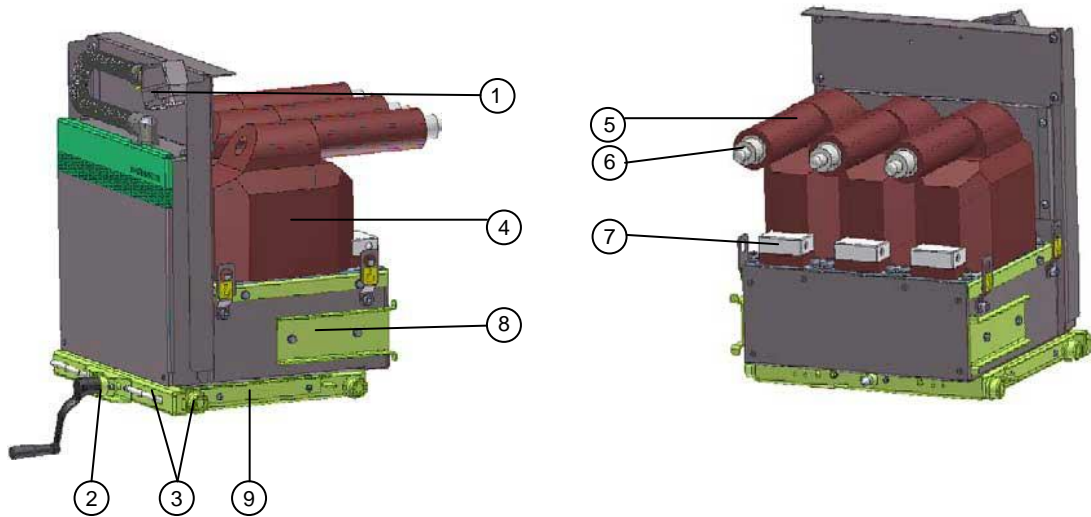


Figure 19
Withdrawable VT: SGComp_VT_1

1. Control wiring plug. The female socket is in the LV compartment of SP (Figure 17, b);
2. Racking mechanism of draw-out plate;
3. Fixing mechanism of draw-out plate;
4. Voltage transformer with fuse;
5. Fuse's compartment;
6. Main contact terminals;
7. Terminal box;
8. Pushing guide;
9. Draw-out plate;

Withdrawable unit with a voltage transformer is installed into the CB compartment of the SP in the same way as the ISMD. Auxiliary switches SQ1, SQ2 are placed in the draw-out plate (see Figure 15).

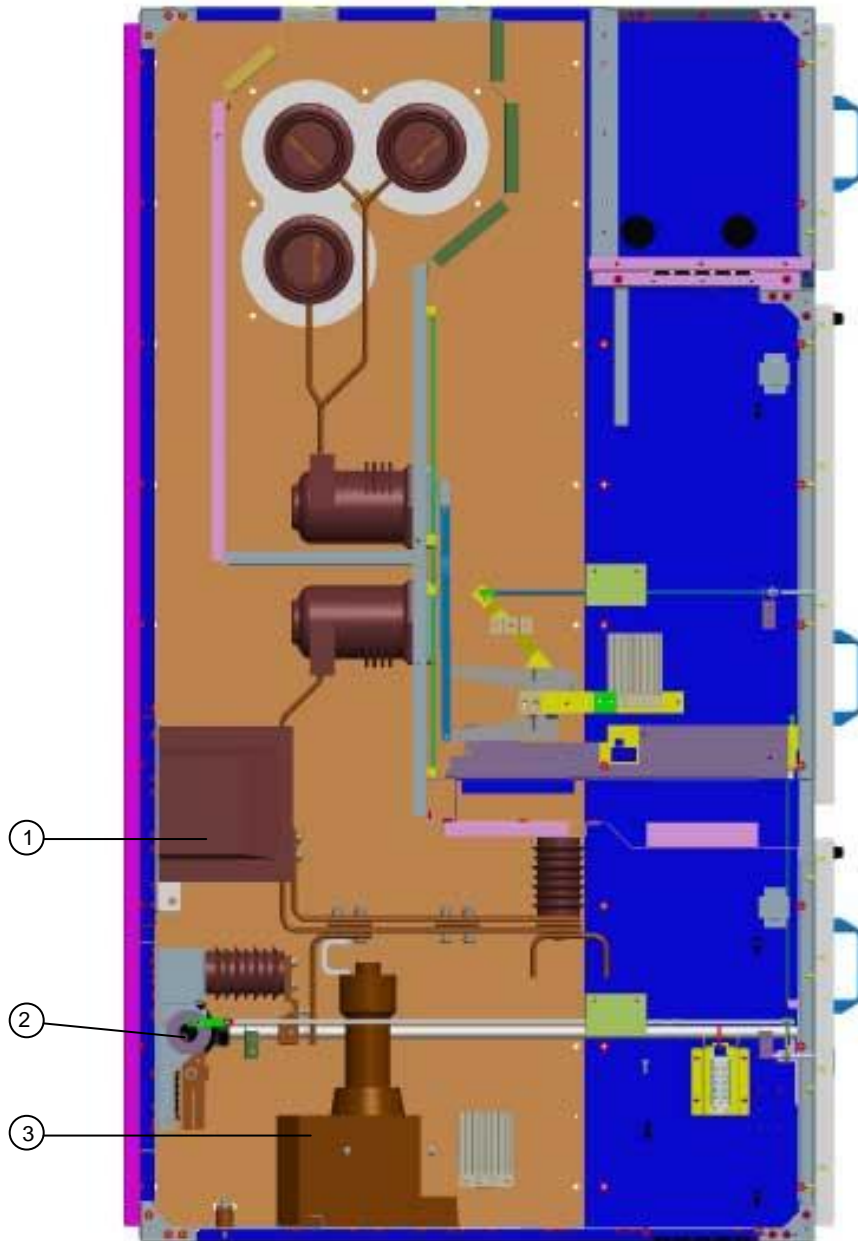
Table 7 WVT terminal arrangement

A		B	
Terminal No.	Connection	Terminal No.	Connection
1	TV1.2: a	1	FREE
2	FREE	2	FREE
3	TV2.2: a	3	FREE
4	FREE	4	FREE
5	TV3.2: a	5	FREE
6	FREE	6	FREE
7	TV3.2: n	7	FREE
8	FREE	8	FREE
9	TV1.3: da	9	FREE
10	FREE	10	FREE
11	TV3.3: dn	11	FREE
12	FREE	12	FREE
13	FREE	13	FREE
14	FREE	14	FREE
15	FREE	15	FREE
16	FREE	16	FREE

C		D	
Terminal No.	Connection	Terminal No.	Connection
1	FREE	1	Test position SQ2.3: 6
2	Service position SQ1.1: 1	2	Test position SQ2.4: 7
3	Service position SQ1.1: 2	3	Test position SQ2.4: 8
4	Service position SQ1.2: 3	4	Test position SQ2.5: 9
5	Service position SQ1.2: 4	5	Test position SQ2.5: 10
6	Service position SQ1.3: 5	6	FREE
7	Service position SQ1.3: 6	7	FREE
8	Service position SQ1.4: 7	8	FREE
9	Service position SQ1.4: 8	9	FREE
10	Service position SQ1.5: 9	10	FREE
11	Service position SQ1.5: 10	11	FREE
12	Test position SQ2.1: 1	12	FREE
13	Test position SQ2.1: 2	13	FREE
14	Test position SQ2.2: 3	14	FREE
15	Test position SQ2.2: 4	15	FREE
16	Test position SQ2.3: 5	16	FREE

2.3 VT, CT, ES arrangement

Installation of CTs and surge arresters as well as an earthing switch is shown on the Figure 20



1. Current transformer;
2. Earthing switch;
3. Voltage transformer

Figure 20
Installation of earthing switch, surge arrester, VT and CT

2.3.1 Surge arrester

SA are not installed as a standard but are supplied as an option as part of an installation kit.

2.3.2 Voltage Transformer

Installation of voltage transformers with fuses in the cable compartment is shown in Figure 21

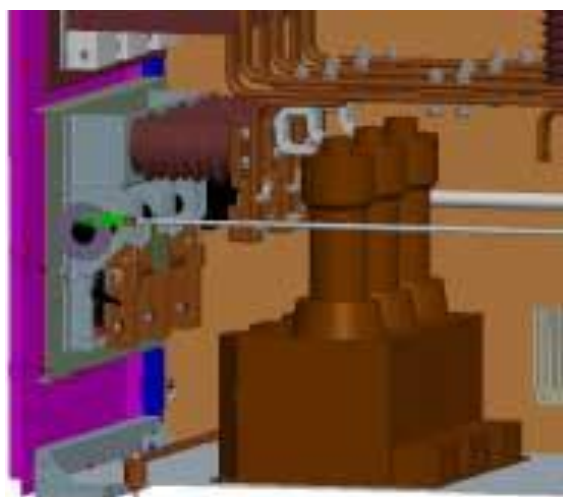


Figure 21
Installation of VTs with fuses in cable compartment

2.3.3 Earthing switch

Table 9 Earthing switch rated parameters

Rated voltage, kV	12
Rated lightning impulse withstand voltage, kV	75
Rated short-time withstand current, kA	31.5
Rated short-circuit making current, kA	31.5
Rated short-circuit duration, s	4
Rated peak withstand current, kA	80
Mechanical operational capability, times	2000

Table 10 ES auxiliary switches rated parameters

Number of available auxiliary contacts	3 NO; 2 NC
Rated current for voltage up to 660 V AC, A	10
Rated power frequency withstand voltage, kV (50 Hz; 1 min)	2

2.4 Cable termination

Up to maximum three or five single or three-core cables can be installed in parallel. It depends on cable cross-section and installed equipment (voltage transformers, surge arrestors, earthing switch).

Depending on different types and cross-sections of the cables, some versions of cable fixing elements are possible. The version of cable fixing elements (as well as base and components of cable compartment), required for cabling, shall be defined by user at the stage of ordering.

The standard cable terminals intended for required cross-section of cable shall be used for termination. If some of the openings intended for cabling are temporarily out of use these openings shall be plugged up by gap closures supplied in accessory set. All cables screens should be earthed in the cable compartment.

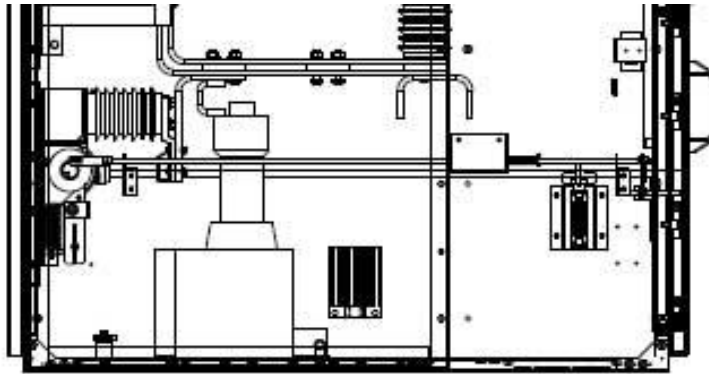


Figure 22
Three cables per phase

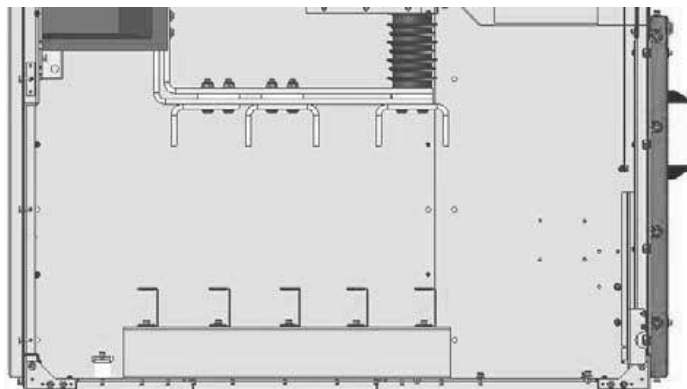


Figure 23
Five cables per phase

2.5 Insulation

DW-2 is air-insulated SP. Additional insulation is used in SP:

1. Fixed contact insulator;
2. Busbar bushing;
3. Shrinkable tube;

Support insulator is used for fixation of bus bars on SP frame.

The insulation of SP complies with requirements of IEC 62271 and GB 11022.

To protect insulation of main circuits from overvoltage SA installation in cable compartment is arranged.

3 SAFETY

3.1 General

The enclosure is made of corrosive resistant hot dip galvanized steel sheets and provides the degree of protection as specified in Table 2. All doors and lateral walls are powder coated by paint in accordance with color matching system.

All parts of the enclosure exposed are earthed.

- Earthing is provided by means of connecting the unpainted surfaces within the enclosure.
- Doors are earthed by means of earthing wires which connect the doors to the enclosure.
- Neighboring panels are connected by an additional earthing bar

ISMD is fixed in designated slots of SP in the test/disconnected position to prevent its movement under external influences that take place during service and type tests. The front doors of the CB and cable compartments have inspection windows so the position of the circuit breaker and ES are visible for the operator. Specially designed labyrinths as well as additional steel sheets in the front doors of the cable compartment provide operator safety in case of internal arc fault. On the top of the SP the overpressure flaps release redundant pressure in case of an arc-fault. An arc venting duct can also be installed.

Metallic shutters automatically protect the operator from touching the high voltage parts when the circuit breaker is withdrawn.

3.2 Arc vent facilities

The CB, busbar and cable compartments of the SP are equipped with flaps on the top of the SP pressure relief in case an internal arc fault. Arc venting duct can also be installed on SPs (Figure 24).

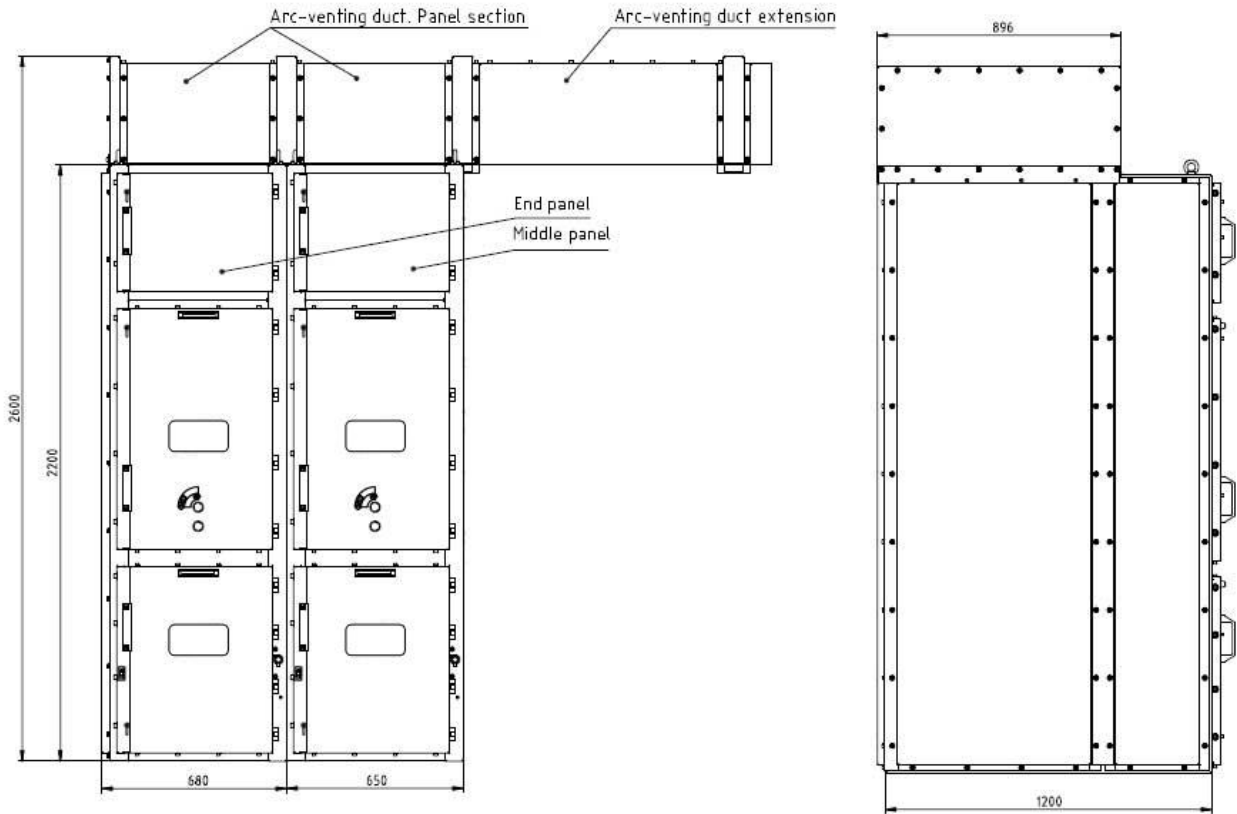


Figure 24
Arc venting duct installation

The arc venting duct is designed in advance for any particular installation.

3.3 Earthing switch

The ES is applicable for indoor installation and fitted with a snap-action operating mechanism for high-speed closing. It is designed to conduct the rated short circuit current. The ES shall be operated through a rotating hexagonal shaft ② (see Figure 25) by the operating lever ④. The cover ① should be pushed down before the operation of the ES shaft.

Position of the ES is shown on the label (see Figure 25 a):

- “I” - the closed position of the earth switch is achieved by means of rotating the operating lever approximately 180° clockwise until it reaches a stop position;
- “0” - the open position of the earth switch is achieved by means of rotating the operating lever approximately 180° counter clockwise until it reaches a stop position.

The operating of the ES is allowed when ISMD/DIS is in the test/disconnected position or removed from the SP. The operation of the ES is permitted when the ISMD. The status of the auxiliary contact 3 provides an indication for the Position of the ES. (see also Figure 26 and Table 12).

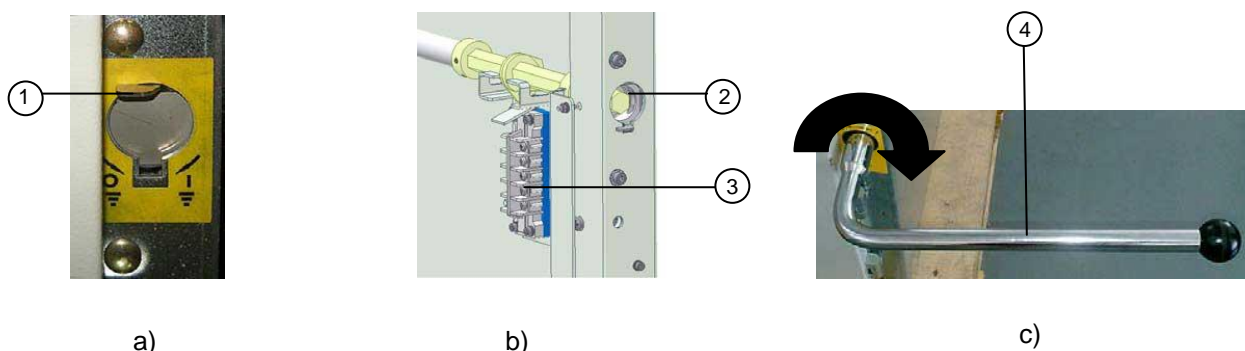


Figure 25
Operating of the ES

1. Cover of ES shaft
2. Hexagonal shaft of ES
3. ES auxiliary switch
4. Operating lever

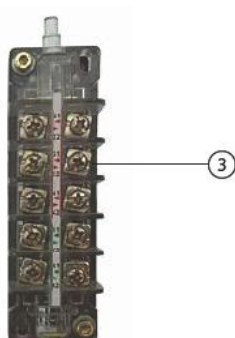




Figure 26
ES auxiliary switch

Table 12 Contacts of ES auxiliary switch

Description	
	Red contact: 21, 22, 31, 32, 41, 42 – NO
	Green contact: 51, 52, 61, 62 – NC

3.4 Interlocks

3.4.1 Interlocking devices

The switchgear is fitted with all interlocks needed to guarantee the highest level of safety. To prevent unsafe situations and flawless operation, there is a series of interlocks to protect both personnel and equipment. According to IEC 62271-200 interlocking devices prevent:

- closing of the circuit breaker in an intermediate position
- racking-out of the circuit breaker in the closed position
- racking-in of the circuit breaker in the closed position
- opening of the circuit breaker compartment door as long as the circuit breaker is not in the test position
- racking-in of the circuit breaker with the circuit breaker compartment door open.

In addition, if the panel is equipped with an earthing switch the interlocking devices prevent:

- racking-in of the circuit breaker with the earthing switch closed
- closing of the earthing switch when the circuit breaker is in the connected or intermediate position
- opening of the cable compartment door with the earthing switch open.

The mentioned interlocks are presented in Table 13. (below)

Interlocks	SP type				
	01/02	03	04	05	06
	IF/OF	BT	BR	M	DIF
A. Interlocks of the SP prevent					
I Closing of the ISMD/DIS in an intermediate position	b/m	b/m	-	-	-
II Racking-out of the ISMD/DIS in closed position of CB/DIS	b/m	b/m	-	-	-
III Racking-in of the ISMD/DIS in closed position of CB/DIS	b/m	b/m	-	-	-
IV Opening of the CB compartment door as long as the WU is not in test position	b/m	b/m	b/m	b/m	b/m
V Opening the cable/bottom compartment door if voltage is on the cables/bars (if there is no ES), with possibility of unlocking	o/em	o/em	b/em	o/em	o/em
VI Racking-in the WU with CB compartment door open	o/m	o/m	o/m	o/m	o/m
B. Interlocks of the SP equipped with ES prevent					
I Racking-in of the ISMD/DIS with the ES closed position;	b/m	b/m	-	-	-
II Closing of the ES when the ISMD/DIS is in connected or intermediate position	b/m	b/m	-	-	-
III Operating of the ES with the cable compartment door open, with possibility of unlocking	o/m	o/m	-	o/m	o/m
C. Interlocks between the SPs prevent					
I Earthing of main busbars when any ISMD/DIS of a relative busbar section is in connected or intermediate position	o/em	o/em	-	o/em	o/em
II Racking-in of the ISMD/DIS if the main busbars are					

earthed. (with the ES of the adjacent SP in section is in closed position)	o/em	o/em	-	-	-
--	------	------	---	---	---

b – basic configuration;
o – optional configuration;

“-“ – not available;
m – mechanical interlock;
em – electromechanical interlock

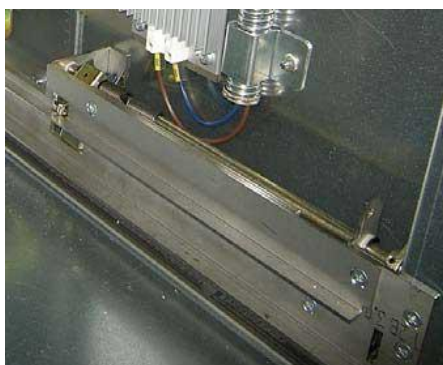


Figure 27
Interlocking device: Earthing Switch end Draw-out unit



Figure 28
Interlocking device: Earthing switch and cable compartment door



Figure 29
Interlocking device: Cable compartment door open preventing the DOU to be racked in

3.4.2 Door keylocks

A swinghandle keylock prevents the door from being opened. To unlock the door the key has to be inserted into the lock and the handle has to be rotated clockwise.

More detailed information can be found in the chapter “Operation”.

3.4.3 Padlocking facilities

The metallic shutters can be locked in the closed position by means of two independent padlocks when the apparatus has been removed.

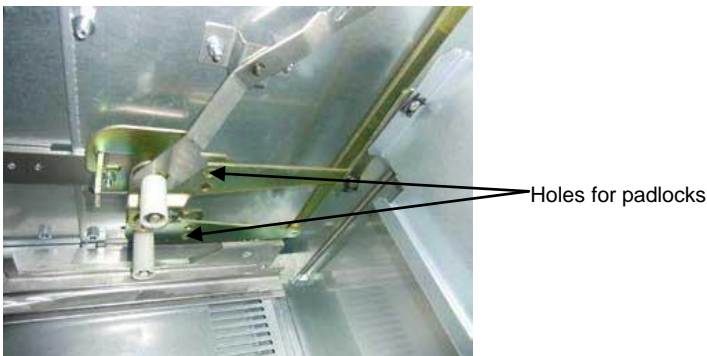


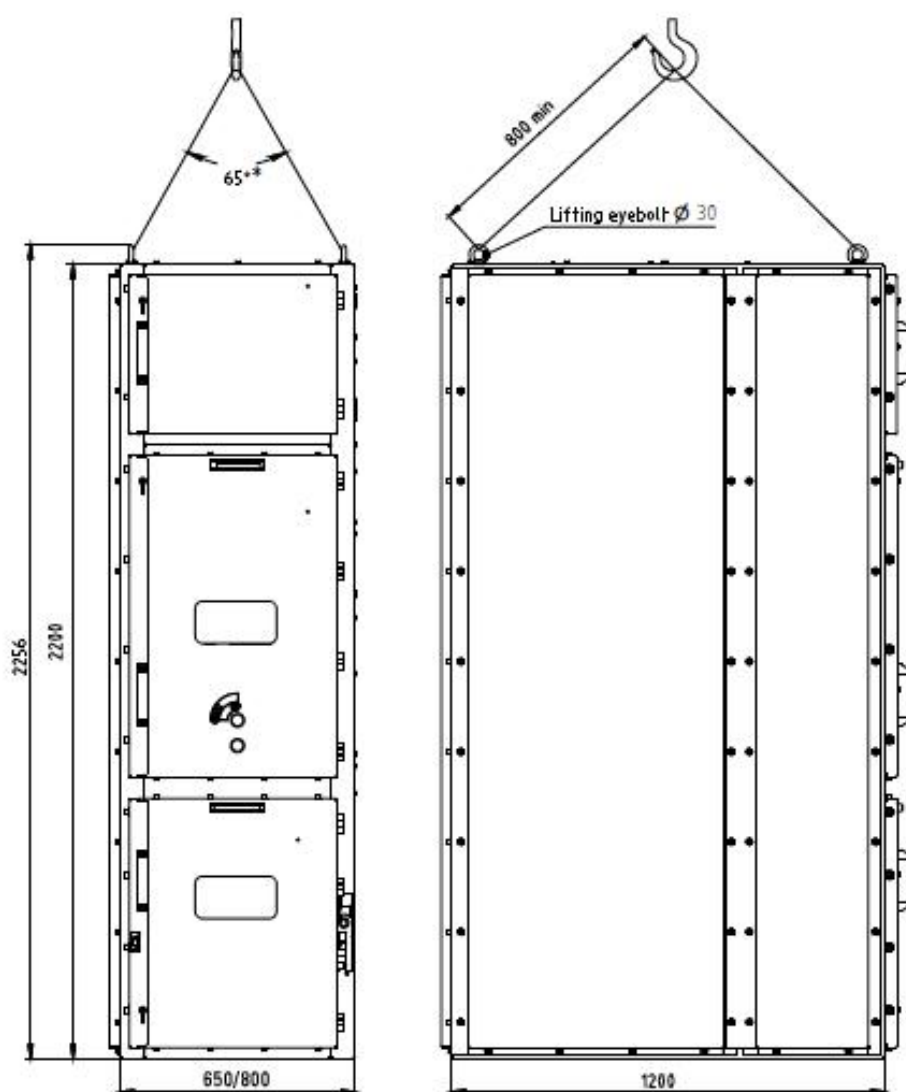
Figure 30
Shutters opening mechanism

4 GOODS ENTRY

4.1 Transportation

DW-2 shall be transported in the original packing only. The packed goods shall be handled in accordance with the handling symbols. Loading procedures for DW-2 packing units shall be carried out only with forklifts or cranes. During transportation DW-2 must not be hit or dropped. The cubicles with a circuit breaker already installed have to be transported in upright position.

Once the panel package has been opened use the eyebolts fixed on the top of the cubicle to transport the panel with a crane.



* The direction of harnesses during of the panel should not be bigger than 65° , so, the length of harness should not be less then 800 mm.

Figure 31
Movement of unpacked panel

4.2 Unpacking, goods received control

Before unpacking, please check the packaging for any kind of damage. Removal of the products from the original packing must be carried out with due care. Every DW-2 package shall be subject to a complete scope of delivery check.

Scope of delivery for DW-2 :

- DW-2 Switchgear
- Set with connection bolts
- Main busbars
- Screwable bushings
- Technical Manual
- Keys for doorlocks
- Set of lateral walls (for left and right panels)
- ES operating lever (if ES is installed)

Any transport damage must be reported immediately to the carrier in writing. Cases of damage must be photographically documented.

4.3 Storage

Should immediate installation not be possible, DW-2 shall be stored upright in the original packing. The storage place must be dry and well ventilated. Place desiccants in the packing.

Climatic conditions according to IEC 60721-3-1, classification 1K3.

Low air temperature	- 5 °C
High air temperature	+ 40 °C
Low relative humidity	50 %
High relative humidity	95 %
Rate of change of temperature	0.5 °C/min

Maximum temporary storage time for the cubicles is 12 months. When the maximum storage period, starting from the date of packing, has been exceeded, the protective function of the packaging can no longer be guaranteed.

5 INSTALLATION

5.1 Preparation

5.1.1 Personnel restrictions

Installation of the medium voltage switchgear is restricted to qualified and trained operators whom strictly adhere to the applicable local safety instructions and guidelines. The switchgear shall be energized by qualified and authorized staff only.

5.1.2 Surrounding

Before installing the switchgear the switch room must be completely finished. This means it must be provided with lighting and an electrical supply. Clean the installation area of the switchgear carefully. Ensure that there is good ventilation of the installation area and protect the ventilation openings. All the necessary preparations, such as wall openings, ducts, etc., for routing the power and control cables up to the switchgear must already be complete. Compliance with the conditions for indoor switchgear according to IEC 62271-1, including the conditions for the indoor temperature class must be ensured.

5.1.3 Room arrangement

For safe installation, operation and maintenance the room arrangement must be considered. The dimensions of SP section and minimal distances to walls or to neighboring sections are given on Figure 32.

1.5m free space in front of the panel shall be provided for service purposes (such as door opening or truck operation to withdraw in/out the ISMD, etc.) The ceiling shall be high enough to make vent duct installation possible. If rear wall of the room is 1m from section or even further, ceiling height can be 2.8m. If rear wall of the room is closer than 0.5m, the recommended ceiling height is 3m.

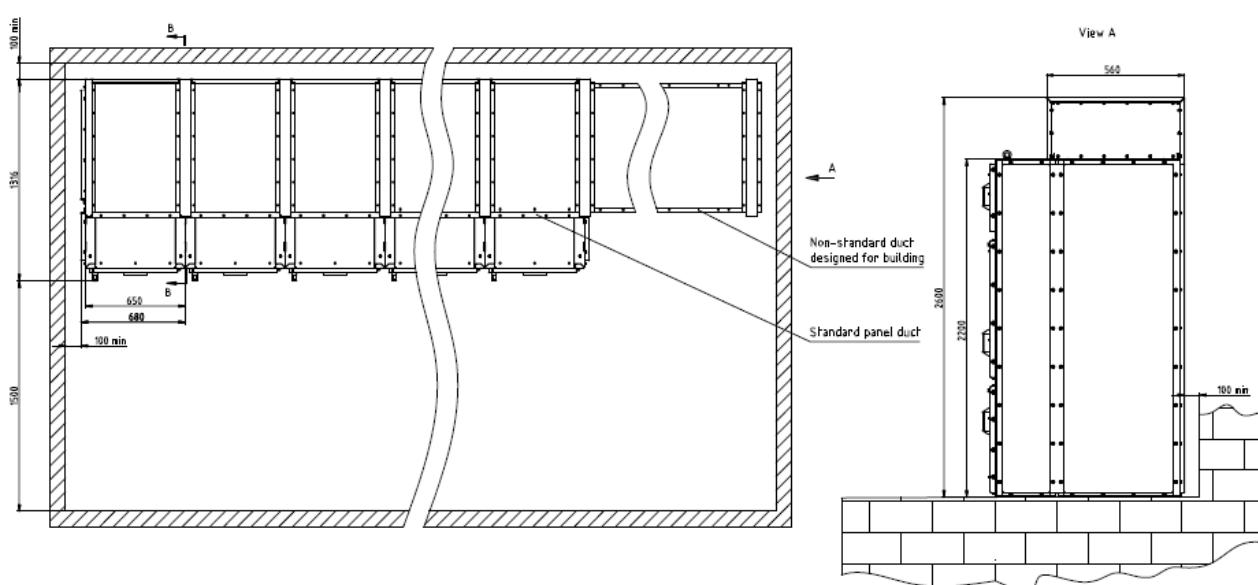


Figure 32
Room arrangement

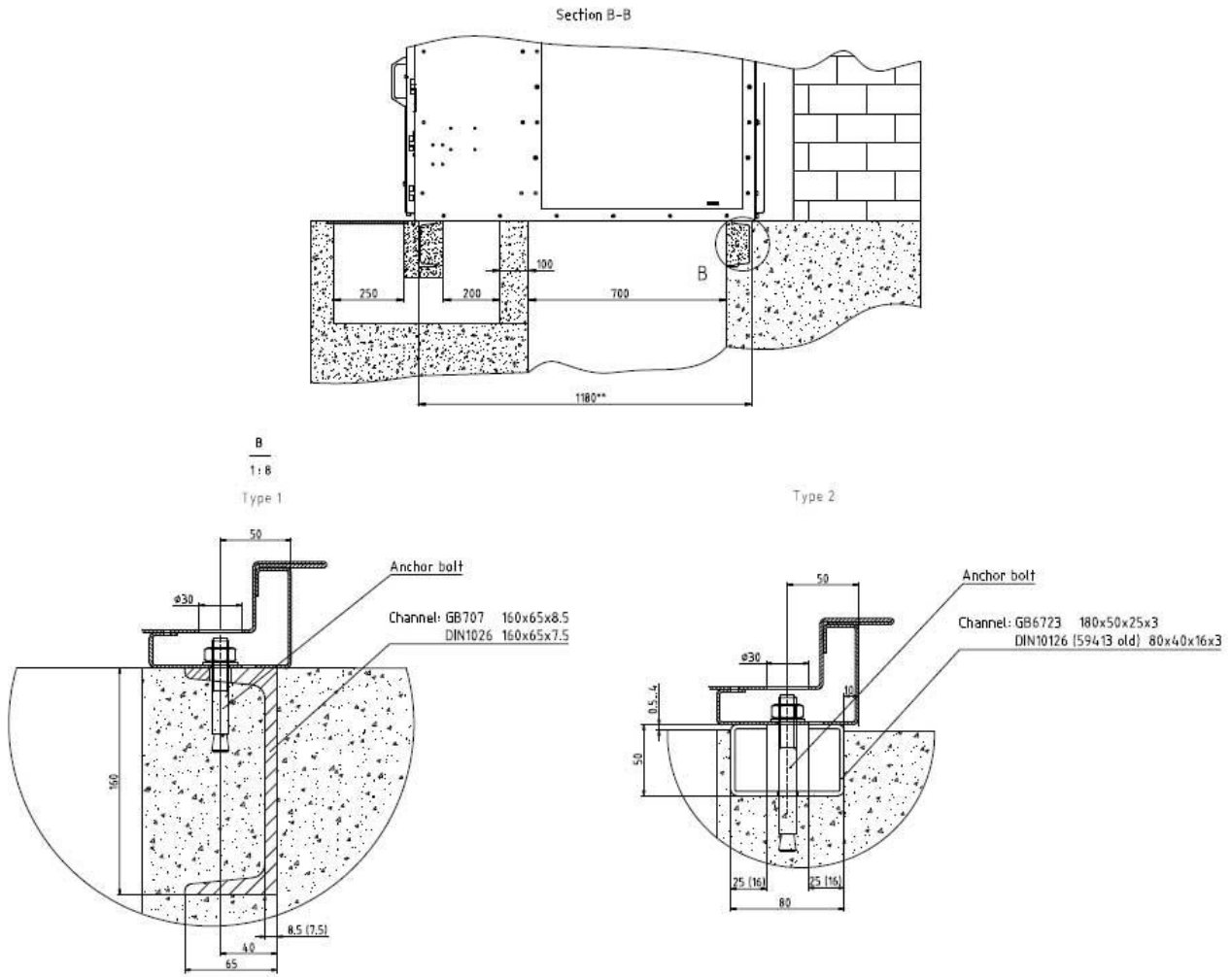
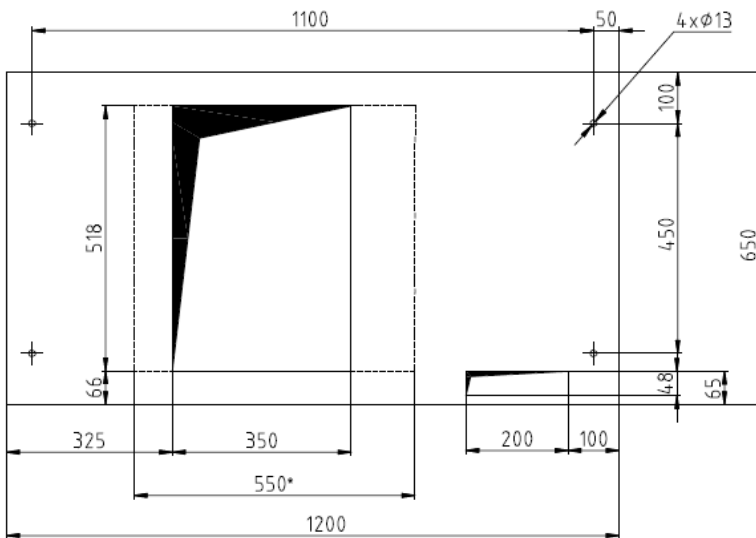


Figure 33
Fastening to the floor



* Dimension for cable space entry might be bigger that depends on structure of panel

Figure 34
Cable space entry

5.1.4 Floor surface

The surface on which the medium voltage switchgear is installed must be sufficiently strong and completely leveled. The maximum permissible difference level is ± 2 mm per meter and not more than ± 5 mm for whole length of the switchboard.

5.1.5 Positioning

Before placing the panels, all the necessary preparations, such as wall openings, ducts, etc., for laying the power and control cables up to the switchgear must already be complete. The cubicles have to be fixed on the floor with four anchor bolts. Two bolts are fixed in the front and two in the rear of the cubicle. Ensure that all panels are in one line and stay level.

5.1.6 Earthing

The frame of support metal structure shall be earthed in two places. The cross-section of the steel bar interconnecting the frame with grounding grid of switchgear room shall not be less than 100mm².

5.2 Assembling and connection

5.2.1 Assembling of the panels

When panels are being installed, the following important steps have to be taken:

- Connecting the cubicles
- Fitting the earthing busbar
- Fitting the busbars
- Fitting the end panels
- Fitting the arc pressure duct

5.2.2 Panel connection points for the installation in the substation

The left side wall of each panel and the right side wall of the panel on the right hand side end of the switchboard has preliminary nuts installed for the connection of two panels together as well as for the fixation of the lateral walls on either end of the board.

Connection of the panels together

1. Unscrew the 10 bolts M8x20 that were inserted for transportation from the left and from the right of the neighbouring panels, see in Appendix;
2. Place the neighbouring panels in one line closer to each other (there is no distance between two neighbouring panels);
3. Install 20 bolts M8x20 from the inside right side of the panel in places, marked by a red circle, see Figure 35;

Torque moment for the installation M8 bolts should be 16 + 2 Nm.

In other connection points, additional screw pins have been installed to close unnecessary open holes between neighboring panels (these open holes are needed to fix the lateral walls of each end panel).

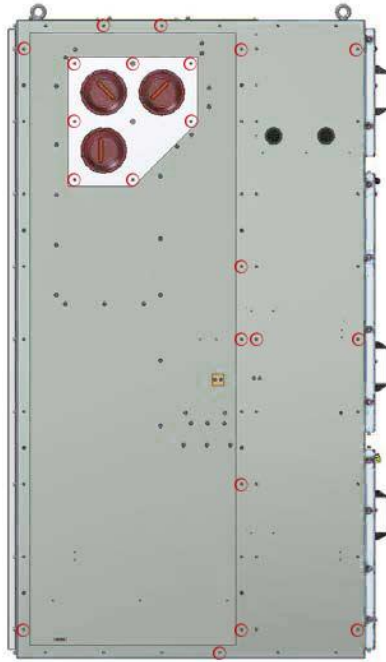


Figure 35
Points for connecting the panels together

5.2.3 Installation of the lateral walls on the end panels of the substation

Usually the lateral walls are already installed on the panels.
In the case where the lateral walls need to be fitted, install 37 bolts M8x16 and 19 M8x12 from the outside of the panel in accordance with fixation places of the lateral walls.

Appearance of the end panel before installation the lateral walls Figure 36.

Appearance of the end panel after installation the lateral walls Figure 37.

Description of the installation the lateral walls Figures 38, 39, 40.



Figure 36
End panel before installation of the lateral walls



Figure 37
End panel with installed lateral walls

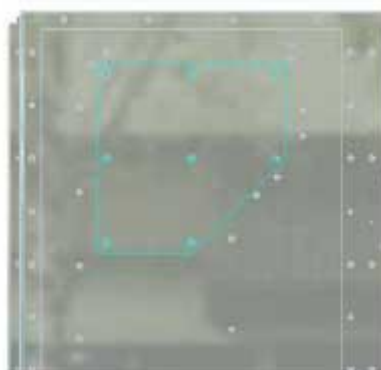


Figure 38
Check the fixation of bolts M8x12
and washers 8 pcs



Figure 39
Installation of the front lateral wall.
Bolt M8x12 and washer, 11 pcs
Bolt M8x16 and washer, 2 pcs



Figure 40
Installation of the back and
middle lateral walls



Figure 41

Fixation of the back and middle lateral wall. Bolt M8x12 and washer, 35 pcs

Transportation bolts are installed on manufacturing site to connect the panel's side wall to the frame wall. 10 of them (Figure 42) shall be used to connect neighboring panels (M8, torque moment 16_+2 Nm)

5.2.4 Transportation bolts installed in the left wall (with though bushing partition)



Figure 42

For the right wall of the panel, additional nuts DIN 934 M8 should be used to fix the bolts for transportation as there are no installed rivet nuts in this right wall.

5.2.5 Transportation bolts together with nuts installed in the right wall (without though bushing partition)



Figure 43


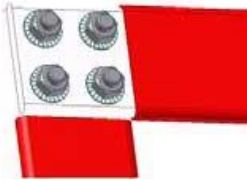
5.2.6 Fitting the earthing busbar

Connect the earthing busbar of each cubicle with the earthing connection piece and two M8x55 bolts, torque moment 25+2 Nm.

5.2.7 Fitting the busbar

The connection busbar copper has to be cleaned and checked for any damage. The busbars have to be fixed together with 4x M12 bolts, torque 70±3 Nm.

Table 14 Fixing the busbar

Position of SP	Connection appearance
Middle panel	
End panel	

5.2.8 Fitting the arc pressure duct

If the room is not high enough or for some reason an arc pressure duct should be installed. The arc pressure duct is shipped dismantled into individual parts and has to be assembled on site. The duct parts shall be fastened together by sheet strips. The bolts are delivered in a separate box.

Additional information can be found in chapter Safety.

5.3 Low-voltage compartment

The design of the LV compartment of the SP provides the installation of the secondary circuit equipment. Particularly, the design contains (Figure 44):

- Special openings ① on both sides of the LV compartment for transit control cables, laid through several SPs;
- Mounting plate ② for possibility to assemble the LV equipment outside of SP and to insert it into the LV compartment there after;
- Special openings ③ for the installation of the female socket for the connection of the withdrawable unit plug to the secondary circuits of the SP in the LV compartment.
- Special box ④ for placing all secondary control wires of both electrical interlocks and sensors.

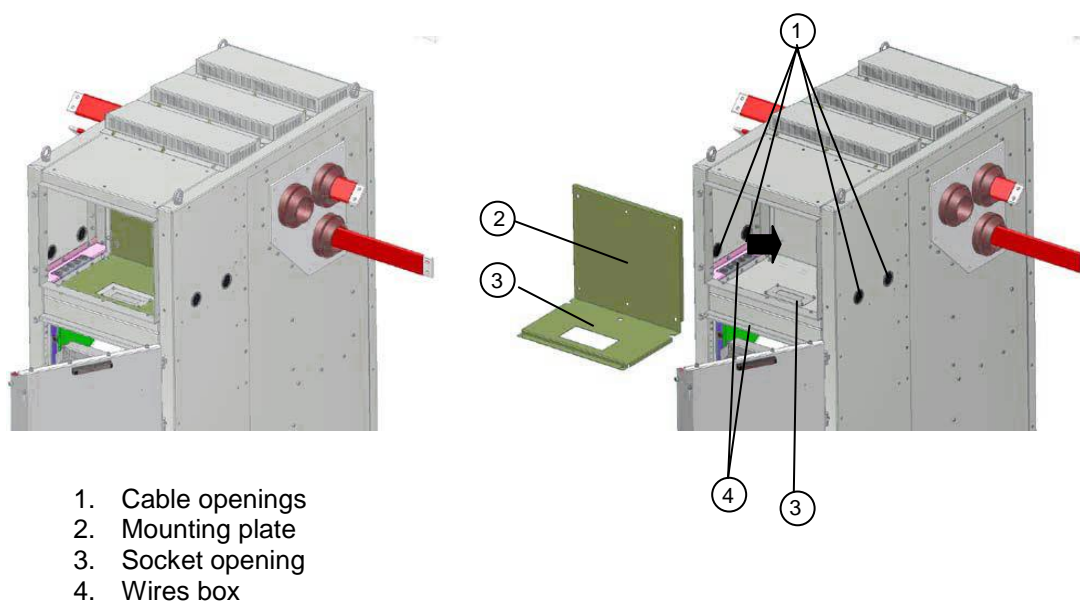


Figure 44
Low-voltage compartment

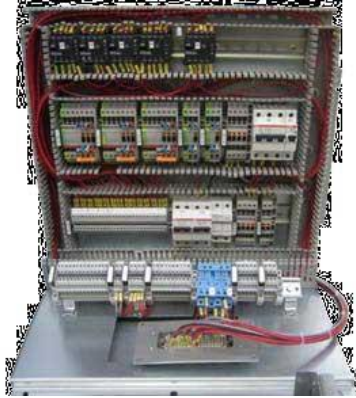


Figure 45
Mounting plate of LV
compartment outside the panel

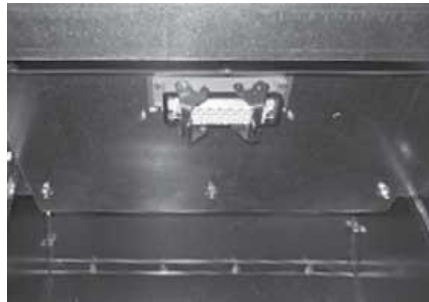


Figure 46
Socket plug at the top of the CB
compartment

Notes:

6 OPERATION

6.1 Setting to work

6.1.1 Preparation

- Check, if all the assembly operations have been correctly performed.
- Check the switchgear for any damage
- Remove dirt and foreign objects
- Check fastening of the earthing switch, transformers and busbar connections
- Perform AC voltage testing of the main circuits according to IEC 62271-200 where necessary.
- Switch the auxiliary and control voltage on
- Carry out testing operations on switching devices manually or by electrical control, and simultaneously observe the relative position indicators
- Check all mechanical and electrical interlocks on functionality

6.1.2 Putting into operation

- Comply with all relevant safety regulations
- Ensure that the circuit-breakers in the system are in the OFF position
- Remove any existing earthing and short-circuiting connections in the critical switching area
- Energize the feeder cables
- Connect the switchgear step by step, observing the signals and indicators;
- Check that relative conductors are in phase, where necessary, when there are several incoming feeder-cables and switchgear sections
- Carry out all measurements and check all functions which depend on high voltage power supply being connected
- Watch out for irregularities of any kind

6.2 Switching operations

Insert the truck from the test/disconnected position to the service position.

- Connect the control wiring plug.
- Close the front door of the circuit breaker compartment
- Put the interlocking knob in locked position
- Insert the crank to the square shaft of the racking mechanism
- Turn the crank clockwise until the stop position (you hear a click sound) is reached (approximately 20 turns).
- Put the interlocking knob into unlocked position

Remove the truck from the service position to the test/disconnected position

- Put the interlocking knob into locked position
- Insert the crank to the square shaft of the racking mechanism
- Turn the crank counter-clockwise until the stop position (you hear a click sound) is reached (approximately 20 turns).
- Open the front door of the circuit breaker compartment
- Disconnect the control wiring plug

Note:

Do not force the lever of the DOU (max. torque 25 Nm)!

After that press against the hand crank and remove it.

When removing the crank, it is essential that the springloaded socket head slides into the intentioned front position. Spindle is thus locked in place, preventing inadvertent turning of the spindle. Turning of the spindle opens auxiliary switches SQ1, SQ2 and thus signals position of draw-out plate.

The draw-out unit shall not be stopped at any position in the travel range between the service position and the test/ disconnected position

Insert the truck from repair position to the test/disconnected position

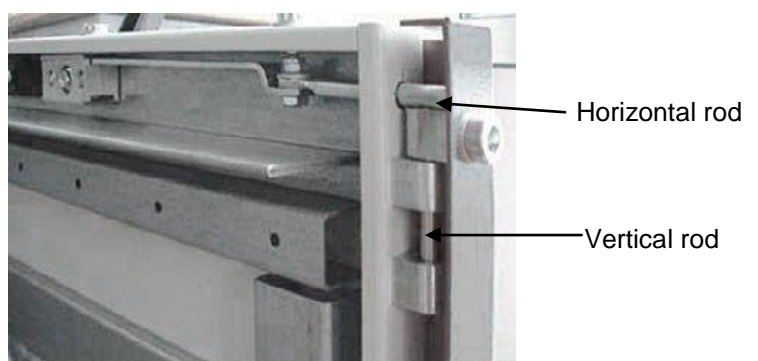
- If in place remove the padlocks securing the shutter sheets
- Move the sliding handles inwards and push the circuit breaker in the switchgear
- Connect the control wiring plug
- Close the front door of the circuit breaker compartment

Remove the truck from test/disconnected position to the repair position

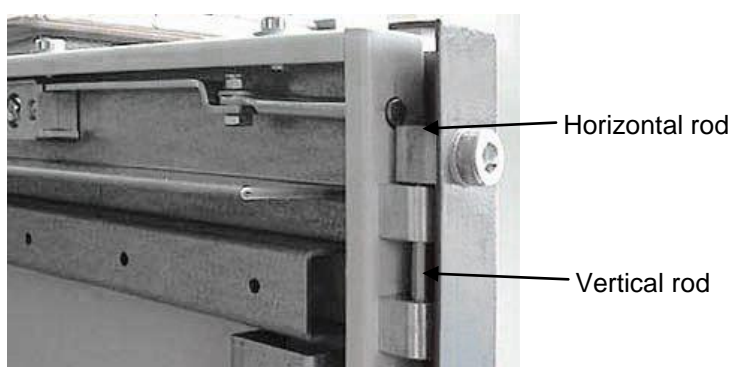
- Open the front door of the circuit breaker compartment
- Disconnect the control wiring plug if connected
- Move the sliding handles inwards and pull the circuit breaker out of the switchgear
- Secure the position of the shutters sheets with padlocks if required

6.3 Opening/closing of the door

Before opening the door ensure that no interlock or keylock is preventing the door from opening. The CB and cable compartment door of the SP is equipped with a swinghandle keylock which prevents the door from being opened. The door in Figure 47 a) is shown in the locked position, with a horizontal rod which prevents and locks the vertical rod of the door. To unlock the door the key has to be inserted into the lock and rotated clockwise. Then the handle has to be rotated clockwise. In this case the horizontal rod is pulled in, unlocking of the vertical rod, see Figure 47 b).



a) locked position of the door



b) unlock position of the door

Figure 47
Key lock of doors

Opening

To open the door the door-handle has to be moved upwards and then pulled toward the operator (see Figure 48).



Figure 48
Opening the door

Closing

To close the door the keylock has to be in the open position. The door-handle has to be moved upwards, the door has to be pushed to the cubicle and the door-handle has to be moved downwards.

6.4 Changing position of the DOU

After inserting the DOU into the panel and fixing it there by putting fixing pins into responsible slots, the DOU stays in the test/disconnected position (Figure 49).



Figure 49
ISMD in test/disconnected position

Before changing the ISMD/DIS position from test/disconnected into the service position ensure that the ES is open and no interlock or keylock is preventing the ISMD/DIS position from changing.

The sequence of changing the position of the WU from test/disconnected into the service position: the control wiring plug should be connected with the SP socket (Figure 49, b), then the CB compartment door shall be closed and CB shall be opened. The racking mechanism is operated by fitting the operating handle onto the square head and turning the handle clockwise according to the sticker until the stop position is reached and the WU is in the service position (service position of ISMD is in Figure 50).

After that the CB is unlocked electrically and mechanically and it can be closed.

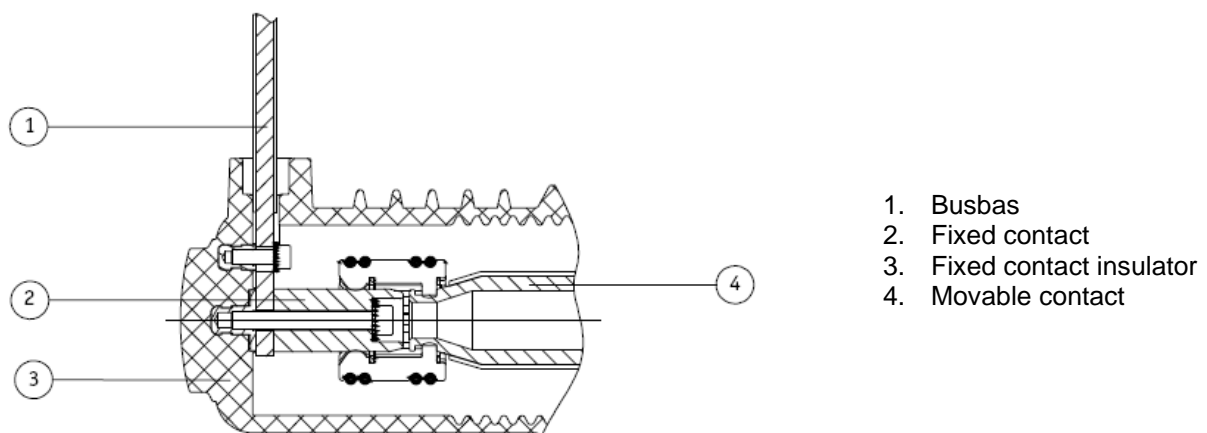


Figure 50
ISMD is in the service position

Before withdrawal from the service position into the test/disconnected position the CB shall be opened. Withdrawal shall be done by turning the handle counterclockwise according to the sticker until the stop position is reached and the WU is in the test/disconnected position.

Before withdrawal from test/disconnected position onto the service trolley, the CB compartment door shall be opened, control wiring plug shall be released and engaged in its storage position on the WU.

After the service trolley is engaged with the switchgear panel, the WU shall be released by moving sliding handles inwards against the springs, withdrawn onto the service trolley and secured on it using catches.

More detail information about ISMD is in document “DW810313 (Addendum)”.

Notes:

7 MAINTENANCE

The maintenance frequency is determined by the user and depends on various operating conditions. At least carry out the inspection every 4 years.

Provide for a free operation of the switchgear according to the five safety rules. Failure to do so could result in death personal injury or electrical shock



First step of the maintenance work is the visual inspection of the surfaces of DW-2 switchgear and the switching devices on dirt, corrosion or humidity. If there is any non-conformity, like heavy oxidation or damage caused by overheating, contact your supplier or SGC - SwitchGear Company.

After the visual inspection carry out following steps if necessary:

- Remove dust and dirt from the insulation components of the switchgear with a soft dry cloth.
- Do not use detergents as sprays, pastes and other solutions. They can damage the insulating surfaces.
- For sticky dirt Ethanol F 25 M might be exceptionally be used. After using Ethanol wipe the parts off with clear water and dry carefully.
- If the lubrication of the contact system is disappeared or insufficient, clean it well but carefully and lubricate it with Isoflex Topas NB52.
- If there is a block in the mechanical movement parts (f.e. shutter sheets, interlocking) treat them with creeping spray oil.

After maintenance some test operations should be performed before setting the switchgear to work.



Notes:

8 TECHNICAL DATA

8.1 Technical specification

Rated voltage, kV	12
Rated feeder current, A	630 1250
Rated busbar normal current, A	1250
Rated frequency, Hz	50, 60
Rated power-frequency test voltage on the main circuit, kV, 1 min	42
Rated power-frequency test voltage on secondary circuits, kV, 50 Hz, 1 min	2
Rated impulse voltage, kV	75
Partial discharge decay voltage level, kV, not less than, (at 10pC)	13.2
Rated short-time withstand current, kA	31.5
Rated duration of short-circuit, s	4
Rated peak withstand current, kA	82
Internal arc withstand current (1s), kA	31.5
Internal Arc classification IAC	AFLR 31.5 kA 1s
Degree of protection	IP4X
Maximum ambient temperature, oC	+40
Minimum ambient temperature, oC	-5/-15 *
Maximum altitude above sea level, m	1000**
Maximum relative humidity	95%
Maintenance	Front access
Availability class	LSC2B
Partition class	PM
Dimensions (WxDxH), mm	650/800x1260x2200 (2260)
Distance between poles, mm	150/210
Weight, kg	760***

* Temperature on request with additional heating. Depending on requirement temperature the technical requirements to the cables, spring washers, LV equipment might be tougher. Material of these components shall be applicable for work by mentioned by user temperature. This option shall be defined by user at the stage of ordering.

** For installations at altitudes higher than 1000m, the insulation withstand level of external insulation at the service location has to be decreased by multiplying the rated insulation levels by a factor Ka in accordance to IEC 62271-1.

*** Weight of the panel with maximum possible arrangement.



Notes:

9 LEGAL INFORMATION

9.1 Warranty

Unless otherwise stated in the contract, the warranty period is 12 months or maximum 18 months after delivery. If agreed to otherwise, the contract conditions apply. No warranty is given in the case of ...

- a) ... the warranty period having run out during the period of storage with the customer.
- b) ... the operating conditions, ambient conditions, transport and storage conditions have not been adhered to according to the application description or the Installation and Operating Instructions.
- c) ... an unauthorized manipulation of the device has been carried out, such as opening the housing or damaging the seal.
- d) ... the device has not been properly installed, such as incorrect connection voltages.

9.2 Quality regulations

All manufacturing facilities of the company have been certified by KEMA and DEKRA in the Netherlands and comply with (DIN EN) ISO 9001:2008 and ISO 14001:2004.

All technical data of the vacuum circuit breaker are stored in an electronic database for each step of the manufacturing process. Testing of the circuit breakers is carried out in accordance with the relevant standards and beyond that the following test are carried out:

- 1000 C-O cycles
- Insulation strength of the primary and auxiliary circuits
at operating frequency
- Measurement of the resistance of the main circuit
- All test results are automatically stored



9.3 Complaints and transport damage

All products are shipped exclusively with original packing to ensure safe transport and avoid transport damage (see Packing, Goods Received).

SGC - SwitchGear Company will not accept any claims for damages caused by improper transport, storage as well as unpacking. Transport damage must be reported in writing to the supplier as soon as it is discovered. A period of maximum 3 weeks after receipt is allowed for this.

For legitimate claims SGC - SwitchGear Company will supply replacement equipment free of charge according to our warranty regulations. SGC - SwitchGear Company reserves the right to verify any claim.

9.4 Environmental friendliness

The modules are manufactured from environmentally friendly material. Therefore, special disposal is not required.

9.5 Liability

Damages and demands for reimbursement of expenses incurred by the customer (in the following: compensation) for what-ever legal reasons, especially due to non-compliance of obligations of the contractual obligations and for unauthorized actions, are excluded. This does not apply, insofar as there is a compulsory liability such as according to the product liability law in cases of malice, gross negligence, because of damage to life, the body or health, because of damage to important contractual obligations.

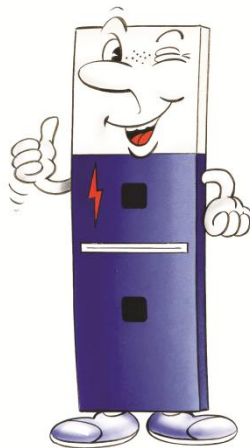
Compensation for damage to important contractual obligations, however, is limited to the damage which can be predicted as typical of the contract insofar as there is no malice or gross negligence, because of damage to life, the body or health. A change of the obligation to provide proof to the disadvantage of the customer is not connected with these regulations.

9.6 Copyright

Without our written permission, this documentation may not be used, also not in extract form, for own general publications, printouts, handbooks, training, lectures, etc. nor copied and further processed. This includes also the duplicating or re-copying in any form of data carriers and microfilms. A one-time written permission is not automatically to be taken as a part or complete surrender of the copyright provisions. We reserve the right to changes. The issue of a new version of these operating instructions renders all other older versions obsolete. SGC - SwitchGear Company and its associated companies make every effort to adapt the contents of their documentation to the latest and most current state of development of the products.

The present documentation was produced with the greatest care. However, we are not liable for possible errors in this information text, user-side incorrect interpretation and/or for consequences arising therefrom.

Notes:



MEDIUM VOLTAGE SWITCHGEAR, BUILT TO LAST

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