ELECTRIFICATION SERVICE

I_s-limiter™ panel

Installation, operation and maintenance manual

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ABB's I_s-limiter™ panel is a three-phase, metal enclosed, air-insulated switchgear and all units are factory-assembled, type tested and suitable for indoor applications up to 40.5 kV. The panels are fitted with I_s-limiter™ switch inserts as fixed installation along with CTs & busbars.

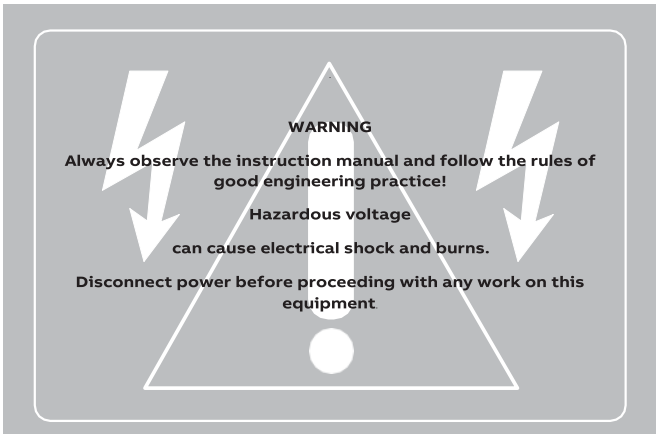
Your safety first - always!

That's why our instruction manual begins with these recommendations.

- Keep this installation, operation and maintenance manual accessible to all personnel involved in installation, operation and maintenance
- Ensure that the switchgear and accessories are stored in a closed room free of dust and moisture till erection
- Ensure installation of switchgear and/or switchboard in closed rooms suitable for electrical equipment
- Ensure that installation, operation and maintenance are carried out by only trained, qualified and authorized personnel
- Fully comply with the legally recognized standards (IEC or local), regulations of the local electrical authority and stipulated safety requirements
- Ensure that activities related to switchgear are carried out as per relevant instructions and guidelines given in this manual, and applicable local safety standards and work practices
- Ensure that operating conditions are within the specified operating limits
- Pay special attention to the hazard notes in the instruction manual marked with this warning symbol

Danger!

- Do not exceed the loads quoted in the technical data of the specification in normal operation of the switchgear or switchboard
- Keep the instruction manual accessible to all persons concerned with installation, operation and maintenance
- Always follow this installation, operation and maintenance manual and respect the rules of good engineering practice
- Hazardous voltage can cause electrical shocks and burns
- Disconnect power, then earth and short circuit connection before proceeding to work on the switchgear
- Do not override safety interlocks, either electrical or mechanical, during operation and/or maintenance
- The user’s personnel are to act responsibly in all matters affecting safety at work and the correct handling of the switchgear



If you have any further questions on this instruction manual, the members of our field organization will be pleased to provide the required information.

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1. Summary

1.1 General

ABB's I_s-limiter™ panel is a three-phase, metal enclosed, air-insulated switchgear and all units are factory-assembled, type tested and suitable for indoor applications up to 40.5 kV. The panels are fitted with I_s-limiter™ switch inserts as fixed installation along with CTs & Busbars.

This Manual does not contain any instruction relevant to customer specific documents. Details of the technical design and equipment of individual switchgear, such as technical data, detailed component lists for the individual panels, detailed wiring diagrams etc. can be found in the relevant order documents.

1.2 Standards and specifications

The I_s-limiter™ switchgear complies with standard and specifications prescribed on IEC publications 62271-200 and 62271-1 for factory-assembled, metal enclosed, and type tested high voltage switchgears.

Additionally, the switchgear offers IP4X degrees of protection for the enclosure as prescribed by the IEC publication 60529.

All other corresponding IEC publications, national and local safety at work regulations and safety regulations for production materials must be followed during erection and operation of these systems. The order related details provided by ABB are also to be taken into account.

1.3 Operating conditions

1.3.1 Normal operating conditions

The switchgear installations are fundamentally designed for the normal operating conditions for indoor switchgear and switchboards in accordance with IEC Publication IEC62271-200. The following limit values, among others, apply:

Ambient temperature:

- Maximum:+ 40°C
- Maximum: 24-hour average+ 35°C
- Minimum: (according to "minus 5 indoor" class) - 5°C

With indoor installation, it is assumed that the humidity within the enclosure can reach high values, but that there is normally no condensation on the equipment installed. Condensation can be prevented by appropriate design of the station building or switch room.

The maximum altitude at which the unit may be installed is 1000 m above sea level.

1.3.2 Special operating conditions

The manufacturer must be consulted in advance for special operating condition.

For example:

- At site altitudes over 1000 m, the insulation level must allow for the reduction in the dielectric strength of the air
- Any increased ambient temperatures must be taken into account in the design of the busbars or their current carrying capacity will be limited

Notes on special climatic operating conditions:
When operating switchgear in climates with high humidity and/or major rapid temperature fluctuations, there is a risk of dew deposits, which has to remain an exceptional condition for indoor switchgear under normal operating conditions. Preventive measures (e.g. suitable ventilation and proper air conditioning of the building or housing, use of dehumidifying equipment, etc.) must be taken into consideration in consultation with ABB to avoid this condensation phenomenon and any resulting corrosion or other adverse effects.

2. Technical data

2.1 I_s-limiter™ panel

Electrical data

Particulars	Unit		Ratings	
Rated voltage	kV	12	36	40.5
Rated power frequency withstand voltage	kV	28	70	85
Rated lightning impulse withstand voltage	kVp	75	170	180
Rated frequency	Hz	50	50	50
Rated current of busbars	A	1250, 2000, 2500, 4000[1)]	1250, 2000, 2500[1)]	1250, 2000, 2500[1)]
Peak withstand current	kAp	130	104	104
Rated short-time current 1s	kA	50	40	40
Rated control supply voltage	V	DC 110, 220; AC 110, 220	DC 110, 220; AC 110, 220	DC 110, 220; AC 110, 220

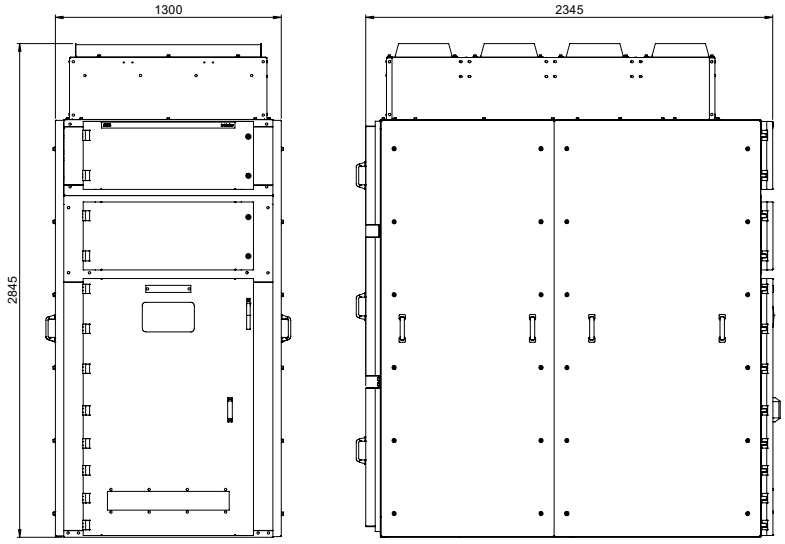
[1)] With cooling fan installed in panel

Dimensions and weight

Dimensions		
Height	mm	2845[1)]
Width	mm	1300[2)]
Depth	mm	2345
Weight including I_s-limiter™ switch (approx.)	kg	2200-2400

[1)] Including absorber assembly. Without absorber assembly 2610

[2)] Including end covers



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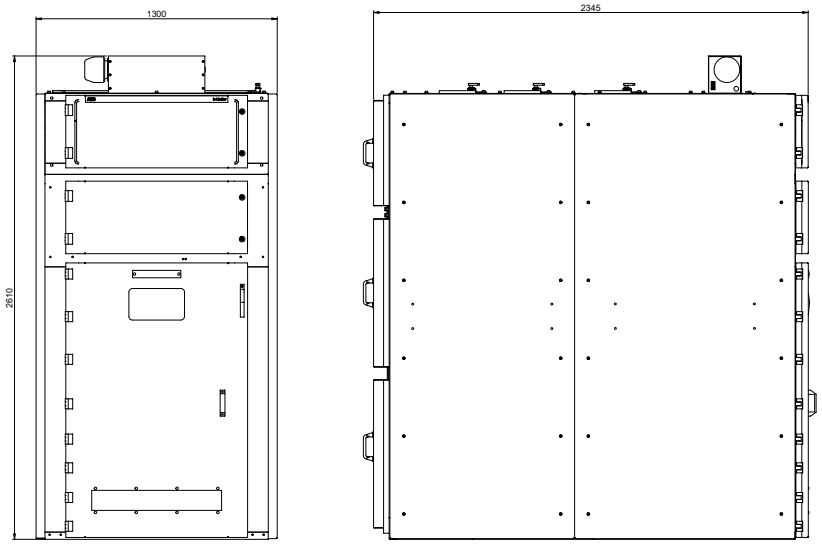
Overall dimension of panel with absorber assembly



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Overall dimension of panel without absorber assembly

2.2 I_s-limiter™ switch

Electrical data

Rated voltage	Rated current	Rated power frequency withstand voltage	Rated lightning impulse withstand voltage	Weight (approx.)	
				I_s-limiter™ insert holder	I_s-limiter™ insert
kV	A	kV	kVp	Kg	Kg
12	1250, 2000, 2500, 4000[1)]	28	75	65	15.5
36	1250, 2000, 2500[1)]	70	170	60	42
40.5	1250, 2000, 2500[1)]	85	180	60	42

[1)] With cooling fan installed in panel

2.3 Tripping device and auxiliary circuits

Electrical data

Device	Power consumption[1)]		Rated supply voltages	
	AC VA	DC W	AC (f=50/60Hz) V	DC V
Tripping device	100	80	110, 240	110, 220
Auxiliary circuits (indicators, auxiliary relays)	–	80	–	110, 220
Auxiliary circuits (Space heaters, interlocking solenoid)	400	–	240	–

[1)] approximate values

3. Panel structure and components

3.1 Basic structure

(Figures 3.1 to 3.4)

The basic design of the panels comprises the stationary enclosure structure parts made from Aluzinc sheet.

The I_s-limiter™ holder assembly is fixed inside panel enclosure on steel frame which is supported with structure. At the bottom of the I_s-limiter™ holder assembly copper contacts are provided for incoming cable connections which are supported by support insulator on steel channel which in turn is fixed with panel structure. At the top side (i.e. outgoing side) T contact is provided which on one side is fixed with I_s-limiter™ top contacts & other side of it, the jumpers are connected.

The outgoing cable connections are provided at rear side below CT.

Panels with I_s-limiter™ are designed for the following applications amongst others:

- feeding into existing systems (transformer or generator feeders)
- coupling between power systems
- bridging of short-circuit current limiting reactors in transformer or generator feeders

The I_s-limiter™ panels can be supplemented by additional panels (circuit-breakers, disconnectors, cable terminal and surge arrestor panel)

Further details on the structure of and equipment in the switchgear can be found in the relevant order documents.

3.2 Enclosure

The panel enclosure consists of Aluzinc steel sheets which are rivetted to each other. The roof of the high voltage compartment is fitted with integrated pressure relief devices. These devices open when overpressure occurs as a result of an internal arc fault. The front is sealed off by flame- proof doors with hinges at the left and an opening angle of approx. 180^0. At rear side, there are rear covers provided to have access to the CTs & other components which are mounted at rear side of the panel. LV compartment containing the tripping device can be assembled separately as a self-supporting sheet-steel enclosure. It is separated and protected from the high voltage area.

If an internal arc fault occurs, the auxiliary switches 3, controlling the pressure relief devices (figure 5.3a) achieve I_{th}-limitation by un-delayed release.

The panel doors are made of high-quality steel sheets, which undergo thorough cleaning through 7 tank process before powder coating. The finishing coat is of standard RAL 7035 color shade. (Special color shades on request and by mutual agreement).

3.3 Construction of panels

I_s-limiter™ fixing
(Figures 3.2a and 3.2b)

The I_s-limiter™ holders are fixed on the steel frames with hex. socket cap screws. These two steel frames are firmly connected with the panel structure with L type frames at both left & right side of the panel side walls.

The I_s-limiter™ inserts are inserted in the fixed contacts of the insert holder & then clamped securely either by proper hardware (for 12kV) or by rotating handle clockwise at top & bottom of holder (in case of 36kV and 40.5kV).

The copper contacts for incoming cable connections are connected to bottom of the I_s-limiter™ assembly which are supported by insulator support. At the out-going side of the I_s-limiter™ assembly, the jumpers are connected.

The jumpers at other end are connected to CT incoming side. These jumpers are having insulator support at top of the panel & at front of the panel above I_s-limiter™ Inserts.
The outgoing cables are connected to the copper contacts which are connected to the jumpers coming from CT outgoing side.

In case of 36kV and 40.5kV rated panel, insulating phase barriers are provided between each I_s-limiter™ and between phases at rear side. Phase barriers are fixed with steel frame with bracket. At bottom side, phase barriers are supported on barrier support. No phase barriers are provided for 12kV rated panel.

LV or tripping cabinet
(Figures 3.1a, 3.5 and 3.6)

LV compartment contains the tripping device for the I_s-limiter™ and the secondary equipment in the panel required for the particular application.

The control wiring is led through generously dimensioned metal covered ducts in the panel area. The left-hand duct is reserved for the incoming and outgoing control wiring.
The internal panel wiring is located on the right-side duct.

Warning! 
In order not to alter the electromagnetic compatibility (EMC) of the tripping device, no additional wiring may be installed parallel to the following connections or laid in the conduits later date:

- connection between the movable hinged frame (where the tripping device is located) and the anti-interference unit
- connections between tripping current transformers and clamps
- connections between pulse transformers and clamps

3.4 Interlocks/protection against maloperation

In order to avoid hazardous situations and maloperation, a series of interlocks are provided to protect personnel and the switchgear.

The normally effective interlocks are as follows:
- The front door of the I_s-limiter™ panel can only be opened when series connected circuit breaker or disconnector is in open condition. (electromechanical interlock)
- The rear covers (3 Nos.) can only be opened when series connected circuit breaker or disconnector is in open condition (electromechanical interlock)
- The series connected circuit breaker can only be closed when the I_s-limiter™ switch is ready for operation & has not tripped (electromechanical interlock).
- If the I_s-limiter™ trips, the series connected circuit-breaker or disconnector must also be opened.
- Details of any further interlocks can be found in the relevant order documents for the individual installation.

3.5 Functions of the I_s-limiter™ components

The I_s-limiter™ is a high-speed switching device with a current-limiting effect. The I_s-limiter™ is tripped and the short-circuit current limited at the first rise in short-circuit current. The maximum asymmetric short-circuit current flowing through the I_s-limiter™ is thus limited.

Please consult the detailed special publications or the ABB I_s-limiter™ brochure for the technical processes involved in short-circuit limiting and for examples of the I_s-limiter™ use.

I_s-limiters basically comprise the following:
- I_s-limiter™ insert holder
- I_s-limiter™ insert
- Tripping current transformer
- Tripping device

3.5.1 I_s-limiter™ insert holder

(Figures 3.7 and 3.8)
Two insulators 5.1 and 5.2 for each phase are located on holder metal bracket 9. The insulators support the pole heads 4.1 & 4.2 with clamping device into which the I_s-limiter™ insert assembly 2 is inserted. Insulators (for 36kV and 40.5kV) are fitted with a pulse transformer. This transmits the tripping pulse from the tripping device to the charge 3 in the I_s-limiter™ insert tube and at the same time serves to isolate the tripping device electrically from the charge at system potential.

The telescope contacts 7 are located on the insulators fitted with pulse transformers.

The clamping device is activated by a lever on pole head. The I_s-limiter™ insert is held in the jaw contacts of the insert holder with the help of lever.

For testing of the pulse transformer, see the notes in section 6.6.2.

3.5.2 I_s-limiter™ insert

(Figures 3.7 and 3.8)
The I_s-limiter™ insert is the switching element. The insert contains the main conductor 6 in a sturdy insulating tube 10 in the form of single/ double/triple bursting bridge 1 each containing one charge 3. When tripping occurs, the charge is activated, and the main conductor is broken at the rupture joint of bursting bridge.

The current commutates to the parallel high voltage high rupturing capacity fuse (HV fuse) 11. The fuse element of the HV fuse blows and limits any further current rise. The current is zero at the next voltage zero.

3.5.3 Tripping current transformers

(Figure 3.5)

The tripping transformers 9 are current transformers which are installed in series with the I_s-limiter™ and serve to measure the current flowing through the I_s-limiter™.

From the outside, the I_s-limiter™ current transformers cannot be distinguished from conventional transformers. The particularly notable characteristics of the special transformer are:

- an extremely high overcurrent factor
- an iron core with air gap to keep remnant induction low
- a low resistance shield between the primary and secondary sides

3.5.4 Tripping device

(Figure 3.1a)

The tripping device 11 is installed in the separate low voltage compartment above the I_s-limiter™ compartment.

For details of the tripping unit type QR6 & Test Procedure please refer separate manual GCEA670650 P0102 Rev 01 .

Note: In some cases, tripping unit is supplied in separate floor mounted steel cabinet, depending on customer requirement & floor space availability.

1 Enclosure assembly
2 LV box door
3 Glass window
4 Main panel door
5 Handle
6 Door hinges
7 Side sheets
8 Vertical L support
9 I_s limiter™ fixing steel frame
10 Top channel for support insulator
11 QR6 tripping device

Fig 3.1a – Panel structure assembly

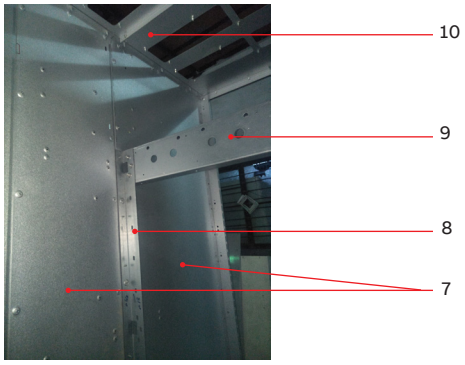
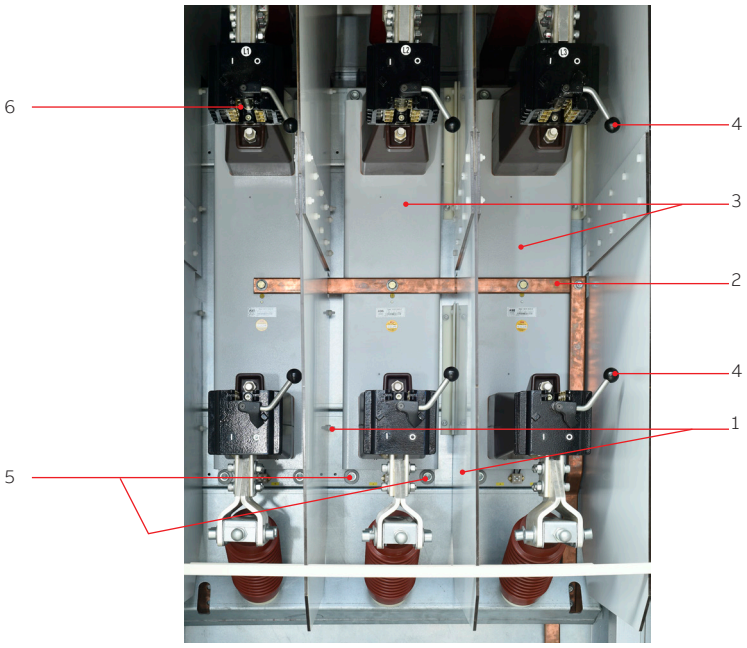


Fig 3.1b – Panel enclosure - inside view

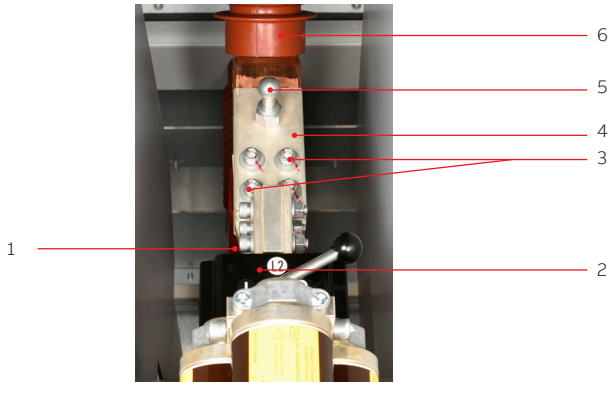


1 Phase barriers
2 Earthing strip
3 Is limiter™ holder assembly
4 Handle for locking
5 Hardware for insert holder
6 Jaw type fixed contact

Fig 3.2a - Insert holder mounting - 36kV and 40.5kV

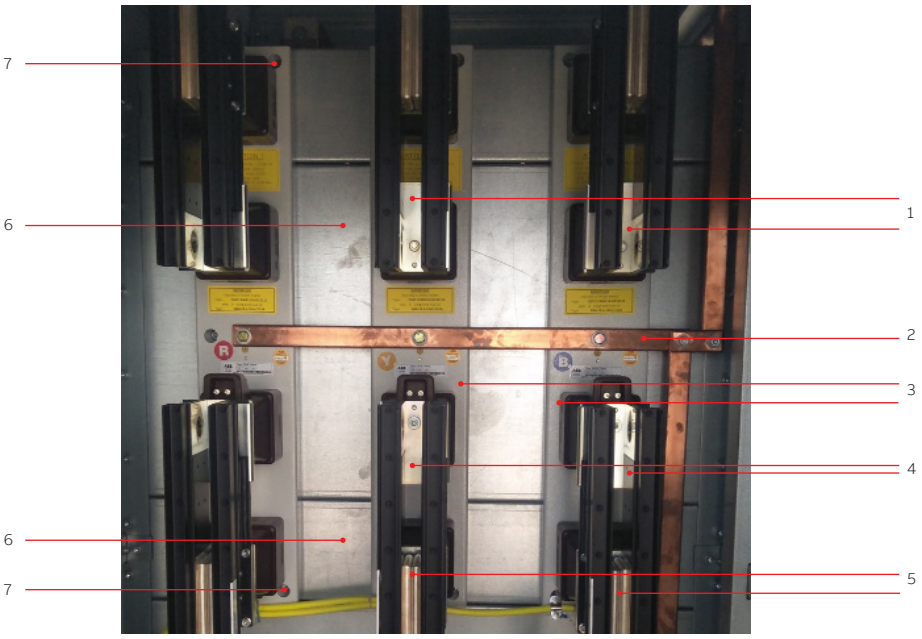
1 Contacts for cable connection
2 Support insulators
3 Steel channel
4 Locking handle
5 Fuse assembly
6 I_s-limiter™ insert

Fig 3.3a – Insert mounting - 36kV and 40.5kV



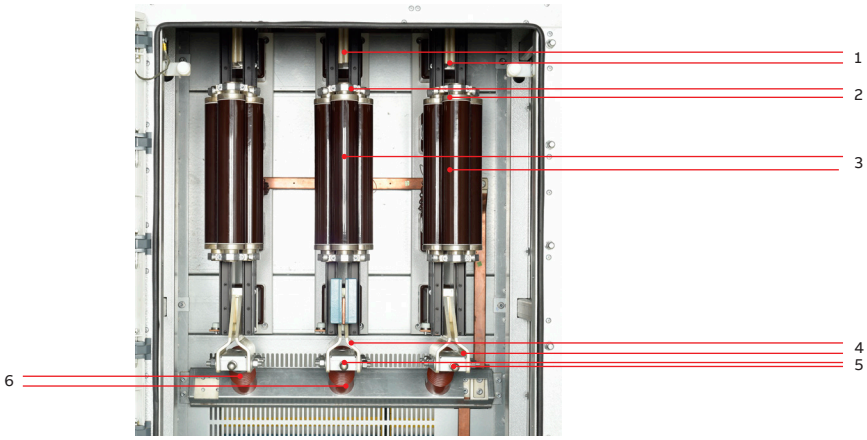
1 T contact
2 I_s limiter™ top side
3 Hardware
4 Jumpers
5 Earthing bolt
6 Insulator support

Fig 3.4a - Top side connection. I_s-limiter™ assembly-36kV



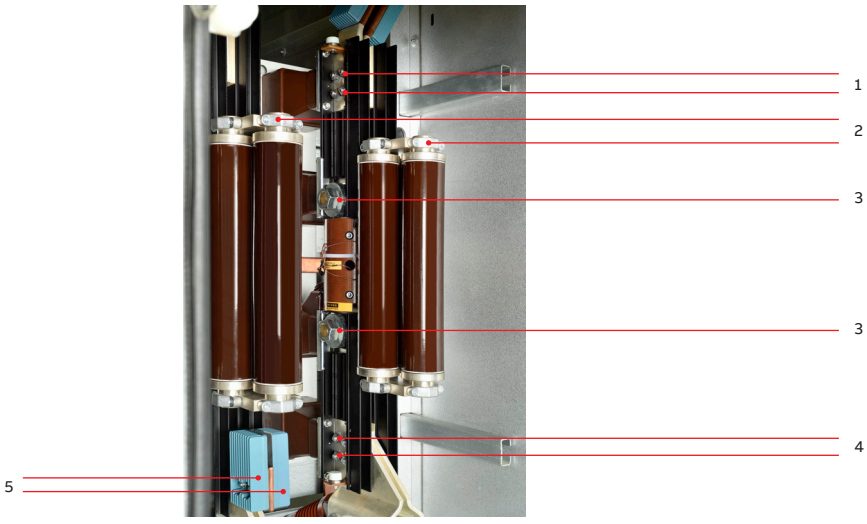
1 Top fixed holder contact
2 Earthing strip
3 I_s limiter™ holder assembly
4 Bottom fixed holder contact
5 Incoming cable connection
6 Steel channel
7 Hardware for mounting insert holder

Fig 3.2b - Insert holder mounting - 12kV



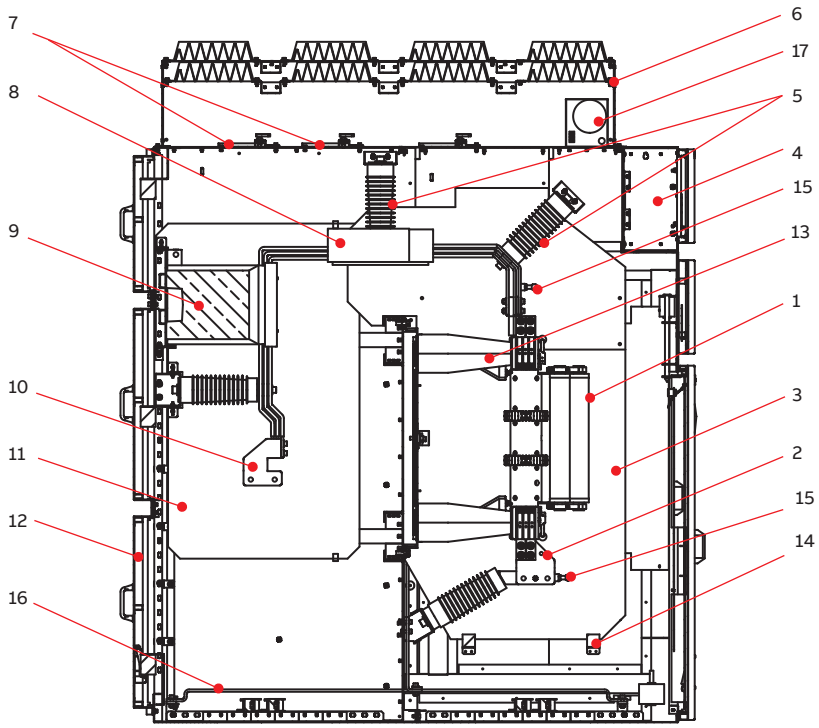
1 Top jumpers
2 I_s limiter™ insert assembly
3 Fuse assembly
4 Incoming cable connection
5 Earthing bolt
6 Insulator support

Fig 3.3b - Insert mounting-12kV



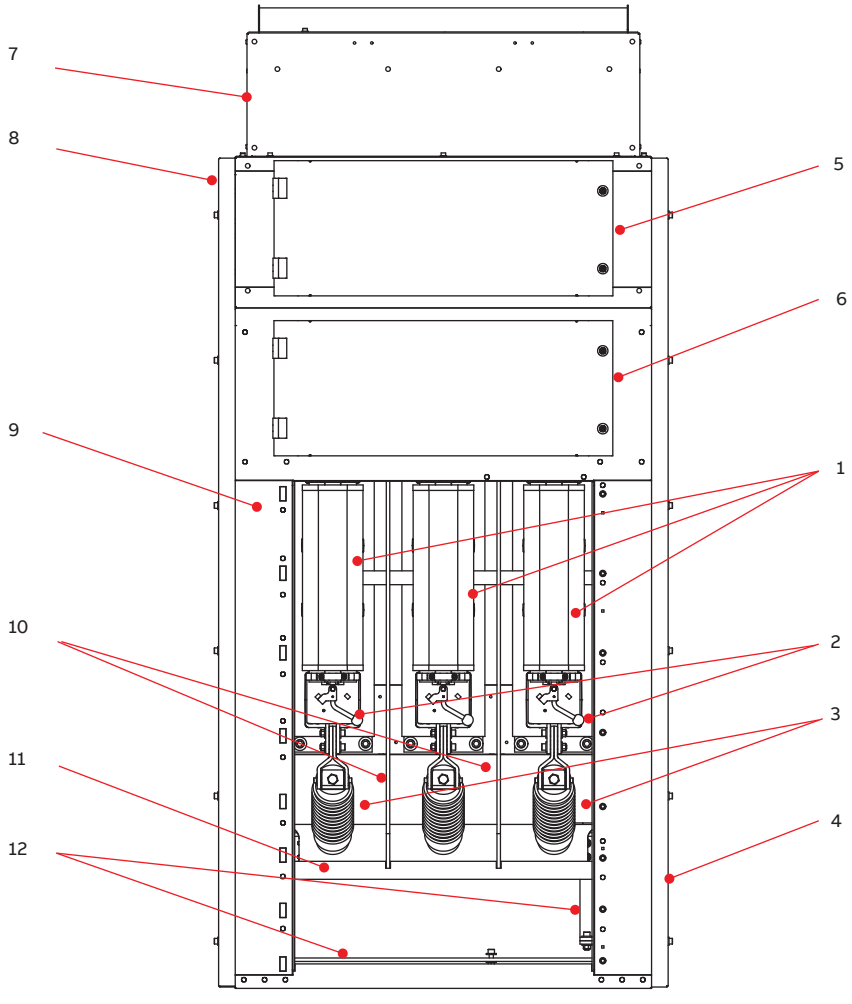
1 Hardware for insert top connection
2 I_s limiter™ insert assembly
3 Nut for heat sink bolt
4 Hardware for insert bottom connection
5 Heat sink

Fig 3.4b - Insert mounting-12kV



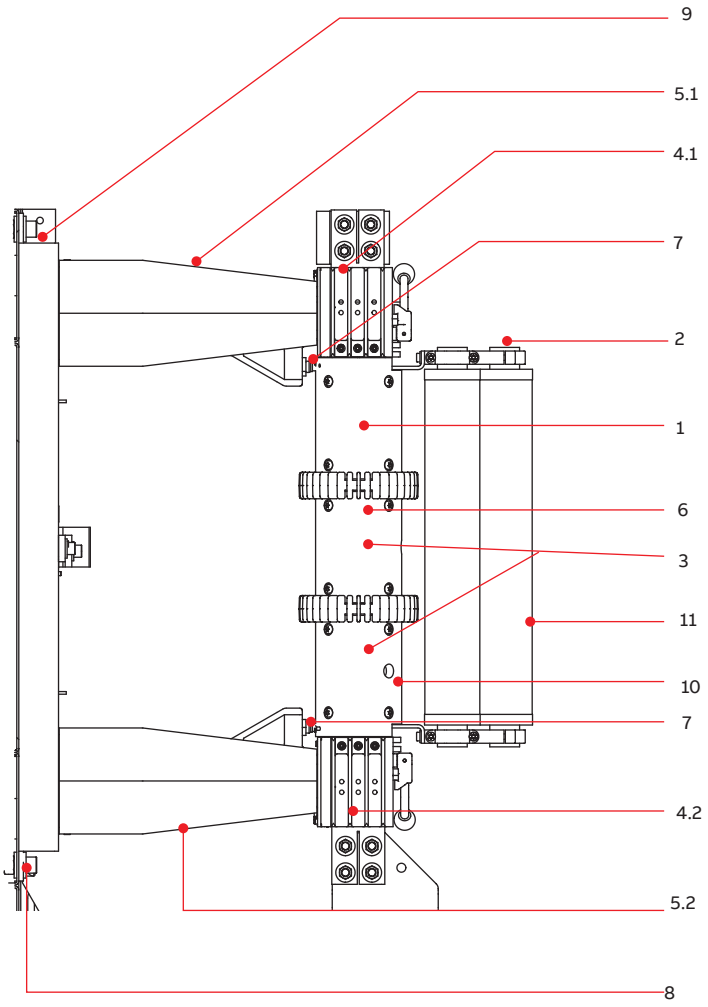
1 I_s-limiter™ insert
2 Contacts for incoming cable connection
3 Phase barrier front
4 LV compartment
5 Support insulators
6 Absorber assembly
7 Explosion vents
8 Shrouds
9 Current transformer
10 Contacts for O/G cable connection
11 Rear phase barrier
12 Rear cover
13 I_s-limiter™ insert holder
14 Phase barrier supports
15 Earthing bolt
16 Earthing bar
17 Cooling fan

Fig 3.5 - Cross section view



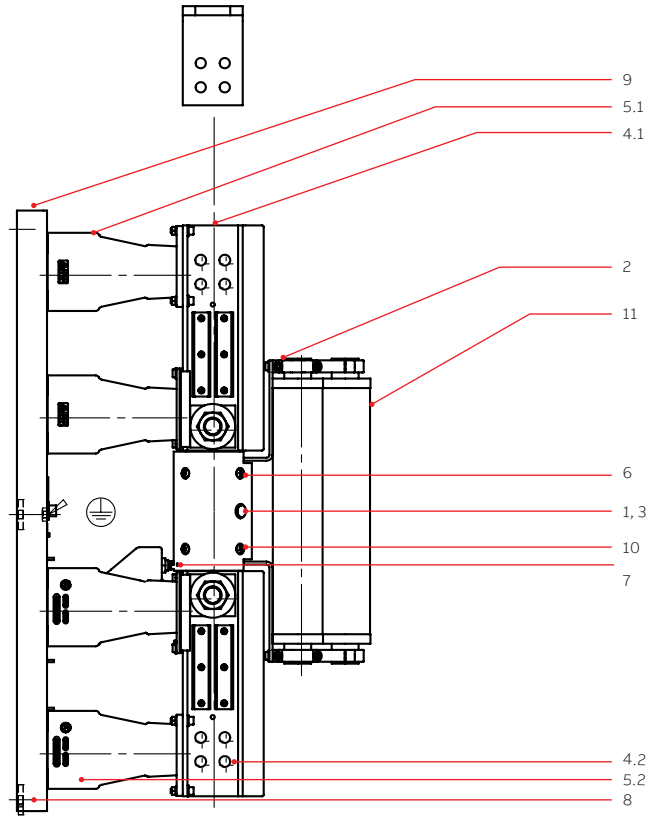
1 I_s-limiter™ insert R Y B phase
2 Lever for clamping
3 Insulator support
4 Right side cover
5 LV compartment door
6 Dummy door
7 Absorber assembly
8 Left side cover
9 Structure assembly
10 Phase barrier
11 Phase barrier support
12 Earthing bar

Fig 3.6 - Front view with door open



1 Bursting bridge
2 I_s-limiter™ insert assembly
3 Charge
4.1 Top pole head
4.2 Bottom pole head
5.1 Top insulator
5.2 Bottom insulator
6 Main conductor
7 Telescopic contact
8 Mounting hardware
9 Mounting bracket
10 Insulating tube
11 Fuse

Fig 3.7 - Is-limiter™ assembly-36kV and 40.5kV



1 Bursting bridge
2 I_s-limiter™ insert assembly
3 Charge
4.1 Top pole head
4.2 Bottom pole head
5.1 Top insulator
5.2 Bottom insulator
6 Main conductor
7 Telescopic contact
8 Mounting hardware
9 Mounting bracket
10 Insulating tube
11 Fuse

Fig 3.8 - Is-limiter™ assembly-12kV

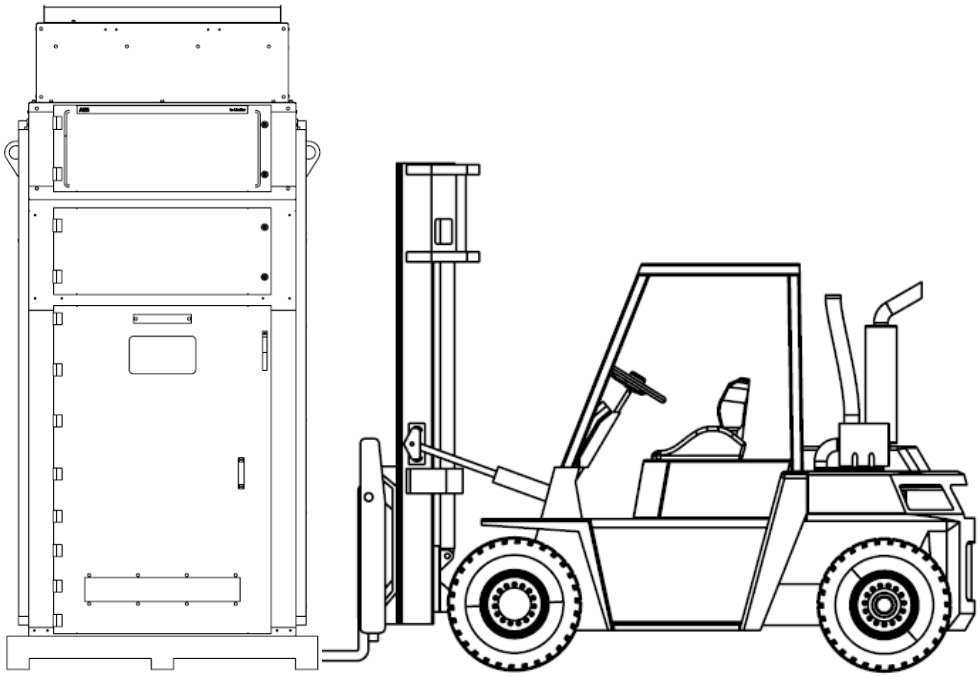


Fig 4.1 - Handling with forklift

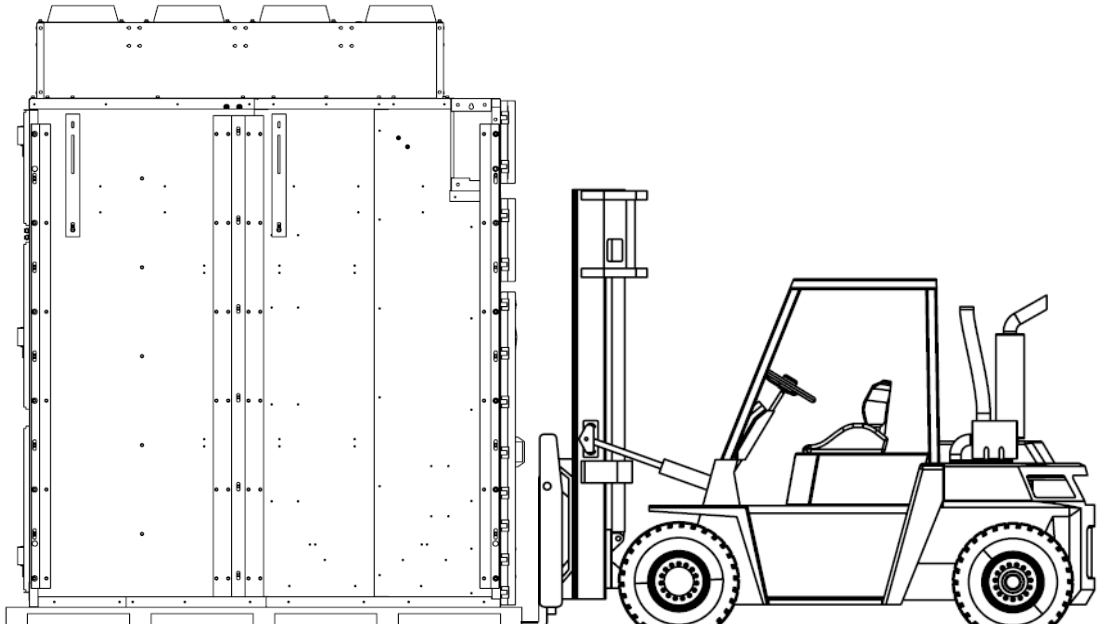


Fig 4.2 - Handling with forklift

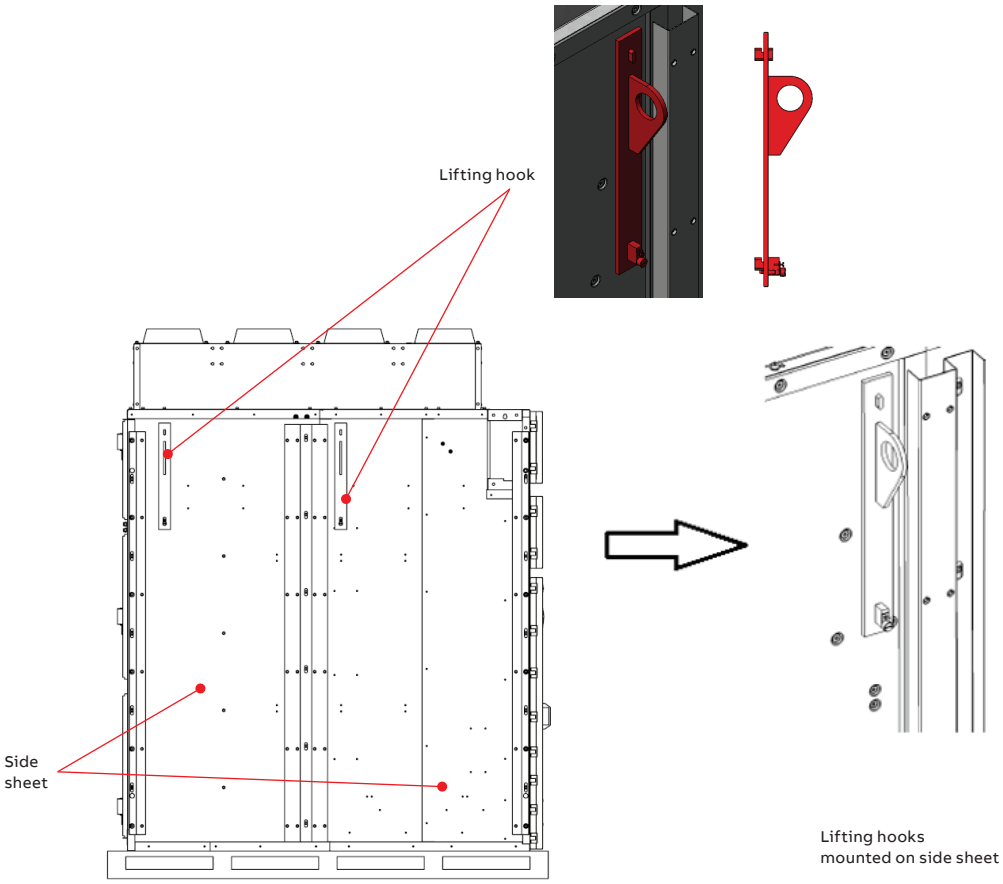


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Fig 4.3 - Mounting of lifting hooks

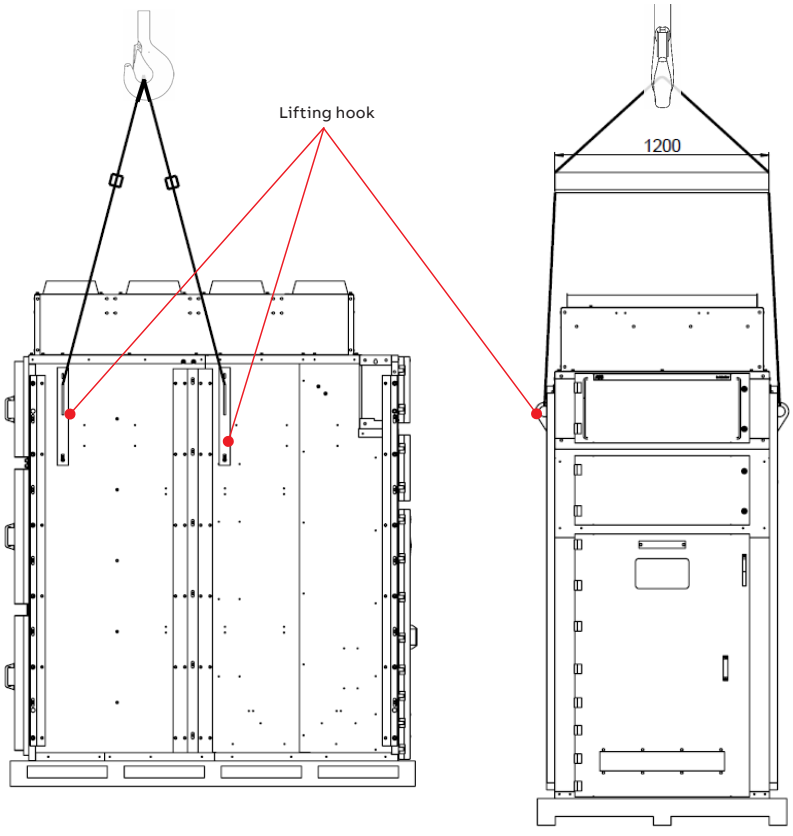

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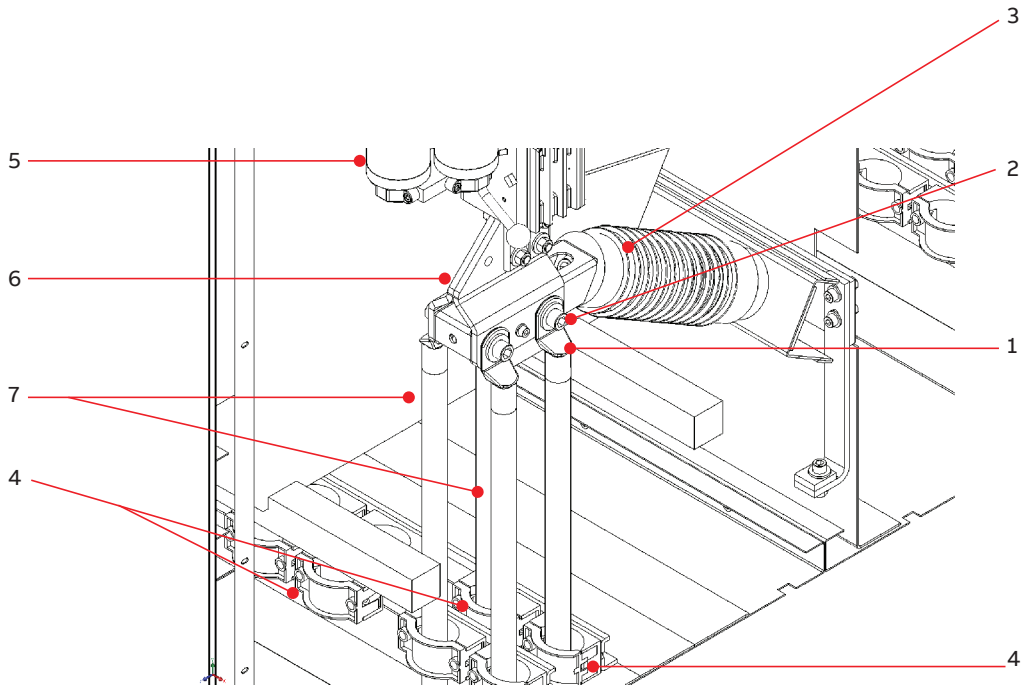
Fig 4.4 - Lifting with crane



1 Cable lug
2 Hardware
3 Insulator support
4 Cable gland
5 I_s-limiter™ assembly
6 Cable connection piece
7 Single core power cable

Fig 5.1 - Incoming cable connection

1 Cable lug
2 Hardware
3 Insulator support
4 Cable gland
5 Cable connection piece
6 Single core power cable

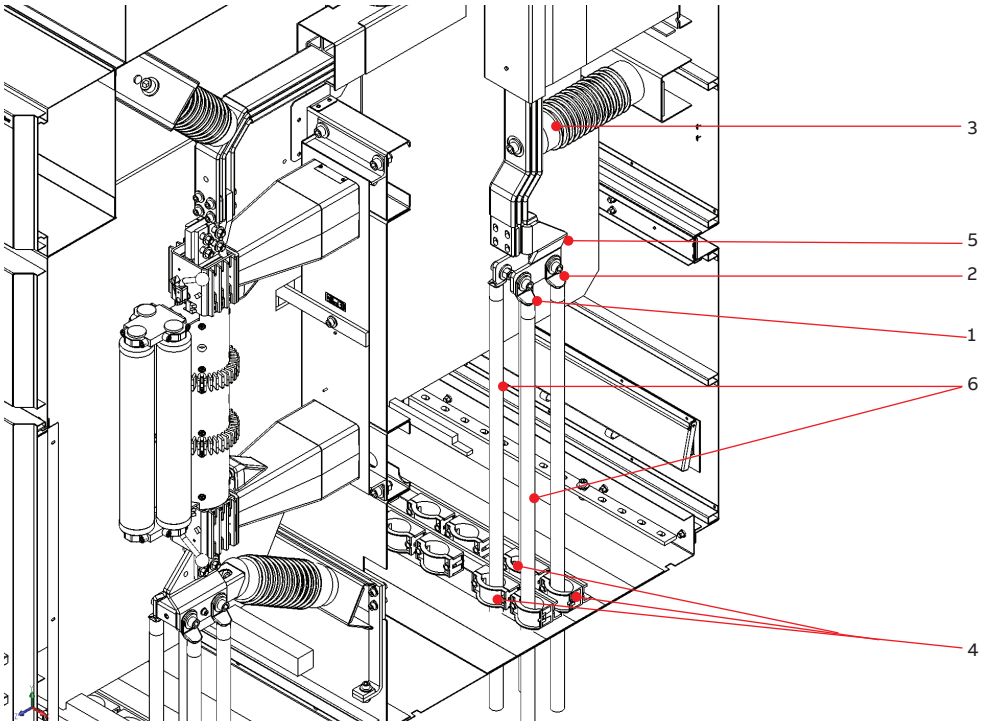
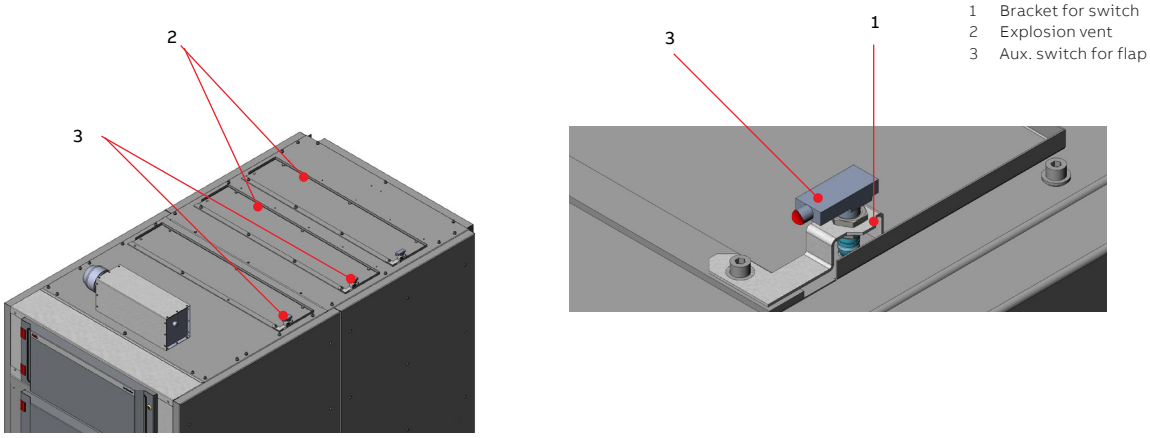


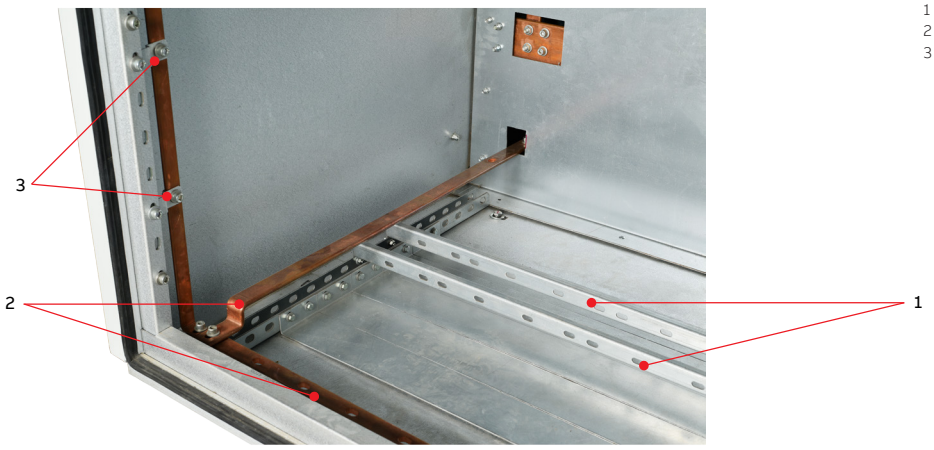
Fig 5.2 - Outgoing cable connection



1 Bracket for switch
2 Explosion vent
3 Aux. switch for flap

Fig 5.3a - Explosion vents and auxiliary switches for flap - 36kV and 40.5kV

Fig 5.3b - Explosion vents - 12kV



1 Cable support channels
2 Earthing bars
3 Earthing support

Fig 5.4 - Earthing bars & connections

4. Dispatch and storage

4.1 Condition on delivery

The factory assembled panels are dispatched without I_s-limiter™ inserts (Inserts are packed separately in separate special packing).

The panels are checked at the works for:
- completeness of the equipment installed
- with reference to the terms on customer order
- Prior to dispatch, panels are subjected to routine tests

4.2 Packaging

The I_s-limiter™ panels are packed for transport in following types:
- Panels with seaworthy packaging or similar (including packaging for containerized shipments):
  - Sealed in polythene sheeting
  - Transport drying agent bags included
  - Moisture indicator included
  - When aluminum composite sheeting is used, a sight window is fitted for checking
- Observe the directions for use of the drying agent bags
  The following applies:
  - Colored indicator blue: contents dry
  - Colored indicator pink: contents moist (relative humidity above 40%)

4.3 Transport

Figure 4.1-4.4
Normally, each individual panel is a separate transport unit. The panels are fixed on wooden pallet with bolts. The foundation frame for installation at site is packed separately during dispatch of panel for transport to customer site.

Following precautions must be taken during transport of the panels:
- Transport switchgears upright
- Take the high center of gravity into account
- Carry out loading operations only after ensuring that all precautionary measures to protect personnel and materials are taken
- Use crane, fork-lift truck and / or manual trolley jack

When performing loading work, take all necessary precautions to avoid injury and damage to the materials.
Loading must only be carried out with
- crane
- forklift and/or
- Trolley jack

Handling by crane:
- Use lifting ropes of appropriate load capacity with spring catches with eyebolt diameter of 30 mm
- Maintain a rope angle of 60° from the horizontal between the shackles and crane hook
- Hang the switchgear using all lifting hooks!

4.4 Delivery

The responsibilities of the consignee when the switchgear arrives at site include, but are not limited to, the following:

- Checking the consignment for completeness and freedom from damage (e.g. also for moisture and its detrimental effects). in cases of doubt, the packaging must be opened and then properly resealed, fitting new drying agent bags, when intermediate storage is necessary
- If any short quantities, defects or transport damages are noted:
  - To be documented on the respective shipping document
  - Notify the relevant carrier or forwarding agent immediately in accordance with the relevant liability regulations
- Note:
  Always take photographs to document any major damage

4.5 Unloading & unpacking

Unloading the switchgear from truck must be carried out by appropriate handling methods described in section 4.3.

Unpacking:

- Remove wrapping / plastic bag covers, cardboard pads etc.
- Open the compartment door and loosen the bolts fixing the switchgear to pallet
- Lift the switchgear by crane following instructions given below:
  remove the pallet
  position unloading shims
  put the switchgear on loading shims using crane

The packing is intended for transport and not for storing purpose. Upon receipt, the switchgear must be unpacked and installed under clean, dry, dust-free, indoor conditions and anti-condensation heaters shall be switched ON.

4.6 Intermediate storage

Optimum intermediate storage where it is necessary – without detrimental consequences depends on compliance with a number of minimum conditions for the panels and assembly materials

1. Panels with seaworthy or similar packaging with internal protective sheeting:
   - Store the transport units:
     - protected from the weather
     - in a dry place
     - safe from damage
   - Check the packaging for damage
   - Check the drying agent (see also section 4.2):
     - on arrival of the consignment
     - later at regular intervals
   - When the maximum storage period, starting from the date of packaging, has been exceeded:
     - the protective function of the packaging can no longer be guaranteed
     - take suitable action if intermediate storage is to continue

Note
 Do not walk on the roof of the panel (rupture points in pressure relief device)!

Note
For the panels which are stored for intermediate periods after unpacking, where panel is subjected to direct ambient / environmental conditions it is recommended to arrange auxiliary supply near panel & to keep heaters inside the panel ON to avoid condensation / dew deposits inside the panel.

5. Erection of the switchgear on site

In the interests of the best possible erection sequence, and to ensure a high-quality standard, local installation of the switchgear should only be carried out by specially trained skilled personnel, or at least responsibly managed and supervised.

5.1 General site requirements

At the start of erection,

- The switchgear room at site must be completely, finished
- Provided with lighting and power for the installation work
- Room shall be lockable and dry, and with good ventilation facilities
- All the necessary preparations such as wall openings, ducts, etc. for laying of the power and control cables must be completed
- The celling must be high enough for assembly of pressure relief duct
- It must be ensured that the conditions for indoor switchgear to IEC62271-1 etc., with temperature class “minus 5 indoor “are complied with

5.2 Foundation

The switchgear can be erected on a foundation frame embedded in the switch room floor, on a raised false floor, on a cable duct, in a pre-fabricated concrete substation or if necessary, directly on to the switch room floor.

Wherever there is requirement of cable box for additional cable termination height, care must be taken for proper accommodation of the cable box below panel.

5.2.1 Checking of foundation

Check the foundation with respect to foundation drawing supplied. The foundation frame on which switchgears are to be installed shall be properly leveled and level difference shall be less than 2 mm. Level is to be checked using an appropriate water level-based indicator. Ensure the good quality of welding and workmanship for fixing the foundation frame.

Make all necessary arrangements for effective earthing of the foundation frame with 40 X 4 mm galvanized steel strip. Two connections are necessary for relatively long switchgear.

5.2.2 Mounting of cubicle on foundation frame

As the switchgear delivered from factory is pallet mounted, it should be unloaded from pallet as close as possible to its foundation frame's location to ensure minimal movement of switchgear on the ground. Please ensure that the switchgear is vertical when mounted on its frame. If necessary, use shims to make the switchgear vertical. Once desired position of switchgear on foundation frame is reached, switchgear on the frame is to be welded to its foundation frame.

5.3 Erection of the panels

Figures 4.1-4.4
Use screws of tensile class 8.8. The tightening torques for the screw connections with dished washers are as follows:

Thread	Recommended tightening torque[1)2)] Nm	
	Lubricant[3)]	
	Without	Oil or grease
M 6	10.5	4.5
M 8	26	10
M 10	50	20
M 12	86	40
M 16	200	80
M 30[4)]	220[4)]	–

[1)] The rated tightening torques for fasteners without lubrication are based on a coefficient of friction for the thread of 0.14 (the actual values are subject to an unavoidable, partly not inconsiderable, spread).

[2)] Rated tightening torques for fasteners with lubrication in accordance with DIN 43 673.

[3)] Thread and head contact surface lubricated.

[4)] Applicable for 12kV I_s-limiter™ insert heat sink bolt & nut.

Take account of any tightening torques which deviate from the general table as stated in the detailed technical documentation.
It is recommended that the threads or head contact surfaces of the screws be lightly oiled or greased, to achieve a precisely defined rated tightening torque.

The individual installation stages are as follows:
- Transport the panels to the prepared assembly location in the order shown on the layout plan
- Remove the LHS & RHS side covers
- Mount the lifting brackets to both side sheet of the panel as shown in figure 4.3-4.4
- With the help of a crane, lift the panel from the ground at appropriate height
- Remove the wooden pallet at bottom of the pallet by unscrewing the nuts & bolts
- Place the panel on foundation frame precisely with the help of crane
- Once the desired position of panel on foundation frame is achieved, remove the lifting hook from panel side sheet
- Weld the panel base to the foundation frame
- Install side covers on both side of the panel

5.4 Fixing I_s-limiter™ inside the panel

Procedure for 36kV and 40.5kV I_s-limiter™ inserts
(Figures 3.1a, 3.2a, 3.3a, 3.4a)

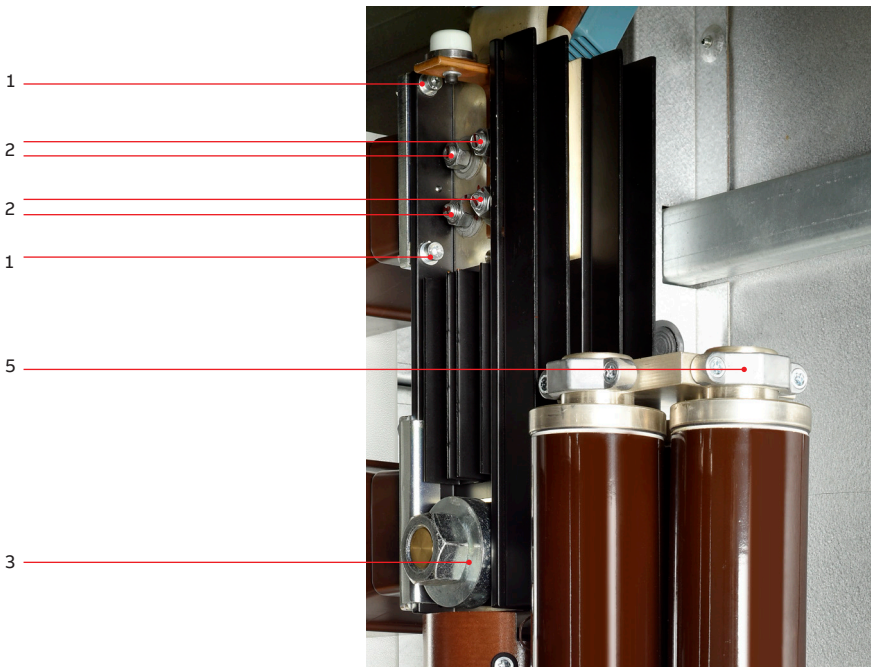
- Open the panel door
- Remove front polycarbonate shield
- Check the position of the rotating lever on the insert holder & turn the lever in anticlockwise direction to open the jaws of fixed contact. (both top & bottom)
- Unpack the I_s-limiter™ insert from plastic box
- Check the sticker for R Y B phase identification on the I_s-limiter™ insert
- Remove & lift the I_s-limiter™ insert & make entry in top & bottom fixed jaw of the holder assembly
- Push theI_s-limiter™ insert into the holder open jaws at top & bottom of the holder
- Once the face of the insert touches the back of the holder, lock the I_s-limiter™ insert at top & bottom of the jaw contact by turning the knob handle clockwise as shown in figure
- Repeat above 6 steps twice, to fix I_s-limiter™ insert of Y & B phases respectively

Procedure for 12kV I_s-limiter™ inserts
(Figures 3.1a, 3.2b, 3.3b, 3.4b, 5.5a, 5.5b)

- Open the panel door
- Remove front polycarbonate shield
- Check & loosen the allen, bolts & nuts at top & bottom contacts of holder to allow lateral movement for insertion of the contact of I_s limiter™ insert
- Remove heat sink bolt, special washer & nut from their position
- Unpack insert & remove all the paper wrapping from the box
- Check the sticker for R phase identification on the I_s limiter™ insert
- Lift the I_s limiter™ insert & make entry in top & bottom fixed contact of the holder assembly
- Lift the heat sink bolt & after sliding insert in the holder contact insert heat sink bolt through fixed holder contact & insert top contact
- Inert heat sink bolt through holder bottom fixed contact & insert bottom contact
- Put special washer & M30 nut on both heat sink bolts from other side
- Laterally move the top & bottom contacts of the holder to touch insert top & bottom contact surface respectively & tighten the bolts & nuts that were loosened in step 3 (Torque M6 size 10.5NM & M10 size 86NM)
- Apply torque of 220NM for heat sink nut
- Repeat above step for other 2 inserts for Y & B phase

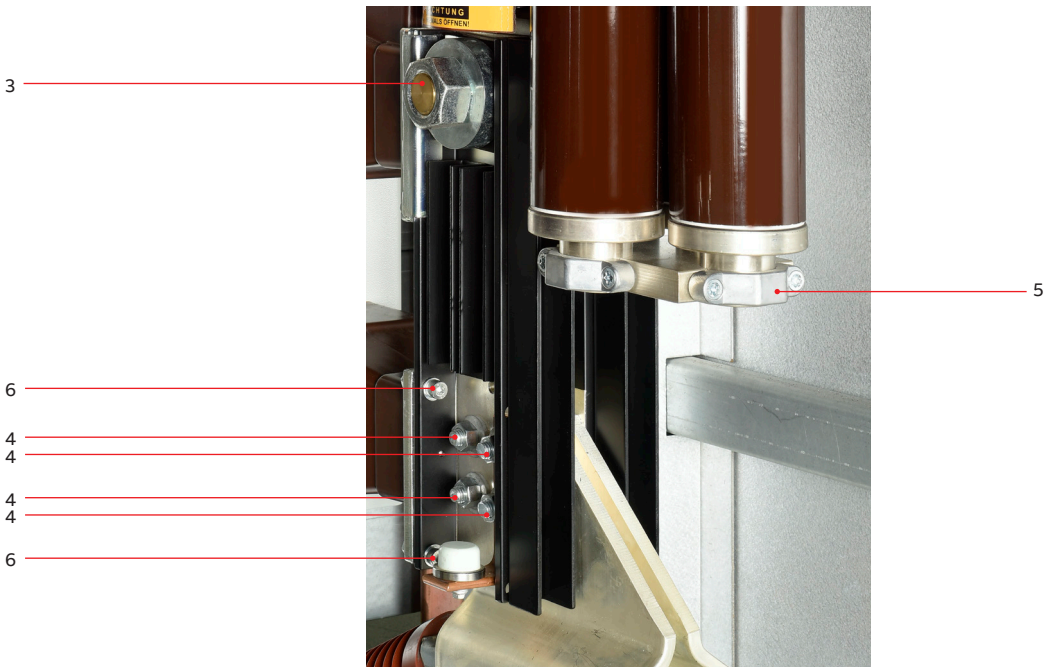
Note : Refer "Annexure-A" for procedure of fixing I_s-limiter™ insert with chain pulley block.

CAUTION	
⚠	Only ever use the correct inserts as specified for the particular I_s limiter™ installation. Observe the label on the I_s limiter™ switch. As a general rule, all the I_s limiter™ inserts must be fitted. When fitting, ensure that the tripping contacts(s) 7 (Fig 3.7 & 3.8) of the insert is (are) precisely positioned on the telescope contact(s).



1 Hardware for top holder contact M8
2 Hardware for top holder contact M12
3 Nut for heat sink bolt
4 Hardware for bottom holder contact M12
5 I_s limiter™ insert assembly
6 Hardware for bottom holder contact M8

Fig 5.5a – 12kV I_s-limiter™ insert assembly fixing



1 Hardware for top holder contact M8
2 Hardware for top holder contact M12
3 Nut for heat sink bolt
4 Hardware for bottom holder contact M12
5 I_s limiter™ insert assembly
6 Hardware for bottom holder contact M8

Fig 5.5b - 12kV I_s-limiter™ insert assembly fixing

5.5 Connection of power cable and control cable

36kV and 40.5kV I_s-limiter™ switchgear can accommodate up to four numbers of parallel single-core copper cables per phase of cross section of 400 sq.mm, at incoming as well as outgoing side, as standard arrangement.

12kV I_s-limiter™ switchgear can accommodate up to six or eight numbers of parallel single-core copper cables per phase of cross section of 300 sq.mm, at incoming as well as outgoing side, as standard arrangement depending upon rated current carrying capacity.

The standard method for terminating power cables in I_s limiter™ switchgear is shown in Fig.5.1 & 5.2. Power cables are conveyed below through floor covering gland plate, which can be adapted to the required cable diameter. Cables can be securely fastened to the cable holding bracket in the switchgear by means of using clamps.

Cable termination kits are mounted on cable cores according to manufacturer's instructions considering cable termination height, and it also recommended to maintain uniform lengths of cable ends, including cable termination kits.

- To facilitate cable connection at incoming side, open front door of the panel
- Remove the bottom cover at incoming front side of the panel for entry of cables to incoming side
- Power cables must be inserted, cut to length and stripped
- Prepare and secure cable sealing ends according to the manufacturer’s instructions
- Mark the cables with letter stickers “R, Y, B” appropriately
- Connect the cable-to-cable connection links for R, Y & B phases respectively
- Connect the cable sheath to earth
- Connect the cable clamps / glands to cable at appropriate locations
- Individual parts of the floor covering must be mounted
- Cable gland must be moved down so that nuts in the rings fit into corresponding recesses in floor coverings. In this way, the cable passages are sealed
- Repeat above 9 steps for rear (outgoing side) cable connections for R, Y & B phases

Note

Note: For some cases depending on the customer requirement, cable box is also used to increase cable termination height. The requirement for additional cable termination height must be indicated during the enquiry stage so that panel with proper cable box arrangement can be delivered.

CAUTION

Use proper personal protective equipment like hand gloves, helmets etc. while handling switchgears & making cable connections.

External control cables:

- Insert the control cables into the left-hand side ducts
- Cut the control cables to length at the top ends of the ducts and fasten. Insert the cores into the tripping cabinet
- Connect the control cables to the terminal strip in accordance with the wiring diagram
- Make the control wiring connections to the adjacent panel using the bushings

Internal control cables:

- Tripping and instrument transformer wiring is to be laid in accordance with a precise diagram and specific instructions (refer wiring diagrams in the order documentation and notes in section 3.3) to preclude mutual interference

5.6 Earthing the switchgear

(Figure 5.4)

- Connect the main earthing bar 2 of the switchgear panel by using the prepared links
- Make the protection conductor connection to the foundation frame
- Connect the earthing conductor coming from the ground electrode, preferably via a removable bolted link for testing purposes, to the main earthing bar 2 of the switchgear

5.7 Concluding installation work

- Check the paintwork of the switchgear for any damage and touch up where necessary (see also section 7.4.1)
- Check bolted connections, especially all those made during on-site assembly in the busbar and earthing system and tighten where necessary
- Align the auxiliary switch for I_{th}-limitation, if ordered and supplied, through the pressure relief apertures after removing the lifting lugs:
  - Guide the auxiliary switch plunger into the bore in the pressure relief plate
  - Align the auxiliary switch holder horizontally figure 5.3a
- Carefully clean the switchgear
- Remove all foreign bodies/tooling etc. from the panels
- Check all interlocking solenoids are working properly at rated supply
- Properly refit all covers etc. removed during installation and connection
- Close off any openings remaining in the enclosure as a result of the design, but which are no longer required

6. Commissioning/Operation

Note on safety at work
The relevant work and operating procedures are to be carried out carefully by trained specialists familiar with the installation, taking into account all the relevant safety regulations to IEC and the other relevant professional bodies, and other local and works regulations and instructions.

6.1 Commissioning

6.1.1 Preparatory work

In preparation for commissioning, the following work should be carried out prior to connection with the high-voltage power supply:

- Check the general condition of the switchgear for adverse circumstances of all kinds.
- Inspect visually major items like I_s-limiter™ insert fixing in the holder, CTs, insulating parts, etc.
- Check the connection of the main earthing bar to the station earthing conductor (follow the appropriate safety regulations)
- Check the paintwork for damage and touch up as described in section 7.4, where necessary
- Remove all material residues, foreign bodies and tools from the switchgear
- Clean the switchgear, rubbing down insulating parts with a clean, soft, non-fraying and dry cloth. Remove greasy or adhesive dirt as described in section 7.3
- Properly refit all covers etc. removed during assembly and testing processes
- Ensure that all shorting wires/links used while testing are removed
- Perform AC voltage testing of the main circuits to IEC 62271-1 as far as necessary. Pay special attention during this procedure to voltage transformers, pulse transformers and cables, etc.

CAUTION!

In order to avoid tripping of the I_s-limiter™ during the high voltage and impulse voltage tests, an insulating disk or cap must be inserted between telescope contact and tripping contact 7 (Figure 3.7 & 3.8)
Ensure CT secondary is shorted while conducting HV test.

After HV test is completed do remember to remove insulating disk or cap inserted between telescopic contacts & tripping device

- Turn the auxiliary and control voltage ON
- Check mechanical and electrical interlocks for effectiveness, without using force
- Set the protective devices in the switchgear to the required values and check their function with test equipment
- When primary current-dependent centrifugal fans are used, their correct function must also be tested (see section 7.2)
- For any further questions on the functions of the I_s-limiter™ switch and its testing, see section 7.5
- Instruct the local operators in the fundamental details of regular handling of the switchgear
- Check the readiness for operation and switching status of electrical systems upstream and downstream from the switchgear

Depending on the allocation of responsibilities, it may also be necessary to check the following equipment in areas adjacent to the switchgear:

- power cables
- auxiliary cables
- auxiliary power source
- remote control system
- complete earthing system
- switch room equipment
- switch room condition

6.1.2 Start-up

- Comply with all relevant safety regulations.
- Ensure that the circuit-breakers and switch disconnectors in series with the I_s-limiter™ are in the off position
- Remove any existing earthing and short- circuiting connections in the critical switching area
- Connect the switchgear step by step, observing the signals and indicators
- Check that the relevant conductors are in phase, as far as necessary when several incoming feeder cables and switchgear sections are concerned
- Carry out all measurements and check all functions dependent on the high-voltage power supply being connected
- Watch out for irregularities of any kind

6.2 Switching the tripping device ON

- Switch the MCB for the AC and DC power supply ON
- Switch the main switch on the power unit ON
- The indicator relay for the monitoring system will pick up and the "I_s-limiter™ not ready" signal is cancelled

Any closing lock-outs with the circuit-breakers or switch disconnectors in series are enabled.

6.3 Switching operation

The tripping device is switched ON and off with the main switch on the power unit. The MCB normally remain permanently ON.

Note

If the tripping device is switched ON without resetting the tripped indication, it has to be switched off again at the main switch:
Reset the tripped indication after approx. 1 minute, and then turn the main switch ON again.

CAUTION!

For tripping devices with coupling: The coupling causes the remaining phases to trip when at least one phase has tripped.

If the indication is reset while the main switch is ON in a device with coupling, this will cause the I_s-limiter™ inserts to trip and the new inserts which have been just replaced, will have to be replaced again!

1. The I_s-limiter™ is then ready for operation.
2. The equipment can be connected, i.e. the circuit-breaker or switch disconnector can be closed after any earthing switches have been switched off.

CAUTION!

Never re-use tripped I_s-limiter™ inserts (green indication), irrespective of the condition of the fuse. Repair and testing of I_s-limiter™ inserts may only be carried out at ABB (manufacturer's works)!

6.4 Electrical displays and monitoring

When the switchgear is in operation, all the visible operating data and condition indicators in the secondary systems are to be observed.

Indicator for power supply:
"No power supply" indication (indicator relay visible at the back of the door of the tripping cabinet).

Indicators for I_s-limiter™:
Indicator relay visible at the back of the door of the tripping cabinet (see also section 3.5.4).
- "I_s-limiter™ not ready" indication (indicator relay)
- "I_s-limiter™ tripped" indication (3 indicator relays)

6.5 Earthing and short circuiting with earthing cable set

Earthing and short-circuiting of the installation with an earthing cable set can be effected if the system is so ordered.

Application on switchgear fitted with phase earthing points, which can be mounted on both the cable and/or busbar sides.

Note

The short-circuit withstand capacity of the earthing device must correspond to the rated short time current of the switchgear.

The individual steps of the earthing and short- circuiting process are as follows:
- Isolate the area to be earthed and secure against reconnection
- Carefully observe all safety regulations
  - Check the area to be earthed for the off-circuit condition, e.g. with a voltage tester in the measuring point sockets of the capacitive voltage indicator system (if fitted), or with a high-voltage tester at the relevant earthing points
  - First firmly bolt the common earthing cable to the earthing point, and then use the insulated rod to connect the short-circuiting cable in a short-circuit-proof manner to the phase earthing points
  - Secure neighbouring live areas (e.g. feeder cables) to prevent inadvertent contact

6.6 Test procedures

6.6.1 Testing the off-circuit condition

In switchgears which are not equipped with capacitive voltage indication checking the off-circuit condition is carried out with a HV tester on the lower side T Connection of the I_s-limiter™.

If the switchgears are equipped with capacitive voltage indication, checking the off-circuit condition can be carried out by means of this device. In this case, proceed according to the manufacturer's instructions for the indicators. In case of any doubt about correct operation of capacitive voltage indication, the off-circuit condition must be checked using a HV tester.

CAUTION!

Checking the off-circuit condition must always be carried out in compliance with the relevant safety regulations and local operating conditions

6.6.2 Tests on the pulse transformer

No continuity tests may be performed on the higher voltage side winding (secondary winding) of the pulse transformer, as otherwise this might destroy the electronic components cast into the pulse transformer!

The following operating instructions must also be observed together with this instruction manual in the individual cases concerned:
For details of the tripping unit type QR6 & test procedure please refer separate manual GCEA670650 P0102 Rev 01

I_s-limiter™ insert: Instruction manual BA 323/04 E (GCEA 67 0323 P0102)

Customer specific test procedures must also be referred where ever applicable

7. Maintenance

7.1 General

Maintenance serves to preserve trouble-free operation and achieve the longest possible working life of the switchgear. It comprises the following closely related activities:

Inspection: Determination of the actual condition

Servicing: Measures to preserve the specified condition

Repair: Measures to restore the specified condition

Note!

When carrying out all maintenance work, the regulations in the country of installation must be strictly complied with.

Maintenance work may only be performed in a careful manner by trained personnel familiar with the characteristics of the individual switchgear, in accordance with all relevant safety regulations to IEC and of other technical authorities, and with other overriding instructions. It is recommended that ABB service personnel be called in to perform servicing and repair work, and this is necessary for some of the work detailed below.

The inspection and servicing intervals for some of the equipment/components (e.g. parts subjects to wear) are determined by fixed criteria such as switching frequency, length of service and number of short- circuit breaking operations. On the other hand, for other parts, the length of the intervals may depend, for example, on the different modes of operation in individual cases, the degree of loading, and also environmental influences (including pollution and aggressive air).

The following operating instructions must also be observed together with this instruction manual in the individual cases concerned:

I_s-limiter™ Insert: Instruction manual BA 323/04 E (GCEA 67 0323 P0102)

Customer specific test procedures must also be referred where ever applicable.

If necessary, further details can be taken from the technical documentation for the switchgear (including, for example, any agreed special operating conditions).

7.2 Inspection

Before inspection, where required, the working area must be isolated and secured against reconnection in accordance with the 'Safety Regulations' specified by IEC and appropriate national standards before inspection

- Correct condition of the switchgear should be monitored by regular inspections
- Under normal operating conditions, inspection should be conducted once every two years by specially trained professional electricians / engineers
- Under unusual operating conditions (including adverse climatic conditions) and/or peculiar environmental stresses (among other strong pollution and aggressive atmosphere), inspection may be necessary at shorter intervals
- Inspection is primarily to constitute a visual check for grime, corrosion and moisture:
  - Effects of high temperature on the main circuits,
  - Traces of partial discharge on the insulating material parts
  - Traces of leakage current on the insulating material parts
  - Surfaces of the contacts
- However, inspection is also to include the proper mechanical/electrical function of the following facilities: switching devices, actuating, inter- locking, protection and signaling facilities
- On panels with additional ventilation devices due to increased ambient temperature

1. Check flap for air inlet for correct function.
2. The centrifugal fan doesn’t require any special maintenance. Its working life, depending on the service conditions - one significant parameter being the room temperature - is approx. 20,000 to 30,000 operating hours.

The voltage is supplied from an external voltage source and is activated by a current-dependent relay at 70% of the instrument transformer's rated current.

Checking of the readiness for operation can be carried out as follows:

a) Load-dependent functional test on the current-dependent transformer:
   1. The current-dependent relay must be activated at a value of 70% of the instrument transformer's rated current.
   2. The air vane with micro-switch is used for the corresponding annunciation/monitoring.
b) Check for unimpeded normal running of the fan and listen for any unusual bearing noise. Remove any dirt on the fan rotor.
c) Check the unimpeded function of the wind vane and microswitch by starting the fan several times.
d) Observe the circuit diagram and carefully reconnect the wiring on completion.

- With regard to the switching devices, their separate instruction manual should be observed (GCEA670650 P0102 Rev 01)
- Check all switchgear accessories and auxiliary facilities
- No external discharge may occur on the surface of the equipment at operating voltage. This can, for example, be detected by characteristic noises, a clearly perceptible smell of ozone, or visible glowing in the dark
- If irregular conditions are detected, then corresponding repair measures should be initiated

7.3 Servicing

If, on the occasion of an inspection in accordance with 7.2, the necessity of cleaning measures has been established, proceed as follows:

- Before cleaning, where required, the working area must be switched off and secured against reconnection in accordance with the "Safety Regulations" specified by IEC or another appropriate national standard
- Cleaning the surface in general:
- Weakly adhering dry dust deposits with a soft dry cloth
- More strongly adhering grime with mildly alkaline household cleanser or with ETHANOL F 25M
- Cleaning insulating surfaces and conductive components:
- Minor pollution with ETHANOL F 25M
- Strongly adhering pollution with ETHANOL F 25M
- Wipe down after cleaning, using clean water, and dry properly
- Should external discharges occur as a result of condensation, application of a thin silicone film on the surface concerned is often effective as a temporary remedy. It is advisable to request advice from the ABB after-sales service department on permanent solutions to such unusual problems
- Check that the bolt connections at the contact points in the jumper system and the earth connections are tight using torque wrench
- Top up grease or regrease with Isoflex Topas NB 52 lubricant when lubrication is inadequate or missing,
- Observe the maintenance instructions in the manuals for the individual devices

7.3.1 I_s-limiter™ device

Tripping device
No particular servicing of the I_s-limiter™ tripping device is generally necessary. Should dust deposits be noted on the equipment installed despite the enclosure after a long period of service in a relatively dusty environment, it is advisable to clean these carefully with a soft brush, so as to prevent the creation of tracking paths.

As with every other protection system, the I_s-limiter™ tripping device should also be checked for perfect function at relatively long intervals (e.g. every 12 months).
In order to conduct such a test, the I_s-limiter™ is to be deactivated and the I_s-limiter™ insert replaced by appropriate test insert. The test insert contains a glow lamp as an indicator, which must flash when a tripping pulse is received. If this occurs, it demonstrates that the tripping circuit including the wiring and pulse transformer is functioning correctly.

Apart from the test insert, other tests are carried out which can be used to check the most important functions of the tripping device. Further instructions on performance of these tests can be found in the relevant instruction manuals GCEA670650 P0102 Rev 01.

Customer specific test procedures must also be referred where ever applicable.

I_s-limiter™ inserts
The I_s-limiter™ inserts should be stored in a dry place.

CAUTION!

Recommendations for the charges:
- Replacement after 8 years for I_s-limiter™ inserts which have been in service
- Replacement after 12 years for I_s-limiter™ inserts which have not been in service

Repair and testing of I_s-limiter™ inserts:
Repair and testing of I_s-limiter™ inserts may only be carried out at ABB Calor Emag (manufacturer's works)!

Continuity testing:
Continuity testing on the I_s-limiter™ inserts can be carried out with a continuity tester. It is essential to unscrew the HV fuse from the main conductor for such a test. Check the HV fuse and main conductor for continuity separately.

CAUTION!

Only test the main conductor for continuity between the face edges. Do not touch tripping contact 7 with the continuity tester, as otherwise, the charge will be activated.

When refitting the HV fuse to the main conductor, firmly tighten the fastening screws

CAUTION!

Verification of design data:
Verification of the design data (response values, settings) and I_s-limiter™ inserts is required on:
- Changes to the operating conditions
- Changes in short-circuit currents
- Installation of capacitor banks on the voltage level of the I_s-limiter™

The response values and settings are listed in the relevant order-related data sheet.

7.4 Repair

7.4.1 Switchgear surfaces

- Carry out repair work immediately after a defect has been discovered
- Completely remove all rust from damaged paint-work areas on steel sheet and other steel parts by mechanical means, e.g. with a wire brush

Lightly grind the surrounding paint coat and carefully degrease the entire area. Then immediately apply an anti-rust primer and, after an appropriate hardening time, apply the topcoat. Only use suitable and compatible paint products.

Topcoat in standard color RAL 7035, or the relevant special color.
- Carefully remove any white rust from aluminum/zinc surfaces with a wire brush or Scotch-Brite, and remove loosely adhering particles with a dry, non-fraying cloth. Then treat the cleaned areas with zinc spray or zinc dust paint, and then with aluminum spray to match up the color
- Carefully remove any white rust on chromium plated functional parts and rust on phosphatized parts with a wire brush or Scotch-Brite, and clean with a dry cloth. Then evenly grease the parts (with Isoflex Topas NB 52)

7.4.2 Replacement of components

I_s-limiter™ insert: In case of tripping of the insert for any one or all the phases, then the I_s-limiter™ insert needs to be replaced with new I_s-limiter™ insert.

Procedure for replacement of the I_s-limiter™ insert after tripping:
1. Check the indicator relay to determine which phase the I_s-limiter™ has tripped in. Do not reset the signal as yet!
2. Switch the tripping device off at the main switch on the power unit.
3. Remove the I_s-limiter™ inserts in phases L1, L2 and L3. We recommend replacing all the I_s-limiter™ inserts with new ones after tripping.
4. Insert new I_s-limiter™ inserts (see section 5.4 for procedure).
5. Reset the trip indication (indicator relay).
6. Switch the tripping device ON at the main switch on the power unit.
7. When the system is ready for operation again, the removed I_s-limiter™ inserts are to be checked:
   - The green indicator on the I_s-limiter™ insert indicates that the insert has tripped
   - The red indicator on the fuse indicates that the fuse has blown

It is possible that an insert has reacted (green indication) even though the fuse has not blown (red ball not visible). See also I_s-limiter™ insert continuity testing in section 7.3.1.

NOTE!

If the tripping device is switched ON without resetting the tripped indication, it has to be switched off again at the main switch:

Reset the tripped indication after approx. 1 minute, and then turn the main switch ON again.

Activity of replacement of I_s-limiter™ insert must be carried out by authorized ABB service engineer

7.5 Tests on interlocks

7.5.1 Testing of interlock conditions (See also sections 3.4, 6.4 to 6.6)

1. Closing of the series connected circuit-breaker or switch-disconnector must only be possible when the I_s-limiter™ switch is in the defined inserted position and the I_s-limiter™ is ready to operate and has not tripped.

   Check these conditions individually as follows:

   - With the I_s-limiter™ switch inserted and the trip indicator relays reset, it must only be possible to close the circuit-breaker with the tripping device switched ON (the "not ready" signal disappears). (All other conditions necessary for switch ON must be fulfilled.)
   - It must not be possible to close the circuit-breaker with the main door of the panel is in open position

2. When the I_s-limiter™ trips, the series connected circuit-breaker or switch-disconnector must receive opening commands.

   Check this condition as follows:

- Effect a trip using test plug QT3a or test equipment QT2b with the I_s-limiter™ inserts removed

3. Any additional interlocks fitted and listed in the order documentation are to be tested separately.

7.6 Spare parts & auxiliary materials

7.6.1 Spare parts

The list of spare parts is available on request.
The following details are required when spare parts are ordered:

- Serial number of the switchboard or I_s-limiter™ .
  Also required for:
  - Power unit, complete
  - Tripping unit (for one phase)
- I_s-limiter™ insert:
  - Serial number
  - Type of I_s-limiter™ insert and integrated fuse

For the procurement of further spare parts, please contact ABB India Ltd. Or on numbers mentioned on service card on panel.

7.6.2 Auxiliary materials

Part No. (order ref.)

Lubricant:

- Isoflex Topas NB 52, GCE0007249P0100

Cleansers:

- ETHANOL F25M, (for general cleaning)
- BA 1002/E GCEA901002P0102
- Touch-up Paint: Standard color RAL 7035
  - 1kg box: GCE9014060R0103
  - Spray tin: GCE0007895P0100

8. Disposal

I_s-limiter™ switchgears are produced in compliance with the requirements of international standards for quality management system and environmental management system. The level of excellence achieved in these fields is documented by quality certificates according to ISO 9001 and by the EMS according to ISO 14001.

End of life of product.

- The ABB company is committed to complying with the relevant legal and other requirements for environment protection according to the ISO 140001 standard.

- The duty of the company is to facilitate subsequent recycling or disposal at the end of product life.

- During disposal of product, it is always necessary to act in according with local legal requirements in force.

The following methods of disposal are possible:

- Disposal can either be carried out thermally in an incineration plant or by storing on a waste site.

Raw material	Recommended method of disposal
Metal material (Fe, Cu, Al, Ag, Zn, W, others)	Separation and recycling
Thermoplastics	Recycling or disposal
Epoxy resin	Separation of metal material and the disposal of rest
Rubber	Disposal
Packing material - wood	Recycling or disposal
Packing material - foil	Recycling or disposal

CAUTION!

Disposal of I_s-limiter™ inserts must be carried out only by ABB Calor Emag (Producer of this equipment).

Inside the I_s-limiter™ inserts a small charge is installed (figure 3.7). For safety reason, it is strictly forbidden to open this I_s-limiter™ insert or to take out the charge.

Annexure A
Procedure of fixing I_s-limiter™ inserts inside the panel with chain pulley block

Procedure for 36kV and 40.5kV I_s-limiter™ inserts:

1. Mounting of chain pulley block in-side the panel

1.1 The I_s-limiter™ panel comes with side main brackets duly mounted on side sheets as shown in pictures (fig. 9.1 & 9.2). These brackets can be found near top insulator support channel on left and right-hand side.

1.2 Insert LHS and RHS grooves of rod (fig. 9.3) inside U cut of LSH and RHS main brackets as shown in pictures (fig. 9.4 & 9.5)

Fig 9.1

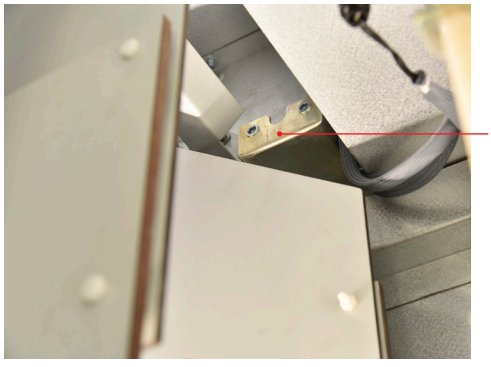


Fig 9.2

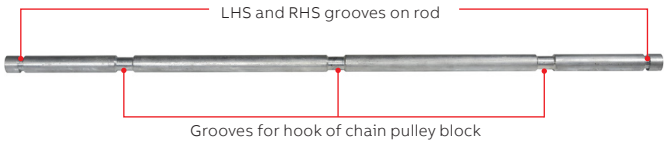


Fig 9.3 - Rod supplied with chain pulley block

Material: Rod - drawing number 1VYN301850-276 (Qty. 1 Pc)

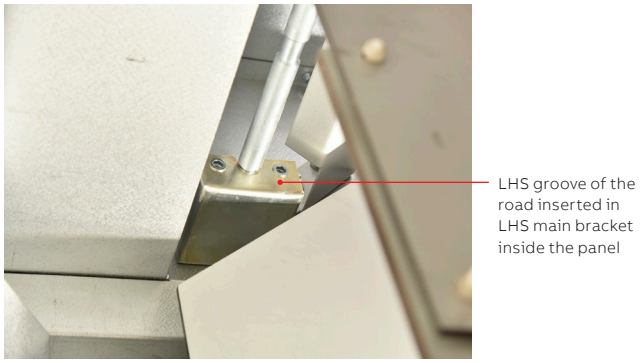


Fig 9.4

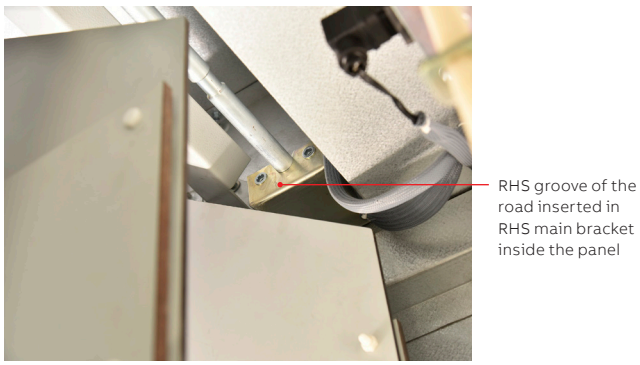


Fig 9.5

1.3 Insert rod holding plates near LHS and RHS groove of rod at LHS and RHS main brackets as shown in pictures (Fig. 9.6 and 9.7). Then mount the hardware (hex socket cap screw and washer) with required torque of 30 NM to connect both holding plates with brackets as shown in pictures (Fig. 9.8 and 8.9)

1.4 Mount the chain pulley block on shaft (rod) at appropriate slot (groove) depending on R, Y, B phase with the help of hook and lock the latch of hook (Fig. 9.10, 9.11 and 9.12).

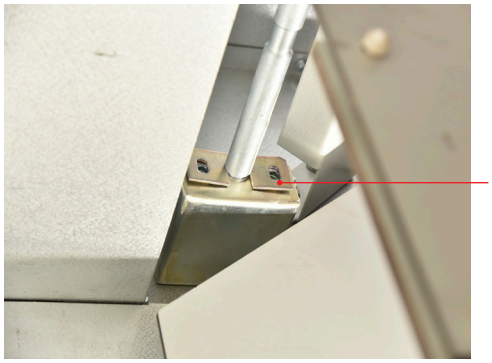


Fig 9.6

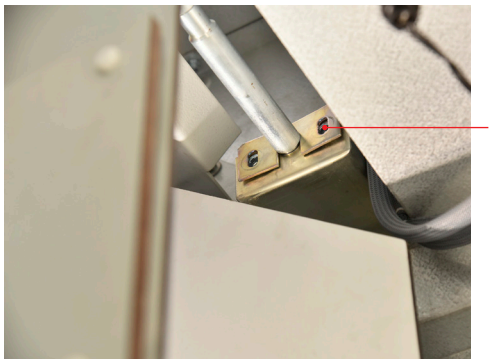


Fig 9.7

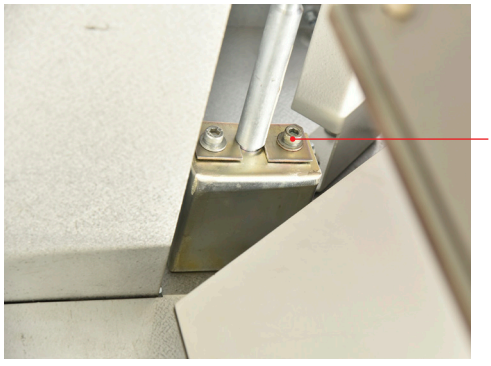


Fig 9.8

Fig 9.9

Material:
Rod holding plates - drawing number 1VYN401850-807 (Qty. 2 Pc)

Hex socket cap screw M8X20 - drawing number IN21212519-451 (Qty. 2 Pc)

Plain washer for M10

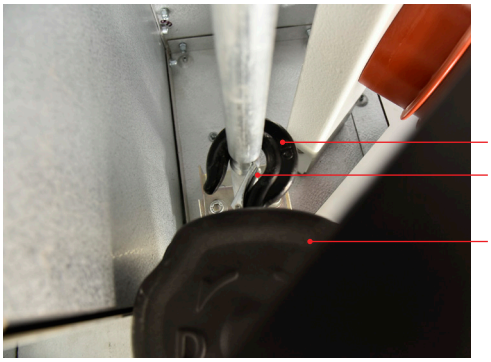


Fig 9.10

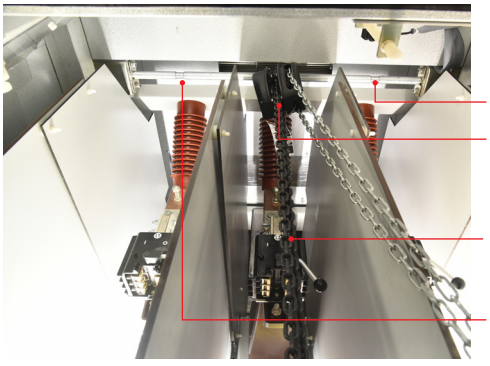
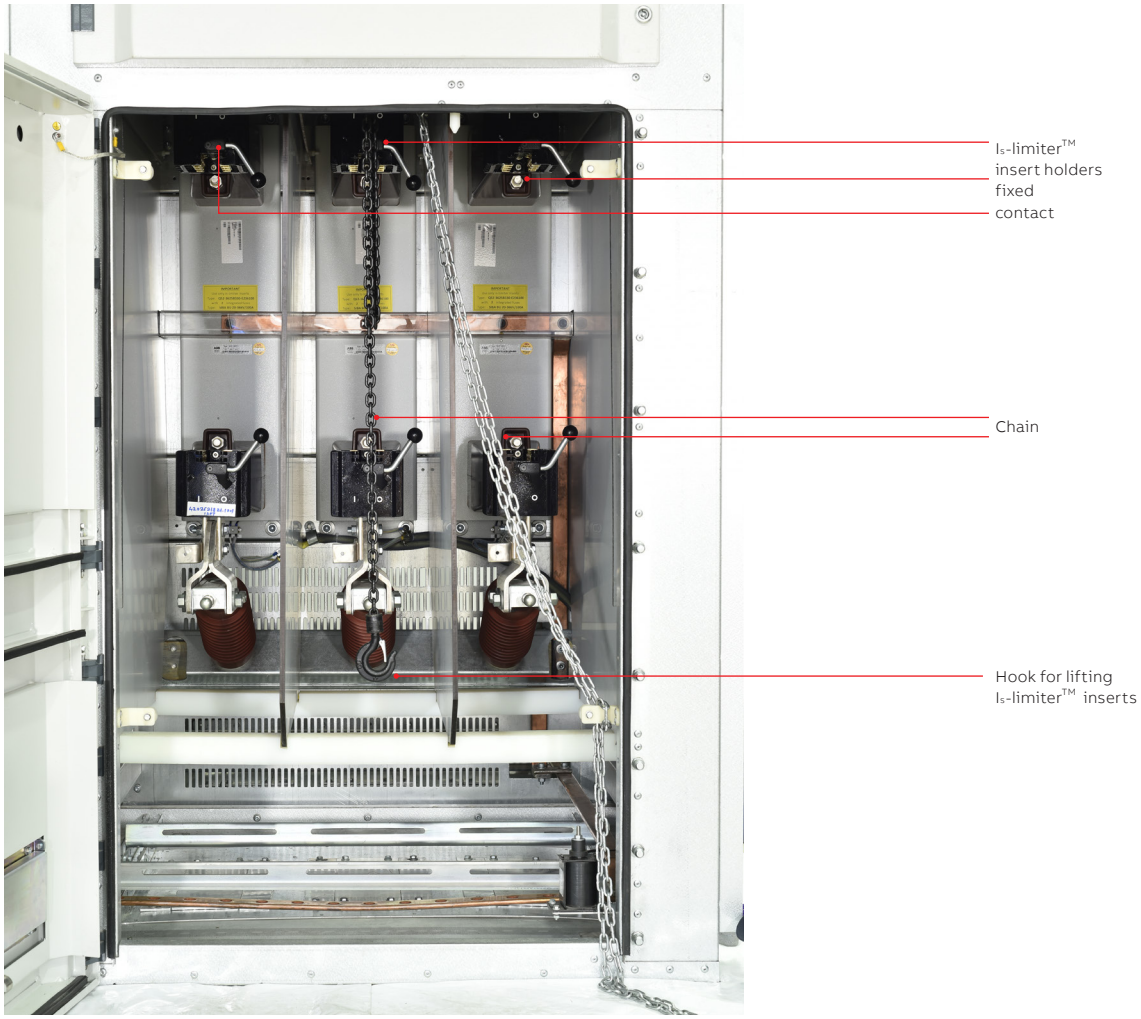


Fig 9.11


Is-limiter™
insert holders
fixed
contact
Chain
Hook for lifting
Is-limiter™ inserts

—
Fig 9.12

2. Handling of I_s-limiter™ inserts with chain pulley block

2.1 Place the container of I_s-limiter™ inserts in front of the panel with correct marking of R, Y and B phase. Check for the upper side of I_s-limiter™ inserts and make them vertical in container with upright position (Fig. 9.13).

2.2 Insert the belt with hook/sling at one side below sheet metal bracket. Mount the hook/sling at other side of the belt as shown in picture (Fig. 9.14).

2.3 With the help of chain, adjust the height of chain pulley block's hook at appropriate level so that it can be engaged with both slings of the belt. Engage chain pulley block's hook with two slings of the belt and lock (Fig. 9.15).

Fig 9.13

Fig 9.14

Fig 9.15

2.4 Lift the I_s-limiter™ insert at appropriate height in the panel with the help of chain of chain pulley block. Height of the insert shall be at such a level that base contact of the insert can be rested on lower fixed contact of the I_s-limiter™ insert holder (Fig. 9.16 & 9.17).

2.5 Adjust the height of I_s-limiter™ insert in such a way that I_s-limiter™ insert's top contact gets engaged with top fixed contact of I_s-limiter™ insert holder. Once top and bottom contacts of insert are engaged with fixed contact of insert holder, push the insert back up to the position where it rests with rear stopper (Fig. 9.17 & 9.18).

Fig 9.16

Fig 9.17

Fig 9.18

2.6 After I_s-limiter™ inserts are fully engaged with top and bottom fixed contact of I_s-limiter™ insert holder, lock the insert by rotating the top and bottom levers to position “I” shown on insert holder till it touches the stopper (Fig. 9.19 & 9.20).

2.7 On insertion and mounting of the I_s-limiter™ insert in I_s-limiter™ insert holder, remove the hook from sling attached to the belt and remove the sling from belt (Fig. 9.21).

2.8 Shift the chain pulley block from current phase location to other desired phase location and repeat steps 2.1 to 2.7 to mount I_s-limiter™ insert of other phases inside I_s-limiter™ insert holder.

Upon insertion and mounting the inserts of all three phases, remove the chain pulley block from horizontal rod by unlocking and removing the hook from rod. After this, remove the horizontal rod holding plates and horizontal rod by dismantling the screws mounted in step 1.3.

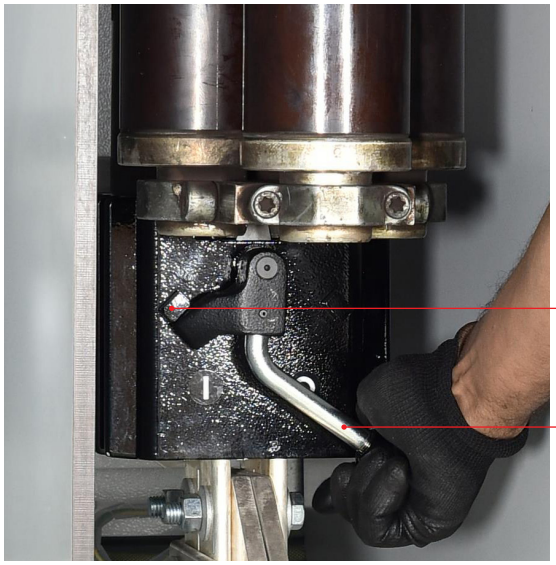


Fig 9.20

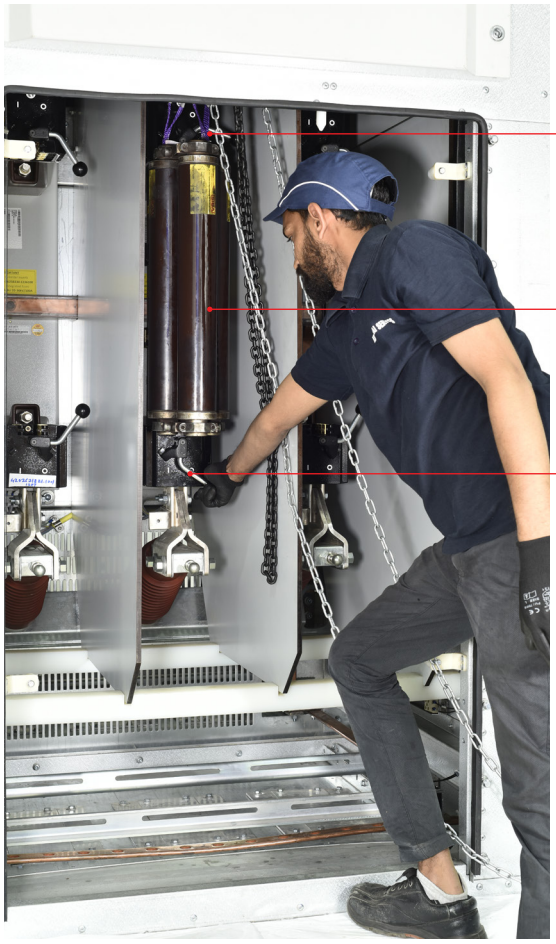


Fig 9.19

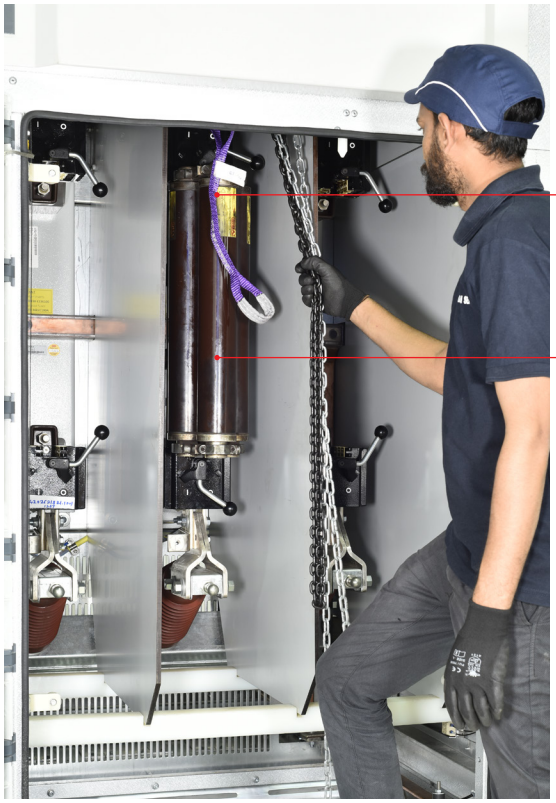


Fig 9.21

Procedure for 12kV I_s-limiter™ inserts:

1. Mounting of chain pulley block inside the panel

Follow the steps 1.1 to 1.4 as explained for 36kV and 40.5kV I_s-limiter™ inserts for mounting of chain pulley block inside the panel.

2. Handling of I_s-limiter™ inserts with chain pulley block

Note: Process of fixing I_s-limiter™ inserts of 12kV is slightly different than 36kV and 40.5kV inserts. 12kV inserts are to be fixed with bolting and not with lock lever which is provided only with 36kV and 40.5kV insert holders.

Before starting steps 2.1 to 2.5 which are common for 12kV and 36/40.5 kV inserts, perform following preparatory steps.

a) Preparatory steps:

a1.1) Loose the allen bolts M10 on LHS and RHS of insert holder at top and bottom fixed contact as shown in picture (Fig. 9.22, 9.23, 9.24 & 9.25). Slide the contacts to create a gap for insertion of I_s-limiter™ inserts at top and bottom fixed contact of holder.

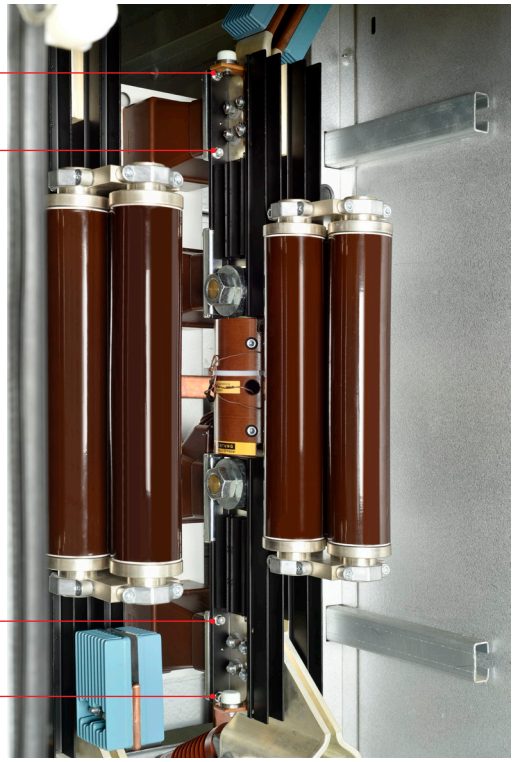


Fig 9.22

Fig 9.23

a1.2) Loose the hex bolt M12 (do not completely remove) of top and bottom conductor near top and bottom fixed contact of I_s-limiter™ insert holder (Fig. 9.24 & 9.25).

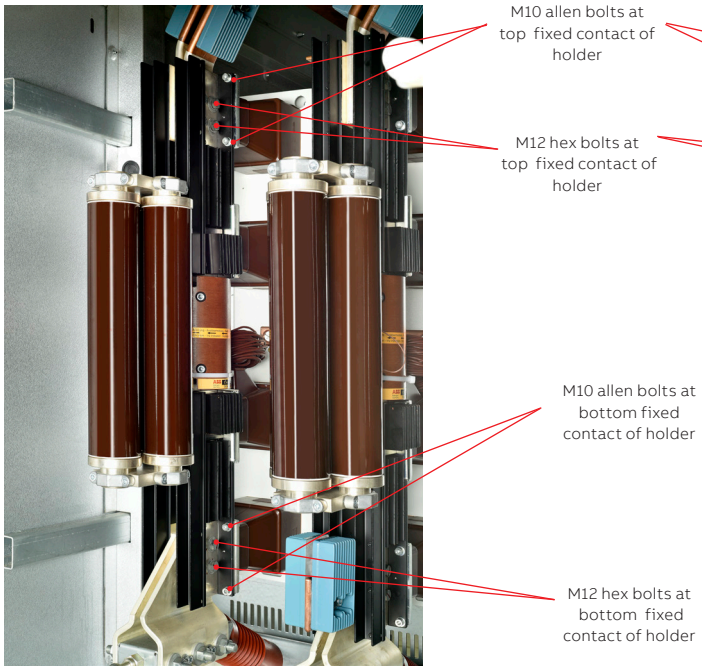


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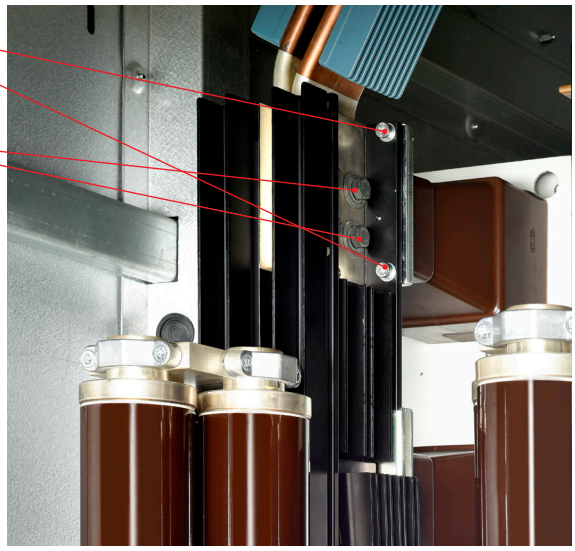
Fig 9.24

After these preparatory steps (a1.1 and a1.2) are performed, follow the steps 2.1 to 2.5 explained in the procedure for 36kV and 40.5kV I_s-limiter™ insert till pushing the insert into the insert holder.

Upon pushing of insert into insert holder, insert M30 hex bolt (Fig. 9.26) in to I_s-limiter™ insert holder at top and bottom and mount the hex bolt and washer on other side of the bolt. Then tighten the bolt applying torque of 220NM with appropriate torque wrench.



—
Fig 9.25

After tightening of M30 hex bolt, tighten the M12 hex bolts and M10 allen bolts which were loosen in preparatory steps a1.1 and a1.2 to completely secure the I_s-limiter™ insert with I_s-limiter™ insert holder. The torque to be applied for M12 hex bolt and M10 allen bolt shall be 70MN and 25NM respectively.

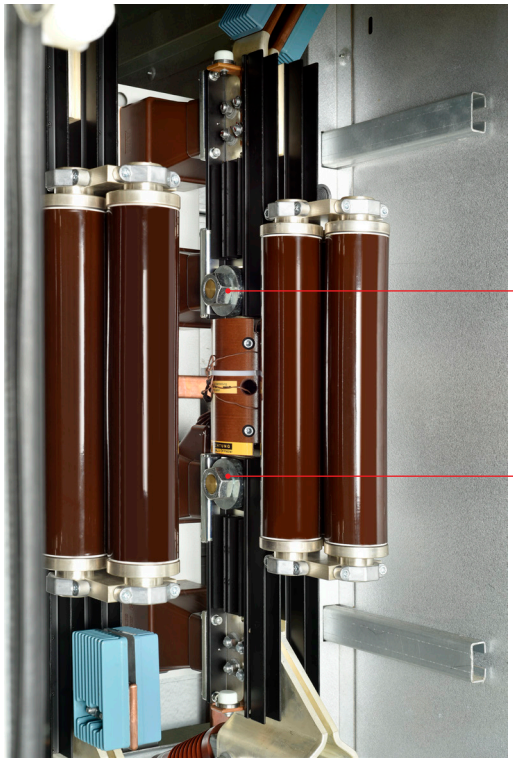


Fig 9.26

To mount the I_s-limiter™ inserts of other phases, shift the chain pulley block from current phase location to other desired phase location and repeat the preparatory steps and I_s-limiter™ insert mounting steps as elaborated above.

Upon insertion and mounting the inserts of all three phases, remove the chain pulley block from horizontal rod by unlocking and removing the hook from rod. After this, remove the horizontal rod holding plates and horizontal rod by dismantling the screws mounted in step 1.3.

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