

HG-SERIES

PV/BPS MOLDED CIRCUIT SWITCH

Instruction Manual



Type covered in this manual

- HGL DC Type : HGL08, HGL10,
HGL12,HGL16,HGL20, HGL25,
HGL32, HGL40

Notice

- Read this instruction manual carefully before using this PV/BPS MOLDED CIRCUIT SWITCH.
- This instruction manual does not include all information regarding installation and maintenance.
- For further information, please contact HD Hyundai Electric or your local dealer.

For Operational Safety of Disconnecter Switch Units

Safety Practices

This instruction manual applies only to HG-Series PV/BPS MOLDED CIRCUIT SWITCH (DSU) regarding installation and maintenance procedures. Installing and maintaining these products improperly may result in serious personal injury, property damage, or even death. Therefore this instruction manual must be read and understood at any step in unpacking, assembly, operation, and maintenance of the DSU. Only qualified persons who are familiar with installing and maintaining DSU are permitted to work on DSUs, and this instruction manual should be accessible to those persons at any time.

Signal Words

Signal words used in this instruction manual are divided by DANGER, WARNING, and CAUTION depending on the situation.

DANGER

Indicates an imminently hazardous point that, if ignored, a serious accident causing death or severe injury could occur. This is the most dangerous point.

WARNING

Indicates a potentially hazardous point that, if ignored, a serious accident causing death or severe injury could occur.

CAUTION

Indicates a potentially hazardous point that, if ignored, minor or moderate injury could occur. This signal reminds operators to work safely.

Transportation Precaution

DANGER

Never lift the DSU over an area where there are people.
Never stand under the DSU.

Operation Precautions

DANGER

- Never touch live terminal parts.
There is a risk of electric shock.
- Do not leave the DSU in the draw-out position.
Dropping the DSU cause serious injury.

CAUTION

- If the DSU trips open automatically, remove the cause before closing the DSU.
Otherwise, a fire could occur.
- For the DSU with the fixing block, be sure to loosen the block screws before drawing out the DSU.
Otherwise, damage to the DSU may occur.

Installation Precautions

CAUTION

- Installation work must be performed by qualified personnel.
- Prior to commencing any installation work, open an upstream circuit Disconnecter switches to shut off all sources of power.
Otherwise, electric shock may occur.
- Tighten terminal bolt up securely to the specified torque.
Otherwise, a fire may occur.
- Fix the draw-out cradle of the DSU firmly on a flat level surface using mounting screws.
Otherwise, draw-out operation may cause the DSU to fall.
- To ensure adequate arc space (insulation distance), avoid blocking the arc gas vents of the DSU.
Otherwise a burn may result from high temperature arc gas.
- Do not place the DSU in such as an area that is subject to high temperature, high humidity, dusty air, corrosive gas, vibration and shock, or other unusual conditions.
Mounting in such area could cause a fire, non-tripping, or malfunction.
- Install the DSU to prevent dust, concrete powder, iron powder, and rainwater from entering the unit.
These materials could cause a fire or non-tripping.
- For the DSU with four poles, connect the neutral wire of a 3-phase, 4-wire cable to the N-phase pole (on the right end).
Otherwise, an overcurrent may cause non-tripping resulting a fire.

Maintenance and Inspection Precautions

CAUTION

- DSU maintenance, inspection and/or parts replacement must be performed by qualified personnel.
- Prior to commencing any work on the DSU, open an upstream Disconnecter switches or the like to isolate all sources of power/voltage from both the primary and auxiliary circuits.
Otherwise, electric shock may result.
- Prior to commencing DSU internal inspection, make sure that the DSU is open and the closing spring is released.
Otherwise, fingers or tools could be pinched in the internal mechanism, resulting injury.
- Retighten the terminal screws periodically to the specified torque.
Otherwise, a fire could result.
- Be sure to reinstall the arc chamber if removed.
Failure to do so or incorrect installation of the arc chamber may result in a fire or burn.
- Do not touch DSU live parts (contacts in particular), or structural parts close to a live part immediately after opening the DSU to stop supplying power.
Otherwise, remaining heat may cause burn or residual charged voltage may cause electric shock.
- Do not bring your hand or face close to the arc gas vent of the arc chute while the DSU is closed.
Otherwise, a burn may result from high-temperature arc gas blowing out of the arc gas vent when the DSU trips open.

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01 Receiving and Handling

Upon receipt of your Disconnectors, check the following first.

HE air circuit Disconnector switches are completely assembled, inspected and tested both electrically and mechanically at the factory, then shipped in fully guaranteed condition in construction and operation.

1.1 Storage

While it is recommended that the Disconnector switches be used as soon as you have received it. If it is necessary to store the DSU, note the followings.

- 1) Store the Disconnector switches in a dry indoor location to prevent condensation due to sudden changes in ambient temperature, which is quite harmful to the Disconnector switches insulation.
- 2) Store the Disconnector switches in a clean place free of corrosive gases, dirt, dust and salinity (NaCl). In particular, a mixture of cement dust and moisture may cause corrosion damage to metal parts of the DSU. Fully protect the Disconnector switches from such mixtures.
- 3) Place the Disconnector switches on a flat, level surface in its normal position.
- 4) Do not place the Disconnector switches directly on the floor.
- 5) When store the DSU without electronic circuit : -25°C - 85°C
When store the DSU with electronic circuit : -15°C - 70°C

1.2 Transportation

When transporting the Disconnector switches, follow these instructions.

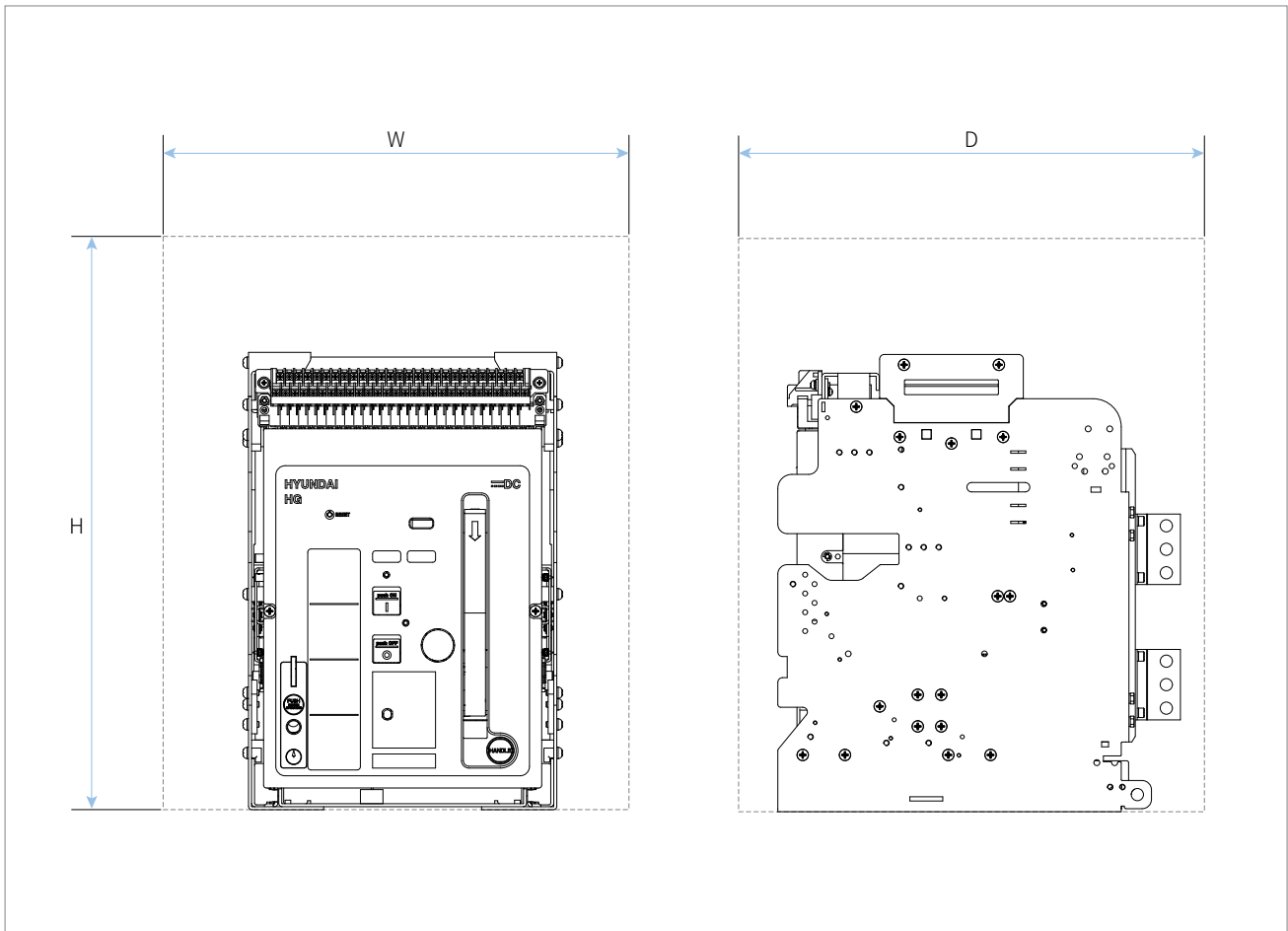
- 1) When lifting up the Disconnector switches, suspend wire rope from lifting lug and take care to ensure that the wire ropes do not touch the arc chute and protection relay. When lifting up the Disconnector switches, be sure to lift it up slowly.
- 2) Lower the Disconnector switches onto a flat surface.
- 3) Avoid impacts and shocks to the Disconnector switches during transportation.

01 Receiving and Handling

(3) Clearance requirements

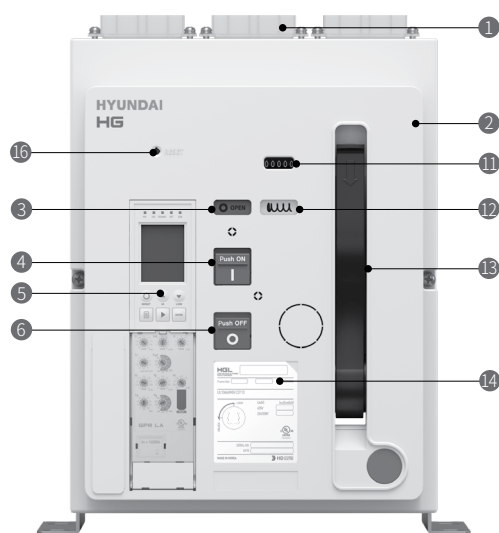
Enclosure Dimension			H	W	D
K Frame	3P	In	19.69	21.18	15.00
		mm	500	538	381
	4P	In	19.69	24.53	15.00
		mm	500	623	381
H Frame	3P	In	19.69	24.02	15.00
		mm	500	610	381
	4P	In	19.69	28.54	15.00
		mm	500	725	381

※ - Enclosure dimension is followed by UL/ANSI Standard.

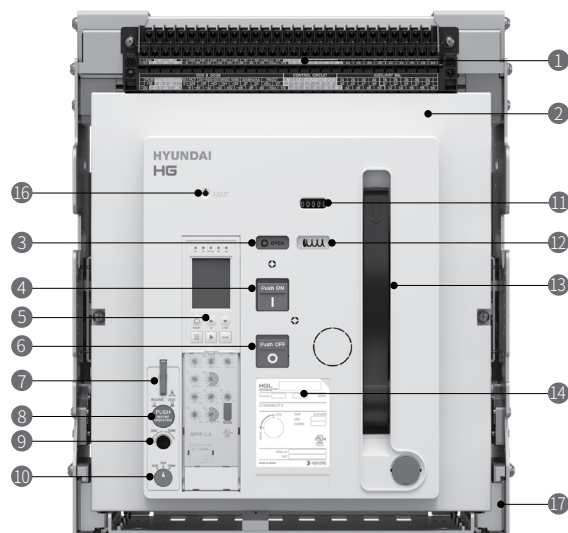


02 Structure

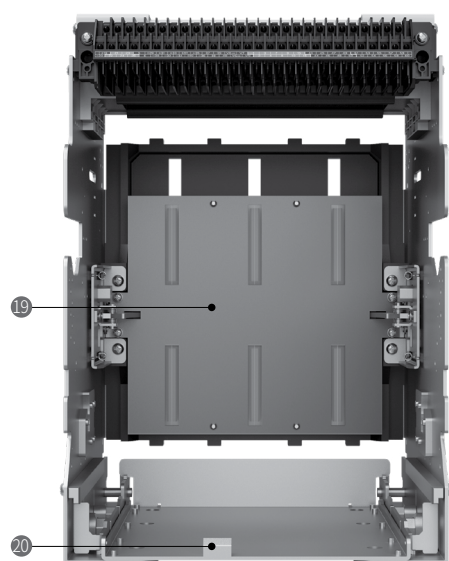
Fig. 1



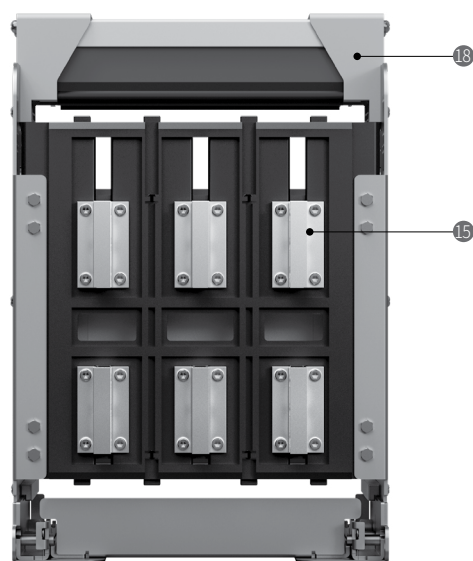
Draw-In/Out Type (DSU Body)



Draw-In/Out Type (Including Cradle)



Cradle Front



Cradle Rear

- | | | | |
|----------------------------|-------------------------------------|--------------------------------|--------------------------|
| ① Control Circuit Terminal | ⑦ Position Padlock | ⑪ Counter | ⑯ OCR & Alarm S/W |
| ② Front-Cover | ⑧ Position Lock Release Button | ⑫ Charged/Discharged Indicator | Reset Button |
| ③ Close/Open Indicator | ⑨ Draw-In/Out Handle Insertion Hole | ⑬ Manual Charging Handle | ⑰ Draw-In/Out Guide Rail |
| ④ Close Button | ⑩ Position Indicator | ⑭ Rating Nameplate | ⑱ Arc Shield |
| ⑤ Overcurrent Relay Device | | ⑮ Terminal Busbar | ⑲ Safety Shutter |
| ⑥ Open Button | | | ⑳ Auto Discharge Block |

03 Operation

Disconnecter switches are available either manual charging type or motor charging type.

3.1 Manual Charging Type

In the manual charging type, both charging the closing springs and open-close control of the Disconnecter switches should be done manually.

The Disconnecter switches is able to close only when the closing spring is charged.

⚠ CAUTION

Do not force down the charging handle after completion of charging.
It may cause a malfunction.

1) Spring charging operation

Follow the procedure given below to charge the closing springs.

- Pump the charging handle (Fig. 2. ①) about five times.
- When closing springs are fully charged, a metallic click will be heard and no more pumping of the charging handle will be possible. Check that the spring charged indicator now shows 「」 (Fig. 2. ②).

2) Closing operation

Check the instruction before closing the Disconnecter switches.

- Closing spring should be charged.
- Position lock release button should be in original position (Fig. 3. ①).
- Specified voltage should be applied to the under-voltage trip device option.
See the description of the under-voltage trip device for the procedure in detail.

Upon satisfactory confirmation of the above three items, press the closing button (Fig. 3. ②).

Then, closing springs are discharged and the Disconnecter switches is closed.

The close/open indicator indicates 「I」 and spring charged indicator shows 「」 (Fig. 3. ③).

3) Opening operation

Press the open button (Fig. 3. ④), close/open indicator indicates 「O」 (Fig. 3. ⑤).

Fig. 2

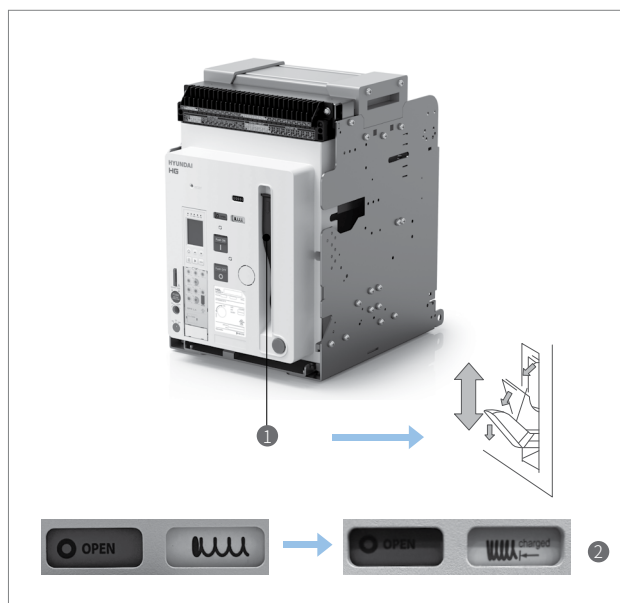
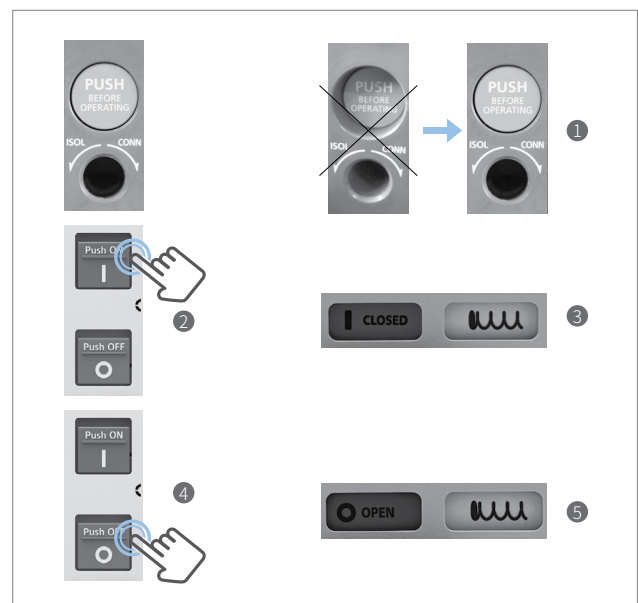


Fig. 3



3.2 Motor Charging Type

In this type, a motor-operated mechanism automatically charges the closing springs.

Means for remote electrical close-open control of the Disconnecter switches are also fitted (see page 50-51 wiring circuit).

Manual operation is also possible (manual operation procedures are described in the 3.1 section manual charging type).

1) Spring charging operation

- Supply the specified control power voltage to the charging motor circuit.
- As soon as the closing springs are discharged, the charging motor is turned on to charge the closing springs.
- The charging motor is automatically stopped after the closing springs are fully charged.

Then, charged/discharged indicator show charged sign, 「」 (Fig. 2. ②).

Spring charging time is different according to control power and type of Disconnecter switches.

This is normally within a range of 3 to 10 seconds.

⚠ CAUTION

The permissible control voltage range for the charging motor is from 85 % to 110 % but 100 % of rated voltage is more recommended to be supplied.

Failure to follow this instruction will result damage in charging motor.

⚠ CAUTION

It is strongly recommended to supply the control power at the rated voltage.

Dielectric withstand test in motor, AC/DC 100-220 V : 1,500 V 1 min, DC 24, 48 V : 500 V 1 min.

The motor jack should be disconnected before dielectric withstand test.

2) Closing operation

Before closing the Disconnecter switches, check the followings.

- Closing springs are charged.
- Position lock release button should be in original position.
- Under voltage trip device (UVT) is supplying rated voltage.

Upon satisfactory confirmation of the above items, press the PB (Close) button (page 50-51).

This energizes LRC (latch release coil, Fig. 9. ④) which in turn release the closing springs and close the Disconnecter switches.

Close/Open indicator indicates 「」 (Fig. 3. ③).

Charged/Discharged indicator indicates 「」 (Fig. 3. ③).

When closing springs are discharged, the charging motor immediately turn to charge closing springs.

⚠ CAUTION

Even when no. 2) is not satisfied, the Disconnecter switches will not be placed in a closed state.

Be sure to perform closing operation according no. 2).

3) Opening operation

The shunt trip device (SHT) or under voltage trip device (UVT) is used for remote electrical opening operation.

Press the open button (PB open, page 50-51). This opens the Disconnecter switches via the SHT or UVT.

⚠ CAUTION

When close-open operations are repeated with the charging motor ON, limit the number of successive close-open cycles to 10 times. If the open-close cycle is repeated more than 10 times, allow a cooling period of at least 10 minutes between the 10th cycle and the 11th cycle.

Repeating open-close cycle more than 10 times consecutively may damage of charging motor.

04 Draw-out Mechanism

In order to test the Disconnecter switches and exchange parts easily, the Disconnecter switches body is drawn-in/out from draw-out cradle, the Disconnecter switches can be fixed in one among three of draw-out cradle.

The Disconnecter switches can be moved to TEST or ISOLATED position when the panel door is closed.

Caution of operation

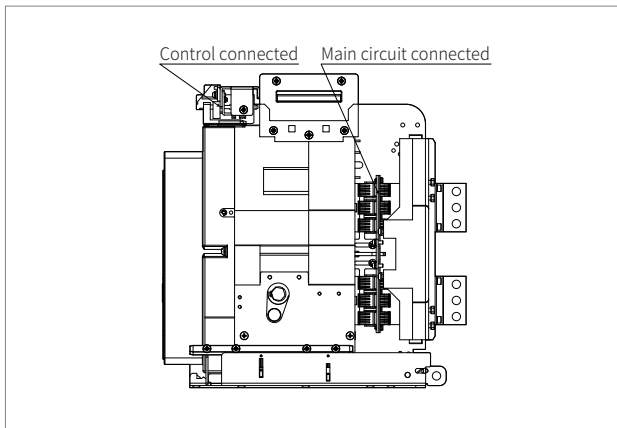
- Open the Disconnecter switches before working with the draw-out mechanism.
- Loosen the screws of the fixing blocks before drawing out the Disconnecter switches body.
- Push the position lock release button (Fig. 1. ⑧), insert draw-in/out handle into the insertion hole (Fig. 1. ⑨).
- When you try to move the Disconnecter switches body to the CONNECTED position, the operating force will increase.
Torque of operating force is about 25 kgf.
- Operate draw-in/out handle totally in inserted state.
- Rotate draw-in/out handle until the handle is locked automatically at each ISOLATED, TEST, and CONNECTED position.
At each locked position, stop turning the draw-out handle.

Failure to follow this instruction can result in equipment damage or malfunction.

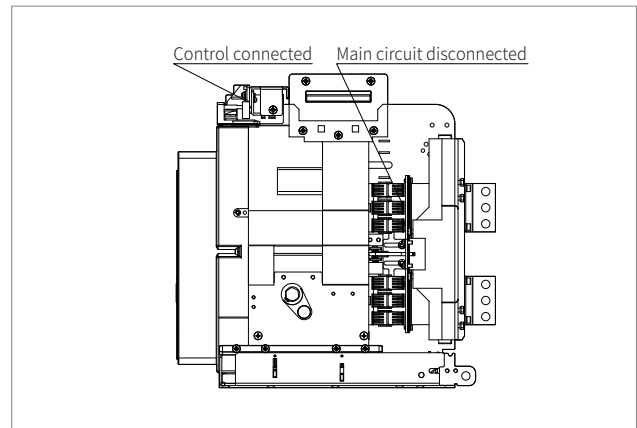
⚠ CAUTION

During the Disconnecter switches body move from ISOLATED to CONNECTED position, or from CONNECTED to ISOLATED position, do not rotate the handle by releasing position locking.

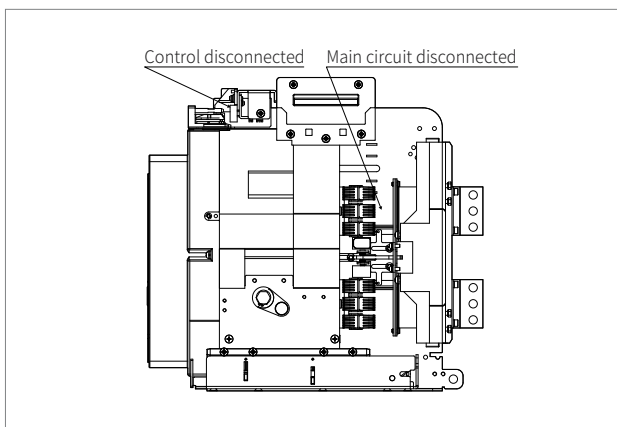
CONNECTED Position



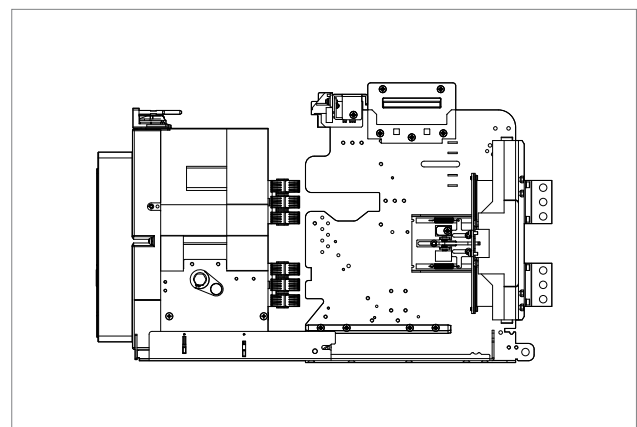
TEST Position



ISOLATED Position



REMOVED Position



4.1 Draw-out Operation

The draw-in/out handle is used to move the Disconnecter switches body to one of the three positions (CONNECTED, TEST, ISOLATED).

⚠ CAUTION

When the fixing blocks (Fig. 4. ② option) are fitted, loosen the right and left screws of the fixing blocks before drawing-out operation.

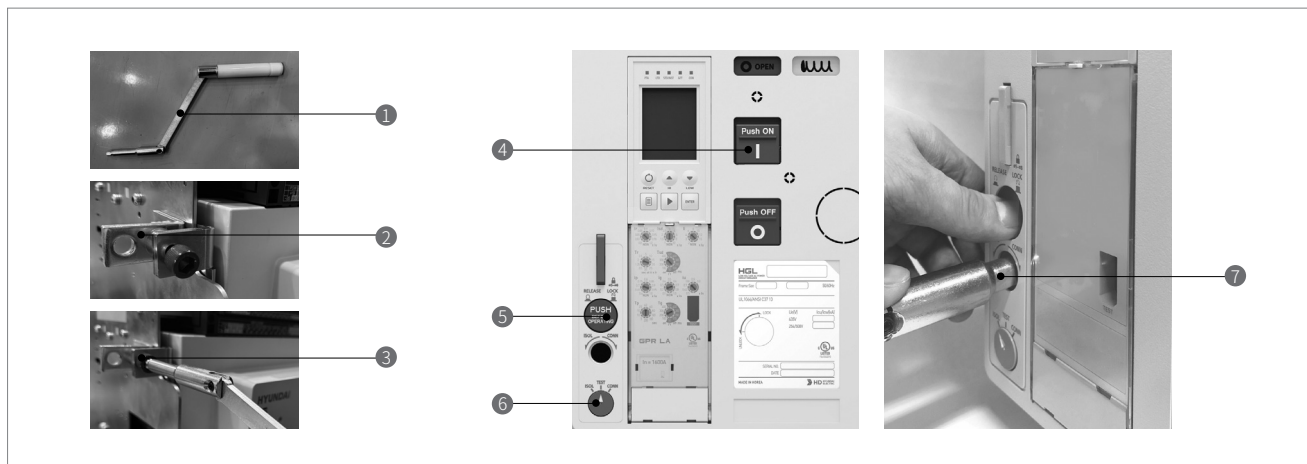
1) Moving from CONNECTED position to TEST position

- When the fixing blocks are fitted, loosen and free right and left screws. (Fig. 4. ③)
- Check that the Disconnecter switches is open.
If it is closed, push open button (Fig. 4. ④) to open Disconnecter switches.
- When the position lock release button is completely pushed in, connect draw-in/out handle to shaft fully. (Fig. 4. ⑦)
If it is not completely pushed in or not inserted, the body doesn't move and indicator doesn't rotate.
The position indicator is rotated while the Disconnecter switches body drawn out.

⚠ CAUTION

When the main circuit is disconnected as the Disconnecter switches body is being drawn out, the Disconnecter switches body will be slightly pushed forward by the spring action of the primary disconnect contacts with a "banging" sound. While the loudness of this sound may vary, the sound itself is perfectly normal and does not affect Disconnecter switches performance.

Fig. 4



⚠ CAUTION

When position lock release button (Fig. 4. ⑤) is pushed, the Disconnecter switches will not close.
In order to test operation, must move to the right position (CONNECTED, TEST, ISOLATED), and position lock release button (Fig. 4. ⑤) should be pushed out.

⚠ DANGER

When Disconnecter switches body is drawn out to the TEST position or ISOLATED position, a metallic sound "click" will be heard, and the draw-in/out handle operation is automatically locked.
At this time, do not attempt to compulsively rotate the handle.

04 Draw-out Mechanism

2) Moving from test position to Isolated position

In order to move from test to Isolated, push position lock release button (Fig. 4. ⑤) shortly after handle locking is released, and turn the draw-in/out handle in a counterclockwise direction.

⚠ CAUTION

If it is approaching ISOLATED position, draw-in/out handle (Fig. 4. ①) will be automatically locked.
Do not attempt to compulsively rotate the handle.

3) Removing body from Isolated position

For maintenance, inspection, or exchanging parts, the Disconnecter switches in the isolated position should be drawn out from the draw-out cradle. If the Disconnecter switches is charged, the Disconnecter switches should release the closing springs, by using the manual close and open button.

- To remove the DSU body from the cradle in the ISOLATED position, grasp both sides of the DSU body (Figure 5, ④) and pull it out completely.
- When the circuit Disconnecter switches is fully withdrawn, slowly remove it from the rails on both sides of the Draw-Out Cradle (Figure 5, ①).

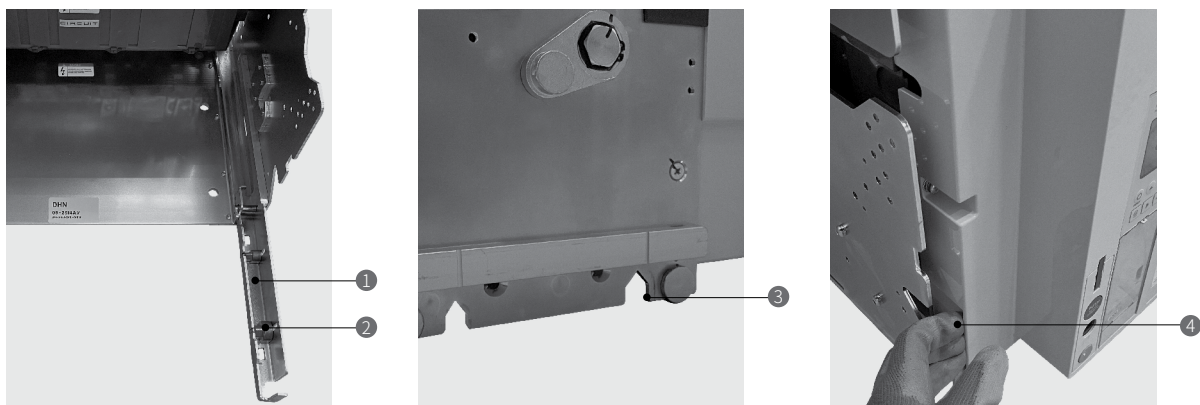
⚠ CAUTION

This operation should be done slowly.
Apply wire rope to the lifting lug and lift the body upward after releasing stoppers.

⚠ CAUTION

Don't leave the Disconnecter switches in Removed position.
When the Disconnecter switches is drawn out, the center of gravity is changed.
The draw-out cradle should be fixed in advance in the PNL.

Fig. 5



4.2 Draw-in Operation

In order to push back the Disconnecter switches body to CONNECTED position, follow steps below.

- Check that the Disconnecter switches is open. Also, check draw-in/out indicator shows isolated.
- Check charged/discharged indicator.
Indicator shows discharged「」.
- Withdraw the rails on both sides of the Draw-Out Cradle (Figure 4, ①).
- Lift the circuit Disconnecter switches using a dedicated lifter or by hanging it, and insert the circuit Disconnecter switches into the Cradle Rail (Figure 4. ①), ensuring that the Side Guide of the circuit Disconnecter switches body (Figure 4. ③) fits perfectly into the Guide of the rail (Figure 4. ②). Push the circuit Disconnecter switches all the way in, but do not apply excessive force.

⚠ CAUTION

Never enter under the Disconnecter switches.
The Disconnecter switches may fall and cause serious injury.
Do not push hard the Disconnecter switches.

- With position lock release button (Fig. 4. ⑤) pushed, connect drawing in/out handle to the shaft.
- Then, when position lock release button (Fig. 4. ⑤) is pushed, it maintains self holding and allows draw-in/out handle (Fig. 4. ①) operation.
- To move the Disconnecter switches to Connected or Test position, rotate draw-in/out handle in a clockwise direction.
With the Disconnecter switches moving, if position indicator is accessing test position, position release button (Fig. 4. ⑤) is automatically pushed out and it locked draw-in/out handle.
When the handle is locked, do not rotate excessively. This may cause damage to the Disconnecter switches.
- In the test position, with the handle stick, PUSH position release button (Fig. 4. ⑤) again and release draw-in/out handles.
- With position lock release button pushed, it maintains self holding, rotate draw-in/out handle in a clockwise direction again.
- Main circuit connection starts just before CONNECTED position, draw-in/out handle operation will become heavy.
But continue the rotating by adding force until, position indicator (Fig. 4. ⑥) of the Disconnecter switches shows connected and, position release button (Fig. 4. ⑤) is automatically pushed out to lock the draw-in/out handle.
Then, remove draw-in/out handle and fix it on the right side of draw-out cradle.
- In Connected position, do not operate draw-in/out handle in a clockwise direction. This may cause damage to the Disconnecter switches.
- When the Disconnecter switches fixing block is fitted, tighten left and right fixing screw by draw-in/out handle.
- In order to control the Disconnecter switches electrically, you should connect all circuit according to the diagram on page 44-45.

05 Periodic Inspection and Parts Replacement

Period of periodic inspection

It is most appropriate that the user works out his or her own inspection plan for the Disconnector switchss according to the switching frequency, the value of normal breaking and making currents, the magnitude of the fault current interrupted, service conditions, and environmental conditions.

It is recommended to perform a simplified inspection once every 6 months and a full inspection once every 12 months. To perform an periodic inspection, draw out to ISOLATED position or move out of draw-out cradle.

Mechanical durability life of the Disconnector switches

The following table shows the mechanical durability of the Disconnector switches for Maximum Warranty Life.

When accumulated counting number of switching cycles exceeds those shown, we recommend you check the Disconnector switches. For renewal or thorough inspection, please contact us.

Frame Size	Up to 2,500 AF					Between 3,200 AF and 4,000 AF					
AF	800	1,000	1,250	1,600	2,000	800	1,600	2,000	2,500	3,200	4,000
Number of switching cycle											
Mechanical	12,500										
Electrical	800	1,000	1,250	1,600	2,000	10,000	8,000	5,000	3,000	2,000	

* Electrical endurance tests were performed at the minimum rated current to reflect the most demanding arc interruption conditions.

Frequency of inspection

Frequency of inspection is considered with service condition and switching numbers, breaking/making current value, but it is recommended to perform a simplified inspection once every 6 months and a full inspection once every 12 months.

Inspection by switching numbers

Switching Conditions of DSU	Inspection Interval Based on Switching Cycles	
	Below 1,000 AF	1,250-2,500 AF
Switching operation in the state of nearly no-carrying current	1,000	1,000
Switching operation in the rated current region	500	100
Switching operation in overload region (about 2-3 times the rated current)	20	10
Switching operation in current interruption region	each time	each time

⚠ CAUTION

Draw out the Disconnector switches to the ISOLATED position or remove the Disconnector switches body from the draw-out cradle for inspection or parts replacement purposes.

Make sure that residual heat of terminal should be cooled down before performing inspection work.

Unless it may cause burn.

5.1 Arc Chamber

Check each arc chamber during the periodic inspection and also, after a fault current take place.

A cracked arc chamber cover or de-ionized grid side plate, or a heavy, hard-to-remove molten contact or de-ionized pieces inside of the arc chamber, requires replacement of the arc chamber unit.

1) Periodic inspection

Inspection Item	Method / Criteria
Dirt, dust, foreign matter	Check visually. Inside must be clean, free of foreign matter and dust. Blow off foreign matter and dust with a jet of compressed air.
Cracks	Check visually. There should be no cracks or other damage.

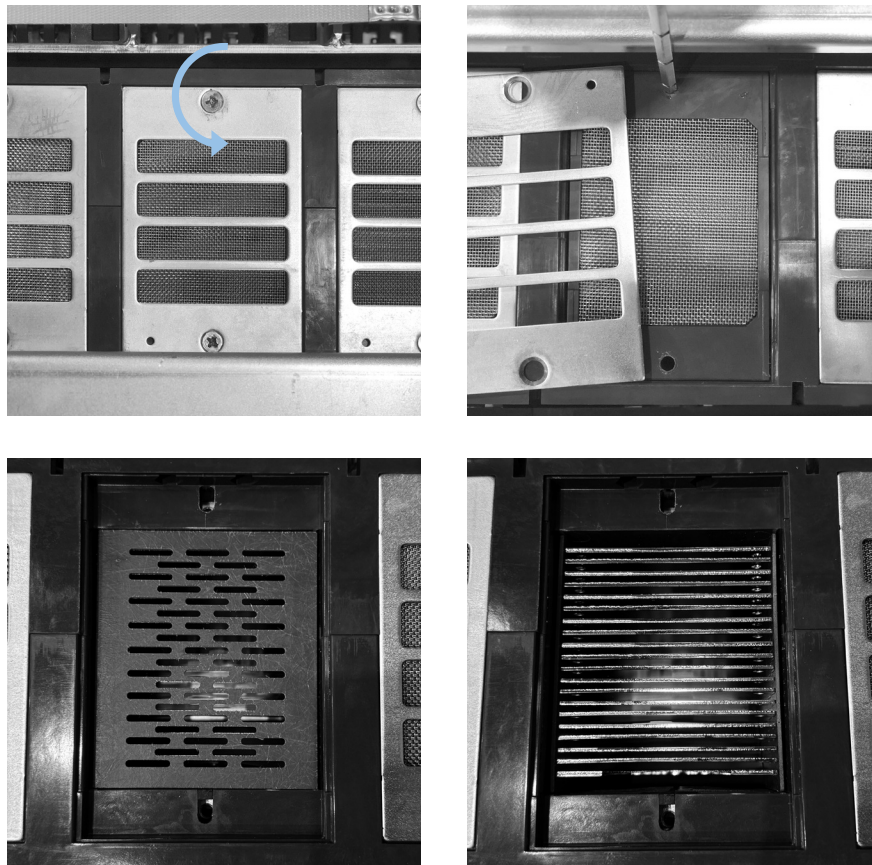
2) Removal and mounting

Loosen the two-mounting screws on the arc chamber cover until they are free. Remove the arc chamber cover and nut.

To mount the arc chamber, set nut and arc chamber in position and tighten with two-mounting screws on the arc chamber cover.

To mount the arc chamber, check square nut, place the arc chamber in position and tighten fixing screw (dish M6).

Fig. 6



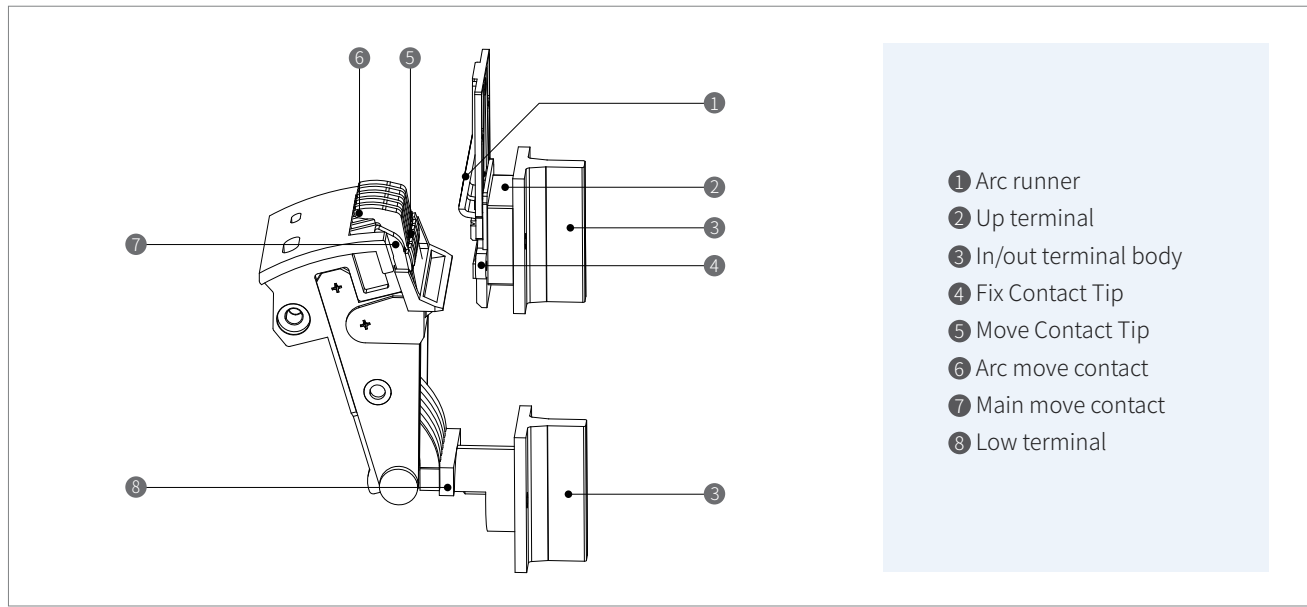
05 Periodic Inspection and Parts Replacement

5.2 Contact Unit

Contact unit are visible and accessible when the arc chamber is removed.

Check the contact unit during a periodic inspection and after a short-circuit fault current take place.

Fig. 7



1) Periodic inspection

(1) Arcing contact

Inspection Item	Method / Criteria
Contact tip surface	- Check visually. - Melting mark in the contact point tip surface is not a problem because it is a normal phenomenon by close-open arc. - Remove dirt, dust, grease, etc. - When the arcing contact is melted less than 33 % original thickness, it should be replaced. For replacements, please contact us.

(2) Main contact

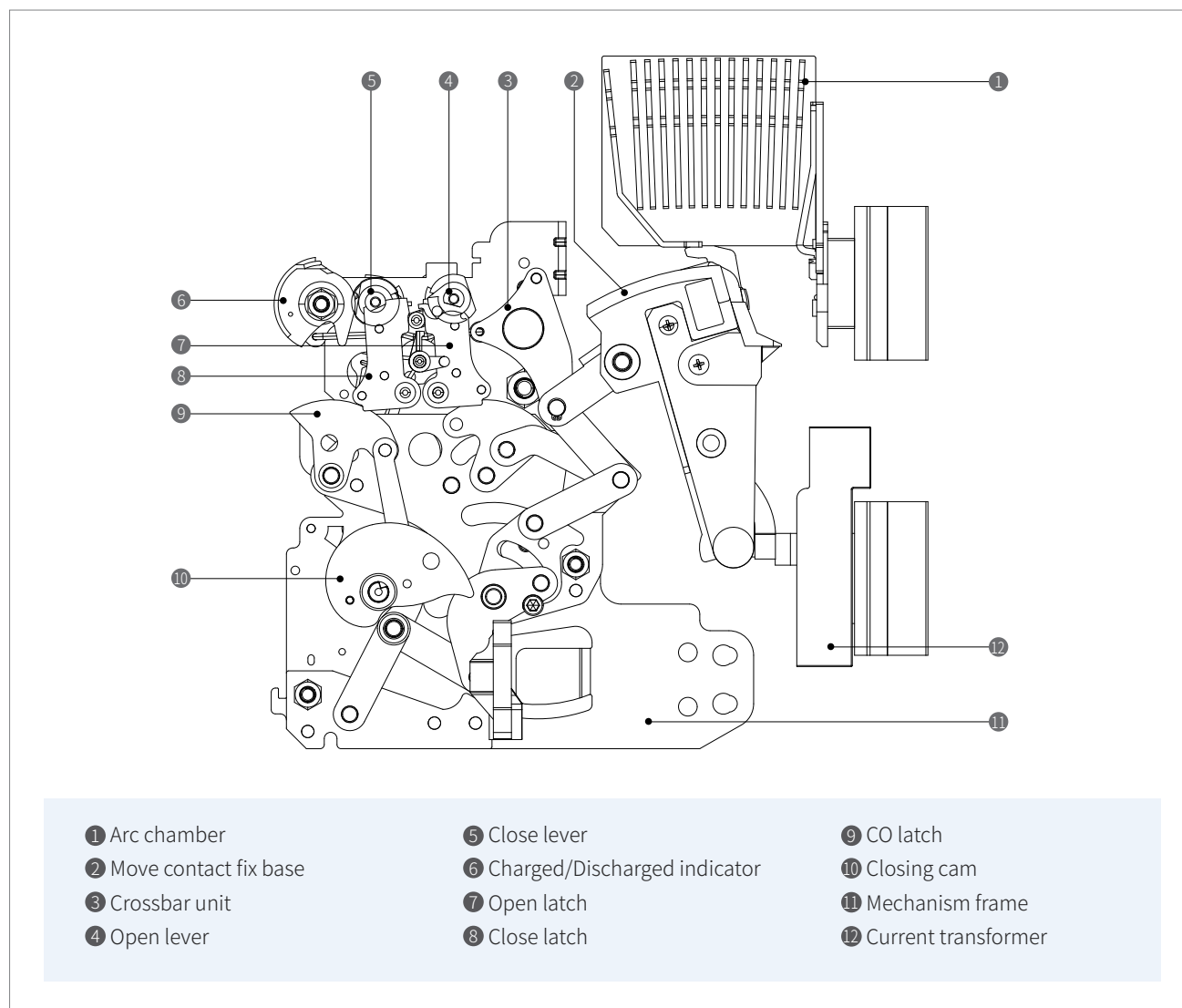
If contact surface is badly worn or become rough, you should clean the surface in case of periodic inspection.

⚠ CAUTION

When scrubbing contact trips' surface, pay attention to not let dust fall into the Disconnecter switches mechanism.
After dressing, be sure to wipe and clean contact trips.

5.3 Operating Mechanism

Fig. 8



1) Periodic maintenance

Check the operating mechanism in detail as much as possible.

If there are parts that seem to be checked or hard to check, please contact us.

Inspection Item	Method / Criteria
Operation	Open and close Disconnecter switches through manual control to check the mechanical parts for normal operation (every six months).
Lubrication	Add a small amount of grease to each of the pins, shafts and their bearings (every six months). Avoid excessive oiling to prevent the accumulation of dirt and dust.
Screws, bolts and springs	Check screws and bolts on each part for signs of loosening. Tighten them if loose. Check each spring for proper engagement and damage. Correct problem through repair or replacement (every six months).
Dirt and dust	Latching parts should be free of dirt and dust. Wipe them with a clean cloth (every six months).

05 Periodic Inspection and Parts Replacement

5.4 Internal Accessories

Loosen the two front cover mounting screws and open the front cover (Fig. 1. ②) to check internal accessories.

⚠ CAUTION

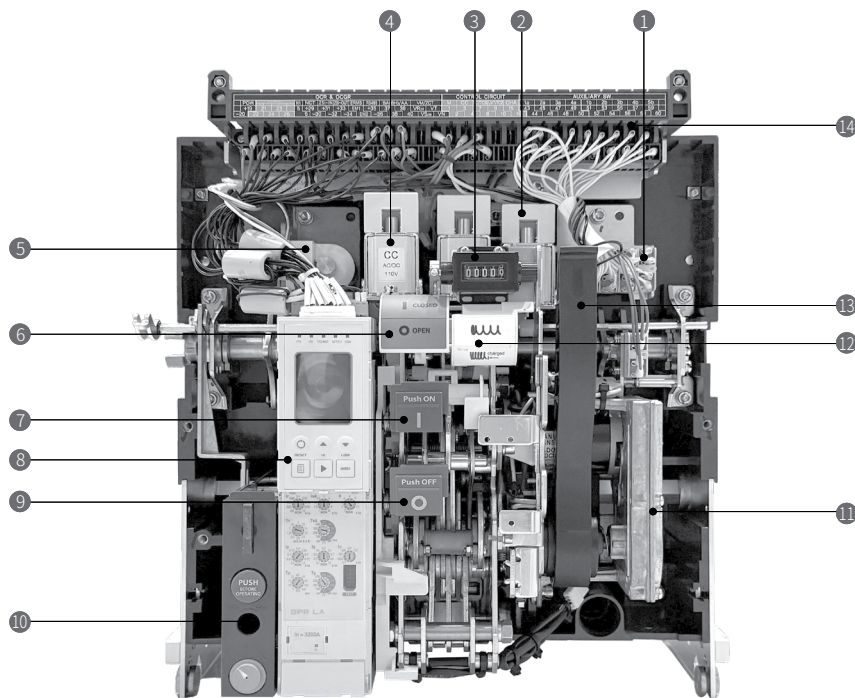
Do not place your fingers or a tool in the gap between close/open and charged/discharged indicator (Fig. 9. ⑥, ⑫) since this gap is closed when the Disconnecter switches is closed.

Do not attempt to put hand or a tool into the Disconnecter switches when closing springs are charged.

Be sure to discharge the closing springs prior to internal inspection.

Do not operate the on-off operation arbitrarily (qualified personnel only).

Fig. 9



- | | | |
|-------------------------------|----------------------------|-------------------------------------|
| ① Auxiliary switch | ⑥ Close/Open indicator | ⑪ Spring charging motor |
| ② Shunt (SHT) | ⑦ Close button | ⑫ Charged/Discharged indicator |
| ③ Cycle counter | ⑧ Over current relay (GPR) | ⑬ Manual charging handle |
| ④ LRC (latch release coil) | ⑨ Open button | ⑭ Automatic connection control jack |
| ⑤ MHT (magnetic hold trigger) | ⑩ Device of drawing in/out | |

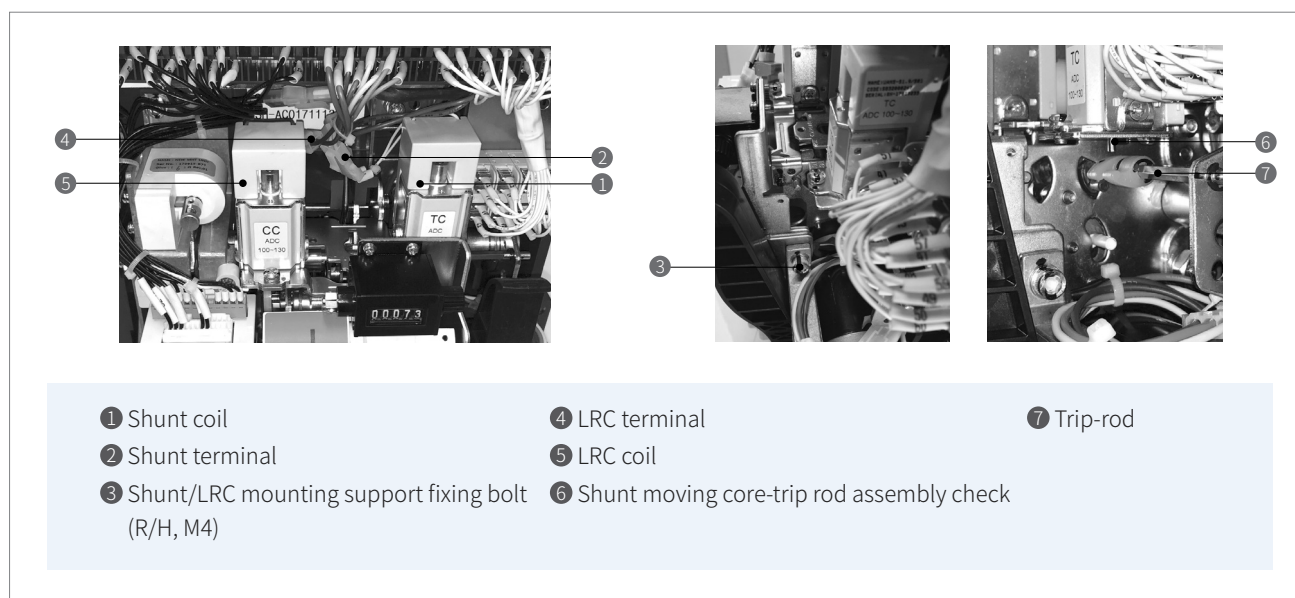
1) Shunt trip device (SHT)

Rated Voltage		Coil Resistance
AC/DC	110	$40 \Omega \pm 5 \%$
	220	$68 \Omega \pm 5 \%$
AC	380	$250 \Omega \pm 5 \%$
	440	$250 \Omega \pm 5 \%$
DC	24	$7 \Omega \pm 5 \%$
	48	$11.8 \Omega \pm 5 \%$

(1) Periodic inspection (Fig. 21. reference)

Inspection Items	Methods / Criteria / Dispositions
Operation	- Push the moving core of SHT with a pointed tool, such as a screwdriver trip, then, slowly release the core. The result is acceptable if the core returns lightly. - Push in the moving core slowly after closing the Disconnecter switches. The result is acceptable if Disconnecter switches trips open. - The result is acceptable, if the Disconnecter switches trips open at less than 70 % of the rated voltage after closing the Disconnecter switches.
Coil	- Measure the coil resistance with an ohmmeter. - If it is much lower than the value shown in table or there is no continuity, replace the coil.
Terminals and mounting screws	- Check terminals and mounting screws. Tighten them if loose.

Fig. 10. Shunt trip equipment mounting



(2) Replacement of SHT (Fig. 10)

- Remove the two pin terminal from the control jack terminals (Fig. 10. ②).
- Remove the one support mount screws (Fig. 10. ③) and take out LRC-UVT-SHT support.
- Remove the coil mount screws (Fig. 13. ③).
- A new coil is properly assembled, and during attaching it. The trip-rod and shunt moving core position is shown as in Fig. 10. ⑥, ⑦.
- After checking the light movement of the moving core of new SHT, mount it in the Disconnecter switches as it was.
- Connect the two pin terminal to the control jack terminals, and test the DSU and trip lever both electrically and mechanically for normal operation (number 7, 8).

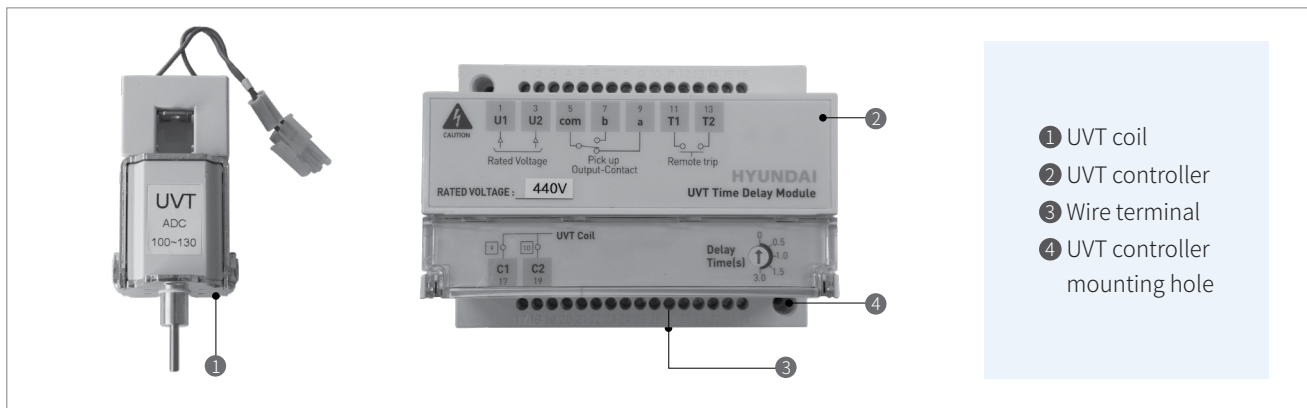
05 Periodic Inspection and Parts Replacement

2) Undervoltage trip device (UVT)

- UVT coil uses only DC rating.
- The under-voltage trip device includes instantaneous trip type and time delay trip type having 0.5 sec, 1 sec, 1.5 sec and 3 sec time delay characteristics.

(1) General view of undervoltage trip coil & controller (time delay trip type)

Fig. 11. UVT coil & UVT controller (only time delay type applied)



(2) Periodic inspection

Inspection Items	Methods / Criteria / Dispositions	
Operation	- The Disconnecter switches can not be closed when the UVT is de-energized. Because of this, if the Disconnecter switches can be closed at more than 85 % of the rated voltage, moving core becomes pick-up, the result is acceptable. - If the Disconnecter switches can be tripped from 35 % to 70 % of the rated voltage after closing the Disconnecter switches, the result is acceptable.	
Coil resistance	- Measure the coil resistance with an ohmmeter. If the measured resistance is much lower than the value shown in the right or there is no continuity, replace the UVT coil.	Coil resistance (Ω)
		118 $\Omega \pm 5 \%$
Terminals and mounting screws	- Check terminals and mounting screws for loosening. Retighten them if loose.	

(3) Replacement of UVT controller

When it is necessary to replace the UVT controller, replace the whole UVT controller unit.

- Remove the UVT wire at the wire terminal (Fig. 11. ①).
- Remove UVT mounting bolt (2-M6x10) (Fig. 11. ④).
- Take out the UVT controller.
- Install new UVT controller as it was on the Disconnecter switches with UVT mounting bolt (Fig. 11. ④).
- Connect the wire terminals with fasten terminals at the same time.
- Test the UVT both electrically and mechanically.

⚠ CAUTION

When inspecting the performance, rated voltage should be supplied unless DSU will not operate.

⚠ CAUTION

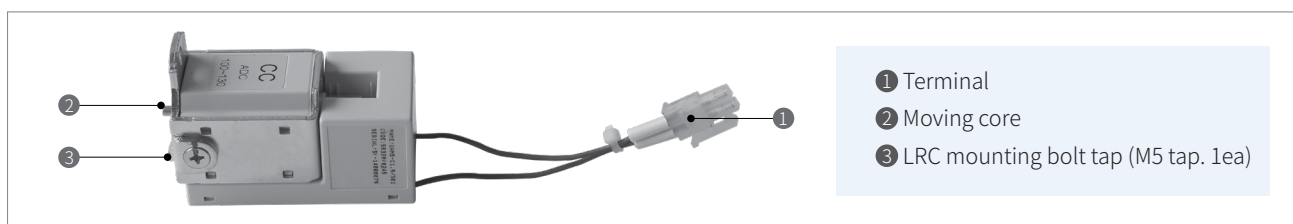
Recheck the wire terminal before supplying power.
Incorrect wiring may cause coil burning.

3) Latch release coil (LRC)

Coil resistance is same with SHT.

(1) General view of latch release coil (LRC)

Fig. 12



(2) Periodic inspection

Inspection Items	Methods / Criteria / Dispositions
Operation	- Push the moving core with a pointed tool, such as a screwdriver tip, then, slowly release the core. The result is acceptable if the core returns lightly. - Charge the closing springs and push the moving core. The result is acceptable if the closing springs are discharged. - If the Disconnecter switches can be closed at 35 % of the rated voltage, the result is acceptable.
Coil resistance	- Measure the coil resistance with an ohmmeter. If resistance was much lower than the value shown in table.1 (page 19) or there is no continuity, replace the CC.
Terminals and mounting screws	- Check terminals and mounting screws for loosening. Tighten them if they are loose.

(3) Replacement of LRC (unit replacement)

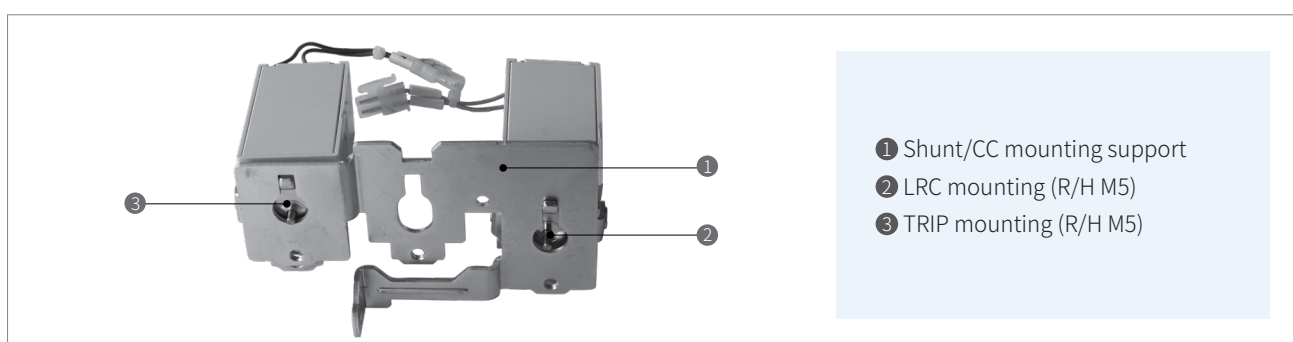
- Remove the pin terminal from the control jack terminals (Fig. 10. ④).
- Remove support mounting screw (Fig. 13. ②) M4, and take out the LRC-UVT-SHT support.
- Remove coil mounting screw (Fig. 13. ②).
- After checking the movement of the new LRC moving core, mount it in the Disconnecter switches as it was.
- Connect the pin terminal to the control jack terminals (Fig. 10. ④).
- Test the device both electrically and mechanically for normal operation in the same manner described in periodic inspection table.

⚠ CAUTION

Take care when checking on/off operation by using mechanism manual button.

Fingers may be pinched during operation.

Fig. 13



05 Periodic Inspection and Parts Replacement

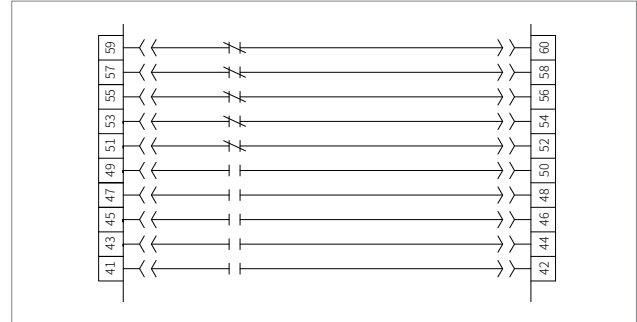
4) Auxiliary switch unit

(1) General view of auxiliary switch unit, connection circuit

Fig. 14. Aux. switch general view



Fig. 15. Aux. switch connection circuit



(2) Periodic inspection

Inspection Items	Methods / Criteria / Dispositions
Operation	- Take the Disconnecter switches body out of the cradle. - Connect the ohmmeter or alarm (buzzer) to each switch element. - Check that a-contact is ON and b-contact is OFF when Disconnecter switches is CLOSED, and that a-contact is OFF and b-contact is ON when Disconnecter switches is OPEN.
Contact surface	- If contact is excessively worn or rough, replace whole switch unit.
Terminals and mounting screws	- Check terminals and mounting screws. Tighten them if loose.

(3) Replacement of auxiliary switch unit (Fig. 17)

The auxiliary switch unit is an assembly of 10 circuits (5 a-contacts and 5 b-contacts).

Replace the whole switch unit even if there is a partial defect.

- Remove the auxiliary switch assembly bolt (1-M6 wrench bolt) (Fig. 14. ①).
- Change wire circuit.
- Tighten the auxiliary switch assembly bolt (1-M6 wrench bolt).
- Conduct periodic inspection mentioned in (2) above and make sure if the switch operates normally.

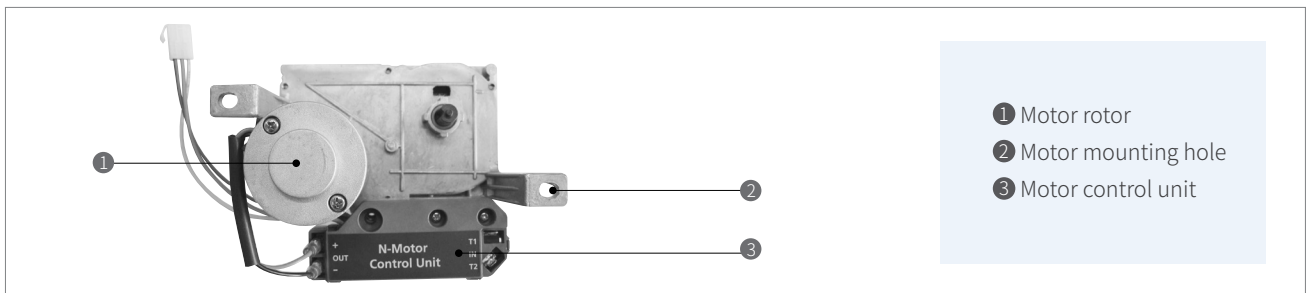
⚠ CAUTION

Replaced terminal must be properly connected before operating.

5) Motor unit

(1) Motor unit general view

Fig. 16



(2) Operation check

Open and close the Disconnecter switches through electrical control to check the relay for normal operation.

Do this in the following procedure.

- After checking front-cover, with the push-button switch ON, close the Disconnecter switches.
- Normal operation is when the Disconnecter switches is closed, the motor is rotating and the charged/discharged indicator displays「」.

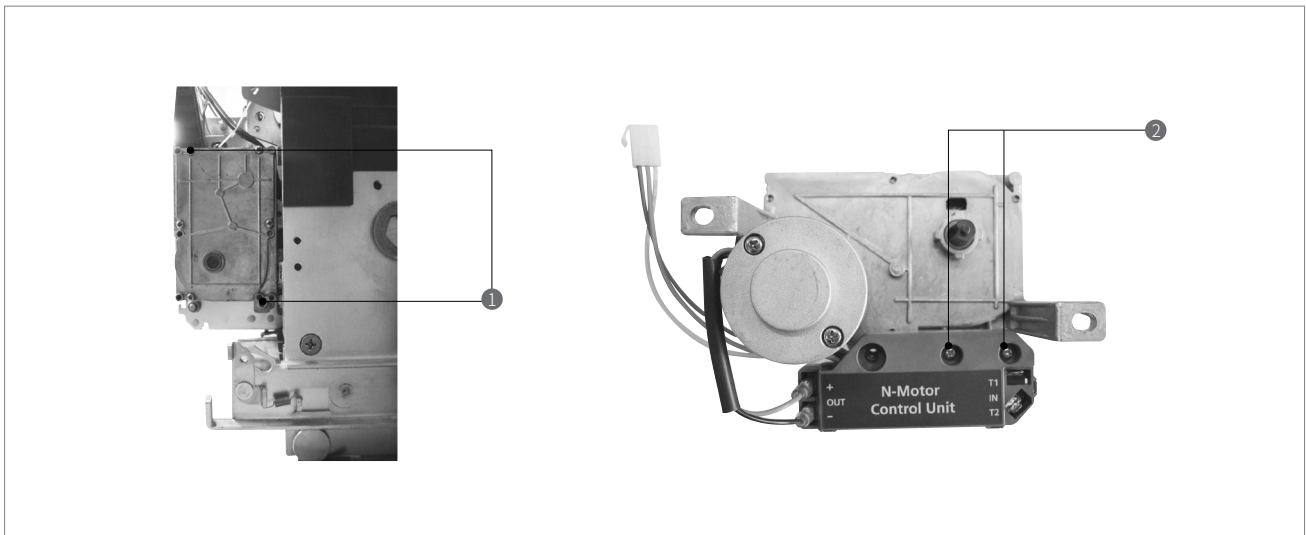
(3) Replacement of motor control unit

- Open the DSU.
- Draw-out the Disconnecter switches body out of draw-out cradle.
- Remove front cover.
- Remove both motor cables (1, 2 terminal) and control jack terminal.
- Release motor fixing bolt (2-M6 wrench bolt, Fig. 17. ①).
- Remove motor from the Disconnecter switches.
- Remove motor connection terminal (Fig. 17. ②).
- After checking new motor unit, replace, and follow steps 4-7 in reverse.
- Charging motor is originally placed position of the Disconnecter switches.
- Attach front cover.
- Check the operation according to operation check (2).

⚠ CAUTION

Replaced line terminal must be properly connected before operation.

Fig. 17



6) Direction of DSU position padlock device

- Purpose: Position padlock device is designed for locking DSU body at three positions (ISOLATED, TEST, CONNECTED) by a shackle.
- Usage: At any position, pull out position padlock plate and attach the shackle (user supplied).

⚠ DANGER

Do not draw out DSU when it is in the service states.
 Since main circuit is live, draw-out operation will cause fatal accident.
 Check the Disconnecter switches is opened before operating draw-in/out.

05 Periodic Inspection and Parts Replacement

5.5 Periodic Inspection

- 1) Special : Fault current cut-off or open and close more than 1,000 times/year
- 2) Usually : Within 2 years of installation
- 3) Thorough : More than 3 years after installation

Inspection Part	Inspection Items	Inspection Cycle			Inspection Details
		Special	Usually	Thorough	
DSU Body exterior	Appearance inspection		1 year		1) Procedures : - Check for insulation mold, control jack, front cover, OCR damage or crack - Check for damage to optional devices such as button lock, position switch, key lock, etc - Check that the body is contaminated with dust and foreign substances - Check DSU body terminal discoloration, contamination, and bolt fastening 2) Judgment : No damage, cracks, dust or foreign substance  CAUTION Contamination with dust or foreign substances may cause faulty operation or insulation performance deterioration.
DSU Body terminal part			1 year		1) Procedures : - Check the level of discoloration of the main body terminal and contamination by foreign substances - Check bolt fastening status 2) Judgment : No abnormality (M8 bolt fastening torque: 135kg·cm)  WARNING In case of contamination or bolt loosening, Overheating may be occurred due to increased resistance in the main circuit.
Arc Chamber		After cutting off fault current	1 year		1) Procedure : - Check for DI GRID unit damage or cracks(Including inspection for dust and conductive foreign substances) 2) Judgment : No damage or contamination
DSU Body contact unit		After cutting off fault current	1 year		1) Procedure : Check for Arc move contact, main move contact damage or cracks (including checking for dust and foreign substances) 2) Judgment : No damage or contamination  WARNING In case of contact contamination, Overheating may be occurred due to increased resistance in the main circuit(If contacts are damaged, parts or products need to be replaced).
Mechanism		1,000 times	1 year		1) Procedures : - Check internal parts for damage and cracks - Check operation part for sticking of dust and lubrication grease - Check the mechanism manual and electric ON/OFF and charge functions (5 times each) - Check mechanism bolt fastening status 2) Judgment : No abnormality (M8 bolt fastening torque: 135kg·cm)  CAUTION Defective operation may occur when bolts are loosened and lubricated grease is hardened.
Cradle			1 year		1) Procedures : - Check for insulation mold, control jack, left/right side plate parts damaged, cracks - Check safety shutter operation and check for damage - Isol contact to check for discoloration, grease sticking and contamination with foreign substances 2) Judgment : No abnormality  CAUTION In case of Isol contact contamination, Overheating may be occurred due to increased resistance.
Closing Coil Trip Coil UVT Coil		1,000 times	1 year		1) Procedures : - Check cable sheath damage, cable breakage and connector connection - Check if the coil internal operation rod works smoothly up/down 2) Judgment : No abnormality
OCR	OCR operation test	After cutting off fault current	1 year		1) Procedures : - Check the OCR Display for any abnormal load current and measurements - Conduct a test of the OCR Tester kit long-term, short-term, instantaneous, and ground fault functions to check the operation - Check output contact points for each function when checking OCR operation (※ Refer to the catalog and user manual for operation time standard) 2) Judgment : The measured tolerance is less than 5% and the OCR function and contact output are not abnormal
CRADLE External Terminals	Load inspection	After cutting off fault current	1 year		1) Procedure : - Check Cradle external terminal temperature with thermal imaging camera and check if there is any abnormality 2) Judgment : Measurement temperature must be 70K or less (K = Measurement temperature - External temperature)  WARNING If it exceeds 70K, overheating is suspected, and it is necessary to contact HD HYUNDAI ELECTRIC for inspection.

Inspection Part	Inspection Items	Inspection Cycle			Inspection Details																					
		Special	Usually	Thorough																						
Closing Coil Trip Coil	Test of operation characteristics	1,000 times		3 year	1) Procedures : - Check closing coil operation within the control voltage (0.85 - 1.1 Vn) range - Check trip coil operation within control voltage (0.7 - 1.1 Vn) 2) Judgment : Nothing wrong																					
UVT Coil UVT Controller		1,000 times		3 year	1) Procedures : - Check UVT Coil operation at 0.85Vn or higher by stepping up the control voltage - Check UVT coil operation at 0.35Vn or less by writing down the control voltage - Check the UVT controller delay set operation time below the control voltage of 0.35Vn (0.5, 1, 1.5, 3 sec) 2) Judgment : Nothing wrong																					
Motor		1,000 times		3 year	1) Procedures : - Check motor operation within the control voltage (0.85 - 1.1 Vn) range - Check mechanism handle limit sw contact before/after motor charging 2) Judgment : Nothing wrong																					
Auxiliary switch				3 year	1) Procedures : - Check auxiliary contact "a" contact status after DSU Close - Check auxiliary contact "b" contact status after DSU Open 2) Judgment : No abnormal contact output																					
Main circuit of the DSU body	Main circuit contact resistance test	After cutting off fault current		3 year	1) Procedure : - Measure the main circuit contact resistance for each phase and check whether there is an abnormality (based on DC100A) 2) Judgment : Below the standard ! WARNING If the main circuit resistance is higher than the standard value, Overheating may be occurred. <table><tr><th colspan="3">HGL TYPE</th></tr><tr><th colspan="2" rowspan="2">TYPE</th><th>RESISTANCE(μΩ)</th></tr><tr><th>DSU BODY (Draw-out TYPE)</th></tr><tr><td>A FRAME</td><td>HGL08~16</td><td>13</td></tr><tr><td rowspan="2">B FRAME</td><td>HGL08~25</td><td>12</td></tr><tr><td>HGL32</td><td>12</td></tr><tr><td>C FRAME</td><td>HGL40</td><td>20</td></tr><tr><td>D FRMAE</td><td>HGL60</td><td>13</td></tr></table>	HGL TYPE			TYPE		RESISTANCE(μΩ)	DSU BODY (Draw-out TYPE)	A FRAME	HGL08~16	13	B FRAME	HGL08~25	12	HGL32	12	C FRAME	HGL40	20	D FRMAE	HGL60	13
HGL TYPE																										
TYPE		RESISTANCE(μΩ)																								
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B FRAME	HGL08~25	12																								
	HGL32	12																								
C FRAME	HGL40	20																								
D FRMAE	HGL60	13																								
Main circuit of the DSU body control circuit	Insulation resistance test	After cutting off fault current		3 year	1) Procedures : - Conduct an insulation resistance test of the main circuit and control circuit to check if there are any abnormalities (applies 500V Megger) 2) Judgment : Main circuit 1000MΩ or more, control circuit: 300MΩ or more																					
Main circuit of the DSU body control circuit	Withstand voltage test	After cutting off fault current		3 year	1) Procedures : - Check the withstand voltage performance of the main and control circuits *Main circuit: AC3500V for 1 minute, Control circuit: AC1500V for 1 minute (OCR is removed during test) 2) Judgment : Nothing wrong ! CAUTION If there is any abnormality in withstand voltage performance, please contact HD HYUNDAI ELECTRIC for inspection.																					

07 Insulation Resistance Test and Dielectric Withstand Test

The insulation resistance test and dielectric withstand test for main circuit and control circuit are performed as follows:

7.1 Main Circuit

- Dielectric withstand voltage performance is AC 3,500 V for one minute.
- Use a DC 500 V insulation resistance tester (megger) (over 300 ohm).

7.2 Control Circuit (to earth)

- Dielectric withstand voltage performance is AC 1,500 V for one minute.

For DC 24 V rating of motor charging and closing operation circuits, its characteristic is AC 500 V for one minute (control circuit terminals ①, ②, ③).

For DC rating of the following control circuits, withstand voltage test is impossible.

- Control circuit terminals ⑨ and ⑩ of undervoltage trip device (UVT).
 - The terminals ⑲ and ⑳ of GPR protection relay.
- Use DC 500 V insulation resistance tester (megger) for insulation resistance test.

CAUTION

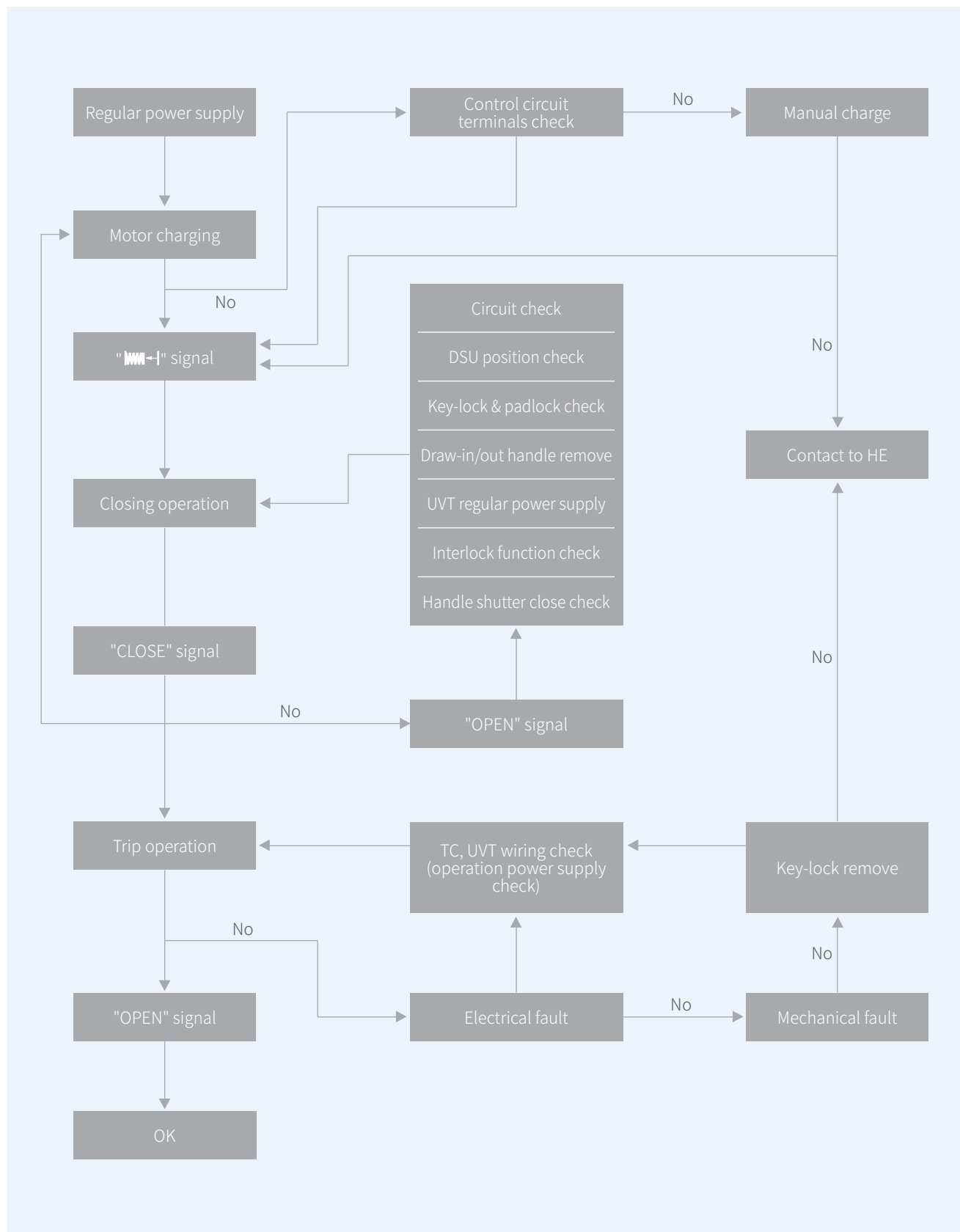
The circuit connected with OCR do not test insulation resistance test and dielectric test.
There are possibilities of malfunction and breakdown by damaging for internal protection device.
(Control Jack : No.19~20, VR, VS, VT, VN)

08 Troubleshooting Points

No.	Trouble	Phenomenon		Expected Causes	Corrective Actions
		Machine	Electrical		
1	Close fault	×	×	1. Mechanism badness	1. Contact HE
				2. Whether it is charging by handle mechanism	2. Contact HE
				3. Is close rod returned ?	3. Close rod returning check
				4. Whether inertia latch is jamming or not ?	4. Inertia latch movement check.
				5. Is DSU placed in proper position (ISO-TEST-CON) ?	5. Move to proper position
				6. Is GPR manual reset button pull out ?	6. Push back GPR manual reset button
				7. Is UVT coil applied proper voltage ?	7. UVT source check
				8. Is position lock button handle cover pushed in ?	8. Handle cover comeback . Push draw in/out handle and adjust position confirm button returning
				9. The Disconnecter switches caught interlock ?	9. Interlock dissolution
				10. Is trip latch turned down ?	10. Trip latch returning
		×	O	1. Is close rod returned ?	1. Close rod returning
				2. Is trip latch turned down ?	2. Trip latch returning
		O	×	1. Is proper voltage applied to CC coil ?	1. CC coil voltage check
				2. Is CC coil operates normally ?	2. Coil replacement
				3. Is CC coil stroke in proper position ?	3. Stroke check
				4. Is UVT coil applied proper voltage ?	4. UVT source check
				5. Is over current relay reset ?	5. Reset OCR
2	Open fault	×	×	1. Whether any interlock system exist ?	1. Contact HE
				2. Whether trip latch exists bur ?	2. Contact HE
		O	×	1. Whether proper voltage applied to TC coil ?	1. TC coil voltage check
				2. Whether TC coil exists mechanical interference	2. After voltage is applied, check core movement
				3. Whether proper voltage applied to UVT coil ?	3. UVT coil voltage check
3	Charging fault	×	×	1. Whether handle mechanism cam operates normally ?	1. Contact HE
		O	×	1. Whether proper voltage applied to motor ?	1. Voltage check (85-110 % of rated voltage)
				2. Whether motor control unit is damaged	2. Motor output voltage check
				3. Whether motor ratchet (M/B) is proper	3. Part check

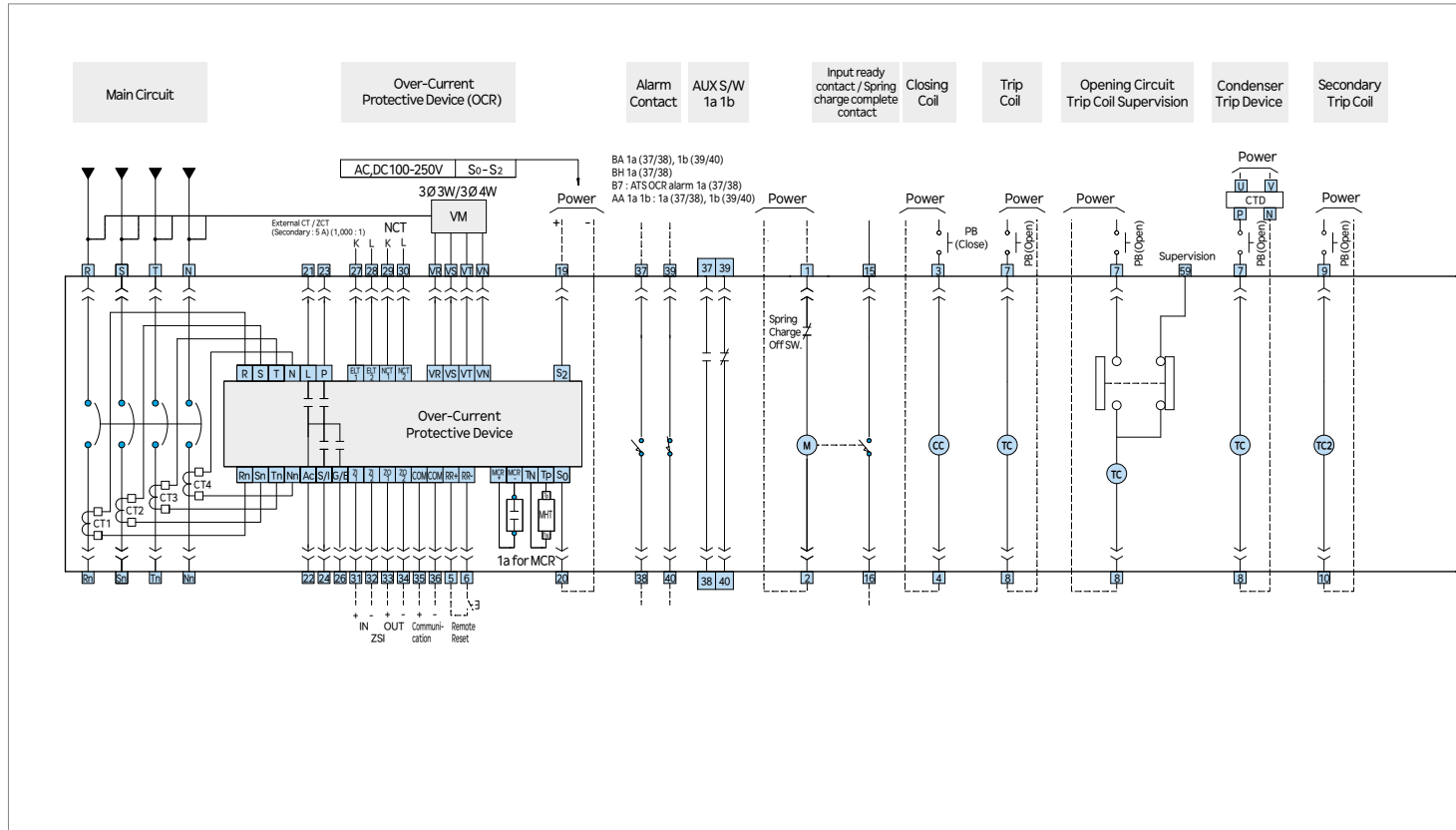
09 Appendix

9.1 Closing and Trip Operation Cycle



09 Appendix

9.5 Wiring Circuit for ACB



Symbol description

CT	Current transformer
L	LTD terminal
PT	PTA (pre-trip alarm) terminal
G	Ground fault terminal
S/I	STD/INST terminal
Ac	Common terminal
NCT	Neutral current transformer
ZI	Zone selective input
ZO	Zone selective output
MCR +/-	MCR input terminal
Tp / Tn	MHT input source
M	Charging motor
CC	Close coil (close)
TC	Trip coil (open)
UVT	Under voltage trip coil
CT	Magnetic hold trigger
S0 / S2	GPR protection relay source power

Terminal description

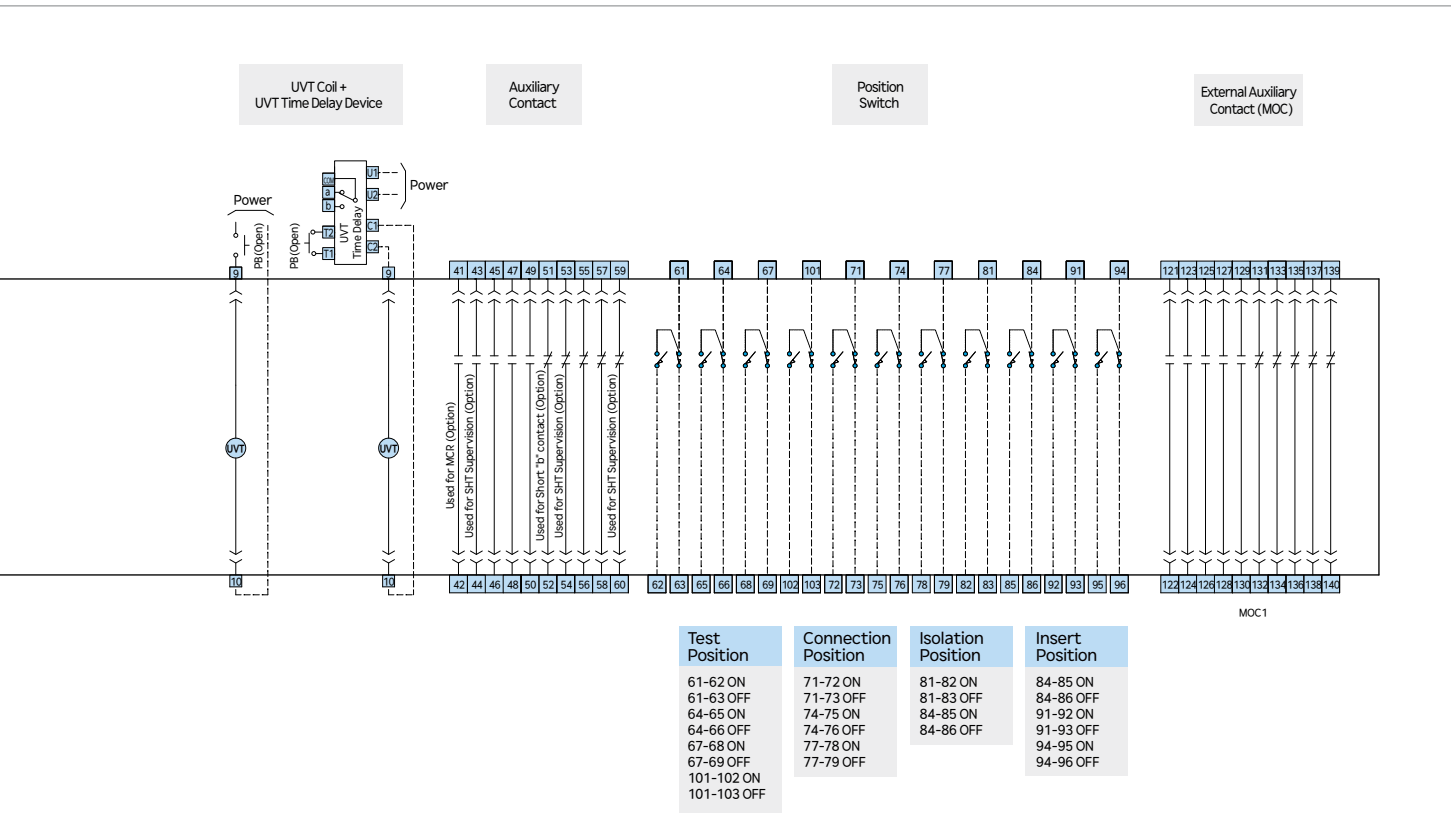
1	2	Charging motor (M) source power
3	4	Closing coil (CC) source power
7	8	Open coil (TC) source power
9	10	UVT coil terminal
15	16	Charge complete contact
19	20	OCR source power
22	21	LTD contact
22	23	PTA/TEMP contact
22	24	STD/INST contact
22	26	GFT/ELT contact
29	30	NCT input terminal
31 - 34		ZSI
41 - 60		AUX. contact
61 - 93		Position switch

— Manufacturer's wiring

--- User's wiring

⌋⌋ Disconnecting device (draw out type)

- RR / Remote Reset
- VM / Voltage Module
- VR~VN / Voltage phase input
- R~N / Current input
- Rn~Nn / Current input



Control jack lay-out

OCR														Operating					Auxiliary switch										
POW	OCR Contact					ELT	N-CT	ZSI	COM	Temp		V Input		M	CC	TC	UVT	CHA	1a	2a	3a	4a	5a	1b	2b	3b	4b	5b	
	COM	L	S/I	P/T	G/E																								
19	21	23		27	29	31	33	35	37	39	VR	VT	1	3	7	9	15	41	43	45	47	49	51	53	55	57	59		
20	22	24		26	28	30	32	34	36	38	40	VS	VN	2	4	8	10	16	42	44	46	48	50	52	54	56	58	60	
OCR Protection relay													Operating circuit					Auxiliary switch											

OCR														
POW	OCR Contact					ELT	N-CT	ZSI		COM	Temp		V Input	
	COM	L	S/I	P/T	G/E									
	19	21	23	27	29	31	33	35	37	39	VR	VT		
20	22	24	26	28	30	32	34	36	38	40	VS	VN		

- GPR Protection relay -

Operating				
M	CC	TC	UVT	CHA
1	3	7	9	15
2	4	8	10	16

- Operating circuit -

Auxiliary switch									
1a	2a	3a	4a	5a	1b	2b	3b	4b	5b
41	43	45	47	49	51	53	55	57	59
42	44	46	48	50	52	54	56	58	60

- Auxiliary switch -

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