T-solution Leader in Electrics & Automation

Installation, Operation and Maintenace Instruction

Vacuum Circuit Breaker

Safety Instructions

- Customers, engineers, operators should read this instruction manual carefully before starting all works.
- Keep this manual at your sight.

Pro-MEC Series

(LVB-12□-25/32/40/50D)

LS Industrial Systems

www.lsis.biz

Contents

Safety Precautions

▶ **Please follow this "Safety Precautions" surely so that any failure to observe these precautions could result in severe personal injury, death or equipment damage.**

⚠ **DANGER**	**This symbol indicates the instant death or serious injury if you don't follow instructions.**
⚠ **WARNING**	**This symbol indicates the possibility of death or serious injury.**
⚠ **CAUTION**	**This symbol indicates the possibility of injury or damage to property.**

■ **The meaning of each symbol in this manual and on your equipment is as follows.**

⚠ **This is the safety alert symbol.**
Read and follow instructions carefully to avoid dangerous situation.

⚠ **This symbol alerts the user to the presence of "dangerous voltage" inside the product that might cause harm or electric shock.**

⚠ **DANGER**

Do not touch charged parts electrically like conductors and connector parts of terminals, under any of energized condition.
Otherwise, there is the danger of severe physical injury, or electrocution is caused by electric shock.

Safety Precautions

⚠ WARNING

1. **Inspection and maintenance have to be performed by a qualified electrician.**
   Otherwise, there is the danger of malfunction, severe physical injury or electric shock.
2. **When the circuit breaker is in service, don't open the front cover.**
   Otherwise, there is the danger of severe physical injury or electric-shock.
3. **When the circuit breaker is in service, don't insert or withdraw the circuit breaker.**
   Otherwise, there is the danger of severe physical injury or electric-shock.
4. **Inspection and maintenance have to be performed only after shutting off the electric power and discharging a charge current.**
   Otherwise, there is the danger of severe physical injury or electric shock.
5. **When making bolts and screw assembling, follow the instruction with recommended torque values.**
   Otherwise, there is the danger of over heating or fire.
6. **After performing installation, maintenance or inspection, remove some foreign objects like tools, test leads or bolts, instruments.**
   Otherwise, there is the danger of short circuit or fire.
7. **When performing a maintenance, make a power-off of the circuit breaker and maintain test position.**
   Otherwise, there is the danger of electric shock.
8. **Do not move the circuit breaker by handling main circuit bus terminals.**
   Otherwise, there is the danger of an electric accidents by temperature rise.

Safety Precautions

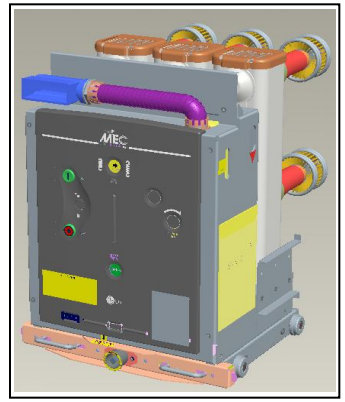
⚠ CAUTION

1. **Don't alter the control circuit at discretion.**
   Otherwise, there is the danger of malfunction or damage to products.
2. **The circuit breakers must be kept in dry condition and don't reach water.**
   Otherwise there is the danger of deterioration of insulation.
3. **This products must be stored at the place with no corrosive gas.**
   Otherwise there is the danger of a damage of products (discoloration, increase in contact resistance).
4. **When storing VCBs for a long period of time, put dust cover on them to prevent dust from entering.**
   Otherwise it may result in electrical accidents during use since dielectric strength gets reduced.

Receiving & Unpacking, Service Conditions

Receiving & Unpacking

1. When unpacking the package, take care to handle the circuit breaker, standard components and accessories.
2. Certify that the instruction manual and a test report of final testing were packed inside each PVC envelop.
3. If damage or breakage of products are founded, immediately notify LSIS' sales office or service representatives.
4. If damage or breakage of products by the carrier are founded, immediately file a claim with the carrier and notify the shipping company.



Operating conditions(Indoor use)

1. Normal operating condition

Design to IEC 62271-100(IEC60694), with the following limits values :

Receiving & Unpacking, Service Conditions

■ Ambient temperature
- * Maximum : +40℃ * Maximum 24 hour average : +35℃
- * Minimum : -5℃

■ Maximum site altitude : ≤ 1000 m above sea level.

■ Relative Humidity
- * 24 hour average value : ≤ 95%
- * One month average value : ≤ 90%

2. Special operating conditions

Special operating conditions are to be agreed on by the manufacturer and user.
The manufacturer must be consulted in advance about each special operating conditions using at the following cases or places :.

■ Higher level of site altitude or ambient temperature exceeding the normal conditions
■ At place much influence by sea wind.
■ At a wet place with high humidity usually
■ At places with much water or oil vapors
■ At places with an explosive, flammable or noxious gas
■ At places with much dust
■ At places with abnormal vibration or impact
■ at places with much ice and snow
■ In case of using at other special conditions besides above cases

Moving, Storage and Disposal

Moving

⚠ WARNING

1. When performing a maintenance, make a power-off of contactor and maintain it at the test position.
may result in electric shock.

2. Make sure to remove the lifting hook for centering weight before inserting circuit breaker into CB compartment of switchgear.
Otherwise, there is the danger of damage to products or short circuit.

Moving, Storage and Disposal

1. For lifting or moving the circuit breaker, a specified lifting device should be used.
2. Before inserting circuit breaker which have special lifting hooks for centering weight into CB compartment of switchgear remove lifting hooks.
3. When lifting the withdraw type of circuit breakers with a cradle, it should be raised at the state of running position.

Storage

⚠ CAUTION

1. The circuit breakers must be stored in clean, dry, dust and condensation- free environment.
may cause a weakness of insulation.

2. The products must be stored at the place with no corrosive gas.
may cause a damage of product s (discoloration, increase in contact resistance)

Disposal

⚠ CAUTION

1. When making a disposal, dispose it at a designated place with no affection to environment.
may cause an environmental pollution

1. According to the ISO 14000, separate all of them as metallic or non-metallic material and dispose them at a designated place after dividing all of material as renewable materials and other materials which may cause an environmental pollution.
2. In case of being materials whatever you want to remake please contact us.
3. In case of special materials making noxious gas when destroying by fire, be sure to dispose them at an approved place

Installation

⚠ Caution

1. VCB life span and performance can be guaranteed when periodic visual inspection and maintenance are in place.

- It shall be kept clean by removing the foreign objects around or inside switchgear.
- Corrective action shall be taken in advance to limit any dust and high humidity since they may result in unexpected faults or accidents.
- Switchgear door shall be well closed to prevent it from being invaded by rats or frogs which may cause the electrical incidents.
- Sufficient effort shall be made to maintain it in a dry condition if it is installed in presence of high humidity or during the rainy season. Humidity is fatal to electricity.
- Check if the wire is well coated and paint dose not come off from the panel.
- The corrective action shall be taken if the installation place has a higher or lower temperature than specified operating range.

2. Any incident or damage resulting from customers neglect or mistake will void the warranty.

⚠ Warning

1. Installing VCB at outdoor switchgear

- Extra care shall be taken to avoid dew condensation(Humidity) on the surface of VCB insulating materials by suitable ventilation of inner heating.
- The reduced dielectric strength can be a major factor causing short-circuit or ground fault.

Pro-MEC VCB

Installation

For safe and normal operation of circuit breaker installed in switchgear, a very careful and special installation should be followed.

- ■ Handle with care when raising up by lift, etc. because circuit breaker lurches.
- ■ Before inserting circuit breaker which have special lifting hooks for centering weight into CB compartment of switchgear remove lifting hooks.
- ■ When installing a fixed type of circuit breaker into switchgear, fix the contactor with same torque value by passing through mounting holes (6-Ø14) after inserting spring washers into head of bolt without high pressure or alteration.
- ■ Take care not to apply pressure or permanent tension by bus bars or others to main bus terminals.
- ■ Keep the terminal of bushing horizontal and centered, otherwise the tulip contacts of circuit breaker may result in overheating and burns in use.
- ■ Remove dust or other foreign substances.
- ■ When bolting, follow the recommended torque value specified in Table 1.

⚠ WARNING

1. When making bolts and screw assembling, follow the instruction with recommended torque values
may result in over heating or burns.

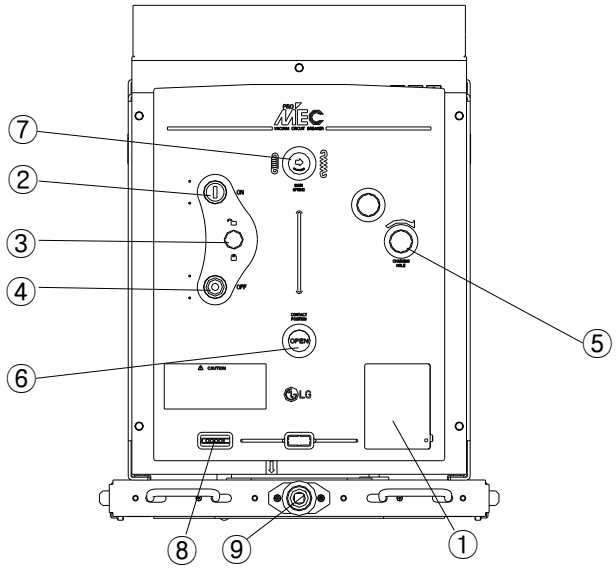
2. Do not alter the control circuit at one's discretion.
may cause of malfunction or damage to products.

<Table 1> Torque value

Torque / Size of bolt	Steel (kgf · cm)	Brass (kgf · cm)
M 3	7.3 (6.2 ~ 8.4)	4.3 (3.7 ~ 4.9)
M 3.5	11.2 (9.5 ~ 12.9)	6.6 (5.6 ~7.6)
M 4	16.8 (14.2 ~ 19.3)	9.8 (8.4 ~ 11.3)
M 5	33.0 (28 ~ 37)	19.1 (16.2 ~ 22.0)
M 6	56.0 (48 ~ 65)	33.0 (28 ~ 38)
M 8	135 (115 ~ 156)	89 (68 ~ 91)
M 10	270 (230 ~ 310)	159 (135 ~ 182)
M 12	470 (410 ~ 540)	270 (230 ~ 310)

Structure and operation

1. Front Parts



<Figure 1> Front part of circuit-breaker
(G Type Withdrawable Type)

① Name plate
② Manual closing button
③ Key-Lock Device
④ Manual trip button
⑤ Manual charging hole
⑥ Contact position indicator
⑦ Closing spring charging indicator
⑧ Operation counter
⑨ Screw for Insertion & Withdrawal

Structure and operation

1.1 Operating method for operating mechanism

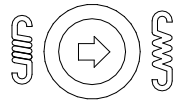
The operating mechanism is designed to be operated by manual and/or electrical motor.

1) Manual spring charging

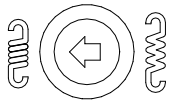
a) Manual : Insert a manual charging handle into a manual charging hole (Fig.1/No.5) and rotate it over 20 times clockwise until it runs idle.
At the same time of charging completion it sounds “clatter”

b) Motor : If the control power is provided to the control circuit of circuit-breaker the charging motor with a gear box is activated and it starts to charge the spring. After a completion of charging for the closing spring the control power for motor will be disconnected by the limit switch of motor.
At this stage the closing spring will be recharged automatically as repeating the above sequence according to manual closing operation.

Summary : It can be verified a completion of closing spring charging by a spring indication shown via the closing spring charging indicator(Fig.1/No.7)
If it is not charged completely, the



<Figure 2.1> Charged



<Figure 2.2> Discharged

2) Closing operation

Manual : If the closing button(Fig.1/No.2) on the front of circuit-breaker is pressed the closing operation is started and the red color of ”ON” plate is appeared by rotation of the contact position indicator(Fig.1/No.6) simultaneously.

3) Trip operation

Manual : If the trip button(Fig.1/No.4) is pressed until the trip latch will be released the trip operation is performed and the green color of “OFF” plate is appeared by rotation of the contact position indicator(Fig.1/No.6).
The electrical remote control for above operations is available if each signals is provided since this operating mechanism have electrical closing and tripping devices.

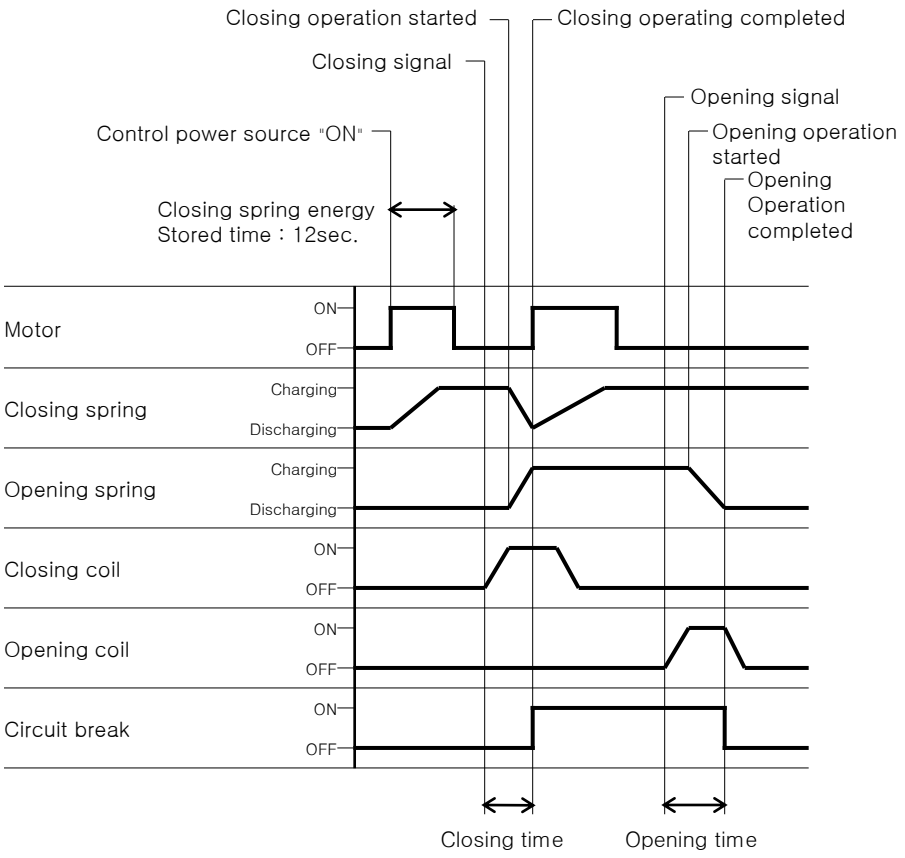
4) High-speed reclosing operation

This operating mechanism is available for the high-speed reclosing (O-0.3s-CO) operating duty by remote operation at the status that the main circuit is “CLOSE” and the closing spring is “CHARGED”
For this operation the auto charging of closing spring should be within 10 sec.
This circuit-breaker is available for auto charging of closing spring within 8 sec.

Structure and operation

1.2 Operating sequence

The sequence of operating mechanism is as follows;



<Figure 3> Operating sequence

Structure and operation

1.3 Operating frequency

In order to keep the operating mechanism parts or components at the best service condition, please avoid any unnecessary operation and also attend the followings.

* Make a successive operation 10 operations with the minimum time interval(about 12 sec.) required for charging the closing spring.
(The 30 min. of time interval should be required at least after a successive operation)
* Operate 20 times per an hour.
* Operate 100 times per a day.

In case of requiring frequent switching operation,or any severe operating duty under the dusty and polluted environment, it needs to be added the frequency of periodic inspection or maintenance.

Structure and operation

1.4 The theory of motor operation

Operating sequence	Operating results		Possible successive operation
	Main circuit contact status	Closing spring status	
Input a control power Electrical charging	Tripped		Closing-Trip
CB Closing	Closed		Trip
Auto Recharging	Closed		Trip-Closing-Trip
CB Trip	Tripped		Closing-Trip
CB Closing	Closed		Trip
Auto Recharging	Closed		Trip-Closing-Trip
High-speed Reclosing	Tripped		
	Closed		Auto Recharging Starting
	Tripped		
Auto Charging Completed	Tripped		Closing-Trip
CB Closing	Closed		Trip
Auto Recharging	Closed		Trip-Closing-Trip

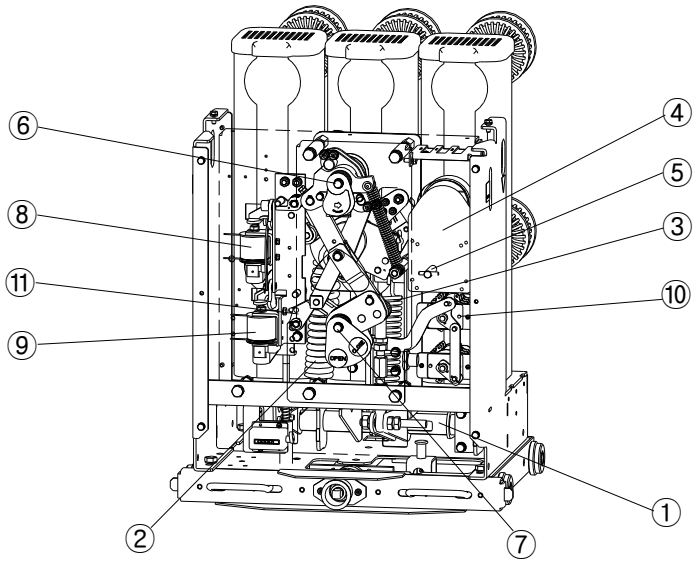
Structure and operation

1.5 The theory of motor operation

Operating sequence	Operating results		Possible successive operation
	Main circuit contact status	Closing spring status	
Manual Charging	Tripped		Closing-Trip
CB Closing	Closed		Trip
CB Trip	Tripped		–
Spring Charging	Tripped		Closing-Trip
CB Closing	Closed		Trip
Manual Recharging	Closed		Trip-Closing-Trip
High-speed Reclosing	Tripped		
	Closed		–
	Tripped		
Manual Charging	Tripped		Closing-Trip
CB Closing	Closed		Trip
Manual Recharging	Closed		Trip-Closing-Trip
CB Closing	Closed		Trip

Structure and operation

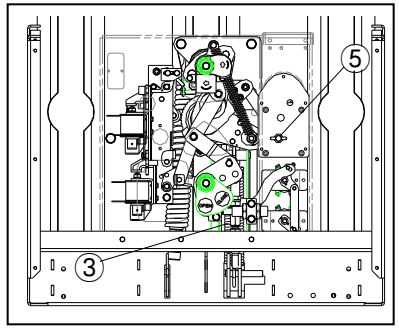
2. Operating mechanism parts



<Figure 4> Structure of operation mechanism

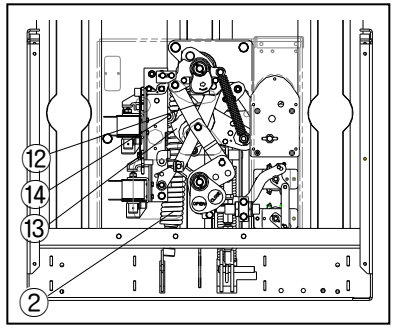
① Switching shaft
② Closing spring
③ Opening spring
④ Motor
⑤ Manual charging shaft
⑥ Driving shaft
⑦ Driven shaft
⑧ Closing coil
⑨ Trip coil
⑩ Auxiliary switch
⑪ Trip latch

Structure and operation



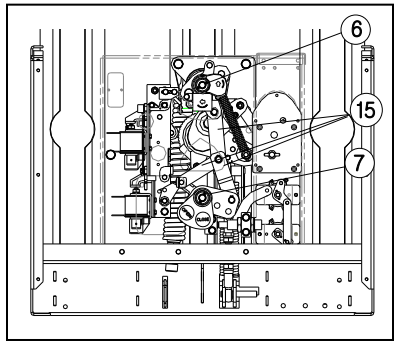
<Figure 5.1>

1) Main circuit is is open.
The closing and opening spring are discharged



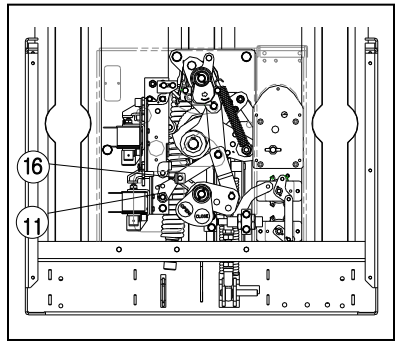
<Figure 5.2>

2) Main circuit is open
The closing spring is charged
The opening spring is discharged



<Figure 5.3>

3) Main circuit is closed
The closing spring is discharged
The opening spring is charged



<Figure 5.4>

4) Main circuit is closed
The closing and opening spring are charged.

② Closing spring
③ Opening spring
⑤ Manual charging shaft
⑥ Driving shaft
⑦ Driven shaft
⑪ Trip latch
⑫ Gear cam
⑬ Crank shaft
⑭ Trip latch and roller
⑮ Linkage
⑯ Roller

Structure and operation

2.1 Operation of operating mechanism

1) Main circuit opening 1

Figure 5.1 shows the main circuit is open status, the closing spring(2) and the opening spring(3) are discharged status. If the gear cam(12) is rotated clockwise by manual or electrical motor, then the closing spring(2) will be charged.

2) Main circuit opening 2

Figure 5.2 shows the main circuit is open status and the closing spring(2) is charged. In this situation, the crank shaft (13) connected with the closing spring (2) is located passing through the Death Point and is getting a rotation force of clockwise, but it maintains the current situation since the roller of closing latch (14) is engaging this rotation. At this time the motor will be stopped when the closing spring is charged completely.

3) Main circuit closing 1

Figure 5.3 shows the main circuit is closed status and the opening spring is only charged. If the roller(14) is released from the cam of crank shaft (13) by a closing signal, the crank shaft will be rotated clockwise. At the same time the driving shaft(6) connected with linkages and the driven shaft(7) are rotating mutually and the closing operation will be completed. At this time the opening spring is charged and tit maintains the closed status since the trip latch(11) is engaging the roller(17) connected with the driven shaft(7) even if the driven shaft(7) is getting a force counter-clockwise by the opening spring.

4) Main circuit closing 2

According that the main circuit is transferring to the closed status, the motor(4) is operated again and the discharged closing spring (2) will be recharged.

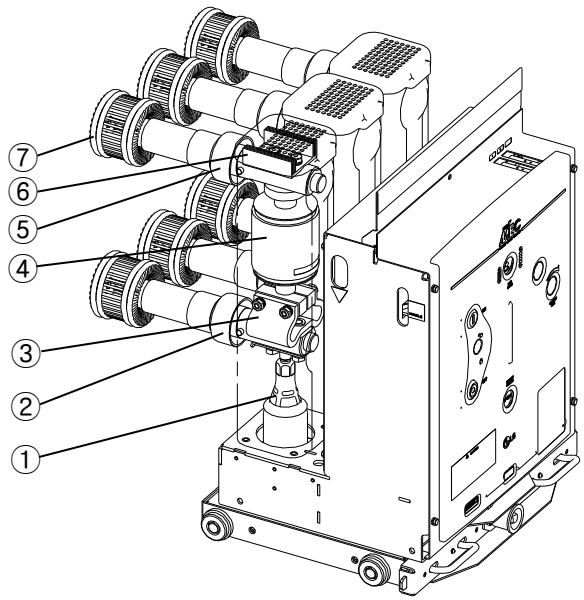
Figure 5.4 shows the main circuit is the closed status and the closing spring is recharged status.

If the trip latch(11) release the roller (16) by a trip signal, the main circuit will be tripped by the driven shaft(7) is rotated counter-clockwise.

At this time it becomes the status as Figure 5.2 that the opening spring(3) is discharged and the closing spring(2) is charged status.

Structure and operation

3. Main circuit parts

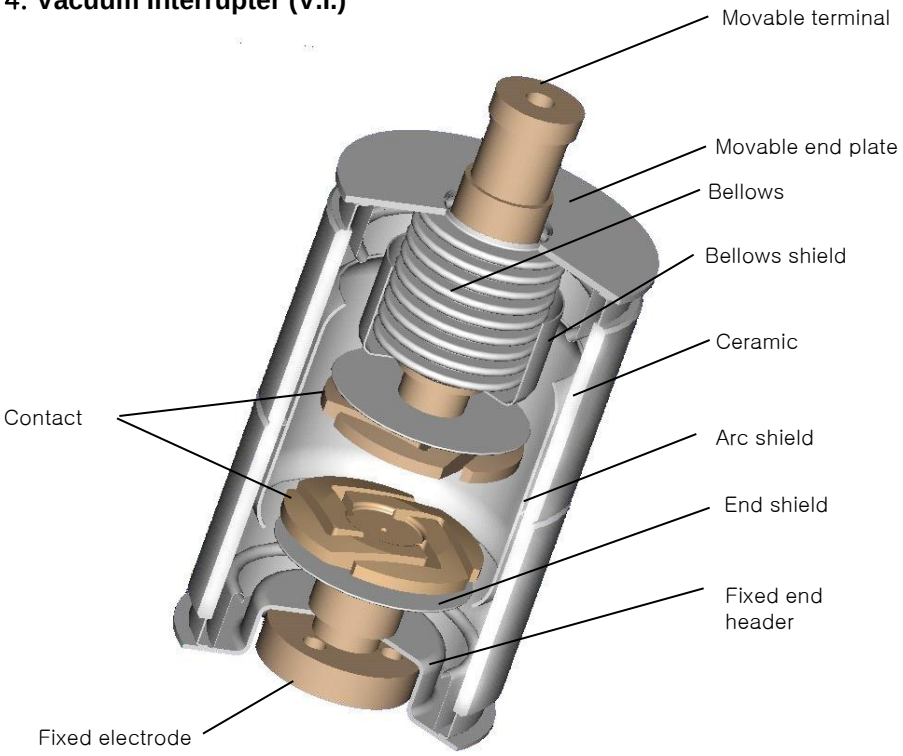


<Figure 6> Structure of main circuit parts

① Insulation rod
② Lower terminal
③ Shunt
④ Vacuum interrupter
⑤ Upper terminal
⑥ Heat sink
⑦ Tulip contactor

Structure and operation

4. Vacuum Interrupter (V.I.)



< Figure 7> Structure of vacuum interrupter

■ The vacuum interrupters has high insulation level with high vacuum integrity (approx. 5x10 Torr) and the gaps of between a stationary contact and moving moving contact are 6~20mm according to the rated voltage.
Both contacts are designed to eliminate the arc easily and are made of special alloy in order to reduce the contact wearing by short circuit interruption and overload,or arc energy when switching.
And the complete insulation of internal part prevents from the deterioration of vacuum integrity.

Insertion/Withdrawal Operation (G Type)

■ In order to make an operation of insertion/withdrawal insert the sliding plate of the withdrawal assembly (Fig.4) into the switchgear or rectangular holes installed at side plate of cradle completely.

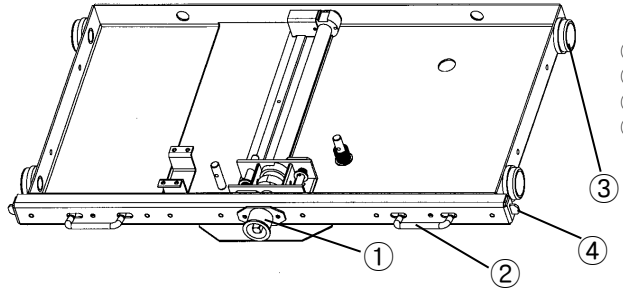
1. Manual insertion (Test Position (TEST)→Run Position (RUN))

1) Connect the wiring plug with the main body of circuit-breaker.
2) Make sure that the contact position indicator is at 'OFF" position.
3) Insert the withdrawal operating handle into a screw for withdrawal(Fig.9.1/No.1)
4) Rotate the withdrawal operating handle about 40 times clockwise, then the circuit-breaker can be positioned at Run Position(RUN) and it sounds successive crash sound at the result of run-idling of this screw.
5) If it appears any successive crash sounds, remove the withdrawal operating handle so that the circuit-breaker can not be moved any more.
6) Verify the plate of position indicator(RUN).

> ⚠ **CAUTION**
>
> **1. Do not position a circuit-breaker on any position besides the Run Position(RUN) and/or Test Position(TEST).**
>
> It may cause of malfunction or damage to products.

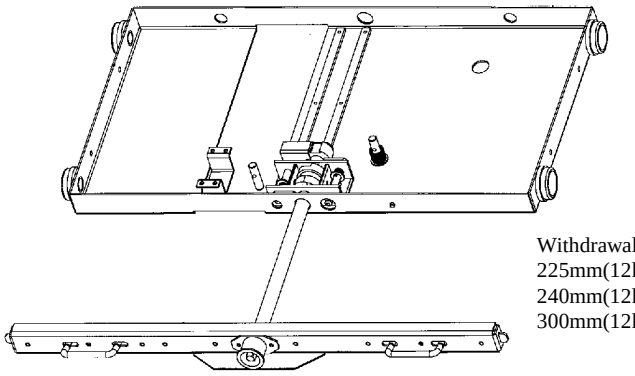
2. Manual withdrawal (Run Position(RUN)→Test Position(TEST))

1) Make sure that the contact position indicator is at "OPEN" position.
2) Perform the same operation as manual insertion(Test Position(TEST)→Run Position (RUN) in a opposite sequence .
3) Verify the plate of position indicator(TEST).



<Figure 9.1> Test Position(TEST) of withdrawable assembly

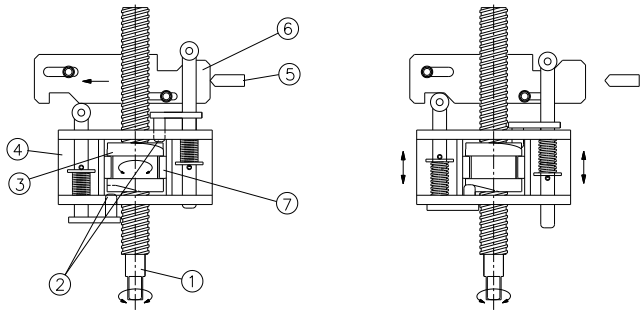
Insertion/Withdrawal Operation (G Type)



Withdrawal Stroke :
225mm(12kV20~40kA 3150A)
240mm(12kV 50kA 1250/2500A)
300mm(12kV40kA4000A)

3. Interlocks for withdrawal/insertion of circuit-breaker

1) Preventing a withdrawal/insertion during a circuit-breaker closing operation



① Withdrawal Screw ⑤ Interlocking pa
② Lock pin ⑥ Plate
③ Nut ⑦ Bearing
④ Nut Assembly

<Figure 10.1> CB is at Closed Position <Figure 10.2> CB is at OPEN position

Insertion/Withdrawal Operation

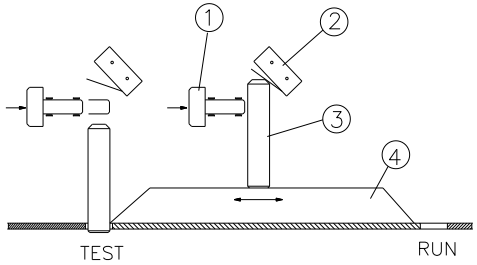
If the circuit-breaker is inserted, the Lock Pin(Fig.10.1/No.2) is disconnected from the Nut (Fig.10.1/No.3) according that the interlocking bar(Fig.10.1/No.5) move the Plate(Fig.10.1 No.6) to left-hand position.

At this condition the Nut Assembly(Fig.10.1/No.4) can not be moved even if rotating the withdrawal screw(Fig.10.1/No.1) and the withdrawal screw(Fig.10.1/No.1) and the Nut (Fig.10.1/No.3) are to be run-idle.

For this reason it is not possible to operate the circuit-breaker for withdrawal and/or insertion at the status of running idle –I.e. at the closed status of circuit-breaker.

But it may be possible to be withdrawn or inserted so that the Nut Assembly(Fig.10.1/No4) can be moved before and behind.

2) Closing prevention during a withdrawal/insertion of circuit-breaker



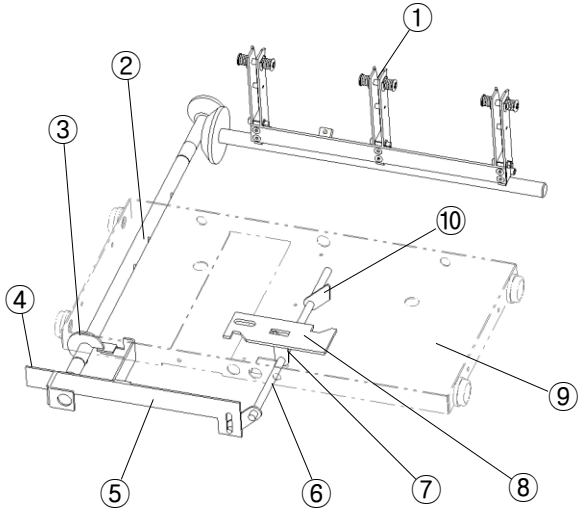
① Closing Button
② Micro Switch
③ Interlocking Bar
④ Position Plate

<Figure 11> Structure of closing prevention during a withdrawal/insertion of circuit-breaker

When making a withdrawal/insertion of circuit-breaker it prevents from the closing electrically so that the interlocking bar(Fig11/No.3) operates a micro switch(Fig.11/No.2) and the closing coil can not be energized. It also makes mechanical closing prevention by means of not operating a push button.

Insertion/Withdrawal Operation

4. Interlocks for earthing switch



NO.	NAME
①	Earthing S/W
②	Operating shaft
③	Cam
④	Pad lock
⑤	Lever
⑥	Shaft weld
⑦	Interlock lever1
⑧	Cam plate
⑨	Truck
⑩	Interlock lever2

<Figure 12> Structure of interlocks for earthing switch and withdrawal/insertion

1) Prevention of a withdrawal/insertion during the closing circuit-breaker
If the handle is inserted into the operating shaft(Fig.12/No.2) for closing the earthing switch by opening the lever(Fig.12/No.5) right-hand, the cam plate(Fig.12/No.3) will be moved left- hand by the interlocking lever(Fig.12/No.7) and the circuit-breaker can not be inserted or withdrawn with a run-idle of screw.

2) Impossible of earthing switch's closing during a withdrawal/insertion or at the Run Position(RUN)
During a withdrawal/insertion or at the Run Position(RUN) the earthing switch closing handle will not be inserted so that the lever(Fig.12/No.5) can not be opened because the interlocking lever 2(Fig.12/No10) can not be rotated by the truck(Fig.12/No.9).

Maintenance · inspection

1.General

⚠ DANGER

Do not make any touch to charged parts electrically like conductors, terminals and disconnects etc., under any of energized condition.
Will result in electric shock, severe bodily injury or electrocution.

⚠ WARNING

1. Only a qualified electrical workers with training and experience high voltage circuits should perform any operation, maintenance and inspection.
may result in malfunction, severe bodily injury or electric shock. . .

2. When the contactor is in service, do not open the front cover.
may result in bodily injury or electric-shock

3. When the contactor is in service, do not insert or withdraw the contactor.
may result in bodily injury or electric-shock

4. Before performing any inspection or maintenance on this device, disconnect all sources of electric power and take every precautions to see that all connections are de-energized and grounded.
may result in severe bodily injury or electric shock.

5. When making bolts and screw assembling, follow the instruction with recommended torque values
may result in over heating or burns..

6. After performing installation, maintenance, inspection, remove some foreign objects like tools, test leads or bolts, instruments.
may result in short circuit or burn.

7. When performing a maintenance, make a power-off of contactor and maintain it at the test position.
may result in electric shock.

8. Do not move the contactor by handling main circuit bus terminals.
may result in an electric accidents by temperature increasing

Maintenance · Inspection

⚠ CAUTION

1. Do not alter the control circuit at one's discretion.
may cause of malfunction or damage to products.

<Table 2> Period of maintenance and inspection

Item	Maintenance and inspection interval	
	Normal condition	Abnormal condition (dusty and wet places)
Usual inspection	6 months	1 month
Periodic inspection	6 months after an installation. Once 3years after that	A periodic inspection
Special inspection	If necessary	If necessary

Maintenance · Inspection

2. Usual inspection

Make an inspection for the contactor on service between the periodic inspection. Be careful for not getting in touch with any energized parts when opening the door of switchgear.

<Table 3> Items for routine inspection

Item	Check list	Method	Solution
Switching indicator	Verifying a normal operation	Visual	Investigating the cause and repair
Control circuit	Verifying a connection of connectors	Visual	Investigating the cause and repair
Operating counter	Verifying a time of operation	Visual	Check the contactor if exceeding 10,000 operations
Others	Verifying abnormal noise,smell	Visual	After disconnecting the main power, investigating and repair

3. Periodic inspection

<Table 4> Items of periodic inspection (1)

Item		Check list	Method	Solution	Frequency
Operation and Equipment parts		Check abnormal assembling parts	Verify a smooth operation by visual or manual	Clean and grease Replace if necessary	Every a periodic inspection, Every 5000 operations
		Check parts to be lubricated			
		Check dust and foreign material			
		Check whether C-Rings, spring pins and divider pins are wrinkled or missed			
Control circuit	Wiring	Poor connection and/or loose wirings	Visual	Retighten any loose parts Replace if necessary	Every periodic inspection
	Closing, tripping device	Check component of Movable parts. Check a discoloration of coil			
	Aux. Switch	Check links and contacts			

Maintenance · Inspection

item		Check list	Method	Solution	Frequency
Main circuit terminals		Check all connections Check the corrosion, discoloration	Visual	Check the torque, Replace if necessary	Every a periodic inspection
V.I	Vacuum integrity	Check the vacuum density	Vacuum integrity Testing method. Check the withstand test	Replace V.I. if necessary	Every a periodic inspection, Every 5000 operations
Aux. Device	Switching Indictor	Check the normal operation	Visual	Check fixed bolts. Replace if necessary	
Insulation Resistance		Main circuit: Over 500MΩ	1000V Megger	Clean it after finding the cause.	Every a periodic inspection
		Control circuit: Over 2MΩ	500V Megger	Replace if necessary	
Withstand voltage test		Main circuit: 1.5 x R.Voltage for 10 min.	Test and check with a withstand voltage tester	Clean and replace if necessary	Every a periodic inspection, every 5000 operations
Operating Characteristics test		Testing for trip/close Testing for trip-free Check the minimum of operating voltage	Perform the electrical testing after a manual operation test	Inspect and repair if finding a matter. Replace if necessary.	Every a periodic inspection, Every 1~2 years
Con-tact part	Contact Finger	Check the sectional traces of heat or discoloration. Check the damage of arc. Check the condition of applied grease on the con-tactor surface.	Visual (Use a microscope if necessary.)	Replace. Apply grease on contact surface. *Specification: HITALUBE280G	Every a periodic inspection, Annually
	Contact Spring	Check the sectional traces of heat or discoloration. Check the damage of arc. Check transformation or mechanical crack of a coil.	Visual (Use a microscope if necessary.)	Replace.	Every a periodic inspection, Annually
	VCB & Cradle Terminal	Check the sectional traces of heat or discoloration. Check the damage of arc. Check mutual eccentricity between terminals. - Tulip type: within ±3mm - Clip type: within ±2mm	Visual (Use a microscope if necessary.) Coherence	Replace. Apply grease on contact part *Specification: HITALUBE280G	Every a periodic inspection, Annually

Maintenance · Inspection

item	Check list	Method	Solution	Frequency
Contact resistance of main circuit	Measure a contact resistance of main circuit after drawing out the VCB - It must be less than 120% of final inspection report value - The variation resistance between phases must be less than 25%	The voltage drop method (DC 100A) -Measure with inserting the same size copper bar (make a jig for measuring if necessary)	1. Dismantle the contactors 2. Clean the discoloration, corrosion or heated parts of arc 3. Clean the contactor surface after removing foreign substances 4. Apply specified grease *Specification: HITALUBE280G	Annually
Temperature rising	Check the temp. rising of contacted and connection parts *The max. available limit of temp. rising - Contacted part: 65K - Connected part: 75K	Visual Infrared camera	Carry out a close inspection	As occasion demands

Notice) Replacement of contactors

The replacement of contactors must be decided with a close inspection and carried out by LGIS service staff. Please follow below 1, 2, 3 when the contactors are replaced.

1. Apply specified grease after replacement. (specification: HITALUBE280G)
2. Measure the contact resistance of main circuit with no-load mechanical operating test after replacement. The measured values should be compared with the measured values before replacement and they should be put on record.
3. If there are traces of arc when replacing contactors, the terminals should be replaced . In case that there aren't any traces, wipe clean on terminal surface.

<Table 5> Items of periodic inspection (2)

	Item	Check list	Method	Solution
Common components of the contactor	Insulated frame Insulated tube Heat shrinkable tube	Check condensation, humidity, stain, discoloration and damage	Visual Clean it, then measure the insulation resistance	Wipe it clearly with a dry cloth

4. Special inspection

Make a special inspection in case of situation as Table 6

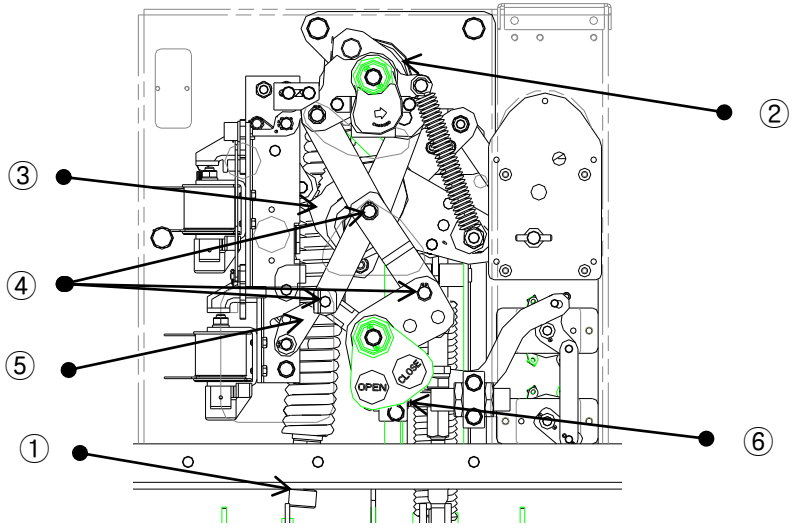
<Table 6> Special inspection

NO	Inspection item	Inspection method
1	When interrupting short-circuit(fault) current several times	Check wearing contacts of vacuum interrupter
2	In case of appearing a abnormal situation at service operation	Check defective parts

Maintenance · Inspection

5. Lubricant Points for Operating Parts

When using the circuit-breaker for long period, lubricate the grease for mechanical device on the surface of operating parts and frictional parts so that the operating mechanism parts have been operated with high-speed. The important parts are indicated by the mark of ←● in the following figure.
When lubricating clean the points to be lubricated and check the condition of wear,then lubricate the grease not to be covered on wiring connection part of control circuit.



<Figure 13> The charging status of opening/closing spring of main circuit

NO	Lubricant Point
1	Fixing part of opening spring
2	Fixing part of closing spring
3	Closing latch roller and crank arm
4	Connecting pin of linkage
5	Trip latch and roller
6	Guide pin for O.D.P

Rating

<Table 7-1> Ratings Table

Rating		LVB – 12□ – 25D/06,12,20	LVB – 12□ – 32D/12,20,30	LVB – 12□ – 40D/12,20,30
Rated voltage (kV)		12		
Rated current (A)		630 1250 2000	1250 2000 3150	1250 2000 3150
Rated frequency (Hz)		50/60		
Rated interrupting current (kA)		25	31.5	40
Rated interrupting capacity (MVA)		520	650	830
Rated short-time current (kA)		25/3sec	31.5/3sec	40/3sec
Rated making current (kA)		65	82	104
Rated interrupting time (Cycle)		3		
Withstand voltage	Frequency (kV)	28		
	Lightning Impulse (kV/1.2×50㎲)	75		
TRV increasing rate (kV/㎲)		0.34		
TRV Max. Value (kV)		20.6		
Operating duty		O-0.3s-CO-3min-CO		
Control voltage for closing (V)		DC 110,220V		
Control voltage for tripping (V)		DC 110,220V		
Standard aux. contacts		4a4b		
Rated opening time (s)		≤ 0.04		
No-load closing time (s)		≤ 0.06		
Current of motor operation (A)		≤ 5		
Control current for closing (A)		≤ 5		
Control current for tripping (A)		≤ 5		
Motor Charging Time (s)		≤ 12		
Pole distance (mm)		150,210(3150A)		
Weight (kgf)		140 160 165	160 165 220	164 165 220
Installation type		G,M		
Applicable standard		IEC 62271-100		

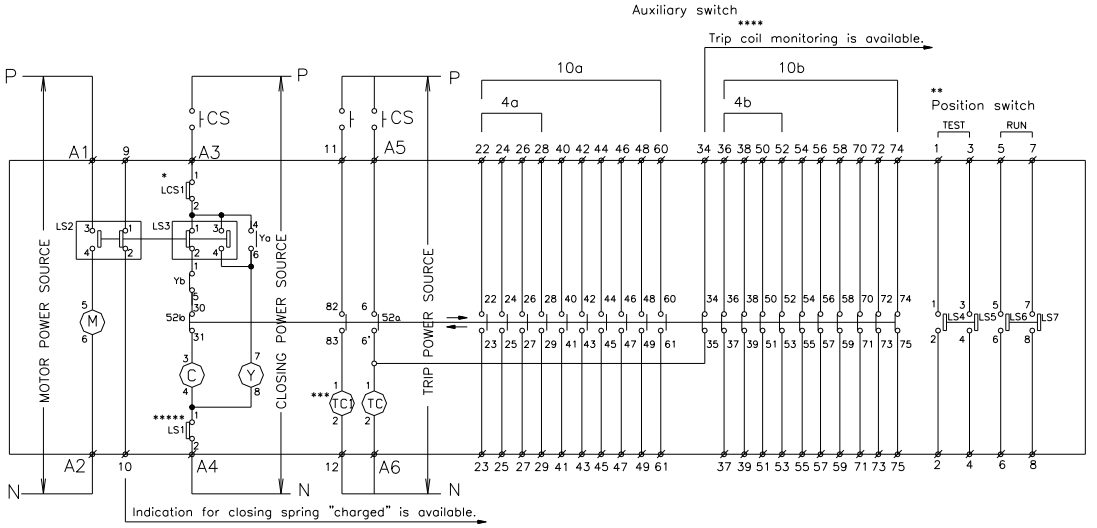
Rating

<Table 7-2> Ratings Table

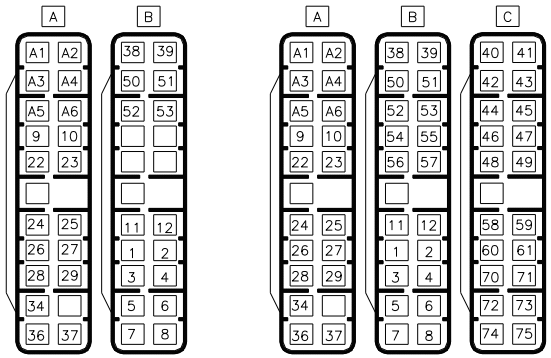
Rating			LVB – 12□ - 40D/40	LVB – 12□ - 50D/12,25	
Rated voltage		(kV)	12		
Rated current		(A)	4000	1250	2000
Rated frequency		(Hz)	50/60		
Rated interrupting current		(kA)	40	50	
Rated interrupting capacity		(MVA)	830	1039	
Rated short-time current		(kA)	40/3sec	50/3sec	
Rated making current		(kA)	104	130	
Rated interrupting time		(Cycle)	3		
Withstand voltage	Frequency	(kV)	28		
	Lightning Impulse (kV/1.2×50㎲)		75		
TRV increasing rate		(kV/㎲)	0.34		
TRV Max. Value		(kV)	20.6		
Operating duty			O-0.3s-CO-3min-CO		
Control voltage for closing		(V)	DC 110,220V		
Control voltage for tripping		(V)	DC 110,220V		
Standard aux. contacts			4a4b		
Rated opening time		(s)	≤ 0.04		
No-load closing time		(s)	≤ 0.06		
Current of motor operation		(A)	≤ 5		
Control current for closing		(A)	≤ 5		
Control current for tripping		(A)	≤ 5		
Motor Charging Time		(s)	≤ 12		
Pole distance		(mm)	275	210	
Weight	VCB	(kgf)	385	200	220
	Cradle		315	155	
Installation type			G,M		
Applicable standard			IEC 62271-100		

Circuit diagram

1. A type connector



ø : External terminal of VCB
52 : Vacuum circuit breaker
M : Spring charging motor
TC : Trip coil
TC1 : Secondary trip coil
C : Closing coil
Y : Anti-pump relay
52a : Auxiliary switch (NO)
52b : Auxiliary switch (NC)
LS1 : Closing interlock limit switch (only withdrawable type)
LS2 : Motor stopping, closing spring charged indication
LS3 : Anti-closing, anti-pumping limit switch
LCS1 : Trip latch checking switch (preventing closing unless the trip latch is properly reset)
LS4, LS5 : Position s/w (close in test position)
LS6, LS7 : Position s/w (close in run position)

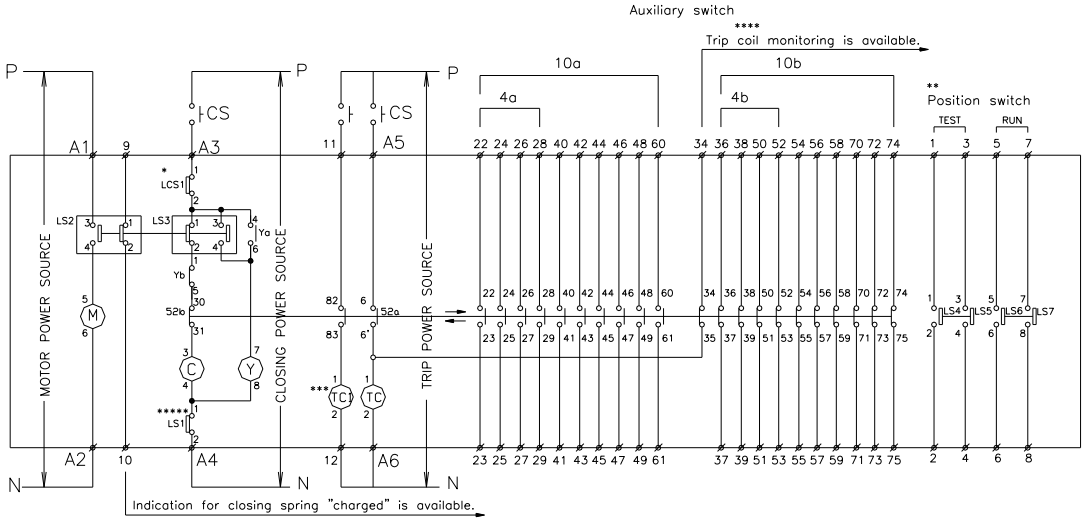


SECONDARY DISCONNECT WIRING
(TOP VIEW)

NOTE : Diagram shows the circuit breaker in position "OFF" with closing spring "Charged".
* : LCS1 – Trip latch checking S/W
** : Position S/W – 4a(No.:1,2,3,4,5,6,7,8)
*** : TC1 – Secondary trip coil (No.:11,12)
**** : Trip coil supervision.
Option
*****: LS1 is not available for fixed type.

Circuit diagram

2. B-type connector



ø : External terminal of VCB
52 : Vacuum circuit breaker
M : Spring charging motor
TC : Trip coil
TC1 : Secondary trip coil
C : Closing coil
Y : Anti-pump relay
52a : Auxiliary switch (NO)
52b : Auxiliary switch (NC)
LS1 : Closing interlock limit switch (only withdrawable type)
LS2 : Motor stopping, closing spring charged indication
LS3 : Anti-closing, anti-pumping limit switch
LCS1 : Trip latch checking switch (preventing closing unless the trip latch is properly reset)
LS4, LS5 : Position s/w (close in test position)
LS6, LS7 : Position s/w (close in run position)

	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
A			29	28	27	26	25	24	23	22	A6	A5	A4	A3	A2	A1
B	39	38	37	36		34										
C													53	52	51	50
D	12	11	10	9					8	7	6	5	4	3	2	1

(4a4b)

	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
A	41	40	29	28	27	26	25	24	23	22	A6	A5	A4	A3	A2	A1
B	39	38	37	36		34	61	60	49	48	47	46	45	44	43	42
C	75	74	73	72	71	70	59	58	57	56	55	54	53	52	51	50
D	12	11	10	9					8	7	6	5	4	3	2	1

(10a10b)

SECONDARY DISCONNECT WIRING
(TOP VIEW)

NOTE : Diagram shows the circuit breaker in position "OFF" with closing spring "Charged".
* : LCS1 – Trip latch checking S/W
** : Position S/W – 4a(No.:1,2,3,4,5,6,7,8)
*** : TC1 – Secondary trip coil (No.:11,12)
Option
**** : Trip coil supervision.
*****: LS1 is not available for fixed type.

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