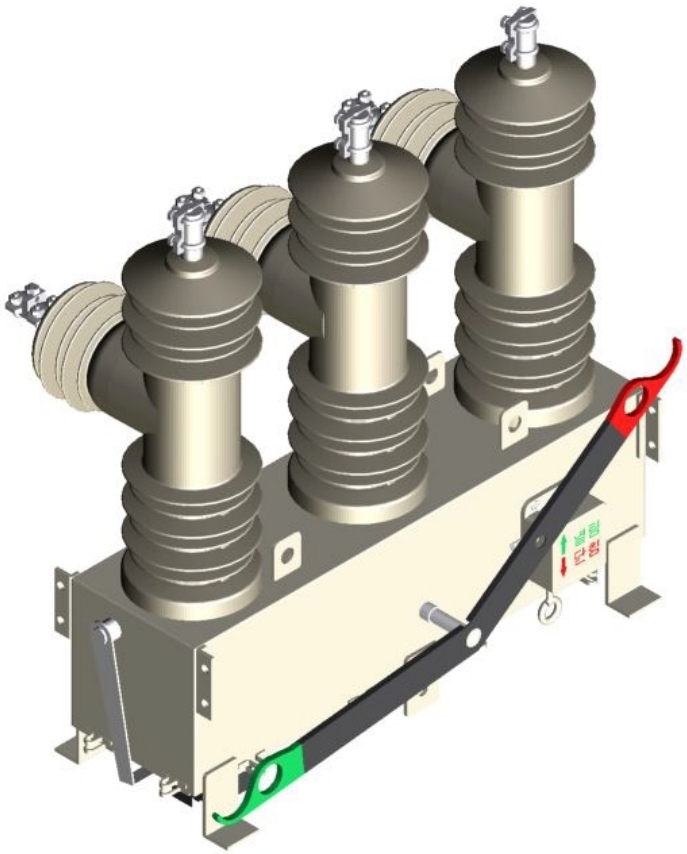
SHINSUNG

Solid Insulation Eco Load Break Switch (SILO)

SILO SERIES

15kV, 27kV

400A, 630A



■ General

SILO is 3 phase, solid insulated load break switch (LBS) and vacuum interruption for overhead power distribution system. SILO series switches have been designed to meet the growing requirements for oil & gas-less, maintenance free, long life, maximum safety, eco-friendly product and all-in-one design for application to Distribution Automation System (DAS) or SCADA System.

SILO series switches have been fully certified in accordance with IEC 62271-1, 62271-103 or their equivalent standards to meet or exceed customer specifications.

■ Characteristics

- ✓ Eco Friendly Product
  The insulation material of SILO switch is solid insulation, which has many benefits of eco-friendly product unlike gas insulation LBS, and also free from gas leakage and maintenance free unlike gas insulation LBS.

- ✓ Vacuum Interruption
  SILO provides excellent load breaking capacity, high insulating ability

- ✓ Operating Mechanism
  It enables the switch to have close/open operation by both manual and automatic and manual lock at user's demand.

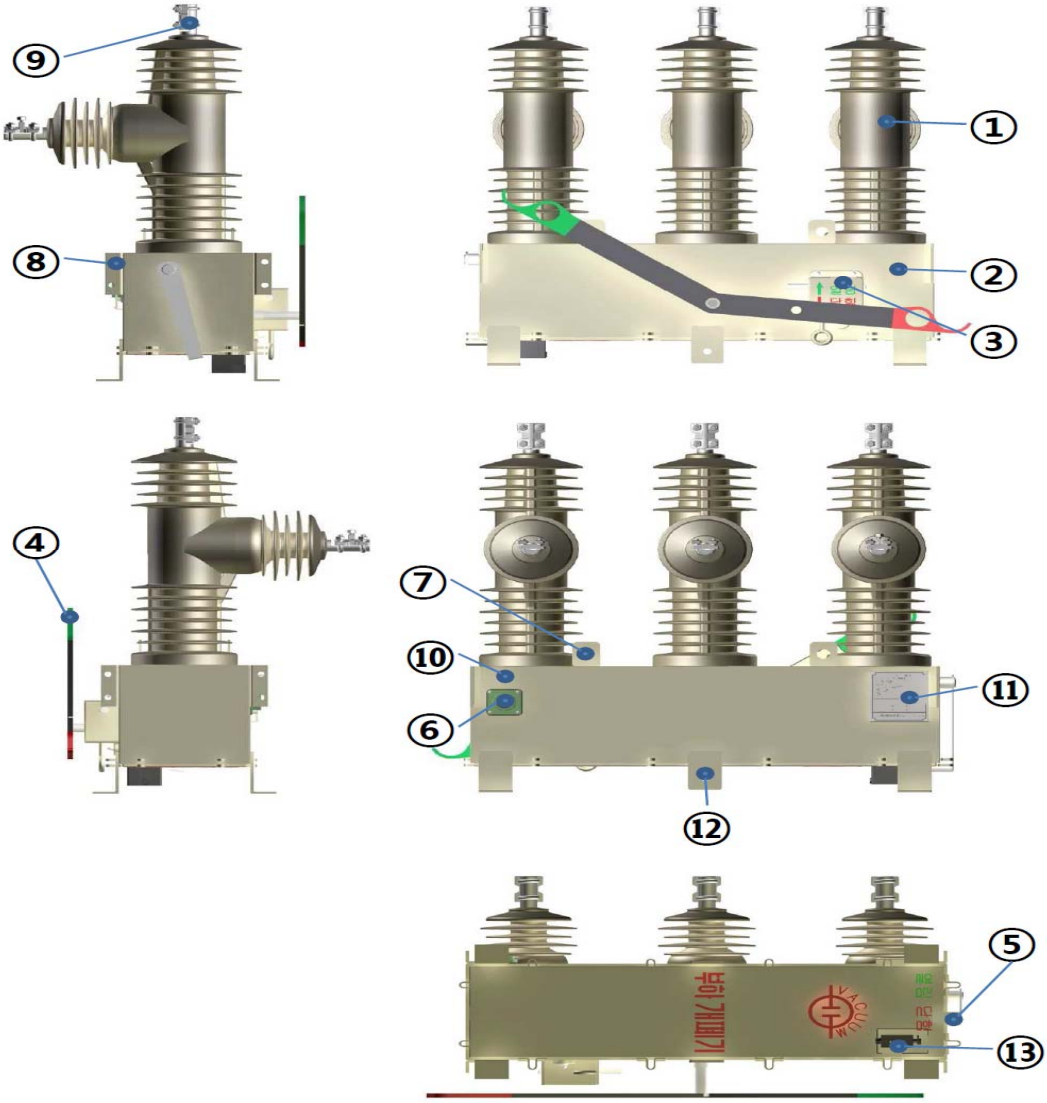
- ✓ Remote Operation
  Integrates current transformers and voltage sensors inside the tank as a standard to obtain the power line information. This type switch is combined with L6 switch control for local or remote operation through embedded RTU.

■ Technical Data

Description	SILO
Rated Maximum Voltage	25.8kV
Rated Continuous Current	630A
Rated Short-Time Withstand Current	12.5kA/1sec
Making Current	32.5kA(Peak), 5times
Power Frequency Withstand Voltage	60kV /1min (Dry) 50kV/10sec (Wet)
Impulse Withstand Voltage	150 kV

- Applied Standard: IEC62271-1, IEC62271-103

■ Construction



No.	Description	No.	Description
1	Polymer Bushing	2	Tank/Body
3	Manual Locking Handle	4	Manual Close/Open Handle
5	Close/Open Indicator	6	Receptacle for control
7	Lifting Hole	8	Upper Mounting Hanger
9	Clamp Terminal	10	Earthing/Ground Terminal
11	Name/Rating Plate	12	Lower Mounting Hanger
13	Operation Counter		

VIT L6 LBS Control

Overview

The VITL6 VIT LBS control with built-in RTU function have not only enhanced protection functions like open conductor, high impedance fault isolation, but also can identify and isolate the faulted section and can restore the service with the coordination of backup circuit breaker or VIT recloser without communication system.

It have two(2) setting groups and it can be changed automatically according to the power direction.

The VIT LBS can achieve the feeder automation with minimum initial investment but in the future it can be integrated to the computer system just through adding a modem.

Functions

■ Main Protection Function

- ☐ **Fault indication**
  - Phase fault / ground fault
  - Permanent fault / temporary fault
- ☐ Open conductor / loss of phase protection
- ☐ Phase synchronization failure detection
- ☐ **Sectionalizer function**
- ☐ **SEF, HIF protection**
- ☐ **Voltage-current-time controlled protection coordination(VIT)**
- ☐ **Inrush current restraint**
- ☐ **Load encroachment**
- ☐ **Sympathetic tripping restraint**
- ☐ **Directional overcurrent**

■ Measurements

- ☐ Magnitude and phase angle of voltages & currents (Fundamental frequency)
- ☐ RMS and phase angle of voltages & currents (Fundamental frequency)
- ☐ Active, reactive and apparent power for each phase and 3-phase
- ☐ Demand current
- ☐ Daily maximum current
- ☐ Symmetric component
- ☐ Power factor
- ☐ Frequency
- ☐ Phase difference between source and load-side voltage

■ Control

- ☐ Manual LBS switch Open / Close at local or remote (SBO operation)
- ☐ Interlocking (Gas low, Handle lock, Sync. Fail, Live Load)
- ☐ Battery test
- ☐ External Trip and Close

■ Switch & Control Status Monitoring

- ☐ Contact inputs
  - Switch Open / Closed
  - Gas pressure low
  - **External AC power loss**
  - **Handle status**
  - **Enclosure door open**
- ☐ **Battery status**
- ☐ **Temperature**
- ☐ **Frequency**
- ☐ **Switch operation count**

■ Event Recording

- ☐ **Sequential events record**
- ☐ **Fault events report**
- ☐ **Fault wave form report**
- ☐ **Demand Current**
- ☐ **Daily maximum current**

■ Additional Control and Communication Function

- ☐ Two(2) selectable setting groups ideal for loop scheme application.
- ☐ Hot line tag against unexpected local and remote operation
- ☐ Local and remote operation
- ☐ RS-232 and RS-485 communication port
- ☐ DNP 3.0 level 2 communication protocol for monitoring/ MODBUS for setting, analysis, control, maintenance and PC communication

Operation

The VITL6 have five(5) operating modes to achieve best coordination.

■ Customer protection (Watch Dog) mode

- 1 count trip
- Inrush restraint feature
- Overload protection
- DIR SEF protection
- HIF protection
- Pure Open conductor protection
- Under voltage protection (loss of phase protection)

■ Radial sectionalizer mode

The radial sectionalizer mode is the best choice at the end of the radial line.

The operation of radial sectionalizer mode is exactly the same with current, counts controlled sectionalizer.

Max. three(3) sectionalizer can be used according to the numbers of operation to lockout of the backup protective device.

If the backup device is circuit breaker, one or two counts can be used and if the backup device is recloser, one, two, three counts sectionalizer can be coordinated.

But if it is necessary to sectionalize more points, the remaining switches other than one or two sectionalizers, the control should be set to radial normal close mode.

Radial sectionalizer mode has the same features with current, counts controlled sectionalizer but has more functions.

- Directional phase, ground minimum pick up
- Counts one(1), two(2), three(3)
- Counts reset timer in load current condition
- Inrush restraint feature
  This feature is activated when the control experience normal current before current cessation to avoid miscounting because of the inrush current during reclosing process of back up equipment. If this feature is activated, the minimum pickup setting raised automatically to the preset multiply during preset restraint time.

- Count restraint feature using current and voltage element
- One(1) count to open feature directly after manual closing
- Sympathetic count restraint feature.
  This feature is activated when the fault is at source side. The algorithm is based on under voltage, no fault current logics. This feature desensitizes the pickup level during preprogrammed time interval.

- Open conductor, high impedance fault isolation
- Over-load protection can protect the line from over-current condition up to the locking current(900A).
- V_0/V_1 unbalance voltage protection protects the line from loss of phase, open conductor and ferro-resonance over voltage

■ Radial normal close mode

This operating mode is selected to expand the number of switches in radial line.

The important features are;

- Phase & Ground fault current counting
- Counts reset timer in load current condition
- Close timer
- Load side lockout timer
- **Open conductor, high impedance fault isolation**

Unlike conventional V-T controlled scheme, only the switch experienced the fault will be open after counts, so the restoration is much fast and can give the chance for backup device to clear the temporary fault.

Also the number of switch operation is reduced more than 50% of V-T scheme through fault current tripping and counts block function.

■ Loop normal close mode

If this operating mode is selected, it has more functions than radial normal close mode.

- Loss of voltage lockout feature
- Loss of voltage, fault current counting
- Counts reset timer in load current condition
- Close timer
- Load side lockout timer
- Source side lockout timer
- Open conductor, high impedance fault isolation
- Two setting groups according to the power direction

If there is a fault in loop network, the source and load side is isolated already before the normal open switch close, so it can avoid unnecessary outage during normal close switch close into fault condition.

■ Loop normal open mode.

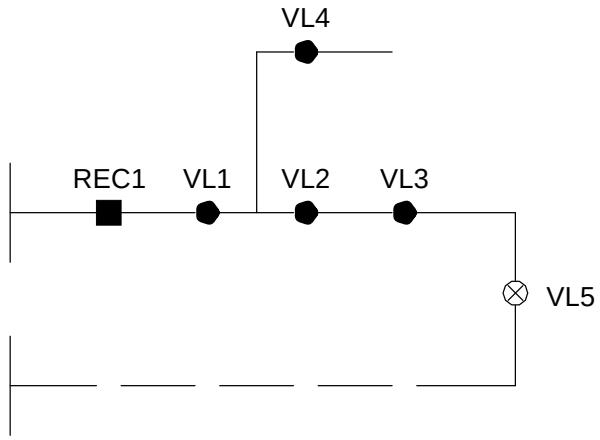
This operating mode has the same function with loop normal close mode, but has more function.

- Normal open source side lockout feature
- Normal open close timer
- Two setting groups according to the power direction
- Automatic mode change from normal open mode to normal close mode when it is closed
- Automatic mode change from normal close mode to normal open mode and lockout when it is open by manually. This lockout state will be reset automatically when there are both side voltages.

Example Illustration of sequential coordination on the loop mode.

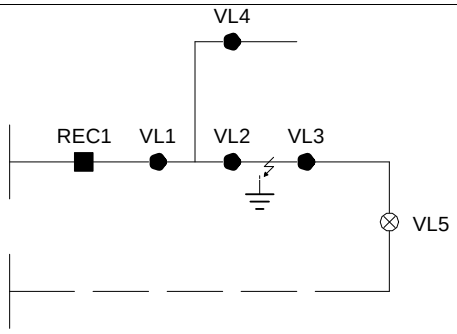
The following is achieved by the coordination between VIT Recloser and VIT LBS.

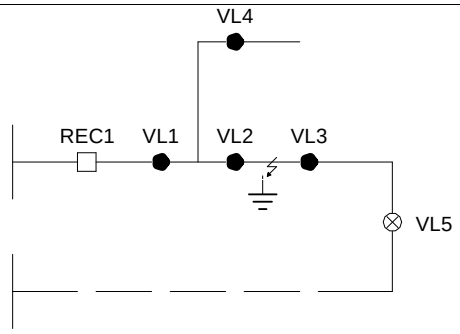
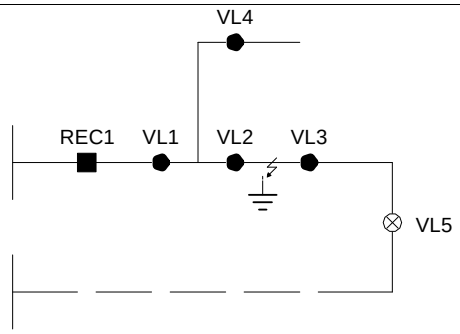
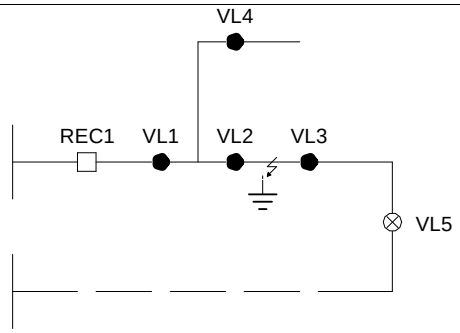
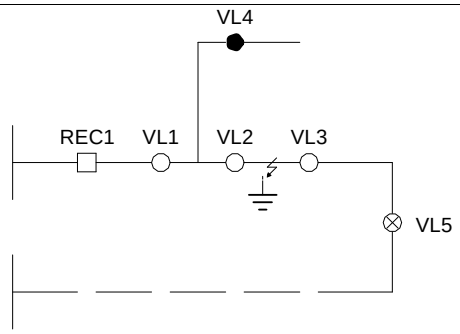
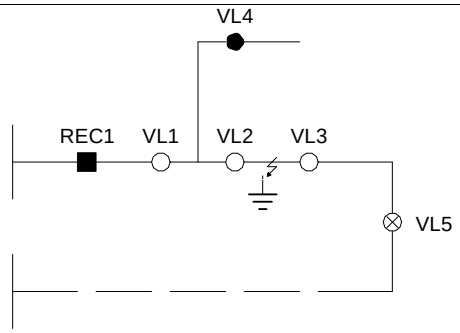
■ Line Diagram and Setting

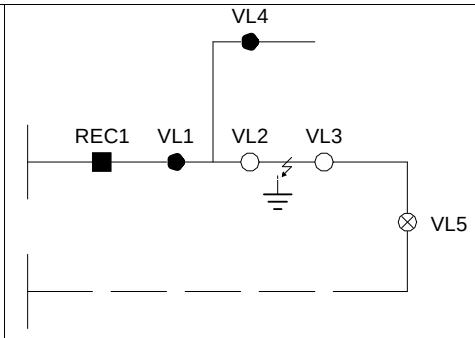
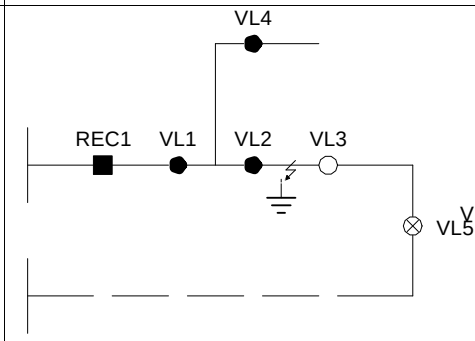
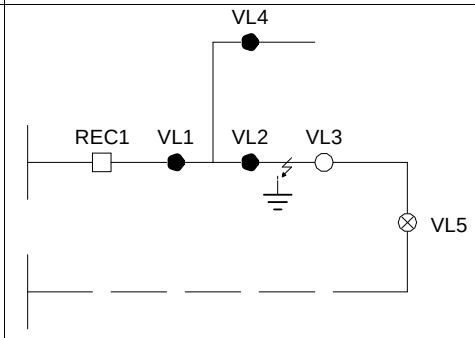
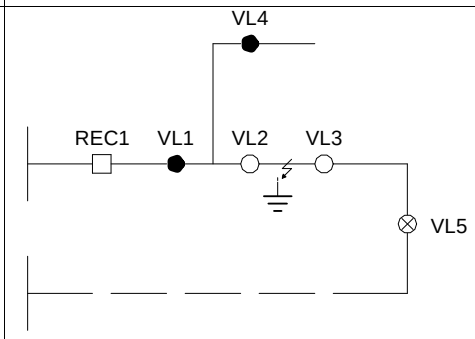
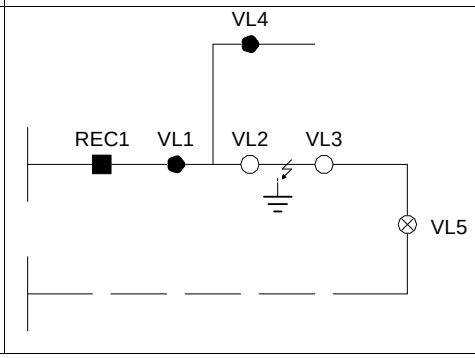


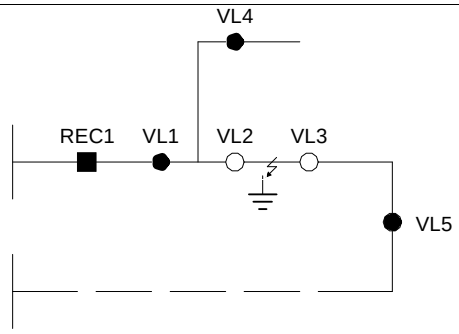
- REC1 : 4trips, 3reclosing /Reclosing interval 1st 2sec, 2nd 5sec, 3nd 5sec
- VL1 : Count = 2 / X Time = 2sec. / XL Time = 20sec.
- VL2 : Count = 2 / X Time = 4sec. / XL Time = 20sec.
- VL3 : Count = 2 / X Time = 2sec. / XL Time = 20sec.
- VL4 : Count = 2 / X Time = 2sec. / Current Mode = Enable

■ Sequential Operation

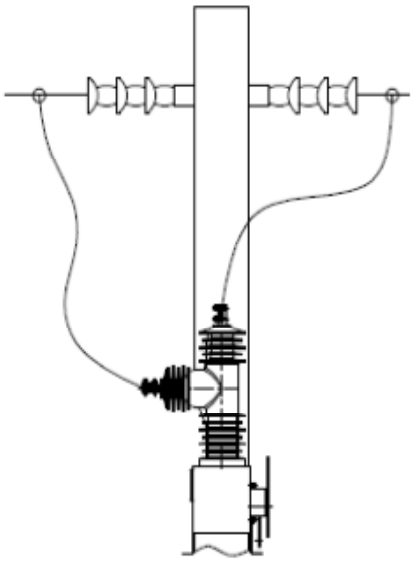
Sequence	Status	Description
1		Fault Initiation

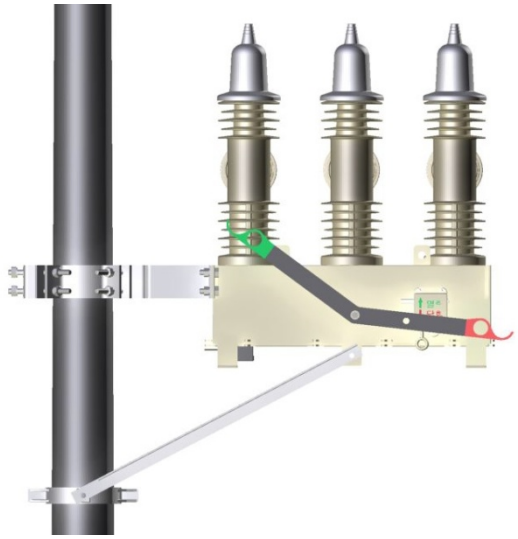
2		REC1 1st trip VL1, VL2, VL3 voltage count VL4 no count VL5 voltage count
3		REC1 1st reclosing
4		REC1 2nd trip VL1, VL2, VL3 voltage count VL4 no count VL5 voltage count
5		VL1, VL2, VL3 open
6		REC1 2nd reclosing after 5sec. VL1 Close Time start

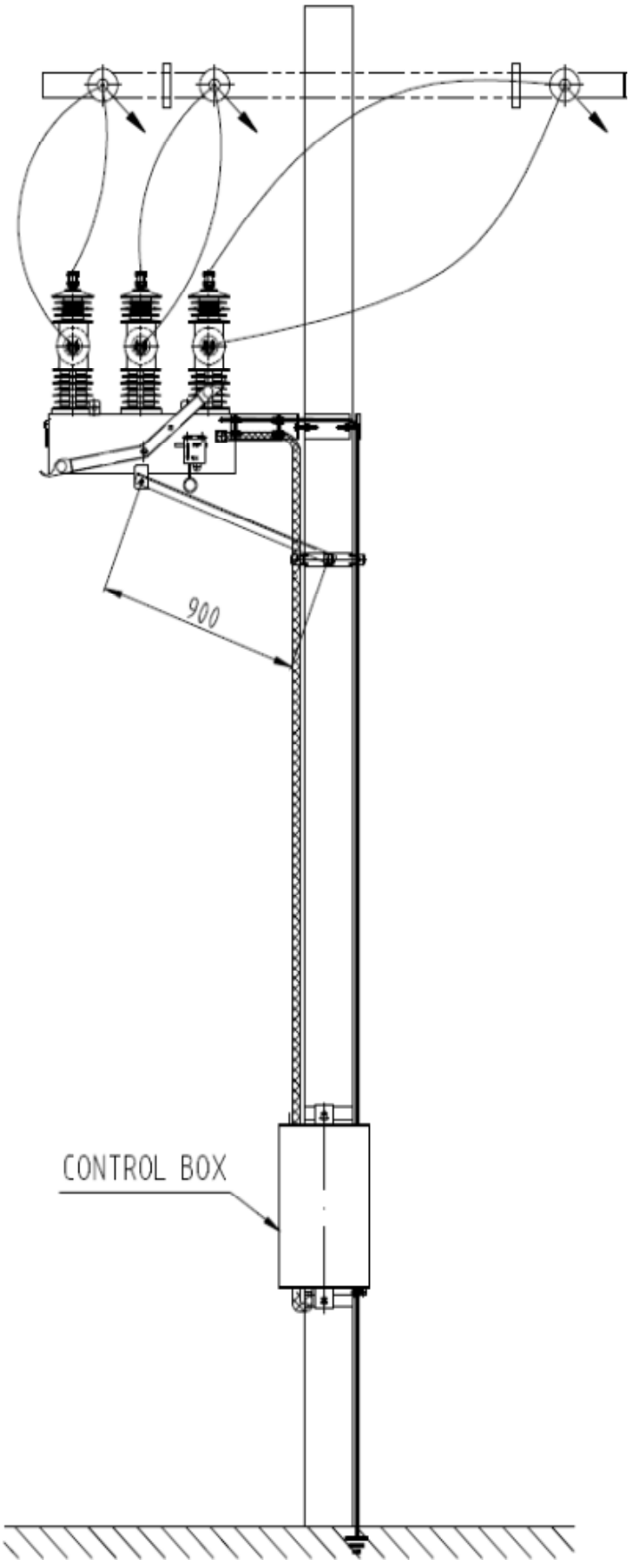
7		VL1 close VL2 Close Time start
8		VL2 close after 4sec. Fault Re-generation VL3 open lockout timer start,
9		REC1 3rd trip
10		VL2 open lockout after 0.7sec, VL3 Lockout
11		REC1 3rd reclose after 5sec.

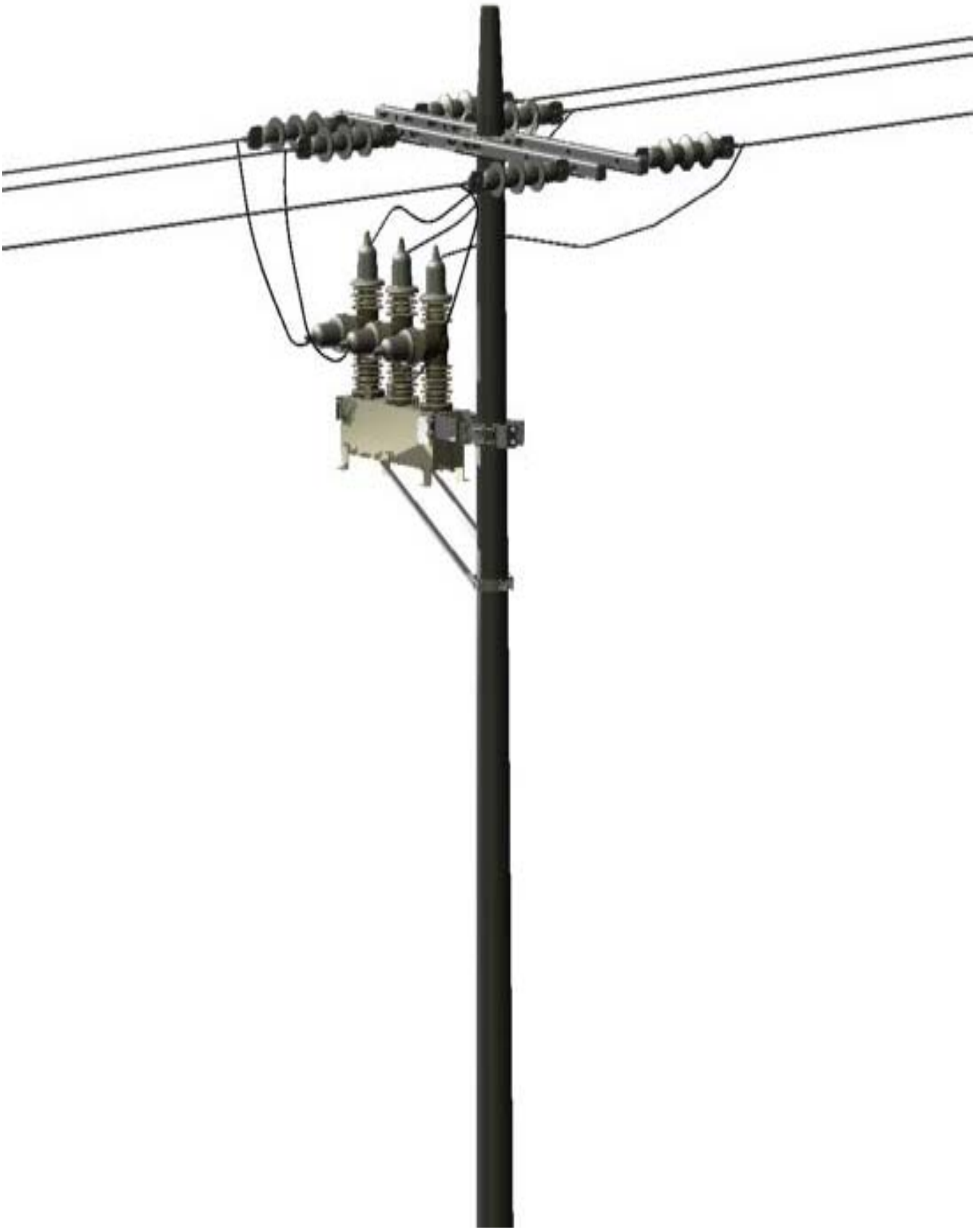
12		VL5 close (Change the mode from normal open to normal close)

■ Pole Top Installation









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