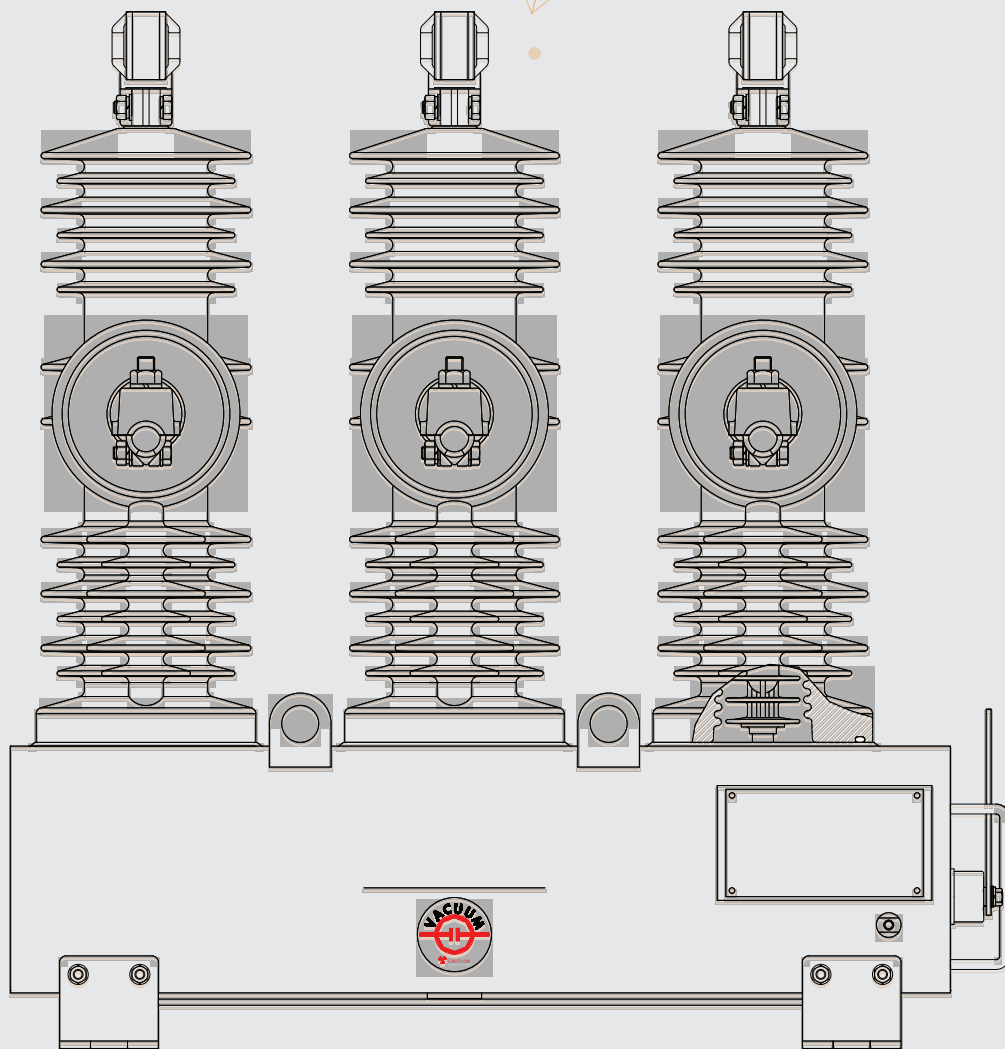


SOLID INSULATED RECLOSER MANUAL





1. SAFETY INFORMATION

Safety information shall be aware to operate the product in correct manner and in order to prevent unexpected danger or damage.

This manual does not include all possible cases while Mold Recloser installation and operation. This manual which includes technical contents, cannot be replaced with proper training or long experience over Recloser. Only well trained Recloser experts shall do installation, operation and maintenance.

Certified electrician shall have following qualification

- 1) Shall read full of this manual
- 2) Shall achieve an education over approved high voltage and low voltage safe operation work and procedure.
- 3) Shall achieve an education over distribution equipment energization and de-energization.
- 4) Shall achieve an education over protection gears such as Insulation hat, insulation globes, COS operation stick etc.

Carefully read and understand following important safety information about Recloser safe installation and operation.

This manual uses 3 levels of expression over the size of danger and damage, and urgent level.



Danger

Violate this mark, may cause serious injury or death



Warning

Violating this mark, may cause serious injury or death



Caution

Violating this mark, may cause light injury or product damage.

- 1.1 Safety Instruction
- 1.2 Following information is about general Danger, Warning, Caution applied to Recloser. Additional information about specific work and procedure refer to the manual.



Danger

1. Touching voltage line shall cause Death, serious injury. During any work with high voltage, low voltage line or equipment, shall follow approved safety instruction.
2. Operation not followed by instruction, may cause product failure or will give severe damage on product. Shall operate the product in regulated circumstance and natural system line.
3. Electric shock accident may cause death, serious injury. Before maintenance, shall check the line is dead and charged voltage remained.



Warning

1. Before use the recloser, carefully read and understand Recloser installation, Operation and maintenance, improper operation, treat or maintenance may cause death, serious injury and recloser damage.
2. Recloser is not designed to protect people's life, during installation and operation, approved procedure shall be used. Violating warning may cause death or serious injury.
3. Recloser shall be handled(operation & maintenance) by someone who had special safety training and understand the recloser such as electrician or electrical engineer. This manual is made for those people and safe instruction does not cover full training and experience. In case of violating proper installation and maintenance may cause death or serious injury and may damage Recloser.
4. During in use, do not dismantle or detach the product. Violating instruction may cause mis- operation and product damage may result in loss of life



Caution

1. Shall use flat plate for storage or transporting.
2. Be careful with unpacking, do not damage the product.
3. Use lugs when lifting the recloser. Do not directly grab Manual operation handle, bushing and Mold cone cable for lifting the recloser
4. Do not impact/shock the recloser.
5. Fully read and aware of recloser operation before operate it.
6. Full safe precaution shall be checked and prepared before installation, operation and maintenance.
7. Each parts are delivered after assemble, test and inspection, however, carefully check anything missing or damaged on recloser.

Standard parts list

Recloser Tank 1 unit	Control panel 1unit
Power supply cable (2pin/6m) 1 ea	Control cable (37pin/8m) 1 ea
Installation bracket 1set	Manual 1ea

Please follow Safety instruction, otherwise may cause serious injury and recloser damage.

2. GENERAL

Electricity demand is increased and Electric power system becomes diversity, higher quality of electric power supply become more important. To satisfy the demand, Distribution Automation System(DAS) and various protection devices are being developed.

In addition, in order to protect environment from pollution, Solid dielectric technology was developed and SF6 gas products are fading away from medium voltage market.

Especially, Recloser one of the main products in the power line, has lots of responsibilities in the power line, such as coordination with other neighbor equipment and fault clearing and so on. Recloser is equipped with Automation System and consist with digital control system and has following features.

- 1) Microprocessor based digital control panel provides easy coordination feature, fault isolation feature and Local / Remote operation feature.
- 2) Distribution automation system purpose protocol is on boarded in control panel so that automatic protection coordination is available.
- 3) 48 TC(Time Current) curves are provided and through key button or RS-232 communication port, basic curve can be modified by using Multiplier, Time adder, Minimum response time and a special curve for high current lockout function also can be made.
- 4) Through RS-232 port, recorded information settings including fault current information can be downloaded into laptop computer
- 5) When 2 reclosers are operated in series, Sequence coordination function shall be used to prevent un-necessary tripping.

3. RATING

3.1 RATING

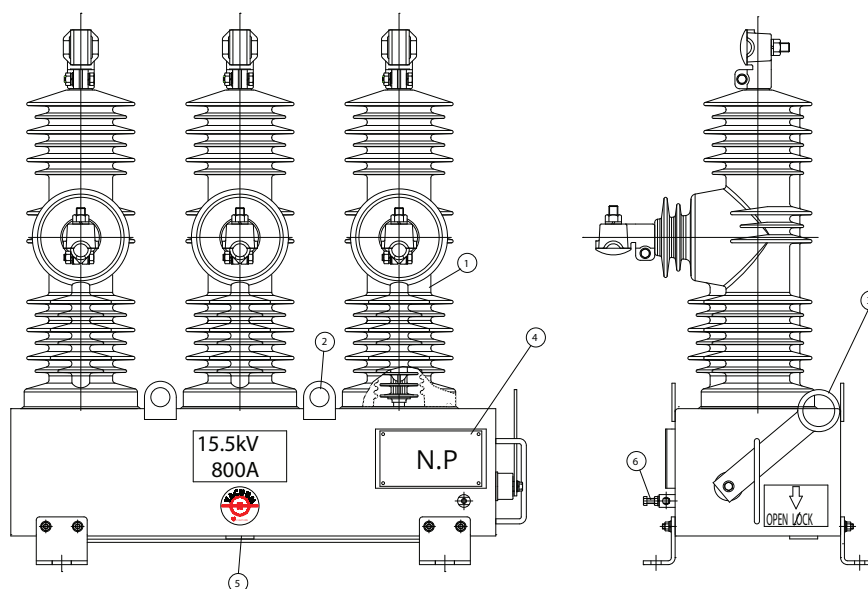
Type	EPMR - 15	EPMR - 38
Rated Voltage	15.5KV	38KV
Rated Current	800A	800A
Rated Frequency	50Hz	50Hz
Rated Interrupting Current	16kA/ 3 sec	16kA/ 3 sec
Mechanical Operation Life	10,000 times of operation	10,000 times of operation
AC Power Frequency Withstand Voltage	110kV BIL	170kV BIL
Power Supply for Control Panel	230V - 240V	230V - 240V
Current Transformer	1000 : 1	1000 : 1
Insulation Media	Epoxy	Epoxy

3.2 Operation condition

- (1) Ambient Temperature
 - Max. Temperature : + 70
 - Min. Temperature : - 30
- (2) Altitude
 - 1,000 Meters Above Sea Level (M.A.S.L)
- (3) Max. Wind velocity
 - Below 40 m/s

4. STRUCTURE AND FUNCTION

4.1 Body structure



Description	
1) Bushing	2) Lifting lug
3) Manual lock handle	4) Name plate
5) Control panel cable receptacle	6) Grounding/Earthing terminal

Recloser has lifting lug on top of tank to make convenient transport and consist with Epoxy housing with Vacuum Interrupter and CT(Current Transformer), and Mechanism inside of Tank. Breaking parts are design for 3 independent phase, polymer housing and each housing has Vacuum Interrupter inside. To operate Vacuum moving contact, mechanism rod is connected between Mechanism and V.I.

Current Transformer is embedded inside of Source side housing and monitoring fault current and load current.

Manal trip lever is located at the side of body(Tank), and Breaker contact status (ON-OFF) is displayed underneath of body(Tank).

Recloser sequence operation is controlled inside of Micro-Processor Relay inside of control panel. Relay will operate when it sense higher value than current setting value. It will operate until 4 shot reclosing otherwise it will stop when a fault current disappears.

If the fault current does not disappear, Reclosing sequence will continue and at the end, it will open the circuit and lockout. If the fault current disappears during reclosing sequence, Recloser will close the circuit and remains for a setting time then, the relay will be reset and be prepared for next fault current. 240V external power supply for control panel is supplied from Power Transformer in order to support Remote operation. In case of external power supply is lost, in-built 24Vdc Battery will take over the power of control panel and proceed.

In case of Surge Voltage from LV side (from Potential Transformer : HV to LV), it is prevented by Metal Oxide Varistors and Surge Observer as an option.

4.2 Magnetic Actuator

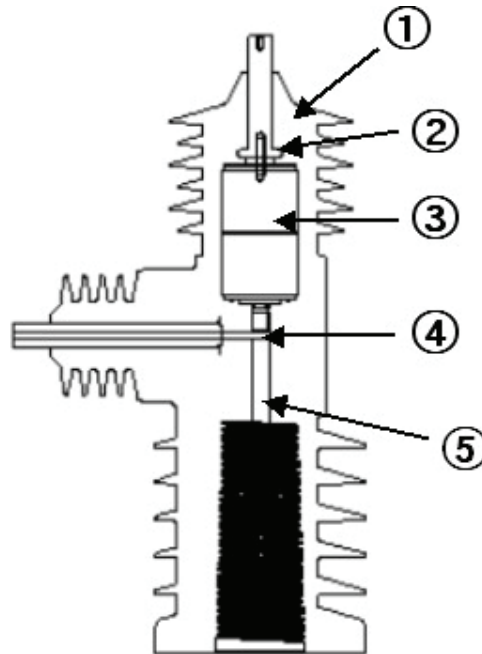
Compare with other oil pressure type, air pressure type or spring charged mechanism, Magnetic Actuator has better reliability. It has optimized number of parts and simple structure. Actuator has Closing coil and Open coil at the both end. By applying a current on either coil, plunger inside of Actuator, moves one to the other direction and stays with Magnetic force.

4.3 Bushing

Bushing is designed to be used outdoor and located on top of mechanism box. Bushing material is Epoxy resin which has reliable polymer composite in terms of electrical and mechanical strength, and has Hydrophobicity feature.

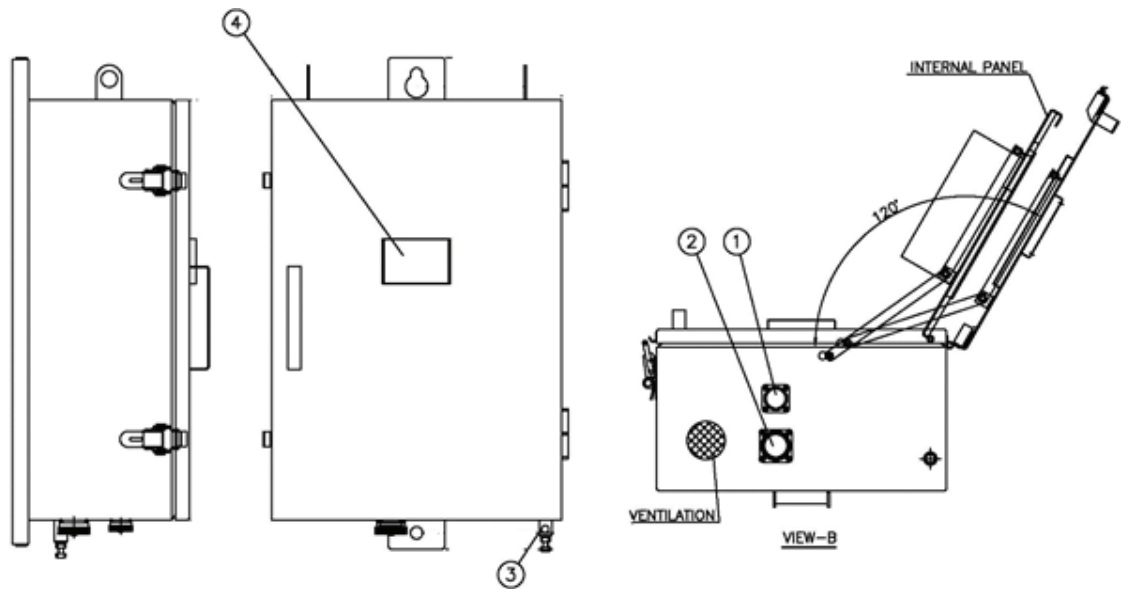
4.4 Breaking part

Vacuum Interrupter is used for breaking current. Breaking contacts are stuck together with proper force in order not to damage the contact. To make press force for contact closing and apart force for contacts opening, there are closing spring and opening springs.



Name of Parts
1) Polymer Housing
2) Fixed contact
3) Vacuum Interrupter
4) Moving Busbar
5) Moving Rod

4.5 Control Panel



Name of Parts	
1) Power Cable Receptacle	2) Control Cable Receptacle
3) Earthing terminal	4) Name Plate

5. TRANSPORT & INSTALLATION

5.1 Check list before Installation

Check following points and see if there is any problem before installation.

- (1) Bushing damage and cable connector assembled condition.
- (2) Manual operation handle
- (3) Layout check (Any damage on surface – scratch. Packing condition)
- (4) LED lamp check (see if any LED dead)
- (5) Battery and Transformer inside of control panel, location and wiring check.
- (6) Manual and electric operation 3~5 times each, see if there is any problem with Battery or external power supply use.

* Battery Start

: If there was no external power supply(220Vac) and try to use Battery first, then press this button to start charging capacitors.

- * First electrical operation on Control panel, battery charging time would be around 2~3 minutes.

So please operate Electrical operation after 2~3 minutes.

5.2 Transportation

Use lifting lug in order to move the recloser and follow approved procedure. Recloser shall be opened status. (Open contact)



Danger

Violate this mark, may cause serious injury or death

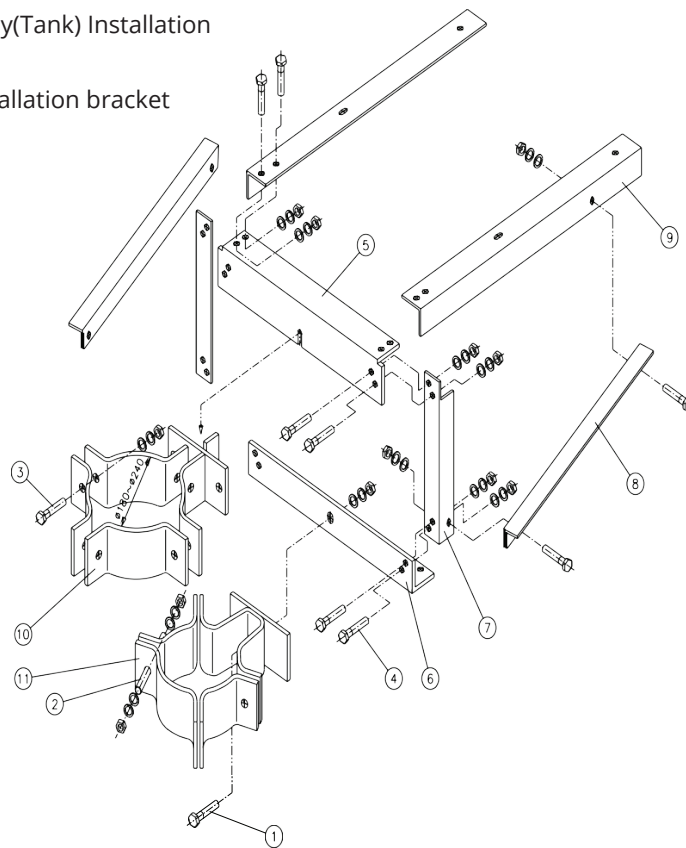


Warning

Violating this mark, may cause serious injury or death

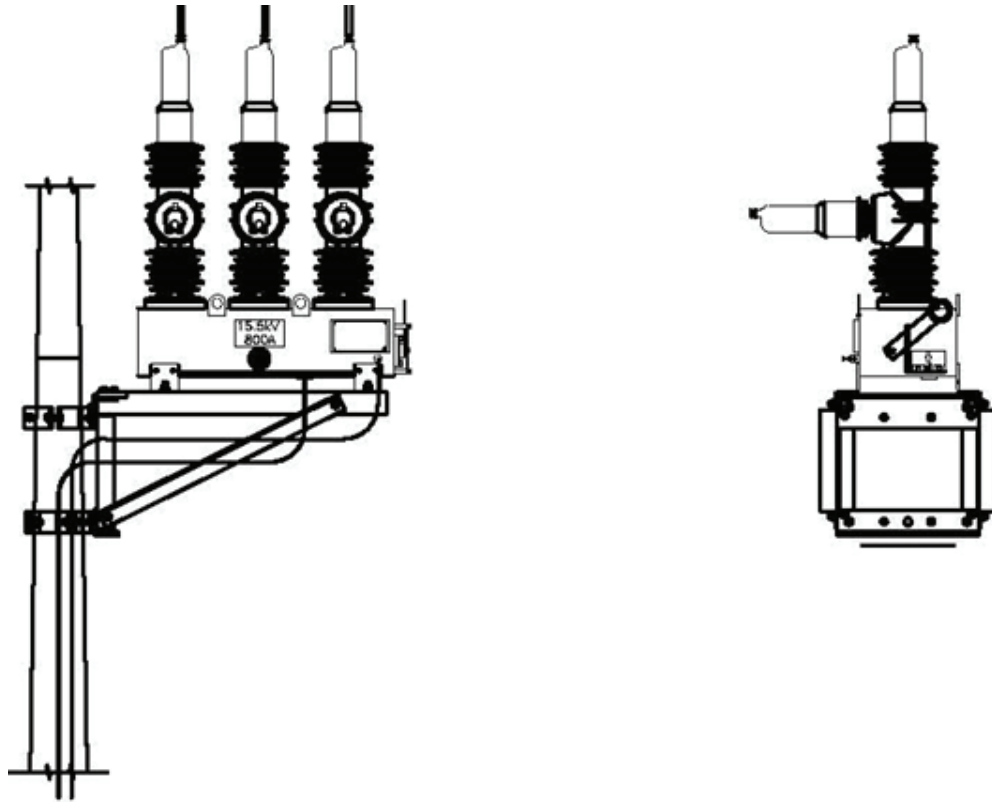
5.3 Body(Tank) Installation

(1) Installation bracket



No.	Name of parts	Quantity
1	Hexagonal bolt, Nut, Spring washer, Flat washer	4
2	Stud bolt	4
3	Hexagonal bolt, Nut, Spring washer, Flat washer	4
4	Hexagonal bolt, Nut, Spring washer, Flat washer	20
5	Upper band	1
6	Lower band	1
7	Vertical bracket	2
8	Bracket support	2
9	Horizontal bracket	2
10	Hanger band "A"	1
11	Hanger band "B"	1

- (2) Installation with Body(Tank)



- (3) Recloser grounding/earthing cable shall be tightened onto the ground/earthing terminal.



Warning

Violating this mark, may cause serious injury or death

5.4 Control Panel installation



Warning

1. Battery check and replacement :

Battery 24V(12Vx2ea), 12Ah rechargeable battery. After ex-factory, the battery is not charged within 6 months, 25% of battery capacity may be decreased, so please check the battery capacity.

- If Battery voltage is 24Vdc, open/close operation is ok. Later check the charging current.
- Battery replacement
: Battery life is about 2-3 years, battery replacement shall be every 2~3 years.
5years at 20°C.

2. Battery spec (12V, 12Ah x 2EA)

: Sealed lead acid Rechargeable Battery is used.

CHARGING INSTRUCTION (AT 25°C)		
TYPE	VOLTAGE REGULATION	INITIAL CURRENT
STAND-BY USE	13.5 ~ 13.8 V	NO Limit
CYCLIC USE	14.4 ~ 15.0 V	1.75A Max >

- (1) Install 2 ea of Band for Control panel.
- (2) Connect the control cable between Recloser and Control panel. (Fix cable every 1~2 meter to prevent any damage from wind or external impact.
- (3) Connect earthing cable onto Ground/earthing terminal.



Warning

Recloser and Control panel shall be well grounded/earthed. Grounding/Earthing shall follow approved procedure for safety reason. Improper grounding/earthing may cause high voltage short circuit and it may cause serious injury.

- (4) Use power cable (2pin) to connect external power supply (220Vac)
 - When AC power supply is connected and supplying power to control panel, connect Battery(2P) connector
 - When the recloser control panel is delivered, battery connector is not connected.

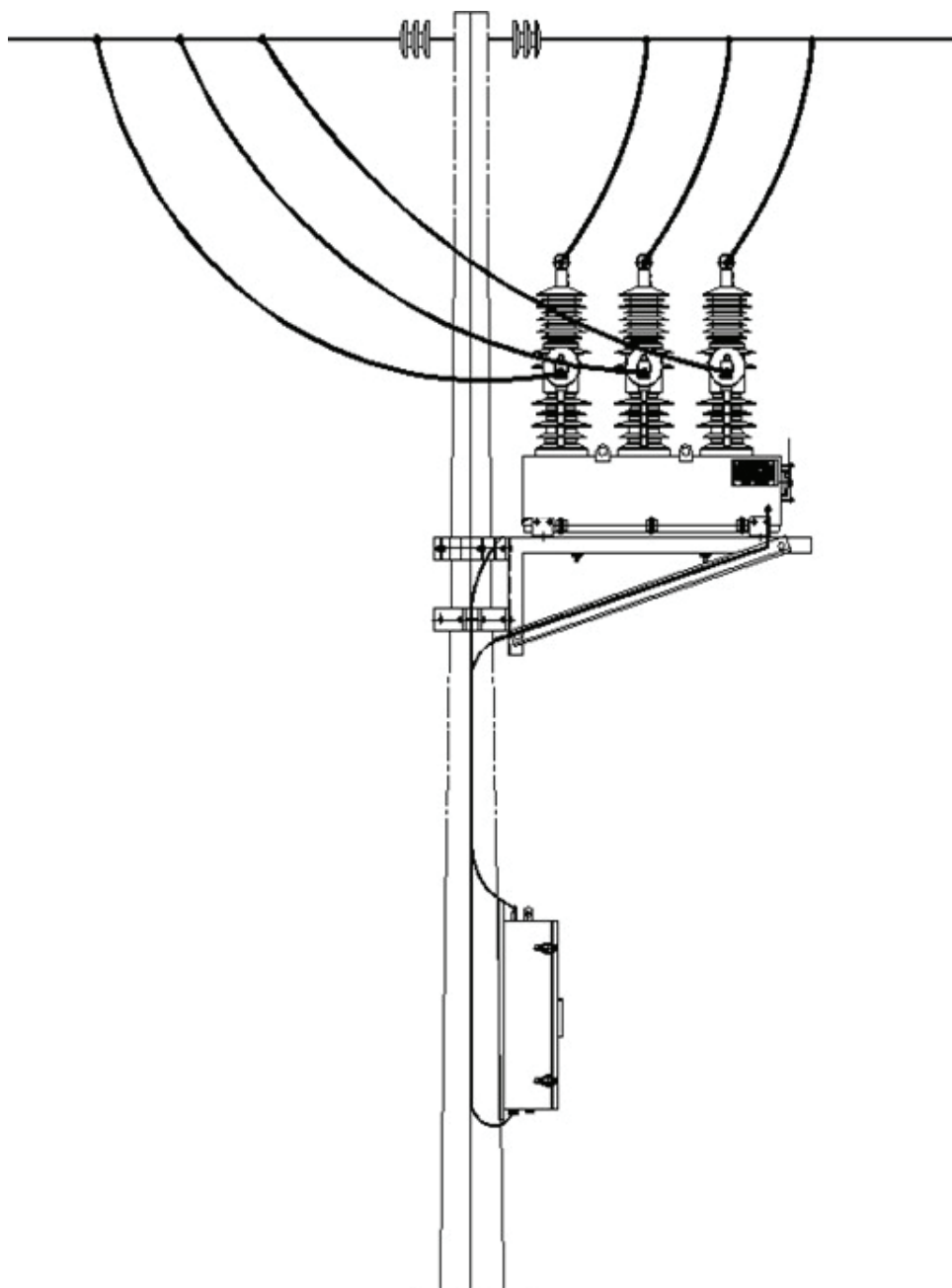
5.5 Check point after installation

After installing the recloser on the pole, following points shall be checked to prevent any operation problem.

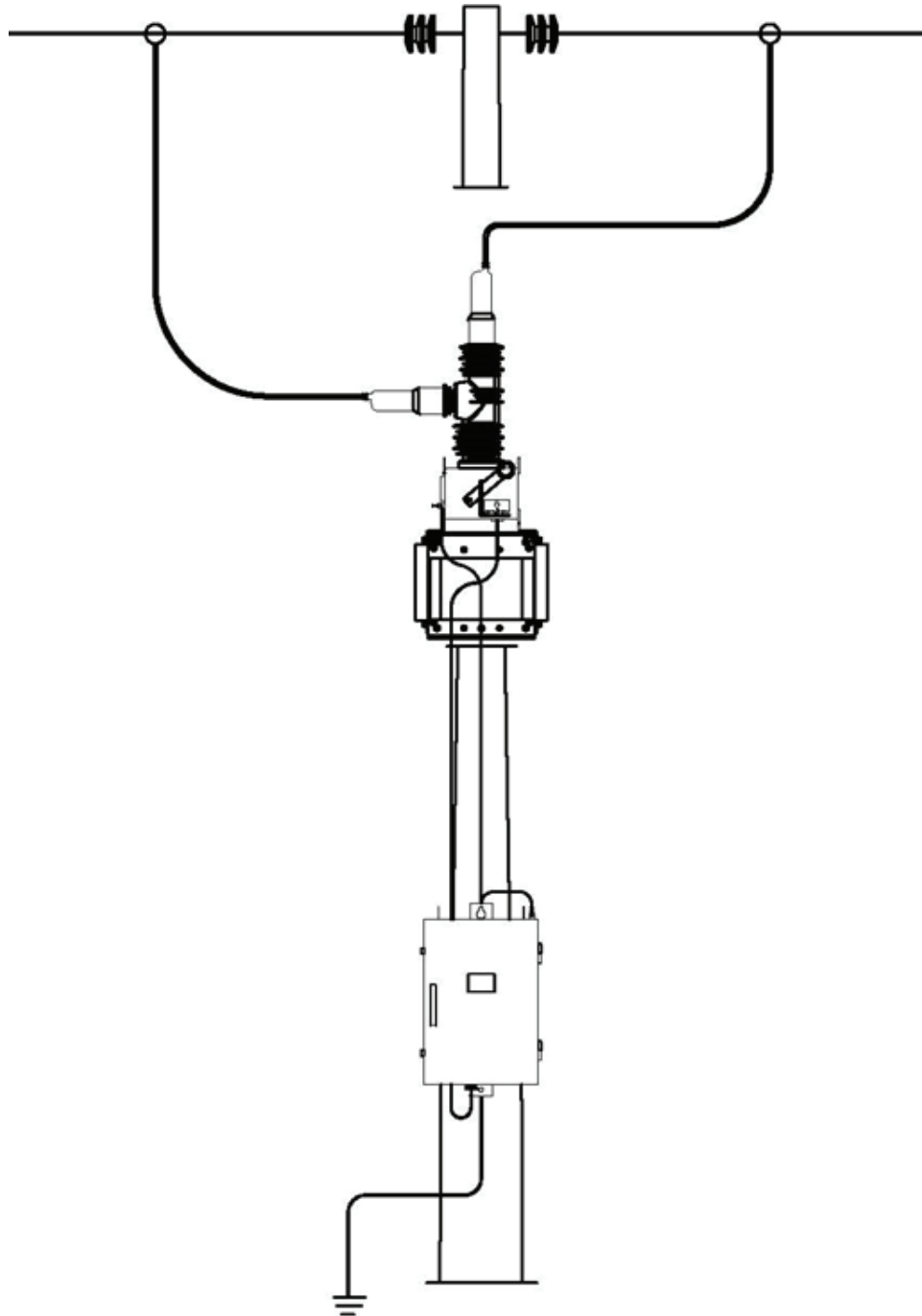
- (1) Bushing terminal cable connection check (Well tightened, Distance between wires shall be Min.250mm)
- (2) Bushing cover installation
- (3) Any tool left On top of Recloser Tank(body) and clean
- (4) Bushing clean
- (5) Manual operation lever position (shall be Close position)
- (6) Close Recloser circuit from control panel and check Tank and Control panel indications to confirm.
- (7) Do battery test and check the battery charging status and capacity
- (8) Tank and Control panel grounding/earthing status.
- (9) Control cable(37Pin) and Power cable (2Pin) connection condition.

5.6 Installation drawing

(1) Installation drawing (Front view)



(2) Installation drawing (Side view)



6. OPERATION METHOD



Warning

1. When Recloser is energized with high voltage, and manual operation is necessary, use COS hot stick. Otherwise, high voltage short circuit may cause a serious injury.
2. Even though manual operation handle and Contact indicator show "Open" status, violating safety instruction may cause serious injury.



Caution

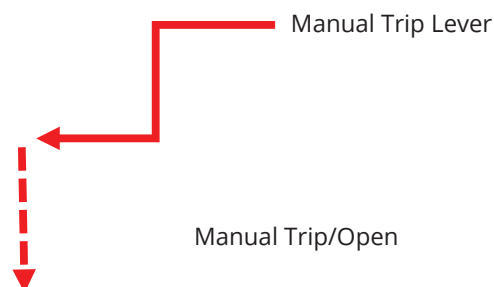
1. **Instantaneous and delay setting :**
During reclosing sequence, at least, one delay operation setting is recommended. In case of all instantaneous setting, it is very difficult to coordinate with other protection device such as C.O.S.
2. **Min. operation current setting :**
Min. phase operation current set value shall be 2~3 times of load current. Min. ground operation current set value shall be selected depending on load unbalance and phase setting value.

6.1 Manual Operation



Caution

Manual operation shall operate Open. For closing, electric closing operation shall be followed from Control panel. Manual open means Locking means as well. Thus, in order to close the circuit, Manual operation handle shall be pushed up.



- (1) Close
Closing operation shall come from control panel by electrical.
Before electrical closing operation, Manual trip lever shall not be at LOCK position.
- * First electrical operation will take 2~3 min for charging capacitors before actual operation.
- (2) Open
Opening operation can be conducted with COS Hotstick by pulling the lever down.
Then, recloser will be locked and it cannot be operated from control panel, electrical operation can't be performed.

6.2 Electrical Operation



Caution

1. Recloser can be operated electrically from control panel. Electrical open and close operation are available if there is no mechanical locking(Manual Open)
2. After power on control panel, electrical closing operation is not conducted, please wait for 2~3minutes. This recloser has Magnetic Actuator mechanism which takes 2~3 minutes for capacitor charging
- * Battery Start
: When 220Vac is not provided, press this button to start Battery use. This button does not make discharge when this button is off.
- (1) Open
Select Local on front panel, and then operate Open.
- * Select Switch : Local
- * Operation Switch : Open
- (2) Close
Closing operation always conducts in Control panel. If manual opening operation is conducted on Recloser, mechanical closing shall be performed first and then, electrical closing operation shall be conducted. Before mechanical closing operation, electrical closing is not possible.



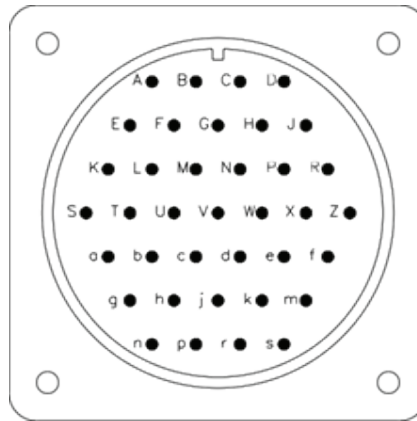
7. Trouble Shooting

In case that Open/Close operation is not performed, please check the following points

- (1) Manual operation lock
Manual operation lock is conducted, push the manual operation lever up to unlock the recloser.
- (2) Control panel operation status(Open/Close) indications are ON, but not able to operate Close/Open.
 - Check if battery capacity is 24Vdc.
 - Check if external power supply is providing 240Vac.
 - Check if the control cable is well connected.

8. Receptacle Pin arrangement

- (1) Control cable receptacle

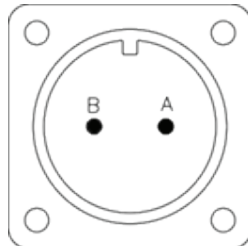


(37P : MS3102A 28-21P)

Pin	Description	Pin	Description
A	A phase Current sensor(1000:1A)	W	Close status info. (Com)
B	B phase Current sensor(1000:1A)	X	Close status info. (N.O)
C	C phase Current sensor(1000:1A)	Z	-
D	N phase Current sensor(1000:1A)	a	Close status info. (N.O) : M1
E	A phase Voltage sensor	b	Close/Open status COM : M1
F	B phase Voltage sensor	c	Open status info. (N.C) : M1
G	C phase Voltage sensor	d	Normal Open contact (spare)

H	R Phase Voltage Sensor	e	Normal Close contact (spare)
J	S Phase Voltage Sensor	f	COM (spare)
K	T Phase Voltage Sensor	g	
L	-	h	
M	-	j	
N	AC Earthing	k	-
P	Close operation signal	m	-
R	Open operation signal	n	+24Vdc Input
S	-	p	-
T	-	r	DC Earth
U	-	s	-
V	-		

(2) Power Supply Cable Receptacle

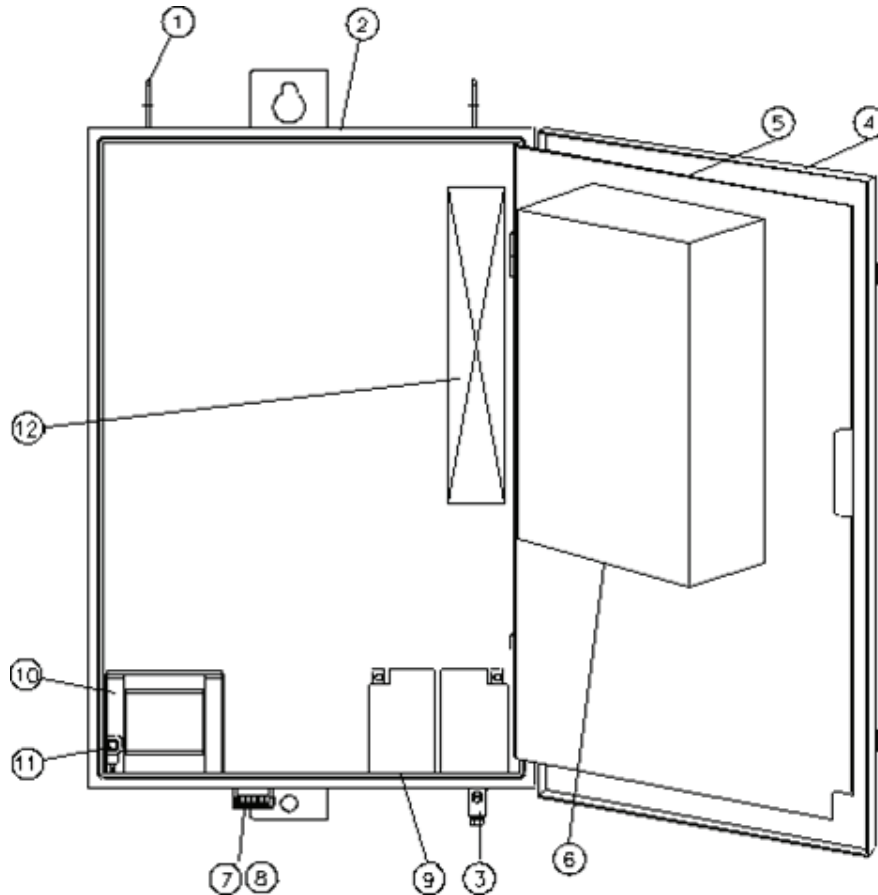


(2P : MS3102A 22-8P)

Pin	Description
A	220V AC Input
B	220V AC Input

9. Control Panel Structure and Rating

(1) Control Panel Structure



NO.	Description	NO.	Description
1	LIFTING LUG	9	BATTERY
2	CONTROL PANEL	10	POWER TRANSFORMER
3	EARTH TERMINAL	11	DOOR SWITCH
4	CONTROL PANEL DOOR	12	MODEM SPACE
5	INTERNAL PANAL		
6	CONTROL MODULE UNIT		
7	POWER CABLE RECEPTACLE		
8	CONTROL CABLE RECEPTACLE		

(2) Control Panel Rating

Rated Frequency	50Hz
AC Power Frequency withstand voltage	2 kV / 1min.
Impulse voltage (1.2x 50µs , 8x 20µs)	6kV(Power supply, Voltage, Current circuit) 4kV (Control, Status)
Surge withstand voltage	Oscillatory : 2.7kV , 1MHzFast transient : 4kV , 2.5kHz
Power Supply	110V AC or 220V AC (50Hz) , 24Vdc
Weight	45 kg

- (3) General condition
- 1) Ambient Temperature
 - Max. Temperature : +50 °C
 - Min. Temperature : - 30 °C
 - 2) Altitude : Below 1,000 Meter Above Sea Level
 - 3) Max. wind velocity : Below 40 m/s

(4) Recloser Control Setting Menu

Item		Range	Default	Step
Pickup current	Phase	50~630A	400A	5A
	Ground	25~315A	70A	5A
Reclosing Sequence	Phase	1~4	4	1
	Ground	1~4	4	1
Instantaneous Curve Operation	Phase	0~4	2	1
	Ground	0~4	2	1
Reclosing Time Interval	1st	0.5~60sec	0.6sec	0.1sec
	2nd	1~60sec	2sec	1sec
	3rd	1~6sec	15sec	1sec
Reset time	Sequence	3~180sec	30sec	1sec
	Lockout	0.00~180.00sec	3.00sec	0.01sec
TC Curve (Phase/ Instantaneous)	TCC type	1~58	1	1
	Multiplier	0.05~2.00	1.00	0.01
	Adder	0.00~1.00sec	0.00sec	0.01sec
	MIN. Response	0.00~1.00sec	0.00sec	0.01sec
	Reset Curve	0.00~100sec	0.00sec	0.01sec
TC Curve (Phase/Delay)	TCC type	1~58	2	1
	Multiplier	0.05~2.00	1.00	0.01
	Adder	0.00~1.00sec	0.00sec	0.01sec
	MIN. Response	0.00~1.00sec	0.00sec	0.01sec
	Reset Curve	0.00~100sec	0.00sec	0.01sec
TC Curve (Ground/ Instantaneous)	TCC type	1~58	20	1
	Multiplier	0.05~2.00	1.00	0.01
	Adder	0.00~1.00sec	0.00sec	0.01sec
	MIN. Response	0.00~1.00sec	0.00sec	0.01sec
	Reset Curve	0.00~100sec	0.00sec	0.01sec
TC Curve	TCC type	1~58	21	1

(Ground/ Delay)	Multiplier	0.05~2.00	1.00	0.01
	Time adder	0.00~1.00sec	0.00sec	0.01sec
	MIN. Response	0.00~1.00sec	0.00sec	0.01sec
	Reset Curve	0.00~100sec	0.00sec	0.01sec
High current (Phase)	Active	Off, 1~4	Off	1
	Pickup current	50~10000A	2000A	1A
	Resp. Time	0.00~1.00sec	0.00sec	0.01sec
High current (Ground)	Active	Off, 1~4	Off	1
	Pickup current	25~10000A	2000A	1A
	Resp. Time	0.00~1.00sec	0.00sec	0.01sec
Cold load Pick up	Multiplier-Phase	0~10	4	1
	Multiplier-Ground	0~10	2	1
Seq. Coordination	Active	ON/OFF	OFF	
On/off Level	On Level	70~85%	80%	5%
	Off Level	50~75%	50%	5%
V.O.C	V.O.C	0~50%	0%	1%
	Minimum V.O.C	0~630A	100A	1A
S/W Count	S/W Count	0~65535	0	1
Phase Difference	Phase Difference	0~80D	30D	5D

[illegible]