

USER GUIDE

## Susol Ring Main Unit



### Safety Instruction

- Please read this instruction carefully before RMU is put into service.
- This manual should be retained by those who are in charge of maintenance and repair.
- This instruction manual shall be kept with easy access for users.

### RMU Series 12/17.5/24kV Type

#### Type

LBS-type : L(1L), LR(1L1R), LLL(3L), LLLL(4L)

Fuse-type : F(1F), LF(1L1F), LFL(2L1F), LLFL(3L1F),  
LFFL(2L2F)

CB-type : C(1C), RC(1R1C), LC(1L1C), LCL(2L1C),  
LLCL(3L1C), LCCL(2L2C)

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## 1. Caution for safety

This message may appear throughout this bulletin or on the equipment to warn of potential hazards or to use safely and appropriately. Please follow this instruction.

Caution for safety is classified according to grade of unsuspected risk, damage and emergency in case of being used by mistake.

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### DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in serious and permanent injury or even death.

### WARNING

Indicates a potentially hazardous situation which, if not avoided, may result in serious and permanent injury or even death.

### CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

---

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



This is the safety alert symbol. It is used to alert you not to happen potential personal injury. Follow all safety messages that follow this symbol to avoid possible injury or death.



This indicates an electrical hazard which will result in electric shock if the instructions are not followed.



## DANGER

- 1. Do not use the RMU that the pressure of SF<sub>6</sub> gas falls below 0.014 Mpa.G. (2 psi.G).**

Otherwise, short circuit fault may occur due to electric breakdown.
- 2. Do not touch the electrically charged parts (connector) under energized conditions.**

Otherwise, it may result in severe physical injury by electric shock.
- 3. Check the remained charging current of insulators like bushing, connector etc. after opening a circuit.**

Otherwise, it may result in severe physical injury by electric shock.
- 4. Before the switch is moved to the earth position, make sure if the high voltage line is not alive.**

Otherwise, there is a danger of ground fault or short circuit fault.
- 5. Earth the switch before replacing fuses.**

Electric shock by the charging current causes serious injury to people.



## WARNING

- 1. Use the RMU under the rated conditions.**

Otherwise, there is a danger of ground fault or short circuit fault.
- 2. Connection of connector should be carried out by a qualified electrician.**

Otherwise, ground fault, short circuit fault may occur due to electric breakdown.
- 3. Be careful when removing front cover.**

Check whether the wire is alive before removing the front cover and work after earthing is completed.
- 4. Inspection and maintenance has to be performed by a qualified electrician.**

Otherwise it may result in malfunction or electric shock.
- 5. Remove unnecessary instruments, metal scrap, etc after finishing installation, inspection and maintenance.**

Otherwise, there is a danger of ground fault, short circuit fault or fire.



## CAUTION

**1. The user must inform in advance about special service conditions.**

Otherwise, this may cause an accident or malfunction.

**2. The RMU must be kept in dry condition and kept away from water.**

Otherwise, there is a danger of insulation deterioration.

**3. When placing the RMU on the ground, be careful not to drop or cause impact.**

Otherwise it may result in deformation or malfunction.

**4. When keeping, handling and installing, follow the instructions with recommended operating method.**

Otherwise, there might be malfunction by deformation or damage to products.

**5. When bolts and screws are assembled, follow the instruction with recommended tightening torque.**

Otherwise, there is a deformation or damage to the product.

**6. If one of fuses is damaged by over-current or fault current, replace all of them.**

There are risks of explosion or fire by break failure or discontinuity.

**7. Do not change the control circuit.**

This may cause malfunction or damage to products.

**8. Check earthing condition of circuits before maintenance/inspection.**

Maintenance/inspection under ungrounded condition may cause accidents.

**9. Discard the RMU at designated areas.**

If not, it may cause environmental pollution.

This instruction manual includes following the essential information such as installation, operation, maintenance of LS Ring Main Unit (L/ LR/ LLL/ LLLL/ F/ LF/ LFL/ LLFL/ LFFL/ C/ RC/ LC/ LCL/ LLCL/ LCCL) and safety for user.

When installing, operating, repairing LS Ring Main Unit (L/ LR/ LLL/ LLLL/ F/ LF/ LFL/ LLFL/ LFFL/ C/ RC/ LC/ LCL/ LLCL/ LCCL), this instruction manual does not guarantee any damage due to natural disaster or unpredictable accidents.

## 2. General outline

### ■ Conception

Susol RMU is a SF<sub>6</sub>-insulated Ring Main Unit for applications in medium voltage distribution networks. Susol RMU can be supplied as 2,3 or 4-way standard configurations with additional equipment according to customer specification. Susol RMU offers a sealed stainless steel tank which contains all the live components and switching functions. The transformer is protected either by a switch fuse combination or a vacuum circuit-breaker.

### ■ Type

- ▶ L (Extensible type; LBS)  
Extensible RMU that consists of 1way LBS
- ▶ LR (Non-Extensible type; LBS – Bus riser)  
Non-extensible RMU that consists of 1way LBS and 1 way Bus riser
- ▶ LLL (Non-Extensible type; LBS – LBS – LBS)  
Non-extensible RMU that consists of 3way LBS
- ▶ LLLL (Non-Extensible type; LBS – LBS – LBS – LBS)  
Non-extensible RMU that consists of 4way LBS
  
- ▶ F (Extensible type; Switch/Fuse)  
Extensible RMU that consists of 1way Switch/Fuse
- ▶ LF (Non-Extensible type; LBS – Switch/Fuse)  
Non-extensible RMU that consists of 1way LBS and 1way Switch/Fuse
- ▶ LFL (Non-Extensible type; LBS – Switch/Fuse – LBS)  
Non-extensible RMU that consists of 2way LBS and 1way Switch/Fuse
- ▶ LLFL (Non-Extensible type; LBS – LBS – Switch/Fuse – LBS)  
Non-extensible RMU that consists of 3way LBS and 1way Switch/Fuse
- ▶ LFFL (Non-Extensible type; LBS – Switch/Fuse – Switch/Fuse – LBS)  
Non-extensible RMU that consists of 2way LBS and 2way Switch/Fuse

- ▶ C (Extensible type; CB/DS)  
Extensible RMU that consists of 1way CB/DS
- ▶ RC (Non-Extensible type; Bus riser – CB/DS)  
Non-extensible RMU that consists of 1way Bus riser and 1way CB/DS
- ▶ LC (Non-Extensible type; LBS – CB/DS)  
Non-extensible RMU that consists of 1way LBS and 1way CB/DS
- ▶ LCL (Non-Extensible type; LBS – CB/DS – LBS)  
Non-extensible RMU that consists of 2way LBS and 1way CB/DS
- ▶ LLCL (Non-Extensible type; LBS – LBS – CB/DS – LBS)  
Non-extensible RMU that consists of 3way LBS and 1way CB/DS
- ▶ LCCL (Non-Extensible type; LBS – CB/DS – CB/DS – LBS)  
Non-extensible RMU that consists of 2way LBS and 2way CB/DS

#### ■ Characteristics

- ▶ SF<sub>6</sub> gas RMU can be capable of movement of opening and closing stably and recovery of insulation by using high speed Rotary Puffer quenching method.
- ▶ RMU can be operated into three position (Close ⇔ Open ⇔ Earth) and has the interlock function between close and earth.
- ▶ RMU can be operated by manual or motor and can be controlled from remote with optional items.
- ▶ RMU protects transformer from the fault at load side when accidents happen.
- ▶ It is possible to protect transformer safely and operate power system efficiently.
- ▶ The Switch /Fuse will be mechanically tripped by operating of fuse striker pin, and then the fault area can be isolated.

### 3. Service condition

#### ■ Normal service conditions

Design to IEC62271-1 with the following limits values.

##### ▶ Ambient temperature

\* Maximum : +40 °C      \* Maximum 24 hour average : +35 °C

\* Minimum : -25 °C

##### ▶ Maximum altitude : ≤ 1000 m above sea level.

##### ▶ Humidity

\* 24hour average value : ≤ 95 %, 2.2kPa below water vapor pressure

\* 1 month average value : ≤ 90 %, 1.8kPa below water vapor pressure

#### ■ Special service conditions

Special service conditions must be agreed on between the manufacturer and user. The user must inform in advance about each special service conditions like below cases or places :

- ▶ Higher level of site altitude or ambient temperature exceeding the normal conditions
- ▶ At a place much influenced by sea wind
- ▶ At a wet place with high humidity
- ▶ At places with a lot water or oil vapors
- ▶ At places with an explosive, flammable or noxious gas
- ▶ At places with a lot dust
- ▶ At places with abnormal vibration or impact
- ▶ At places with a lot snow or ice
- ▶ Other special conditions besides the above cases



**CAUTION**

**1. The user must inform in advance about special service conditions.**

Otherwise, it may cause an accident or malfunction to products.



## 4. Ratings

[Table 4-1] Ratings

Installation type		<b>Indoor/Outdoor(Enclosure)</b>
Rated voltage		<b>12/17.5/24</b>
Rated Current	Cable Switch, busbars	<b>630</b>
	Switch/Fuse	<b>200</b>
	Circuit breaker	<b>200 / 400 / 630</b>
Rated frequency		<b>50 / 60</b>
Rated short time withstand current		<b>21</b>
Rated peak withstand current		<b>54.6</b>
Power frequency withstand voltage		<b>28/38/50</b>
Impulse withstand voltage		<b>75/95/125</b>
Operating method	LBS, CB, Switch/Fuse	<b>Manual / Motor (Option)</b>
	ES	<b>Manual</b>
Operating voltage		<b>AC/DC 110/220, DC 24</b>
Insulating medium		<b>SF6 Gas</b>
Standard operating pressure (psi.G(20 °C))		<b>0.034 (5 psi.G)</b>
Minimum operating pressure (psi.G(20 °C))		<b>0.014 (2 psi.G)</b>
Electrical endurance	LBS	<b>E3</b>
	ES	<b>E1</b>
	DS	<b>E1</b>
	CB	<b>E2</b>
Mechanical endurance	LBS	<b>M1(1,000 times)</b>
	ES	<b>M0(1,000 times)</b>
	DS	<b>M1(2,000 times)</b>
	CB	<b>M1(2,000 times)</b>
Standard		

## 5. Storage

- When storing RMU for a long period of time, keep in dry and clean condition.
- When storing RMU, keep in the wooden packing shown in the [Figure 5-1]. In case of no wooden packing, keep with vinyl wrapping without any damage shown in the [Figure 5-2].
- When storing RMU for a long period of time, there must be no impact to RMU.



[Figure 5-1] Wooden packing



[Figure 5-2] Vinyl wrapping



### CAUTION

- 1. The RMU must be kept in dry condition and kept away from water.**

Otherwise, there will be a danger of insulation deterioration.


## 6. Unpacking

- When unpacking, take care while handling the RMU and check if standard components were packed inside the package shown in the Table 6-1.
- Check that an instruction manual and a final test report were packed inside the package.
- If damage or breakage of RMU are found, immediately notify sales office or service centers.
- If damage or breakage of RMU by the carrier are found, immediately file a claim and notify shipping company.



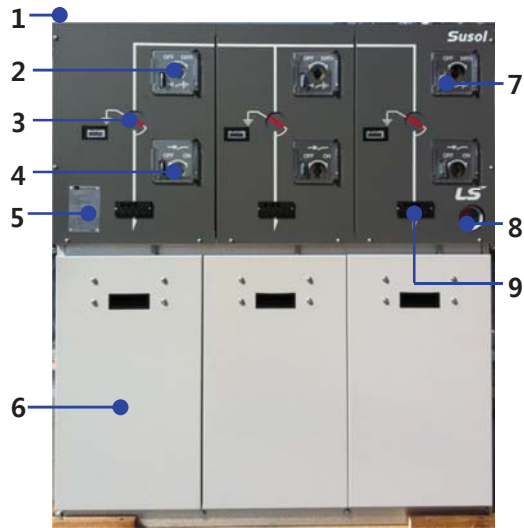
[Figure 6-1] LC RMU

[Table 6-1] Standard components

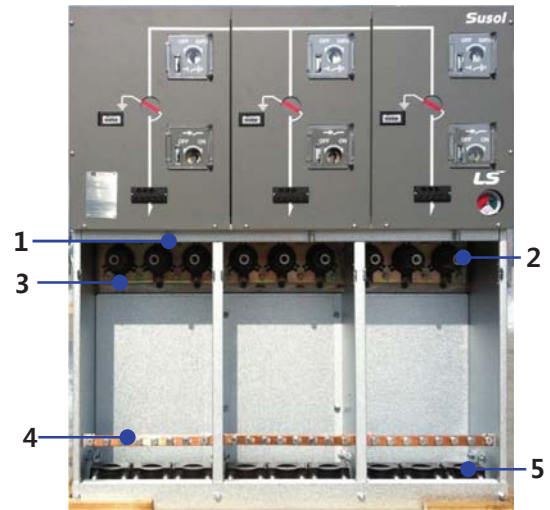
Item	Quantity	Remark
Test report	1 ea	-
LBS Manual operating handle	1 ea	

## 7. External view

### ■ LLL : Non-Extensible Type



[Figure 7-1] LLL external view-1

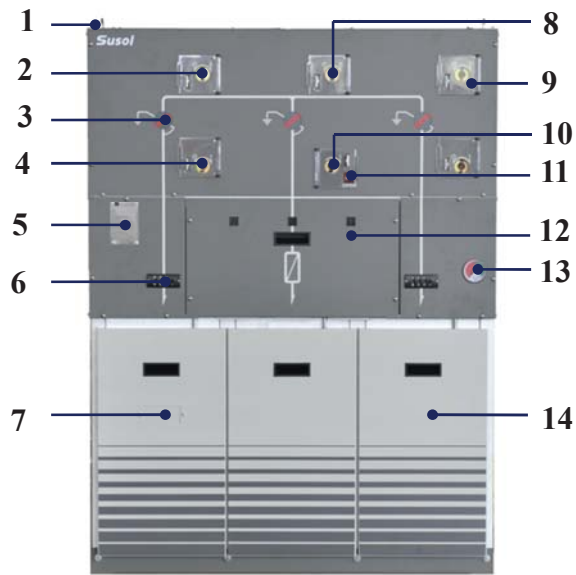


[Figure 7-2] LLL external view-2

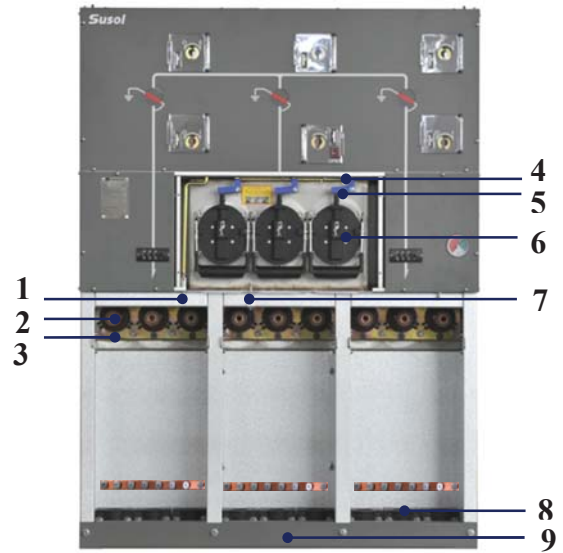
1. Lifting eye
2. LBS earthing and opening operation hole
3. Switch status indicator
4. LBS closing and opening operation hole
5. Name plate
6. Cable cover
7. Pad lock
8. SF<sub>6</sub> gas pressure gauge
9. VPIS

1. LBS cable cover interlock bar
2. Bushing
3. Phase indicator sticker
4. Earthing busbar
5. Cable supporter

■ LFL : Non-Extensible Type



[Figure 7-3] LFL external view-1

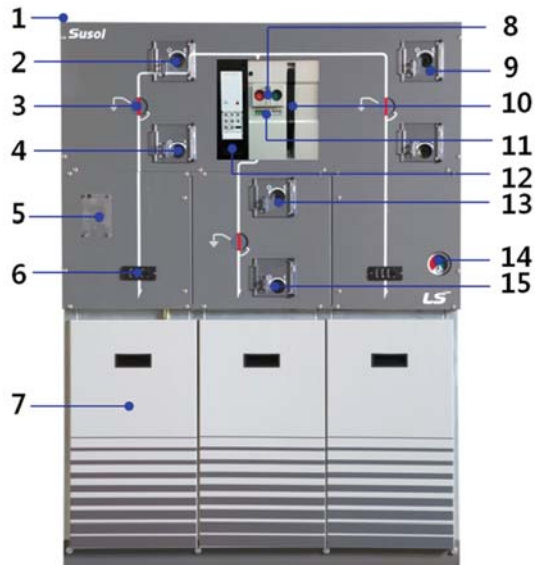


[Figure 7-4] LFL external view-2

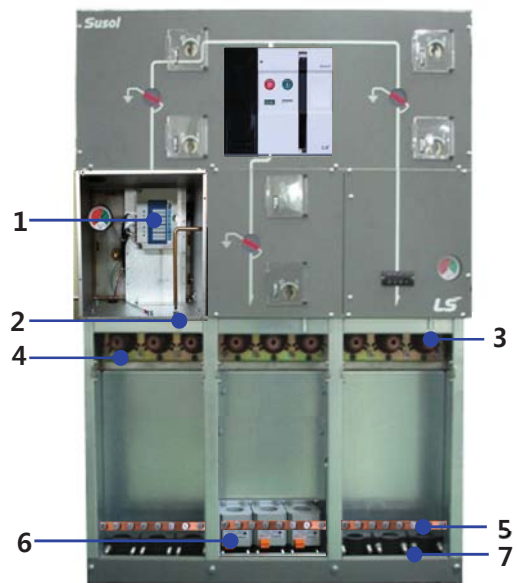
1. Lifting eye
2. LBS earthing and opening operation hole
3. Switch status indicator
4. LBS closing and opening operation hole
5. Name plate
6. VPIS
7. EFCI mounting hole (option)
8. F-LBS earthing and opening operation hole
9. Pad lock
10. F-LBS closing operation hole
11. F-LBS opening push button
12. Fuse holder cover
13. SF<sub>6</sub> gas pressure gauge
14. Cable cover

1. LBS cable cover interlock bar
2. Bushing
3. Phase indicator sticker
4. Fuser cover interlock bar
5. Fuse strike operation lever
6. Fuse holder
7. F-LBS cable cover interlock bar
8. Cable supporter
9. Earthing busbar supporter

■ LCL : Non-Extensible Type



[Figure 7-5] LCL external view-1




[Figure 7-6] LCL external view-2

1. Lifting eye
2. LBS earthing and opening operation hole
3. Switch status indicator
4. LBS closing and opening operation hole
5. Name plate
6. VPIS
7. Cable cover
8. CB on/off button
9. Pad lock
10. CB manual charging handle
11. CB on/off and charging/discharging indicator
12. OCR (LSIS)
13. ES closing and opening hole
14. SF<sub>6</sub> gas pressure gauge
15. DS closing and opening hole

1. OCR (WOODWARD, option)
2. LBS cable cover interlock bar
3. Bushing
4. Phase indicator sticker
5. Earthing busbar supporter
6. CT
7. Cable supporter

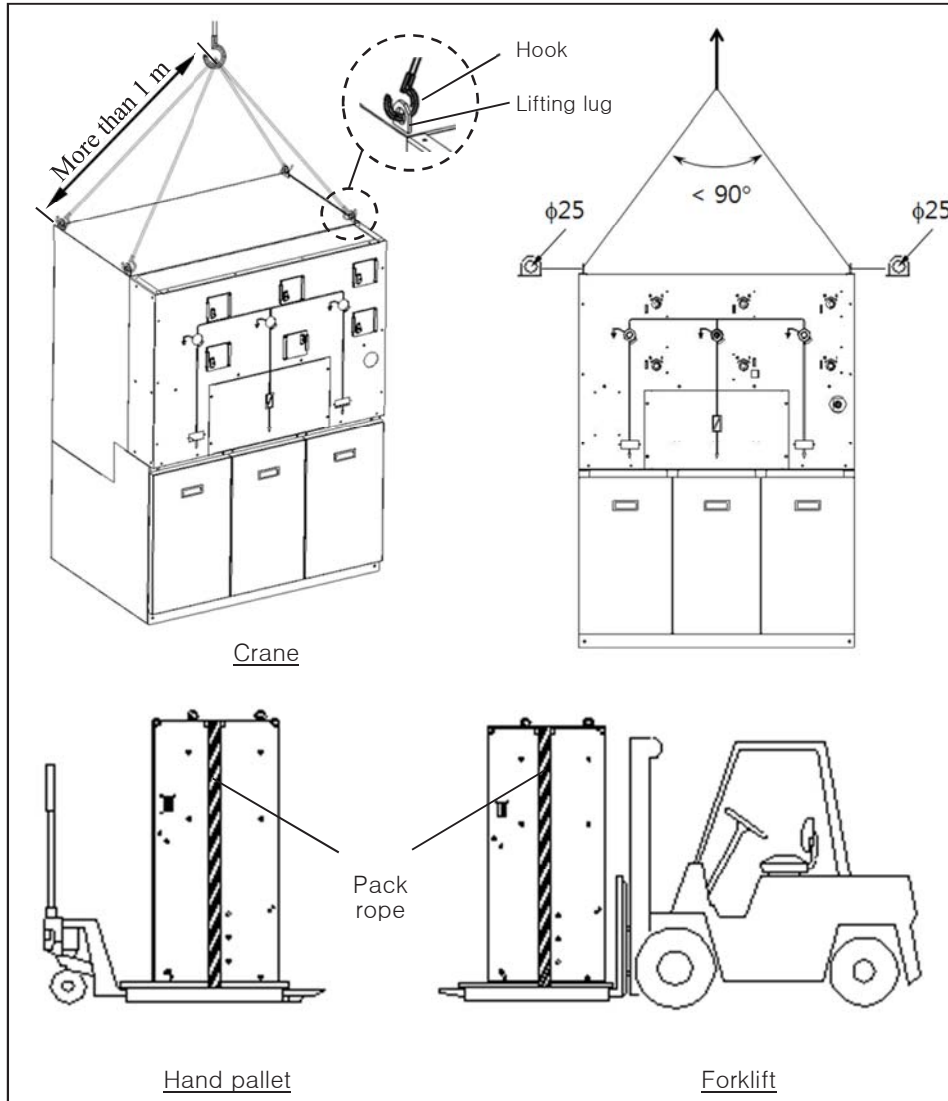
## 8. Handling

 <span style="font-size: 24px; font-weight: bold; margin-left: 10px;">CAUTION</span>
<p><b>1. When placing the RMU on the ground, be careful not to drop or cause impact.</b> Otherwise, it may result in deformation or malfunction.</p> <p><b>2. When keeping, handling and installing, follow the instructions with recommended operating method.</b> Otherwise, there might be malfunction by deformation or damage to products.</p>

- When up/downloading the RMU into a truck, use the crane or forklift and be careful not to impact the product.
- When handling or installing, please use a crane, forklift or a hand pallet shown in the [Figure 8-1].
- When using the crane, do not directly connect to rope or cable at lifting lug. Use the shackle or hook. Please use the crane, rope and cable over 1000kg and the RMU must not be slanted during the lifting. Also, use a sufficient length (more than 1m) rope or cable during handling shown in the [Figure 8-1].
- When using a forklift and hand pallet, fix the RMU to forklift or hand pallet with clamp, etc..
- When using another handling method, be careful not to impact the product. It might cause damage or deformation to RMU itself.

[Table 8-1] RMU weights

L	LR	LLL	LLLL	F	LF	LFL	LLFL
<b>175 kg</b>	<b>230 kg</b>	<b>305 kg</b>	<b>400 kg</b>	<b>200 kg</b>	<b>230 kg</b>	<b>310 kg</b>	<b>390 kg</b>
LFFL	C	RC	LC	LCL	LLCL	LCCL	
<b>400 kg</b>	<b>225 kg</b>	<b>260 kg</b>	<b>290 kg</b>	<b>370 kg</b>	<b>450 kg</b>	<b>520 kg</b>	



[Figure 8-1] RMU handling



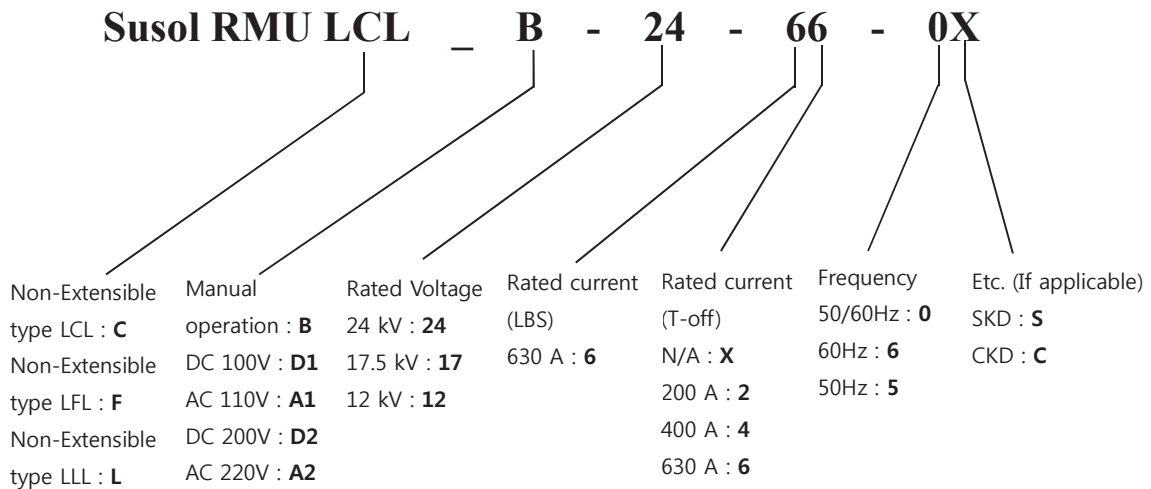
## 9. Checking point before installation

- Check a nameplate correspond to the ratings of operating system.


LS Ring Main Unit	
TYPE	: Susol RMU LCL_B-24-66
S/N	: YYMMDD-8XXX.XX
MFG. DATE	: YYYY. MM.
STANDARD	: IEC 62271-200
RATED VOLTAGE	$U_r$ 24 kV
RATED FREQUENCY	$f_r$ 50/60 Hz
RATED LIGHTNING IMPULSE WITHSTAND VOLTAGE	$U_p$ 125 kV
RATED POWER FREQUENCY WITHSTAND VOLTAGE	$U_d$ 50 kV
RATED NORMAL CURRENT	$I_r$ 630 A
	$I_{r T-off}$ 630 A
RATED SHORT-TIME WITHSTAND CURRENT	$I_k$ 21 kA
	$I_{k T-off}$ 21 kA
RATED PEAK WITHSTAND CURRENT	$I_p$ 54.6 kA
	$I_{p T-off}$ 54.6 kA
RATED DURATION OF SHORT CIRCUIT	$t_k$ 3 s
	$t_{k T-off}$ 3 s
RATED FILLING LEVEL FOR INSULATION	$P_{re}$ 5 psi.G
MINIMUM FUNCTIONAL LEVEL FOR INSULATION	$P_{me}$ 2 psi.G
SF <sub>6</sub> GAS MASS	4 kg
INTERNAL ARC CLASSIFICATION	IAC AFL
ARC TEST CURRENT	21 kA
ARC TEST CURRENT DURATION	1 s
MADE IN KOREA LS IS	

[Figure 9-1] Name plate

- Type check.



[Figure 9-2] RMU description



## WARNING

**1. Use the RMU under the rated conditions.**

Otherwise, there is a danger of ground fault or short circuit fault.

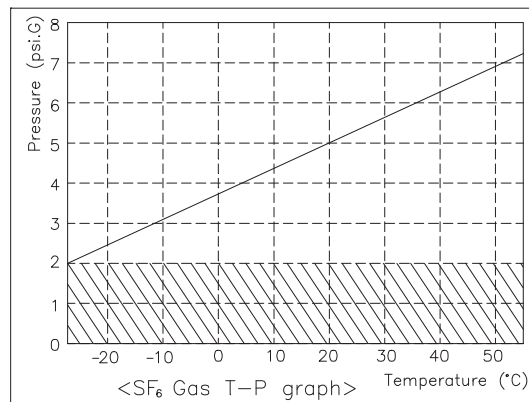
- When transporting or handling, check a damage of the products or a leak of SF<sub>6</sub> gas if a gauge points out the red area shown in the [Figure 9-3].
- If breakage, deformation or leakage of RMU are found, do not use the product and immediately notify sales offices and service centers.
- The Pressure gauge is not always constant because it is affected by temperature, Please check the SF<sub>6</sub> gas temperature pressure characteristic curve shown in [Figure 9-4].

Pointer in green area → SF<sub>6</sub> gas pressure is correct

Pointer in red area → SF<sub>6</sub> gas pressure is low



[Figure 9-3] Gas pressure gauge



[Figure 9-4] SF<sub>6</sub> gas temperature pressure characteristic curve

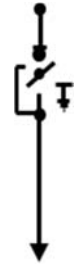
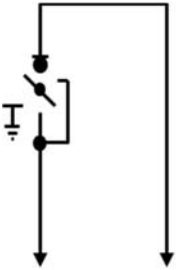
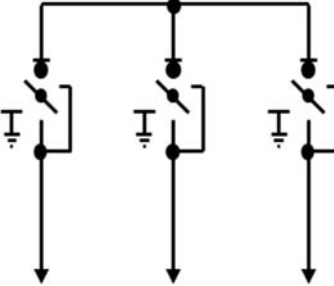
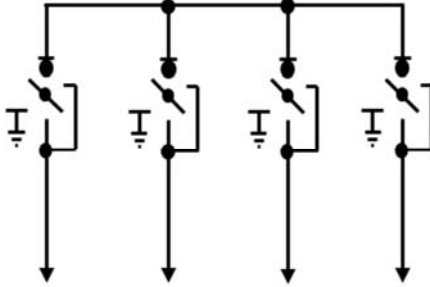
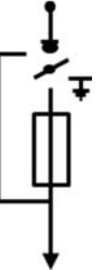


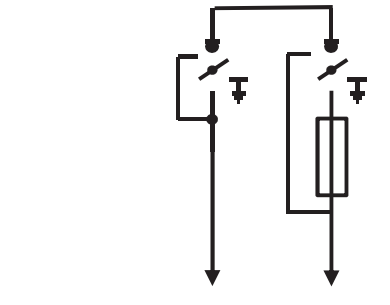
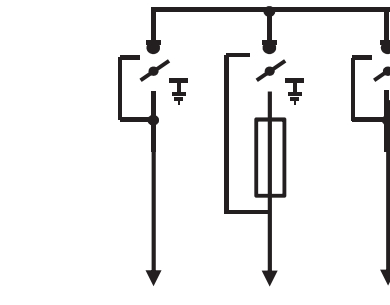
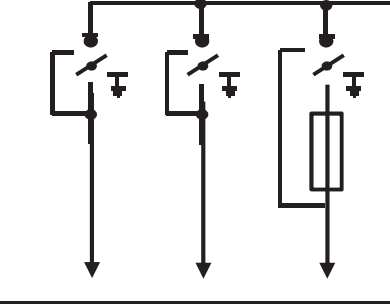
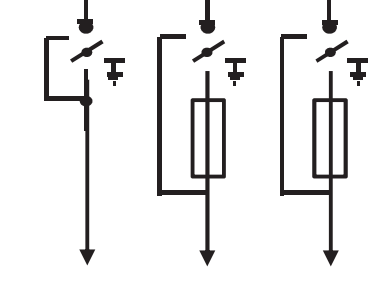
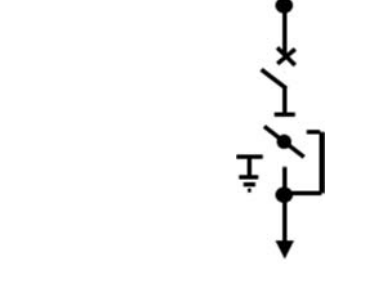
**DANGER**

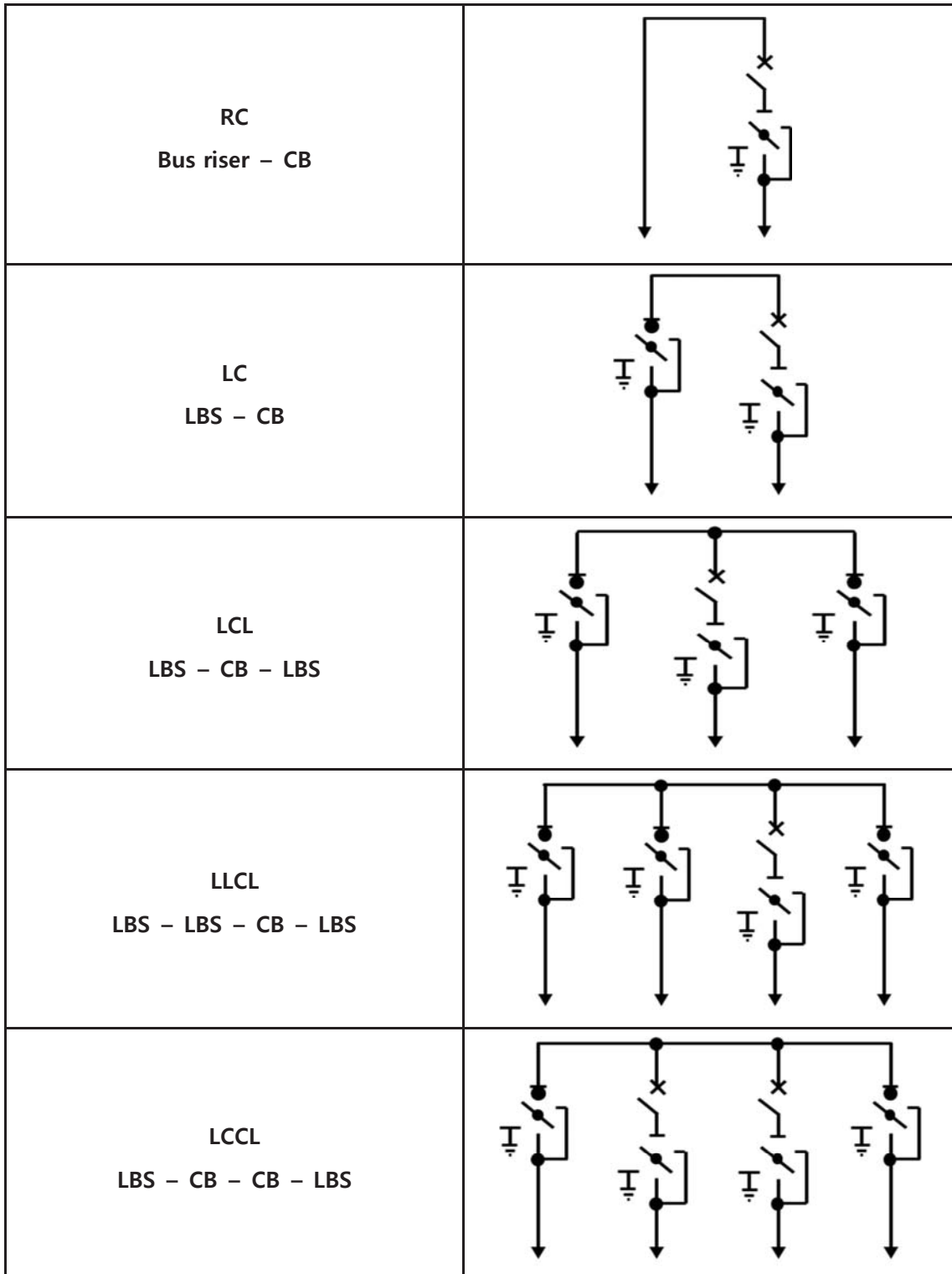
1. Do not use the RMU that the pressure of SF<sub>6</sub> gas falls below 0.014 Mpa.G. (2 psi.G).

Otherwise, short circuit fault may occur due to electric breakdown.

- Check the product suitability for the purpose of operating and refer to the [Figure 9-5].

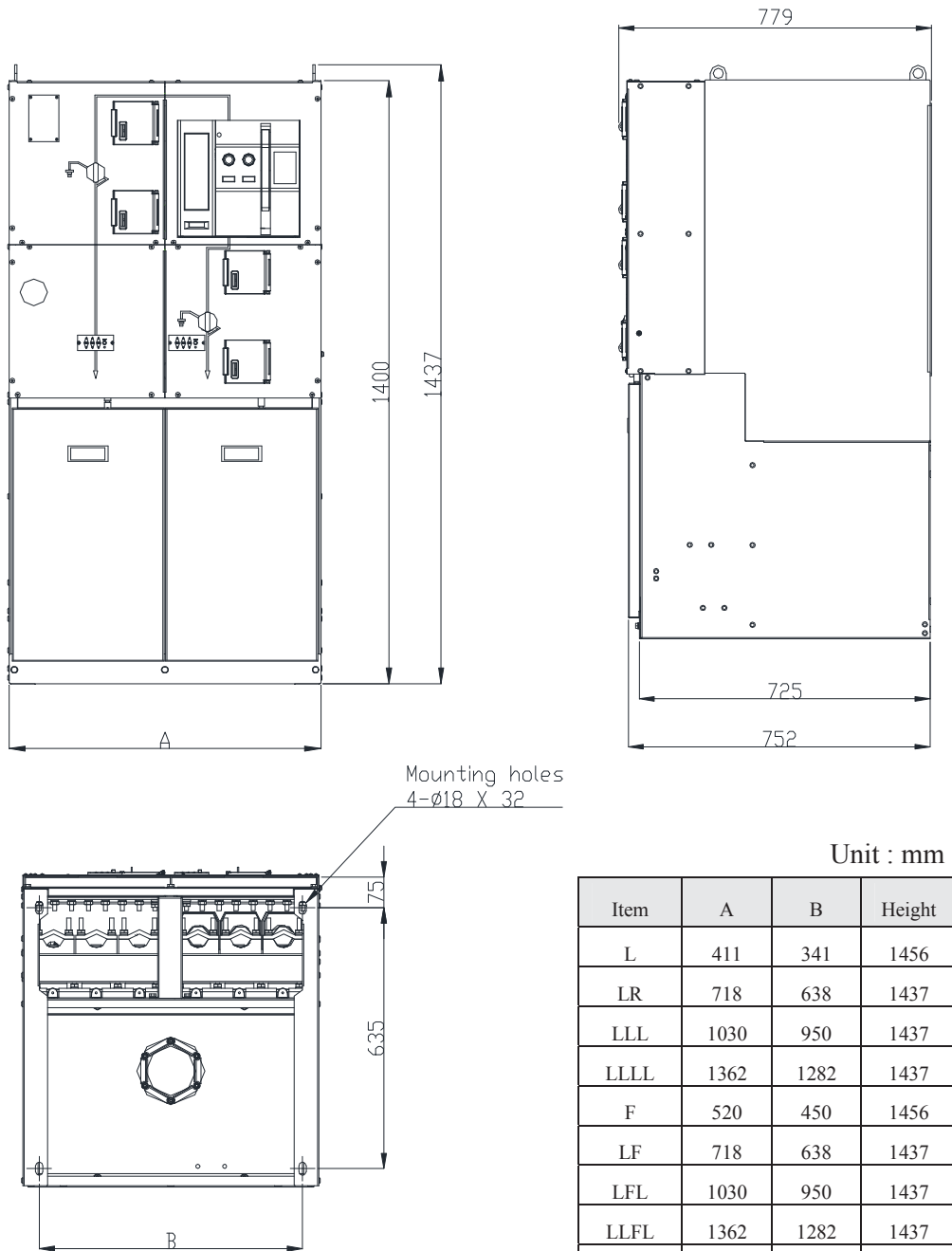
Item	Single line diagram
<p style="text-align: center;">L LBS</p>	
<p style="text-align: center;">LR LBS – Bus riser</p>	
<p style="text-align: center;">LLL LBS – LBS – LBS</p>	
<p style="text-align: center;">LLLL LBS – LBS – LBS – LBS</p>	
<p style="text-align: center;">F FLBS</p>	

<p>LF LBS - FLBS</p>	
<p>LFL LBS - FLBS - LBS</p>	
<p>LLFL LBS - LBS - FLBS - LBS</p>	
<p>LFFL LBS - FLBS - FLBS - LBS</p>	
<p>C CB</p>	



[Figure 9-5] RMU combination

- Check the space to install the RMU and refer to the [Figure 9-6] and also check the product suitability for the purpose of operating.



[Figure 9-6] RMU dimension

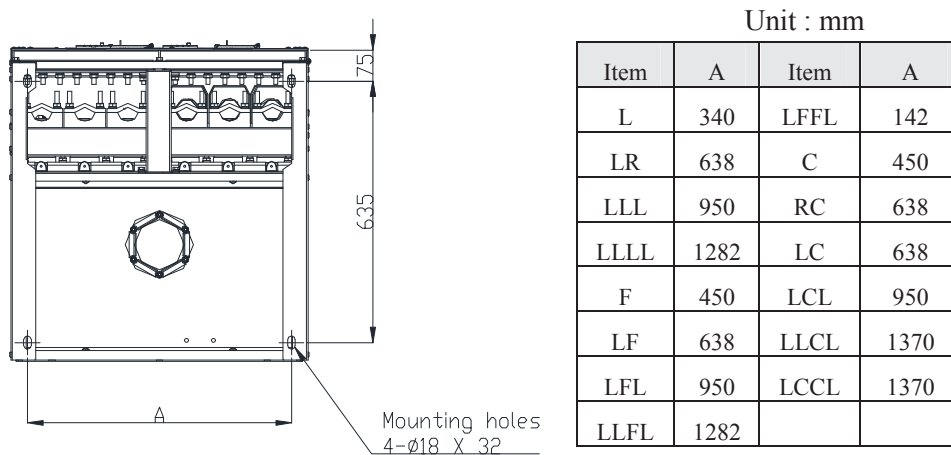
## 10. Installation

- To operate safely without any problems, follow the installation methods.
- When fixing products or terminal, follow the instruction with recommended torque values.

[Table 10-1] Recommended torque

Bolt	Torque	
	Steel type (kgf · cm)	Brass type (kgf · cm)
M 4	16 (14~19)	9 (8~11)
M 5	33 (28~37)	19 (16~22)
M 6	56 (48~65)	33 (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)

- Fix the RMU using the mounting holes shown in the [Figure 10-1].



[Figure 10-1] Mounting layout



### CAUTION

1. When bolts and screws are assembled, follow the instruction with recommended tightening torque.

Otherwise, there is a deformation or damage to the product.

■ LBS cable cover open

1. The LBS must be opened before opening the cable cover.
2. Rotate earth operating handle to the earth position.

(※ The cable cover can only be accessed when the earthing switch is in the earthed position)



[Figure 10-2] LBS cable cover open



**DANGER**

- 1. Do not touch the electrically charged parts (connector) under energized conditions.**

Otherwise, it may result in severe physical injury by electric shock.

- 2. Check the remained charging current of insulators like bushing, connector etc. after opening a circuit.**

Otherwise, it may result in severe physical injury by electric shock.

- 3. Before the switch is moved to the earth position, make sure that if high voltage line is not alive.**

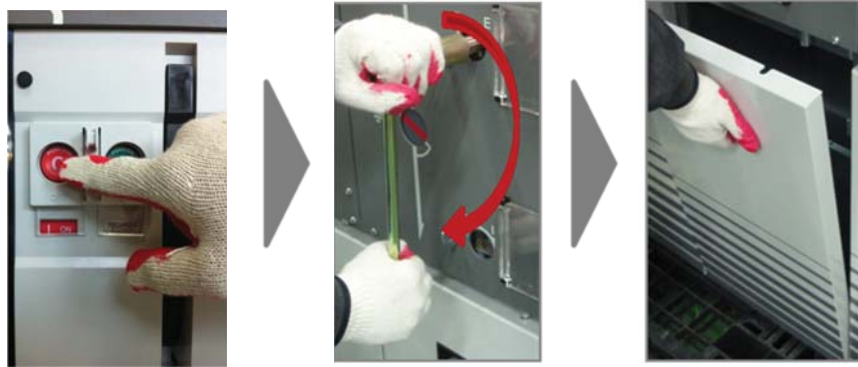
Otherwise, there is a danger of ground fault or short circuit fault.



■ CB cable cover open.

1. Push the CB open button.
2. Rotate operating handle to the earth position.

(※ The cable cover can only be accessed when the earthing switch is in the earthed position)



[Figure 10-3] CB cable cover open



**DANGER**

- 1. Do not touch the electrically charged parts (connector) under energized conditions.**

Otherwise, it may result in severe physical injury by electric shock.

- 2. Check the remained charging current of insulators like bushing, connector etc. after opening a circuit.**

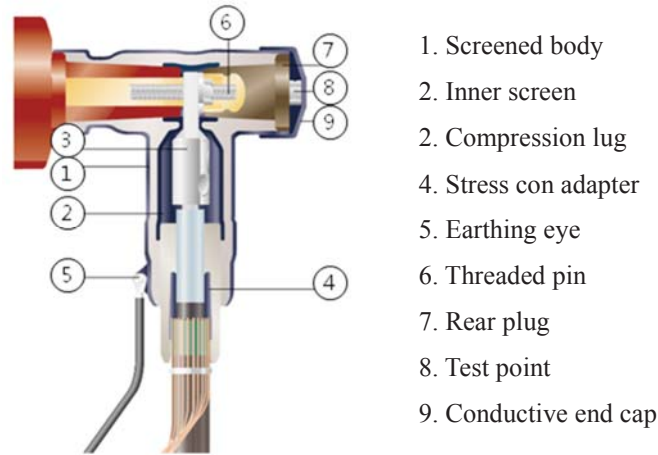
Otherwise, it may result in severe physical injury by electric shock.

- 3. Before the switch is moved to the earth position, make sure that if high voltage line is not alive.**

Otherwise, there is a danger of ground fault or short circuit fault.

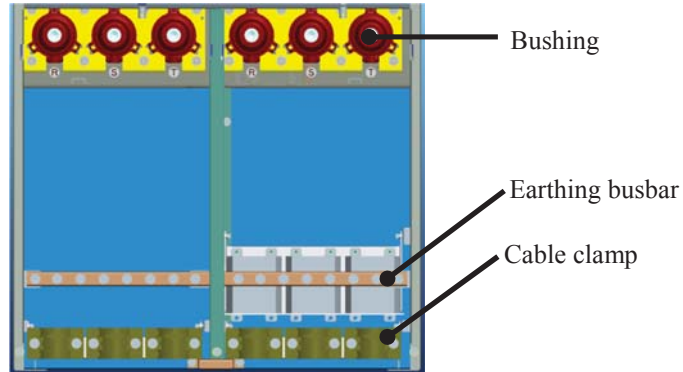
■ To install cable connector, refer to the instruction of the connector manufacturer.

▶ Use the DIN 47636 Type C Bushing as a cable connector.



[Figure 10-4] Connector installation

▶ Fix the cable with a cable clamp and make earthing by tightening the earthing eye of the connector and cable shield wire to the earthing busbar.



[Figure 10-5] Cable clamp & earthing busbar

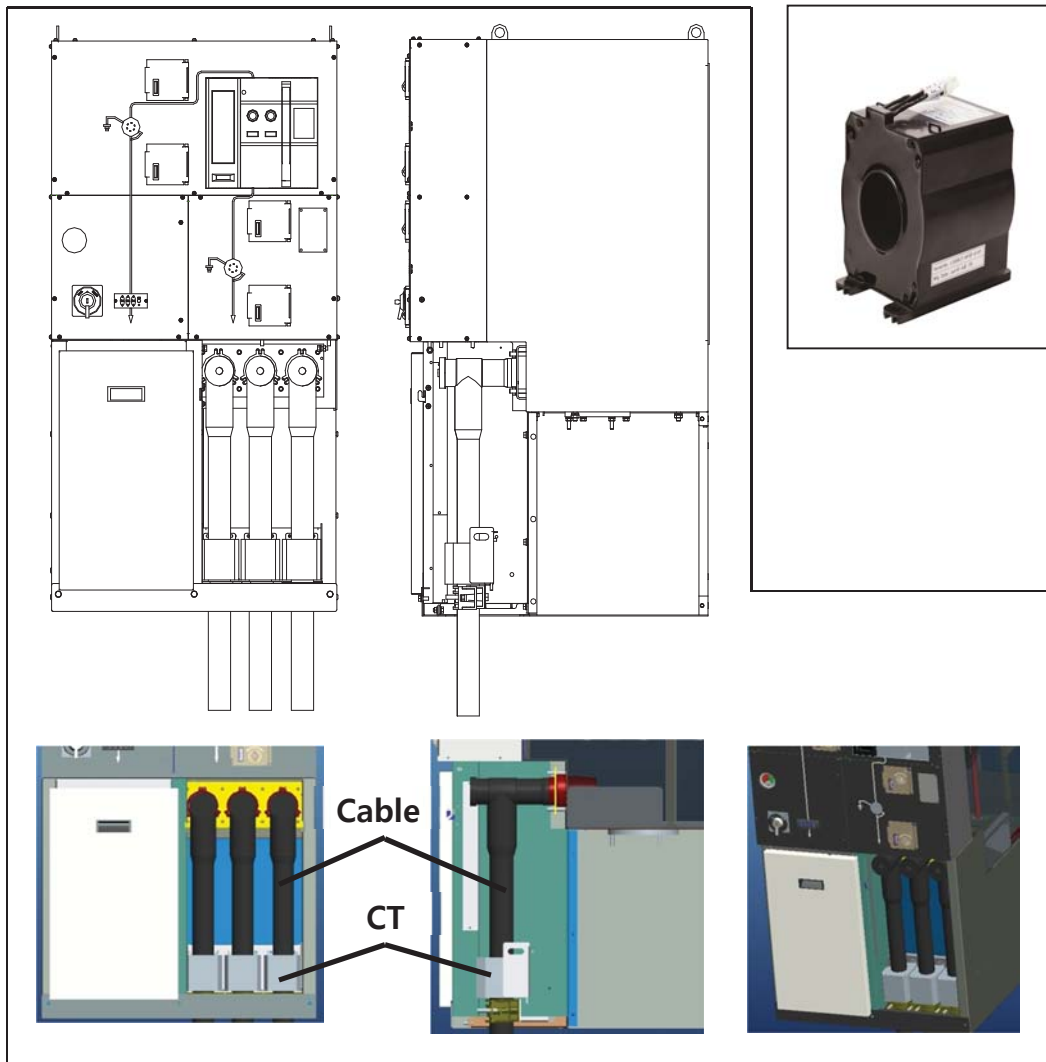


**WARNING**

**1. Connection of connector should be carried out by a qualified electrician.**

Otherwise, ground fault, short circuit fault may occur due to electric breakdown.

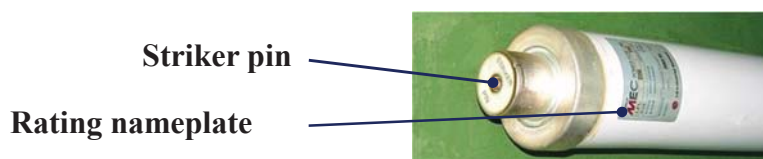
- Install the window type CT before installing cable connector.
- The control cable must be connected to the CT output port. Be careful to connect it to the own way.



[Figure 10-6] CT installation

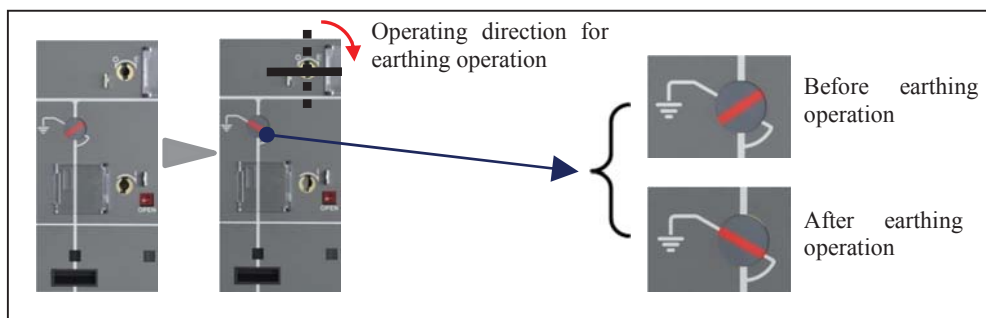
■ In case you need to install the fuse or replace the damaged fuse, follow below.

- ▶ To select correct ratings of fuses for transformer protection, the following criteria should be discussed. Please consult us.
  - Ambient temperature
  - Service voltage
  - Transformer rating
  - Derating rate related with thermal dissipation
- ▶ Check nameplate of supplied fuse with RMU or new fuse for replacement.



[Figure 10-5] External view of power fuse

- ▶ Make earth the switch after tripping by fuse operation. Refer to Chapter 12. Operation (LBS) for details.



[Figure 10-6] Panel schematic



**DANGER**

**1. Earth the switch before replacing fuses.**

Electric shock by the charging current causes serious injury to people.

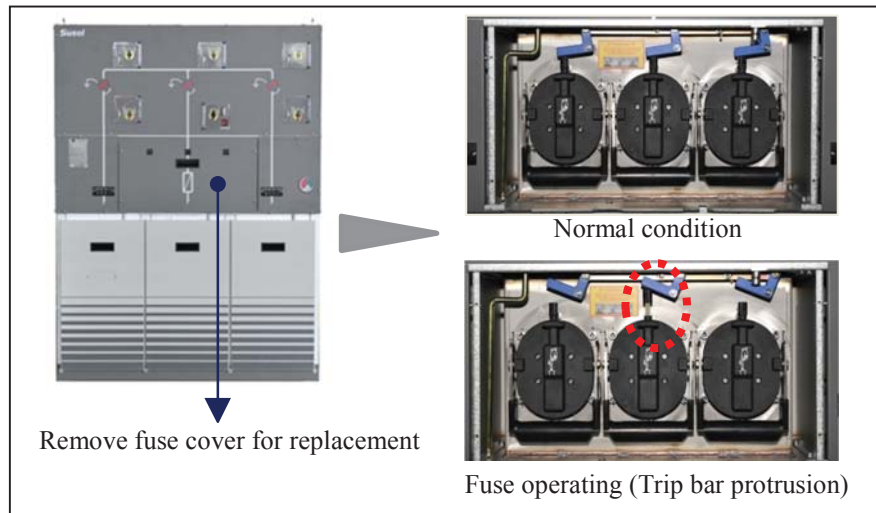


**CAUTION**

**1. If one of fuses is damaged by over-current or fault current, replace all of them.**

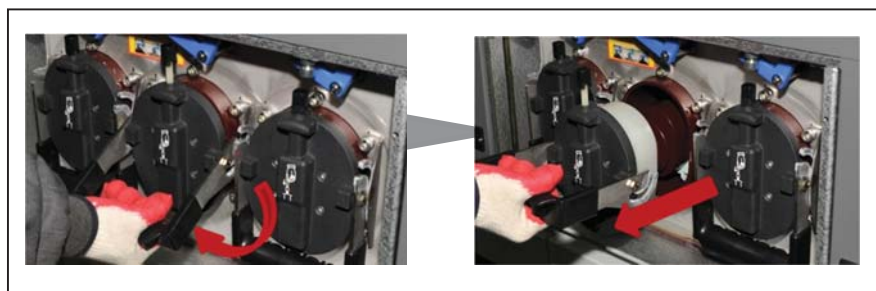
There are risks of explosion or fire by break failure or discontinuity.

- ▶ After completion of fuse-switch earthing operation, loosen the bolt on the fuse cover. Then lift a doorknob and pull it to open cover.
- ▶ Check whether fuse operates or not according to [Figure 10-7].



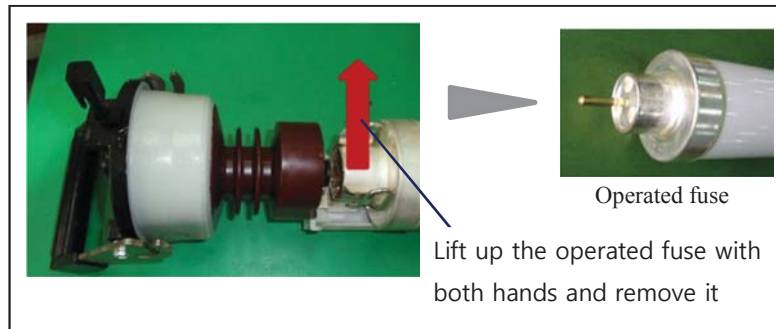
[Figure 10-7] Fuse operating condition check

- ▶ Lift draw-in/out handle of fuse holder more than 90 degrees then pull the handle to separate the fuse holder.  
(While drawing out fuse holder, take it out little by little slowly in order not to make product damage or operator injury)



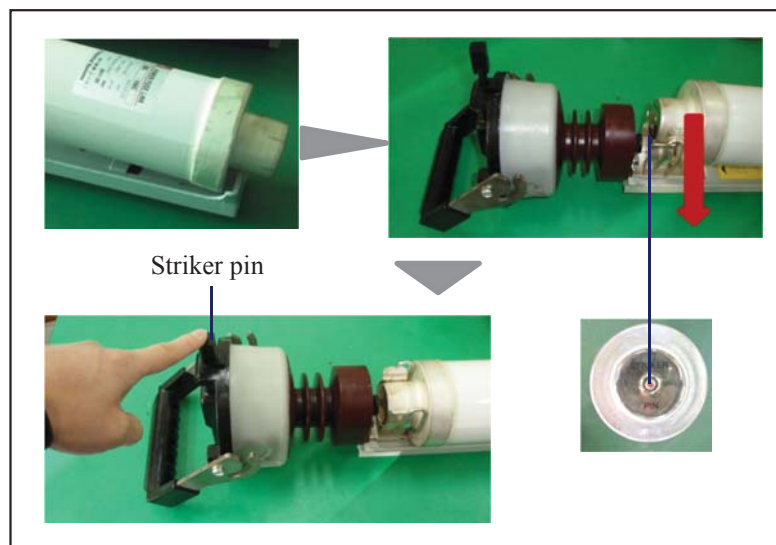
[Figure 10-8] Fuse holder draw-out

- ▶ Put down the fuse holder on a worktable, and remove the operated fuse. (Check the strike pin position). Refer to the picture below.



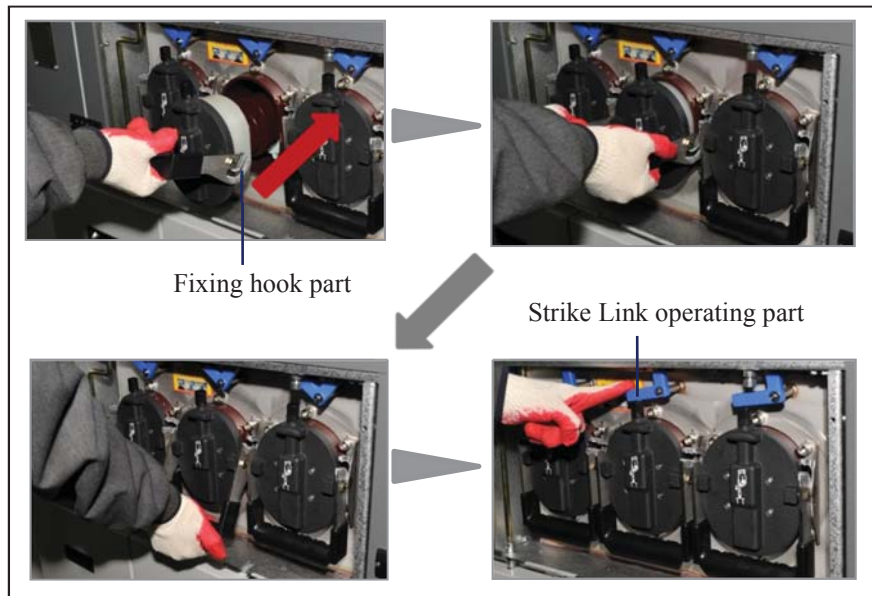
[Figure 10-9] Power fuse separation

- ▶ Check the specification of new fuse for replacement. Make striker pin face the direction like below figure. Push it into the fuse holder and make it tight. (At this time, push a holder cap strike pin backward)



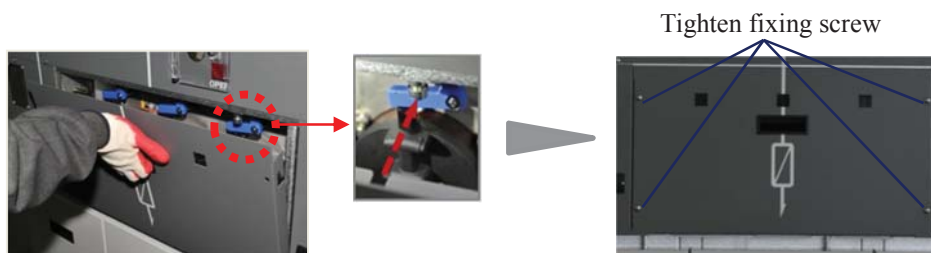
[Figure 10-10] Fuse assembling

- ▶ Push fuse holder into the fixing part. Fix the fuse holder tightly with hooking part. Then check the strike pin status.



[Figure 10-11] Fuse holder draw-in

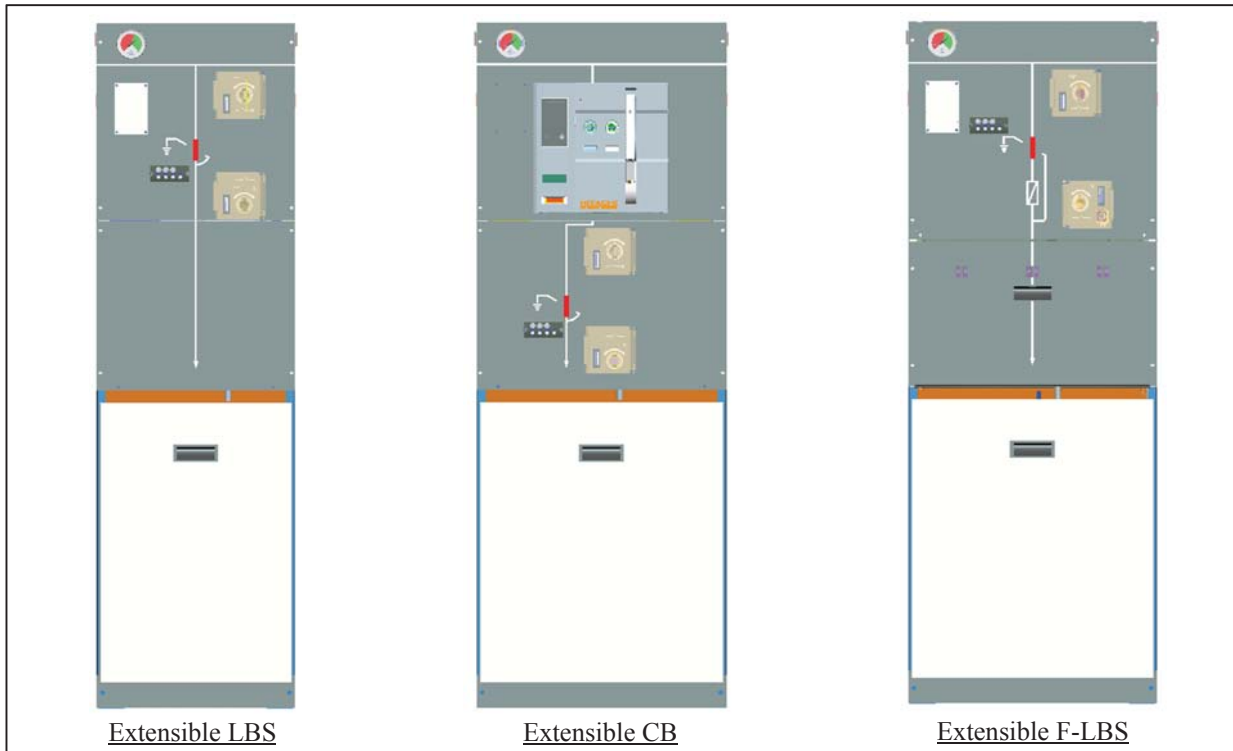
- ▶ Once finishing replacement of fuse, close the cover and tighten screw to fix it. (The groove on upper part of cover has to be on interlock lever first then fix it)



[Figure 10-12] Fuse cover assembling

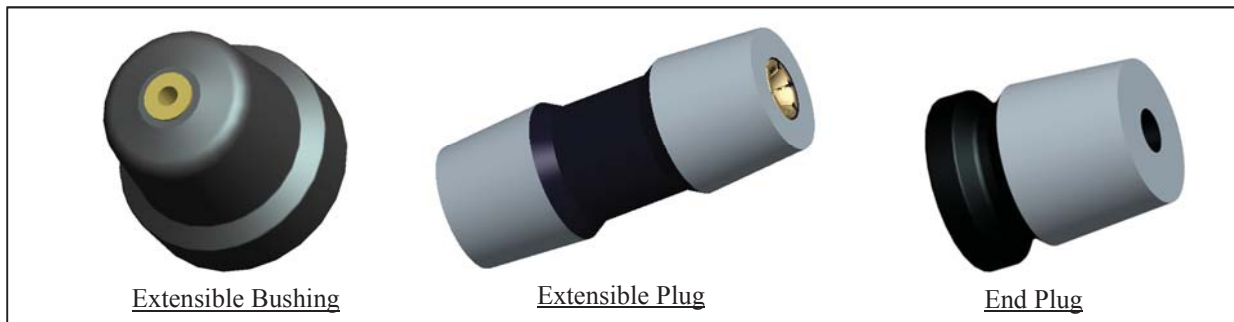
## 11. Extension of RMU

### ■ General Description (LBS, CB & F-LBS)



[Figure 11-1] External view of Extensible RMU

### ■ Description of Assembly Parts



[Figure 11-2] Assembly Parts for extension




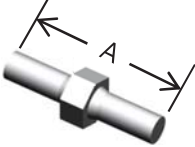



## CAUTION

1. This is recommended that you read the entire manual carefully before starting to assemble this kit.
2. This extension must be conducted after power OFF.
3. This extension must be completed by a competent technician, who is familiar with both electric equipment and safety locking rules.



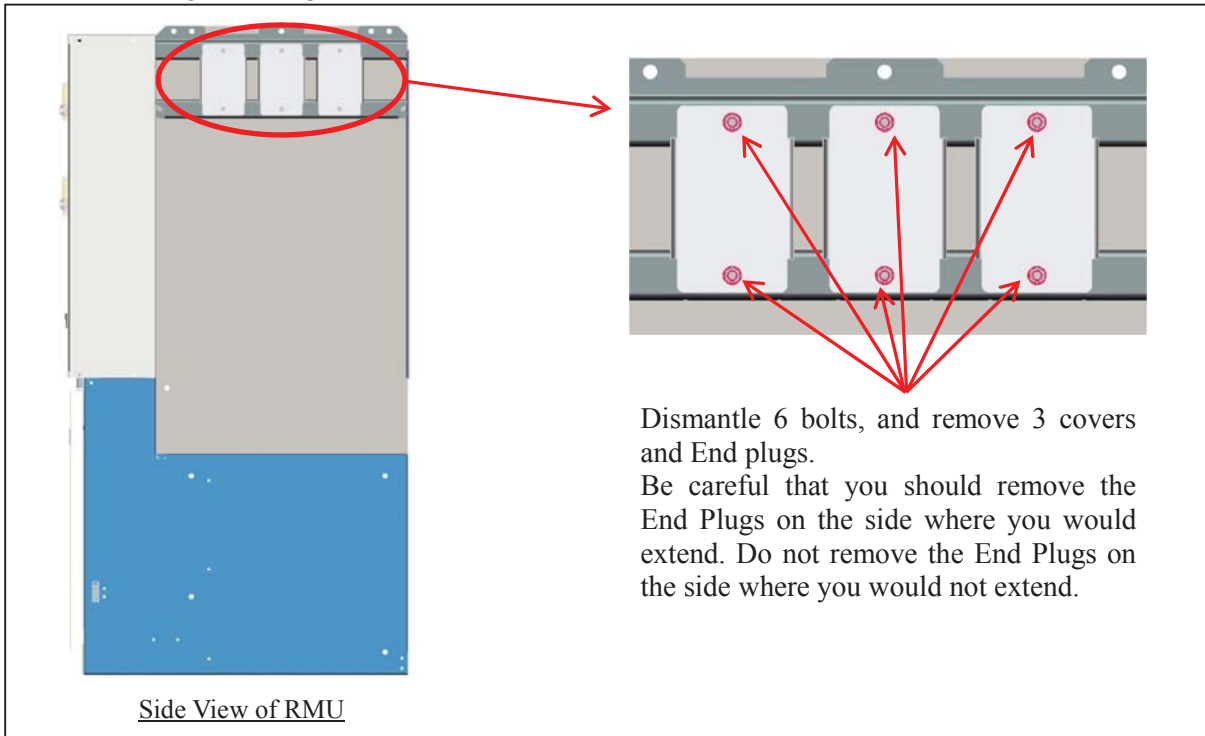
■ The Assembly Components List for Extensible Plug

[Table 11-1] The Assembly Components List for Extensible Plug

Description	Feature	Quantity
Extensible Plug		3
Tension Earth Spring		6
Top Spacer[A=96 mm, B=36 mm]		3
Mid Spacer[A=84 mm, B=42 mm]		1
Bottom Spacer[A=57 mm]		4
Hex Nut M10		16
Plain Washer M10		16
Spring Washer M10		16
Hex, bolt, P.S/W,M8,L20		1
Plain Washer M8		1
Hex Nut M8		1
Silicone Grease (for Insulation)	-	4
Cleaning Tissue	-	6
Vinyl Gloves	-	4

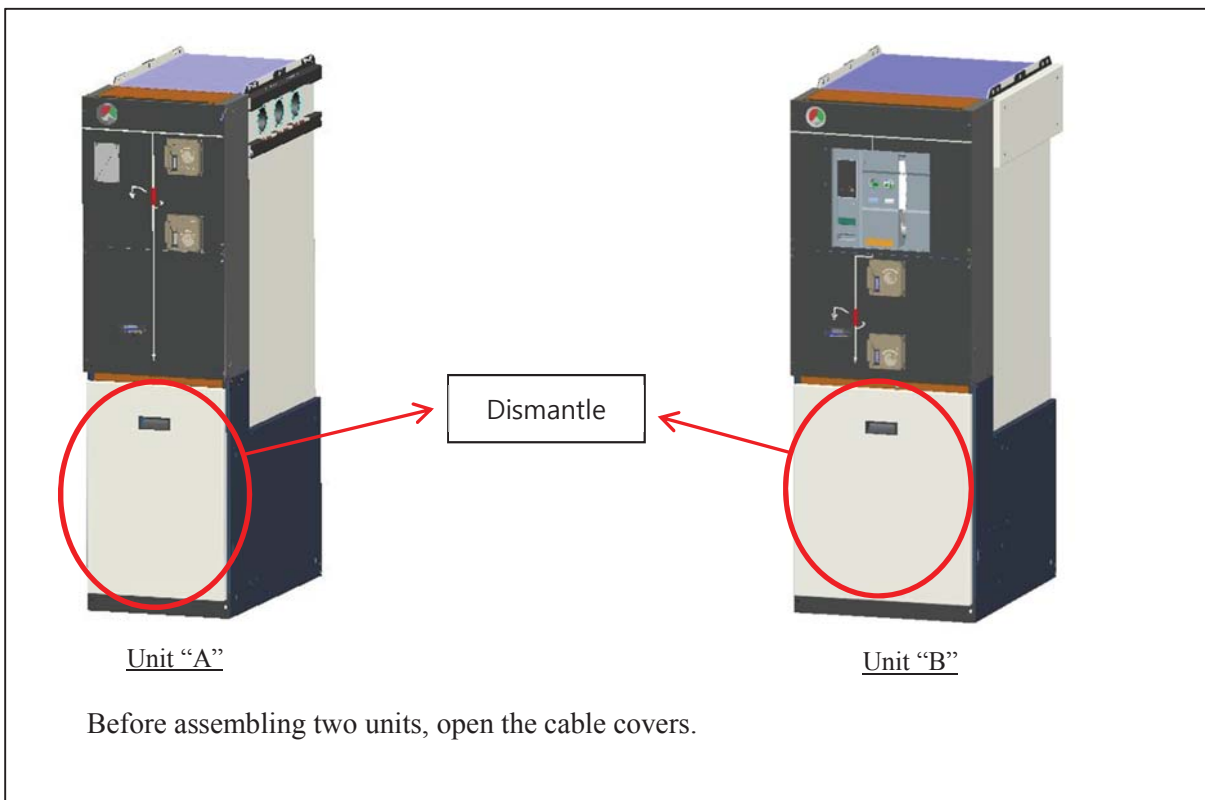
■ The Assembly of Extensible RMU

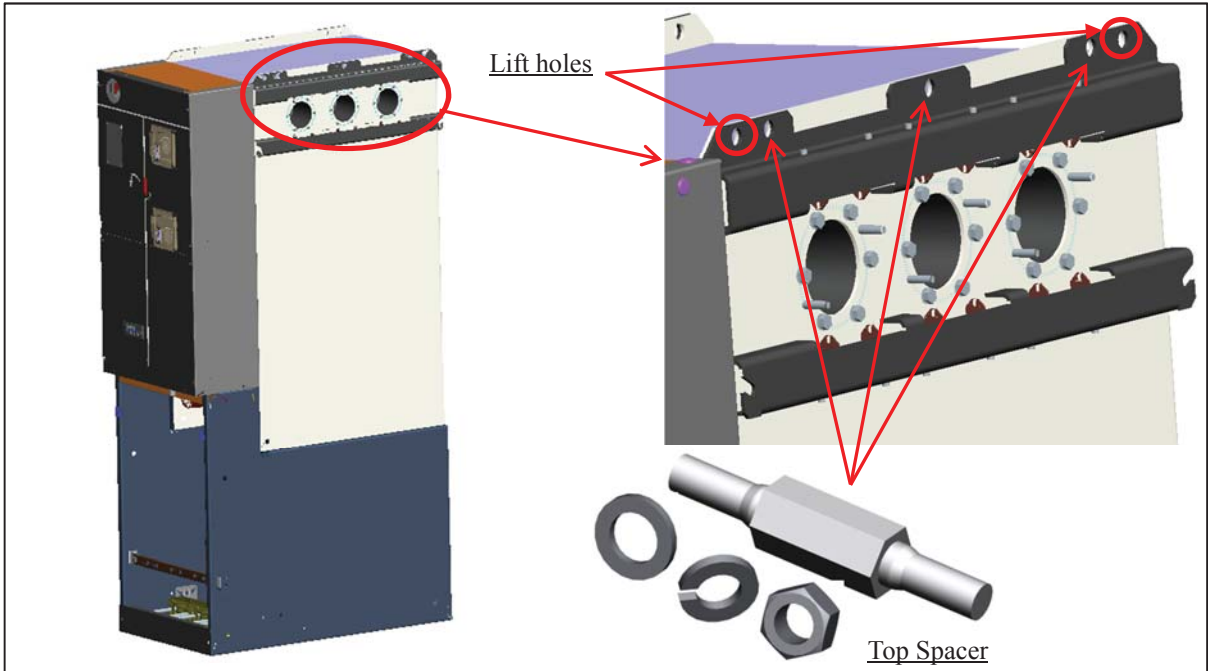
▶ End Plug removing



[Figure 11-3] End Plug separation for extension

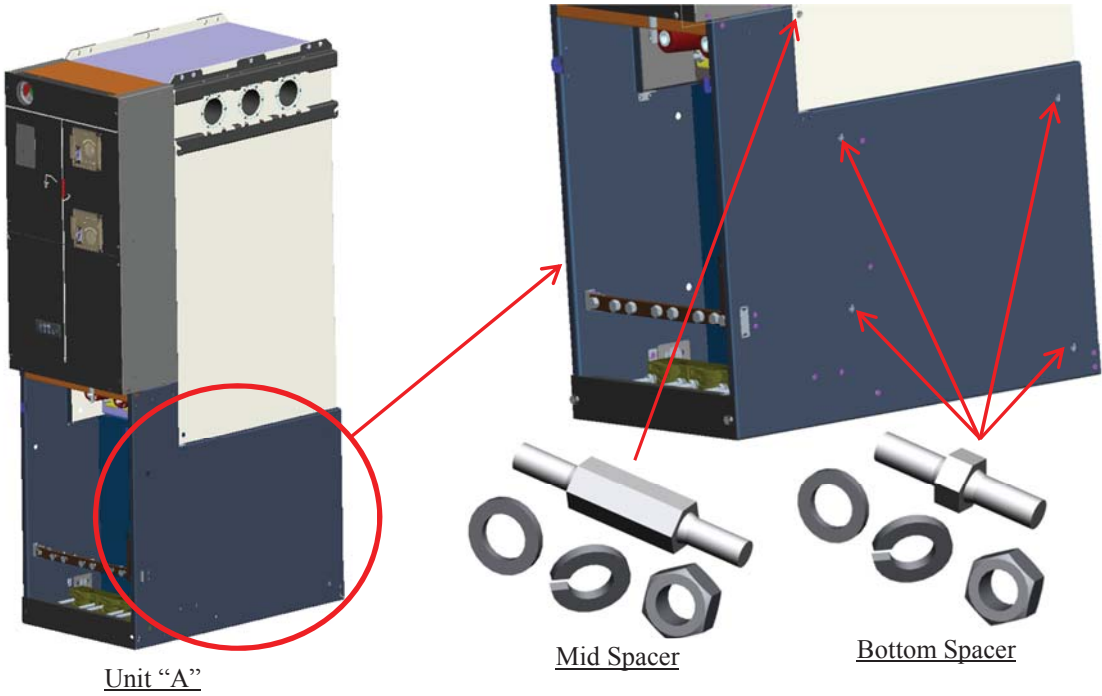
▶ Preparing for Extension





Unit "A"

Please insert and assemble 3 top spacers with M10 p/w, s/w and nuts as picture described on the above.

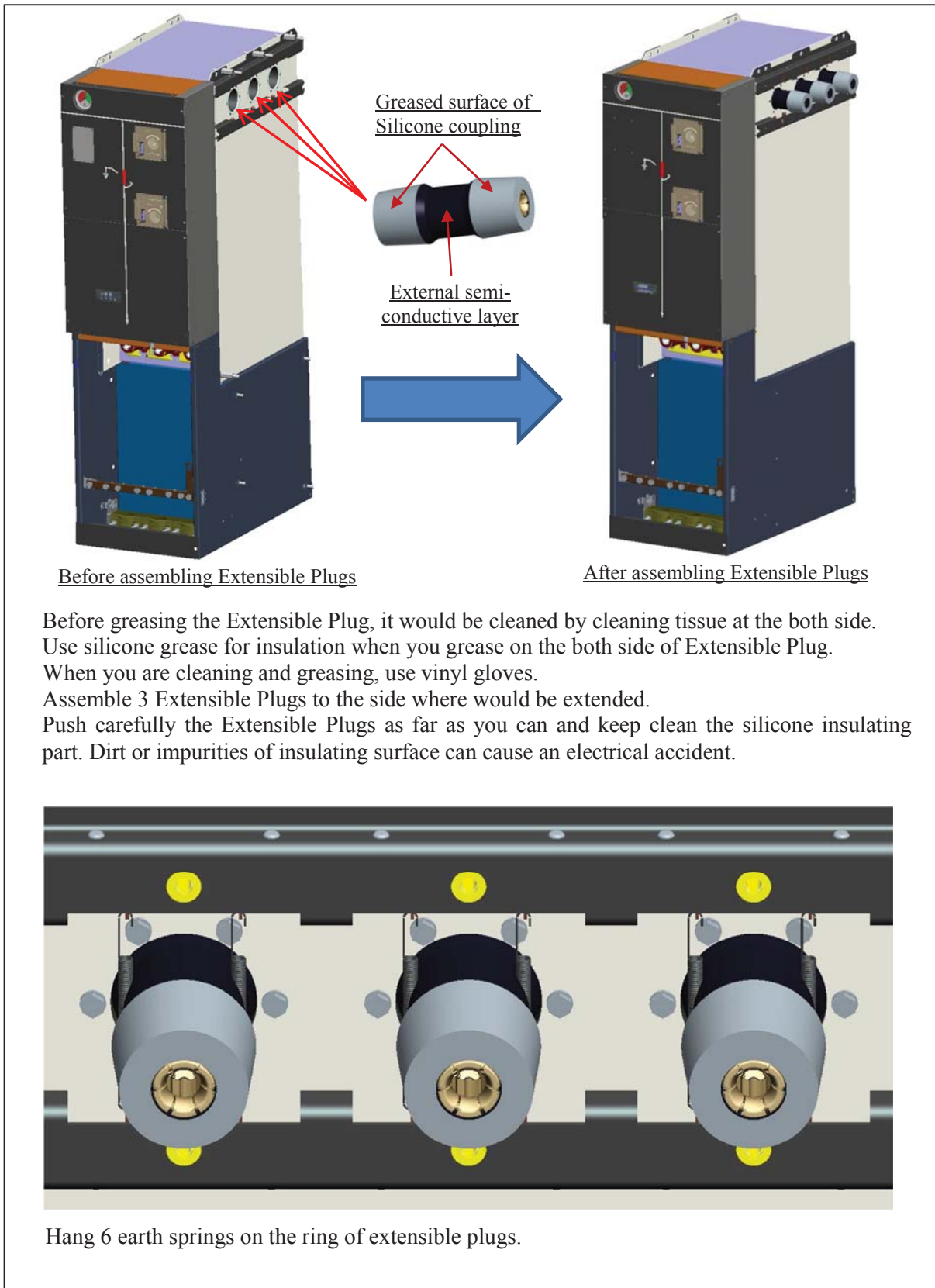


Unit "A"

Insert 1 mid spacer and 4 bottom spacers on the right bottom frame of Unit "A" then assemble with M10 p/w, s/w and nuts.

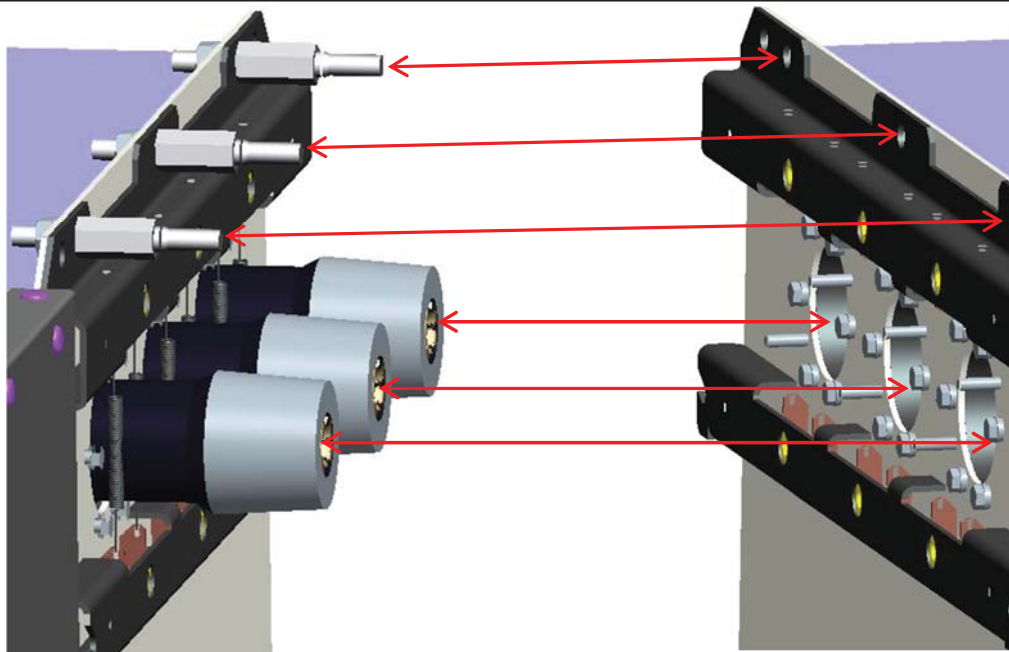
[Figure 11-4] Preparing for Extension

► Extensible Plug inserting into the Bushing



[Figure 11-5] Extensible Plugs inserting

► Connecting Units

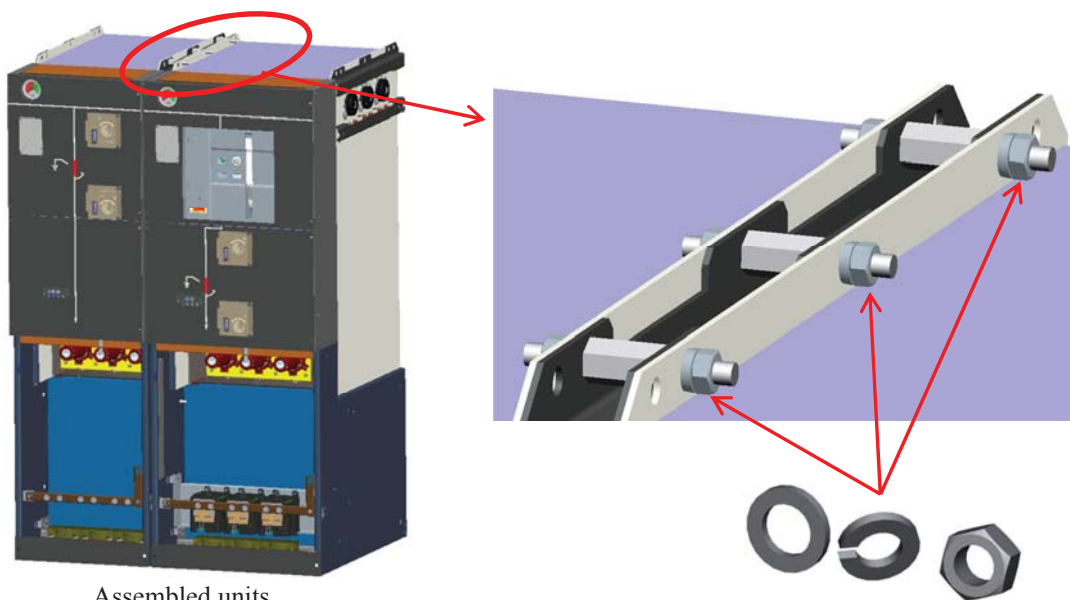


Upper part of Unit "A"

Upper part of Unit "B"

When you assemble unit "A" and "B", unit A's Extensible Plugs must be joined with the Extensible bushing of unit "B". Furthermore, 3-top spacers, 4-bottom spacers and 1 mid spacer must be inserted through the each holes of unit "B".

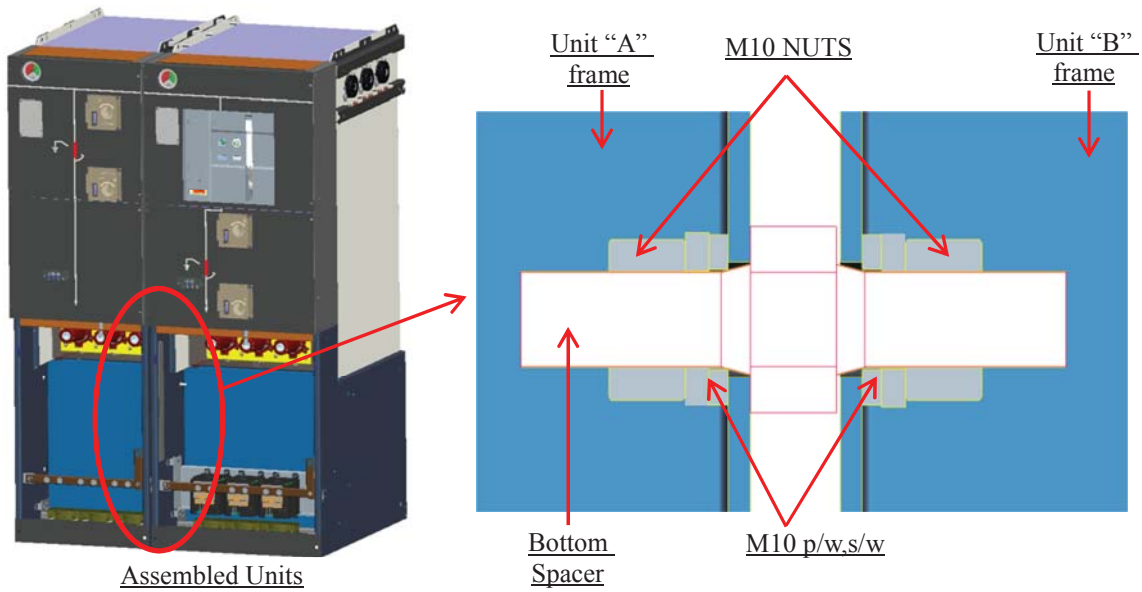
2 Units should be aligned when you are assembling.



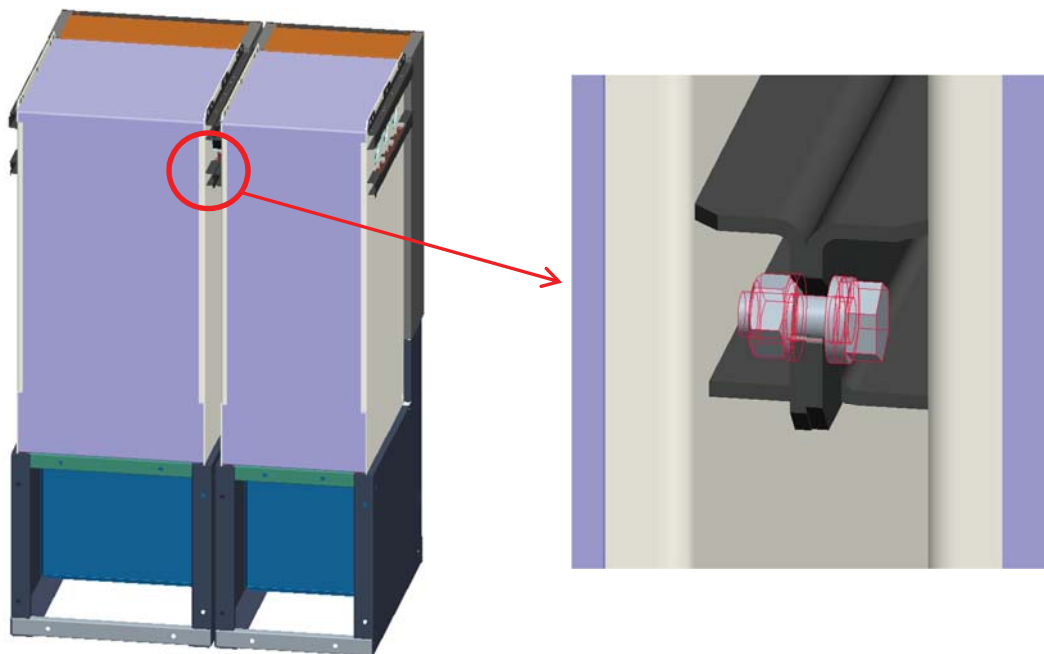
Assembled units

Upper part of assembled modules must be tightened by 3 M10 p/w and s/w, nuts.  
(Recommended torque M10 : 270[kgf · cm])

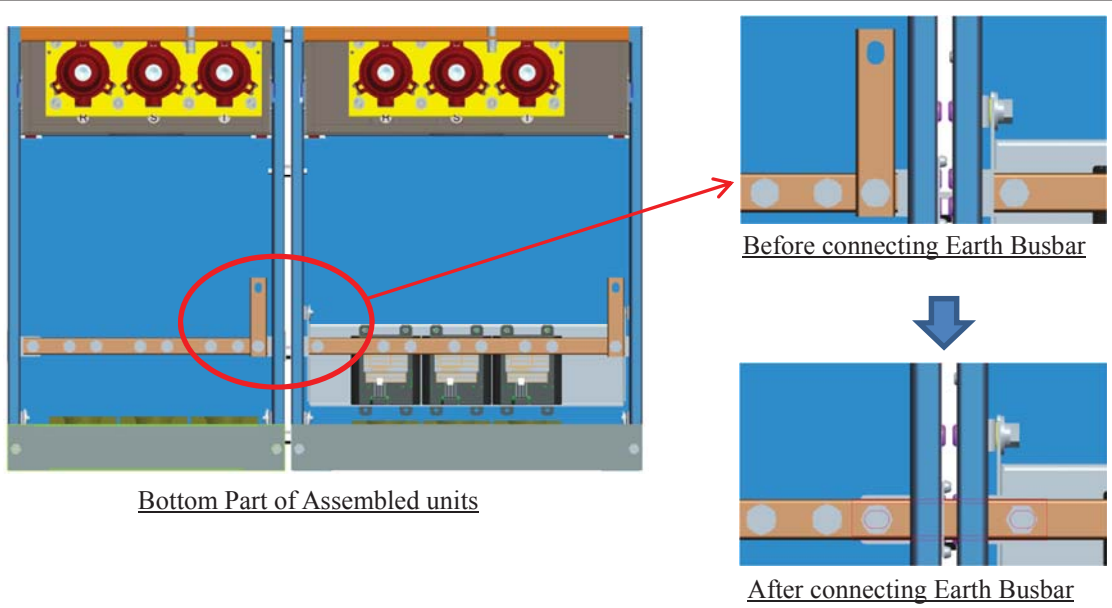
[Figure 11-6] Extensible Plug assembling



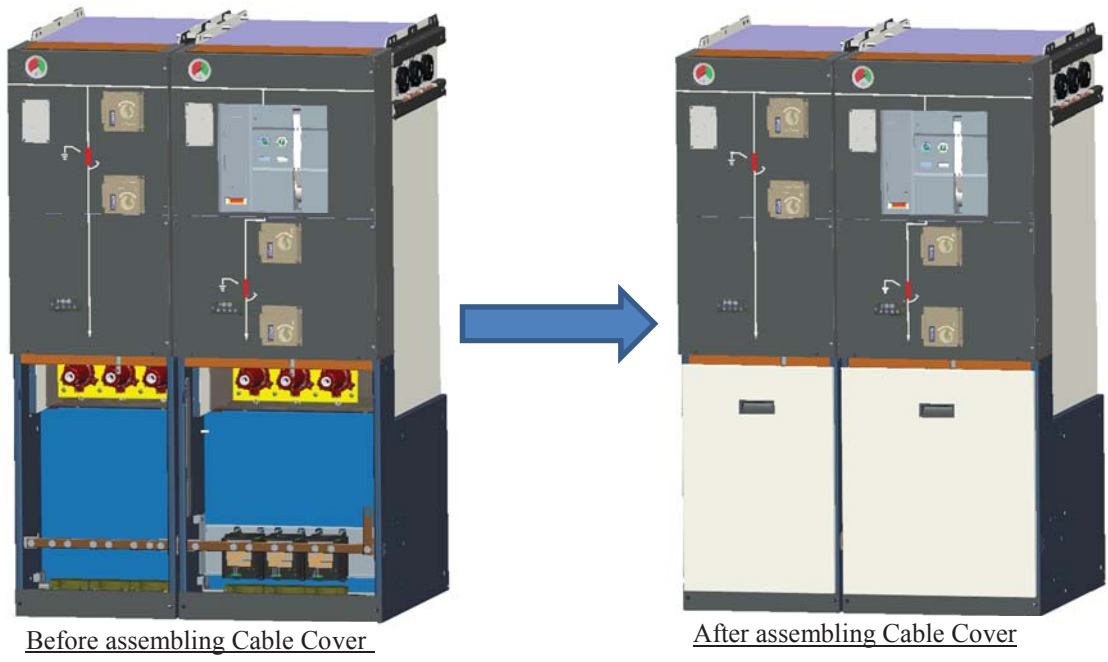
Fasten the 4-bottom spacers and 1 mid spacer with 5-M10 nuts, p/w and s/w.  
 (Recommended torque M10 : 270[kgf · cm])



Fasten M8 bolt, p/w and nut where are connected through the two units in the back side.  
 (Recommended torque M8 : 135[kgf · cm])



Use the earth conductor to connect two earth busbars between 2 units.  
 Earth conductor is assembled at the Bottom part of extensible RMU. M10 bolts, nuts, p/w and s/w that are already assembled on the busbars will be used for connection.  
 (Recommended torque M10 : 270[kgf · cm])









If the earth busbar connection is done, assemble 2 cable covers.

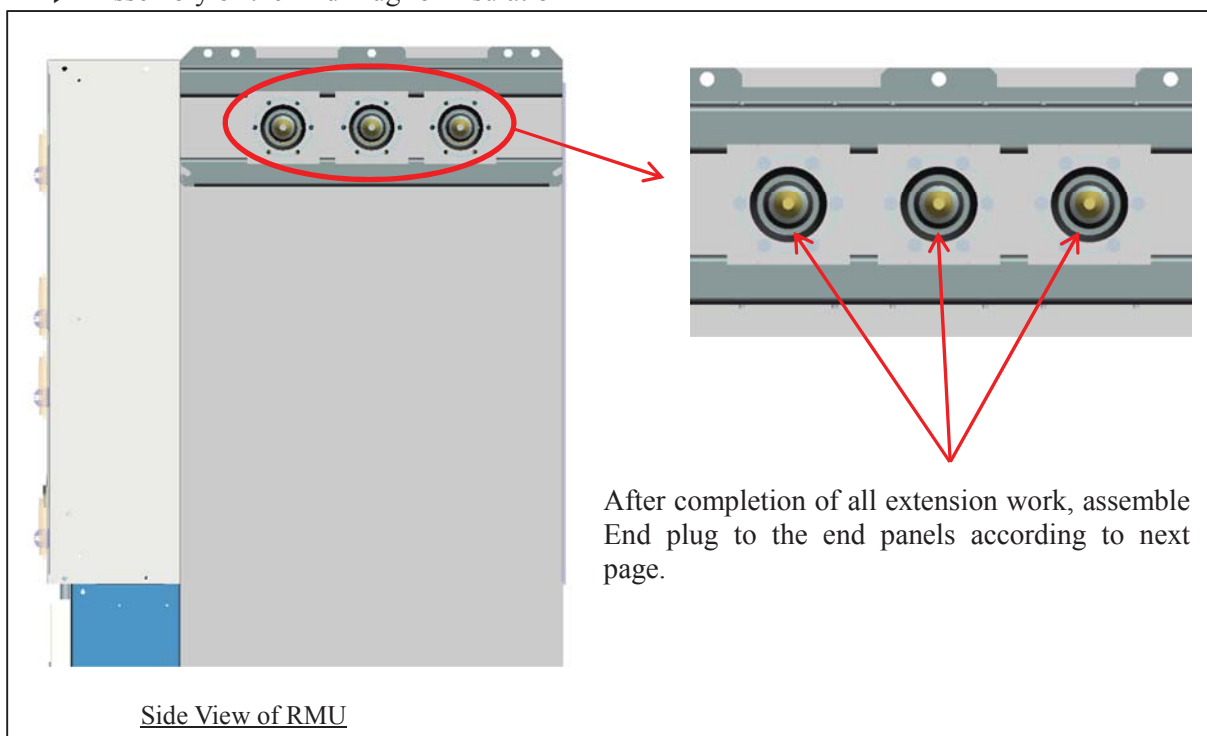
[Figure 11-7] 2 Units connecting

■ The Assembly Components List for End Plug

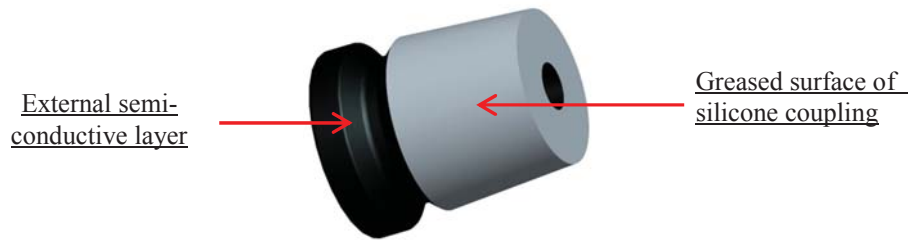
[Table 11-2] The Assembly Components List for End Plug

Description	Feature	Quantity
End Plug		3
End Plug phase cover		3
Hex, bolt, P.S/W,M8,L25		6
End Plug protection cover		1
SCREW,(+)PH,P.S/W,M5,L20		4
Silicone Grease (for Insulation)	-	3
Cleaning Tissue	-	3
Vinyl Gloves	-	4
Cable Tie		3

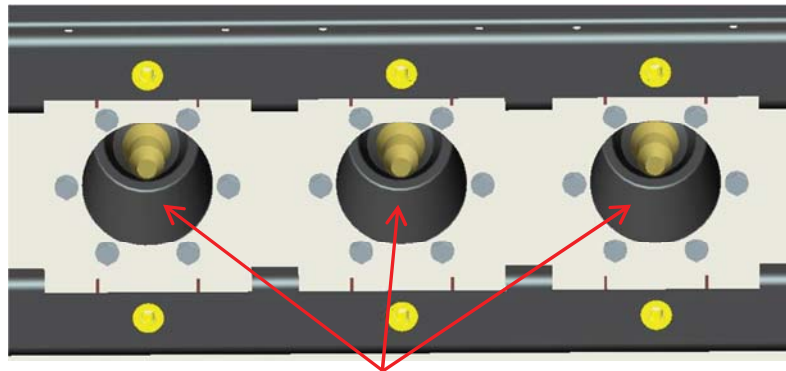
► Assembly of the End Plug for insulation







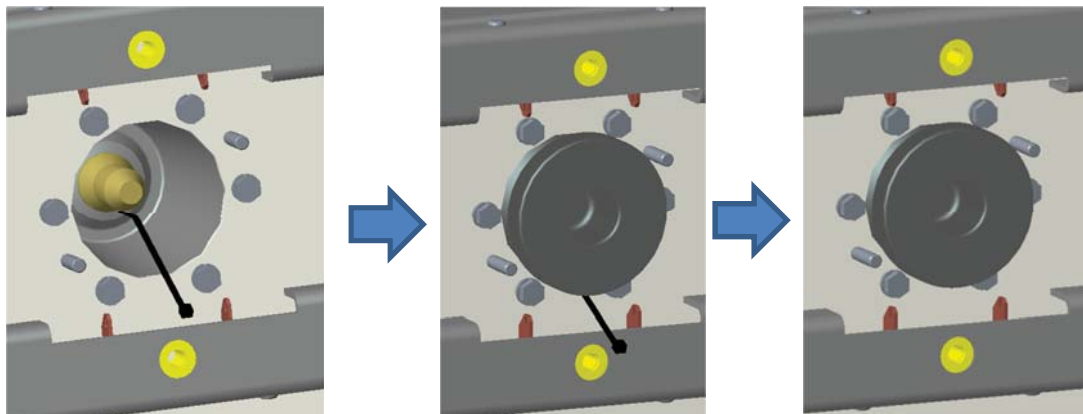
Before greasing the End Plug, it would be cleaned by cleaning tissue at the surface. Use silicone grease for insulation when greasing on the surface of End Plug.



Cleaned & Greased surface of extensible bushing by cleaning tissue

Before greasing the Extensible bushing, it would be cleaned by cleaning tissue at both modules.

Use silicone grease for insulation when you grease on the outside of Extensible bushing.



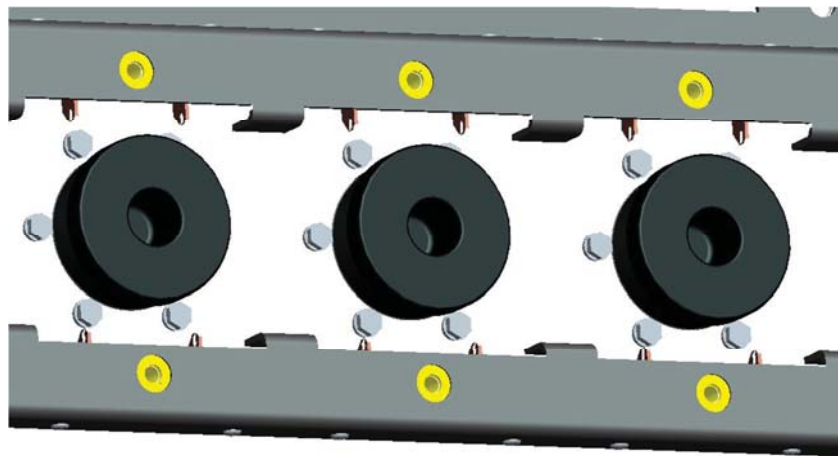
Put the cable tie on the Extensible Bushing

Insert the End Plug with cable tie

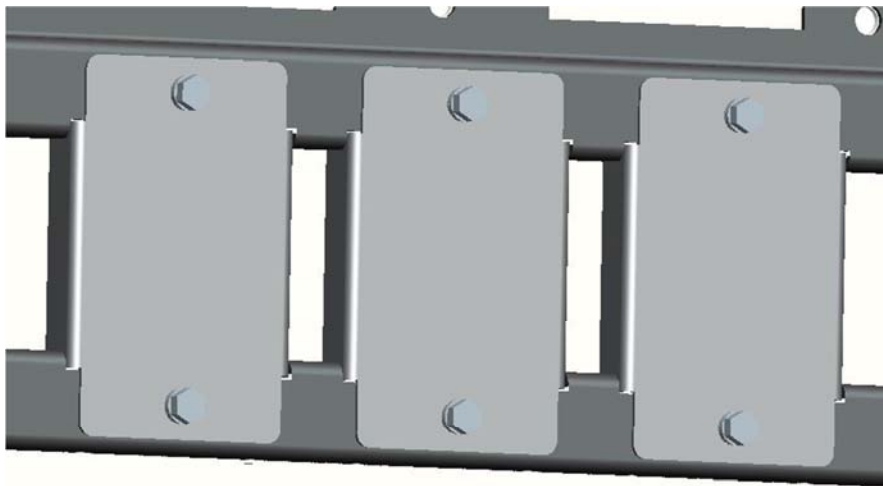
Remove the cable tie for pulling out the air

After finish the cleaned and greased surface of Extensible Bushing, please put the cable tie on the surface of the Extensible Bushing. Please push the cable tie into the Extensible Bushing as far as it will touch the end of the bushing.

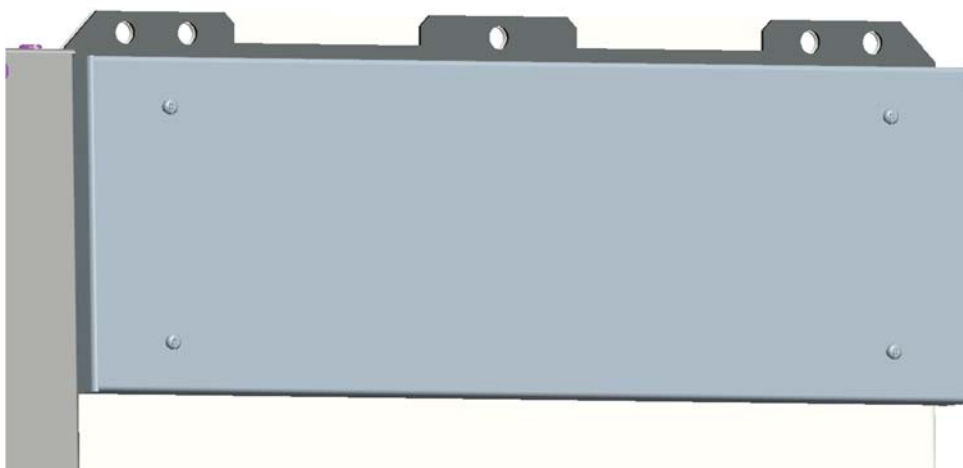
Then, please carefully insert End Plug. The cable tie also would be inserted between End Plug and Extensible Bushing. After inserting End Plug is finished, please remove the cable tie carefully for pulling out the air in the Extensible Bushing.



Please repeat the inserting End Plug at another two phases.



Please assemble 3-End Plug covers with hex M8 bolts.



Finally assemble End Plug protection cover with M5 screw bolts.

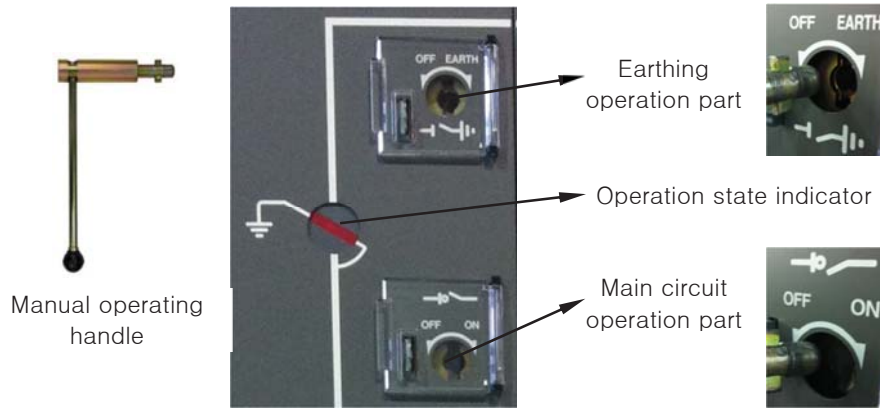
[Figure 11-8] End Plug assembling

## 12. Operation (LBS)

### ■ Manual operation of LBS

#### ▶ Main circuit Open $\Rightarrow$ Close

1. Put the manual operating handle into the lower operation hole. (Refer to the picture below)



2. Rotate the manual operating handle to clockwise.



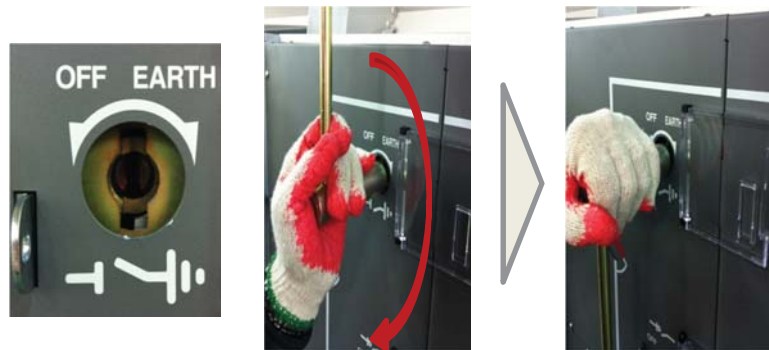
#### ▶ Main circuit Close $\Rightarrow$ Open

1. Put the manual operating handle into the lower operation hole. (Refer to the picture above)

2. Rotate the manual operating handle to counterclockwise.

► Open ⇒ Earth

1. Put the manual operating handle into the upper operation hole. (Refer to the picture below)
2. Rotate the manual operating handle to clockwise.

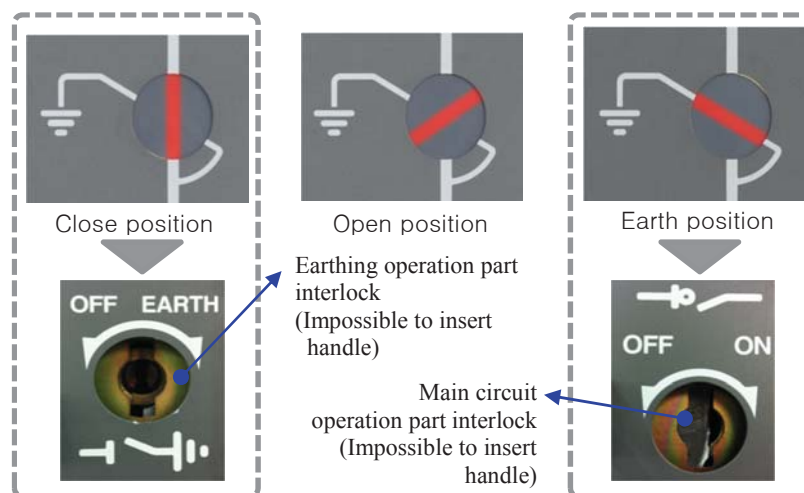


► Earth ⇒ Open

1. Put the manual operating handle into the upper operation hole. (Refer to the picture above)
2. Rotate the manual operating handle to counterclockwise.

► The state of interlock between the main circuit and earth operation is as below.

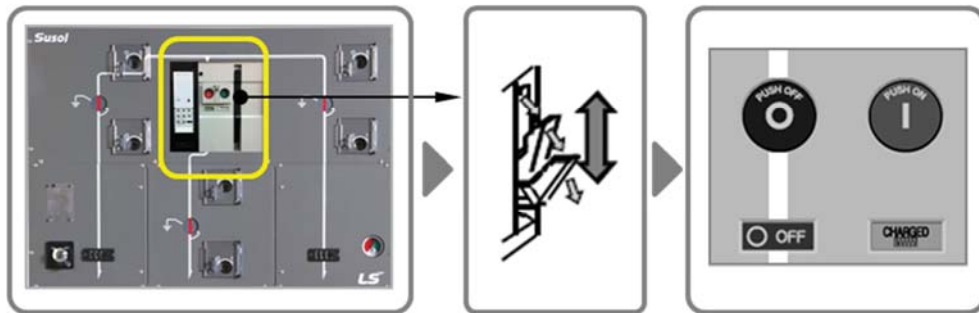
(Main circuit closing and earth operation can be operated under the open position only)



■ The manual operation of CB

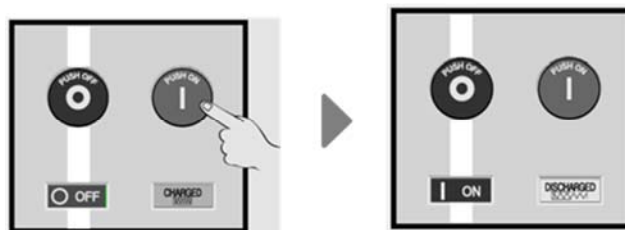
▶ Manual charging

1. Charge the handle 7~8 times with full strokes. (Refer to the below)
2. When charging is completed, indicator shows “CHARGED”.



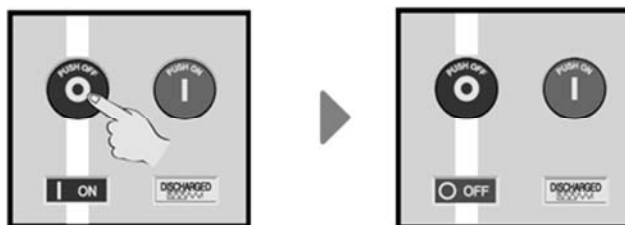
▶ Open ⇒ Manual close

1. Push ON button and CB will be closed.
2. ON/OFF indicator shows “ON” and the charging indicator shows “DISCHARGED”.



▶ Close ⇒ Manual open

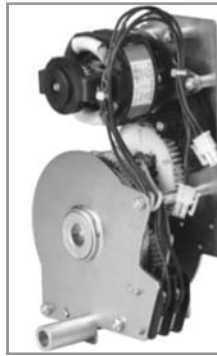
1. Push OFF button and CB will be tripped.
2. ON/OFF indicator shows “OFF”.



■ The electrical operation of CB.

▶ Electrical charging

1. Automatic charging can be done electrically. If you push OFF button, closing spring is automatically charged by a geared motor and the circuit breaker can be closed by pushing the ON button.



[Figure 12-1] CB geared motor

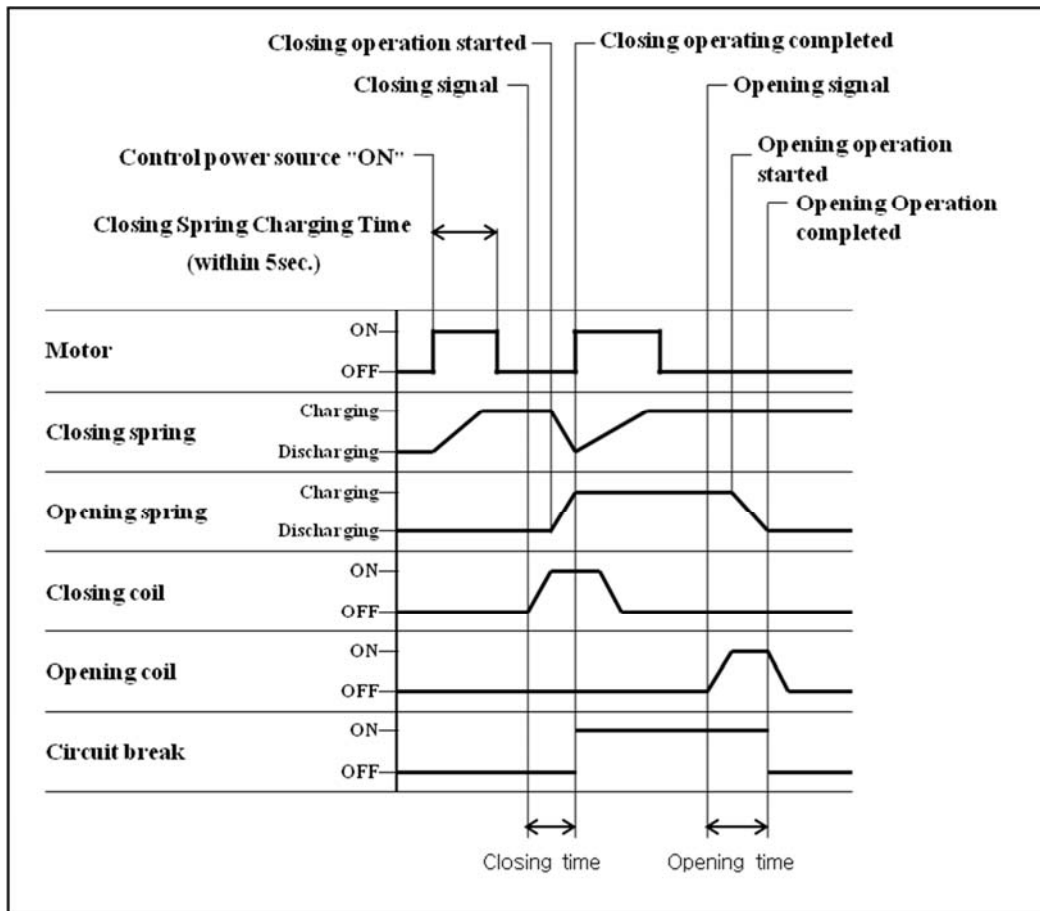
▶ Open ⇒ Electrical close

1. It is available under closing coil operation.

▶ Close ⇒ Electrical open

1. It is available under trip coil operation.

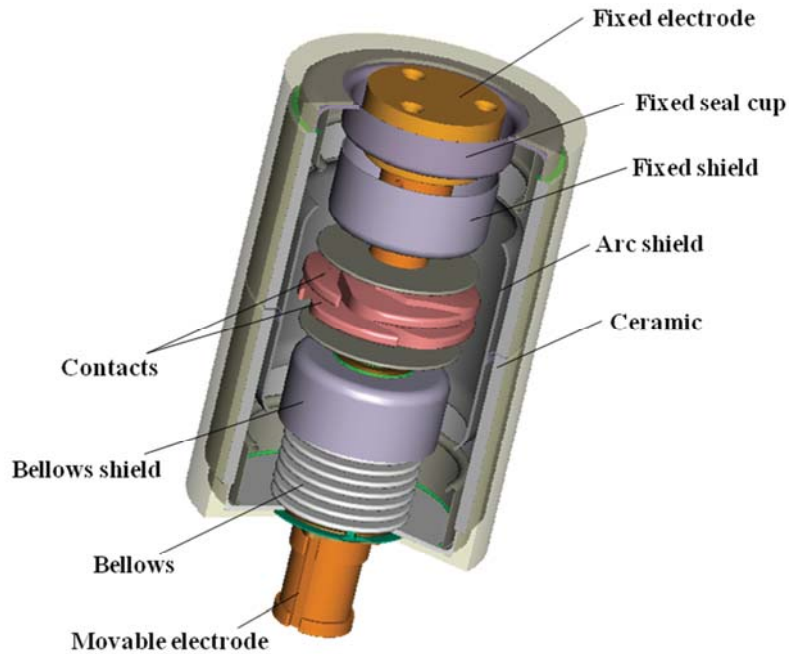
- The sequence of operating mechanism is as follows.



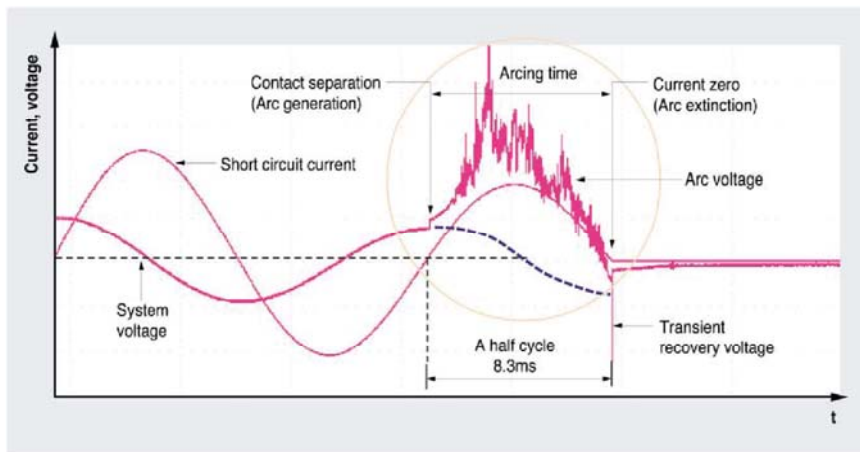
[Figure 12-2] Operating sequence

## ■ Vacuum Interrupter (VI)

The vacuum interrupters have a high dielectric strength with high vacuum integrity (approx.  $5 \times 10^{-5}$  Torr). The gaps between a stationary contact and moving contact are 6~20mm according to the rated voltage. Both contacts are designed to extinguish 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. The internal side is completely sealed to prevent the deterioration of vacuum integrity.



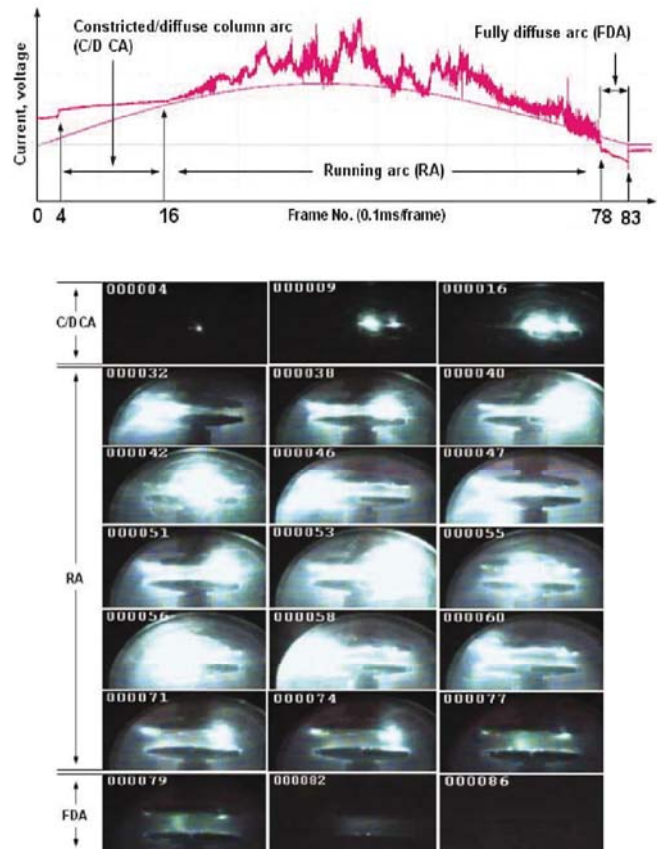
[Figure 12-3] Vacuum interrupter structure



[Figure 12-4] Oscillograph example (Interrupting Test using LC Resonant Circuit)

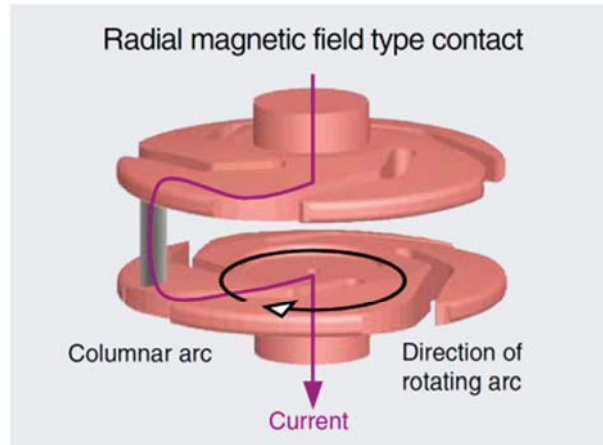


If a flat contact is used, the arc of high temperature is contracted when opening contacts and is concentrated in the center of a contact. This is called pinch effect. Axial magnetic field (Preventing the contraction of the arc in advance by directly spreading the arc) and Radial magnetic field (Permitting the contraction of the arc but dispersing arc energy by rotating the arc) are contact forms designed to prevent this. The contracted arc is close to cylindrical so it is also called as contracted arc or columnar arc.



[Figure 12-5] Arc Voltage Waveform and Arc Image Recording during Arcing Time

Spiral contact structure (Radial magnetic field) minimizes contact damage by evenly dispersing arc energy on the surface of contact by rotating the arc contracted by force generated by the current flowing through the arc electrically connecting two contacts at the top and bottom and the interaction ( $F = j \times B$ ) of Radial magnetic field caused by it to ensure that the arc contracted by pinch effect is stuck between poles and does not damage contacts. [Figure 12-5] is the figure that divided ARC status by section by shooting arc behavior during arcing time of about 8ms with a high-speed camera that can take 10,000 frames (0.1ms/frame) per second and showing it with measured arc voltage focusing on arcing time part of [Figure 12-4].



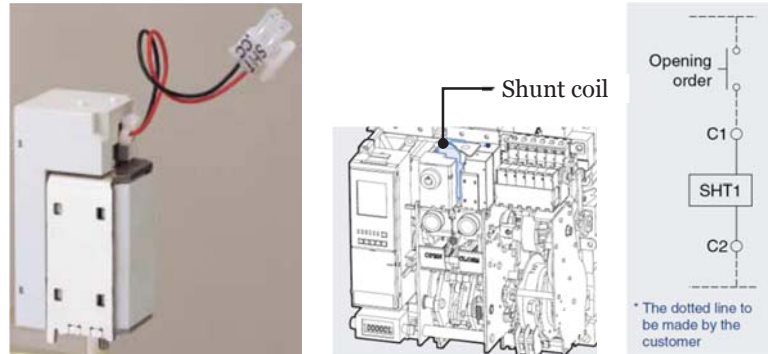
[Figure 12-6] Arc Operating Principle at Radial magnetic field contacts

In the closed position, normal current flows through the interrupter. When a fault occurs and interruption is required, the contacts are quickly separated. The arc drawn between the surfaces of contacts is rapidly moved around the slotted contact surface by self-induced magnetic effects, preventing gross contact erosion and the formation of hot spot on the surface. The arc burns in an ionized metal vapor, which condenses on the surrounding metal shield. At current zero the arc extinguishes and vapor production ceases. The metal vapor plasma is very rapidly dispersed, cooled, recombined, and deionized, and the metal vapor products are quickly condensed so that the contacts withstand the transient recovery voltage.

■ Accessories

▶ Shunt Coil [SHT]

1. SHT is a control device which trips a circuit breaker from a remote place when applying voltage continuously or instantaneously over 200ms to coil terminals (C1, C2).
2. When install UVT coil, the SHT installation position is changed.



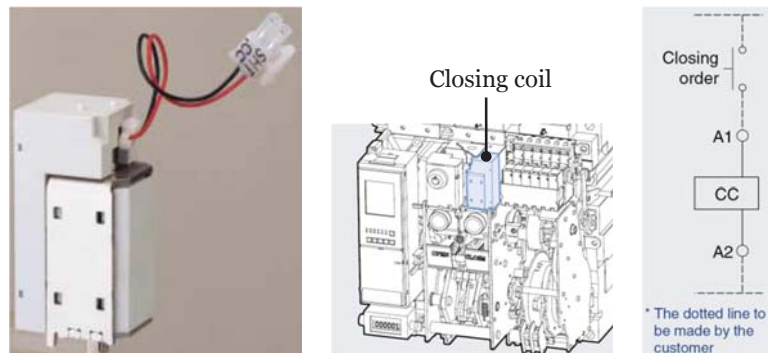
[Figure 12-7] Shunt coil

[Table 12-1] Rated voltage and characteristics of Trip coil

Rated voltage [Vn]		Operating voltage range [V]	Power consumption. (VA or W)		Trip time [ms]
DC [V]	AC [V]		Inrush	Steady-state	
100~130	100~130	0.56~1.1 Vn	200	5	Less than 40ms
200~250	200~250	0.56~1.1 Vn			

▶ Closing Coil [CC]

1. CC is a control device which closes a circuit breaker when the voltage is applied continuously or instantaneously over 200ms to the coil terminals (A1, A2).



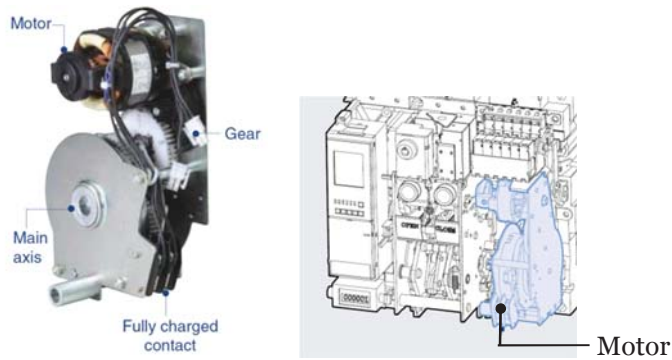
[Figure 12-8] Closing coil

[Table 12-2] Rated voltage and characteristics of Closing coil

Rated voltage [Vn]		Operating voltage range [V]	Power consumption. (VA or W)		Trip time [ms]
DC [V]	AC [V]		Inrush	Steady-state	
100~130	100~130	0.75~1.1 Vn	200	5	Less than 80ms
200~250	200~250	0.75~1.1 Vn			

► Motor [M]

1. Motor is a device which charge the closing spring of a circuit breaker by the external power source. Without the external power source, charging must be done manually.
2. Operating voltage range(IEC 60947) 85%~110%Vn.



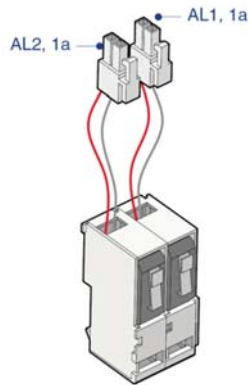
[Figure 12-9] Motor

[Table 12-3] Rated voltage and characteristics of Motor

Input voltage (V)	AC/DC 100~130V	AC/DC 200~250V
Load current (Max.)	1A	0.5A
Starting current (Max.)	5 times of load current	
Load rpm (Motor)	15000 ~ 19000 rpm	
Charge time	Less than 5sec.	
Dielectric strength	2kV/min	
Using temperature range	-20° ~ 60°	
Using humidity range	Max. RH 80% (No dew condensation)	
Endurance	15,000 cycle (Load connection, 2 times/min)	
Charge switch	10A at 250VAC	

► Trip Alarm Contact [AL]

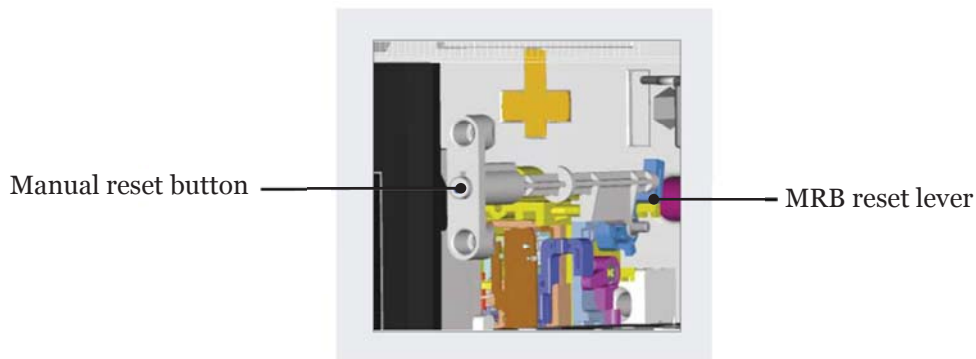
1. When a circuit breaker is tripped by OCR(Over Current Relay) which operates against the fault current, the trip alarm switch provides the information regarding the trip of the circuit breaker, by sending an electrical signal.
2. When MRB(Manual Reset Button) is operated,the switch (AL) sends control signal electrically
3. 2pcs (AL1, AL2, 1a) or 1pc (AL1, 1a) of AL are provided as Optional.



[Figure 12-10] Trip alarm contact

► Manual Reset Button [MRB]

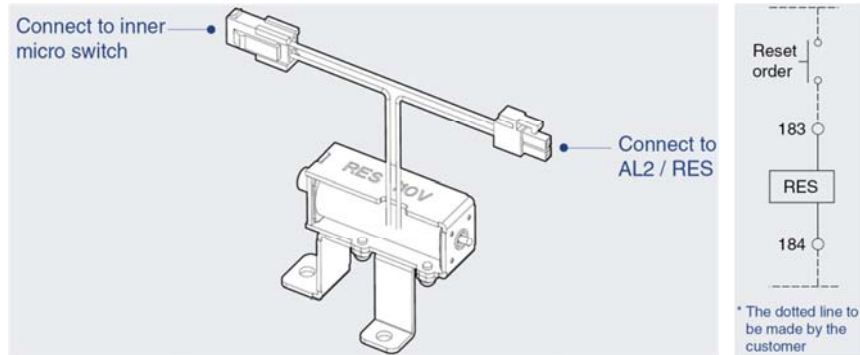
1. It is a function which resets a circuit breaker manually when a circuit breaker is tripped by OCR.
2. When a circuit breaker is tripped by a fault current, a mechanical trip indicator (MRB, Manual Reset Button) pops out from the main cover.
3. MRB can be operated only by OCR but not by OFF button or SHT operation. To reclose a circuit breaker after a trip, press MRB or reset through RES for closing.



[Figure 12-11] Manual reset button(MRB)

► Remote Reset Switch [RES]

1. When a circuit breaker is tripped by Over Current Relay (OCR), it resets MRB as optional.
2. It is not possible to use both AL2 and RES at the same time.



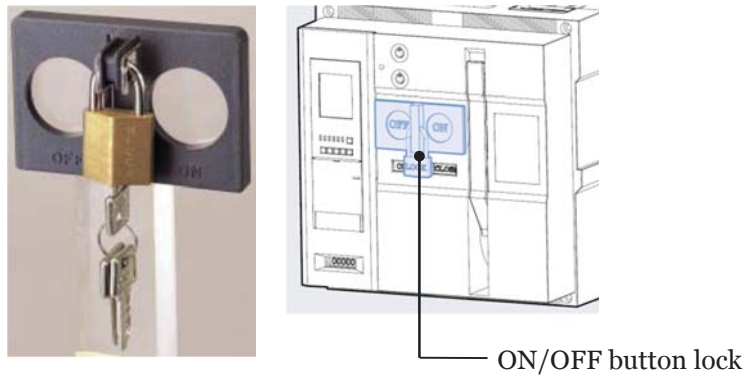
[Figure 12-12] Remote reset switch(RES)

[Table 12-4] Rated voltage and rated current of RES

Rated voltage (V)	Operating current (Max.)		Operating time	Wire spec.
	AC	DC		
AC/DC 100~130 V	AC	6A	Less 40ms	#14 AWG (2.08 mm <sup>2</sup> )
	DC	5A		
AC 200~250 V	AC	3A		#16 AWG (1.31 mm <sup>2</sup> )

▶ ON/OFF Button Lock [B]

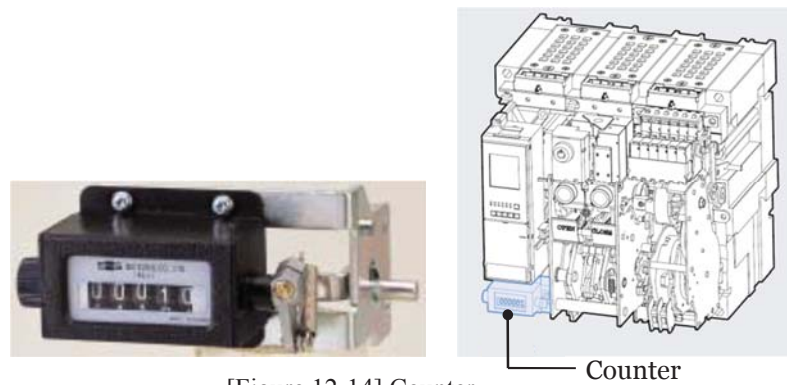
1. It prevents manual operation due to user error.
2. It is not possible to operate ON/OFF manually under the button lock.  
(We do not provide locks and key.)



[Figure 12-13] ON/OFF button lock

▶ Counter [C]

1. It displays the total numbers of CB ON/OFF operation.



[Figure 12-14] Counter

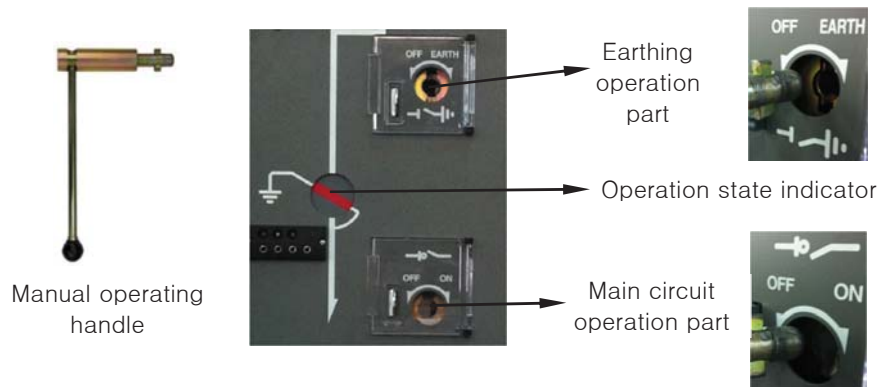
## Operation (DS/ES)

■ The DS/ES can only be operated when CB is in the open position.

■ The manual operation of DS/ES.

▶ Main circuit Open ⇒ Close

1. Put the manual operating handle into the lower operation hole of mechanism. (Refer to the figure below for more detail)



2. Rotate the manual operating handle to clockwise.



▶ Main circuit Close ⇒ Open

1. Put the manual operating handle into the lower operation hole. (Refer to the picture above)

2. Rotate the manual operating handle to counterclockwise.



► Open ⇒ Earth

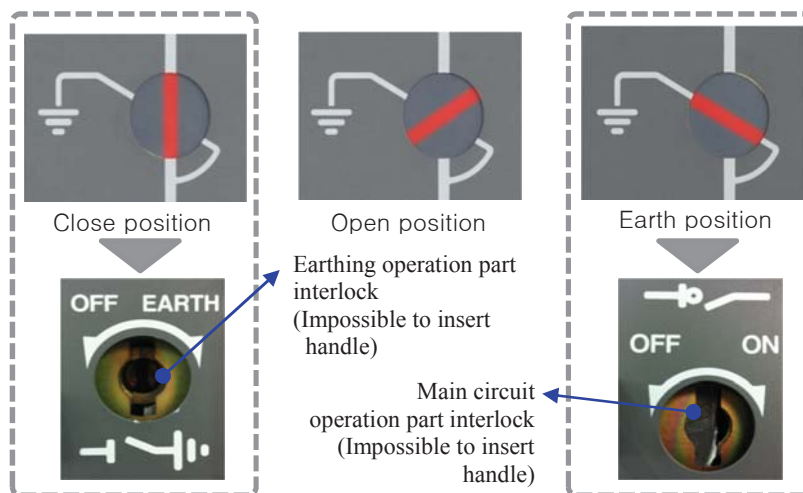
1. Put the manual operating handle into the upper operation hole. (Refer to the picture below)
2. Rotate the manual operating handle to clockwise.



► Earth ⇒ Open

1. Put the manual operating handle into the upper operation hole. ( Refer to the picture above)
2. Rotate the manual operating handle to counterclockwise.

- The state of interlock between the main circuit and earth operation is as pictured below.  
(Main circuit closing and earth operation can be operated under the open position only)

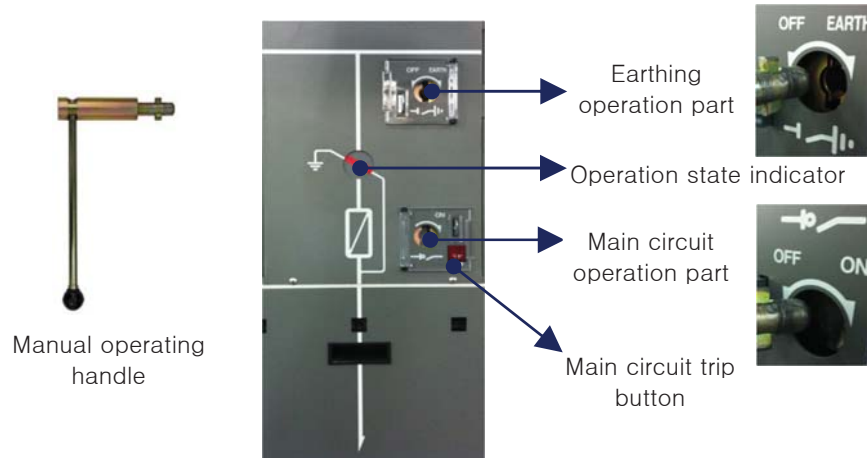


## Operation (F-LBS)

### ■ The manual operation of FLBS.

#### ▶ Main circuit Open ⇒ Close

1. Put the manual operating handle into the lower operation hole. (Refer to the picture below)



2. Rotate the manual operating handle to clockwise.



▶ Main circuit Close ⇒ Open

1. Push the trip button(OOPEN) placed on the right side of F-LBS lower operation hole.  
(Refer to the picture below)



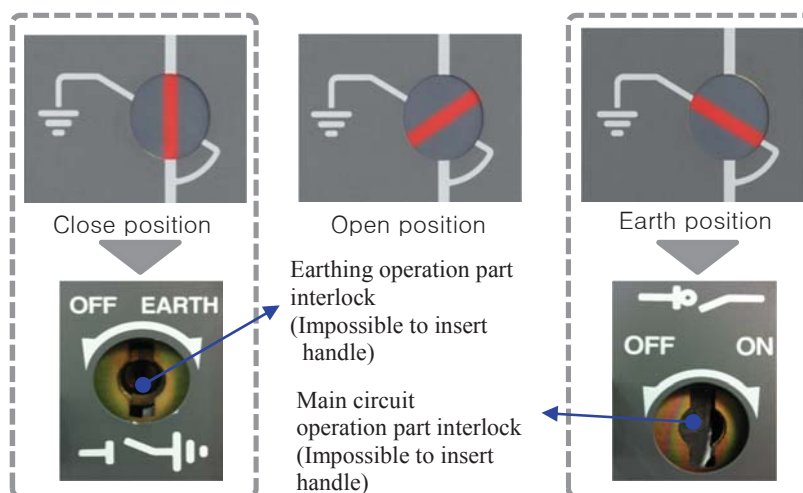
▶ Open ⇒ Earth

1. It is the same as Open ⇒ Earth operation of LBS.

▶ Earth ⇒ Open

1. It is the same as Earth ⇒ Open operation of LBS.

- ▶ The state of interlock between the main circuit and earth operation is as pictured below.  
(Main circuit closing and earth operation can be operated under the open position only)



### 13. Precaution when using (Interlock)

■ Interlock of RMU is supplied for user's safety. Even though you are trying to operate with excessive force, it can cause damage to the product.

1. The earthing switch can only be closed when the main circuit is in the open position.
2. The main circuit can only be closed when the E/S is in the open position.
3. The cable cover can only be accessed when the E/S is in the earth position.
4. When the cable cover is opened, operating mechanism for the related circuit is not available.  
(Including main circuit/earth)
5. The DS can only be operated when the CB-mechanism is in the open position.

► Refer to the Table 13-1 for more details.

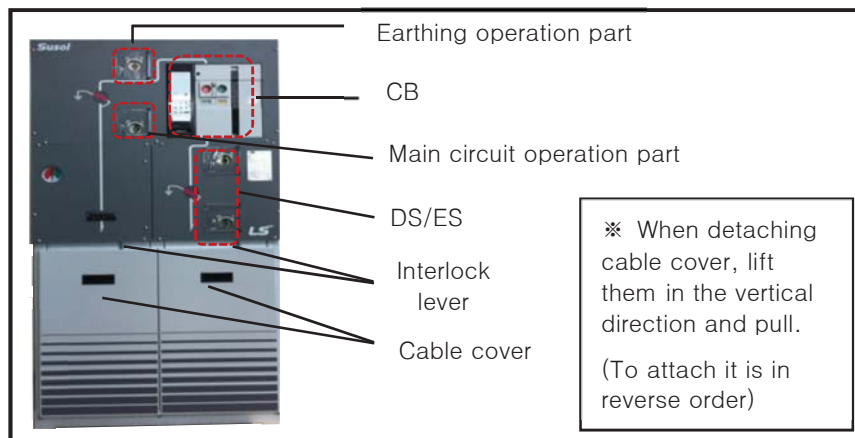
[Table 13-1] Interlock matrix table

Status Operation		LBS-Mech.			Cable cover/ Fuse cover		CB-Mech.		DS/ES		
		On	Off	Earth	Close	Open	On	Off	On	Off	Earth
LBS-Mech.	On	-	○	×	○	×	-	-	-	-	-
	Off	○	-	○	○	×	-	-	-	-	-
	Earth	×	○	-	○	-	-	-	-	-	-
Cable cover/ Fuse cover	Close	×	×	○	-	-	-	-	×	×	○
	Open	×	×	○	-	-	-	-	×	×	○
CB-Mech.	On	-	-	-	-	-	-	-	○	○	○
	Off	-	-	-	-	-	-	-	○	○	○
DS/ES	On	-	-	-	○	×	×	○	-	-	-
	Off	-	-	-	○	×	×	○	-	-	-
	Earth	-	-	-	○	-	-	○	-	-	-

\* CB-Mech. cable cover can only be opened when the E/S is in the earth position.

■ To attach/detach cable cover, refer to [Table 13-1] and [Figure 13-1].

▶ The cable cover can be attached/detached only after completion of earthing operation.



[Figure 13-1] Main part regarding interlock



## WARNING

### 1. Be careful when removing front cover.

Check whether the wire is alive before removing the front cover, and work after earthing is completed.

## Precaution when using (OCR)

### ■ OCR(WOODWARD)



[Figure 13-2] OCR (WOODWARD)

1. Loosen the screw of the front cover placed OCR. (Refer to [Figure 13-2])
2. If you would like to set the OCR, please refer to the OCR manual enclosed CD made by WOODWARD company.

### ■ OCR(LSIS)

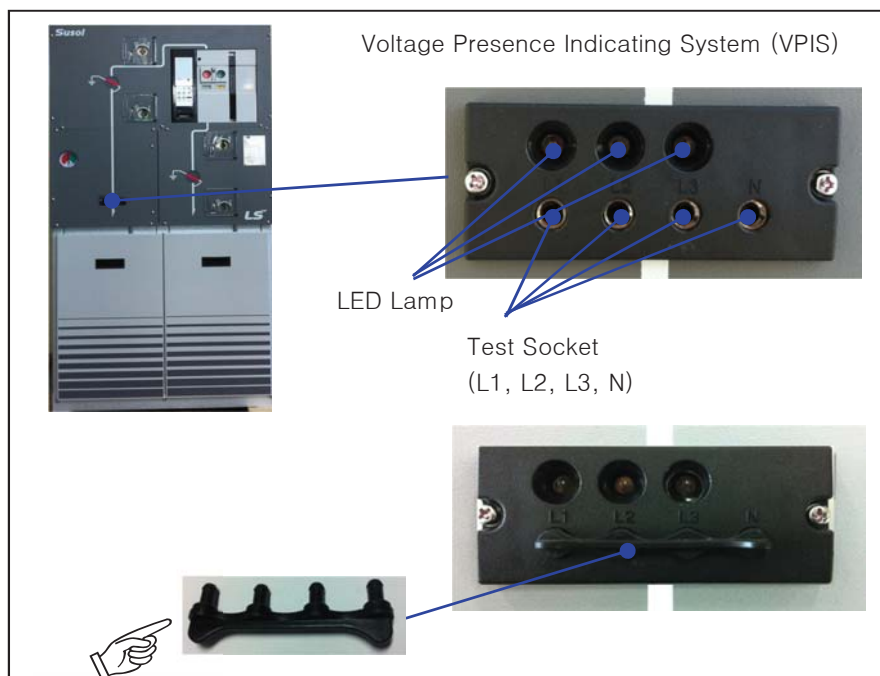


[Figure 13-3] OCR (LSIS)

1. Next to the circuit breaker, you can find LSIS OCR. (Refer to the [Figure 13-3])
2. If you would like to set the OCR, please refer to OCR manual.

## 14. Inspection item after power supply

- Check the condition of voltage detector before power supply.
- If there is noise or sparks around the connector, turn off the power immediately and discuss with a qualified electrician.
- In order to check the phase concordance between two ways, insert the probe of a phase concordance unit to the socket of the VPIS and check the lamp of the phase concordance unit.
  - If the phase on line cable matches, the lamp of a phase concordance unit is off.
  - If the phase on line cable does not match, the lamp of a phase concordance unit is on.



[Figure 14-1] Inspection item after power supplying




## WARNING

### 1. Be careful when removing the front cover.

Check whether the wire is alive before removing the front cover and work after earthing is completed.

## 15. Maintenance and inspection

 <b>CAUTION</b>
<p><b>1. Do not change the control circuit.</b> This may cause malfunction or damage to products.</p> <p><b>2. Check earthing condition of circuits before maintenance/inspection.</b> Maintenance/inspection under ungrounded condition may cause accidents.</p>

 <b>WARNING</b>
<p><b>1. Inspection and maintenance must be performed by a qualified electrician.</b> Otherwise, it may result in malfunction or electric shock.</p>

### Inspection Period

RMU has to be inspected once a year or when required due to environmental condition such as numbers of operation, polluted surroundings or overload etc.

[Table 15-1] Maintenance and inspection period

Item	Maintenance and inspection Period	
	General Environment	Poor Environment (The place where has dust and humidity)
Normal Inspection	Every 6 months	Every 1 month
Regular Inspection	1~2 years after installation then every 3 years	More than 1 time per a year
Extra Inspection	When necessary	When necessary



## Normal Inspection

RMU has to be checked every 6 months. (Once a month in poor condition)

Normal inspection is the RMU condition checking under power supply so special caution is needed.

[Table 15-2] Normal inspection item

Inspection Item	Check Point	Inspection Method	Treatment Method
Connector	No carbonized, heat modification on the surface	Visual inspection	Inspect causes and repair after cutting main power
Operation indicator	Accuracy of display condition		
Live wire indication lamp	Light is normally on when wire is live		
Control circuit	Connection condition of connector	Visual inspection	Inspect causes and repair
Etc.	No abnormal noise and smell Gas condition	Visual inspection	Inspect causes and repair after cutting main power

## Regular Inspection

The 1<sup>st</sup> regular inspection for RMU should be performed between 1<sup>st</sup> year and 2<sup>nd</sup> year of use. After 1<sup>st</sup> inspection, regular inspection should be performed every 3 years. (Once a year in poor conditions)  
Regular inspections have to be performed after power shut down.

[Table 15-3] Regular inspection item

Inspection Item	Check Point	Inspection Method	Treatment Method
Mechanical part	Accuracy of display condition	Visual inspection Smooth operation on manual control	Repair after checking damage of components
	No abnormal noise		
	No Grease coagulation by foreign element and dust		Apply grease after removing foreign debris (Nichimori CRS-842)
	Tightened bolt and nut		Retighten bolts and nuts
	No modified or left C-Ring, E-Ring and split pin		Replace components
Control circuit	Connection condition of connector	Visual inspection Connection test	Reconnect, Replace connector
	Connection of circuit		Replace circuit
	No heat damage on shunt trip coil		Replace Coil
	Output of auxiliary contact		Replace auxiliary switch
Connector	No carbonized, heat modification on the surface	Visual inspection	Replace connection component after checking insulation failure
Live wire indication lamp	Light is normally on when wire is live	Visual inspection	Check wire connection and replace lamp
Etc.	No abnormal noise and smell Gas condition	Visual inspection	Inspect causes and repair

## Extra Inspection

Extra inspections should be taken after RMU performs operations such as breaking overload and short circuit current and shunt trip. Extra inspections have to be performed after power shut down.

[Table 15-4] Extra inspection item

Inspection Item	Check Point	Inspection Method	Treatment Method
Connector	No carbonized, heat modification on the surface	Visual inspection Disassemble connector	Replace connection component after checking insulation failure
	Condition of terminal connection parts		
Insulation resistance	Insulation resistance (Over 500 MΩ)	1000 V Megger	Check failed insulation part and repair
	Insulation resistance (Over 2 MΩ)	500 V Megger	
Withstand voltage test	Withstand voltage test by supplying 1.5 times voltage of rated voltage of main circuit for 1 minute	Withstand voltage tester	
Contact resistance	Contact resistance after closing RMU, measure input and output terminal of main circuit on each phase	Main circuit resistance tester	Check the part resistance increased and repair (refer to test report)



## WARNING

- 1. Remove unnecessary instruments, metal scrap, etc after finishing installation, inspection and maintenance.**

Otherwise, there is a danger of ground fault, short circuit fault or fire.

## 16. Disposal

- Separate steel and non-steel materials according to ISO 14000 then discard them at designated area.
- Please contact us if you have materials that you would like to recycle.
- Discard the materials which make toxic gas during incineration at permitted locations.



### CAUTION

**1. Discard the RMU at designated areas.**

If not, it may cause environmental pollution.

# Warranty

Model Name		Buying Date	
Serial No.		Warranty Period	1 year
Customer Information	Name		
	Address		
	Tel.		
Sales Office (Distributor)	Name		
	Address		
	Tel.		

- Product quality is strictly controlled and inspected.
- If the defective part is identified to have been properly used under the guarantee term, it will be repaired at our expense.
- The problems occur out of warranty term will be repaired at your expense.
- When applying for repair, please present this warranty.

■ **In-Warranty Repair – Under Guarantee Term**

■ **Out-of-Warranty Repair**

The guarantee will not be applied to any of the below listed conditions even if the term of guarantee is still valid.

- Defect caused by misuse or improper maintenance of customer
- Defect caused by improper repair or modification by unauthorized distributors or service center
- Damage caused by natural phenomenon such as earthquake, fire, flooding and lightning
- Claim guarantee without presented warranty form.

**LSIs**

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79563570001

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Specifications in this manual are subject to change without notice due to continuous product development and improvement.

Ring Main Unit  
2015. 06