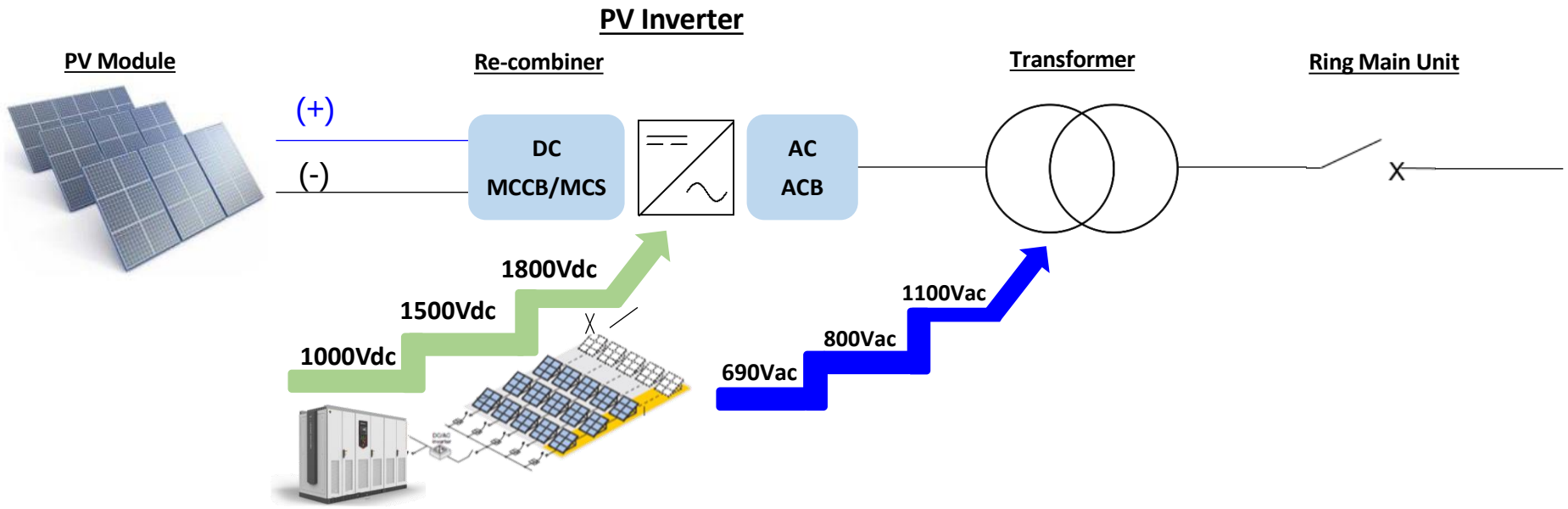
LS ELECTRIC Webinar series

1500Vdc Molded Case Circuit Breaker

Simon LEE,
LS ELECTRIC

Market Trend

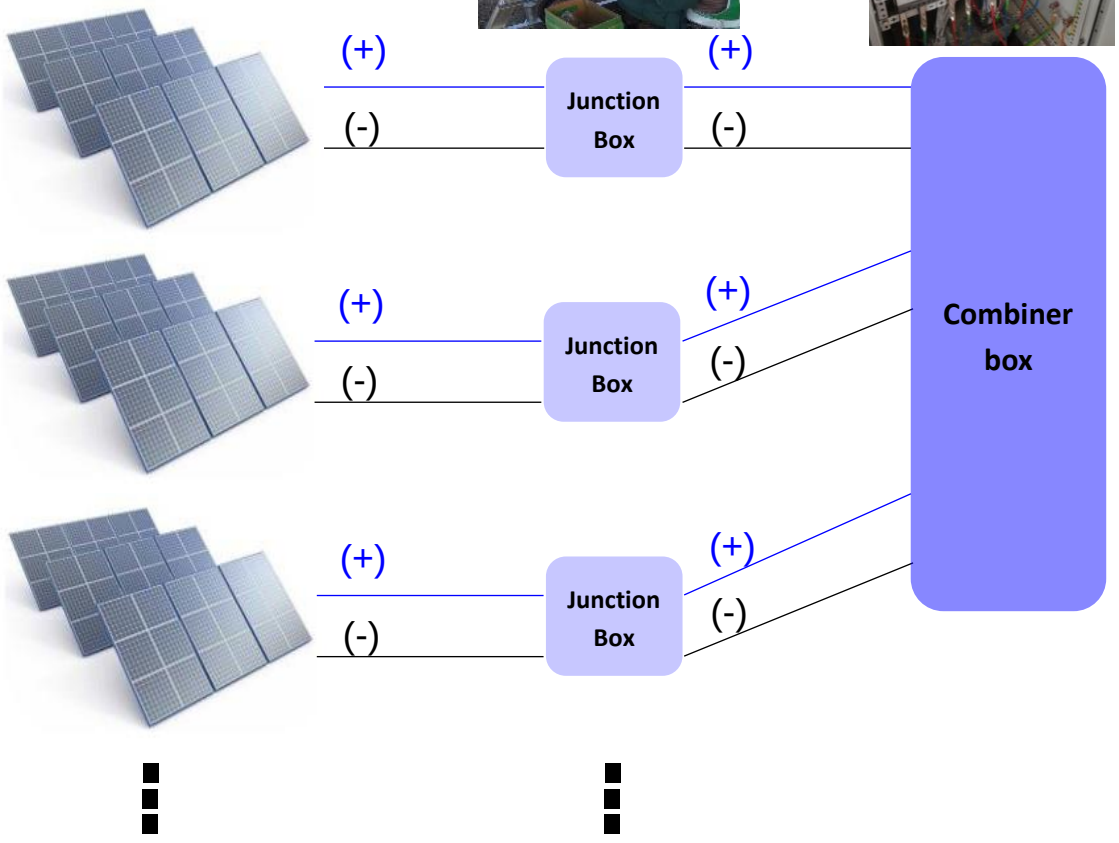


Demand of MCCB specification

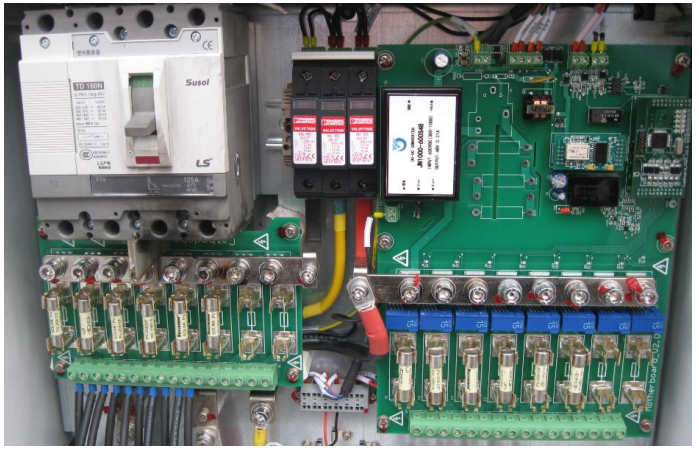
- ✓ String inverter offer a high level of redundancy and plant availability
- ✓ A few medium capacity of inverter rather than high capacity inverter

- High voltage (1500Vdc, 800Vac, etc.)
- Compact size
- Adequate current rating

Application- Photovoltaic



Example of Junction Box configuration

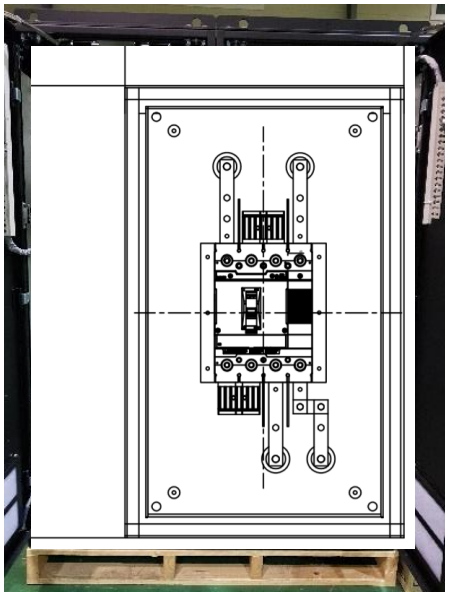


MCCB/MCS DC protection in Energy Storage System

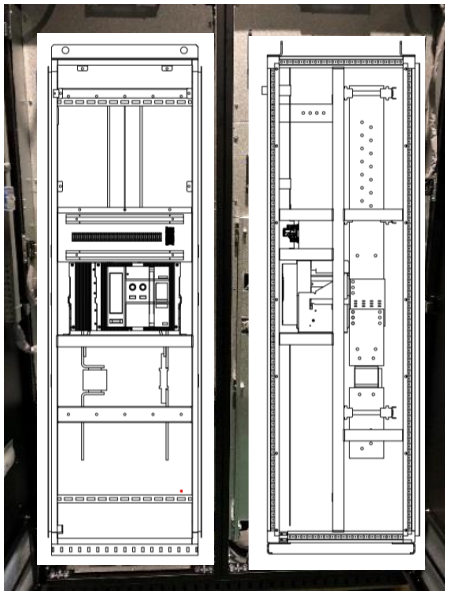
Battery Rack Battery Connecting Panel

1200Vdc / 1500Vdc

DC MCCB/MCS



DC Switch Disconnector/
DC ACB



Low Battery capacity

High Battery capacity

Main feature

UTD250, 400, 600

- **World first UL Certified 1500Vdc MCCB up to 600AF**
  *According to updated UL certification list

- **World Class short-circuit breaking capacity**
  - 65kA for UL Certified MCCB(UTD series)
  - 50kA for IEC Certified MCCB(TSD series)

- **Simultaneous acquisition of both UL489B & UL489F**
  - UL489B for Photovoltaic system
  - UL489F for Battery Power supply system

Product Line-up UL

AC/DC Common Frame

MCCB(3P) & MCS(3P)

100AF

DC 250(2P)/500(3P)

150AF

250AF

400AF

600AF

DC 250(2P)/600(3P)

DC only (Expected '20.08)

MCCB(4P) & MCS(4P)

DC 1000(MCCB)/1500(MCS)

[Specifications, AC/DC common, MCCB&MCS]

Applicable Standard	UL489
Max. Operational Voltage(Ue)	DC 600V
Rated Current(In)	15A~600A
Operation Temperature	-25℃ ~ 70℃

[Specifications, DC only, MCCB&MCS]

Applicable Standard	UL489B&F, IEC60947-2/3, GB/T14048.2/3
Max. Operational Voltage(Ue)	DC 1000V(MCCB)/1500V(MCS)
Rated Current(In)	63A~600A
Operation Temperature	-25℃ ~ 70℃

[Feature and customer]

- **DC 600V Series**
  - AC/DC circuit common use maximizes compatibility
- UL489 Full certification hold

- **DC 1000V MCCB & 1500V MCS**
  - **World-class short-circuit breaking capacity**
    : Icu 65kA

*** MCS: Molded Case Switch**

Product Line-up IEC

AC/DC Common Frame

MCCB

DC 500(2P)/750(3P)/1000(4P)

DSU

DC 500(2P)/750(3P)/1100(4P)

DC 750(3P)/1150(4P)

DC 250AF

MCCB & DSU

DC 1000(2P)/1500(4P)

[Specifications, MCCB]

Applicable Standard	IEC 60947-2, GB/T14048.2
Max. Operational Voltage(Ue)	DC 1000V/1500V
Rated Current(In)	16A~1600A
Operation Temperature	-25℃ ~ 70℃

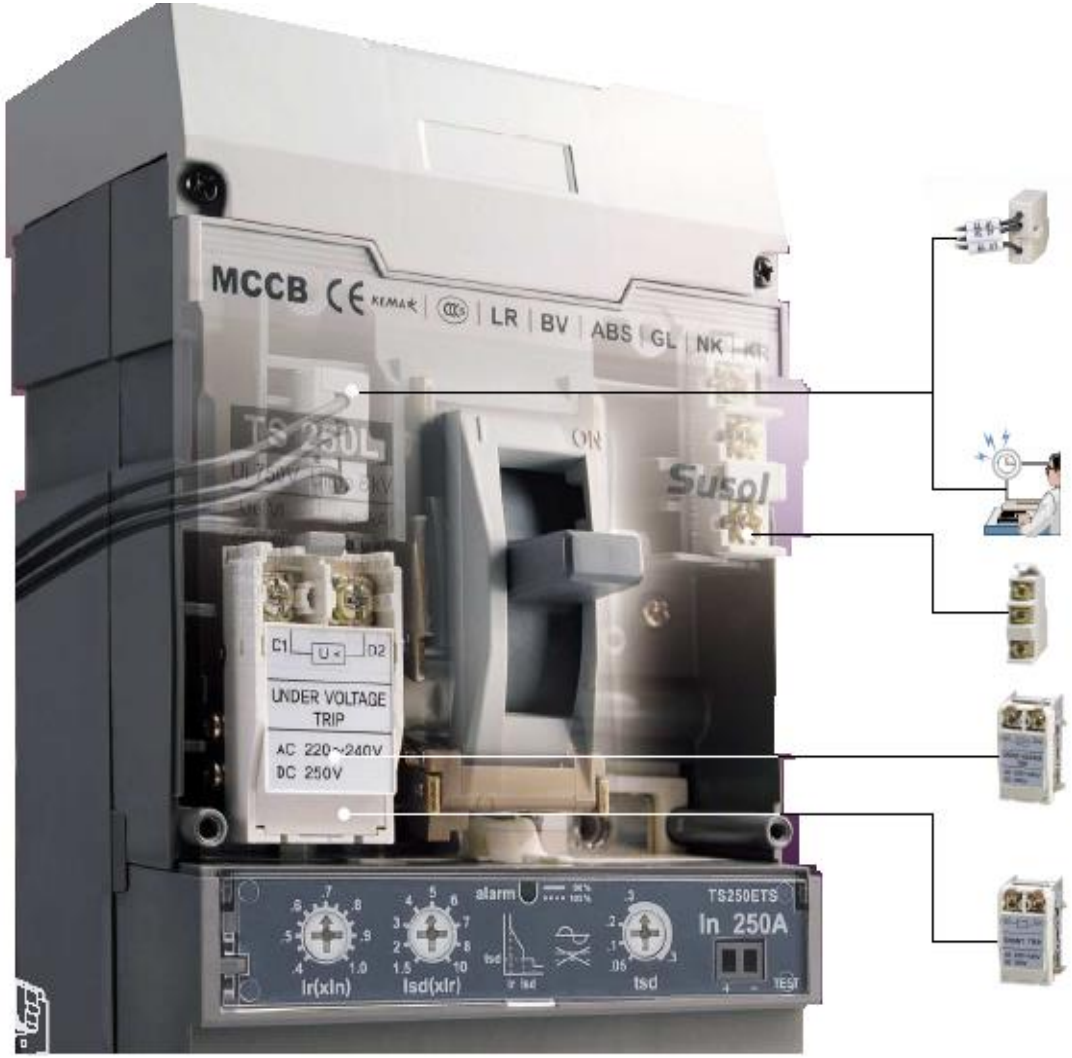
[Specifications, DSU]

Applicable Standard	IEC 60947-3, GB/T14048.3
Max. Operational Voltage(Ue)	DC 1100V/1500V
Rated Current(In)	100A~1600A
Operation Temperature	-25℃ ~ 70℃

[Feature and customer]

- **DC 1000V Series**
  - AC / DC circuit common use maximizes compatibility - DC CB all certification hold
- **DC 1500V MCCB**
  - **Compact Size**
  - **World-class short-circuit breaking capacity**
    : Icu 50kA

Accessories-Internal Equipment



1. Alarm Switch(AL)

- External indicating of trip state due to overload, short circuit, shunt trip or under voltage release condition.
- No function when the breaker is operated manually.

2. Axially Switch(AX)

- circuit breaker states indicating Tip
- C Tip composition

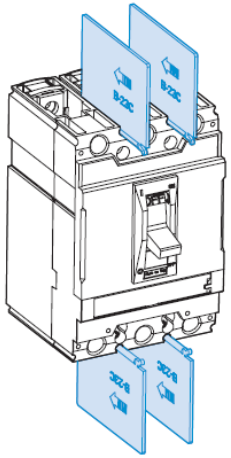
3. Shunt Trip(SHT)

- Control device which trips a circuit breaker from remote place with applying specific voltage.

4. Under-Voltage Trip(UVT)

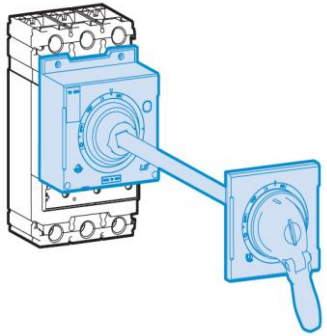
- Device which opens a circuit breaker when voltage drops to a value ranging between 35% to 70% of the line voltage.

Accessories-external Equipment



1. Insulation Barrier

- Equipment for insulation between phase.

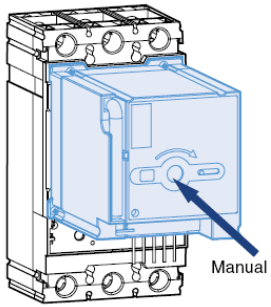


2. External Rotary Handles

-The rotary handle make it available to checking the MCCB states and controlling it even if PNL door is closed.

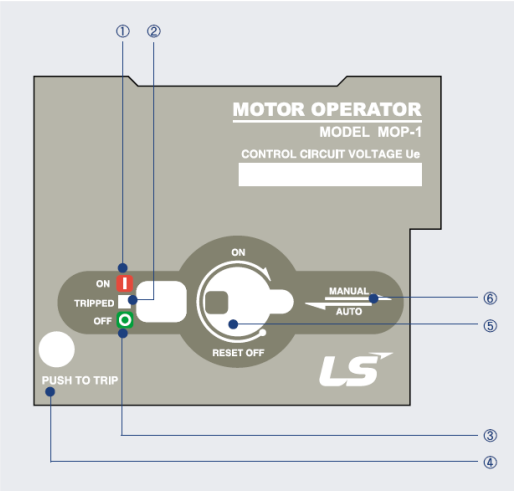
3. Motor Operator

- The motor drives a mechanism which switches handle to the “ON” and “OFF/RESET” positions.
- Easy to configure emergency power supply system.
- Manual or Automatic operation can be selected.



Feature

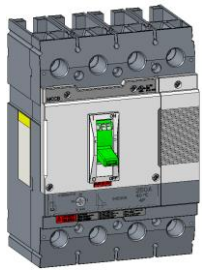
① On position indication (Red color)
② Trip position indication (White color)
③ Off position indication (Green color)
④ Button for push to trip
(available for only for TD160AF and TS630AF)
⑤ On/Off/Reset selection lever
⑥ Manual/Auto selection lever



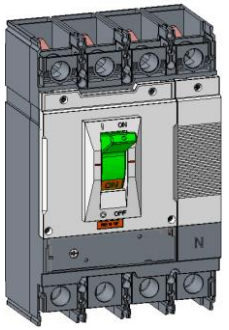
Upcoming product

Development plan for AC 1000V MCCB up to 600AF

- AC 1000V, 250AF, 400AF, 600AF
- IEC 60947-2 Certified
- Applicable for AC grid of Photovoltaic system



<250AF>



<400/600AF>

Model		TS250V	TS400V	TS600V
Frame size		250AF	400AF	600AF
Rated current		63, 80, 100, 150, 200, 250A	250, 300, 350, 400A	500, 600A
Number of poles		3	3	3
Rated voltage		AC 1000V	AC 1000V	AC 1000V
Short-circuit interrupting rating		20kA	20kA	20kA
Mechanical life(Cycle)		10,000	10,000	10,000
Electrical life(Cycle)		1,000	1,000	1,000
Trip Unit	FTU	●	●	●
	FMU	●(0.8~1*In)	●(0.8~1*In)	●(0.8~1*In)
Dimension(W*H*D, mm)		105*190*92	140*290*110	140*290*110
Standard		IEC 60947-2	IEC 60947-2	IEC 60947-2

LS ELECTRIC Webinar series

1500Vdc GPR DC Contactor

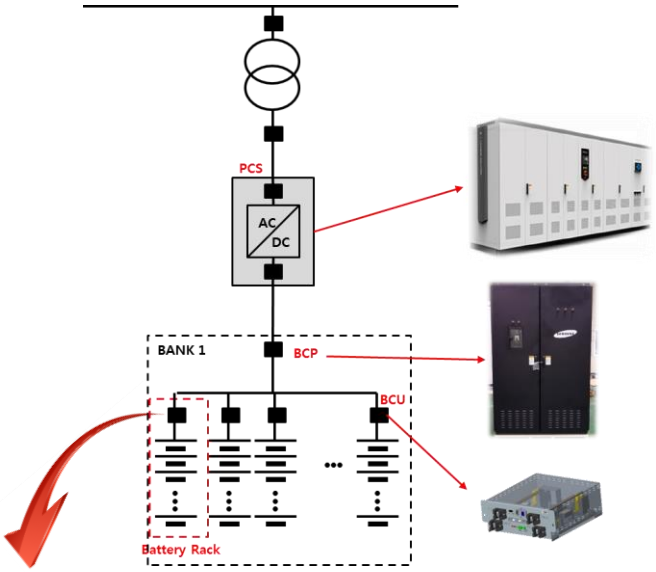
Simon LEE, LS ELECTRIC

Market Trend

Range		10A	40A	100A	150A	250A	400A	~1000A
DC 450V (EV)	LS	10A/20A	40A/75A	80A/100A	150A/200A	250A	400A	No demand yet
DC 1000V	LS	600V 10A	40A	100A	150A	250A	400A/ 400A w aux	1000A w aux
DC 1500V	LS	-					500A w aux	1000A w aux

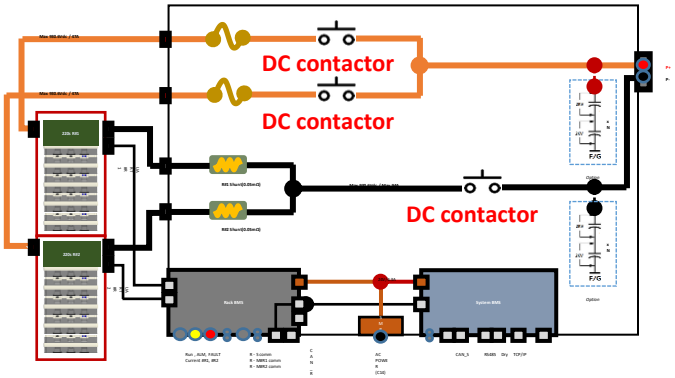
- ✓ Higher voltage(up to 1500Vdc) with higher breaking capacity(800A, 1000A)
- ✓ Reliability (Crucial safety issue in Energy Storage System application)
- ✓ Compact size
- ✓ Higher level of Electrical durability (400A: 3,000cycles, 500A: 1,000cycles)

Application_Energy Storage System

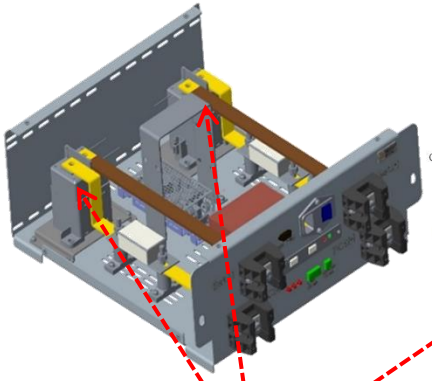


BPU: Battery Protection Unit

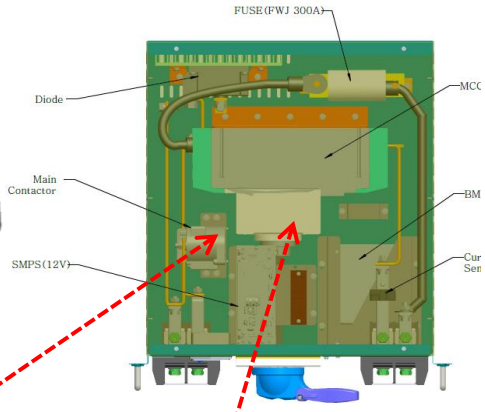
- Battery Charging & Discharging Control



Type 1. DC contactor +Fuse



Type 2. DC MCCB+DC contactor + Fuse



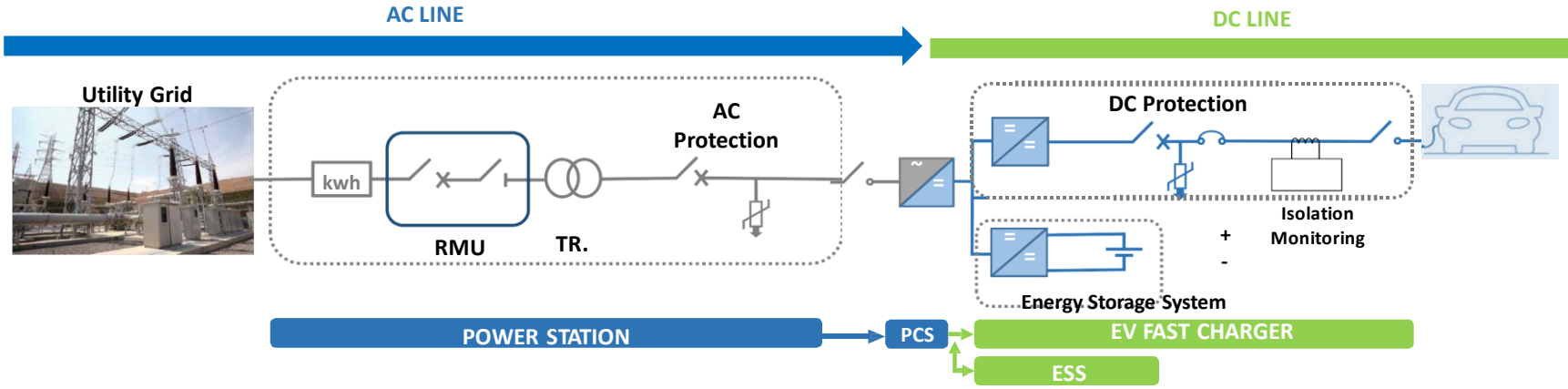
[DC-Relay]

- Ue: DC 600~1500V
- Ith: 10~500A

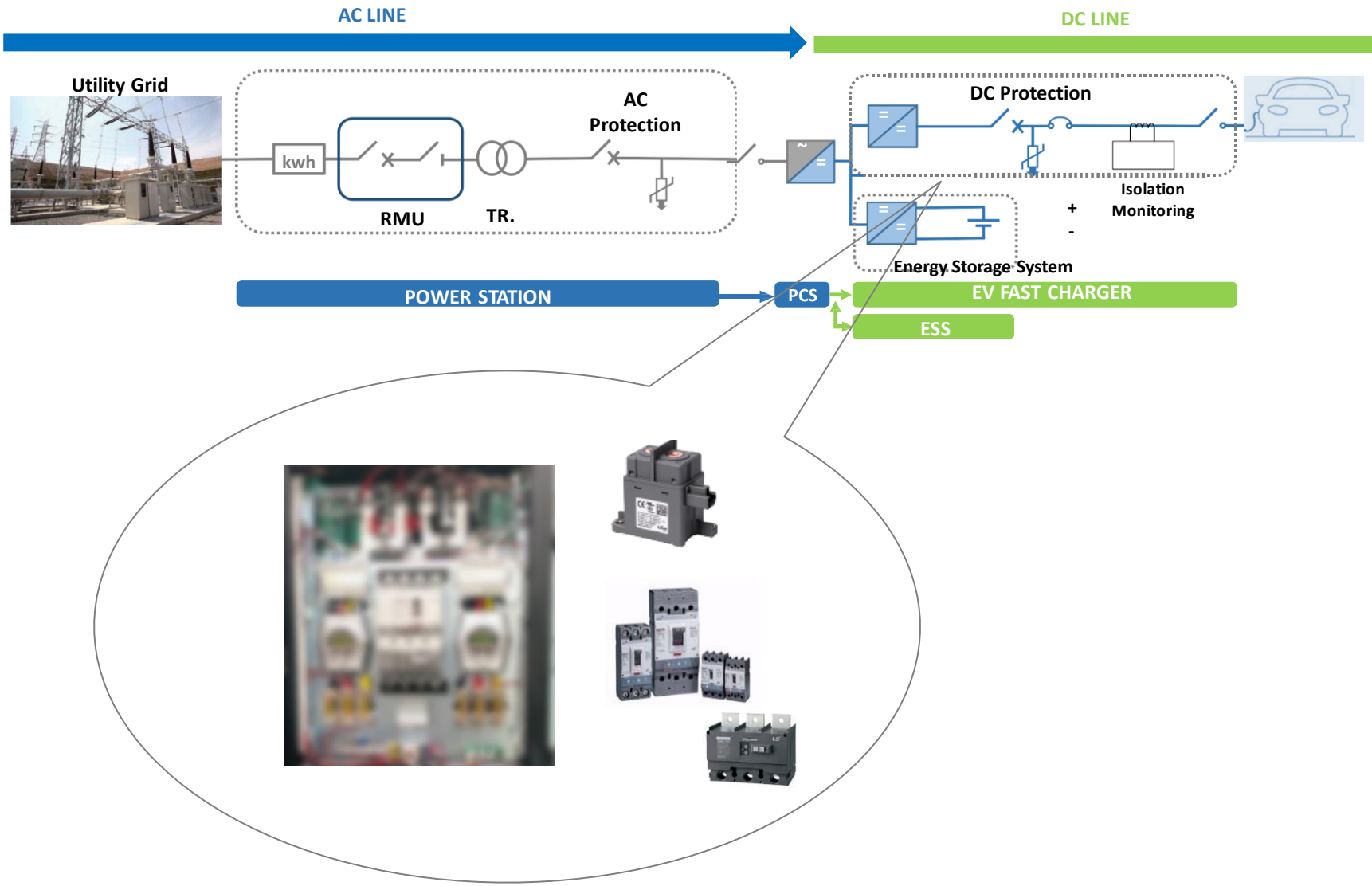
[DC MCCB]

- Ue: DC 1000V,1500V
- In : 63~800A

Application_EV charging station

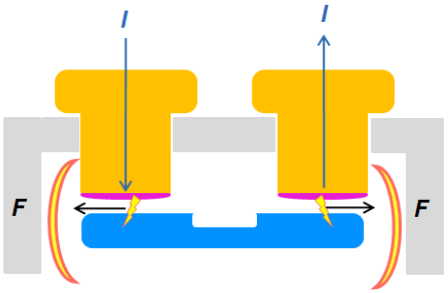


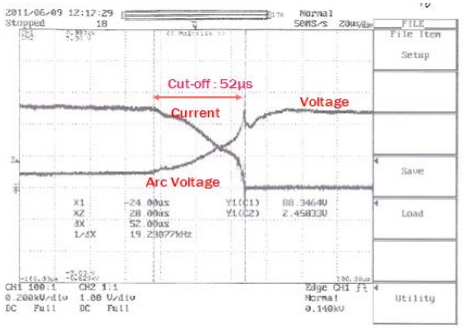
Application_EV charging station



Main Characteristic

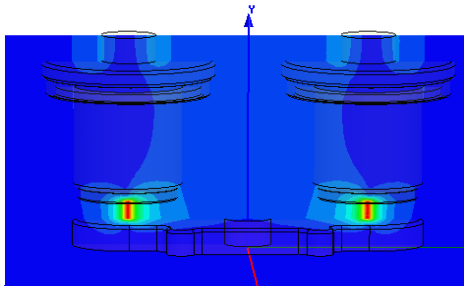
Arc Quenching

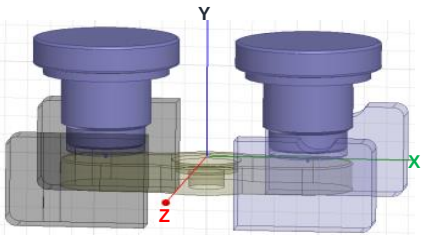




- Optimal design of Quenching force
- **H2/N2 gas mixture ratio** : fast Arc quenching
- Protect contact from damage : reliability over life time
- Sealing technology of H2/N2 gas

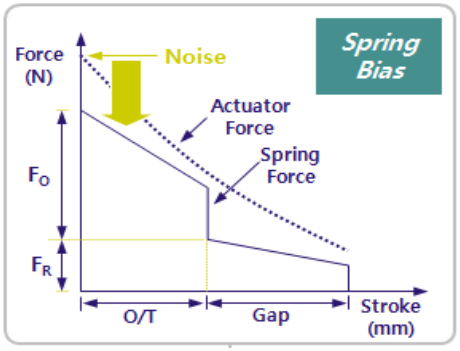
Short-circuit Capability

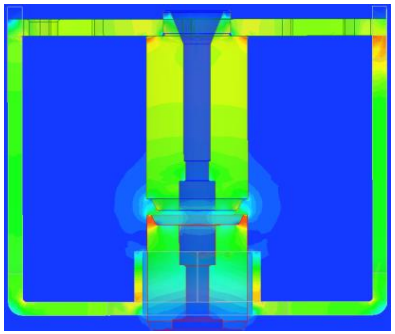




- Short-circuit current withstanding : safety factor from fire
- Main design concept to increase the capability
  - **Contact material and shape**
  - **Contact spring design**
  - Change of permanent magnet to reduce electromagnetic field

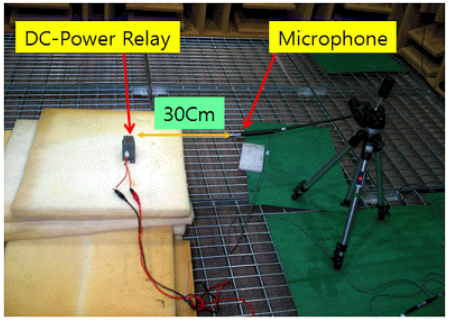
Electromagnetic Actuator

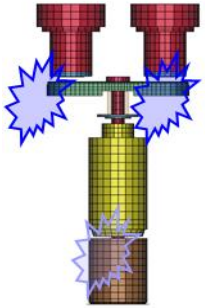




- Key-On/Off operation of EV
- Less power consumption of actuator : driving time of EV
- Noise Reduction when Key-On and Off

Noise Reduction

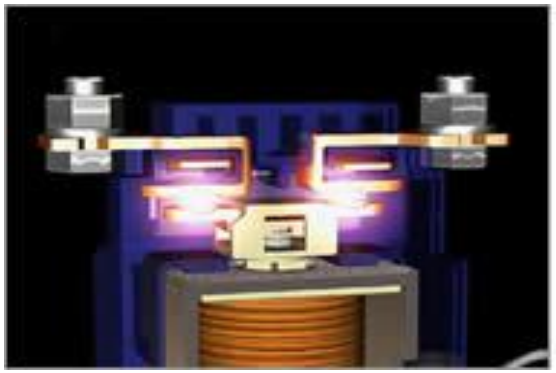




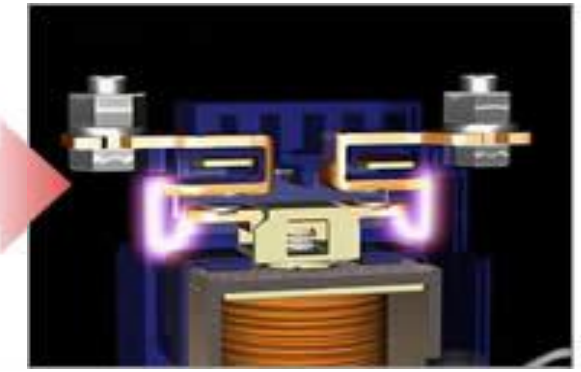
- **Optimal design of electromagnetic force of actuator**
- Sealing structure of Noise
- Less than 50dB ≤ Competitor's product

Main Characteristic_*Arc Quenching*

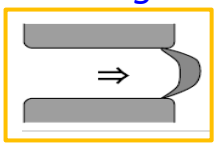
Arc Quenching

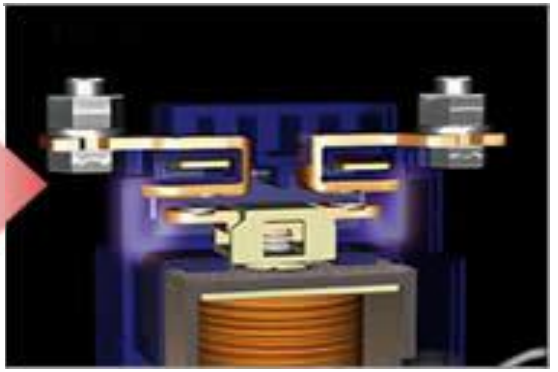


Arc Ignition

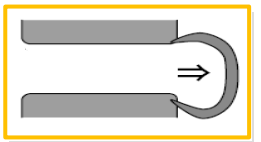


Arc Elongation

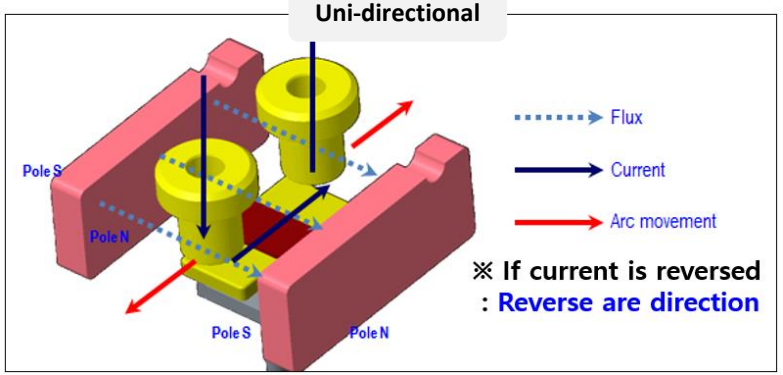




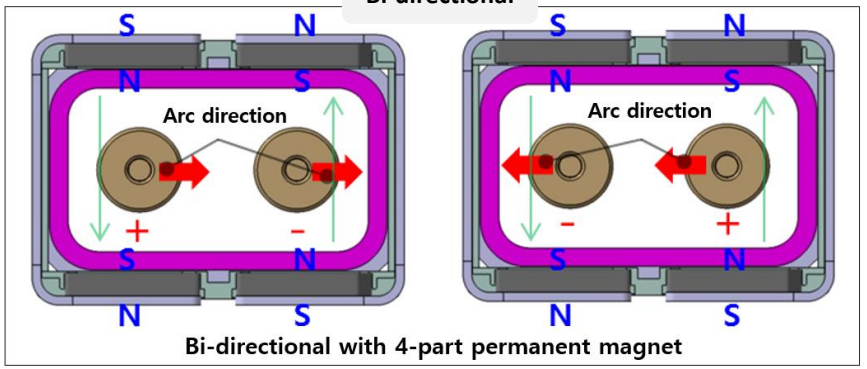
Arc Quenching



Uni-directional

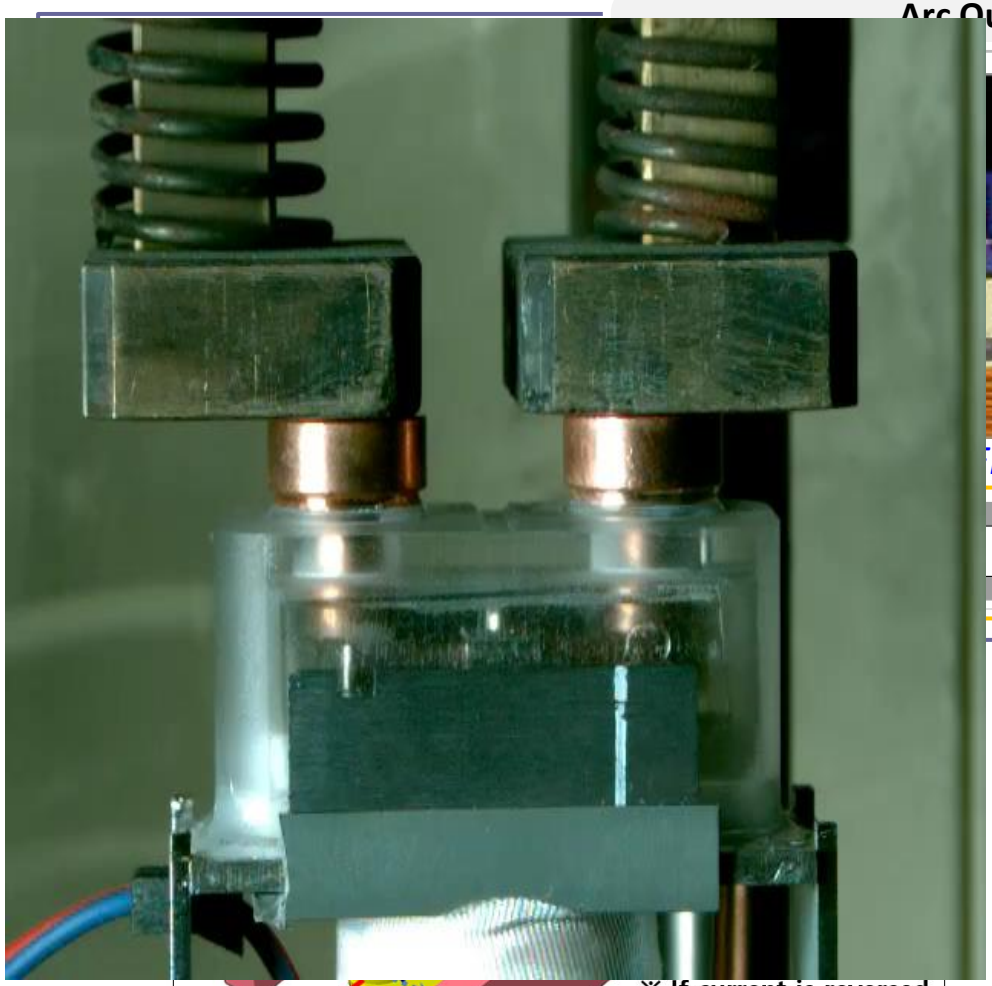


Bi-directional



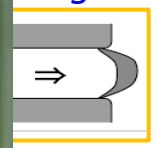
Bi-directional with 4-part permanent magnet

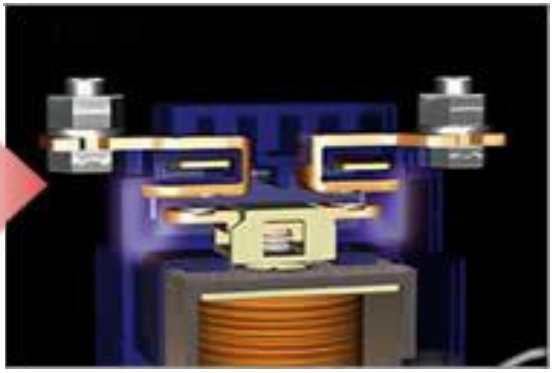
Main Characteristic_*Arc Quenching*



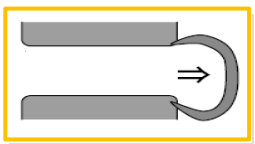
Arc Quenching

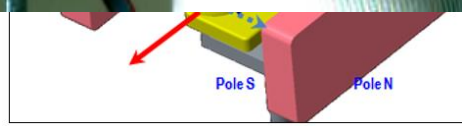
longation





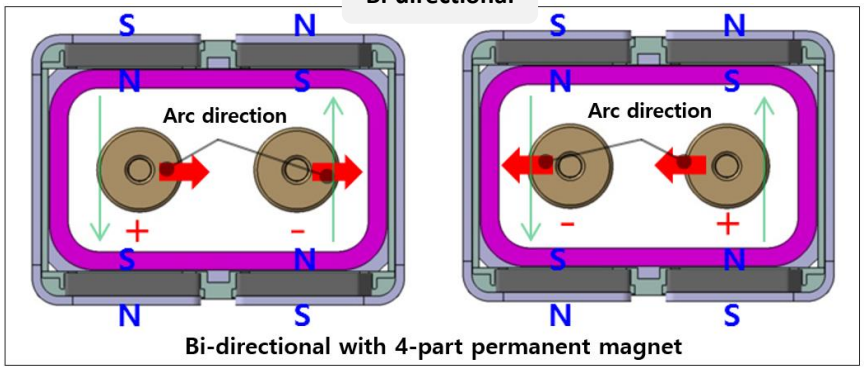
Arc Quenching





※ If current is reversed
: Reverse are direction

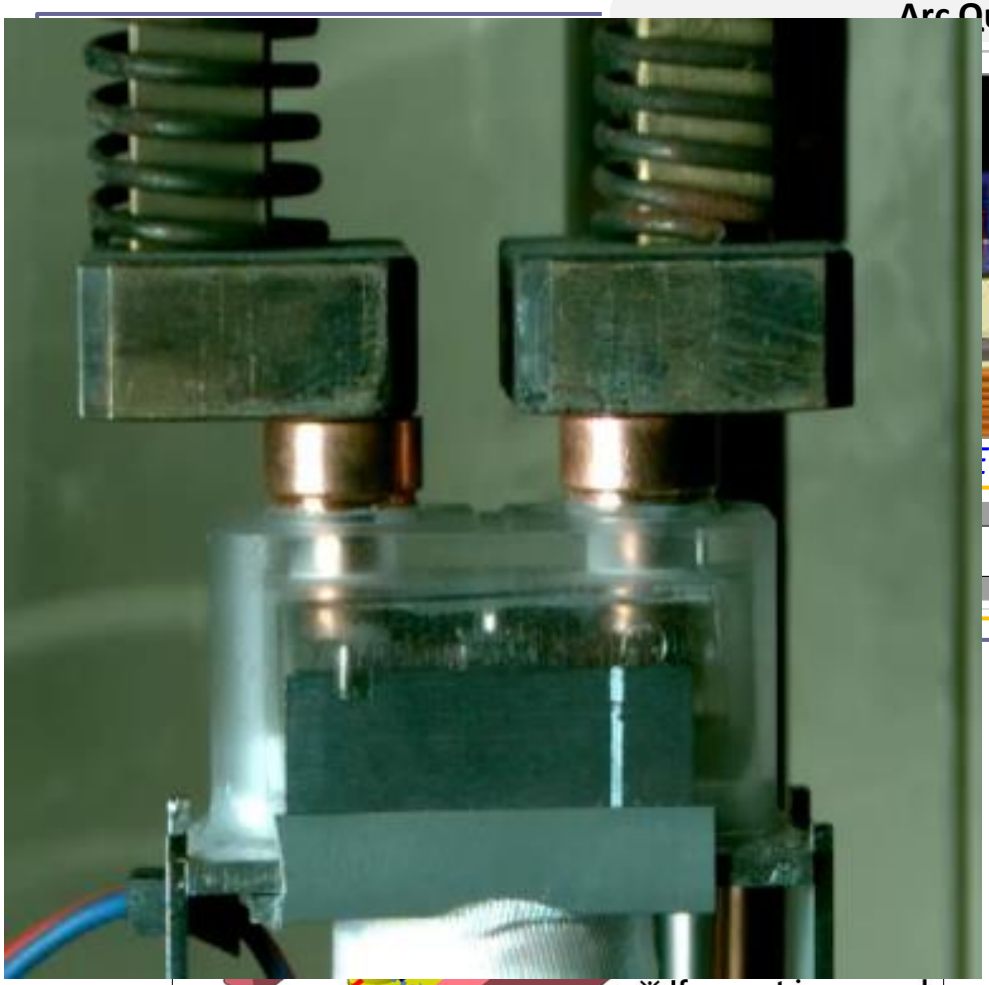
Bi-directional

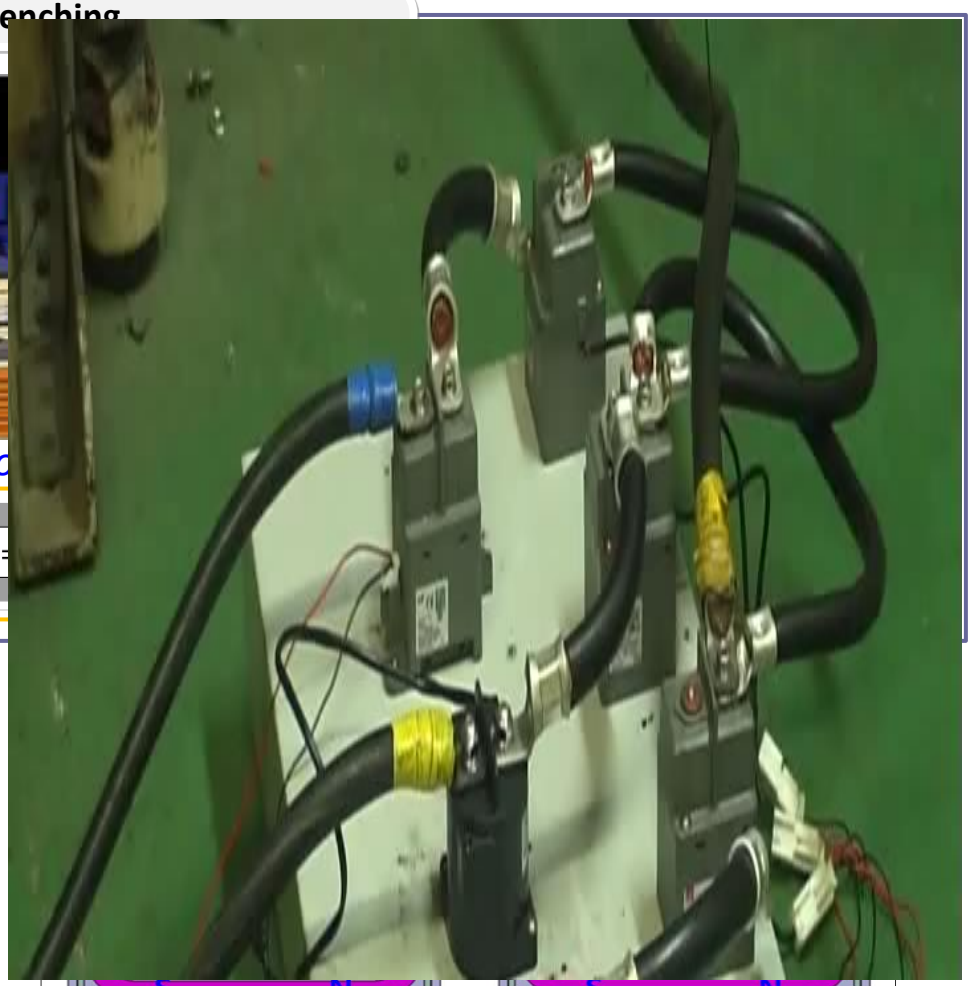


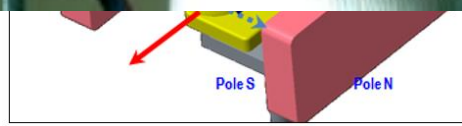
Bi-directional with 4-part permanent magnet

Main Characteristic_*Arc Quenching*

Arc Quenching







※ If current is reversed
: Reverse are direction

Bi-directional with 4-part permanent magnet

Product Line-up IEC/UL

450Vdc DC contactor

Type		GPR010	GPR040	GPR100	GPR150	GPR250	GPR400
Rated operational voltage, Ue		DC 450V	DC 450V	DC 450V	DC 450V	DC 450V	DC 450V
Rated impulse withstand voltage, Uimp		4kV	4kV	4kV	4kV	4kV	4kV
Conventional thermal current, Ith		10A	40A	100A	150A	250A	400A
Rated Short-time withstand current	120s	-	100A	225A	320A	500A	750A
	15Min	15A	60A	150A	225A	350A	500A
Expected Life	Mechanical (3,600cycles/1h)	200,000cycles	200,000cycles	200,000cycles	200,000 cycles	200,000 cycles	200,000 cycles
	Electrical	**10A, 450VDC, 150,000cycles (at 360cycles/Hr) *only Making**	**40A, 450VDC, 1,000cycles (at 1200cycles/Hr)**	**100A, 450VDC, 1,000cycles (at 1200cycles/Hr)**	**150A, 450VDC, 1,000cycles (at 1200cycles/Hr)**	**250A, 450VDC, 1,000cycles (at 360cycles/Hr)**	**400A, 450VDC, 1,000cycles (at 360cycles/Hr)**
W × H × D (mm)		56 × 28 × 45	67 × 47 × 35	81 × 39 × 70	81 × 39 × 70	92 × 45 × 87	100 x 58 x 91
Temperature range		-40 ~ 85℃	-40 ~ 85℃	-40 ~ 85℃	-40 ~ 85℃	-40 ~ 85℃	-40 ~ 85℃
Weight (g)		80g	145g	330g	330g	500g	630g

Product Line-up IE/UL

1000Vdc Contactor

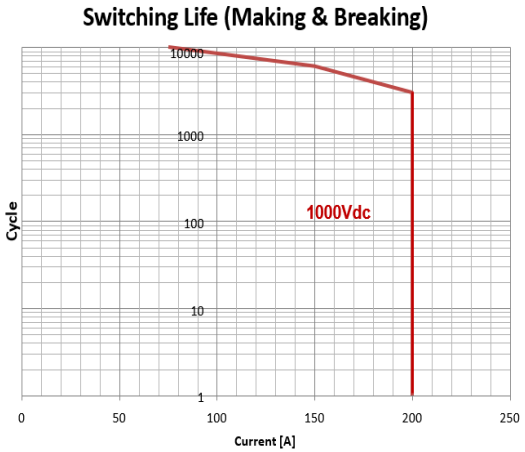
Type		GPR-M010	GPR-M040	GPR-M100	GPR-M150	GPR-M250	GPR-M400
Rated operational voltage, Ue		DC 1000V	DC 1000V	DC 1000V	DC 1000V	DC 1000V	DC 1000V
Rated impulse withstand voltage, Uimp		4kV	4kV	4kV	4kV	4kV	4kV
Conventional thermal current, Ith		10A	40A	100A	150A	250A	400A
Rated Short-time withstand current	120s	-	100A	225A	320A	500A	750A
	15Min	15A	60A	150A	225A	350A	500A
Expected Life	Mechanical (3,600cycles/1h)	200,000 cycles	200,000 cycles	200,000 cycles	200,000 cycles	200,000 cycles	200,000 cycles
	Electrical	5A, 1000VDC, 10,000cycles (at 360cycles/Hr) *only Making)	25A, 1000VDC, 1,000cycles (at 360cycles/Hr)	50A, 1000VDC, 1,000cycles (at 360cycles/Hr)	100A, 1000VDC, 1,000cycles (at 360cycles/Hr)	150A, 1000VDC, 1,000cycles (at 360cycles/Hr)	200A, 1000VDC, 1,000cycles (at 360cycles/Hr)
W × H × D (mm)		56 × 28 × 45	67 × 47 × 35	81 × 39 × 70	81 × 39 × 70	92 × 45 × 87	100 × 58 × 91
Temperature range		-40 ~ 85℃	-40 ~ 85℃	-40 ~ 85℃	-40 ~ 85℃	-40 ~ 85℃	-40 ~ 85℃
Weight (g)		80g	145g	330g	330g	500g	630g

Product Line-up IEC/UL

1000/1500Vdc Contactor with Auxiliary contact

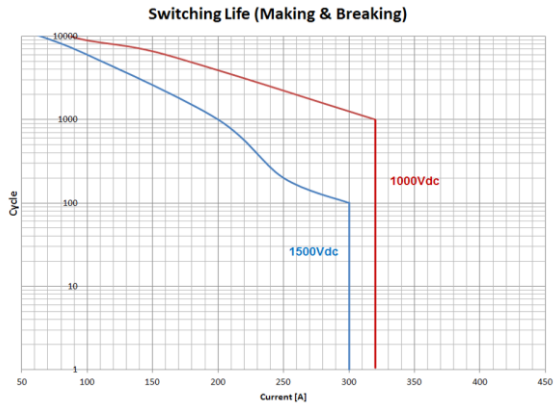
GPR-M400-A

Model		GPR-M400-A
Rated operational voltage (Ue)		DC1000V
Continuous current (Ith)		400A
Rated impulse withstand voltage (Uimp)		4kV
Electrical Endurance		200A, 1000Vdc 3,000 cycles
Short Time withstand Current	120s	750A
	15Min	500A
Coil voltage		12VDC, 24VDC
Auxiliary contact		1 NO(Normally Open)



GPR-H500-A

Model		GPR-H500-A
Rated operational voltage (Ue)		DC1500V
Continuous current (Ith)		500A
Rated impulse withstand voltage (Uimp)		8kV
Electrical Endurance		200A, 1500Vdc 1,000 cycles
Short Time withstand Current	120s	900A
	15Min	750A
Coil voltage		12VDC, 24VDC
Auxiliary contact		1 NO(Normally Open)



* DC 1500V 300A : Breaking Only

LEADING SOLUTION

THANK YOU

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