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2020

# UL Electric Products

ACB / MCCB / MCB / MC&TOR / Mini-MS / MMS /  
EMPR / DC Relay / VCB



**LS** ELECTRIC

### Susol series

- 85, 100 and 130kA short circuit current with instantaneous at 508V
- High functional digital trip relays
- UL approved



## Molded Case Circuit Breakers

### Susol series

- 2, 3 pole series up to 1200AF
- UL approved

## Miniature Circuit Breakers

- UL 489 R-Series
- UL 1077 R-Series



## Contactor & Overload Relays

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### Metasol series

- 3 and 4 pole series up to 2650AF Mini-contactors available
- AC/DC common use coil from 150AF to 800AF
- Thermal (Bimetallic) and electronic type overload relays are available
- UL approved

### Mini Contactors

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### Manual Motor Starters

Page 35



### Electronic Motor Protection Relays (Electronic type overload relays)

Page 40

- Various connection & mount
- Reliability by real-time data processing and high precision.
- Wide current setting range & Various protection functions
- Inverse or definite time mode
- Display the causes of the fault by LED
- CE marked and UL approved type

### High Voltage DC Relays

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### Vacuum Circuit Breakers

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### Susol series



# Air circuit breakers

## Ratings for UL listed / ANSI certified Susol UA circuit breakers



Type						
AF						
Rated current (In max)	(A)		at 40°C			
Rated current	(A)		at 40°C			
Rated maximum voltage	(V)					
Frequency	(Hz)					
Number of poles	(P)					
Type of trip relay (Electronic trip device)						
Rated short circuit current (kA) (Sym.) UL 1066 ANSI C37.13		With AC instantaneous	635V <b>508V</b> 254V			
		Without AC instantaneous	635V <b>508V</b> 254V			
Rated short time current	(kA)					
Operating time (t)	(ms)	Maximum total breaking time				
		Maximum closing time				
Life cycle	ACB	(time)	Mechanical	Without maintenance		
				With maintenance		
			Electrical	Without maintenance		
				With maintenance		
Weight	lb (kg)	Drawout type	Main Body	3P		
			with Cradle	4P		
			Only Cradle	3P		
				4P		
			Fixed type	Motor charging type	3P	
					4P	
External dimension	Draw-out type	in (mm)	H×W×D	3P		
				4P		
			Fixed type	in (mm)	H×W×D	3P
						4P
Enclosure dimension		in (mm)	H×W×D	3P		
				4P		



<i>Susol</i>	
UAS-□□□	
08	16
800	1600
	800
400	1000
600	1200
630	1250
800	1600
254V / 508V / 635V	
50 / 60	
3P / 4P	
N, A, P, S (4 type)	
	65
	<b>85</b>
	85
	65
	<b>65</b>
	65
	65
	50ms
	80ms
	12,500
	-
	2,800
	-
	154 (70)
	187 (85)
	71 (32)
	84 (38)
	77 (35)
	99 (45)
	16.93×13.15×16.02 (430×334×407)
	16.93×16.5×16.02 (430×419×407)
	11.81×11.81×11.61 (300×300×295)
	11.81×15.16×11.61 (300×385×295)
	19.69×15.75×13.39 (500×400×340)
	19.69×19.69×13.39 (500×500×340)



<b>Susol</b>				
UAH-□□E				
08	16	20	25	32
800	1600	2000	2500	3200
400	800	1000	1200	1600
600	1000	1200	1250	2000
630	1200	1250	1600	2500
800	1250	1600	2000	3000
	1600	2000	2500	3200
254V/508V/635V				
50/60				
3P/4P				
N, A, P, S (4 type)				
85				
<b>100</b>				
100				
85				
<b>85</b>				
85				
85				
50ms				
80ms				
12,500			12,500	
-			-	
2,800			1,000	
-			-	
214 (97)		245 (111)		326 (148)
269 (122)		309 (140)		414 (188)
99 (45)		123 (56)		205 (93)
121 (55)		152 (69)		256 (116)
101 (46)		110 (50)		196 (89)
126 (57)		137 (62)		249 (113)
16.93×16.22×16.02 (430×412×407)				
16.93×20.75×16.02 (430×527×407)				
11.81×14.88×11.61 (300×378×295)				
11.81×19.41×11.61 (300×493×295)				
19.69×19.69×13.39 (500×500×340)				
19.69×24.21×13.39 (500×615×340)				

<b>Susol</b>			
UAH-□□G			
32	40	50	60
3200	4000	5000	6000
1600	2000	2500	3000
2000	2500	3000	3200
2500	3000	3200	3600
3000	3200	3600	4000
3200	3600	4000	5000
	4000	5000	6000
254V/508V/635V			
50/60			
3P/4P			
N, A, P, S (4 type)			
100			
<b>130</b>			
130			
100			
<b>100</b>			
100			
100			
50ms			
90ms			
10,000			
-			
1,000			
-			
489 (222)		709 (321)	
626 (284)		919 (417)	
276 (125)		482 (218)	
355 (161)		630 (286)	
227 (103)		433 (196)	
287 (130)		561 (255)	
18.11×30.91×16.02 (460×785×407)			
18.11×39.96×16.02 (460×1015×407)			
11.81×29.57×11.61 (300×751×295)			
11.81×38.62×11.61 (300×981×295)			
31.5×32.48×13.39 (800×825×340)			
31.5×41.54×13.39 (800×1055×340)			





# Trip relay(OCR)

The trip relay of Susol ACB provides the additional protection functions for voltage, frequency, unbalance, and others in addition to main protection functions for over current, short-circuit, ground fault. It supports the advanced measurement functions for voltage, current, power, electric energy, harmonics, communication function, and others. Analog trip function interlocked with mechanism enhances the durability as well as the breaking capacity of the ACB. Zone selective interlocking function makes the protective coordination more simple and thermal memory can be applied to various loads.



# Air circuit breakers

## Trip relay types

Classification	N type	A type	P type	S type
Externals				
Current protection	• L / S / I / G	• L / S / I / G(or Earth leakage) • Thermal • ZSI(Protective coordination) • ERMS	• L / S / I / G(or Earth leakage) • Thermal(Continuous) • ZSI(Protective coordination) • ERMS	• L / S / I / G(or Earth leakage) • Thermal(Continuous) • ZSI(Protective coordination) • ERMS
Other protection	-	• Earth leakage (Option)	• Earth leakage(Option) • Over/Under voltage • Over/Under frequency • Unbalance(Voltage/Current) • Reverse power	• Earth leakage(Option) • Over/Under voltage • Over/Under frequency • Unbalance(Voltage/Current) • Reverse power
Measurement function	-	• Current (R / S / T / N)	• 3 Phase Voltage/Current RMS/Vector • Power(P, Q, S), PF(3-Phase) • Energy(Positive/Negative) • Frequency, Demand	• 3 Phase Voltage/Current RMS/Vector • Power(P, Q, S), PF(3-Phase) • Energy(Positive/Negative) • Frequency, Demand • Voltage/Current harmonics (1st-63th) • 3 Phase Waveforms • THD, TDD, K-Factor
Fine adjustment	-	-	• Fine adjustment for long/short time delay/instantaneous/ ground	• Fine adjustment for long/short time delay/instantaneous/ ground
Pre Trip Alarm	-	-	• Overload protection relays : DO (Alarm) (Ground fault is not available when using Pre trip alarm)	• Overload protection relays : DO (Alarm) (Ground fault is not available when using Pre trip alarm)
Digital Output	-	• 3DO (Fixed) • L, S/I, G Alarm	• 3DO (Programmable) • Trip, Alarm, General	• 3DO (Programmable) • Trip, Alarm, General
IDMTL setting	-	-	• Compliance with IEC60255-3 SIT, VIT, EIT, DT	• Compliance with IEC60255-3 SIT, VIT, EIT, DT
Communication	-	• Modbus/RS-485 • Profibus-DP	• Modbus / RS-485 • Profibus-DP	• Modbus / RS-485 • Profibus-DP
Power supply	• Self Power - Power source works over 20% of load current.	• Self Power - Power source works over 20% of load current. - External power source are required for comm. • AC/DC 100~250V • DC 15~60V	• AC/DC 100~250V • DC 15~60V	• AC/DC 100~250V • DC 15~60V
RTC timer	-	• Available	• Available	• Available
LED for trip info.	• Long time delay • Short time delay/Instantaneous • Ground fault	• Long time delay • Short time delay/Instantaneous • Ground fault	• Long time delay • Short time delay/Instantaneous • Ground fault	• Long time delay • Short time delay/Instantaneous • Ground fault
Fault recording	-	• 10 records (Fault/Current/Date and Time)	• 256 records (Fault/Current/Date and Time)	• 256 records • Last fault wave recording (voltage, current are recorded in 3-phase, and can be read only by communication)
Event recording	-	-	• 256 records(Content, Status, Date)	• 256 records(Content, Status, Date)
Operating button	• Reset button	• Reset, Menu Up/Down, Tap, Enter	• Reset, Menu Up/Down, Tap, Enter	• Reset, Menu Up/Down, Tap, Enter

Each OCR type has Battery in itself.

1. Battery lifespan

1) When turned off: 14~28years

2) When using 1 LED consecutively or turned off: 7~14days

2. The display minimum range of OCR current

1) A type: When more 15% than rated current (In)

2) P/S type: When more 12% than rated current (In)

\* L/S/I/G(or Earth leakage) configuration as standard  
Unable to select ground fault and earth leakage simultaneously

# Air circuit breakers

## Numbering system

### Breaker and accessories

UAS	16	D	3	16	A
Frame type	Frame size	Phasing	Poles	Sensor rating	Mounting and terminal
	08 800AF 16 1600AF	D 3/4P standard RST(N) W 4P reversed NRST	3 3P 4 4P	04-08 400A~800A 08-16 800A~1600A	Mounting
					A Drawout
					Fixed
					H Horizontal terminals
					V Vertical terminals
					M Horizontal for line Vertical for load
					N Vertical for line Horizontal for load
					P Front terminal
					G Horizontal-con type
					W Vertical-con type
					* Terminals for P type must be ordered separately
					* G and W types can be applicable to D-Frame only
					* Front terminal is only available for 800~2000A
					* 3200AF(E, X), 6000AF(G,Z) offers only vertical type terminals (Busbar).

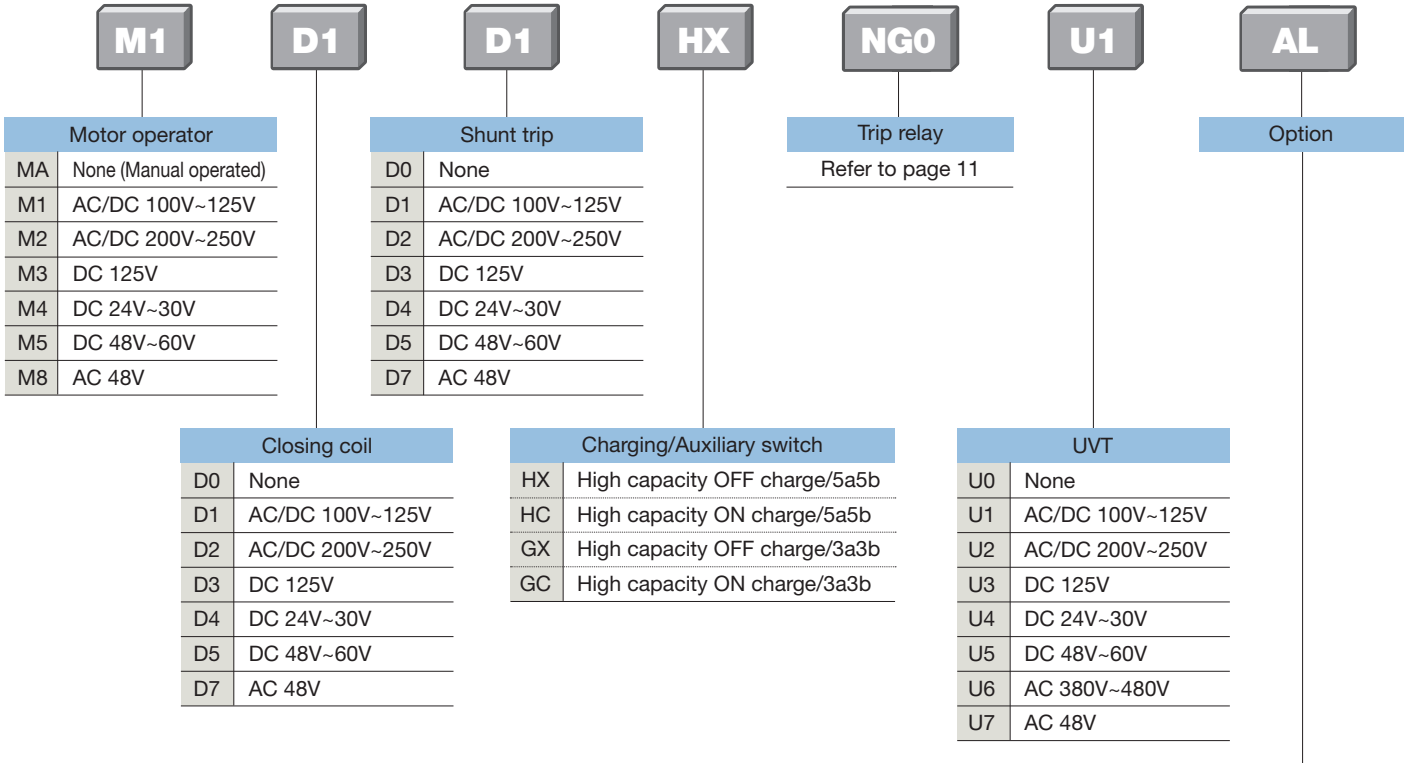
  

UAH	32	E	3	32
Frame type	Frame size	Phasing	Poles	Sensor rating
	08 800AF 16 1600AF 20 2000AF 25 2500AF 32 3200AF	E 3/4P standard RST(N) X 4P reversed NRST	3 3P 4 4P	04-08 400A~800A 08-16 800A~1600A 10-20 1000A~2000A 12-25 1200A~2500A 16-32 1600A~3200A
	32 3200AF 40 4000AF 50 5000AF 60 6000AF	G 3/4P standard RST(N) Z 4P reversed NRST	3 3P 4 4P	16-32 1600A~3200A 20-40 2000A~4000A 25-50 2500A~5000A 30-60 3000A~6000A

UAA	16	D	3	00
Frame type	Frame size	Phasing	Poles	Sensor rating
	08 800AF 16 1600AF	D 3/4P standard RST(N) W 4P reversed NRST	3 3P 4 4P	Not applied
	08 800AF 16 1600AF 20 2000AF 25 2500AF 32 3200AF	E 3/4P standard RST(N) X 4P reversed NRST		
	32 3200AF 40 4000AF 50 5000AF 60 6000AF	G 3/4P standard RST(N) Z 4P reversed NRST		





Code	Description	Code	Description
AL	AL1+MRB	K	K1 Key lock
A1	AL1+MRB +RES (AC110~130V) *AC only	K2	K2 Key Interlock set
A2	AL1+AL2 +MRB	K3	K3 Key Interlock double
A3	AL1+MRB +RES (DC110~125V) *DC only	K5	K5 Profalux lock (CAMLOCK type)
A4	AL1+MRB +RES (AC200~250V) *AC only	K6	K6 Kirkkey lock (CAMLOCK type)
A5	AL1+MRB +Auto reset	K7	K7 Kirkkey lock (CN22 type)
A6	AL1+AL2 +MRB +Auto reset	R	R RCS Ready to close switch
A7	AL1+MRB +RES (DC110~125V) +Auto reset *DC only	T	TM Temperature monitoring
A8	AL1+MRB +RES (AC200~250V) +Auto reset *AC only	H1	H1 AC/DC 100V ~125V, Double shunt coil
A9	AL1+MRB +RES (AC110~130V) +Auto reset *AC only	H2	H2 AC/DC 200V ~250V, Double shunt coil
S	CS2 Charge switch communication	H3	H3 DC 125V, Double shunt coil
B	B Lockable On/Off button cover	H4	H4 DC 24V ~30V, Double shunt coil
M	MI Mechanical interlock	H5	H5 DC 48V ~60V, Double shunt coil
D	DI or MOC Door interlock or MOC (Mechanism operated cell switch)	H7	H7 AC 48V, Double shunt coil

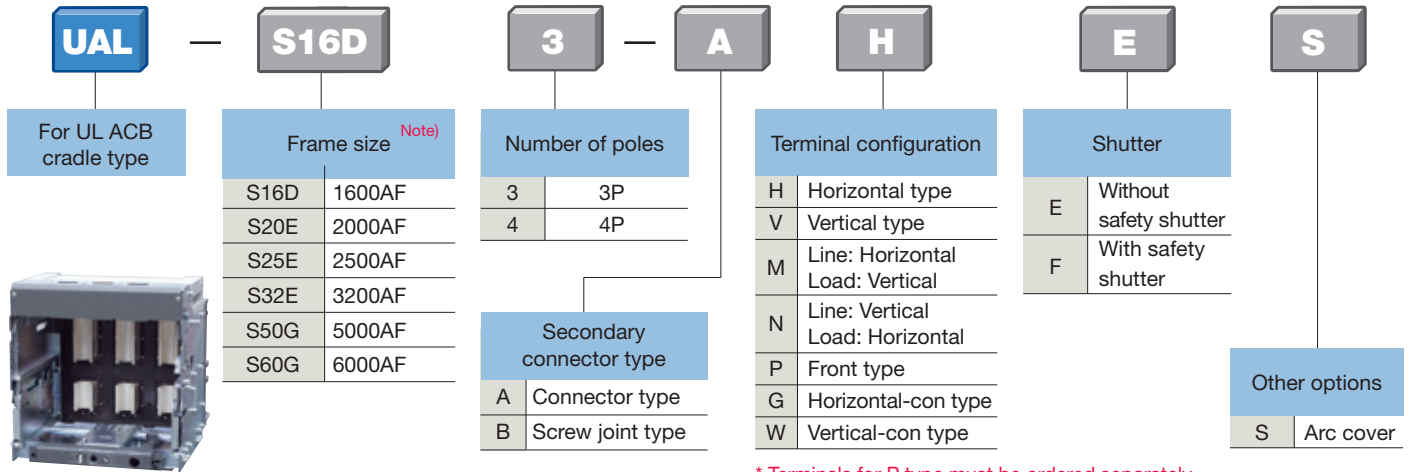
N01	A4 (AL1+MRB +RES(AC200~250V))+B(Lockable On/Off button cover)+K(Key lock)+R(Ready to close switch)+M(Mechanic interlock)+E(Spring auto release)
N02	AL (AL1+MRB)+K(Key lock(OFF lock))+R(Ready to close switch)+D(Door interlock or MOC)+H1(AC/DC 100V~130V, Double shunt coil)+E(Spring auto release)
N03	B(Lockable On/Off button cover)+K2(Key interlock set)+R(Ready to close switch)+T(Temperature monitoring)
N04	A4(AL1+MRB+RES(AC200~250V))+B(Lockable On/Off button cover)+K(Key lock(OFF lock))+M(Mechanical interlock)+T(Temperature monitoring)
N05	A1(AL1+MRB+RES110~130V)+B(Lockable On/Off button cover)+K(Key lock(OFF lock))+R(Ready to close switch)+M(Mechanical interlock)+T(Temperature monitoring)
N06	A2(AL1+AL2+MRB)+K(Key lock(OFF lock))+R(Ready to close switch)+T(Temperature monitoring)

Note) 1. \* Codes for over 5 optional accessories are composed separately 2. UVT and SHT2 can not be selected together. Select one of two.  
3. C(counter) is provided as standard.

# Air circuit breakers

## Numbering system

### Adapter (Cradle)



Note) The corresponding Breaker Adapter

Breaker		Adapter
UAS-08D	UAS-08W	S16D
UAS-16D	UAS-16W	
UAH-08E	UAH-08X	S20E
UAH-16E	UAH-16X	
UAH-20E	UAH-20X	
UAH-25E	UAH-25X	S25E
UAH-32E	UAH-32X	S32E
UAH-32G	UAH-32Z	S50G
UAH-40G	UAH-40Z	
UAH-50G	UAH-50Z	
UAH-60E	UAH-60Z	
		S60G

\* Terminals for P type must be ordered separately

\* G and W types can be applicable to S16D (1600AF) only.

### Rating plug

Rating plug classification				ACB ampere frame							
Rating plug code	For none NCT type	For NCT type	Rating	800A	1600A	2000A	2500A	3200A	4000A	5000A	6000A
		73263466352	73263466372	400A	400A~ 800A						
	73263466353	73263466373	600A								
	73263466354	73263466374	630A								
	73263466355	73263466375	800A								
	73263466356	73263466376	1000A	800A~ 1600A							
	73263466357	73263466377	1200A								
	73263466358	73263466378	1250A		1000A~ 2000A						
	73263466359	73263466379	1600A								
	73263466360	73263466380	2000A								
	73263466361	73263466381	2500A					1600A~ 3200A			
	73263466362	73263466382	3000A								
	73263466363	73263466383	3200A								
	73263466364	73263466384	3600A								
	73263466365	73263466385	4000A						2000A~ 4000A		
	73263466366	73263466386	5000A								
	73263466367	73263466387	6000A							2500A~ 5000A	
											3000A~ 6000A

\* A rating plug ranging from 50 to 100% of the ACB ampere frame should be used.

\* The minimum value of the OCR self-power supply is based on the CT rating, not the rating plug rating.

## Trip relay

N		G		0	
Trip relay type		Communication & protection		Control voltage & frequency	
N		G		0	
000	Without trip relay	G	Ground fault	0	Self-power only <sup>Note1)</sup> 60Hz
N	Normal	* L/S/I/G configuration as standard - with LED indicators - without output contacts * Ground fault detection by vector sum		5	Self-power only <sup>Note1)</sup> 50Hz
A		G		0	
A	Ammeter	G	Ground fault + ERMS	0	Self-power only 60Hz
		I	Ground fault	1	AC/DC 100V~250V 60Hz
		E	Earth leakage(External CT, Earth leakage over 30A) + ERMS	2	DC 15V~60V 60Hz
		T	Earth leakage(External CT, Earth leakage over 30A)	5	Self-power only 50Hz
		C	Ground fault + Comm. + ERMS	6	AC/DC 100V~250V 50Hz
		Q	Ground fault + Comm.	7	DC 15V~60V 50Hz
		X	Earth leakage(External CT, Earth leakage over 30A) + Comm. + ERMS		
		R	Earth leakage(External CT, Earth leakage over 30A) + Comm.		
		N**	Ground fault (External NCT) + Comm. + ERMS		
		M**	Ground fault (External NCT) + Comm.		
		* L/S/I/G(or Earth leakage) configuration as standard (Unable to select ground fault and earth leakage simultaneously) * Ground fault detection by vector sum(G,C) * Earth leakage system - E,X: External CT - Private ZCT applied(fault current >30A) * Comm. and output contacts DO NOT work under self-power condition. (LED indicators will still function)			
P		C		1	
P	Power meter	C	Ground fault + Comm. + ERMS	1	AC/DC 100V~250V 60Hz
		Q	Ground fault + Comm.	2	DC 15V~60V 60Hz
		X	Earth leakage(External CT, Earth leakage over 30A) + Comm. + ERMS	6	AC/DC 100V~250V 50Hz
		R	Earth leakage(External CT, Earth leakage over 30A) + Comm.	7	DC 15V~60V 50Hz
		N**	Ground fault (External NCT) + Comm. + ERMS		
		M**	Ground fault (External NCT) + Comm.		
		* L/S/I/G(or Earth leakage) configuration as standard (Unable to select ground fault and earth leakage simultaneously) * Ground fault detection by vector sum * Earth leakage system - X: External CT - Private ZCT applied(fault current >30A) * Applicable to generator protection purpose * Comm. and output contacts DO NOT work under self-power condition. (LED indicators will still function)			
S		C		1	
S	Supreme meter	C	Ground fault + Comm. + ERMS	1	AC/DC 100V~250V 60Hz
		Q	Ground fault + Comm.	2	DC 15V~60V 60Hz
		X	Earth leakage(External CT, Earth leakage over 30A) + Comm. + ERMS	6	AC/DC 100V~250V 50Hz
		R	Earth leakage(External CT, Earth leakage over 30A) + Comm.	7	DC 15V~60V 50Hz
		N**	Ground fault (External NCT) + Comm. + ERMS		
		M**	Ground fault (External NCT) + Comm.		
		* L/S/I/G(or Earth leakage) configuration as standard (Unable to select ground fault and earth leakage simultaneously) * Ground fault detection by vector sum * Earth leakage system - X: External CT - Private ZCT applied(fault current >30A) * Applicable to generator protection purpose * Comm. and output contacts DO NOT work under self-power condition. (LED indicators will still function)			

Note) 1. L/S/I/G(or Earth leakage) configuration as standard (Unable to select ground fault and earth leakage simultaneously)

2. Ground fault, earth leakage and pre-trip alarm functions are mutually exclusive.

3. Functions like Metering, Communication, ZSI, Remote reset and Digital output are NOT available only under Self-power condition.

4. P and S types require voltage module to be purchased separately.

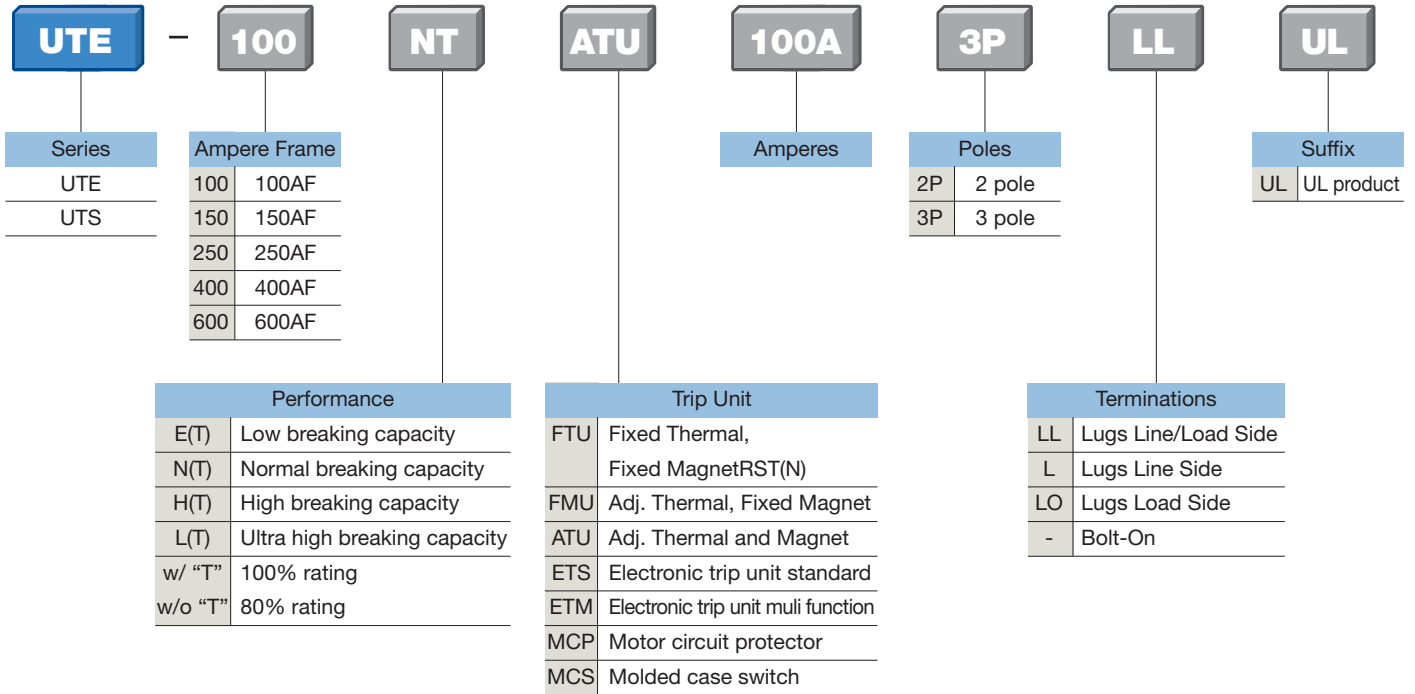




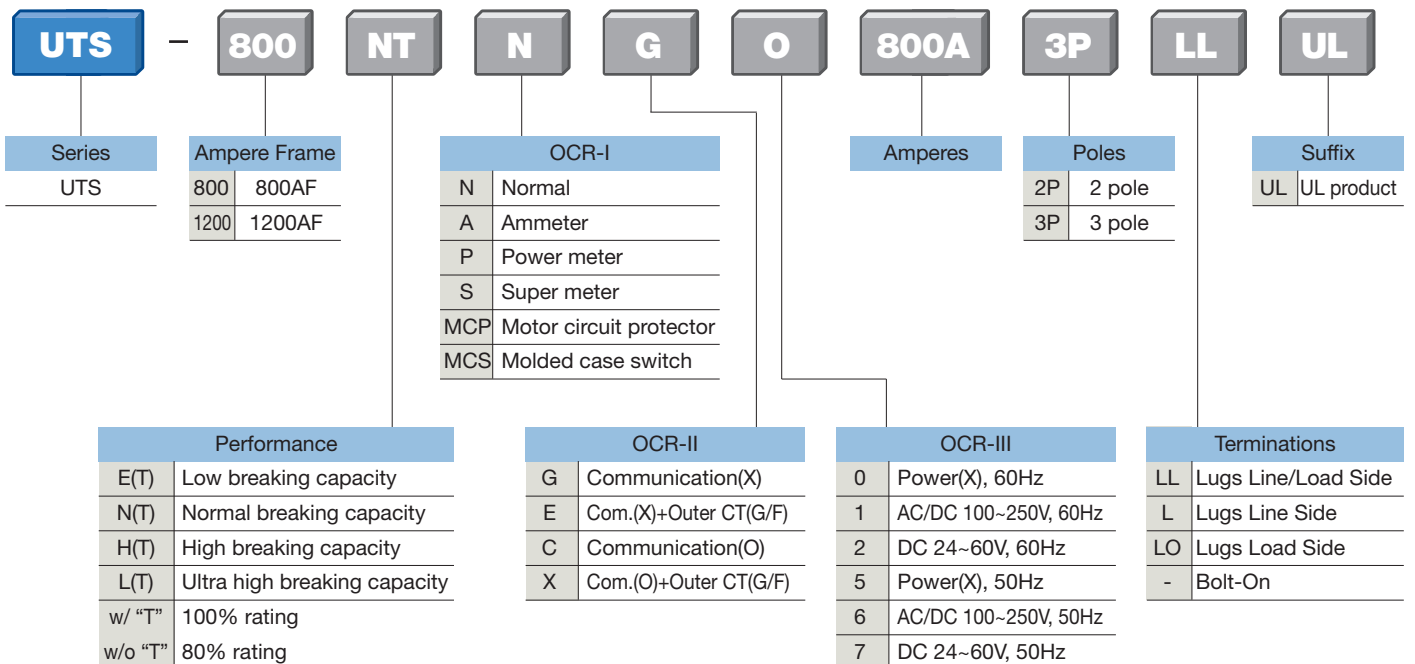
# Molded case circuit breakers

## Numbering system

### UL MCCB 100~600AF



### UL MCCB 800~1200AF



# Miniature circuit breakers

## UL MCB



BK63H-UL 1P

BK63H-UL 2P



BK63HU 1P

BK63HU 2P

BK63HU 3P



BK63H-UL 3P

BK63H-UL 4P



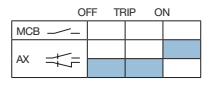
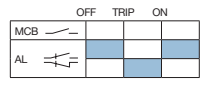
### Ratings



Performance	UL489 MCB	UL1077 MCB
Standard	UL489, UL486E(Lug)	UL 1077
Protection	Overload, Short circuit	Overload, Short circuit
Rated current	1, 2, 3, 4, 6, 10, 16, 20, 25, 32, 40, 50, 63A	1, 2, 3, 4, 6, 10, 16, 20, 25, 32, 40, 50, 63A
Number of poles	1P, 2P, 3P	1P, 2P, 3P, 4P
Rated short circuit capacity	(AC) 1P: 10kA @120/240VAC, 1~63A 2~3P: 10kA @240VAC, 1~63A 1P: 10kA @277VAC, 1~25A 2~3P: 10kA @480Y/277VAC, 1~25A (DC) 1P: 10kA @DC 60V 2~3P: 10kA @DC 125V	1P: 10kA @120/240VAC 6kA @277VAC 2~4P: 10kA @120/240VAC 6kA @480Y/277VAC
Rated frequency	50/60 Hz	50/60 Hz
Reference temperature	40°C	40°C
Normal ambient temperature	-5 ~ 40°C	-5 ~ 40°C
Tripping curve	B, C, D Curve	B, C, D Curve
Trip type	Thermal Magnetic	Thermal Magnetic
Type of terminals	Terminal with stirrup(indirect pressure)	Terminal with stirrup(indirect pressure)
Terminal size acceptability - Min/Max	14 / 4AWG	14 / 4AWG
Tightening Torque	3.9 Nm (35 lbf-in)	2Nm (17.5 lbf-in)
Installation	Mounting on 35mm Din rail	Mounting on 35mm Din rail
Dimension of specimen (W×H×D)	18×105×66 (1P)	18×81×66 (1P)
Protection degree	IP20	IP20
Accessory	AX-HU, AL-HU, SHT-HU, UVT-HU	AX-H, AL-H, SHT-H, UVT-H
Relative humidity	45~85%RH	45~85%RH
Electrical Endurance	6,000	6,000
Maximum switching frequency (time/h)	360/h	360/h
Approvals	UL	UL, CB, CCC

# Miniature circuit breakers



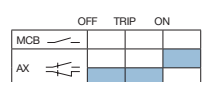
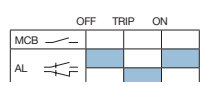
## Accessory / Circuit Diagrams(BK63HU)



### UL489 accessory

Type	AX-HU	AL-HU
Appearance		
Rating	AC circuit	6A at 240V 3A at 415V
	DC circuit	1A at 110V DC 2A at 48V DC
Contact		
Dimension(W×H×D)	9×105×66	

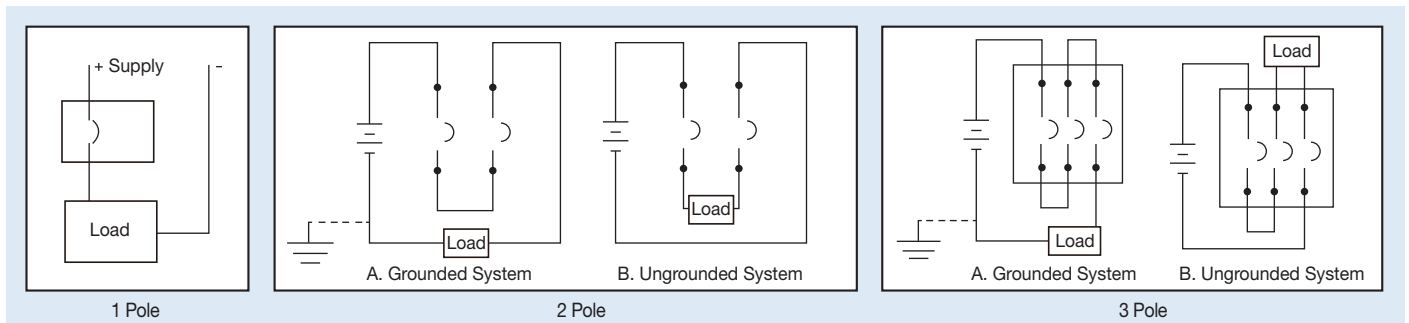
Type	SHT-HU	UVT-HU
Appearance		
Control Voltage [Ue]	AC 110~380V DC 60~220V	AC 110~120V AC 220~240V AC 380~415V
Operation Voltage	80~110% Ue	-
Contact	-	35~70% Ue
Dimension(W×H×D)	18×105×66	

### UL1077 accessory

Type	AX-H	AL-H
Appearance		
Rating	AC circuit	6A at 240V 3A at 415V
	DC circuit	1A at 110V DC
Contact		
Dimension(W×H×D)	9×105×66	

Type	SHT-H	UVT-H
Appearance		
Control Voltage [Ue]	AC 110~380V DC 60~220V	AC 110~120V AC 220~240V AC 380~415V
Operation Voltage	80~110% Ue	-
Contact	-	35~70% Ue
Dimension(W×H×D)	18×105×66	

### Exemplary DC circuit diagrams(BK63HU)

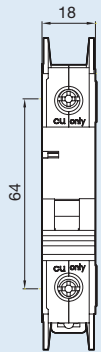
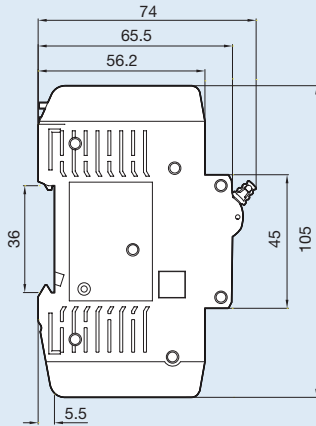




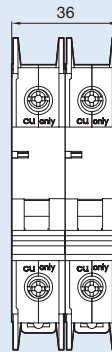
# Dimension / Operating curve

## UL489 MCB

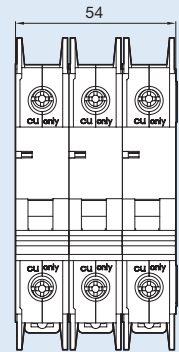
### ● BK63HU



1P : 130g

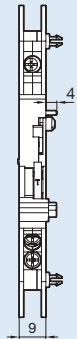
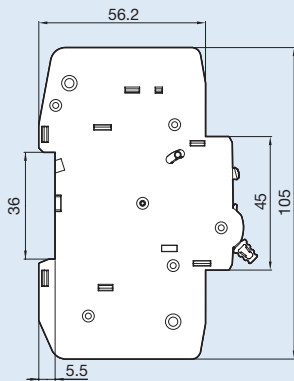


2P : 260g

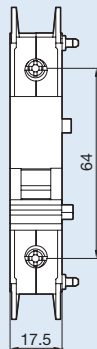
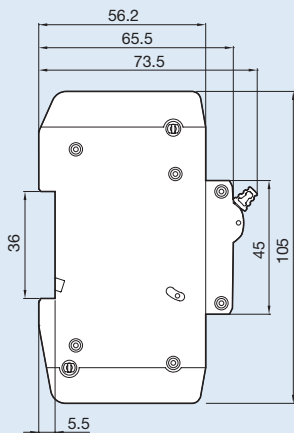


3P : 390g

### ● AX-HU/AL-HU



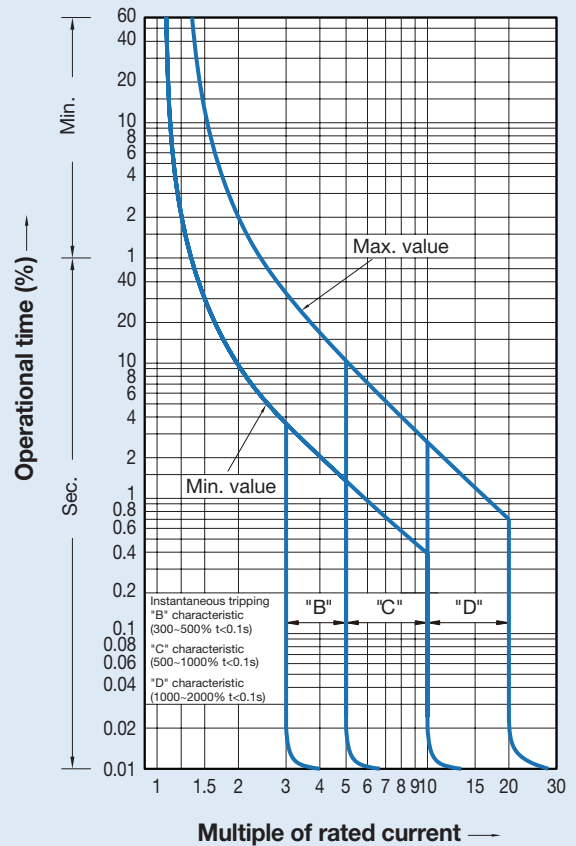
### ● SHT-HU/UVT-HU



SHT : 100g / UVT : 110g

AX : 48g / AL : 48g

UL489 MCB Operating curve

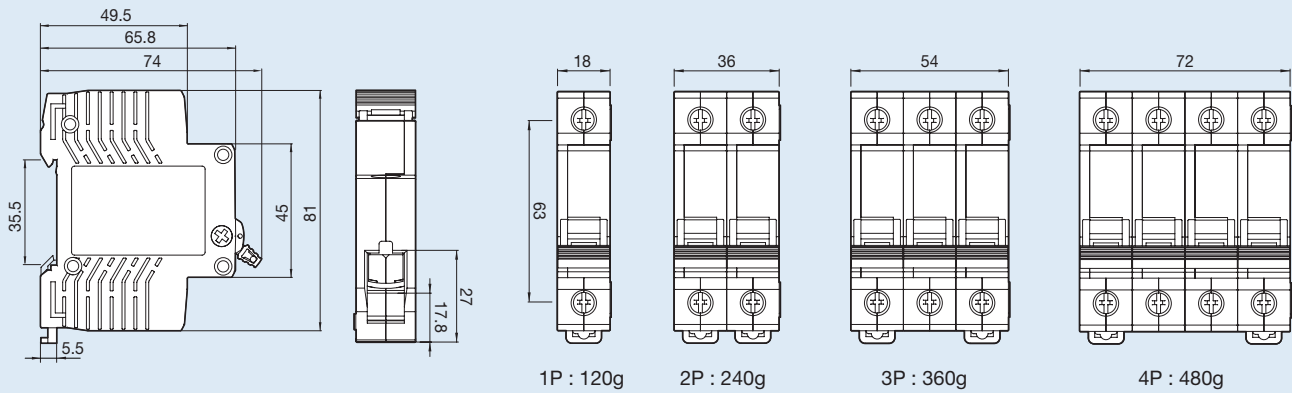


# Miniature circuit breakers

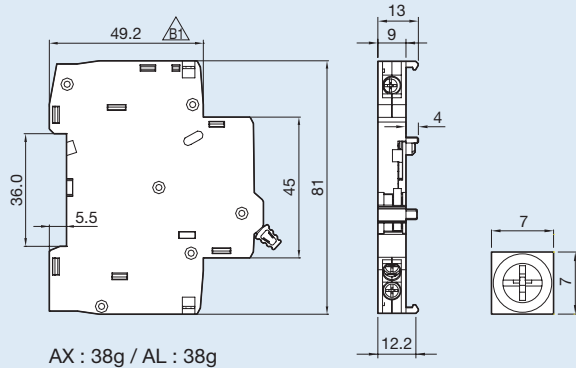
## Dimension / Operating curve

### UL1077 MCB

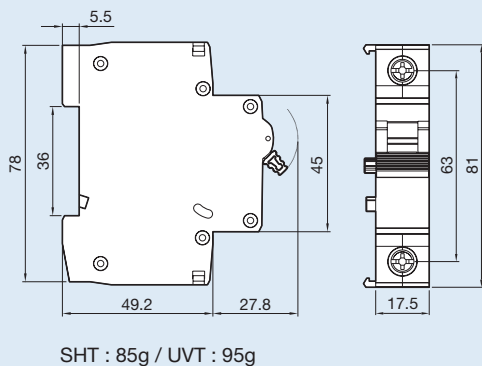
#### ● BK63H



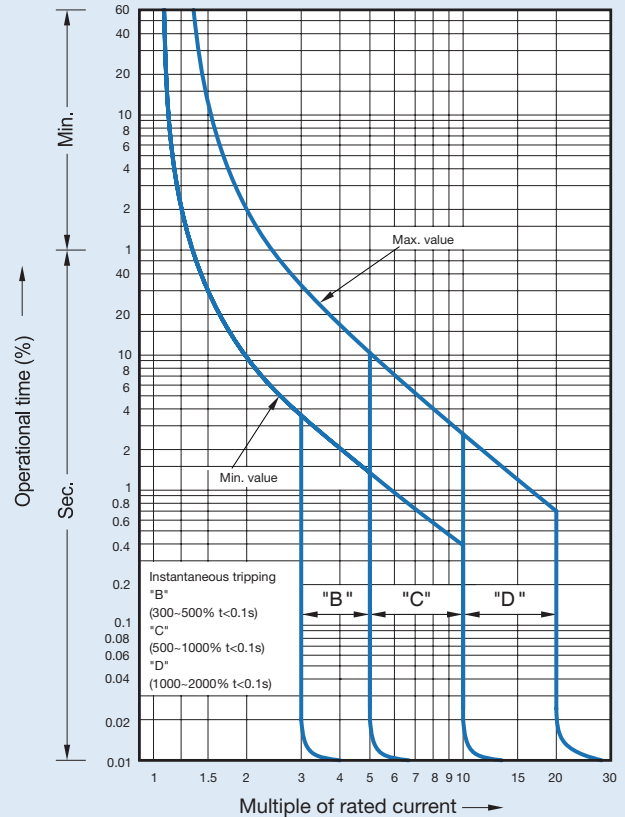
#### ● AX-HU/AL-HU



#### ● SHT-HU/UVT-HU



UL1077 MCB Operating curve



# Numbering system / Accessory connecting

## UL 489 / 1077 MCB

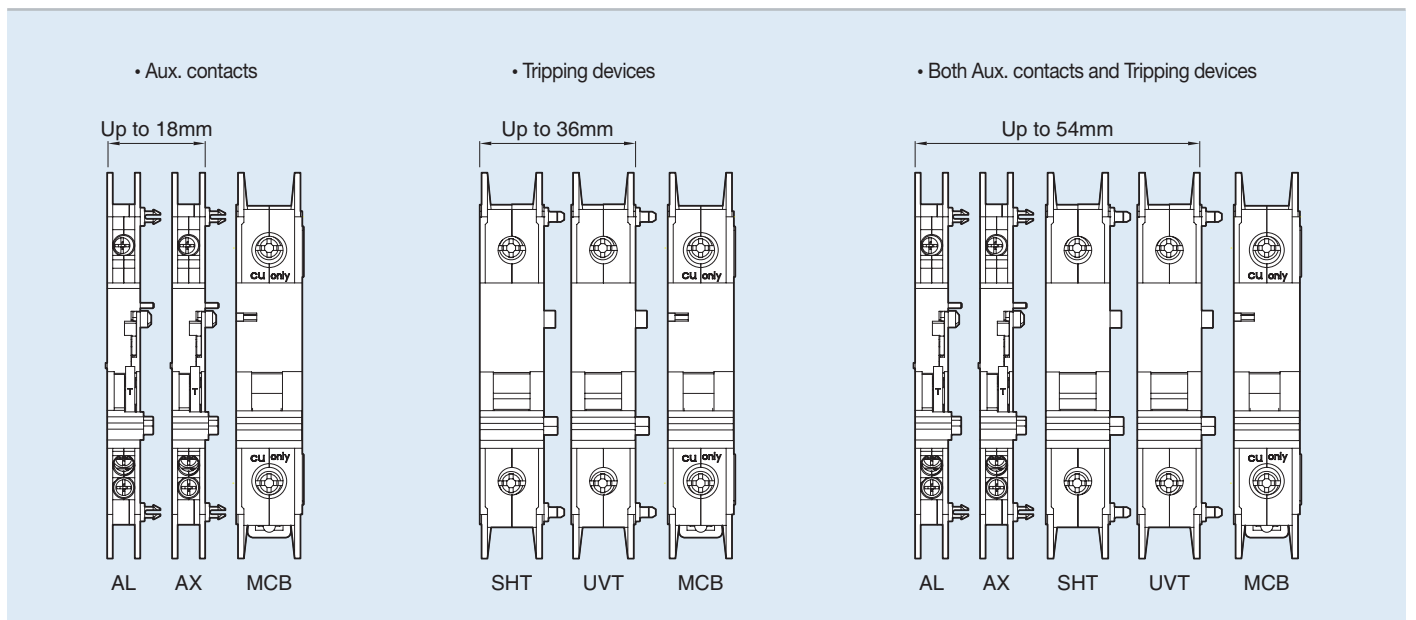
<b>BK</b>	—	<b>63H</b>	<b>U</b>	<b>1P</b>	<b>B</b>	<b>63A</b>	<b>10kA</b>	<b>240VAC</b>	<b>UL489</b>
Series		AF	Standard	Poles	Type	A	kA	Rated voltage	Standard
MCB		63	U   UL489 U   UL1077	1P 2P 3P 4P	B-Type C-Type D-Type	1, 2, 3, 4, 6, 10, 16, 20, 25, 32, 40, 50, 63	6 10	120/240VAC 240VAC 277VAC 480Y/277VAC	UL489 UL1077

<b>AX</b>	
Accessory	
AX	Auxiliary switch
AL	Alarm switch
SHUT	Shunt trip device
UVT	Under voltage trip device

<b>H</b>	
applicable product	
H (UL1077)	BK63H
HU (UL489)	BK63HU

<b>UL1077</b>	
applied standard	
UL1077	UL1077
UL489	UL489

## Accessory connecting



# Contactors & Overload relays

## Metasol MC 3P 18 to 150A

### MC type Magnetic Contactors



Frame size				18AF				22AF			
Type	screws clamp terminals			MC-6a	MC-9a	MC-12a	MC-18a	MC-9b	MC-12b	MC-18b	MC-22b*
Number of poles	3pole			●	●	●	●	●	●	●	●
Rated operational voltage, U <sub>e</sub>	600V										
Rated insulation voltage, U <sub>i</sub>	690V										
Rated frequency	50/60Hz										
Rated impulse withstand voltage, U <sub>imp</sub>	6kV										
Maximum operating rate in operating cycles per hour(AC3)	1800 operations per hour										
Durability	Mechanical			15 mil. operations				15 mil. operations			
	Electrical			2.5 mil. operations				2.5 mil. operations			
UL rating (50/60Hz)	Continuous current		A	25	25	25	32	25	25	40	40
	Single phase	110~120V	HP	0.5	0.5	0.75	1	0.5	0.75	1	2
		220~240V	HP	1.5	1.5	2	3	1.5	2	3	3
	Three phase	200~208V	HP	2	2	3	7.5	2	3	7.5	7.5
		220~240V	HP	3	3	5	7.5	3	5	7.5	10
		440~480V	HP	5	5	7.5	10	5	7.5	10	15
	550~600V	HP	7.5	7.5	10	15	7.5	10	15	20	
NEMA size			00	00	0	1	00	0	1		
Size and weight	AC control	Weight	kg	0.33				0.34			
		Size	inch	1.77×2.89×3.17				1.77×2.89×3.44			
	DC control	Weight	kg	0.5				0.51			
		Size	inch	1.77×2.89×3.80				1.77×2.89×4.08			
W×H×D		(mm)	(45×73.5×80.4)				(45×73.5×87.4)				
W×H×D		(mm)	(45×73.5×96.6)				(45×73.5×103.6)				
Auxiliary(standard)				<b>1NO or 1NC</b>				<b>1NO1NC</b>			
Auxiliary				UA-1				UA-1			
Front mount				UA-2, UA-4				UA-2, UA-4			

Note) Minimum conduct current of Auxiliary contactor is DC 17V 5mA.

### MT type Thermal Overload Relays



Type				MT-12/□		MT-32/□	
Screws clamp terminals				●		●	
Rated operational voltage, U <sub>e</sub>				690V		690V	
Rated insulation voltage, U <sub>i</sub>				690V		690V	
Rated impulse withstand voltage, U <sub>imp</sub>				6kV		6kV	
Trip class				10A, 20		10A, 20	
Setting range				0.1~18A		0.1~40A	
Size and weight		Weight	kg	0.1		0.17	
		Size	inch	1.77×2.88×2.51		1.77×2.95×3.54	
		W×H×D	(mm)	(45×73.2×63.7)		(45×75×90)	

\* The safety cover of magnetic contactor and thermal overload relay is optional.



40AF	
MC-32a	MC-40a
●	●
3pole	
600V	
1000V	
50/60Hz	
8kV	
1200 operations per hour	
12 mil. operations	
2 mil. operations	
50	60
2	3
5	7.5
7.5	15
10	15
20	30
25	30
1P	2
0.4	
1.77×3.27×3.54	
(45×83×90)	
0.6	
1.77×3.27×4.61	
(45×83×117.1)	

65AF	
MC-50a	MC-65a
●	●
3pole	
600V	
1000V	
50/60Hz	
8kV	
1200 operations per hour	
12 mil. operations	
2 mil. operations	
70	100
3	5
10	15
20	25
25	30
40	50
50	60
0.9	
2.17×4.17×4.69	
(55×106×119)	
1.2	
2.17×4.17×5.76	
(55×106×146.4)	

100AF		
MC-75a	MC-85a	MC-100a
●	●	●
3pole		
600V		
1000V		
50/60Hz		
8kV		
1200 operations per hour		
12 mil. operations		
2 mil. operations		
110	135	160
5	7.5	10
15	15	20
25	30	30
30	40	40
50	60	75
60	75	75
1.6		
2.76×5.51×5.35		
(70×140×135.8)		
2.6		
2.76×5.51×6.78		
(70×140×172.3)		

150AF	
MC-130a	MC-150a
●	●
3pole	
600V	
1000V	
50/60Hz	
8kV	
1200 operations per hour	
5 mil. operations	
1 mil. operations	
200	250
10	15
20	25
40	40
40	50
75	100
75	75
2.4	
3.74×6.22×5.13	
(95×158×130.3)	
2.3	
3.74×6.22×5.13	
(95×158×130.3)	

UA-1	
UA-2, UA-4	

UA-1	
UA-2, UA-4	

UA-1	
UA-2, UA-4	

UA-1	
UA-2, UA-4	



MT-32/□	
●	
690V	
690V	
6kV	
10A, 20	
0.1~40A	
0.17	
1.77×2.95×3.54	
(45×75×90)	

MT-63/□	
●	
690V	
690V	
6kV	
10A, 20	
4~65A	
0.31/0.33	
2.77×3.19×3.94	
(55×81×100)	

MT-95/□	
●	
690V	
690V	
6kV	
10A, 20	
7~100A	
0.48/0.5	
2.76×3.82×4.33	
(70×97×110)	

MT-150/□	
●	
690V	
690V	
6kV	
10A, 20	
34~150A	
0.67	
3.74×4.29×4.45	
(95×109×113)	

# Contactors & Overload relays

## Metasol MC 3P 225 to 2100A

### MC type Magnetic Contactors



Frame size			
Type	screws clamp terminals		
Number of poles	3pole		
Rated operational voltage, Ue	600V		
Rated insulation voltage, Ui	1000V		
Rated frequency	50/60Hz		
Rated impulse withstand voltage, Uimp	8kV		
Maximum operating rate in operating cycles per hour(AC3)	1200 operations per hour		
Durability	Mechanical	5 mil. operations	
	Electrical	1 mil. operations	
UL rating (50/60Hz)	Continuous current	A	
	Single phase	110~120V	HP
		220~240V	HP
	Three phase	200~208V	HP
		220~240V	HP
		440~480V	HP
	550~600V	HP	
NEMA size			
Size and weight	AC control	Weight	kg
	DC control	Size	inch
		W×H×D	(mm)
	DC control	Weight	kg
Size		inch	
W×H×D (mm)			
Auxiliary(standard)			
Auxiliary	Side mount Front mount		



225AF	
MC-185a	MC-225a
●	●
3pole	
600V	
1000V	
50/60Hz	
8kV	
1200 operations per hour	
5 mil. operations	
1 mil. operations	
300	350
15	15
30	40
60	60
60	75
125	150
125	150
5.4	
5.43×7.99×7.29	
(138×203×185.1)	
2NO2NC	
AU-100 (Max.4NO4NC), AU-100E	
-	

400AF		
MC-265a	MC-330a	MC-400a
●	●	●
3pole		
600V		
1000V		
50/60Hz		
8kV		
1200 operations per hour		
5 mil. operations		2.5 mil. operations
1 mil. operations		0.5 mil. operations
400	500	520
-	-	-
-	-	-
75	100	125
100	100	150
200	200	300
200	200	300
5		
9.2		
6.48×9.92×8.05		
(163×243×204.4)		
2NO2NC		
AU-100 (Max.4NO4NC), AU-100E		
-		

### MT type Thermal Overload Relays



Type	Screws clamp terminals		
Rated operational voltage, Ue	690V		
Rated insulation voltage, Ui	690V		
Rated impulse withstand voltage, Uimp	6kV		
Trip class	10A, 20		
Setting range	65~240A		
Size and weight	Weight	kg	
	Size	inch	
W×H×D (mm)			



MT-225/□	
●	
690V	
690V	
6kV	
10A, 20	
65~240A	
2.5	
5.79×5.55×7.24	
(147×141×184)	

MT-400/□	
●	
690V	
690V	
6kV	
10A, 20	
85~400A	
2.6	
5.94×6.73×7.79	
(151×171×198)	

\* The safety cover of magnetic contactor and thermal overload relay is optional.



800AF		
MC-500a	MC-630a	MC-800a
●	●	●
3pole		
600V		
1000V		
50/60Hz		
8kV		
1200 operations per hour		
2.5 mil. operations		
0.5 mil. operations		
700	900	1050
-	-	-
-	-	-
150	200	200
200	250	300
400	500	600
400	500	600
6		7

1260AF
MC-1260a
●
3pole
1000V
1000V
50/60Hz
8kV
300 operations per hour
0.5 mil. operations
0.5 mil. operations
1260
-
-
-
-
-
-
-
-
-

2650AF			
MC-1400a	MC-1700a	MC-2100a	MC-2650a
●	●	●	●
3pole			
1000V			
1000V			
50/60Hz			
8kV			
300 operations per hour			
0.5 mil. operations			0.3 mil. operations
0.05 mil. operations			0.02 mil. operations
1400	1600	2100	2650
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

22.2		
11.22×12.2×9.68		
(285×310×246)		

24
11.22×13.86×9.68
(285×352×246)

33.8		
16.97×14.96×9.68		
(431×380×246)		
47		
16.97×15.43×9.68		
(431×392×246)		

2NO2NC
AU-100 (Max.4NO4NC), AU-100E
-

2NO2NC
AU-100, AU-100E (Max.4NO4NC)
-

2NO2NC
AU-100, AU-100E (Max.4NO4NC)
-



MT-800/□
●
690V
690V
6kV
10A, 20
200-800A
11.5
14.17×20.87×8.35
(360×530×212)

# Contactors

## Metasol MC 4P 18 to 85A

### MC type Magnetic Contactors



Frame size				18AF				
Type		Screw clamp terminal		MC-6a/4	MC-9a/4	MC-12a/4	MC-18a/4	
Number of poles				4pole				
Rated operational voltage (Ue)				600V				
Rated insulation voltage (Ui)				690V				
Rated frequency				50/60Hz				
Rated impulse withstand voltage, Uimp				6kV				
Maximum operating rate in operating cycles per hour(AC1)				1800 operations per hour				
Durability		Mechanical		15 mil. Operations				
Electrical				0.5 mil. Operations		0.8 mil. Operations		
UL rating (50/60Hz)	Continuous current		A	25	25	25	32	
	Single	110~120V	HP	0.5	0.5	0.75	1	
		Phase	220~240V	HP	1.5	1.5	2	3
			200~208V	HP	2	2	3	7.5
	Three	220~240V	HP	3	3	5	7.5	
		Phase	440~480V	HP	5	5	7.5	10
		550~600V	HP	7.5	7.5	10	15	
Size and weight	AC	Weight	kg	0.33				
		Control	Size	inch	1.77×2.89×3.77			
			W×H×D	(mm)	(45×73.5×80.4)			
	DC	Weight	kg	0.5				
		Control	Size	inch	1.77×2.89×3.80			
			W×H×D	(mm)	(45×73.5×96.6)			
Auxiliary(standard)				-				
Auxiliary		Side Mount		UA-1				
		Front Mount		UA-2, UA-4				







22AF
MC-22a/4
●
4pole
600V
690V
50/60Hz
6kV
1800 operations per hour
15 mil. Operations
1 mil. Operations
32
2
3
7.5
7.5
10
15
0.4
1.86×3.15×3.42 (47.2×80×86.8)
0.5
1.86×3.15×4.47 (47.2×80×113.2)
-
AU-1
UA-2, UA-4

40AF	
MC-32a/4	MC-40a/4
●	
4pole	
600V	
690V	
50/60Hz	
6kV	
1800 operations per hour	
15 mil. Operations	
1 mil. Operations	
45	50
2	3
5	5
7.5	10
10	10
20	25
20	25
0.59	
2.32×3.29×3.72 (59×83.5×94.5)	
0.7	
2.32×3.29×4.76 (59×83.5×121)	
-	
AU-1	
UA-2, UA-4	

85AF			
MC-50a/4	MC-65a/4	MC-75a/4	MC-85a/4
●			
4pole			
600V			
1000V			
50/60Hz			
8kV			
1800 operations per hour			
12 mil. Operations			
1 mil. Operations			
70	80	90	100
3	5	5	7.5
7.5	10	15	15
10	15	20	25
15	20	25	30
30	40	50	50
30	40	50	50
1.2			
3.58×4.86×4.64 (91×123.5×117.8)			
1.29			
3.58×4.86×4.64 (91×123.5×117.8)			
-			
AU-1			
UA-2, UA-4			

# Contactors

## Metasol MC 4P 225 to 800A

### MC type Magnetic Contactors



Frame size			
Type	Screw clamp terminal		
Number of poles	4pole		
Rated operational voltage (Ue)	600V		
Rated insulation voltage (Ui)	1000V		
Rated frequency	50/60Hz		
Rated impulse withstand voltage, Uimp	8kV		
Maximum operating rate in operating cycles per hour(AC1)	1200 operations per hour		
Durability	Mechanical		
Electrical	0.8 mil. Operations		
UL rating (50/60Hz)	Continuous current	A	
	Single	110~120V	HP
	Phase	220~240V	HP
		200~208V	HP
	Three	220~240V	HP
	Phase	440~480V	HP
Size and weight	AC	Weight	kg
		Control Size	inch
	DC	W×H×D	(mm)
		Weight	kg
		Control Size	inch
		W×H×D	(mm)



225AF				
MC-100a/4	MC-130a/4	MC-150a/4	MC-185a/4	MC-225a/4
●				
4pole				
600V				
1000V				
50/60Hz				
8kV				
1200 operations per hour				
5 mil. Operations				
0.8 mil. Operations				
200	250	275	300	350
7.5	10	15	15	15
15	20	25	30	40
30	40	40	60	60
30	40	50	60	75
60	75	100	125	150
60	75	100	125	150
5.6				
6.89×7.99×7.28				
(175×203×185)				
2NO2NC				
AU-100				
-				

\* - FLA = 722 A, LRA = 5618 A  
 \*\* - FLA = 566 A, LRA = 4495 A



400AF		
MC-265a/4	MC-330a/4	MC-400a/4
●		
4pole		
600V		
1000V		
50/60Hz		
8kV		
1200 operations per hour		
2.5 mil. Operations		
0.5 mil. Operations		
400	500	520
-	-	-
-	-	-
75	100	125
100	100	150
200	200	300
200	200	300

800AF		
MC-500a/4	MC-630a/4	MC-800a/4
●		
4pole		
600V		
1000V		
50/60Hz		
8kV		
1200 operations per hour		
2.5 mil. Operations		
0.5 mil. Operations		
700	900	1050
-	-	-
-	-	-
150	200	200
200	250	300
400	500	600 *
400	500	600 **

2NO2NC	
AU-100	
-	

2NO2NC	
AU-100	
-	

9.9  
8.11×9.57×8.07  
(206×243×205)

26.3  
13.62×12.20×9.61  
(346×310 ×244)

# Contactors

## Metasol MC 3P 1260 to 2650A



### Renewable Magnetic Contactor

- Eco-friendly contact material applied (Cd free)
- Type 2 coordination data with MCCB or ACB

Frame size			
Type	Screw clamp terminals		
Number of poles		pole	
Rated operational voltage (Ue)		Vac	
Rated insulation voltage (Ui)		Vac	
Rated frequency		Hz	
Rated impulse withstand voltage (Uimp)		kV	
Mechanical operating cycle		cycles/hour	
Electrical operating cycle		cycles/hour	
Durability	Mechanical	million	
	Electrical (AC-1@690V)	million	
	Electrical (AC-1@400V)	million	
Current and Power (IEC)	AC-1 1000V 55/60/70°C	A	
	Thermal current	A	
	Heat dissipation	W	
Rated Short-time withstand current(Icw) (IEC 60947)	1s	A	
	10s	A	
	1min	A	
	10min	A	
max. breaking capacity (Icd)	400V	A	
	690V	A	
	1000V	A	
Type-2 Coordination (with MCCB or ACB)		kA	
Current and HP (UL)	Thermal current		
	Single phase	110~120V	HP
		220~240V	HP
	Three phase	200~208V	HP
		220~240V	HP
		440~480V	HP
550~600V		HP	
Weight (kg)			
Size (W×H×D)		mm	
<b>Auxiliary(standard)</b>			
Auxiliary	Side Mount		
	Front Mount		

			1260AF		
			MCI-900	MCI-1050	MCI-1260
				●	
				3	
				1000	
				1000	
				50/60	
				8	
			600	600	300
			600	600	300
			100	100	50
			26	26	15
			50	50	20
			900/850/700	1050/875/720	1260/1060/900
			900	1050	1260
			100	170	170
			7000	7500	8000
			6400	7000	7200
			3500	3800	4000
			1550	1550	2300
			6000	7500	7500
			5000	7000	7000
			2000	2500	2500
			42kA (Break time: less than 20ms)		
			900	1050	1260
			-	-	-
			-	-	-
			200	200	-
			250	300	-
			500	600	-
			500	600	-
			22.2	22.2	25
			285×310×246	285×310×246	285×352×246
			<b>2NO2NC</b>		
			AU-100, AU-100E (max.4a4b)		
			-		



2650AF		
MCI-1700	MCI-2100	MCI-2650
	●	
	3	
	1000	
	1000	
	50/60	
	8	
	300	
300	300	120
50	50	30
5	5	2
5	5	5
1700/1450/1300	2100/1750/1500	2650/2350/2150
1700	2100	2650
220	350	350
	12000	
	10000	
	5500	
	3000	
9000	12000	1200
8000	8500	8500
3000	3150	3150
42kA (Break time: less than 50ms)		
1700	2100	2650
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
34.6	34.6	47
431×380×246	431×380×246	431×392×246

2NO2NC		
AU-100, AU-100E (max.4a4b)		

# Contactors & Overload relays

## Numbering system

### Contactors

<b>MC-65A</b>		-	<b>40</b>		-	<b>22</b>		-	<b>K7</b>		-	<b>L</b>	
<b>Product (6A~2650A)</b>			<b>Main contact</b>			<b>Auxiliary contact</b>			<b>Coil voltage</b>			<b>Terminal <sup>Note2)</sup></b>	
MC6A	MC-6a		30	3NO0NC		00	None		See coil code table			S	Screw
·	·		40	4NO0NC		11	Normal 1NO normal 1NC		<i>Note) MC catalog reference 23 for details</i>		L	Lug	
MC2650A	MC-2650a		22	2NO2NC		22	Normal 2NO normal 2NC			B	hex Bolt		
MC6B	MC-6b					11L	Low current 1NO Low current 1NC						
·	·					22L	Low current 2NO Low current 2NC						
MC22B	MC-22b					11H	Hoist 1NO normal 1NC						
						22H	Hoist 2NO normal 2NC						

- A : Metasol A Type  
- B : Metasol B Type

ex)

MC65A-30-00-Q7-S-E	MC-65a AC380V 50/60Hz SCREW (Metasol) EXP
MC75A-30-22-H7-L-E	MC-75a AC100V 50/60Hz LUG 2a2b (Metasol) EXP
MC185A-30-22-FV-B-E	MC-185a AC100-240V 50/60Hz, DC100-220V 2a2b (Metasol) EXP
MC85A-40-00-M7-S-E	MC-85a AC220V 50/60Hz 4P (Metasol) EXP
MC800A-40-22-EV-B-E	MC-800a AC/DC200V 2a2b 4P (Metasol) EXP

Note2)

3Pole

S: Screw with Phillips head; Bare wire or fork terminal are accessible. (Applied model : MC6a to MC150a)

L: Box Lug ; Bare wire is accessible. (Applied model : MC50a to MC150a)

B: Screw with hex Bolt head; Ring terminal or fork terminal are accessible (Applied model : MC185a to MC2100a)

4Pole

S: Screw with Phillips head; Bare wire or fork terminal are accessible. (Applied model : MC6a to MC85a)

L : X

B : Screw with hex Bolt head; Ring terminal or fork terminal are accessible (Applied model : MC100a to MC800a)

### Renewable Contactors

<b>MCi-900</b>		-	<b>AC 300V</b>		-	<b>50/60Hz</b>		-	<b>2NO2NC</b>	
<b>Rated current</b>			<b>Coil voltage</b>			<b>Frequency</b>			<b>Auxiliary contact</b>	
900	900A		AC 300V			50/60Hz			2NO2NC	
·	·		·			·			·	
2650	2650A		AC 100~240V			·			·	
			DC 100~220V			·			·	

## Contactor relays

<b>MR4</b>	-	<b>22L</b>	-	<b>B7</b>
<b>Product</b>		<b>Main contact</b>		<b>Coil voltage</b>
MR4 MR-4 MR6 MR-6 MR8 MR-8		00 None 13 Normal 1NO normal 3NC 22 Normal 2NO normal 2NC 22L Low current 2NO low current 2NC 44 Normal 4NO normal 4NC 44L Low current 2NO low current 2NC		See coil code table <i>Note) MC catalog reference 23 for details</i>

<b>ex)</b>	MR4-22-B7-E	MR-4 AC24V 50/60Hz 2a2b (Metasol) EXP
	MR6-42-JD-E	MR-6 DC12V 4a2b (Metasol) EXP
	MR8-44-MD-E	MR-8 DC220V 4a4b (Metasol) EXP

## Thermal overload relay

<b>MT-12</b>	-	<b>2H</b>	-	<b>0.1</b>
<b>Rated current</b>		<b>Relay version</b>		<b>Relay setting current</b>
12 12AF 32 32AF 63 63AF 95 95AF ⋮ 800 800AF		3H Non-differential (3-heater) 3K Differential 3D Class 20		0.1 0.1A ⋮ 800 800A

## Enclosed motor starters

<b>MW22B</b>	-	<b>M</b>	-	<b>B</b>
<b>Product</b>		<b>Material</b>		<b>Material</b>
MW6A MW-6a ⋮ MW100A MW-100a  MW9B MW-9b ⋮ MW22B MW-22b		- Iron  M Mold		- None  B Button

<b>ex)</b>	MW32aB-30-22-M7-21.5-3H-S-E	MW-32aB AC220V 50/60Hz SCREW 2a2b 21.5A 3H (Metasol) EXP
	MW32a-30-22-N5-34-3H-S-E	MW-32a AC415V 50Hz SCREW 2a2b 34A 3H (Metasol) EXP
	MW22BMB-11-Q7-19-SH-S-E	MW-22bMB AC380V 50/60Hz SCREW 1a1b 19A 3H (Metasol) EXP

Main Coil Voltage											
AC						DC		Semi-electric (AC)		Electric (AC/DC)	
50Hz		60Hz		50/60Hz				50/60Hz			
Coil Voltage(V)	code	Coil Voltage(V)	code	Coil Voltage(V)	code	Coil Voltage(V)	code	Coil Voltage(V)	code	Coil Voltage(V)	code
24V	B5	24V	B6	24V	B7	12V	JD	100~120	HF	24 (AC24~25 50/60Hz, DC24)	AV
48V	E5	48V	E6	48V	E7	24V	BD	220~240	MU	48 (AC48~50 50/60Hz, DC24)	BV
110V	F5	110V	F6	110V	F7	48V	ED	265~347	OQ	24/48 (AC24~50 50/60Hz, DC100~110)	CV
220V	M5	220V	M6	220V	M7	110V	FD	380~440	OV	100/200 (AC100~240 50/60Hz, DC100~220)	FV
380V	Q5	380V	Q6	380V	Q7	125V	GD	440~575	S7	100/200 (AC100~240 50/60Hz, DC100~220)	DV
415V	N5	415V	N6	415V	N7	220V	MD				EV
440V	R5	440V	R6	440V	R7	240V	OD				GV

\* MC catalog reference 23 for details

# Contactors & Overload relays

## Numbering system

### Optional Accessories

#### Auxiliary contact unit



Version		Contact composition	
UA-1	Side mount	11	1NO+1NC
AU-100		20	2NO
AU-100E		02	2NC
UA-2	Front mount(2P)	40	4NO
UA-4	Front mount(4P)	31	3NO+1NC
		22	2NO+2NC
		13	1NO+3NC
		04	4NC

Note) UA-2: 2NO, 1NO1NC, 2NC  
 UA-4: 4NO, 3NO1NC, 4NC,  
 2NO2NC, 1NO3NC,

#### Surge absorber



Product composition		Voltage	
Varistor+RC	1	AC 24~48V	
Varistor+RC	2	AC 100~125V	
Varistor+RC	3	AC 200~240V	
Varistor+RC	4	DC 24~48V	
Varistor+RC	5	DC 100~125V	
Varistor+RC	6	DC 200~220V	
Varistor	11	AC/DC 24~48V	
Varistor	12	AC/DC 100~125V	
Varisto	13	AC/DC 200~240V	
Varistor	14	AC/DC 380~440V	
RC	22	AC 100~125V	

Note) MC catalog reference 82 for details

#### Interlock unit



Product	Contact composition	
02	2NC	
00	None	

#### Wire kit for Interlocking



Product	Rated current	
18	18AF	
22	22AF	
32	40AF	
63	65AF	
95	100AF	

#### Separate mounting unit (For relay)



Product	Rated current	
12	12AF	
32	32AF	
63	63AF	
95	95AF	
150	150AF	

#### Remote reset unit (For relay)















Product	Cable length	
12	12AF	
32	32AF	
63	63AF	





# Mini contactors

## 6 to 12A

Mini contactors					
3NO main contacts 1 auxiliary contacts		<b>Screw clamp type</b>	<b>Fast-on type</b>	<b>Cage clamp type</b>	
Frame size		6A	9A	12A	
Screw clamp type	AC coil	GMC-6M	GMC-9M	GMC-12M	
	DC coil	GMD-6M	GMD-9M	GMD-12M	
Fast-on type	AC coil	GMC-6MF	GMC-9MF	GMC-12MF	
	DC coil	GMD-6MF	GMD-9MF	GMD-12MF	
Cage clamp type	AC coil	GMC-6MC	GMC-9MC	GMC-12MC	
	DC coil	GMD-6MC	GMD-9MC	GMD-12MC	
Solder pin type	AC coil	GMC-6MP	GMC-9MP	GMC-12MP	
	DC coil	GMD-6MP	GMD-9MP	GMD-12MP	
Ratings / UL508		hp	A	hp	A
continuous current		I <sub>th</sub> = 20A (maximum for cage clamp type is 10A)			
single phase	120V	1/2	1/2	1 *	
	230V/240V	1	1.5	2 **	
three phase	240V	1.5	3	3	
	480V	3	5	7.5 ***	
	600V	3	5	7.5	
Wire Range : Copper, 75°C, Stranded, 18-12AWG					
NEMA size		00	00	00	
Additional auxiliary contacts		<b>Screw clamp type</b>	<b>Fast-on type</b>	<b>Cage clamp type</b>	
	2-pole, Front mount	AU-2M 	AU-2MF 	AU-2MC 	
	4-pole, Front mount	AU-4M 	AU-4MF 	AU-4MC 	
	2-pole, Side mount	AU-1M 	AU-1MF 	AU-1MC 	

Note) \* = 1/2 for cage clamp type  
 \*\* = 1.5hp for cage clamp type  
 \*\*\* = 5hp for cage clamp type  
 16AF : not approved from UL

## Overload Relays

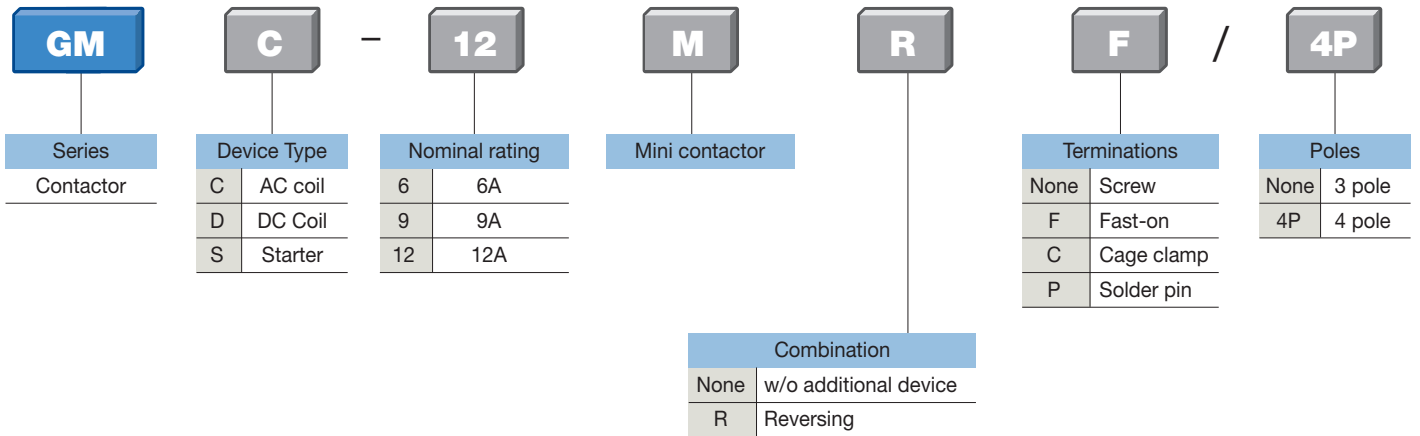
Bimetallic style Type GT		<b>Setting ranges (A)</b>	0.1 - 0.16 0.16 - 0.25 0.25 - 0.4 0.4 - 0.63 0.63 - 1 1 - 1.6 1.6 - 2.5 2.5 - 4	4 - 6 5 - 8 6 - 9 7 - 10 9 - 13 12 - 16		Base for separate mount
	Differential	GTK-12M				
	Non-differential (3-heater)	GTH-12M/3				
	Non-differential (2-heater)	GTH-12M				

# Mini contactors

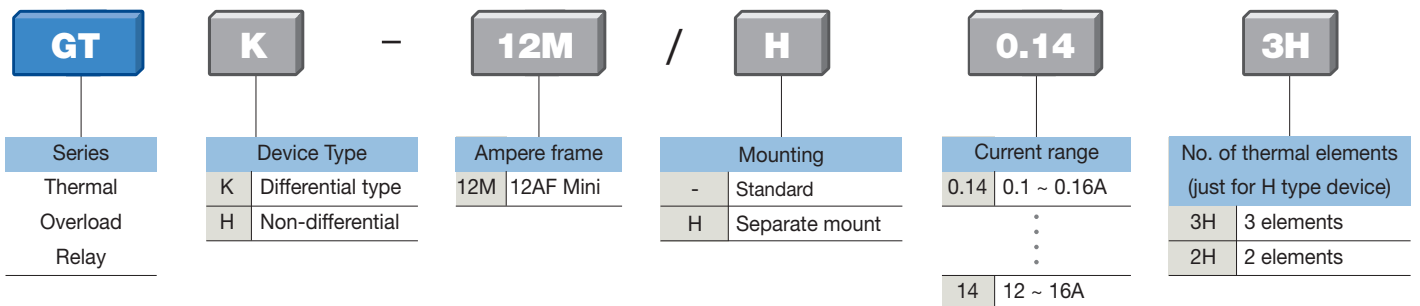
## Numbering system

### Mini-MC / TOR series

#### Catalog Numbering [Mini-MC]



#### Catalog Numbering [Mini-TOR]



# Manual motor starters

## Technical information

### Manual motor controller (UL 508, CSA C22.2 as Manual motor controllers)

#### Combination Motor Controller

- Group Installation
- Type E starter



#### MMS 32S

Rated operational current I <sub>e</sub> [A]		0.16	0.25	0.4	0.63	1	1.6	2.5	4	6	8	10	13	17	22	26	32	40	
<b>Max. short-circuit current</b>																			
240V	[kA]	100	100	100	100	100	100	100	100	100	100	50	50	40	30	30	20	20	
480V	[kA]	50	50	50	50	50	50	50	50	25	25	10	10	10	10	7.5	7.5	7.5	
600V	[kA]	10	10	10	10	10	10	10	5	5	5	5	5	5	5	5	5	5	
<b>Motor load</b>																			
1 Phase	115V	[HP]	-	-	-	-	-	-	1/8	1/4	1/3	1/2	1/2	1	1½	2	2	3	
	230V	[HP]	-	-	-	-	1/10	1/6	1/3	1/2	1	1½	2	3	3	3	5	7½	
3 Phase	200V	[HP]	-	-	-	-	-	1/2	3/4	1	2	2	3	3	5	7½	7½	10	
	230V	[HP]	-	-	-	-	-	1/2	3/4	1½	2	3	3	5	7½	7½	10	10	
	460V	[HP]	-	-	-	-	3/4	1	2	3	5	5	7½	10	15	15	20	30	
	575V	[HP]	-	-	-	-	1/2	3/4	1½	3	5	5	7½	10	15	20	20	30	30
<b>Max. fuse size</b>		[A]	1	1	1	1	3	6	10	15	20	30	40	50	60	80	100	125	125
<b>Max. breaker size</b>		[A]	15	15	15	15	15	15	15	20	30	40	50	60	80	100	125	125	

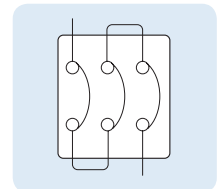
#### MMS 63S

Rated operational current I <sub>e</sub> [A]		10	13	17	22	26	32	40	50	63	65	
<b>Max. short-circuit current</b>												
240V	[kA]	100	100	100	100	100	100	100	100	100	100	
480V	[kA]	50	50	40	40	40	40	40	40	40	40	
600V	[kA]	10	10	10	10	10	10	10	10	10	10	
<b>Motor load</b>												
1 Phase	115V	[HP]	1/2	1/2	1	1½	2	2	3	3	5	5
	230V	[HP]	1½	2	3	3	3	5	7½	10	10	10
3 Phase	200V	[HP]	2	3	3	5	7½	7½	10	15	20	20
	230V	[HP]	3	3	5	7½	7½	10	10	15	20	20
	460V	[HP]	5	7½	10	15	15	20	30	30	40	40
	575V	[HP]	7½	10	15	20	20	30	30	40	60	60
<b>Maximum rated current of fuse or breaker</b>		[A]	600	600	600	600	600	600	600	600	600	

#### MMS 100S

Rated operational current I <sub>e</sub> [A]		17	22	26	32	40	50	63	75	90	100	
<b>Max. short-circuit current</b>												
240V	[kA]	100	100	100	100	100	100	100	100	100	100	
480V	[kA]	50	50	50	50	50	50	40	40	40	40	
600V	[kA]	10	10	10	10	10	10	10	10	10	10	
<b>Motor load</b>												
1 Phase	115V	[HP]	1	1½	2	2	3	3	5	5	7½	10
	230V	[HP]	3	3	3	5	7½	10	10	15	20	20
3 Phase	200V	[HP]	3	5	7½	7½	10	15	20	20	25	30
	230V	[HP]	5	7½	7½	10	10	15	20	25	30	30
	460V	[HP]	10	15	15	20	30	30	40	50	60	75
	575V	[HP]	15	20	20	30	30	40	60	60	75	100
<b>Maximum rated current of fuse or breaker</b>		[A]	1000	1000	1000	1000	1000	1000	1000	1000	1000	

In case of 1-phase use in series as shown below



# Manual motor starters

## Technical information

### Manual motor controller (UL 508, CSA C22.2 as Manual motor controllers)



#### Combination Motor Controller

- Group Installation
- Type E starter

#### MMS 32H

Rated operational current I <sub>e</sub> [A]	0.16	0.25	0.4	0.63	1	1.6	2.5	4	6	8	10	13	17	22	26	32	40	
<b>Max. short-circuit current</b>																		
240V [kA]	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
480V [kA]	65	65	65	65	65	65	65	65	65	65	65	65	65	30	30	30	30	
600V [kA]	25	25	25	25	25	25	25	25	25	25	25	25	25	10	10	10	10	
<b>Motor load</b>																		
1 Phase 115V [HP]	-	-	-	-	-	-	-	1/8	1/4	1/3	1/2	1/2	1	1½	2	2	3	
230V [HP]	-	-	-	-	-	1/10	1/6	1/3	1/2	1	1½	2	3	3	3	5	7½	
3 Phase 200V [HP]	-	-	-	-	-	-	1/2	3/4	1	2	2	3	3	5	7½	7½	10	
230V [HP]	-	-	-	-	-	-	1/2	3/4	1½	2	3	3	5	7½	7½	10	10	
460V [HP]	-	-	-	-	-	3/4	1	2	3	5	5	7½	10	15	15	20	30	
575V [HP]	-	-	-	-	1/2	3/4	1½	3	5	5	7½	10	15	20	20	30	30	
<b>Maximum rated current of fuse or breaker</b> [A]	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	

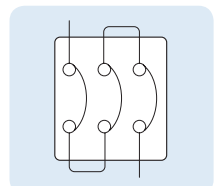
#### MMS 63H

	10	13	17	22	26	32	40	50	63	65
<b>Max. short-circuit current</b>										
240V [kA]	100	100	100	100	100	100	100	100	100	100
480V [kA]	65	65	50	50	50	50	50	50	50	50
600V [kA]	25	25	10	10	10	10	10	10	10	10
<b>Motor load</b>										
1 Phase 115V [HP]	1/2	1/2	1	1½	2	2	3	3	5	5
230V [HP]	1½	2	3	3	3	5	7½	10	10	10
3 Phase 200V [HP]	2	3	3	5	7½	7½	10	15	20	20
230V [HP]	3	3	5	7½	7½	10	10	15	20	20
460V [HP]	5	7½	10	15	15	20	30	30	40	40
575V [HP]	7½	10	15	20	20	30	30	40	60	60
<b>Maximum rated current of fuse or breaker</b> [A]	600	600	600	600	600	600	600	600	600	600

#### MMS 100H

Rated operational current I <sub>e</sub> [A]	17	22	26	32	40	50	63	75	90	100
<b>Max. short-circuit current</b>										
240V [kA]	100	100	100	100	100	100	100	100	100	100
480V [kA]	65	65	65	65	65	65	50	50	50	50
600V [kA]	25	25	25	20	20	20	10	10	10	10
<b>Motor load</b>										
1 Phase 115V [HP]	1	1½	2	2	3	3	5	5	7½	10
230V [HP]	3	3	3	5	7½	10	10	15	20	20
3 Phase 200V [HP]	3	5	7½	7½	10	15	20	20	25	30
230V [HP]	5	7½	7½	10	10	15	20	25	30	30
460V [HP]	10	15	15	20	30	30	40	50	60	75
575V [HP]	15	20	20	30	30	40	60	60	75	100
<b>Maximum rated current of fuse or breaker</b> [A]	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

In case of 1-phase use in series as shown below



# Technical information

## Manual motor controller (UL508)



### MMS 32S

Rated operational current I <sub>e</sub> [A]		0.16	0.25	0.4	0.63	1	1.6	2.5	4	6	8	10	13	17	22	26	32	40	
<b>Max. short-circuit current</b>																			
240V	[kA]	100	100	100	100	100	100	100	100	100	100	50	50	40	30	30	20	20	
480V	[kA]	50	50	50	50	50	50	50	50	25	25	10	10	10	10	7.5	7.5	7.5	
600V	[kA]	10	10	10	10	10	10	10	5	5	5	5	5	5	5	5	5	5	
<b>Motor load</b>																			
1 Phase	115V	[HP]	-	-	-	-	-	-	1/8	1/4	1/3	1/2	1/2	1	1½	2	2	3	
	230V	[HP]	-	-	-	-	1/10	1/6	1/3	1/2	1	1½	2	3	3	3	5	7½	
3 Phase	200V	[HP]	-	-	-	-	-	1/2	3/4	1	2	2	3	3	5	7½	7½	10	
	230V	[HP]	-	-	-	-	-	1/2	3/4	1½	2	3	3	5	7½	7½	10	10	
	460V	[HP]	-	-	-	-	3/4	1	2	3	5	5	7½	10	15	15	20	30	
	575V	[HP]	-	-	-	1/2	3/4	1½	3	5	5	7½	10	15	20	20	30	30	
<b>Max. fuse size</b>		[A]	1	1	1	1	3	6	10	15	20	30	40	50	60	80	100	125	150
<b>Max. breaker size</b>		[A]	15	15	15	15	15	15	15	20	30	40	50	60	80	100	125	150	

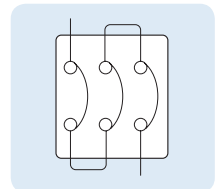
### MMS 63S

Rated operational current I <sub>e</sub> [A]		10	13	17	22	26	32	40	50	63	65	
<b>Max. short-circuit current</b>												
240V	[kA]	100	100	100	100	100	100	100	100	100	100	
480V	[kA]	25	25	25	25	25	25	25	25	25	25	
600V	[kA]	10	10	10	10	10	10	10	10	10	10	
<b>Motor load</b>												
1 Phase	115V	[HP]	1/2	1/2	1	1½	2	2	3	3	5	5
	230V	[HP]	1½	2	3	3	3	5	7½	10	10	10
3 Phase	200V	[HP]	2	3	3	5	7½	7½	10	15	20	20
	230V	[HP]	3	3	5	7½	7½	10	10	15	20	20
	460V	[HP]	5	7½	10	15	15	20	30	30	40	40
	575V	[HP]	7½	10	15	20	20	30	30	40	60	60
<b>Max. fuse size</b>		[A]	40	50	60	80	100	125	150	200	250	250
<b>Max. breaker size</b>		[A]	40	50	60	80	100	125	150	200	250	250

### MMS 100S

Rated operational current I <sub>e</sub> [A]		17	22	26	32	40	50	63	75	90	100	
<b>Max. short-circuit current</b>												
240V	[kA]	100	100	100	100	100	100	100	100	100	100	
480V	[kA]	25	25	25	25	25	25	25	25	25	25	
600V	[kA]	10	10	10	10	10	10	10	10	10	10	
<b>Motor load</b>												
1 Phase	115V	[HP]	1	1½	2	2	3	3	5	5	7½	10
	230V	[HP]	3	3	3	5	7½	10	10	15	20	20
3 Phase	200V	[HP]	3	5	7½	7½	10	15	20	20	25	30
	230V	[HP]	5	7½	7½	10	10	15	20	25	30	30
3 Phase	460V	[HP]	10	15	15	20	30	30	40	50	60	75
	575V	[HP]	15	20	20	30	30	40	60	60	75	100
<b>Max. fuse size</b>		[A]	60	80	100	125	150	200	250	300	350	400
<b>Max. breaker size</b>		[A]	60	80	100	125	150	200	250	300	350	400

In case of 1-phase use in series as shown below



# Manual motor starters

## Technical information

### Manual motor controller (UL508)



#### MMS 32H

Rated operational current I <sub>e</sub> [A]	0.16	0.25	0.4	0.63	1	1.6	2.5	4	6	8	10	13	17	22	26	32	40
<b>Max. short-circuit current</b>																	
240V [kA]	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
480V [kA]	50	50	50	50	50	50	50	50	50	50	50	50	30	30	30	30	30
600V [kA]	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
<b>Motor load</b>																	
1 Phase 115V [HP]	-	-	-	-	-	-	-	1/8	1/4	1/3	1/2	1/2	1	1½	2	2	3
230V [HP]	-	-	-	-	-	1/10	1/6	1/3	1/2	1	1½	2	3	3	3	5	7½
3 Phase 200V [HP]	-	-	-	-	-	-	1/2	3/4	1	2	2	3	3	5	7½	7½	10
230V [HP]	-	-	-	-	-	-	1/2	3/4	1½	2	3	3	5	7½	7½	10	10
460V [HP]	-	-	-	-	-	3/4	1	2	3	5	5	7½	10	15	15	20	30
575V [HP]	-	-	-	-	1/2	3/4	1½	3	5	5	7½	10	15	20	20	30	30
<b>Max. fuse size</b> [A]	1	1	1	1	3	6	10	15	20	30	40	50	60	80	100	125	150
<b>Max. breaker size</b> [A]	15	15	15	15	15	15	15	15	20	30	40	50	60	80	100	125	150

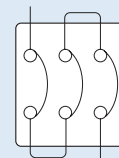
#### MMS 63H

Rated operational current I <sub>e</sub> [A]	10	13	17	22	26	32	40	50	63	65
<b>Max. short-circuit current</b>										
240V [kA]	100	100	100	100	100	100	100	100	100	100
480V [kA]	50	50	50	50	50	50	50	50	50	50
600V [kA]	10	10	10	10	10	10	10	10	10	10
<b>Motor load</b>										
1 Phase 115V [HP]	1/2	1/2	1	1½	2	2	3	3	5	5
230V [HP]	1½	2	3	3	3	5	7½	10	10	10
3 Phase 200V [HP]	2	3	3	5	7½	7½	10	15	20	20
230V [HP]	3	3	5	7½	7½	10	10	15	20	20
460V [HP]	5	7½	10	15	15	20	30	30	40	40
575V [HP]	7½	10	15	20	20	30	30	40	60	60
<b>Max. fuse size</b> [A]	40	50	60	80	100	125	150	200	250	250
<b>Max. breaker size</b> [A]	40	50	60	80	100	125	150	200	250	250

#### MMS 100H

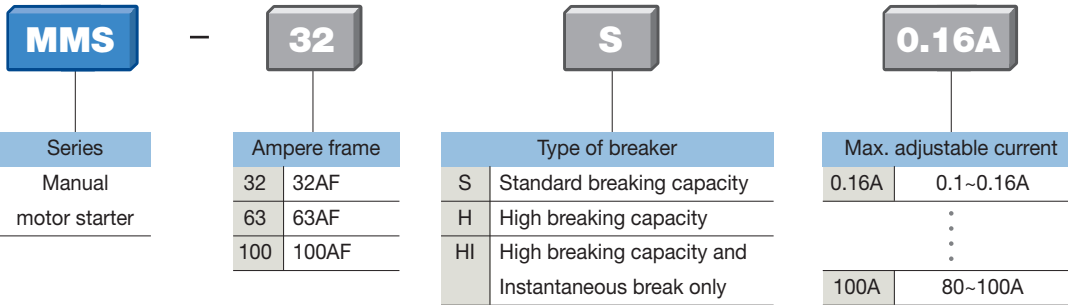
Rated operational current I <sub>e</sub> [A]	17	22	26	32	40	50	63	75	90	100
<b>Max. short-circuit current</b>										
240V [kA]	100	100	100	100	100	100	100	100	100	100
480V [kA]	50	50	50	50	50	50	50	50	50	50
600V [kA]	10	10	10	10	10	10	10	10	10	10
<b>Motor load</b>										
1 Phase 115V [HP]	1	1½	2	2	3	3	5	5	7½	10
230V [HP]	3	3	3	5	7½	10	10	15	20	20
3 Phase 200V [HP]	3	5	7½	7½	10	15	20	20	25	30
230V [HP]	5	7½	7½	10	10	15	20	25	30	30
460V [HP]	10	15	15	20	30	30	40	50	60	75
575V [HP]	15	20	20	30	30	40	60	60	75	100
<b>Max. fuse size</b> [A]	60	80	100	125	150	200	250	300	350	400
<b>Max. breaker size</b> [A]	60	80	100	125	150	200	250	300	350	400

In case of 1-phase use in series as shown below

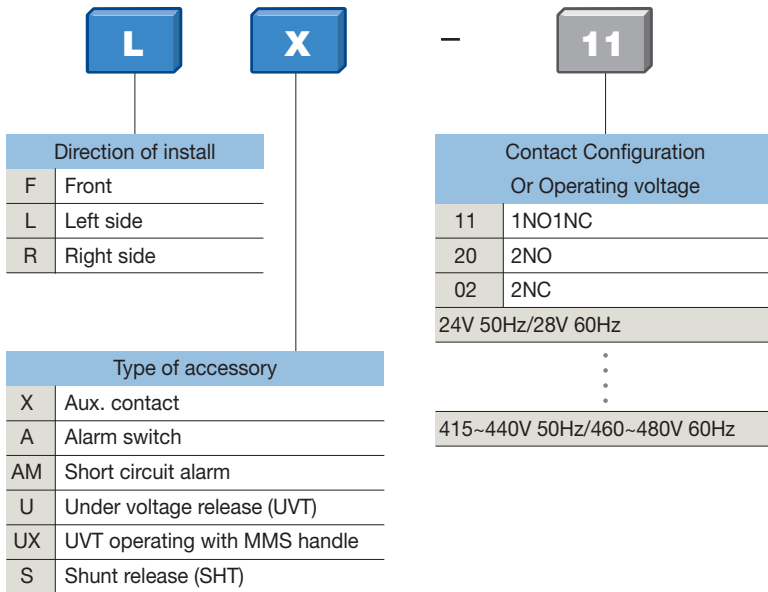


# Numbering system

## Numbering [Manual Motor Starter]







## Catalog Numbering [Aux. contact, Alarm, Release unit]



# Electronic motor protection relays

## GMP Series







Ratings												
Model			GMP22-2P (1c)		GMP22-2P(1a1b)	GMP22-3P/3PR	GMP22-2S		GMP22-3S/3SR	GMP22-2T		GMP22-3T/3TR
Type			Pin type			Screw type			Tunnel type			
No. of CT			2CT		2CT	3CT	2CT		3CT	2CT		3CT
Protection	Overcurrent		●	●	●	●	●	●	●	●	●	
	Phase failure <small>Note1)</small>		●	●	●	●	●	●	●	●	●	
	Lock/Stall		●	●	●	●	●	●	●	●	●	
	Phase unbalance		-	-	●	-	●	-	●	-	●	
	Reverse phase		-	-	●(3PR)	-	●(3PR)	-	●(3PR)	-	●(3PR)	
Current setting range (A)			0.3~1.5, 1~5, 4.4~22									
Operating time characteristics			Inverse time (GMP22-2PD: Definite time)									
Time setting (sec)	Inverse time		0~30 sec									
	Definite	D-time	0.2~60 sec for GMP22-2PD									
		O-time	5sec (Fixed) for GMP22-2PD									
	Reset-time		Manual reset									
Tolerance	Current		±5%									
	Time		±5% (or ±0.5sec)									
Control power	Voltage		AC 110V/220V(±10%)			AC 100~260V(±10%)						
	Frequency		50/60Hz									
Aux. contact	Contact <small>Note 3)</small>		1SPDT (1c)			2SPST (1a1b)						
	Ratings		5A/250VAC Resistive load			3A/250VAC Resistive load						
	Operate		(95 ⚡ 96 Close)			(95 ⚡ 96 Close)		(97 ⚡ 98 Open)				
Insulation resistance			Min 100MΩ at 500Vdc									
Surge endurance (IEC 61000-4-5)			5kV Apply the standard wave									
Fast transient burst (IEC 61000-4-4)			2kV									
Environment	Operation		-25~70℃									
	Temperature	Storage		-30~80℃								
Relative humidity		30~90%RH(No freezing)										
Trip indicator			Red LED			Red/Green LED			Red LED		Red/Green LED	
Dimension	W×H×D	inch	1.73×2.80×3.07			2.09×3.07×3.44			2.87×2.68×3.44		2.09×1.50×3.44	
		(mm)	(44×71×78)			(53×78×87.5)			(53×68×87.5)		(53×38×87.5)	
Mounting type			Direct mount onto a Metasol MC (MC-9b-22b)				Separate mount (Screw or Din-rail) <small>Note2)</small>					
Certification			UL, cUL, CE									

Note) 1. When it is 2CT model, only two-phase protection is available

2. The bracket for Din-rail mount is optional

3. When power applied Aux. contact operate



Ratings														
Model			GMP40-2P	GMP40-3P/3PR	GMP40-2S	GMP40-3S/3SR	GMP40-2T	GMP40-3T/3TR	GMP80-2S	GMP80-3S/3SR	GMP60T	GMP60TE		
Type			Pin type *		Screw type		Tunnel type		Screw type		Tunnel type			
No. of CT			2CT	3CT	2CT	3CT	2CT	3CT	2CT	3CT	2CT			
Protection	Overcurrent		●	●	●	●	●	●	●	●	●			
	Phase failure <small>Note1</small>		●	●	●	●	●	●	●	●	●			
	Lock/Stall		●	●	●	●	●	●	●	●	●			
	Phase unbalance		-	●	-	●	-	●	-	●	-			
	Reverse phase		-	●(3PR)	-	●(3PR)	-	●(3PR)	-	●(3PR)	-			
Current setting range(A)			4~20, 8~40						16~80		0.5~6, 3~30, 5~60			
Operating time characteristics			Inverse time characteristics, Definite (GMP-PD Type)									Definite		
Time setting (sec)	Inverse time		0~30 sec									-		
	Definite D-time		0.2~60 sec (GMP40-2PD)									0.2~30 sec		
	O-time		5sec (Fixed) (GMP40-2PD)									0.2~30 sec		5 sec (Fixed)
	Reset time		Manual reset (Auto Reset type : GMP□-A)									-		GMP-TA
Tolerance	Current		±5%									±5%		
	Time		±5% (or ±0.5 sec)									±5% (or ±5 sec)		
Control power	Voltage <small>Note3</small>		AC 100~260V									AC 110V/260V		
	Frequency		50/60Hz									50/60Hz		
Aux. contact	Contact <small>Note4</small>		2SPST (1a1b)									1SPDT (1c)		
	Ratings		3A/250VAC Resistive load									1A/250VAC Resistive load		
	Operate		(95 ⇄ 96 Close)			(97 ⇄ 98 Open)						-		
Insulation resistance			Min 100MΩ at 500Vdc									Min 100MΩ at 500Vdc		
Surge endurance (IEC 61000-4-5)			5kV Apply the standard wave									5kV Apply the standard wave		
Fast transient burst (IEC 61000-4-4)			2kV									2kV		
Environment	Operation		-25~70°C									-25~70°C		
Temperature	Storage		-30~80°C									-30~80°C		
	Relative humidity		30~90%RH (No freezing)									30~90%RH (No freezing)		
Trip indicator			Red LED	Red/Green LED	Red LED	Red/Green LED	Red LED	Red/Green LED	Red LED	2Red LEDs	Red LED			
Dimension	W×H×D	inch	2.09×3.07×3.44		2.09×2.68×3.44		2.09×2.68×3.44		3.50×3.05×3.83		2.83×2.64×2.72			
		(mm)	(53×78×87.5)		(53×68×87.5)		(53×38×87.5)		(89×77.5×97.4)		(72×67×69)			
Mounting type			Direct mount onto a Metasol MC (MC-32a, 40a)			Separate mount (Screw or Din-rail)						Separate mount (Screw or Din-rail)		
Certification			UL, cUL, CE											

Note) 1. When it is 2CT model, only two-phase protection is available.

2. GMP60T/TE: AC24V, 48V or 380V, 50/60Hz types a option.

3. When power applied the Aux. contact operate.

# Electronic motor protection relays

## Numbering system

### GMP series

#### GMP series - ordering



Frame	Nominal Current	Type
22	1.5A	P, S, T*
	5A	
	22A	
40	20A	T*
	40A	
60	06A	S*
	30A	
	60A	
80	80A	S*

\* Refer to 'Type' for details

CT Type	
2	2CT
2	3CT

Classification	
-	Existing model
a	Operation time function

Reverse Phase	
-	No reverse protection
R	Reverse protection available
A	Automatic recovery

Control Voltage	
110/220	AC 100~160V
24	AC 24V
48	AC 48V
110	AC 110V
220	AC 220V
380	AC 380 (440V)

Note) AC24V, AC48V and AC380(440)V are for GMP60T

Type	
P	Direct Coupling(Pin)
S	Terminal Connection(Screw)
T	Penetration(Tunnel)
TE	Economic
PD	Direct Coupling (Definite Time)
TD	Current Display (Definite Time)
TZ	Ground Fault Protection (Zero-Phase Sequence Current Detection)
TN	Ground Fault Protection (Residual Current Detection)

Nominal Current	Current Adjustment	
	Range (A)	
1.5A	0.3~1.5	
5A	1~5	
22A	4.4~22	
20A	4~20	
40A	8~40	
80A	16~80	
06A	0.5~6	
30A	3~30	
60A	0.5~6	

Note) For GMP60-TD, GMP60-TDa 6/60A, GMP60-3TZ(R), 3TN(R), 3T(R)

Aux. contactor	
1c(N)	
1a1b	

Note) 1. When the power is applied, the system is in the contacting status  
2. 1c(R) type is optional

Model Type	
-	Terminal(Screw) Penetration (Tunnel)
Sol	Metasol direct coupling(Pin)

# DMPi series

## A list of standard models



### A list of standard models

Rated current	Connection method	Model No.	Over-current	Stall/ Locked rotor	Phase fail current	Phase un-balance	Reverse phase	Under current	Ground fault	Instant short circuit	Remarks
0.5~6A	Terminal type	DMP06i-S	●	●	●	●	●	●	-	-	<ul style="list-style-type: none"> <li>If there is the function of RS485 communication, 'M' is appended to its type name. If there is the function of 4~20mA DC output, 'A' is appended to its type name.</li> <li>RS485 communication function and 4~20mA DC output function are not supported at the same time.</li> </ul>
		DMP06i-SZ, SB	●	●	●	●	●	●	●	-	
		DMP06i-SI	●	●	●	●	●	●	-	●	
		DMP06i-SZI, SBI <sup>Note1)</sup>	●	●	●	●	●	●	●	●	
	Penetrated type	DMP06i-T	●	●	●	●	●	●	-	-	
		DMP06i-TZ, TB	●	●	●	●	●	●	●	-	
		DMP06i-TI	●	●	●	●	●	●	-	●	
DMP06i-TZI, TBI <sup>Note1)</sup>	●	●	●	●	●	●	●	●	●		
5~65A	Terminal type	DMP65i-S	●	●	●	●	●	●	-	-	
		DMP65i-SZ, SB	●	●	●	●	●	●	●	-	
		DMP65i-SI	●	●	●	●	●	●	-	●	
		DMP65i-SZI, SBI <sup>Note1)</sup>	●	●	●	●	●	●	●	●	
	Penetrated type	DMP65i-T	●	●	●	●	●	●	-	-	
		DMP65i-TZ, TB	●	●	●	●	●	●	●	-	
		DMP65i-TI	●	●	●	●	●	●	-	●	
DMP65i-TZI, TBI <sup>Note1)</sup>	●	●	●	●	●	●	●	●	●		

Note) 1. It is possible to set up ground fault and instantaneous trip contacts separately.

# Electronic motor protection relays

## DMPi series

### Rated specifications / Model numbering system

#### Rated specifications

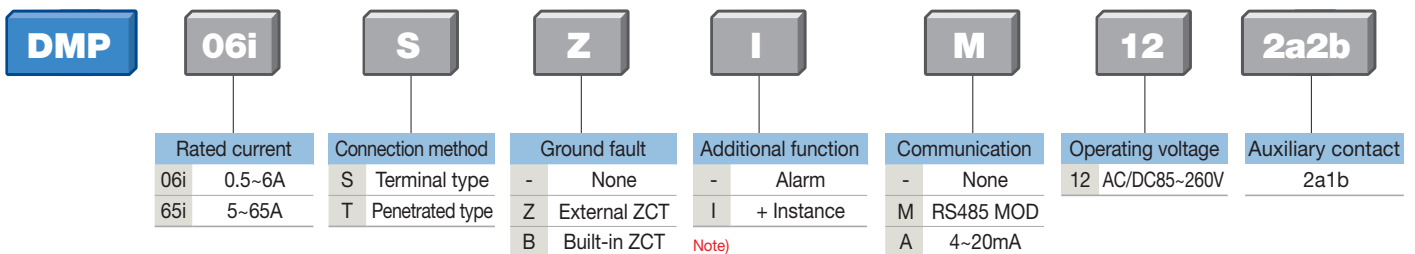
Connection method		Penetrated / Terminal type
Protection functions		Overcurrent, phase fail, phase unbalance, stall, locked rotor, reverse phase, ground fault (Type option) Instance (Type option)
Connection method		Penetrated / Terminal type
Operating time characteristics		Thermal heat build-up inverse time / Non-thermal heat build-up inverse time / Definite time
Rated current		0.5~6A/5~65A(Rating option upon placing an order)
Display		4 digit, 7-Segment
Operating power		AC/DC 85~260V(50Hz/60Hz)
Reset method	Automatic	1~20min (only for overcurrent)
	Manual	(Electrical reset)
Installation / Mounting method		Display can be installed separately, 35mm DIN rail / Screw installation
Tolerance	Current	±3%
	Time	±5%
	4~20mA output	±5%
Time setting	Startup delay	1~200sec
	Operation delay	1~60sec
Aux. contact	Composition	3-SPST(Power supply 1a1b, instantaneous operation 1a) <sup>Note1</sup>
	Capacity	3A/250VAC Resistive Load
	Contact minimum load	100mA / 6VDC : (95-996, 97-98) 10mA / 5VDC ( 07-08)
ZCT Input	External	200mA/100mV(Exclusive ZCT) <sup>Note2</sup>
	Built-in	Support (Separate connection unnecessary) <sup>Note2</sup>
Service environment	Service temperature	-20°C ~ 60°C
	Storage temperature	-30°C ~ 70°C
	Relative humidity	Below 50% RH (Without condensation)
Insulation resistance		100MΩ/500VDC
Lightning impulse voltage		1.2X50us 5kV Prototype waveform supply
Fast transient		2kV/1Min
Power consumption		Below 2W

Note) 1. See No. 21 to 23 of A-Group in Setting menu If single phase is set, the device measures R/S/T phase. In HMI, the maximum phase of three phases is displayed without any indication of phase.

2. It is used when zero current detection type is selected.

3. This product is used to protect a low-voltage motor with 1000V or less

#### Model numbering system



Note)  
“-” models have Alarm + Operating Time + Failure History storage functions as the default.

“I” models have an additional instance protection function.

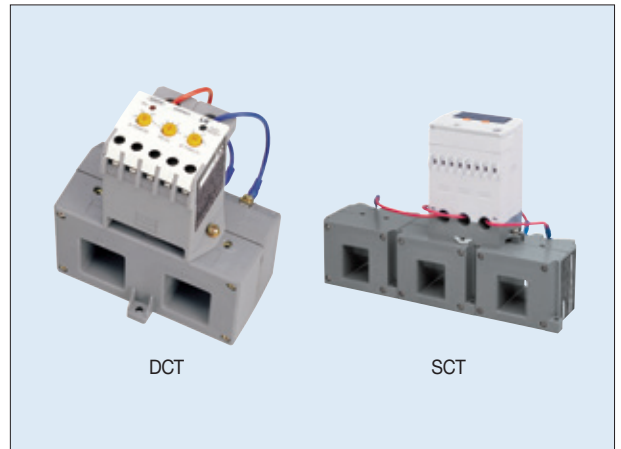
# Accessories

## CT, ZCT, Cable and Terminal

### CT Ratings

Type		2CT	3CT
CT ratio	100 : 5A	DCT-100	
	150 : 5A	DCT-150	SCT-150
	200 : 5A	DCT-200	SCT-200
	300 : 5A	DCT-300	SCT-300
	400 : 5A	DCT-400	SCT-400
Class		1.0	
Burden		5VA	
Insulation voltage		600VAC	
Insulated impulse voltage		2kV	
Insulation resistance		10MΩ(DC 500V Megger)	
Mounting		Panel	

Note) Please use DCT for LS Electronic Motor Protection Relay only.

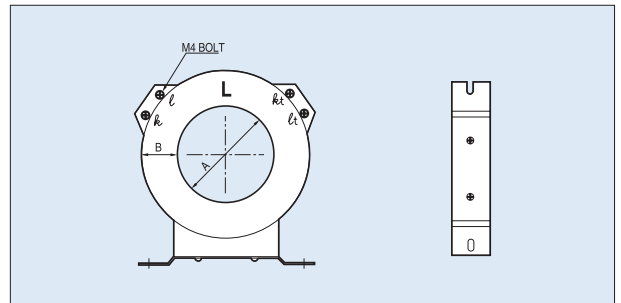


DCT

SCT

### ZCT (Zero Sequence CT) Ratings

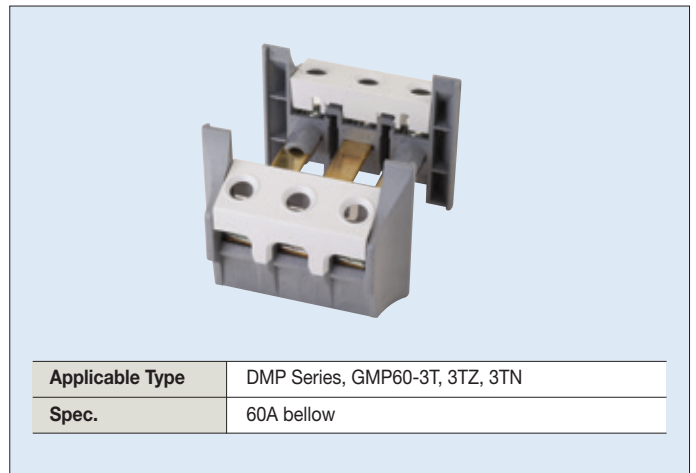
Type	Diameter (A)	Ratio	Diameter (A)
LZT-030	30	0.5	100mA/40~55mV
LZT-050	50	0.7	
LZT-065	65	0.9	200mA/100mV
LZT-080	80	1.5	



### Cable



### Terminal Block



# High Voltage DC Relay

## GPR Series

### GPR-M type



Type		GPR-M010	GPR-M040	GPR-M100	GPR-M150
Number of poles		1 Pole	1 Pole	1 Pole	1 Pole
Operating Voltage, Ue		DC 600V	DC 1000V	DC 1000V	DC 1000V
Rated impulse withstand voltage, Uimp		4kV	4kV	6kV	6kV
Conventional thermal current, Ith		10A	40A	100A	150A
Short-time withstand current	2Min	-	100A	225A	320A
	15Min	15A	60A	150A	225A
Durability	Mechanical (*) (3,600 operations per hour)	200,000 cycles	200,000 cycles	200,000 cycles	200,000 cycles
	Electrical	5A, 600VDC, 10,000cycles (at 360cycles/Hr) (only Making)	20A, 1000VDC, 1,000cycles (at 360cycles/Hr)	50A, 1000VDC, 1,000cycles (at 360cycles/Hr)	75A, 1000VDC, 1,000cycles (at 360cycles/Hr)
Voltage drop (Initial)		0.5V @ 10A	0.2V @ 20A	0.04V @ 20A	0.04V @ 20A
Operating time		Max. 50ms	Max. 50ms	Max. 50ms	Max. 50ms
Release time		Max. 30ms	Max. 30ms	Max. 30ms	Max. 30ms
Insulation strength (Initial)		Min. 100MΩ(@1000VDC)	Min. 100MΩ(@1000VDC)	Min. 100MΩ(@1000VDC)	Min. 100MΩ(@1000VDC)
W × H × D ( mm )		56 × 28 × 45	67 × 35 × 47	81 × 39 × 70	81 × 39 × 70
Temperature range		-40 ~ 85°C	-40 ~ 85°C	-40 ~ 85°C	-40 ~ 85°C
Humidity		5-95% R.H.	5-95% R.H.	5-95% R.H.	5-95% R.H.
Weight		80g	145g	330g	330g
Certification		CE cRUUS CCC	CE cRUUS CCC	CE cRUUS CCC	CE cRUUS CCC

\* The number of Mechanical times is the number that meets the basic performance after durability.

# GPR Series

## GPR-M/GPR-H type



Type		GPR-M250	GPR-M400	GPR-M400-A	GPR-H500-A
Number of poles		1 Pole	1 Pole	1 Pole	1 Pole
Operating Voltage, Ue		DC 1000V	DC 1000V	DC 1000V	DC 1500V
Rated impulse withstand voltage, Uimp		6kV	6kV	6kV	8kV
Conventional thermal current, Ith		250A	400A	400A	500A
Short-time withstand current	2Min	500A	750A	750A	900A
	15Min	350A	500A	500A	750A
Durability	Mechanical (*) (3,600 operations per hour)	200,000 cycles	200,000 cycles	200,000 cycles	200,000 cycles
	Electrical	125A, 1000VDC, 1,000cycles (at 360cycles/Hr)	200A, 1000VDC, 1,000cycles (at 360cycles/Hr)	200A, 1000VDC, 3,000cycles (at 360cycles/Hr)	200A, 1500VDC, 1,000cycles (at 360cycles/Hr)
Voltage drop (Initial)		0.02V @ 20A	0.02V @ 20A	0.02V @ 20A	0.04V @ 20A
Operating time		Max. 30ms	Max. 30ms	Max. 30ms	Max. 35ms
Release time		Max. 10ms	Max. 10ms	Max. 10ms	Max. 15ms
Insulation strength (Initial)		Min. 100MΩ(@1000VDC)	Min. 100MΩ(@1000VDC)	Min. 100MΩ(@1000VDC)	Min. 100MΩ(@1000VDC)
W x H x D ( mm )		92 x 45 x 87	100 x 58 x 91	100 x 58 x 99	118 x 70 x 108
Temperature range		-40 ~ 85°C	-40 ~ 85°C	-40 ~ 85°C	-40 ~ 85°C
Humidity		5-95% R.H.	5-95% R.H.	5-95% R.H.	5-95% R.H.
Weight		500g	630g	750g	1.3kg
Certification		CE cRUUS CCC	CE cRUUS CCC	CE cRUUS	CE cRUUS CCC

\* The number of Mechanical times is the number that meets the basic performance after durability.

# High Voltage DC Relay

## Numbering system

### Model number structure

**GPR-M 400 -A DC12V SM □**

①                      ②                      ③                      ④                      ⑤                      ⑥

**① Operating Voltage**

R	450V
R-M	1,000V
R-H	1,500V~

**② Conventional thermal Current**

010	10A	250	250A
040	40A	400	400A
100	100A	500	500A
150	150A		

**③ Aux Type**

-A	Aux.
blank	No Aux.

**④ Control Voltage**

DC12V
DC24V
DC48V

**⑤ Mounting Type**

blank	Bottom Mounting
SM	Side Mounting

**⑥ Brand Name**

blank	General Brand name
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# Vacuum Circuit Breakers

## Susol VCB Series

4.76/15kV 25/31.5kA 1200/2000A

### VL-05/15



Item			VL-05 □ 25, 32 □ 12, 20				VL-15 □ 25, 32 □ 12, 20			
Rated voltage	Ur (kV)		4.76				15			
Rated current	Ir (A)		1200	2000	1200	2000	1200	2000	1200	2000
Rated frequency	fr (Hz)		60							
Rated interrupting current	Ik (kA)		25	31.5	25	31.5	25	31.5	25	31.5
Rated interrupting capacity	(MVA)		207	260	207	260	650	820	650	820
Rated short-time current	Ik/tk (kA)		31.5/2s							
Rated making current	Ip (kA)		81.9							
Rated interrupting time	(cycle)		3							
Withstand Voltage	Frequency	Ud (kV)	19				95			
	Impulse	Ud (kV/1.2×50μs)	60				95			
Operating duty			O-0.3s-CO-3min-CO							
Rated Closing Control voltage	(V)		DC 24~30, DC 48~60, DC 110, DC 125, DC 220, AC 48, AC100~130, AC 220~250							
Rated Trip Control voltage	(V)		DC 24~30, DC 48~60, DC 110, DC 125, DC 220, AC 48, AC100~130, AC 220~250							
Standard aux. contacts			4a4b, 10a10b							
Rated opening time	(s)		≤0.04							
No-load closing time	(s)		≤0.06							
Mechanical Endurance	(Operations)		10,000							
Electrical Endurance			Reference Standard							
Capacitive current switching			C2							
Life time	Electrical	(Operations)	Reference Electrical Life Graph							
Installation	Fixed		P Type							
	Draw-out		H Type							
Phase distance	(mm)		150	210	150	210	150	210	150	210
Weight(H, Cradle)	(kg)		430	510	430	510	430	510	430	510
Weight(H, Circuit Breaker)	(kg)		115	140	115	140	115	140	115	140
Weight(P, Circuit Breaker)	(kg)		85	130	85	130	85	130	85	130
Applicable standard			IEEE Std C37.09, IEEE Std C37.20.2, ANSI C37.54, ANSI C37.55, UL (CSA)							

\* Lifetime with maintenance.

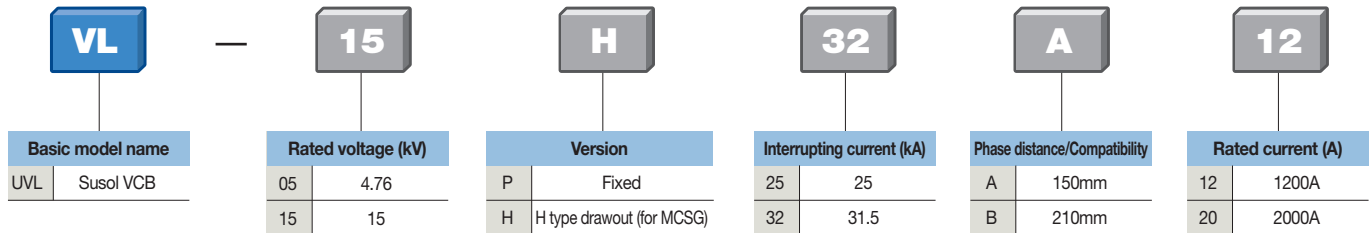
\*\* H type is a box type cradle with CB compartment style structure.

# Vacuum Circuit Breakers

## Numbering system

4.76/15kV 25/31.5kA 1200/2000A

### Breaker



Basic model name	
UVL	Susol VCB

Rated voltage (kV)	
05	4.76
15	15

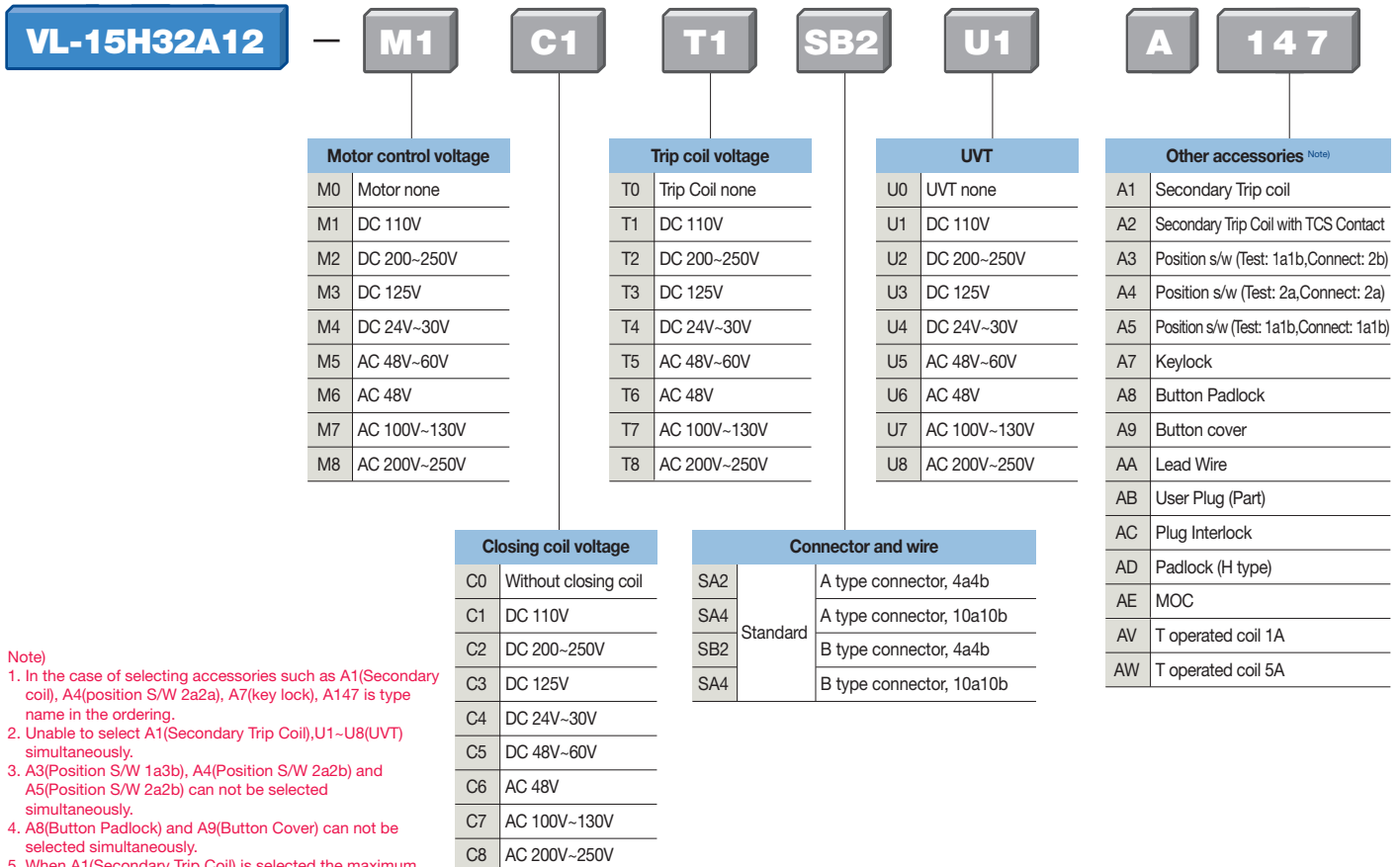
Version	
P	Fixed
H	H type drawout (for MCSG)

Interrupting current (kA)	
25	25
32	31.5

Phase distance/Compatibility	
A	150mm
B	210mm

Rated current (A)	
12	1200A
20	2000A

\* - In case of 1200A VCB, only 150mm is applicable.  
 - In case of 2000A VCB, only 210mm is applicable.



Motor control voltage	
M0	Motor none
M1	DC 110V
M2	DC 200~250V
M3	DC 125V
M4	DC 24V~30V
M5	AC 48V~60V
M6	AC 48V
M7	AC 100V~130V
M8	AC 200V~250V

Trip coil voltage	
T0	Trip Coil none
T1	DC 110V
T2	DC 200~250V
T3	DC 125V
T4	DC 24V~30V
T5	AC 48V~60V
T6	AC 48V
T7	AC 100V~130V
T8	AC 200V~250V

UVT	
U0	UVT none
U1	DC 110V
U2	DC 200~250V
U3	DC 125V
U4	DC 24V~30V
U5	AC 48V~60V
U6	AC 48V
U7	AC 100V~130V
U8	AC 200V~250V

Other accessories <sup>Note)</sup>	
A1	Secondary Trip coil
A2	Secondary Trip Coil with TCS Contact
A3	Position s/w (Test: 1a1b,Connect: 2b)
A4	Position s/w (Test: 2a,Connect: 2a)
A5	Position s/w (Test: 1a1b,Connect: 1a1b)
A7	Keylock
A8	Button Padlock
A9	Button cover
AA	Lead Wire
AB	User Plug (Part)
AC	Plug Interlock
AD	Padlock (H type)
AE	MOC
AV	T operated coil 1A
AW	T operated coil 5A

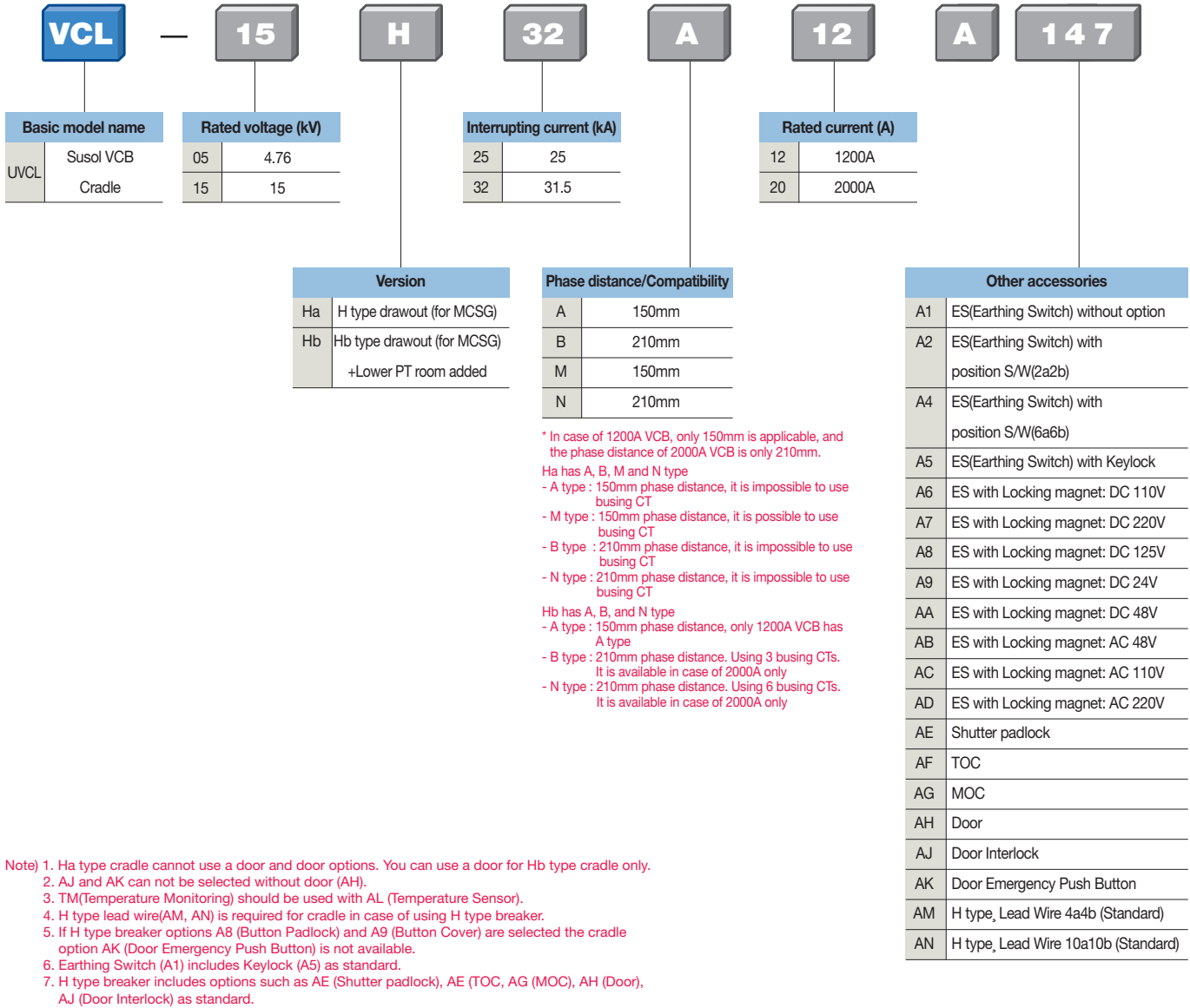
Closing coil voltage	
C0	Without closing coil
C1	DC 110V
C2	DC 200~250V
C3	DC 125V
C4	DC 24V~30V
C5	DC 48V~60V
C6	AC 48V
C7	AC 100V~130V
C8	AC 200V~250V

Connector and wire		
SA2	Standard	A type connector, 4a4b
SA4		A type connector, 10a10b
SB2		B type connector, 4a4b
SA4		B type connector, 10a10b

#### Note)

- In the case of selecting accessories such as A1(Secondary coil), A4(position S/W 2a2a), A7(key lock), A147 is type name in the ordering.
- Unable to select A1(Secondary Trip Coil),U1~U8(UVT) simultaneously.
- A3(Position S/W 1a3b), A4(Position S/W 2a2b) and A5(Position S/W 2a2b) can not be selected simultaneously.
- A8(Button Padlock) and A9(Button Cover) can not be selected simultaneously.
- When A1(Secondary Trip Coil) is selected the maximum available auxiliary contacts are 9a9b.
- When A2(Secondary Trip Coil with TCS Contact) is selected the maximum available auxiliary contacts are 4a3b, 9a8b.
- The flame retardant wire is applicable to auxiliary contacts 4a4b, not to 10a10b.
- Locking magnet of breaker use the same control power supply as motor.
- In case of UL Type, AC(Plug Interlock), AD(Padlock(H type)) and AE(MOC) are included as standard.

## Cradle



# Vacuum Circuit Breakers

## Susol VCB Series

27kV 25kA 1200/2000A

### VH-27



Item			VH-27□25□12	VH-27□25□20
Rated voltage	Ur (kV)		27	
Rated short-circuit current	Isc (kA)		25	
Rated normal current	Ir (A)		1200	2000
Rated withstand voltage	Power frequency (1 min)	Ud (kV)	60	
	Impulse (1.2×50μs)	Up (kV)	150	
Rated frequency	fr (Hz)		60	
Rated short-circuit making current	Ip (kA)		65	
Rated short-time withstand current	Ik/tk (kA/s)		25/2	
Rated breaking time	(cycle)		3	
Rated operating sequence			O-0.3s-CO-3min-CO	
Control voltage	Closing coil	(V)	DC 24~30, DC 48~60, DC 110, DC 125, DC 220, AC 48, AC 100~130, AC 220~250	
	Trip coil	(V)	DC 24~30, DC 48~60, DC 110, DC 125, DC 220, AC 48, AC 100~130, AC 220~250	
Auxiliary contacts	Point of contacter		4a4b, 10a10b	
	Class		Class 1	
Trip coil resistance	(Ω)		37±10%	
Closing coil resistance	(Ω)		37±10%	
Rated short-circuit breaking capacity	(MVA)		1169	
Rated opening time	(sec)		≤ 40	
No-load closing time	(sec)		≤ 60	
VI stroke	(mm)		17~18	
Weight	Breaker	(kg)	400	
	Cradle	(kg)	400	
Applicable standard			ANSI/IEEE Std. C37.09	

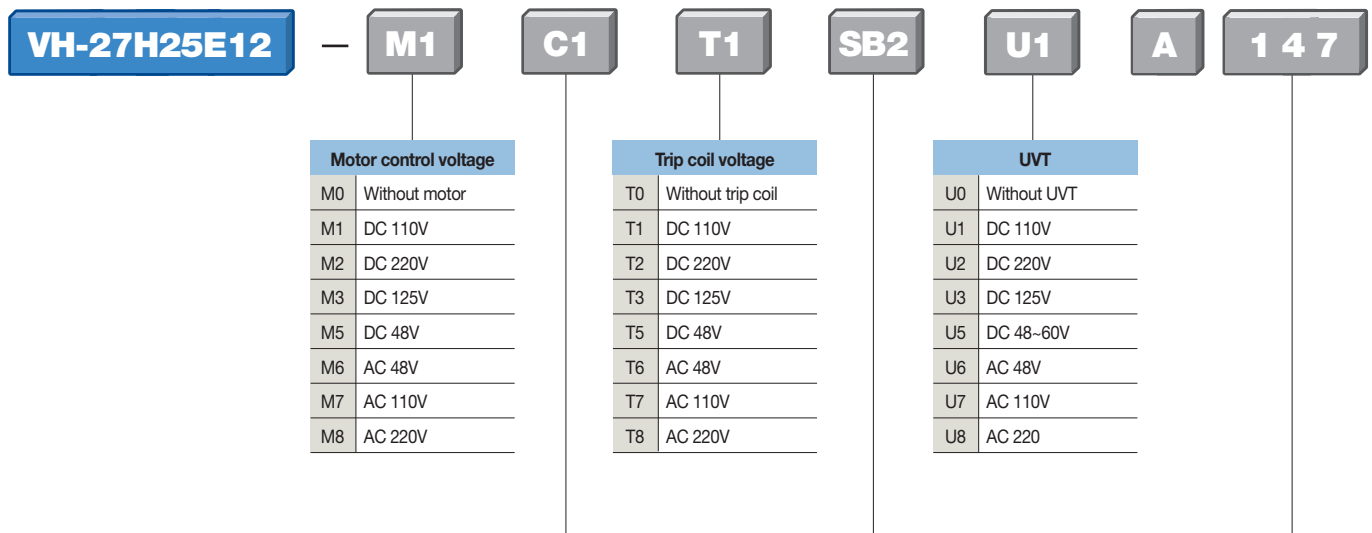
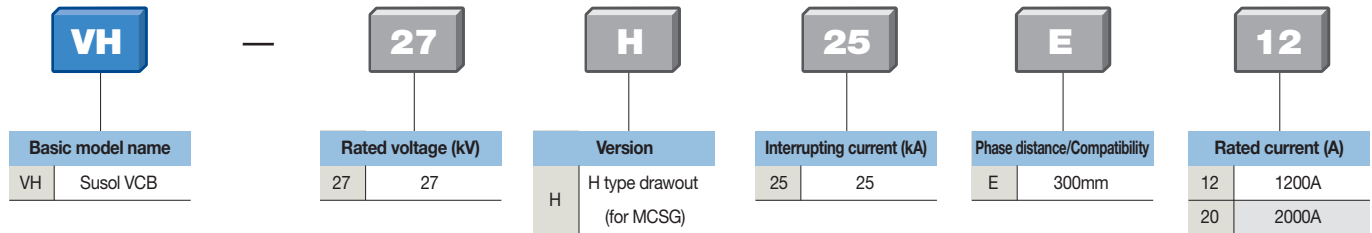
\* Lifetime with maintenance.

\*\* H type is a box type cradle with CB compartment style structure.

# Numbering system

## 27kV 25kA 1200/2000A

### Breaker



Closing coil voltage	
C0	Without closing coil
C1	DC 110V
C2	DC 220V
C3	DC 125V
C5	DC 48V
C6	AC 48V
C7	AC 110V
C8	AC 220V

Connector and wire		
SB2	Standard	B type connector, 4a4b
SB4		B type connector, 10a10b
SB6	Flame retardant	B type connector, 4a4b

Other accessories <small>Note)</small>	
A1	Secondary Trip coil
A4	Position s/w(2a2a)
A5	Position s/w(2a2b)
A6	Latch checking s/w
A7	Keylock
A8	Button Padlock
A9	Button cover
AA	Lead Wire
AB	User Plug(Part)
AC	Plug Interlock
AD	Padlock(H type Door Interlock)
AE	MOC
AF	Locking Magnet
AG	ANSI type Charge interlock
AP	Trip Coil Monitoring Contact

**Note)**

- If A2 (UVT), A4 (Position S/W 2a2b) and A7 (Keylock) are selected, A247 is the type name in the ordering.
- A1 (Secondary Trip Coil) and A2 (UVT) can not be selected simultaneously.
- A4 (Position S/W 2a2a) and A5 (Position S/W 2a2b) can not be selected simultaneously.
- A8 (Button Padlock) and A9 (Button Cover) can not be selected simultaneously.
- AC (Plug interlock), AD (H type Door interlock), AE (MOC) and AF (Locking magnet) are available only for H type.
- In case of B-type connector the flame retardant wire is applicable to auxiliary contacts 4a4b, not to 10a10b.
- Locking magnet can be applied only to H type VCB - breaker and cradle.
- Locking magnet of H type breaker use the same control power supply as motor.
- A-type connector is applicable to P/E/F/G type and B-type connector to H type.
- In case of selecting UVT A6 (Latch checking S/W) is not allowed. A6 (Latch checking S/W) is installed by default to make electrical interlock with UVT.
- Lead wire is enclosed in the breaker in case of ordering fixed type or H type breaker without cradle, installed of cradle in case of ordering the breaker with cradle. If user plug is selected it will be enclosed in the breaker.

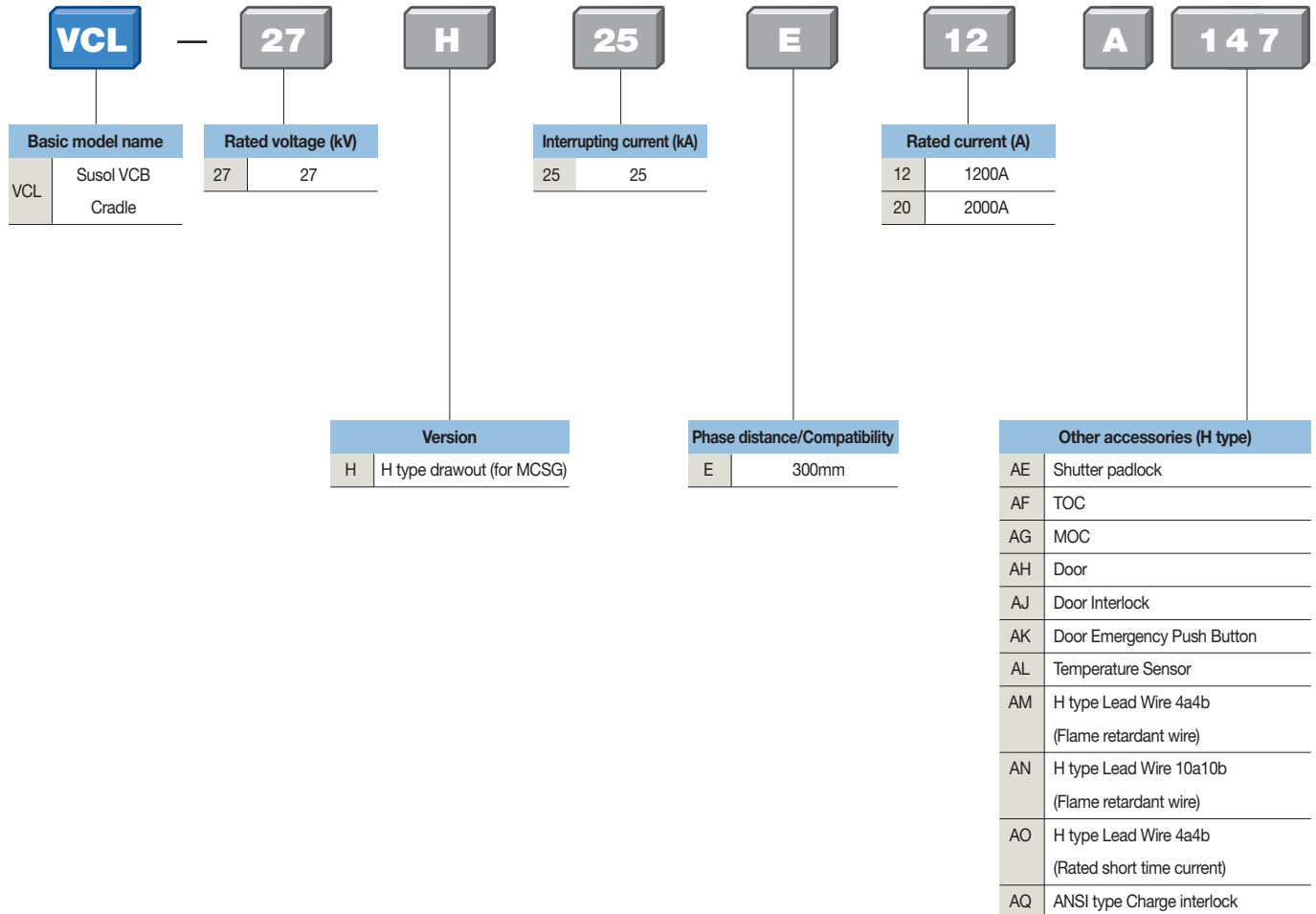
Note) A is written only once in case of more than one.

# Vacuum Circuit Breakers

## Numbering system

27kV 25kA 1200/2000A

### Cradle



- Note) 1. These accessories for cradle and TM can be applied only to H type.  
 2. AJ and AK can not be selected without door (AH).  
 3. TM (Temperature Monitoring) should be used with AL (Temperature Sensor).  
 4. H type lead wire - one of AM, AN or AO is required for cradle in case of H type breaker.

Note) A is written only once in case of more than one.

# Susol VCB Series

4.76/15kV 40/50kA 1250/2000/3150A

## VH-05/15



Item			VH-05H50C12/20/30			VH-15H40,50C12/20/30		
Rated voltage	Ur (kV)		4.76			15		
Rated normal current	Ir (A)		1250	2000	3150	1250	2000	3150
Rated frequency	fr (Hz)		50/60					
Rated short-circuit current	Isc (kA)		50			40, 50		
Rated short-time withstand current	Ik/tk (kA/s)		50/2			40/2, 50/2		
Rated short-circuit breaking capacity	(MVA)		412			1039, 1299		
Rated short-circuit making current	Ip (kA)		2.5 × Isc (50Hz)/2.6 × Isc (60Hz)					
Rated breaking time	(Cycle)		3					
Rated withstand voltage	Power frequency (1 min)	Ud (kV)	19			36		
	Impulse (1.2 × 50μs)	Up (kV)	60			95		
Rated operating sequence			O-0.3s-CO-3min-CO					
Control voltage	Closing coil	(V)	DC 125					
	Trip coil	(V)	DC 125					
Auxiliary contacts *			3a3b					
Rated opening time	(sec)		≤ 0.04					
No-load closing time	(sec)		≤ 0.06					
Mechanical Endurance	(Operations)		5,000					
Electrical Endurance			Reference Standard					
Life time	Electrical (Operations)		Reference Electrical Life Graph					
Installation version	Drawout		H type (for MCSG)					
Phase distance	(mm)		254					
Weight	Breaker (MESG, MCSG)	(kg)	230	230	265	230	230	265
	Cradle (MESG, MCSG)	(kg)	248	248	286	248	248	286
Applicable standard			ANSI/IEEE Std. C37.09					

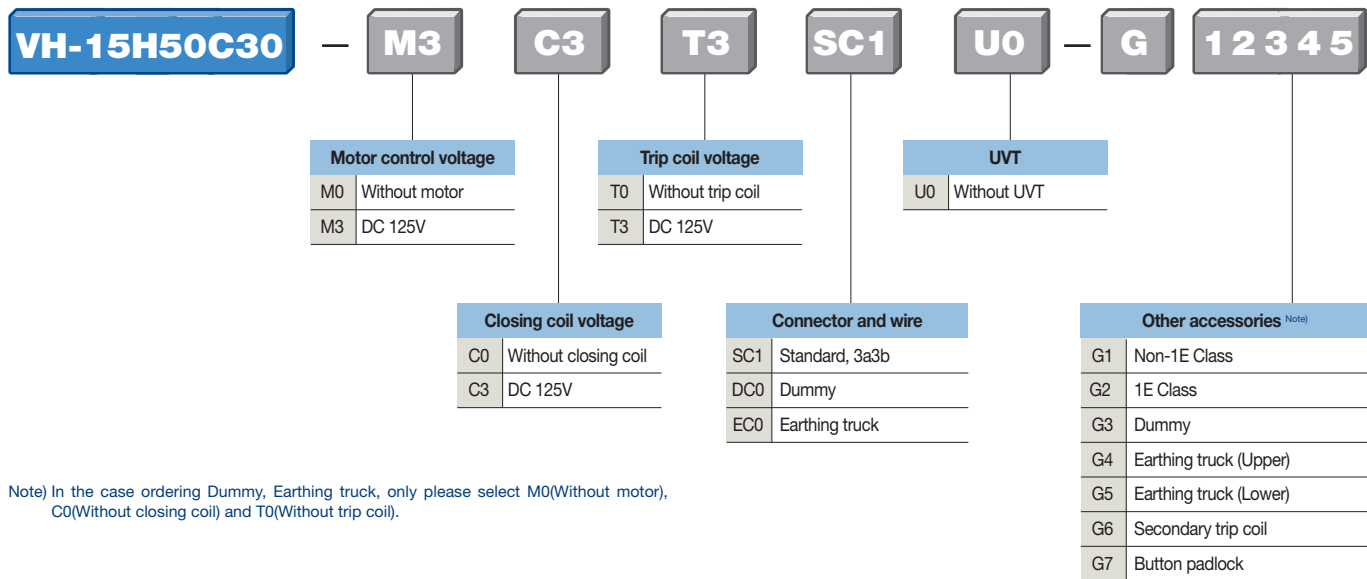
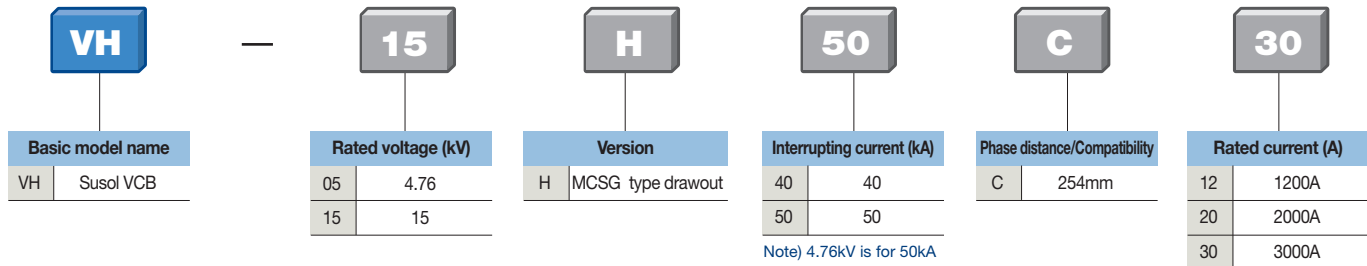
\* Two(2) "Early b" auxiliary contact is provided.

# Vacuum Circuit Breakers

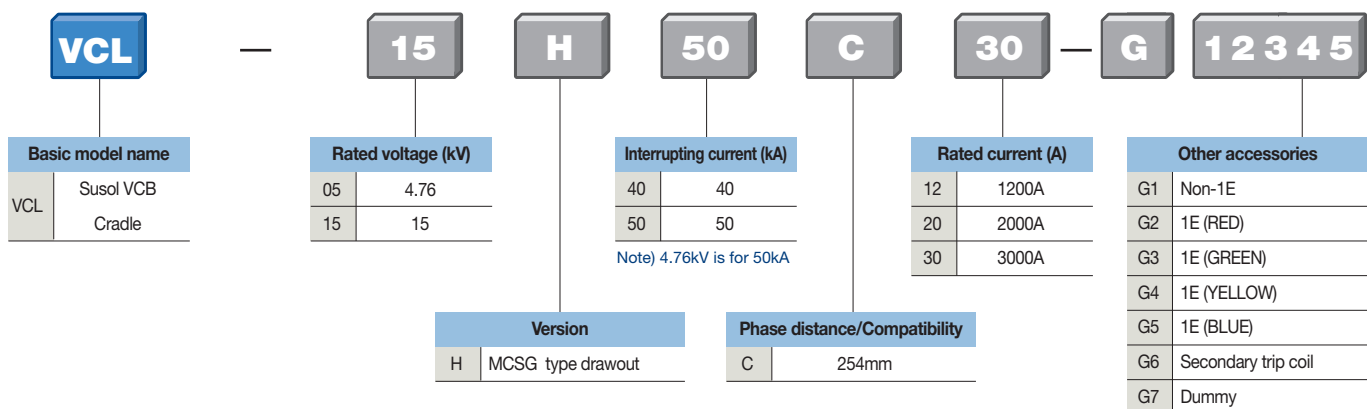
## Numbering system

4.76/15kV 40/50kA 1250/2000/3150A

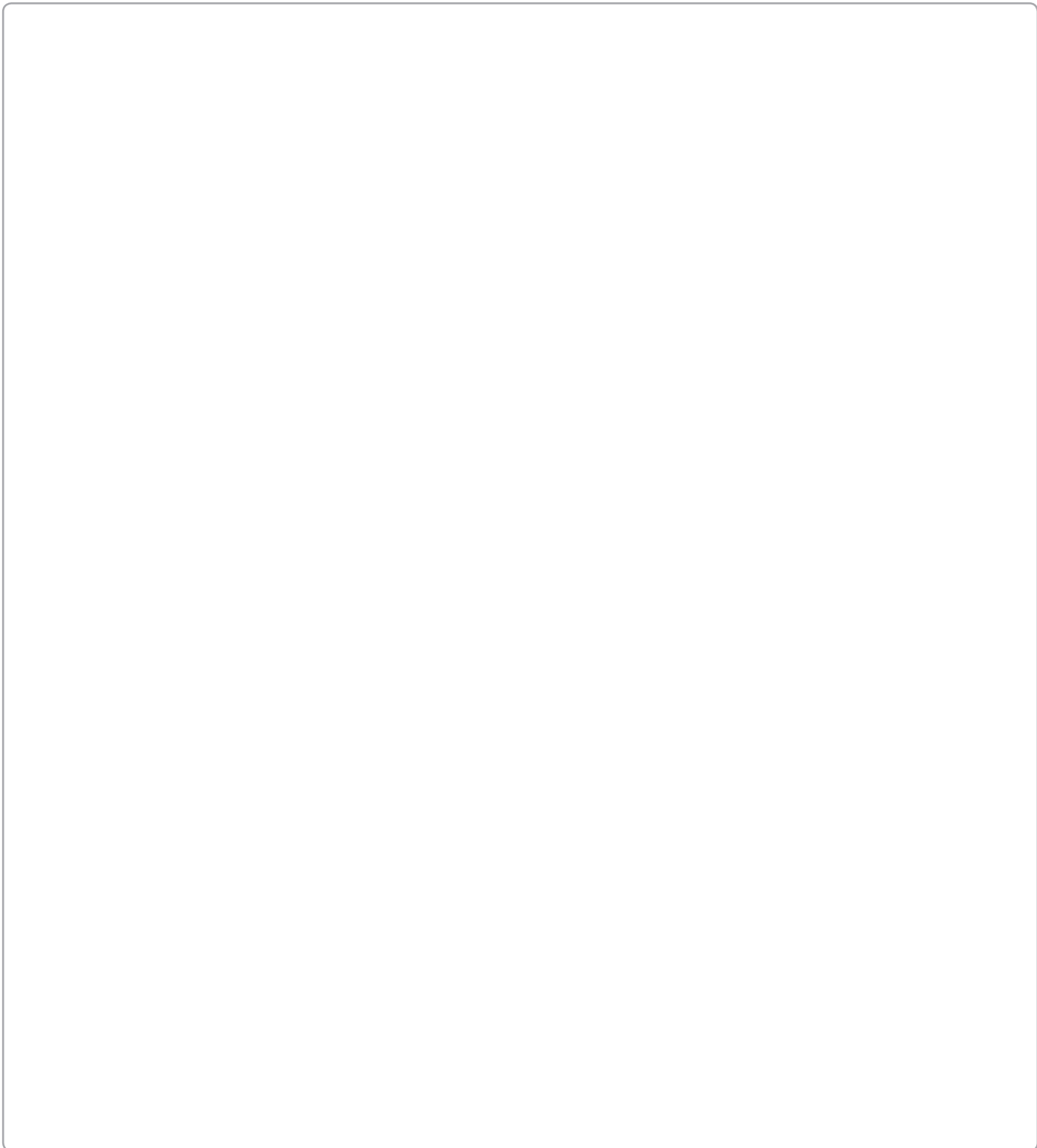
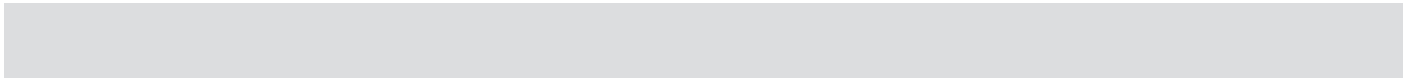
### Breaker



### Cradle





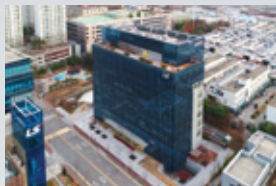


# Global Network

LS is engaged in business all over the world.  
 LS global network includes 7 overseas corporations, 12 overseas branches, and 224 clients in 77 countries.



## ► R&D



### R&D campus

Focuses on gaining competitive advantages through development of next generation platforms



### Power device R&D center

Leading technology in electric industry and continuously developing future-growth dynamic engines



### Automation R&D Center

Serves as the main research institute for LS



### PT&T (Testing laboratory)

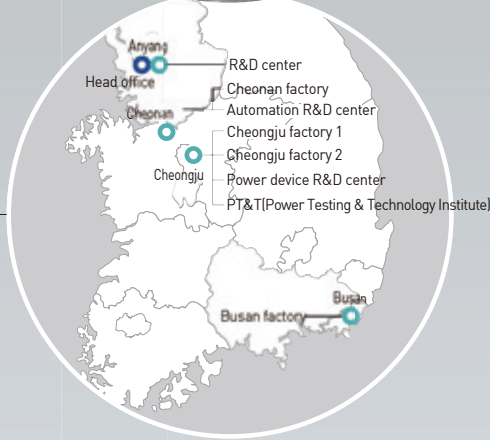
Internationally-renowned testing center that has formed partnerships with the UL, CE, KEMA and CESI

## ► Factory



### Cheongju factory (Korea)

Electric products, mold TR, MV/LV switchgear, HV GIS



**Cheonan factory** (Korea)  
PLC, AC drive, HMI, DCS, PV module



**Busan factory** (Korea)  
HV TR, HVDC, FACTS



**Wuxi factory** (China)  
Electric products



**Dalian factory** (China)  
MV/LV switchgear,  
MV contactor



**Hanoi factory** (Vietnam)  
MV/LV switchgear,  
Mold TR



### Safety Instructions

- For your safety, please read user's manual thoroughly before operating.
- Contact the nearest authorized service facility for examination, repair, or adjustment.
- Please contact qualified service technician when you need maintenance. Do not disassemble or repair by yourself!
- Any maintenance and inspection shall be performed by the personnel having expertise concerned.



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