

New name of the Electrical-equipment

VIDER
Value Provider



Medium-Voltage Equipment

General Catalog



VITZRO EM

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Create Better Life

To the Light of Technology, To the Light of Value and To the Light of Reliability VITZRO EM, in company with the customers

VITZRO EM is a leading company in the electric equipment field, developing an advanced technology, to provide more satisfaction and more advantages for you. Based on a great, expert knowledge and technology on heavy electric equipment, electric power equipment and aerospace field, VITZRO EM creates a new value to propose a new standard that will change the future.

A Bright Future, VITZRO EM

A company that customers love more than ever for we give you a larger value.
Find a bigger world along with VITZRO EM!



A company that believes in faith and creativity as the optimal value

VITZRO EM has developed into a manufacturer of MV equipment, LV equipment, protective equipment and relays in the domestic electric equipment business with the company vision, 'Faith' and 'Creativity.' Based on the 'Faith', we think of our customers and with 'Creativity', we provide a new value. VITZRO EM will provide the new value for the convenience of customers. Basically, high-quality electric equipment and services will be provided and we will endeavor to meet the requirements of customers through our humane and sensible attitudes. Our company represents the electric equipment, yet we are the company of humans. Our company thinks of customers first by providing and enabling the use of convenient and stable equipment. VITZRO EM is the new value to pursue.

Technology Integrated Global Group

The History of VITZRO EM is the History of Technology.

VITZRO EM was founded in 1955, at the embryonic stage of domestic electric power industry and as we continue our tradition and history for over half a century, we constantly challenged and leapt forward, leading the future with the reputation of Korea's best technology company.

1955 Establishment for Gwang Myung electric machinery (at present VITZRO EM)

1999 Designated as Top 50 companies for competitive quality (at present VITZRO EM)

2006 Awarded prize for USD 10 million tower of export

2009 K-STAR Plasma facing component manufacture & assembly

1955~1988 __ History of Technology, Open Up New Vistas

Kwangmyung Electric Co. was founded in 1955 and started as a neutral electricity manufacturer in January, 1968 and moved the plant to Seongsu-dong in April, 1972. The company prepared a foundation as a technology company through a technical tie-up with AICHI Company and VSS & ATS of Japan in April, 1981 and a technical cooperation with MEIDENSHA Company of Japan and a contract was concluded on Korean retail stores (V.I) in December of the same year. VCB 7.2kV-Class Type Test (localization) was completed in July, 1982 and VCB 25.8kV-Class MCSG 2 Type and 7.2kV Type Tests were completed in September of the following year. We were designated as an electric parts and materials development company (Ministry of Commerce, Industry and Energy) for Type1 other than a vacuum contact in July, 1986 and established a technical cooperation with LINDSEY Company, USA on Polymer Concrete in December of the following year. In addition, 4 types of ACB were developed in June, 1988 and successfully localized them (KEMA Authentication, Netherlands).

1989~1999 __ Opportunity, Challenge and Remarkable Leap

The company name was changed to Kwangmyung Electric Generation Co. in June, 1989 and an affiliated technology lab was founded in December of the same year. We obtained KS marks for VCB 7.2kV, 8kV and 12.5kV in 1990 (Industrial Advancement Administration) and passed the development test for ACB 2 Types (KERI) in 1991 and for outdoor VCB and Gas Insulated Load Break Switch (PGS) (CESI, Italy) in 1993. We acquired the KS mark for Gas Insulated Load Break Switch (PGS for manufacturing) in 1995 and were awarded with the first Export Award (KEMC). We began exporting ATS to GENERAC.CORP, USA in 1995 and obtained KSA-QA ISO9001 certificate. We moved the office to Seoul in August, 1996 (Neung-dong, Gwangjin-gu, Seoul) and successfully developed Manual/ Motorized ASS 25.8kV 200A in December. Also, VCB development test was completed in 1997 (POWER TECH, CANADA), developed L/A 5kA in 1998 (Polymer Rubber Type), developed VCB 25.8kV, 31.5kV, 38kV and 40kV and acquired BVQ1 ISO 9001 certificate. A joint company with China was founded in 1998 and we were awarded IR52 Jang Young Shil Award in February of the following year (Maeil Business Newspaper) and selected as one of the 50 firms with qualitative competitiveness in 1999 which displayed our technical skills and quality that we strengthened for years.

2000~2016 __ VITZRO, Stepping Forward to the World

The company name was changed to VITZRO EM Co. in 2000. We laid a foundation for a rapid growth by developing VCB 12kV 1250A 25kV/15kV 1200A 25kV and registering in KOSDAQ stock market. A new plant was constructed in July of the following year (located in Seonggok-dong, Ansan, Gyeonggi Province) and we were designated as a promising small business (Gyeonggi Province Office), an electric parts and materials development company and INNO BIZ company (Joint Korean Economic Newspaper/Small and Medium Business Administration). We sped up on development of new technology and products and developed Cable Termination kits, Insulation Cover, Feed-type ASS (auto & manual), Outdoor VCB Bushing (Polymer Type) and Processed Gas Insulated Load Break Switch in 2002, VCB for nuclear power, ACB for nuclear power (508V 30/50/65kV), Current Limit Power Fuse and so forth in 2003. We were also awarded with various certificates and awards that prove our quality and technology such as a reliability certificate on Processed Gas Insulated Load Break Switch (PGS) in 2004 (R Mark, Korean Agency for Technology and Standards), a Certificate of Quality & Environment System and Aerospace Quality System (ISO 9001 & AS9100, ISO 14001) and a grand prize at the 1st Logo & Symbol Mark Contest (Ministry of Commerce, Industry and Energy Award). We obtained GD mark in 2005 and finally got a 1,000 ten million dollar-export prize in November, 2006, confirming the remarkable growth of VITZRO EM.

2017 __ VITZRO EM New Subsidiary

In July 2017, VITZRO EM starts its electric-power equipment business through physical division. Through product development using VI technology, we plans to grow into a only one of electrical equipment industry, VITZRO EM has a vision to become a global leader based on its technical superiority and business expertise.

Best products of electric equipment field including LV and HV from designing, manufacturing, installing and diagnosing the equipment to composing the power system, it is based on the accumulated, global standard technology and continuous R&D.

LV Equipment



Air Circuit Breakers

- ANSI C37.13/EED1200 Certification for Nuclear Power
- Adopted multifunction digital trip relay
- KS, KERI, IEC Certification
- Compact, lightweight
- Standard Specification: IEC 60947-2
- Implementing remote monitoring and control communication



Earth Leakage Circuit Breakers

- Standardized main sizes, easy manufacturing of panel
- Composed of max. 225AF, 2/3/4P
- MCCB / ELCB same frame
- Compatible installation of new and old products
- Adjustable sensitivity current, Max. 500mA



Auto Transfer Switches

- UL1008 Certification, KERI Type Test completed
- Maximum short circuit capacity in the country
- Optimal form that enables installation of 600mm-panel board for all types
- Ensure stability through separately sealed structure for each phase



Thermal Overload Relay

- Direct connection to a magnetic contactor
- Finger proof cover can be installed
- Separation of power/operation part



Molded Case Circuit Breakers

- UL Certification, Max. 800AF
- Max. 1200AF, fully equipped with all series 3/4P
- MCCB / ELCB same frame
- Realization of various auxiliary devices
- Compatible installation of new and old products



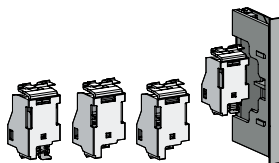
Miniature Circuit Breakers

- Minimum size, easy to apply panel board
- Increase of breaking capacity (5kA at AC 220V)
- Equipped with leakage display button



Magnetic Contact

- Improved Quality and Decreased Noise
- Convenient and Safe structure
- Enhanced safety by adopting Transparent Safety Cover



Auxiliaries

- Standardized auxiliaries, easier to apply
- AL, AX, UVT, Shunt - various auxiliaries

MV Equipment



Vacuum Circuit Breakers

- Rated breaking time of all types - 3 cycle
- Nuclear power certification ANSI C37.06 / EED1100
- Developed the first domestic Embedded VCB
- Passed KERI, KEMA, CESI development test
- Standard Specification: IEC 62271-100 [M2, E2, C2 Class]



Load Break Switch/Auto Section Switch

- Maximum fuse combined capacity in the country—Max. 100A
- LA & PF external combination structure
- Easy to design single-body panel through optimal form design
- Standard Specification: IEC 62271-105, IEC 60265-1, KEMC1126
- Compatible structure for LBS and ASS



Vacuum Contact Switches

- Rated breaking time 6.3kA(16.4kA peak)
- Minimize switch surge through optimal VI design
- Standard Specification: IEC 60470, IEC 60282-1
- Realization of mechanical interlock between VCSs or with other devices



Vacuum Interrupter/Embedded Pole

- Maintain high-vacuum state through automation process
- Compact and lightweight, durable design
- Collect and store all manufacturing information
- Excellent mechanical strength and degassing
- High-speed breaking and short arcing time

IED & Controller



Main Circuit Breaker for Rolling Stock/ Vacuum Train Breaker (MCB/VTB)

- The sole main circuit breaker for rolling stock in the country
- Excellent seismic performance
- Detection of operating pressure and auto trip function
- Stable breaking feature (AC, DC line)



Gas Insulated Load Break Switch (GLBS)

- Division of lines and tapped line applied
- 3 position function (ON, OFF, Earth)
- Increase safety with hot-line display
- Certificate on reliability by KATS
- Low pressure display and lock function



Vacuum Transfer Switches

- The one and only Medium Voltage Transfer Switch in Korea
- Electrical & Mechanical Interlock available.
- Economical optimization (Two sides of panels and two pieces of VCBs are not necessary.)
- Minimized outside dimension which can be possible with multistage loading.



Current Limit Power Fuse

- Optimal current limit feature
- Protection through full back-up with high breaking capacity
- Maximum striker motional energy in the country
- Simplified with 4 types of fuse forms
- Protect transformers, motors, Capacitor and wires



Digital Protection Relay VIPAM

- System protection required, relay element provided
- Store history of faults (trouble) and wave form
- Provide analysis function through PC interlocking
- RS422/485 communication support
- English/Korean language support



Digital Control Meter VIMAC, VIDER

- Power quality analysis and breaker control
- Automatic power factor control (APFC), harmonic analysis

Protective Device



Lightning Arrester/Surge Absorber (LA/SA)

- Optimal motion of Gapless type
- Scatter prevention when explodes using a polymer LA
- Can be used outdoors using a polysil SA
- Fire prevention due to nonflammable material



Surge Protective Device

- IEC and KS standard certification
- Built-in fuse with disconnecting device function
- Excellent TOV failure feature
- Operation status display lamp (LED Lamp)
- Easy to install using a Plug In type

VITZRO EM

We Create the Next Value

By the light of technology, value and confidence,
Together with customers, we are VITZRO EM

Leading the pleasant and affluent field of electric power equipment with state-of-the-art technology, VITZRO EM is creating new value in order to offer greater customer satisfaction with greater business value as well as present new standards, while making a difference for a better future, based on thorough knowledge and skills in the fields of heavy electric equipment, power electronics and aerospace.

VITZRO EM



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Medium-Voltage 
Equipment



B1 Vacuum Circuit Breakers

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Vacuum Circuit Breakers

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Vacuum Circuit Breakers

7.2kV~36kV(IEC Std.)/4.76kV~38kV(IEEE Std.)



It provides a product with an integrated technology, qualified nuclear energy and various voltage ranges.

- It is a product incorporated with an accumulated vacuum technology, operating device design and insulation design.
- VITZRO Vacuum circuit breakers meet or exceed IEC and IEEE standard. Vacuum circuit breakers are designed and tested per applicable section at IEC and IEEE.
- It is a product that can be used at various voltage rating from 4.76kV through 38kV.
- V-CHECK MARK Certification(VIDER VCB)

It ensures the stability by self-manufacturing the vacuum interrupters.

- VITZRO Vacuum circuit breakers meet all standards and certifications such as IEC, ANSI, UL, IEEE, KEMA and CSA.
- We provide the optimal arc extinguishing medium with high-vacuum, high arc extinguishing capability.

The product stability and life is greatly improved due to the solid insulation by applying molding to the interruption part.

- A core part of the interruption part, VI is molded and solid-insulated to improve the stability and life of the product.
- We are fully prepared for the surface discharge of vacuum circuit breaker by enhancing the insulation performance through the solid insulation.

It is easy to perform maintenance and compatible with new and old products.

- It uses the accumulated design data to display outstanding compatibility with old/new products.
- It is designed to enable easier maintenance and VCB can be inspected by simply checking the contact consumption and control circuits.
- A cover made up of an insulation material is adopted to maximize the safety of operators

Class1E Vacuum Circuit Breakers For Nuclear Power Plant



It is well-known throughout the world as it passed Class 1E VCB performance test.

Class 1E VCB for nuclear power plants is manufactured based on the nuclear power certification system and it has completed the development test complying with KEPIC, EED 1100-2005.

Its quality improved greatly with the superior breaking function.

The Vacuum interrupters consist of three Vacuum bottles mechanically to spring-assisted operating mechanism, the interrupting time of the Vacuum bottle is approximately 3cycles (50millise), and it can be used under unfavorable conditions such as under gas and ion emission without any severe impacts on circuit switching, ground fault, high-speed reclosing and Capacitor bank switching.

It completed the seismic test, acquiring GENERIC Class.

It completed the seismic test based on Broadband Generic Spectra of IEEE C37.98 and meets the seismic standards of all nuclear power plants around the world.

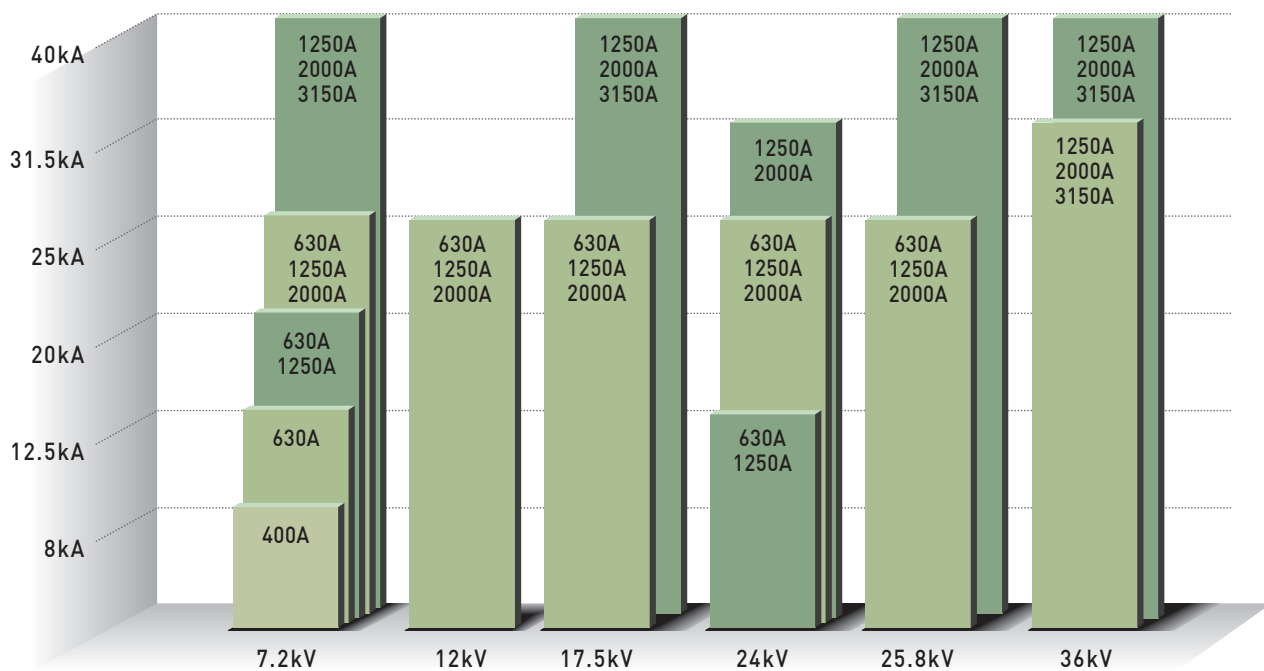
Product Line-Up

The full line up, various options to choose from!



For Nuclear Power Plant

IEC Standard



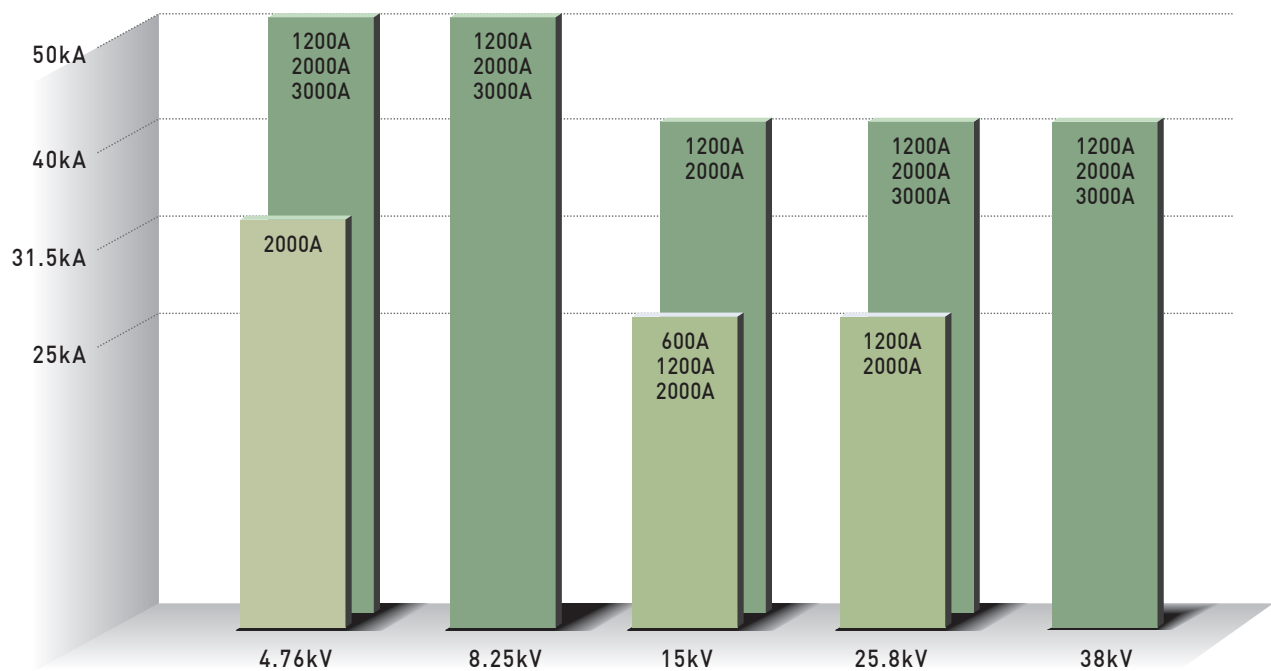


Overseas IEEE (ANSI) Applied/
For Use Indoors



Outdoor

IEEE Standard



Ratings

Small Capacity (7.2kV)

Type	VVB□-07408S	VVB□-07612S	VVB□-07620S	VVB□-07120S	VVB□-07625S
Rated Voltage (kV)	7.2	7.2	7.2	7.2	7.2
Rated Current (A)	400	630	630	1250	630
Rated Breaking Current (kA)	8	12.5	20	20	25
Rated Frequency (Hz)	60	60	60	60	60
Rated Short Time Withstand Current (kA/3sec)	8	12.5	20	20	25
Rated Breaking Capacity (MVA)	100	160	250	250	320
Rated Making Current (kAp)	20.8	32.5	52	52	65
Rated Breaking Time (Cycle)	3	3	3	3	3
Withstand Voltage Power Frequency (1min) (kV/1min)	20	20	20	20	20
Withstand Voltage Lightning Impulse (1.2×50μs) (BIL)	60	60	60	60	60
Operating Sequence	0-0.3s-CO-3min-CO				
Closing Operation Method	Motor-Spring Charge Type				
Trip Control Method	Shunt release				
Making Voltage (V)	*DC24, 48, 110, 220 / AC 110, 220				
Standard Auxiliary Contact	4NO 4NC	4NO 4NC	4NO 4NC	4NO 4NC	6NO 6NC
Rated Opening Time (sec)	0.03	0.03	0.03	0.03	0.03
No-load Closing Time (sec)	0.05	0.05	0.05	0.05	0.05
Installation Method (Fixed (N), Drawout (E, F, G))	N, E, F, *G	N, E, F, *G	N, E, F, *G	N, E, F, *G	N, E, F, *G
Body Weight (kg)	38	38	42	45	45
Applicable Standard	IEC 62271-100				

* To be released in 2018

Type	VVB□-07125S	VVB□-6225M	VVB□-07140M	VVB□-07240M	VVB□-07340M
Rated Voltage (kV)	7.2	7.2	7.2	7.2	7.2
Rated Current (A)	1250	2000	1200/1250	2000	3000/3150
Rated Breaking Current (kA)	25	25	40	40	40
Rated Frequency (Hz)	60	60	60	60	60
Rated Short Time Withstand Current (kA/3sec)	25	25	40 (2sec)	40 (2sec)	40 (2sec)
Rated Breaking Capacity (MVA)	320	-	500	500	500
Rated Making Current (kAp)	65	65	104	104	104
Rated Breaking Time (Cycle)	3	3	3	3	3
Withstand Voltage Power Frequency (1min) (kV/1min)	20	20	20	20	20
Withstand Voltage Lightning Impulse (1.2×50μs) (BIL)	60	60	60	60	60
Operating Sequence	0-0.3s-CO-3min-CO				
Closing Operation Method	Motor-Spring Charge Type				
Trip Control Method	Shunt release				
Making Voltage (V)	*DC24, 48, 110, 220 / AC 110, 220				
Standard Auxiliary Contact	6NO 6NC	6NO 6NC	6NO 6NC	6NO 6NC	6NO 6NC
Rated Opening Time (sec)	0.03	0.03	0.03	0.03	0.03
No-load Closing Time (sec)	0.05	0.05	0.05	0.05	0.05
Installation Method (Fixed (N), Drawout (E, F, G))	N, E, F, *G	N, E, F, G	N, E, F, G	N, E, F, G	N, E, F, G
Body Weight (kg)	45	145	270	285	310
Applicable Standard	IEC 62271-100				

* To be released in 2018

Medium Capacity(12kV~17kV)

Type	WVB□-12625S	WVB□-12125S	KVA□-12225M	WVB□-12140S	WVB□-12240S	WVB□-12340S	KVA□-15625M
Rated Voltage (kV)	12	12	12	12	12	12	15
Rated Current (A)	630	1250	2000	1250	2000	3150	600
Rated Breaking Current (kA)	20/25	20/25	20/25	40	40	40	20/25
Rated Frequency (Hz)	50/60	50/60	50/60	60	60	60	50/60
Rated Short Time Withstand Current (kA/3sec)	25	25	25	40	40	40	25
Rated Breaking Capacity (MVA)	520	520	520	520	520	520	650
Rated Making Current (kAp)	65	65	65	104	104	104	65
Rated Breaking Time (Cycle)	3	3	3	3	3	3	3
Withstand Voltage Power Frequency (1min) (kV/1min)	28	28	28	28	28	28	36
Withstand Voltage Lightning Impulse (1.2×50μs) (BIL)	75	75	75	75	75	75	95
Operating Sequence	0-0.3s-CO-3min-CO						
Closing Operation Method	Motor-Spring Charge Type						
Trip Control Method	Shunt release						
Making Voltage (V)	*DC24, 48, 110, 220 / AC 110, 220						
Standard Auxiliary Contact	6NO 6NC	6NO 6NC	6NO 6NC	6NO 6NC	6NO 6NC	6NO 6NC	6NO 6NC
Rated Opening Time (sec)	0.03	0.03	0.03	0.03	0.03	0.03	0.03
No-load Closing Time (sec)	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Installation Method (Fixed (N), Drawout (E, F, G))	N, E, F, G	N, E, F, G	N, E, F, *G	N, E, F, *G	N, E, F, *G	N, E, F, *G	N, E, F, *G
Body Weight (kg)	42	45	130	208	218	249	130
Applicable Standard	IEC 62271-100		IEC 60056	IEC 62271-100			ANSI C37.09

* To be released in 2018

Type	KVA□-15125M	KVA□-15225M	WVB□-17625S	WVB□-17125S	WVB□-17140S	WVB□-17240S	WVB□-17340S
Rated Voltage (kV)	15	15	17.5	17.5	17.5	17.5	17.5
Rated Current (A)	1200	2000	630	1250	1250	2000	3150
Rated Breaking Current (kA)	20/25	20/25	20/25	20/25	40	40	40
Rated Frequency (Hz)	50/60	50/60	50/60	50/60	60	60	60
Rated Short Time Withstand Current (kA/3sec)	25	25	25	25	40	40	40
Rated Breaking Capacity (MVA)	650	650	750	750	750	750	750
Rated Making Current (kAp)	65	65	65	65	104	104	104
Rated Breaking Time (Cycle)	3	3	3	3	3	3	3
Withstand Voltage Power Frequency (1min) (kV/1min)	36	36	38	38	38	38	38
Withstand Voltage Lightning Impulse (1.2×50μs) (BIL)	95	95	95	95	95	95	95
Operating Sequence	0-0.3s-CO-3min-CO						
Closing Operation Method	Motor-Spring Charge Type						
Trip Control Method	Shunt release						
Making Voltage (V)	*DC24, 48, 110, 220 / AC 110, 220						
Standard Auxiliary Contact	6NO 6NC	6NO 6NC	6NO 6NC	6NO 6NC	6NO 6NC	6NO 6NC	6NO 6NC
Rated Opening Time (sec)	0.03	0.03	0.03	0.03	0.03	0.03	0.03
No-load Closing Time (sec)	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Installation Method (Fixed (N), Drawout (E, F, G))	N, E, F, *G	N, E, F, G	N, E, F, G	N, E, F, G	N, E, F, G	N, E, F, G	N, E, F, G
Body Weight (kg)	130	130	42	45	208	218	249
Applicable Standard	ANSI C37.09		IEC 62271-100				

* To be released in 2018

Ratings

Large Capacity (24kV~38kV)

Type	WB□-24613S	WB□-24113S	WB□-24625S	WB□-24125S	WB□-2225M	WB□-25625S	WB□-25125S	WB□-2225M
Rated Voltage (kV)	24	24	24	24	24	25.8	25.8	25.8
Rated Current (A)	630	1250	630	1250	2000	630	1250	2000
Rated Breaking Current (kA)	12.5	12.5	25	25	25	25	25	25
Rated Frequency (Hz)	60	60	60	60	60	60	60	60
Rated Short Time Withstand Current (kA/3sec)	12.5	12.5	25	25	25	25	25	25
Rated Breaking Capacity (MVA)	520	520	1040	1040	1040	1120	1120	1120
Rated Making Current (kAp)	32.5	32.5	65	65	63	65	65	63
Rated Breaking Time (Cycle)	3	3	3	3	3	3	3	3
Withstand Voltage Power Frequency (1min) (kV/1min)	50	50	50	50	50	50	50	50
Withstand Voltage Lightning Impulse (1.2×50μs) (BIL)	125	125	125	125	125	125	125	125
Operating Sequence	O-0.3s-CO-3min-CO							
Closing Operation Method	Motor-Spring Charge Type							
Trip Control Method	Shunt release							
Making Voltage (V)	*DC24, 48, 110, 220 / AC 110, 220							
Standard Auxiliary Contact	6NO 6NC	6NO 6NC	6NO 6NC	6NO 6NC	6NO 6NC	8NO 8NC	8NO 8NC	8NO 8NC
Rated Opening Time (sec)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
No-load Closing Time (sec)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Installation Method (Fixed (N), Drawout (E, F, G))	N, *E, *F, *G	N, *E, *F, *G	N, *E, *F, *G	N, *E, *F, *G	N, E, F, G	N, *E, *F, *G	N, *E, *F, *G	N, E, F, G
Body Weight (kg)	90	90	90	90	180	90	95	180
Applicable Standard	IEC 62271-100				IEC60056	IEC 62271-100		IEC60056

Type	KVA□-2140M	KVA□-2240M	KVA□-2340M	KVA□-3131M	KVA□-3231M	VVA□-38140M	VVA□-38240M	VVA□-38340M
Rated Voltage(kV)	25.8	25.8	25.8	36/38	36/38	38	38	38
Rated Current(A)	1250	2000	3150	1200	2000	1200	2000	3000
Rated Breaking Current(kA)	40	40	40	31.5	31.5	40	40	40
Rated Frequency(Hz)	60	60	60	60	60	60	60	60
Rated Short Time Withstand Current(kA/3sec)	40	40	40	31.5	31.5	40	40	40
Rated Breaking Capacity(MVA)	1800	1800	1800	2070	2070	2630	2630	2630
Rated Making Current(kAp)	104	104	104	82	82	104	104	104
Rated Breaking Time(Cycle)	5	5	5	3	3	3	3	3
Withstand Voltage Power Frequency(1min)(kV/1min)	60	60	60	80	80	80	80	80
Withstand Voltage Lightning Impulse(1.2×50μs)(BIL)	150	150	150	170	170	150	150	150
Operating Sequence	O-0.3s-CO-3min-CO			O-0.3s-CO-3min-CO, CO-15S-CO		O-0.3s-CO-3min-CO		
Closing Operation Method	Motor-Spring Charge Type							
Trip Control Method	Shunt release							
Making Voltage(V)	*DC24, 48, 110, 220 / AC 110, 220							
Standard Auxiliary Contact	8NO 8NC	8NO 8NC	8NO 8NC	8NO 8NC	8NO 8NC	6NO 6NC	6NO 6NC	6NO 6NC
Rated Opening Time(sec)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
No-load Closing Time(sec)	0.05	0.05	0.05	0.1	0.1	0.05	0.05	0.05
Installation Method (Fixed(N), Drawout(E, F, G))	N, E, F, G	N, E, F, G	N, E, F, G	N, E, F, G	N, E, F, G	N, G	N, G	N, G
Body Weight(kg)	350	370	370	530	550	530	550	580
Applicable Standard	IEC 60056			IEEE C37.09				

For Use Outdoors (25.8kV~36kV)

Type	KVAX-2625M	KVAX-2125M	KVAX-2225M
Rated Voltage (kV)	25.8(Outdoor)	25.8(Outdoor)	25.8(Outdoor)
Rated Current (A)	600	1200	2000
Rated Breaking Current (kA)	25	25	25
Rated Frequency (Hz)	60	60	60
Rated Short Time Withstand Current (kA/3sec)	25	25	25
Rated Breaking Capacity (MVA)	1120	1120	1120
Rated Making Current (kAp)	63	63	63
Rated Breaking Time (Cycle)	5	5	5
Withstand Voltage Power Frequency (1min) (kV/1min)	60	60	60
Withstand Voltage Lightning Impulse (1.2×50μs) (BIL)	150	150	150
Operating Sequence	0-0.3s-CO-3min-CO, CO-15S-CO		
Closing Operation Method	Motor-Spring Charge Type		
Trip Control Method	Shunt release		
Making Voltage (V)	Default: DC125 SCADA Option Voltage: DC24, DC125V		
Standard Auxiliary Contact	10NO 10NC	10NO 10NC	10NO 10NC
Rated Opening Time (sec)	0.05	0.05	0.05
No-load Closing Time (sec)	0.1	0.1	0.1
Installation Method (Fixed (N), Drawout (E, F, G))	For Outdoor	For Outdoor	For Outdoor
Body Weight (kg)	1000	1020	1060
Applicable Standard	GS5925-0025(2007), IEC60056		

Type	VVBX-25640M	VVBX-25140M	VVBX-25240M	VVBX-25340M	VVBX-36125M
Rated Voltage (kV)	25.8(Outdoor)	25.8(Outdoor)	25.8(Outdoor)	25.8(Outdoor)	36(Outdoor)
Rated Current (A)	600	1200	2000	3000	1250
Rated Breaking Current (kA)	40	40	40	40	25
Rated Frequency (Hz)	60	60	60	60	50/60
Rated Short Time Withstand Current (kA/3sec)	40	40	40	40	25
Rated Breaking Capacity (MVA)	1800	1800	1800	1800	1560
Rated Making Current (kAp)	104	104	104	104	65
Rated Breaking Time (Cycle)	5	5	5	5	3
Withstand Voltage Power Frequency (1min) (kV/1min)	60	60	60	60	70
Withstand Voltage Lightning Impulse (1.2×50μs) (BIL)	165	165	165	165	170
Operating Sequence	0-0.3s-CO-3min-CO, CO-15S-CO				0-0.3s-CO-3min-CO
Closing Operation Method	Motor-Spring Charge Type				
Trip Control Method	Shunt release				
Making Voltage (V)	Default : DC125 SCADA Option Voltage : DC24, DC125V				
Standard Auxiliary Contact	10NO 10NC	10NO 10NC	10NO 10NC	10NO 10NC	10NO 10NC
Rated Opening Time (sec)	0.05	0.05	0.05	0.05	0.03
No-load Closing Time (sec)	0.1	0.1	0.1	0.1	0.05
Installation Method (Fixed (N), Drawout (E, F, G))	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor
Body Weight (kg)	1750	1800	1900	2000	1290
Applicable Standard	Item exempted from ES-5925-0001 certification				IEC62271-100, 200

Ratings / Ordering Information

For Nuclear Power Plants

Type Name	KVAH 7□50M	KVAH 6□50M	KVAH 1□40M
Max Rated Voltage	4.76 kV	8.25 kV	15 kV
Rated Current	1200A / 2000A / 3000A	1200A / 2000A / 3000A	1200A / 2000A
Rated Frequency	60 Hz	60 Hz	60 Hz
Constant (K)	1.0	1.0	1.0
Rated Breaking Current	50 kA rms	50 kA rms	40 kA rms
Rated Breaking Capacity	410 MVA	710 MVA	1040 MVA
Rated Short Time Withstand Current (3S)	50 kA rms	50 kA rms	40 kA rms
Rated Making Current	130 kA p	130 kA p	104 kA p
Rated Breaking Time	5 cycle	5 cycle	5 cycle
Power Frequency Withstand Voltage	19 kV	36 kV	36 kV
Impulse Withstand Voltage (1.2×50μs)	60 kVp	95 kVp	95 kVp
Nuclear Power Electrical Class	Class 1E	Class 1E	Non Class 1E
Nuclear Power Quality Class	Q	Q	S
Rated Operating Seq.	0-0.3S-CO-3min-CO		
Life (Rated Current Input)	5,000 times		
Operation Mode	Spring Operation Mode		
Rated Operating Voltage (For Motor)	DC 125V		
Rated Operating Current (For Motor)	Inrush 8.5A, steady state 1.5A		
Rated Operating Voltage / Current (For Coil)	DC 125V, 5A		
Rated Spring Reduction Time	< 15 sec		
Rated Making Time	< 0.06 sec		
Rated Opening Time	< 0.05 sec		
Auxiliary Contact	2NO + 2NC		
MOC Number of Contacts / TOC Number of Contacts	5NO + 5NC / 3NO + 3NC		
CB Weight (body)	288 kg / 318 kg / 318 kg	288 kg / 318 kg / 318 kg	285 kg / 318 kg / 318 kg
Certificate & Approval	EED1100(2005) / IEEE Std C37.09(1999) / IEEE Std C37.09a(2005)		

Ordering Information

□□□		N	07	4	08	M	
Applied Standards		Rated Voltage		Rated Current		Operation Method	
WB	IEC 62271-100	07	7.2kV	4	400A	M Motor Drive Operation	
VWA	IEEE C37.09	12	12kV	6	600/630A	MA Permanent Magnet Operation	
KVA	IEC60056	15	15kV	1	1200/1250A		
	IEEEC 37.09	17	17.5kV	2	2000/2500A		
Installing Method		24	24kV	3	3000/3150A	Rated Breaking Current	
		25	25.8kV	08 8kA			
		38	36/38kV				
		1	12/15kV				
		2	24/25.8kV				
		4	4.76kV				
N	Fixed Type	6	7.2kV	13(12) 12.5kA			
E	Draw-Out Type	Rated Breaking Current		20	20kA		
F	Draw-Out Type (ShutterType,F2)			25	25kA		
G(H)	Draw-Out Type (Shutter, Bushing Type)			31	31.5kA		
X	For Outdoors			40	40kA		
				50	50kA		

Designation parameters for order

1. Quantity

3. Applied Standards

5. Rated Current (A)

7. Standard Frequency(Hz)

9. Operation Method

11. Control Voltage (AC/DC)

13. Number of auxiliary contacts

15. Designated parts

17. Designated spare parts

19. Delivery Due
2. Type Name

4. Rated Voltage (kV)

6. Rated Breaking Current (kA)

8. Installation Method

10. Operating Voltage (AC/DC)

12. BCT used or not & specifications

14. Standard parts

16. Name plate

18. Usage (Purpose)

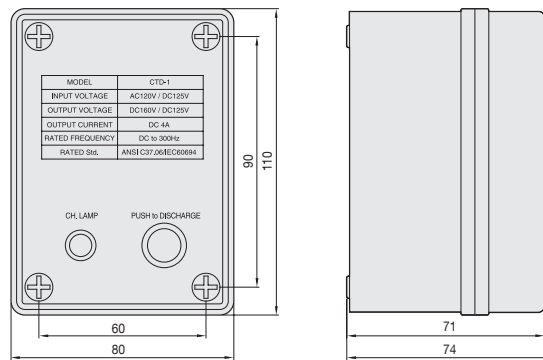
Accessories / Dimensions

Capacitor Trip Device (CTD)

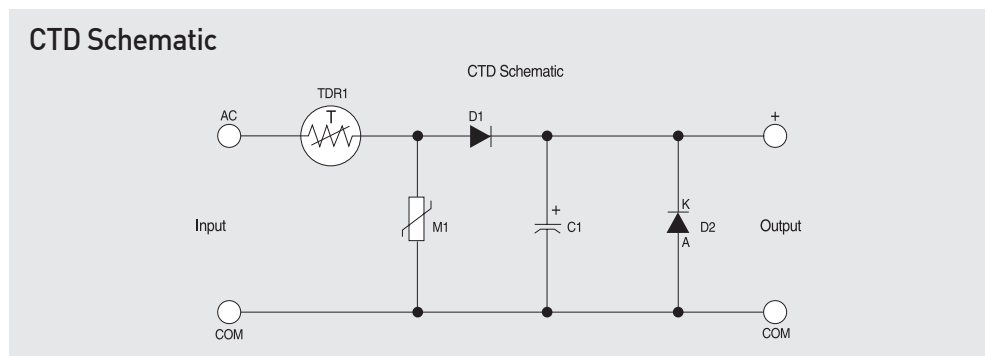
The operating and control power of our VCB is DC power in standard but AC power can also be used depending on the composition of load equipment and conditions. A Capacitor Trip Device can be installed in addition in order to control the VCB even when there is a commercial power failure.

Type	CTD-1	CTD-2
Rated Input Voltage	AC 100 / 120V	AC 200 / 220V
Rated Output Voltage	DC 130 / 150V	DC 240 / 260V
Max. Discharge Holding Time	5 min	5 min

External Dimensions



Connection Diagram



Position Display Switch

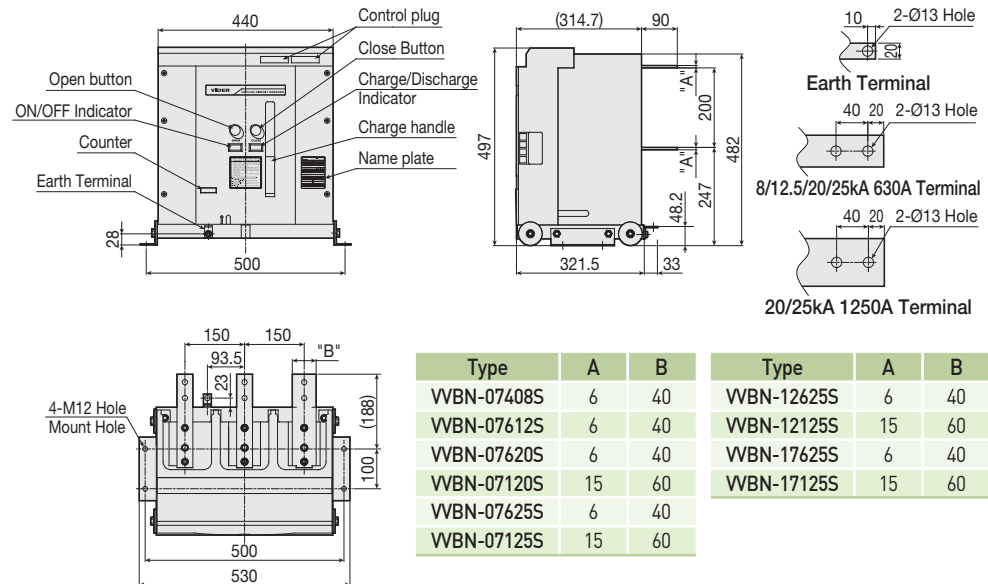
It is a switch to indicate whether a draw-out type VCB that uses a draw-out unit is in the connecting position or test position in remote and this is installed in the draw-out unit of the VCB.

Standard Auxiliaries

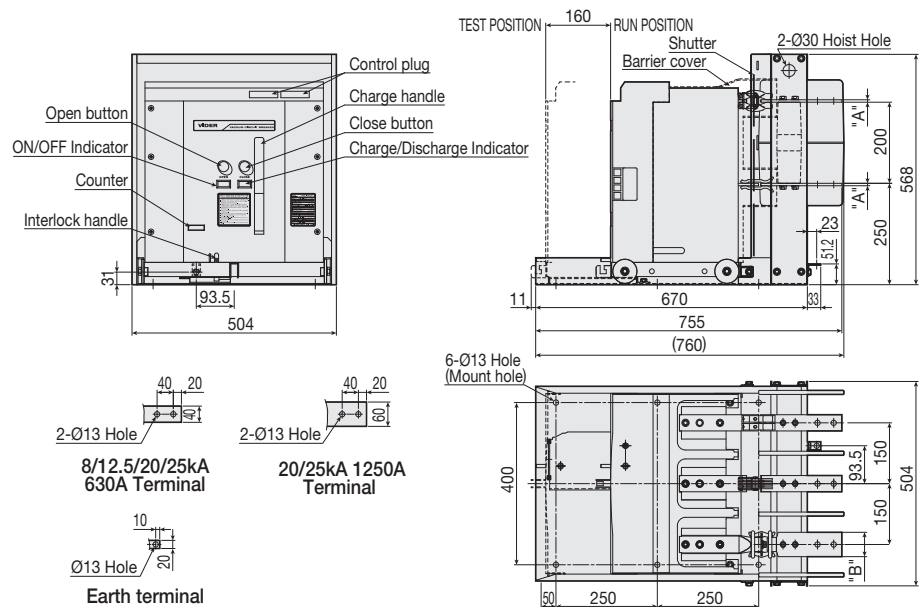
Type	Fixing Device	Charging Handle	Draw-In/Out Handle	Control Circuit Connecting Cable	Remarks
Fixed Type(N)	1 set	1	1	1	Connecting cable is 1.5m long, standard type
Draw-Out Type (E, F, G(H))	-	1	1	1	

7.2kV
8/12.5kA
7.2/12/17.5kV
20/25kA
(VVB□-xxxxS)

Fixed Type (N)



Draw-Out Type (E/F)



* However, Shutter Part is not applied to E-Class
* 7.2kV 8/12.5kA Barrier Cover does not apply

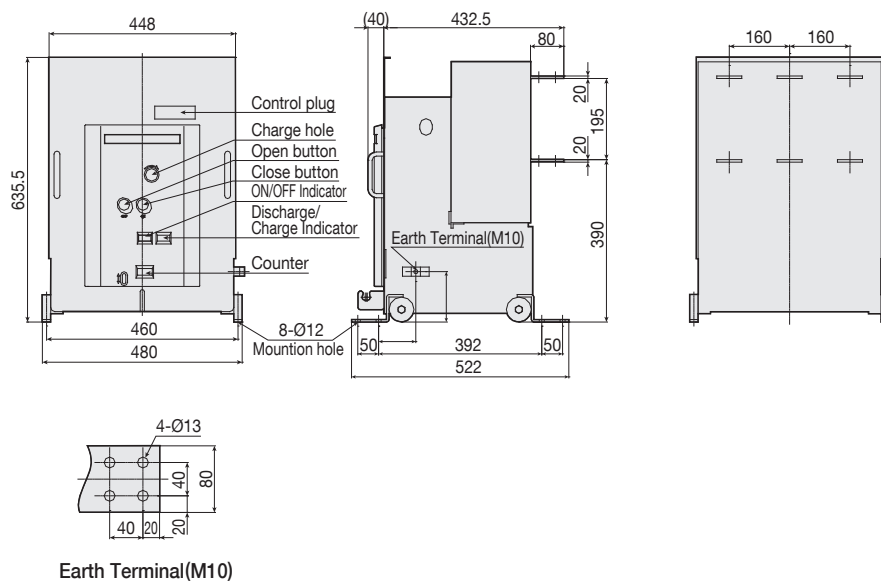
Type	A	B	Type	A	B
VBN-07408S	6	40	VBN-12625S	6	40
VBN-07612S	6	40	VBN-12125S	15	60
VBN-07620S	6	40	VBN-17625S	6	40
VBN-07120S	15	60	VBN-17125S	15	60
VBN-07625S	6	40			
VBN-07125S	15	60			

Note: G (Bushing type) will be released in 2018.

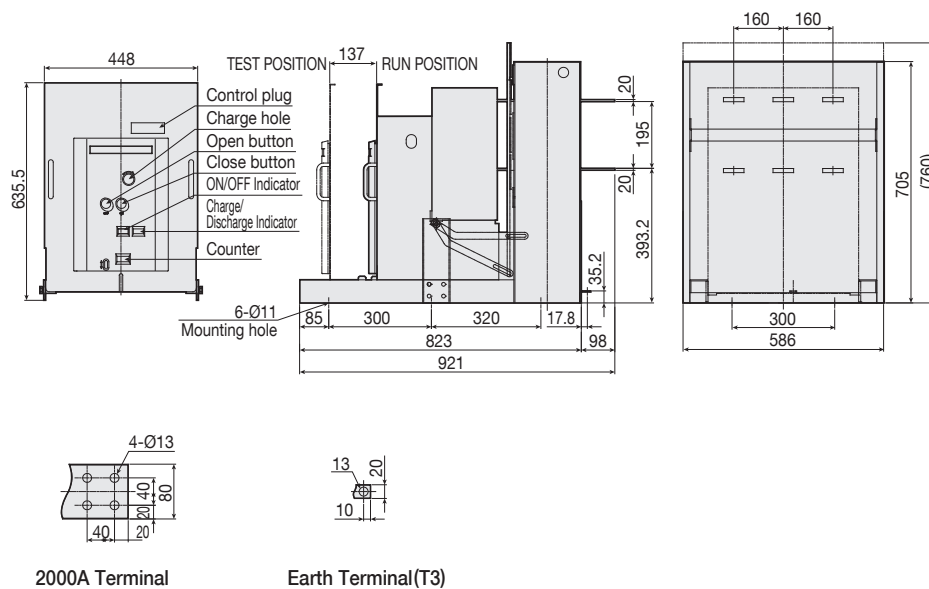
Dimensions

7.2kV
25kA 2000A
(VVBN-xxxxM)

Fixed Type (N)



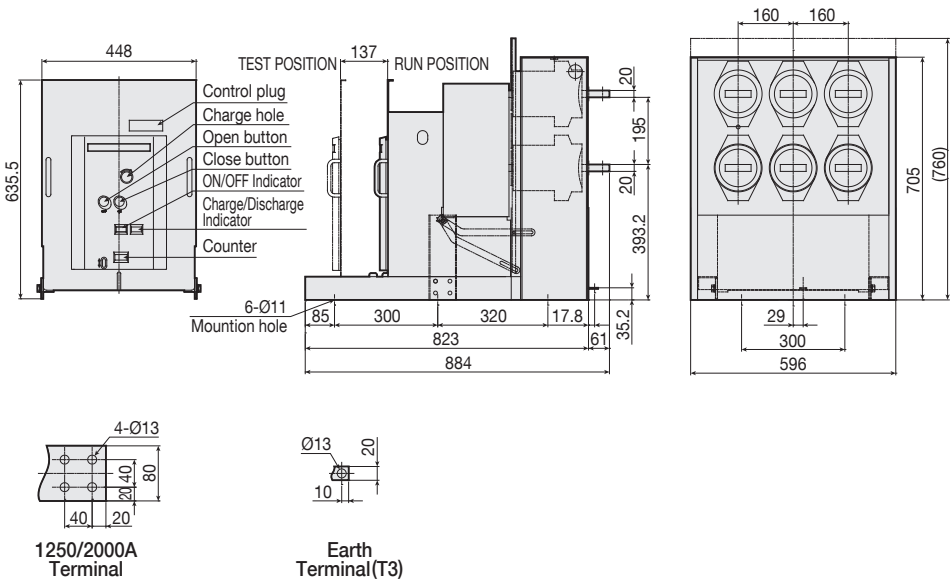
Draw-Out Type (E/F)



* However, Shutter Part is not applied to E-Class

7.2kV
25kA 2000A
(VVBG-xxxxM)

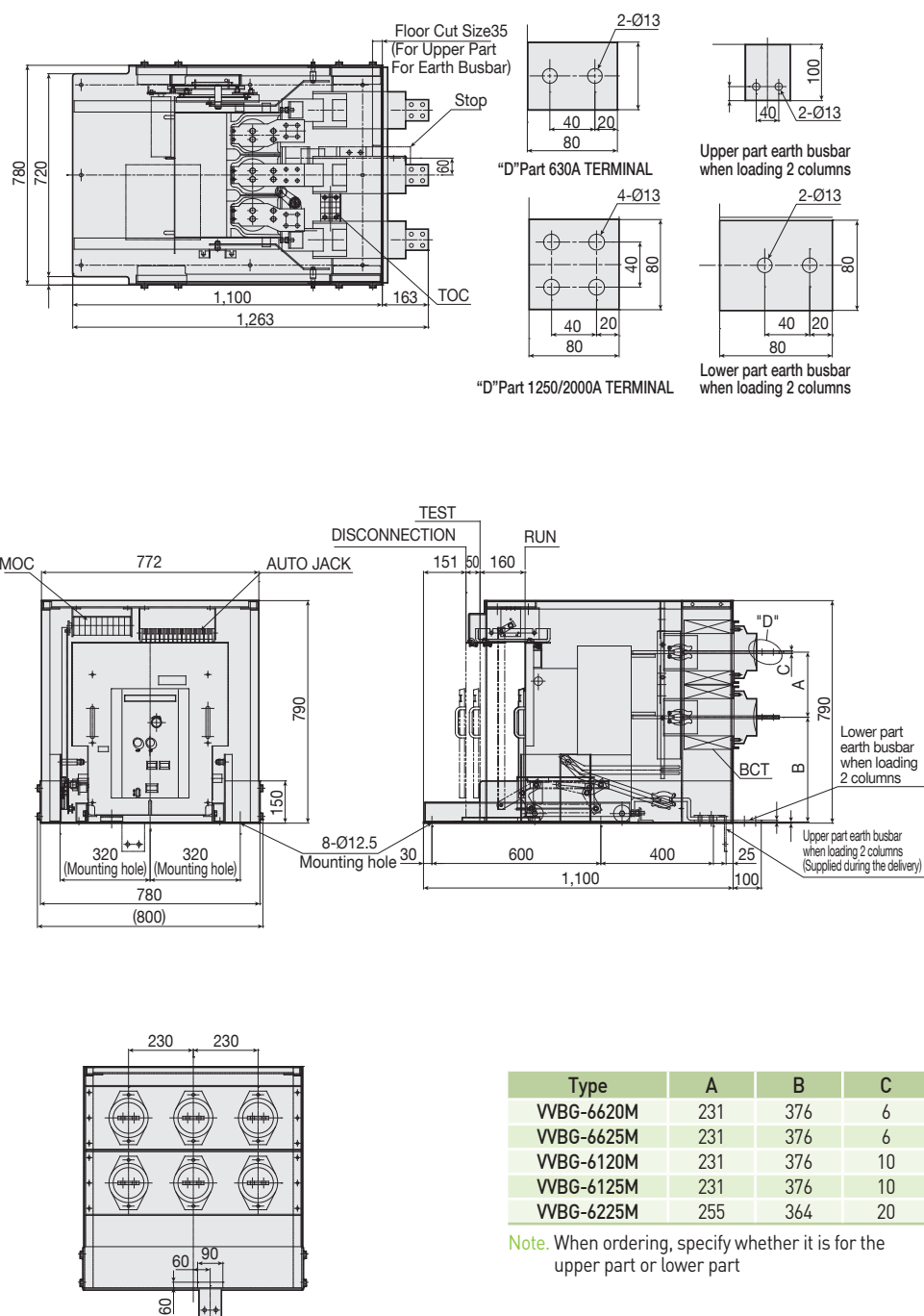
Bushing Type (G)



Dimensions

7.2kV 20/25kA
(VVB□-xxxxM)

Unit Type (G Class+MOC / TOC+CT mount in Front)

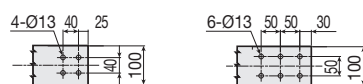
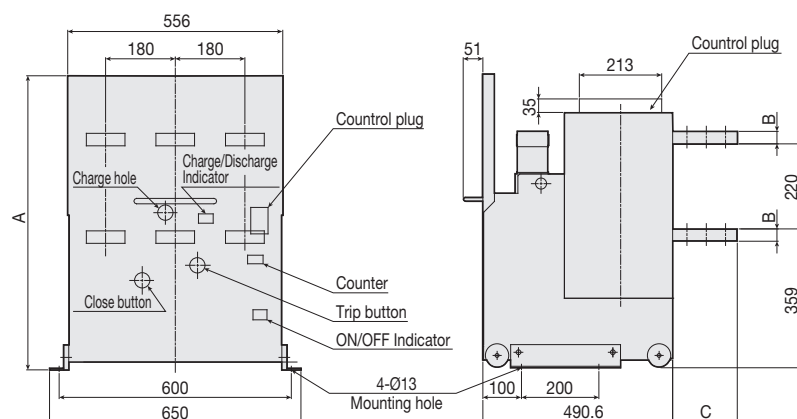


Type	A	B	C
VVBG-6620M	231	376	6
VVBG-6625M	231	376	6
VVBG-6120M	231	376	10
VVBG-6125M	231	376	10
VVBG-6225M	255	364	20

Note. When ordering, specify whether it is for the upper part or lower part

7.2kV 40kA
(VVB□-xxxxM)

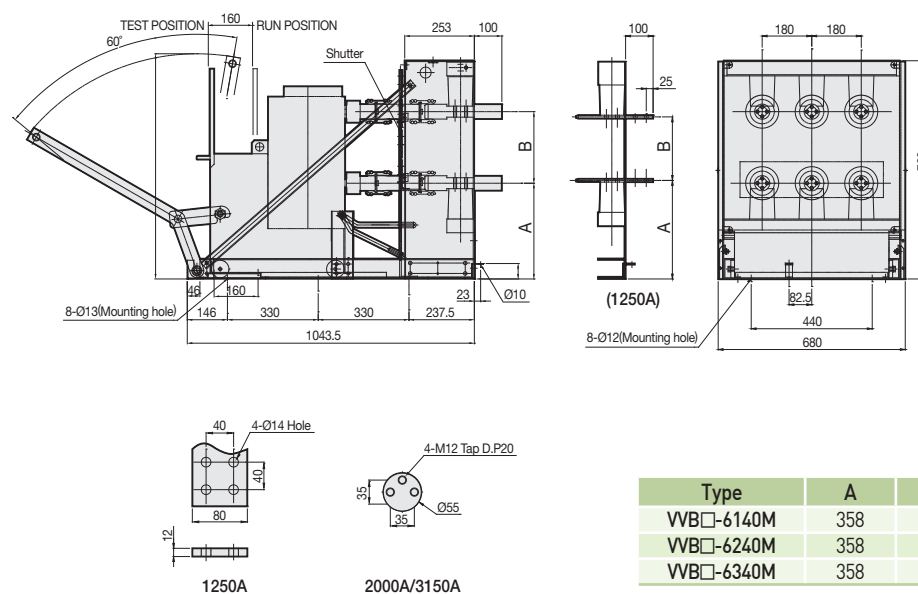
Fixed Type (N)



1250 / 2000A Terminal 3150A Terminal

Type	A	B	C
VBN-6140M	670	12	97
VBN-6240M	670	25	97
VBN-6340M	760	32	167

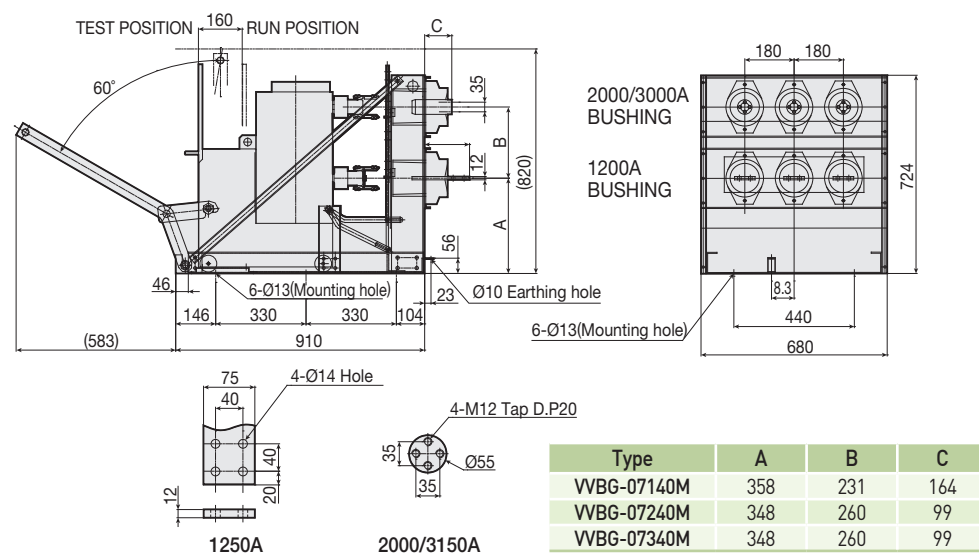
Draw-Out Type (E/F)



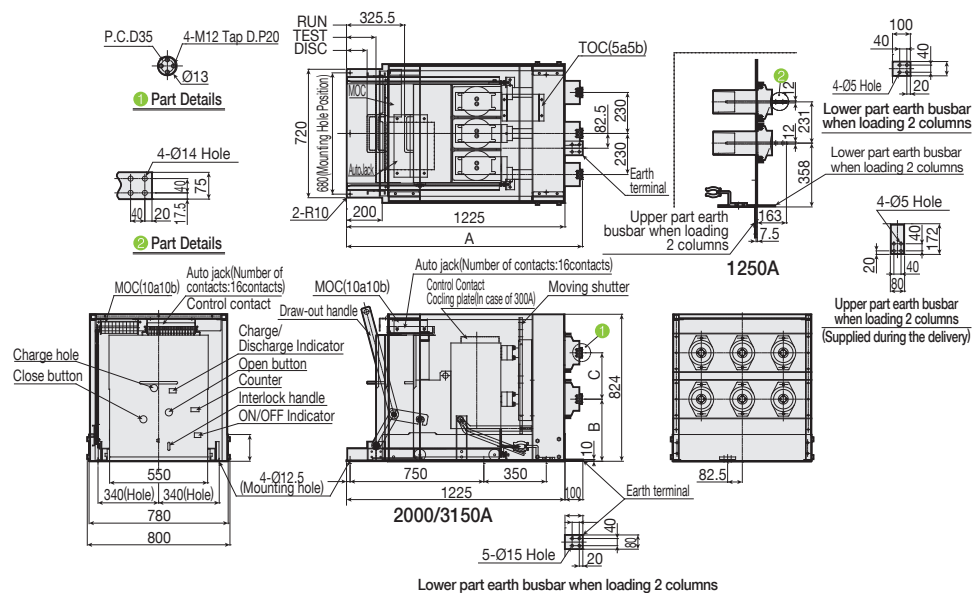
Type	A	B
WB□-6140M	358	231
WB□-6240M	358	260
WB□-6340M	358	260

* However, Shutter Part is not applied to E-Class

Bushing Type (G)



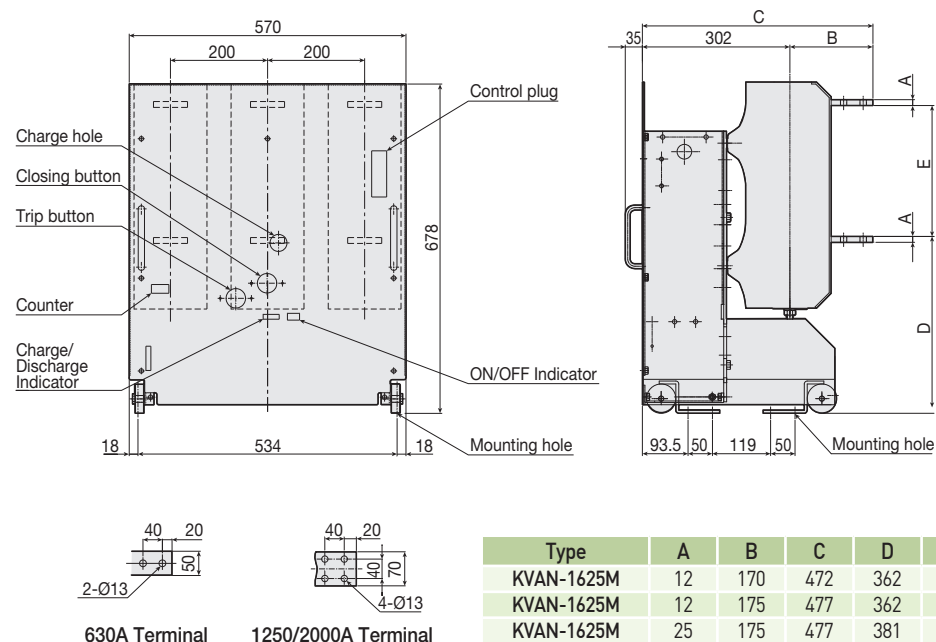
Unit Type (G Class+MOC / TOC+CT mount in Front)



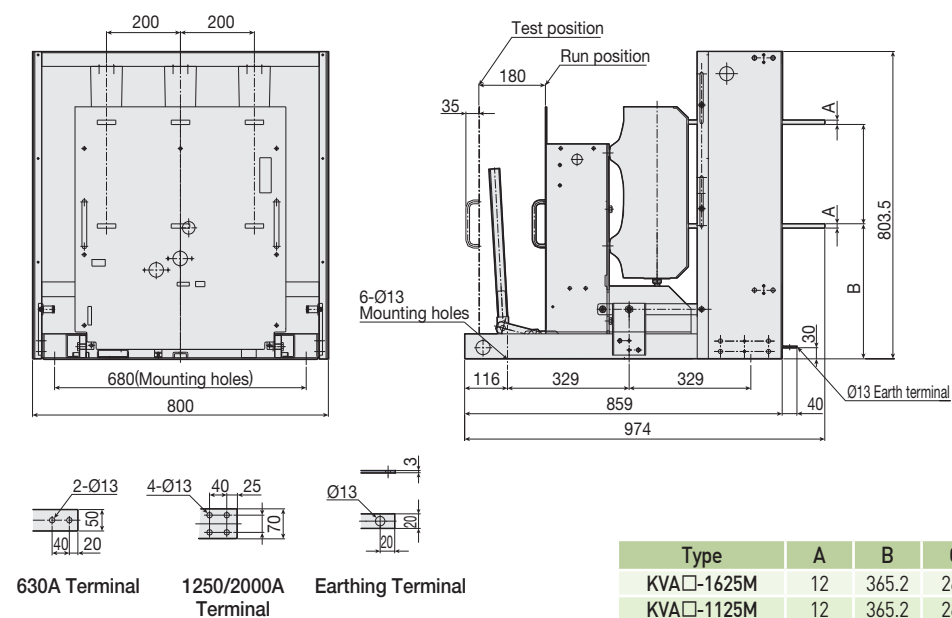
Type	A	B	C
WBG-07140M	1388	358	231
WBG-07240M	1323	348	260
WBG-07340M	1323	348	260

12/15kV 25kA
(KVA□-xxxxM)

Fixed Type (N)



Draw-Out Type (E/F)

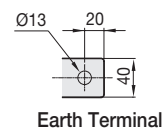
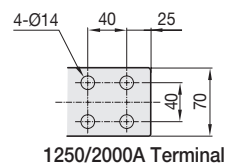
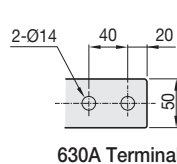
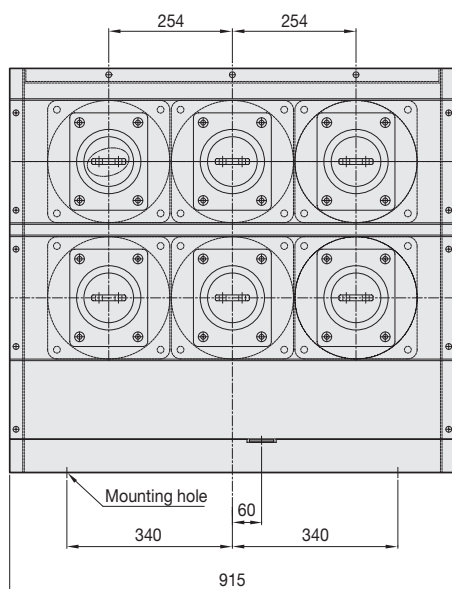
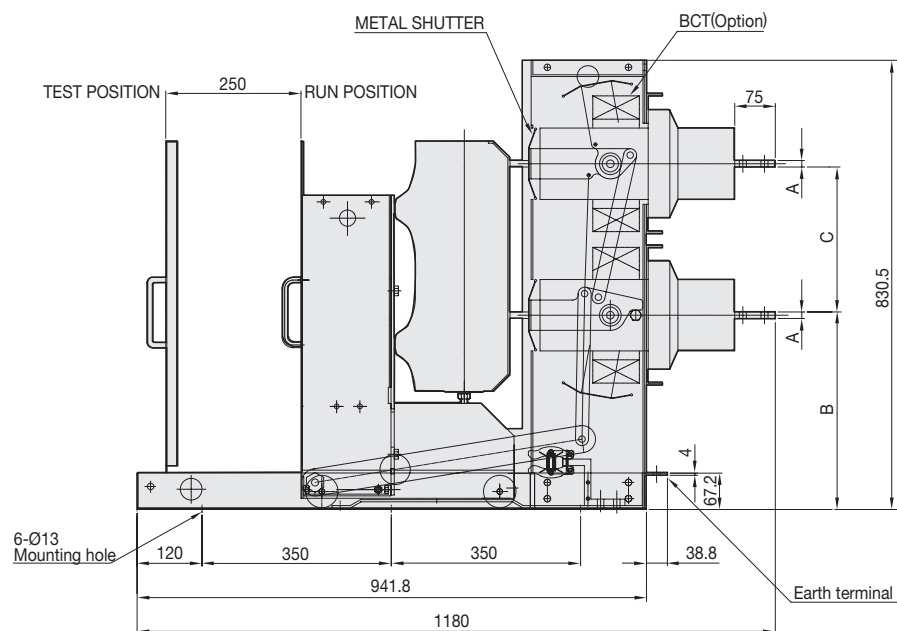


* However, Shutter Part is not applied to E-Class

Dimensions

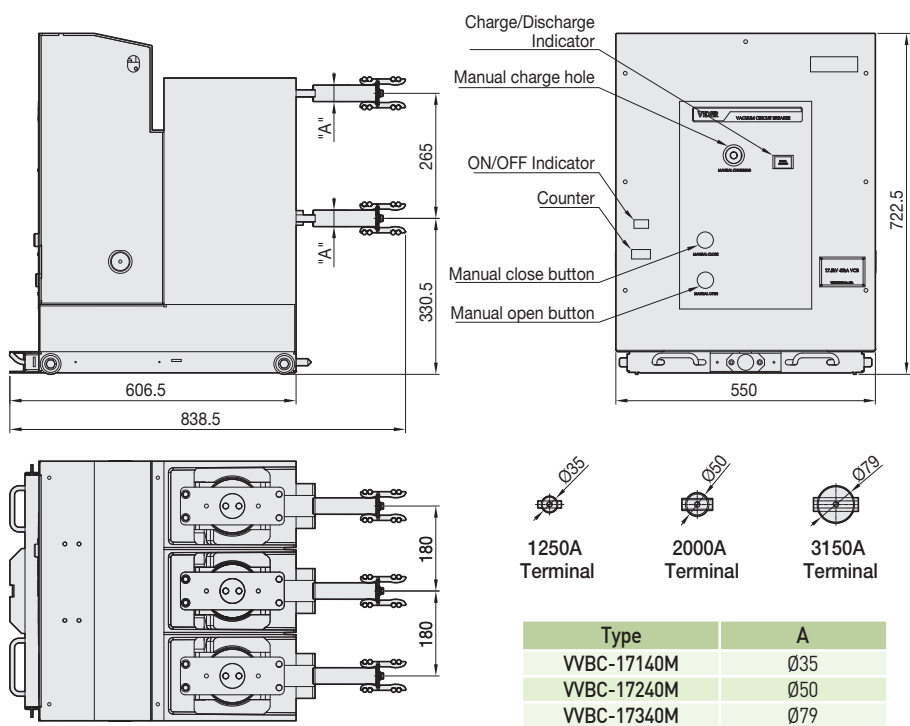
12/15kV 25kA
(KVAG-xxxxM)

Bushing Type(G)



Type	A	B	C
630/1250A	12	365.2	268
2000A	15	384.2	249

12/17.5kV
40kA 1250A/
2000A/3150A
(VVBC-xxxxM)

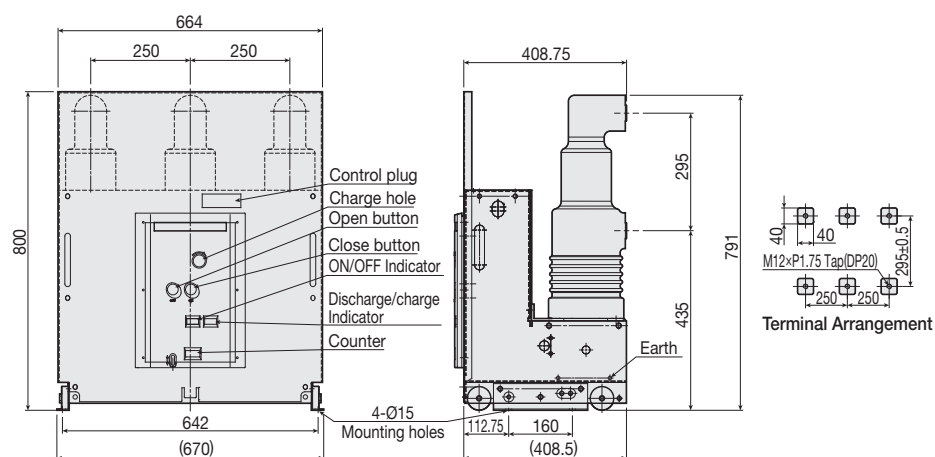


Note: C: MCSG Type

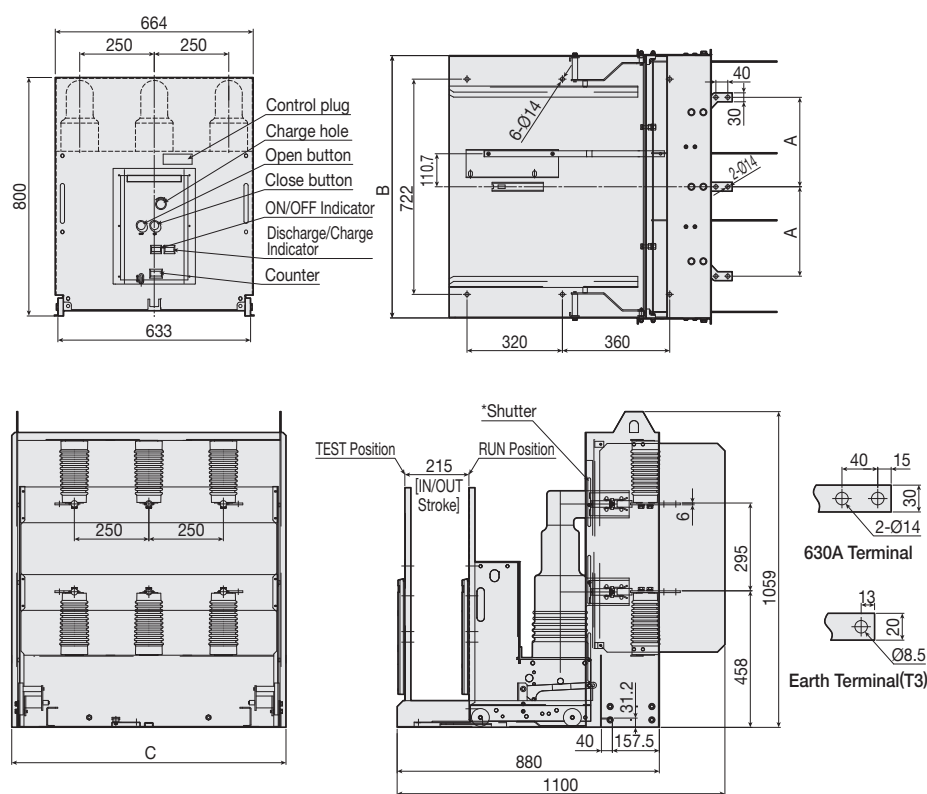
Dimensions

24kV 12.5kA
(VVB□-xxxxM)

Fixed Type (N)



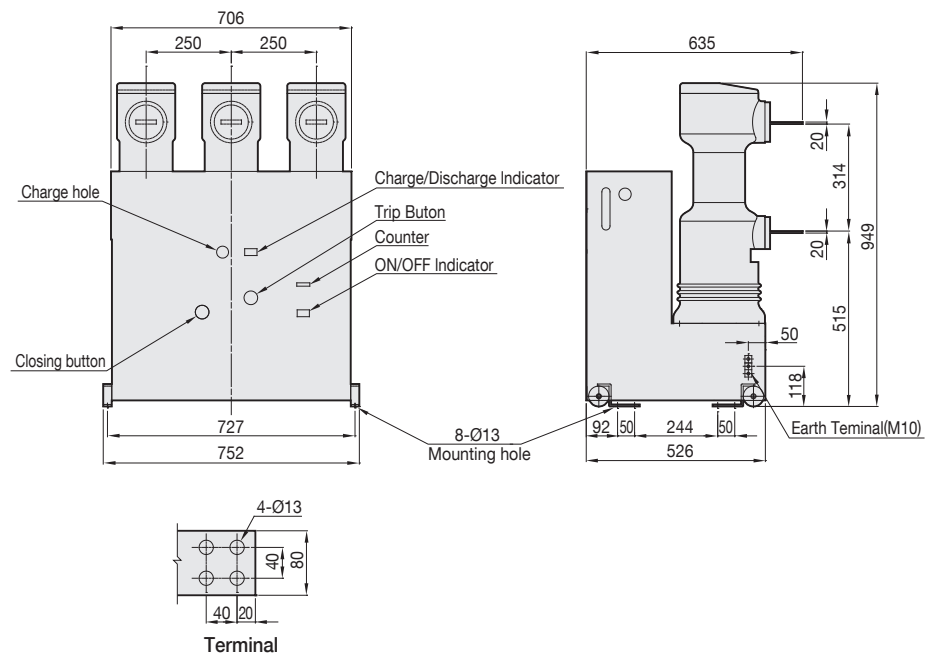
Draw-Out Type (E/F Class)



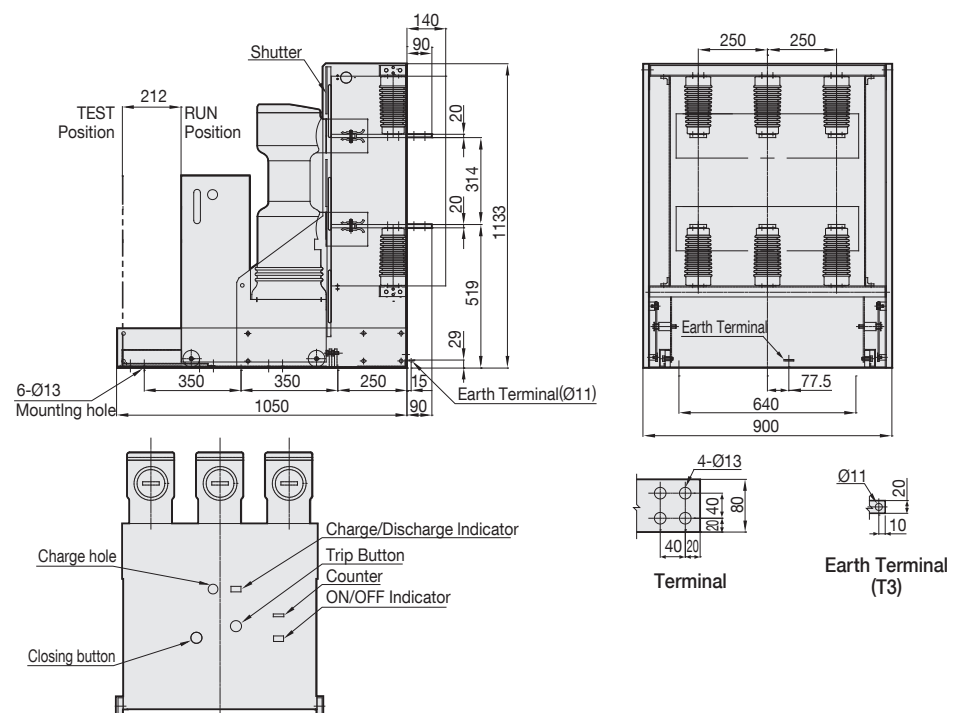
Type	A	B	C	Application
VVB□-2613M	250	766	806	Switchboard phase distance : 250
	300	880	920	Switchboard phase distance : 300

24kV 25kA
2000A
(VVB□-xxxxM)

Fixed Type (N)



Draw-Out Type (E/F Class)

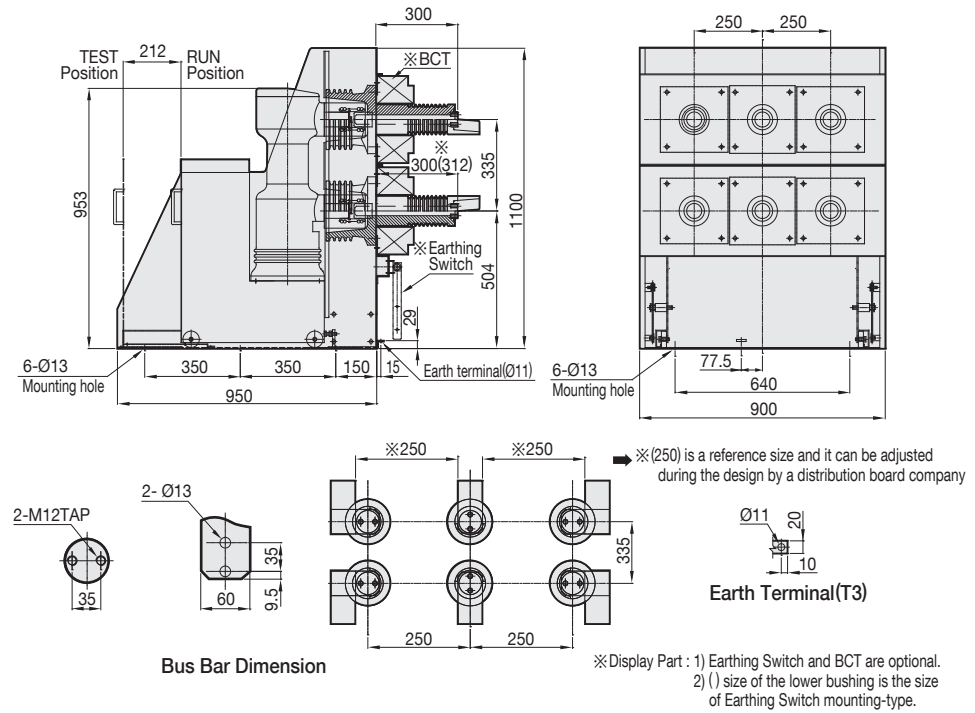


* However, Shutter Part is not applied to E-Class

Dimensions

24kV 25kA
2000A
(VVBG-xxxxM)

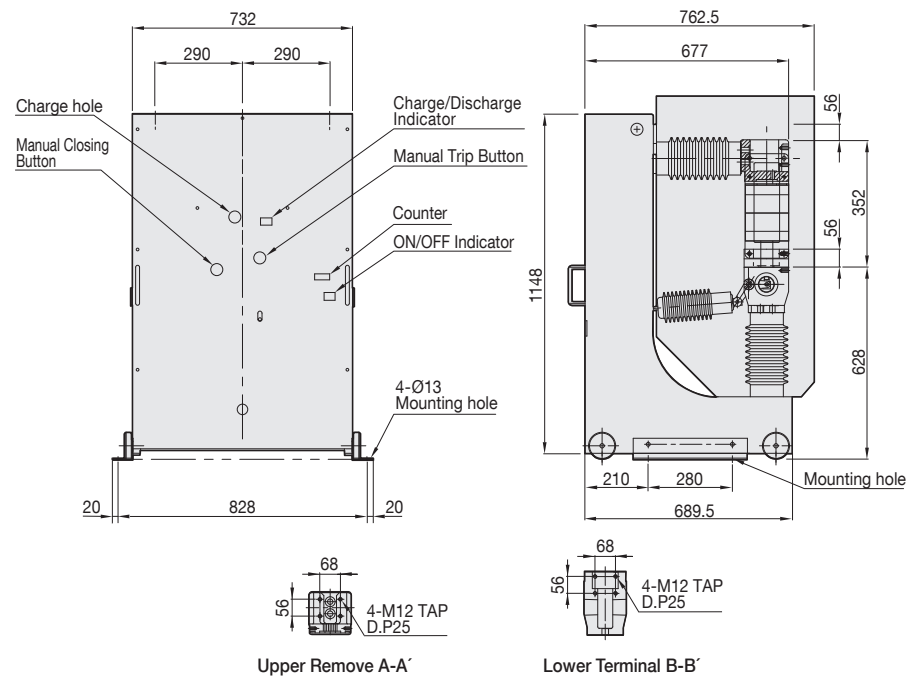
G Class Cradle



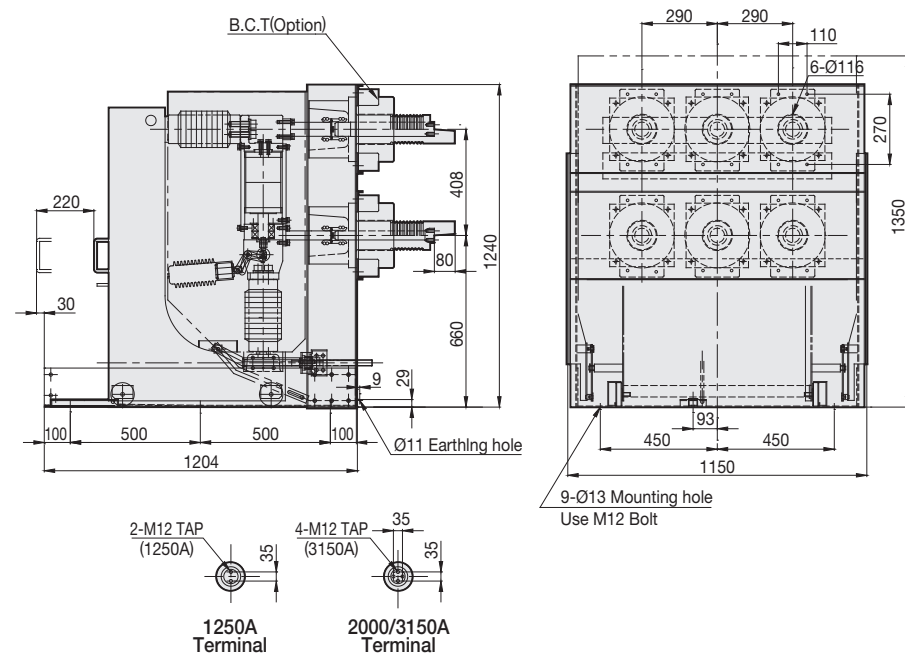
Note. When ordering, specify whether it is for the upper part or lower part

24kV 40kA,
1250/2000/3150A
(VVB□-xxxxM)

Fixed Type (N)



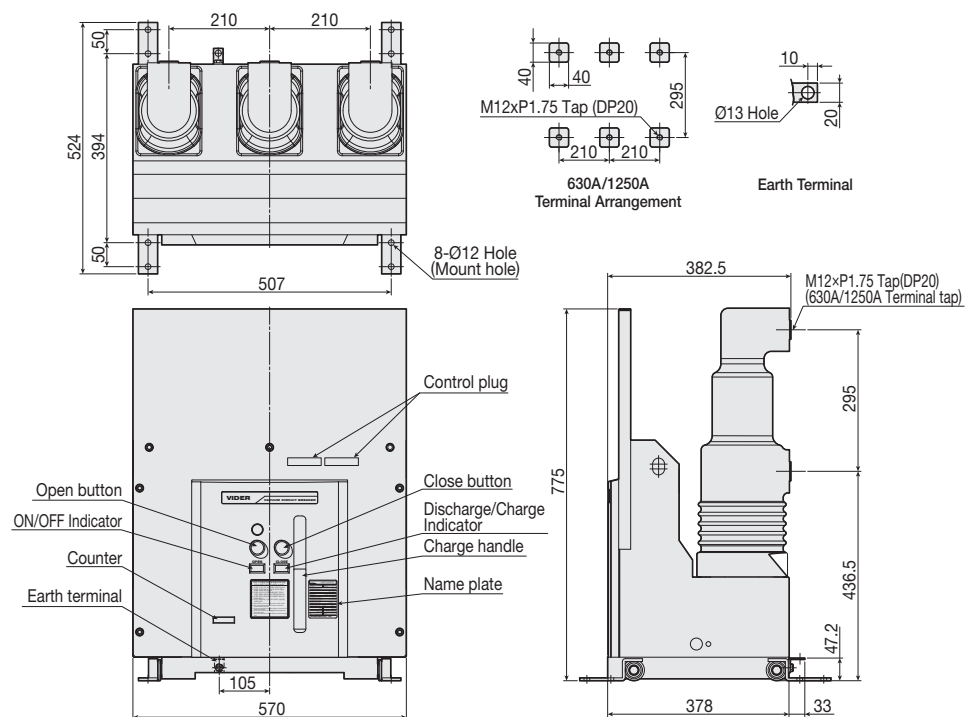
G Class Cradle



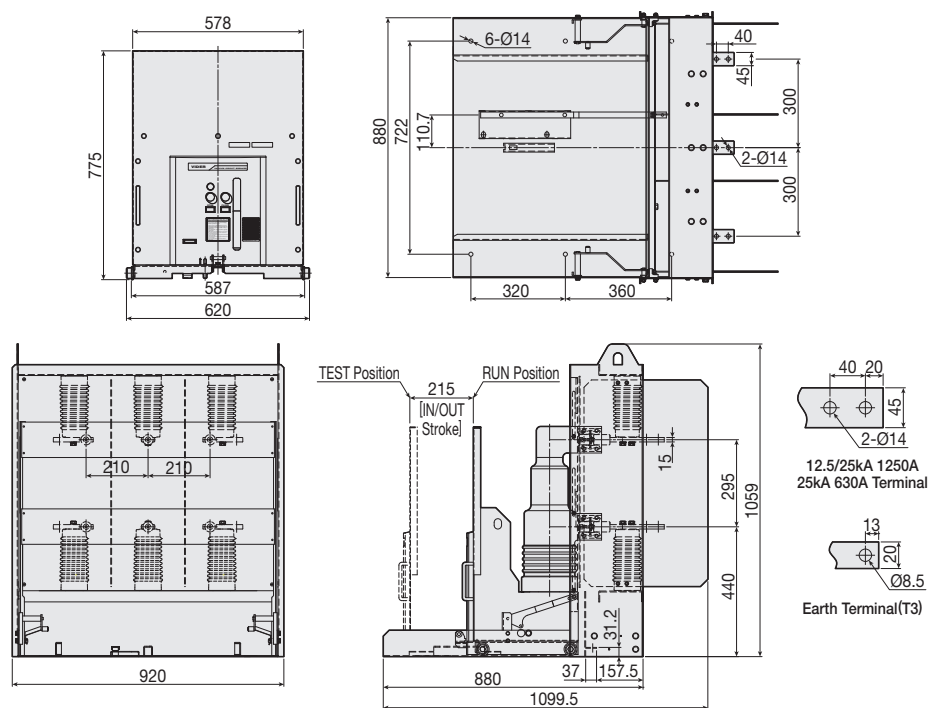
Dimensions

24/25.8kV
12.5/25kA
630/1250A
(VVB□-xxxxS)

Fixed Type (N)

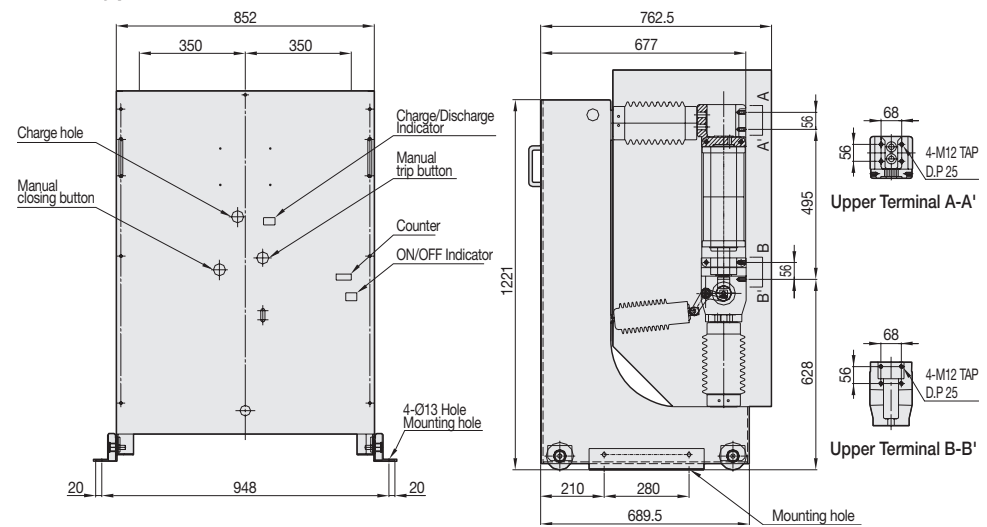


Draw-Out Type (E/F Class)

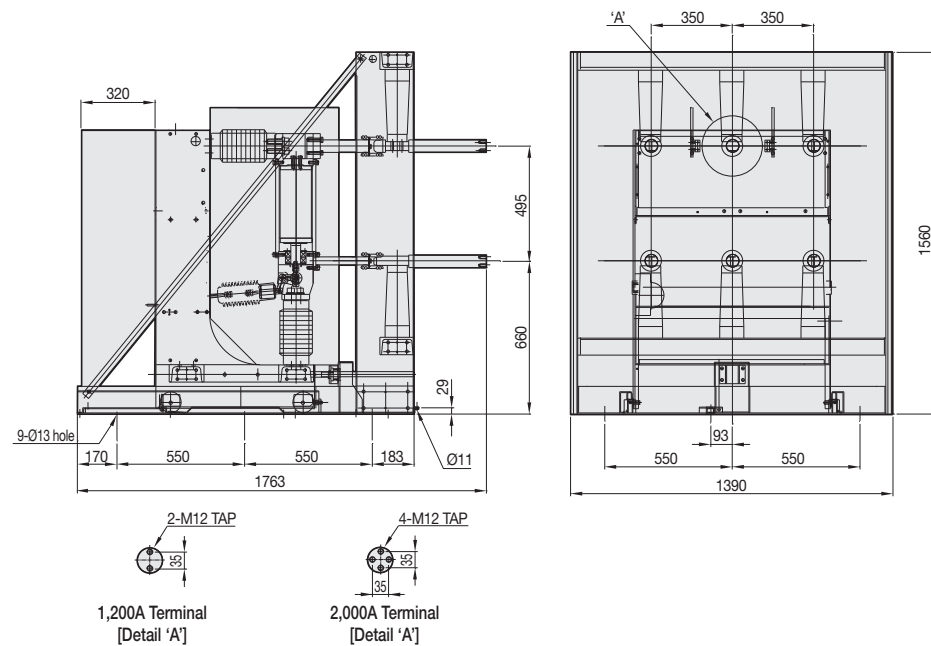


36/38kV
31.5/40kA
(VVB□-xxxxM)

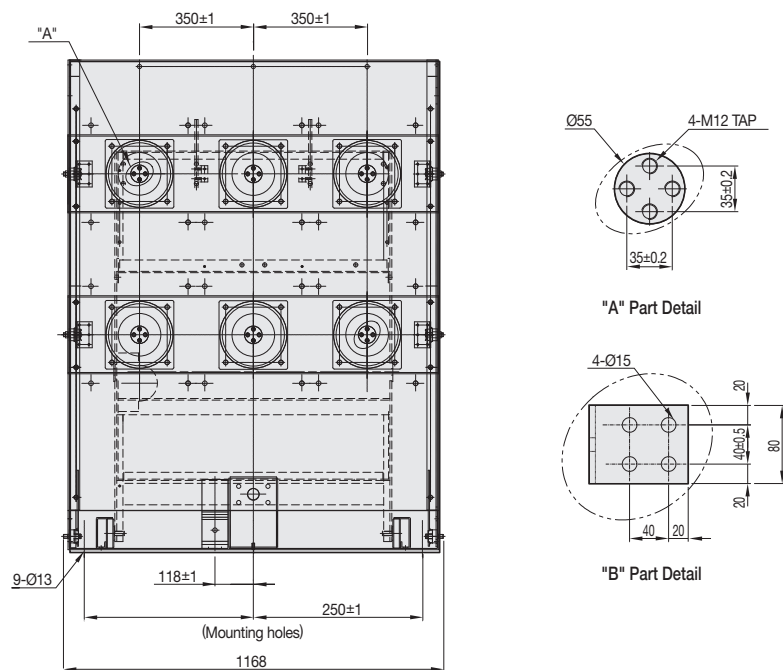
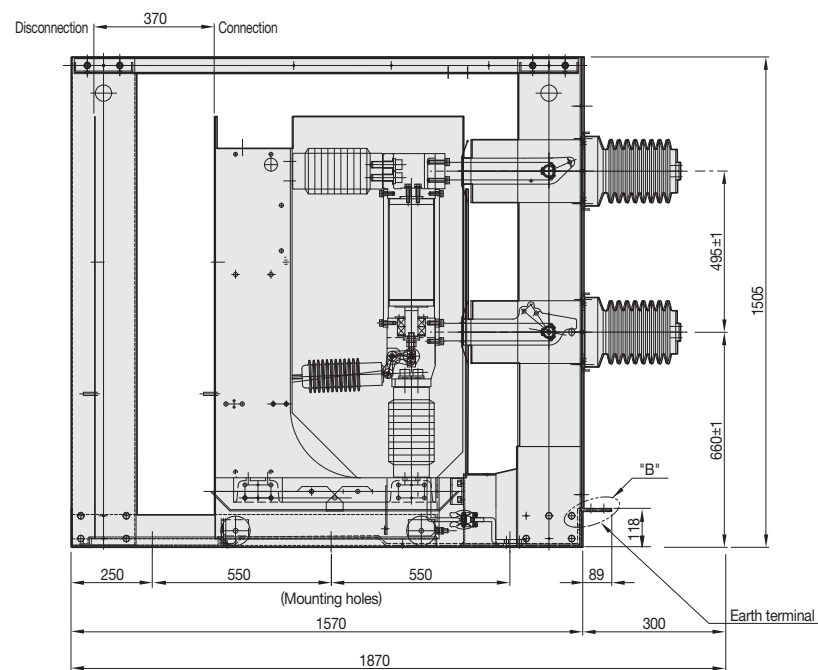
Fixed Type (N)



Draw-Out Type (E/F Class)

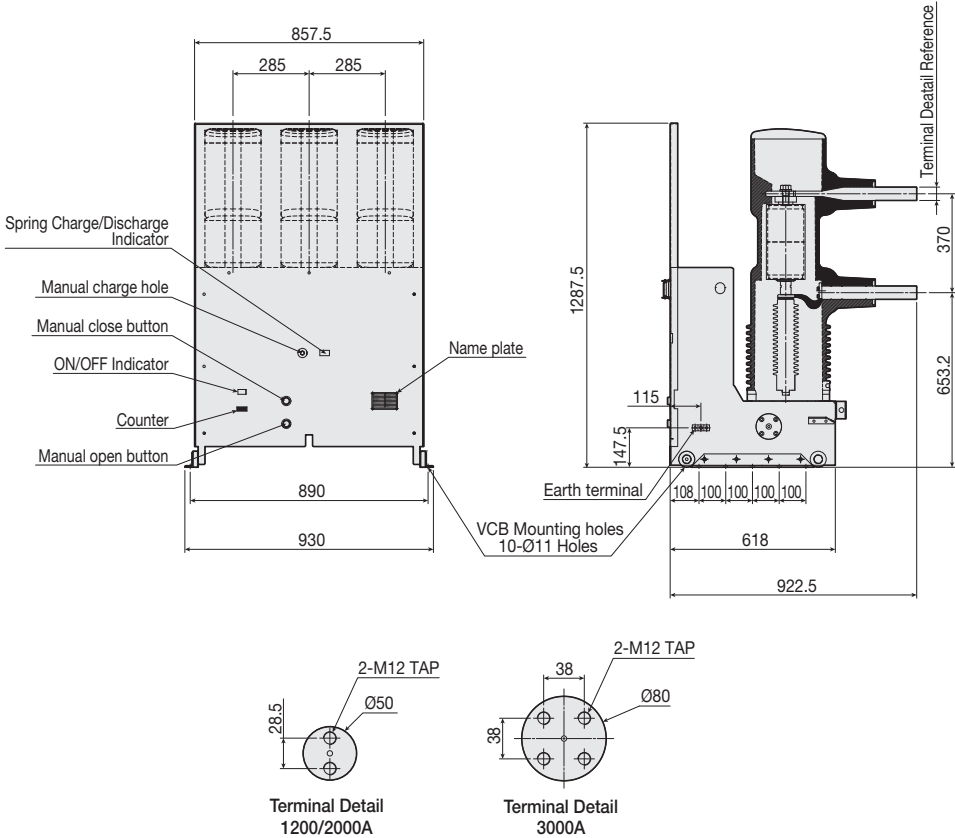


G Class Cradle



38kV 40kA
(VVAN-xxxxM)

Fixed Type (N)

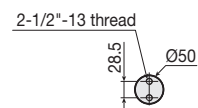
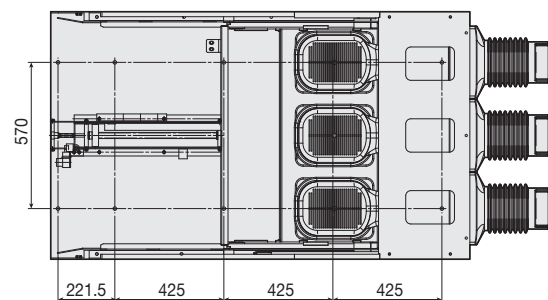


Type	Diameter
VVAN-38140M	Ø50
VVAN-38240M	Ø50
VVAN-38340M	Ø79

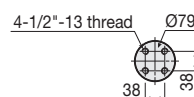
Dimensions

38kV 40kA
(VVAG-xxxxM)

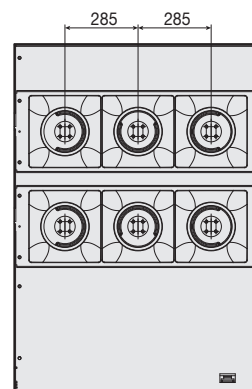
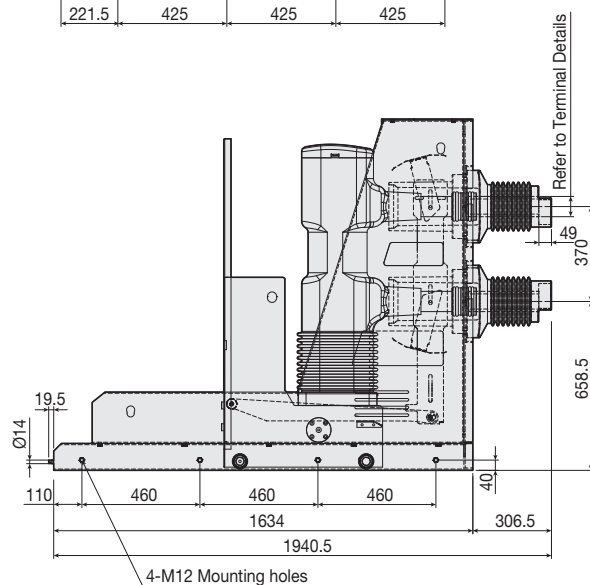
G Class Cradle



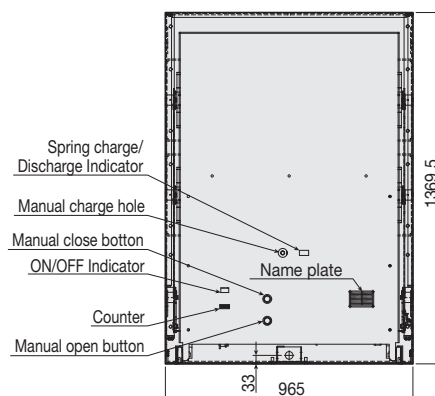
Terminal Detail
1200/2000A



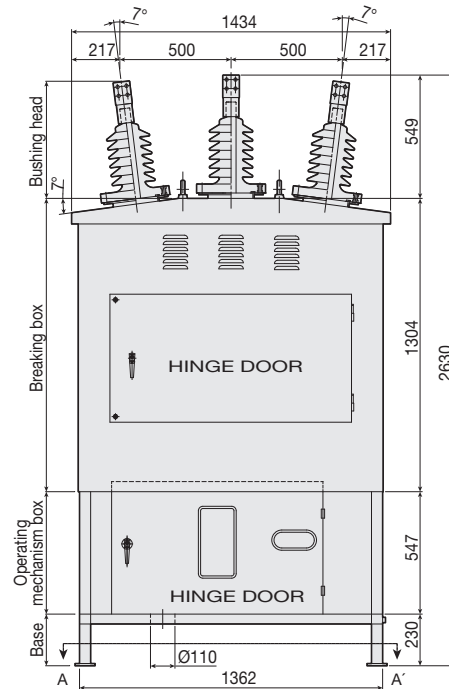
Terminal Detail
3000A



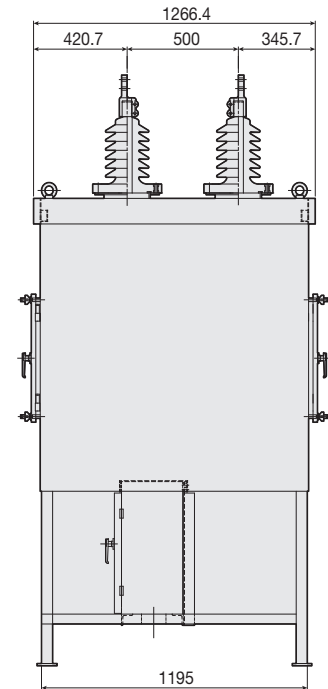
Type	Diameter
VVAG-38140M	Ø50
VVAG-38240M	Ø50
VVAG-38340M	Ø79



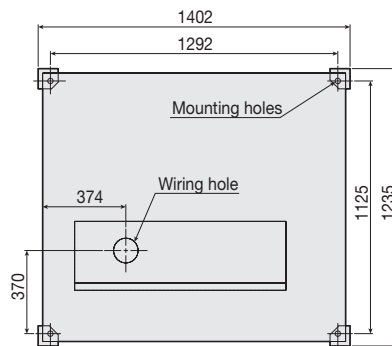
For Outdoor use
25.8kV 25kA
(KVAX Type)



Front View

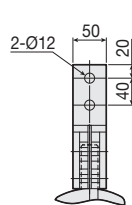


Side View

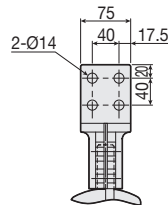


A-A' Section View

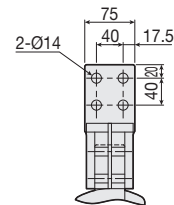
* Dimension Tolerance: $\pm 5\%$



Upper Terminal
600A



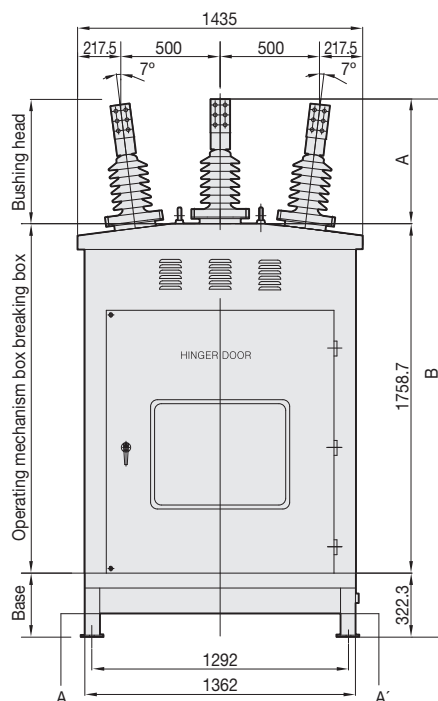
Upper Terminal
1200A



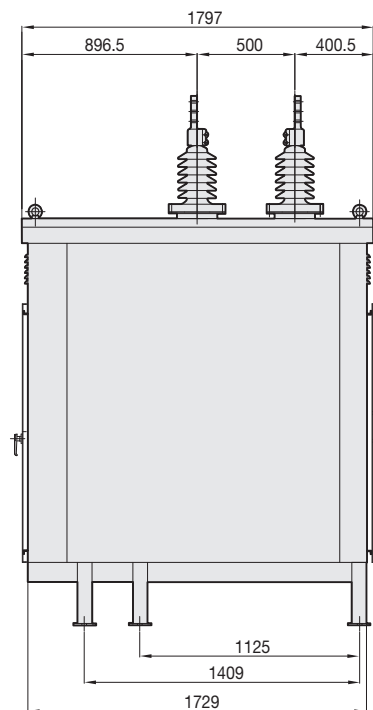
Upper Terminal
2000A

Dimensions

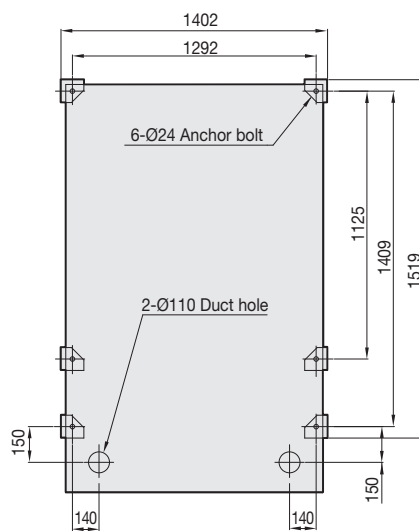
For Outdoor use
25.8kV 40kA
(VVBX Type)



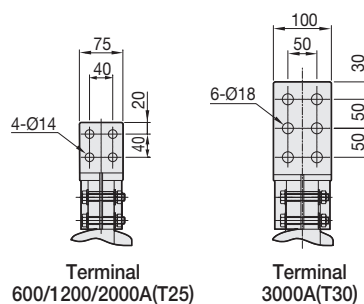
Front View



Side View



A-A' Section View



Terminal
600/1200/2000A(T25)

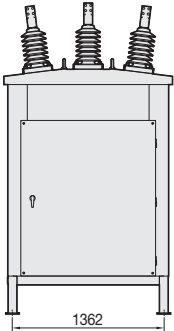
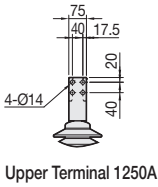
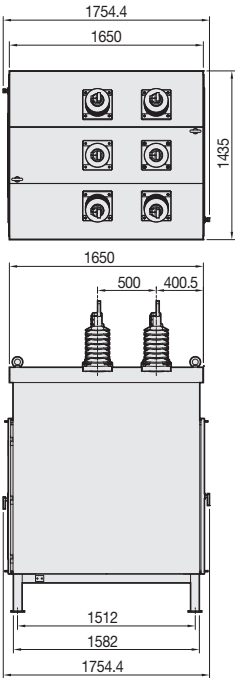
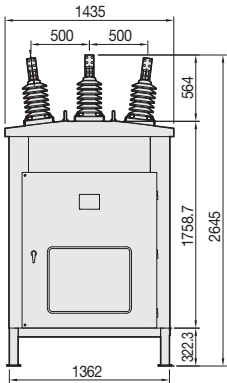
Terminal
3000A(T30)

Type	Standard	Rated Voltage (kV)	Rated Current (A)	Rated Breaking Current (kA)	Impulse Withstand Testing Voltage (kV)	Weight (kg)
WBX-25640M	ES-5925 0001	25.8	600	40	150	1850
WBX-25140M		25.8	1200	40	150	1900
WBX-25240M		25.8	2000	40	150	2000
WBX-25340M		25.8	3000	40	150	2100

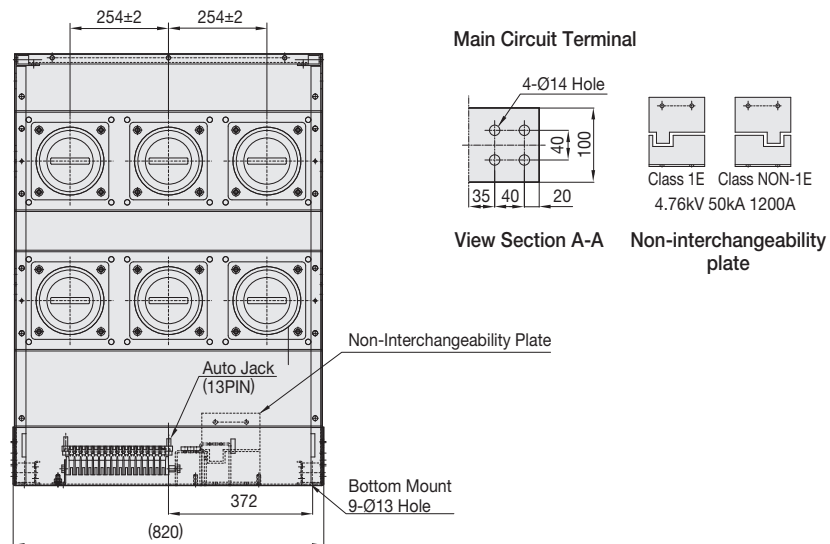
Type	A	B	Note
WBX-25640M	558.5	2639.5	600A
WBX-25140M	558.5	2639.5	1200A
WBX-25240M	558.5	2639.5	2000A
WBX-25340M	268.5	2709.5	3000A

Note. Dimension tolerance : $\pm 5\%$

For Outdoor use
36kV 25kA
1250A
(VVBX-xxxxM)

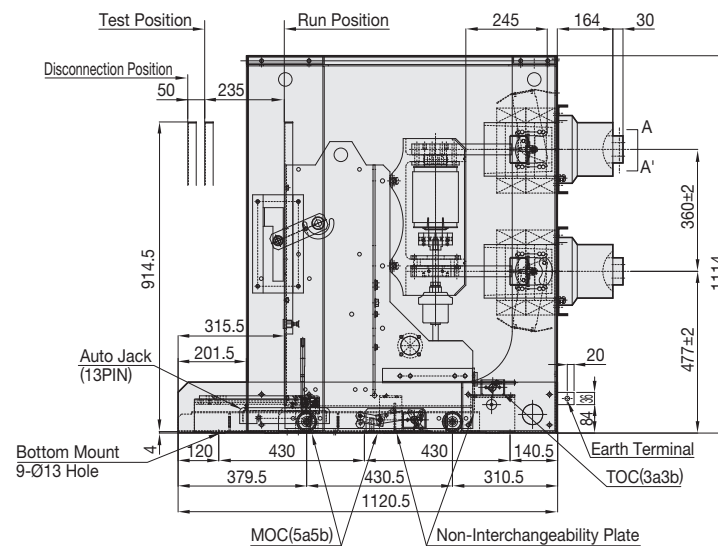


1200A



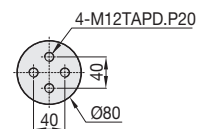
For Nuclear
Power Plant
4.76kV 50kA
8.25kV 50kA
15kV 40kA

2000/3000A

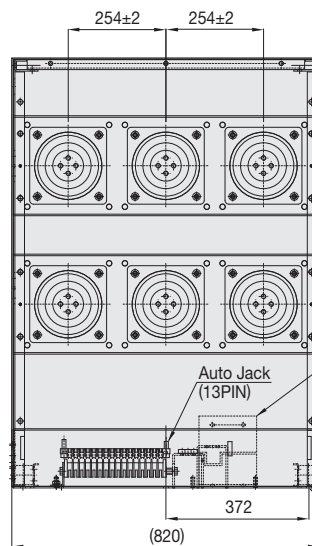


Nuclear Safety Related

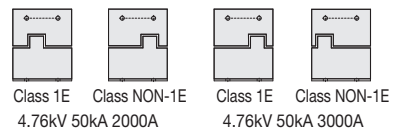
Main Circuit Terminal



View Section A-A'



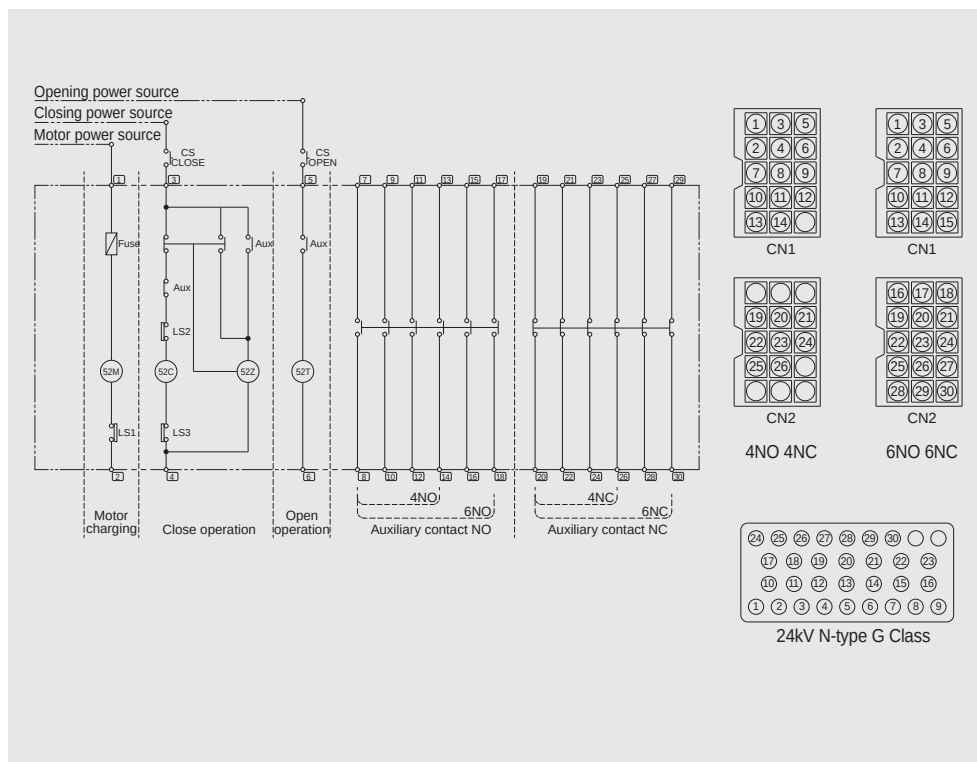
Non-Interchangeability Plate



Non-interchangeability plate

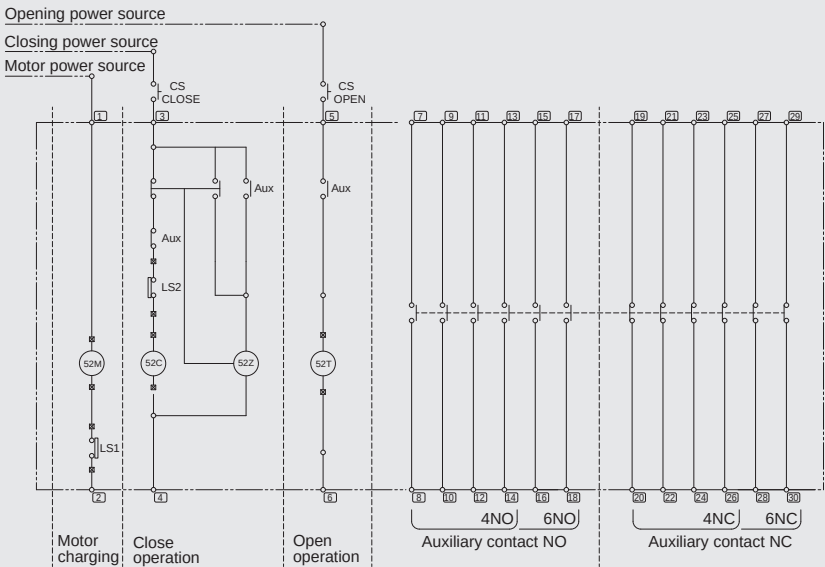
Control Circuit Diagrams

7.2kV 20~40kA,
24kV 12.5~25kA
(VVA□-xxxxM)



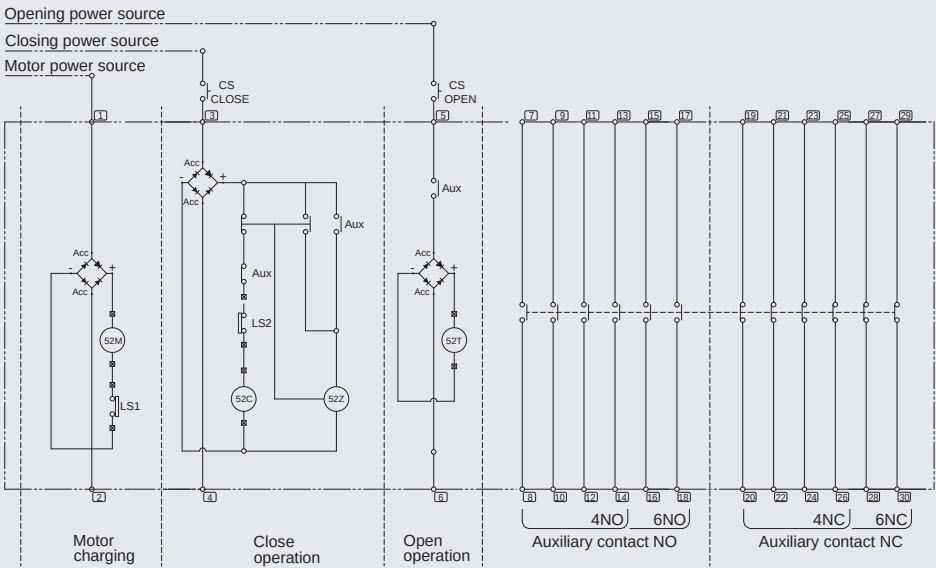
7.2/12/17.5/
25.8kV
8/12.5/20/25kA

DC Circuit



Internal Diagram

AC Circuit



Internal Diagram

19	21	23	25	-	-	-	-	-	-
20	22	24	26	-	-	-	-	-	-

CN1

1	3	5	-	7	-	9	11	13	-
2	4	6	-	8	-	10	12	14	-

CN2

19	21	23	25	27	-	29	-	-	-
20	22	24	26	28	-	30	-	-	-

CN1

1	3	5	-	7	-	9	11	13	15
2	4	6	-	8	-	10	12	14	16

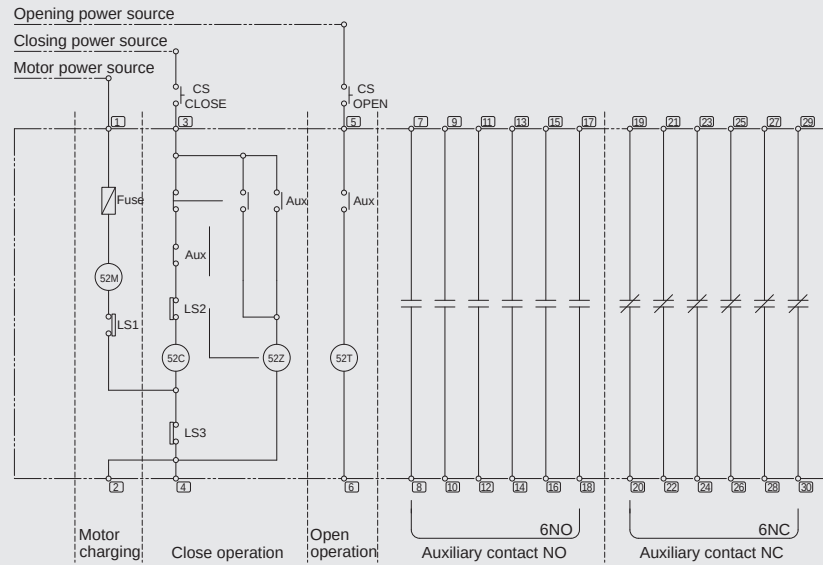
CN2

Connector Pin Array(CB Frontal)

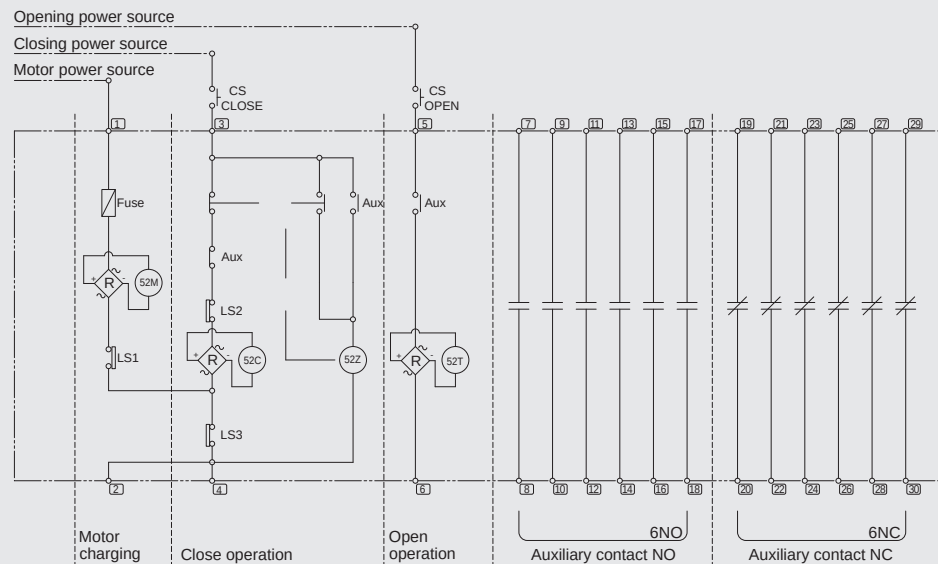
Control Circuit Diagrams

38kV 40kA

DC Circuit



AC Circuit

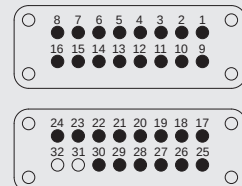


Note. 1. Applicable for standard type of VCB for AC operation.

2. Information of bridge rectifier

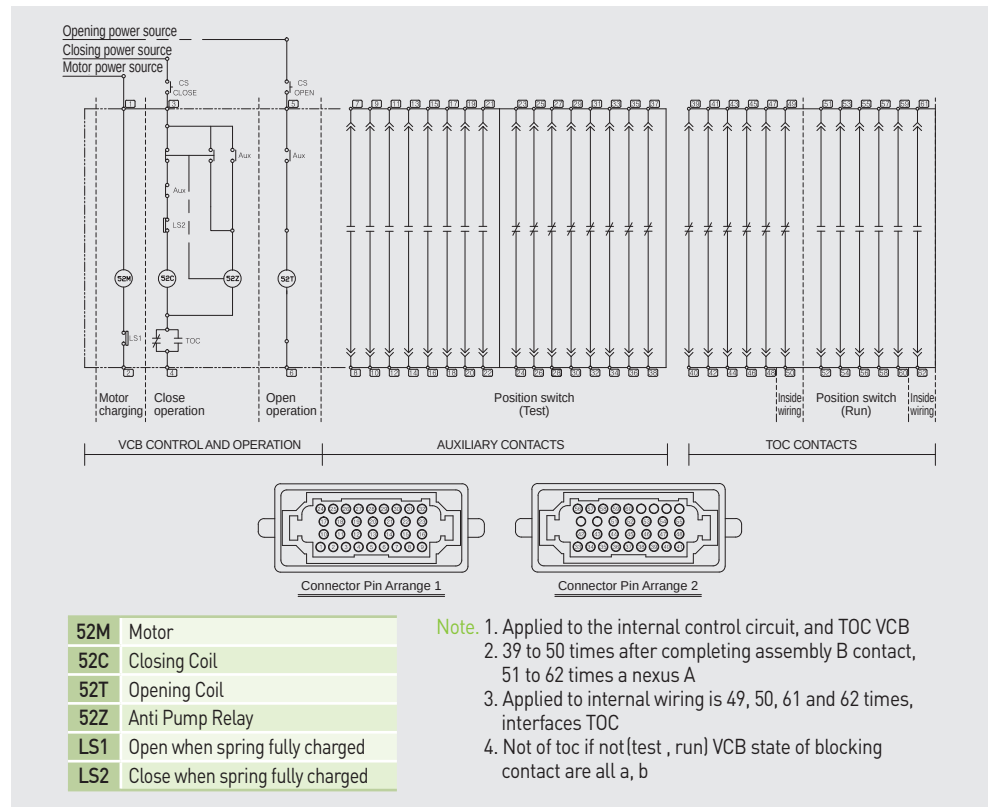
- Type : GBPC5010
- Max. average forward rectified current : 50A
- Max. recurrent peak reverse voltage : 1000V
- Operating temperature : -50 ~ 150°C

52M	Motor	LS1	Open when spring fully charged
52C	Closing Coil	LS2	Close when spring fully charged
52T	Opening Coil	LS3	Close when circuit breaker in fully connected or in test position (LS3 is not available in fixed type)
52Z	Anti Pump Relay		

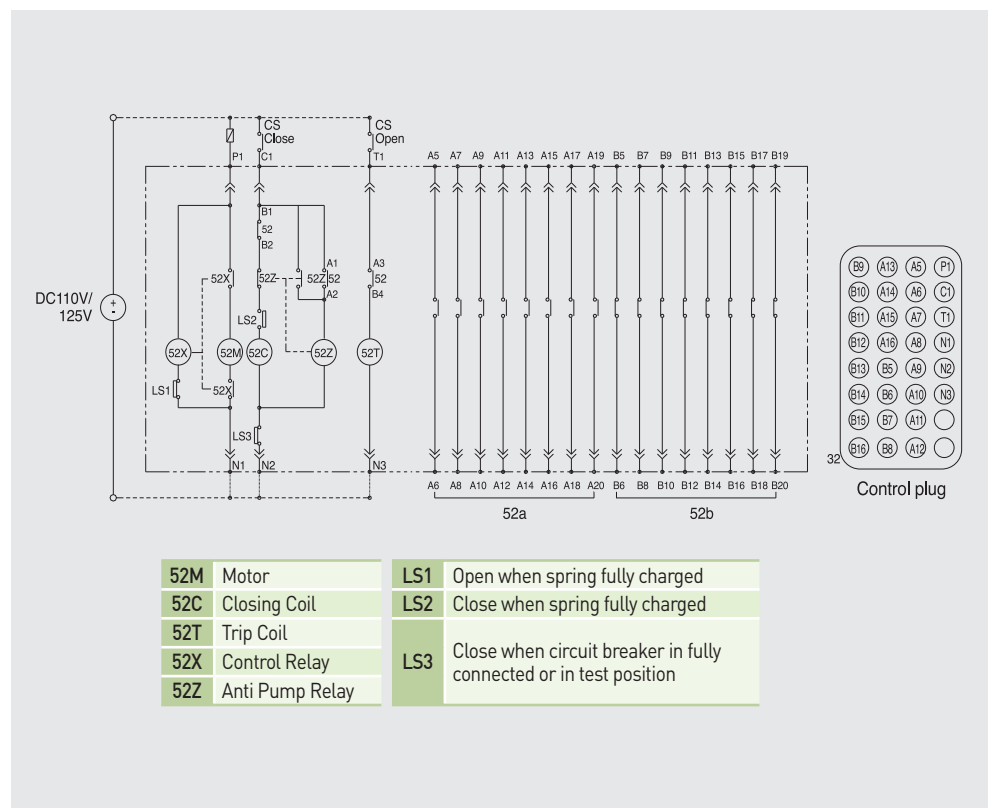


38kV 40kA 1200/2000A VCB
(Front view of VCB)

17.5kV 40kA

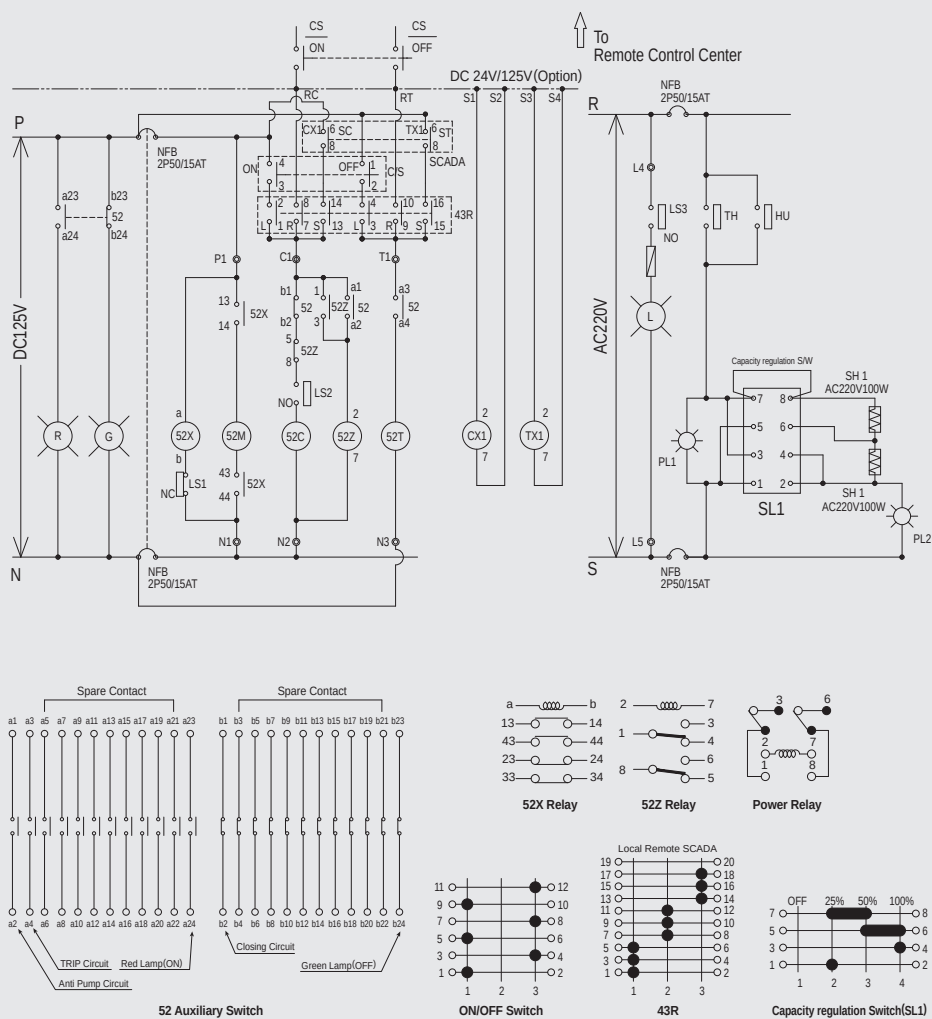


24kV/38kV 40kA



Control Circuit Diagrams

For Outdoor use
25.8kV 25kA

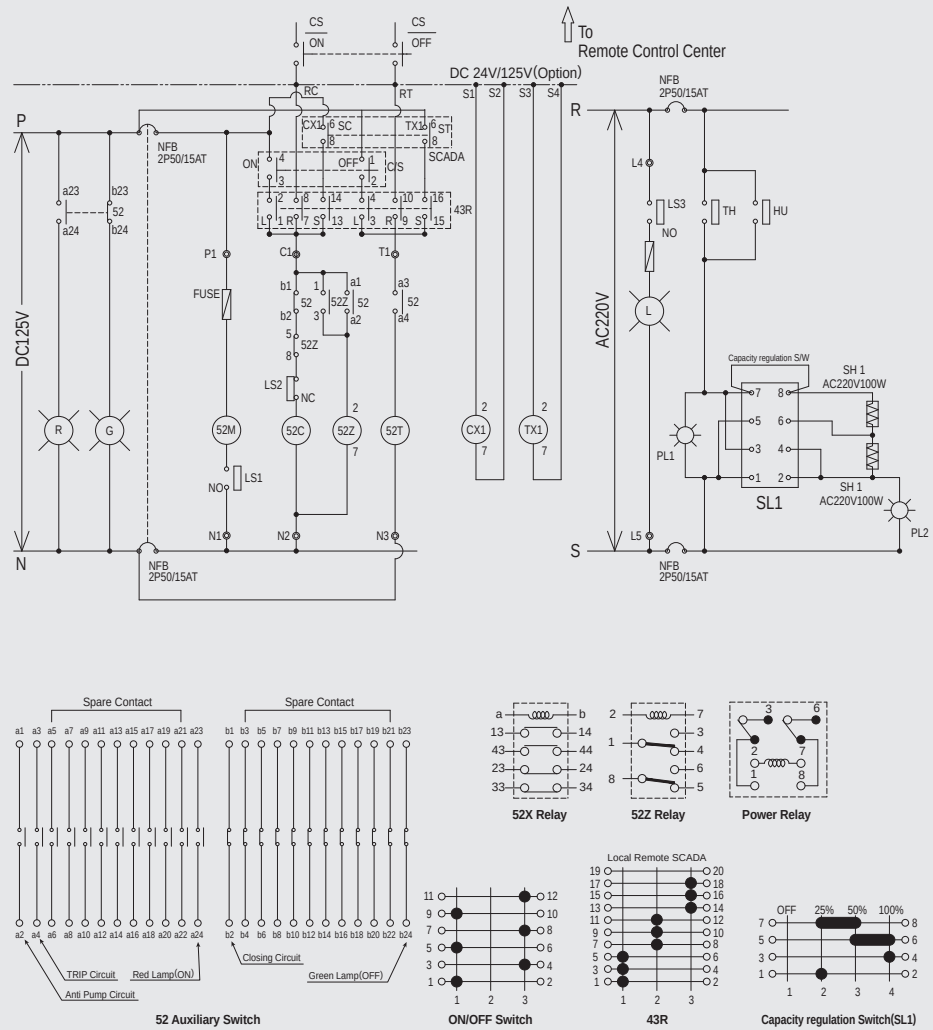


Note. 1. SCADA(DC 24/125V Optional)
2. DC FAIL(27D) Circuit

52M	Spring Charged Motor
52C	Closing Coil
52T	Trip Coil
52Z	Anti Pump Relay
52X	Control Relay
52a	AUX S/W - a
52b	AUX S/W - b
R	Red Lamp (VCB ON)
CX1	Closing Relay (for SCADA)

LS	Limit Switch
L	Lamp (Three-Wave Bulb, AC220V 11W)
43R	Local Remote Scada Control Switch
NFB	No Fuse Breaker
SL1	Heater Selector Switch
TH	Thermo Stat
HU	Humidity Control Switch
G	Green Lamp (VCB OFF)
TX1	Trip Relay (for SCADA)

For Outdoor use
25.8kV 40kA



Note: 1. SCADA(DC 24/125V Optional)
2. DC FAIL [27D] Circuit

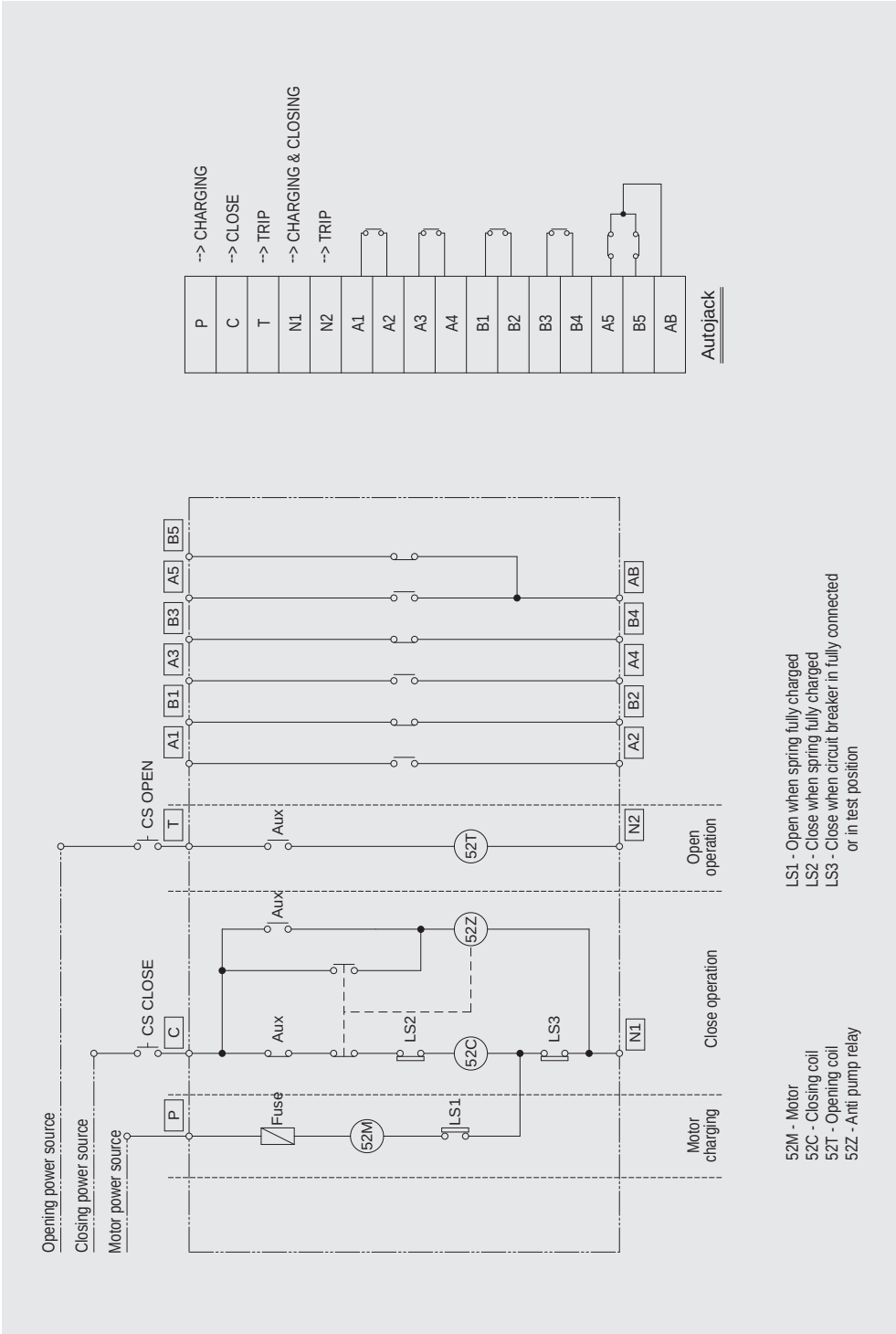
52M	Spring Charged Motor	L.S	Limit Switch
52C	Closing Coil	L	Lamp
52T	Trip Coil	43R	Local Remote Scada Control Switch
52X	Control Relay	NFB	No Fuse Breaker
52a	AUX S/W - a	SL1	Heater Selector Switch
52b	AUX S/W - b	TH	Thermo Stat
R	Red Lamp (VCB ON)	HU	Humidity Control Switch
CX1	Closing Relay (for SCADA)	G	Green Lamp (VCB OFF)
		TXI	Trip Relay (for SCADA)

Note:

- SCADA(DC 24V/125V Optional)
- DC FAIL (27D) Circuit

52M	Spring Charged Motor	L.S	Limit Switch
52C	Closing Coil	L	Lamp
52T	Trip Coil	43R	Local Remote Scada Control Switch
52Z	Anti Pump Relay	NFB	No Fuse Breaker
52a	AUX S/W - a	SL1	Heater Selector Switch
52b	AUX S/W - b	TH	Thermo Stat
R	Red Lamp (VCB ON)	HU	Humidity Control Switch
CX1	Closing Relay (for SCADA)	G	Green Lamp (VCB OFF)
BD	Bridge Diode	TXI	Trip Relay (for SCADA)

For Nuclear
Power Plant

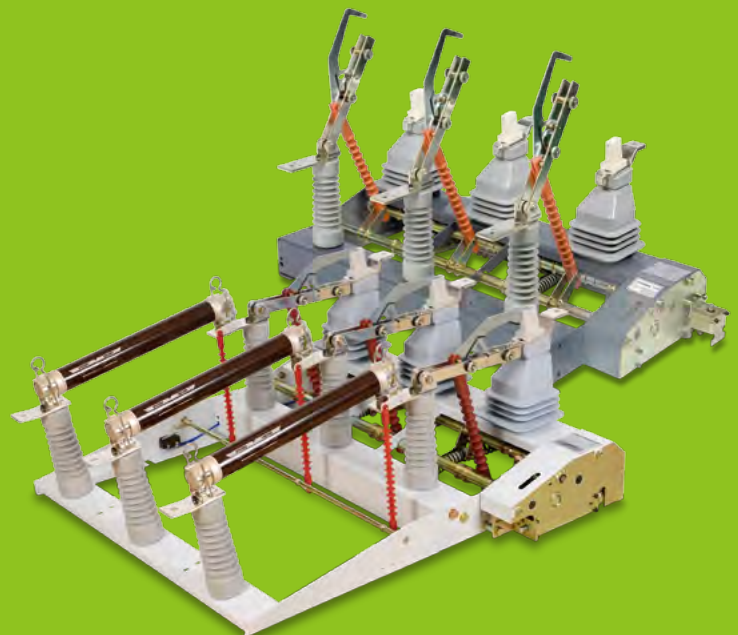




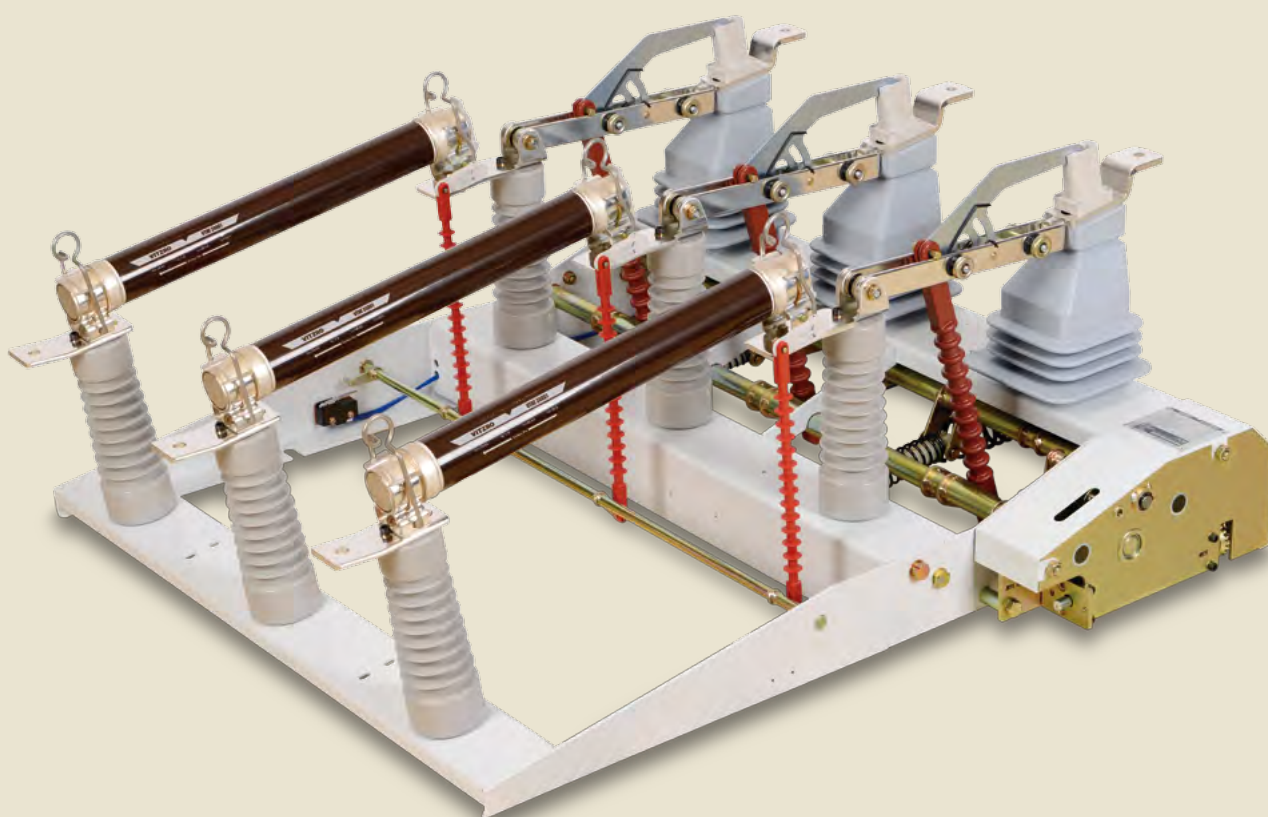
B2 Load Break Switches

CONTENTS

Features	B2-02
Ratings	B2-04
Accessories	B2-06
Installation Method & Structure	B2-08
Control Circuit Diagrams & Dimensions	B2-10
Fuse Selection Criterias	B2-12



Load Break Switches LBS



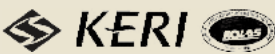
VITZRO EM Load Break Switch is a product developed from the previous model E3-Class and manufactured based on the 100A fuse-combined type test, which displays an excellent breaking performance and safety.

In addition, it is a user-friendly, innovative premium-type product with various protection functions.

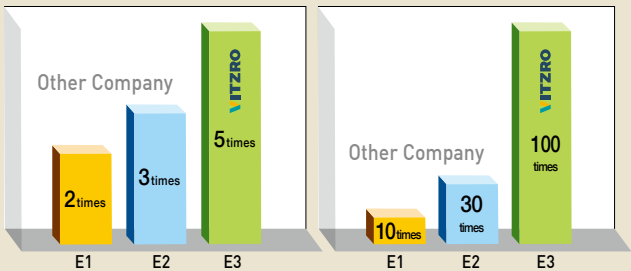
Certifications

It is successfully internationalized based on the KERI development test for the first time in the country.

- IEC62271-105 (Switch-Fuse)
- IEC60265-1 (Load Break Switch)
- Reference Standard : KSC4615



E3 Class LBS product with the best performance in the country is the first one to be manufactured by VITZRO EM.



100A Fuse Combination Type LBS that requires 3 times the existing 63A or below is developed to expand the transformer protection range up to 100A.

Other Company	~63A
VITZRO	~100A

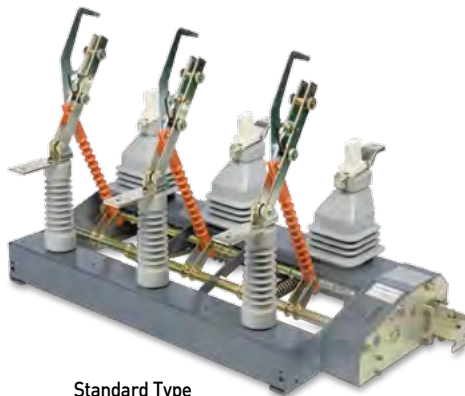
Maximum Fuse Capacity of Fuse Combination Type LBS.

Other Company	500A
VITZRO	1250A

Transfer Current Breaking Capability of LBS based on Fuse Capacity.

Ratings

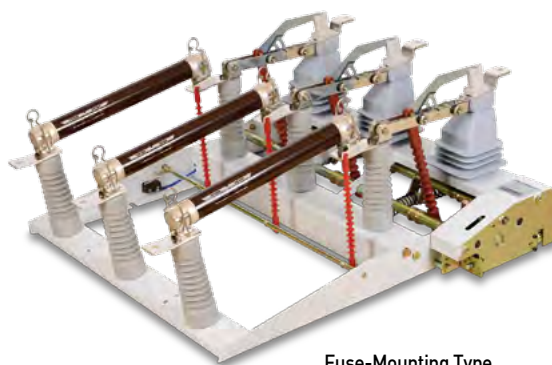
E3 Class High-
Performance
New Model



Standard Type

Type			LBS Standard Type	
Product Type			VTL 24/630A1	VTL 24/630M1
Operation Method			Electrically-Powered	Manual
Existence of Fuse			No	
Rated Voltage			24kV	
Rated Current			630A	
Switch Class (IEC Standard)			E3, M1 Class	
Poles			3 Pole	
Rated Frequency			AC 60Hz	
Rated Short Time Withstand Current			20kA/1sec	
Rated Making Current			52kAp	
Power Frequency Withstand Voltage	Between Earth		50kV/1 min	
	Between Pole		60kV/1 min	
Impulse Withstand Voltage	Between Earth		125kVp	
	Between Pole		145kVp	
Number of Current Switching	Load Current	630A	100 times	
		31.5A	20 times	
	Loop Current	630A	20 times	
	Cable	31.5A	10 times	
	Charging Current	9.45A	10 times	
	Line Charging Current	1.5A	10 times	
	No-load Switching Performance			1,000 times
Rated Breaking Current			-	
Rated Transfer Current			-	
Rated Current for Fuse (Fuse-Mounting Type)			N/A	
Rated Control Voltage			DC 110V / AC 110, 220V	-
Rated Control Current			5A	-
Manual Operating Cable Length			Standard 2.0m (Selection 1.5/1.8m)	
Weight			68kg	70kg
Certificate & Approval			IEC62271-103(IEC60265-1), IEC62271-105, IEC60282-1, KSC4615	

E3 Class High-Performance New Model



Fuse-Mounting Type

Type			LBS Fuse-Mounting Type	
Product Type			VTLF 24/630A1	VTLF 24/630M1
Operation Method			Electrically-Powered	Manual
Existence of Fuse			Yes	
Rated Voltage			24kV	
Rated Current			Switch 630A/Fuse Capacity 100A	
Switch Class (IEC Standard)			E3, M1 Class	
Poles			3 Pole	
Rated Frequency			AC 60Hz	
Rated Short Time Withstand Current			-	
Rated Making Current			104kAp	
Power Frequency Withstand Voltage	Between Earth		50kV/1 min	
	Between Pole		60kV/1 min	
Impulse Withstand Voltage	Between Earth		125kVp	
	Between Pole		145kVp	
Number of Current Switching	Load Current	630A	100 times	
		31.5A	20 times	
	Loop Current	630A	20 times	
	Cable	31.5A	10 times	
	Charging Current	9.45A	10 times	
	Line Charging Current	1.5A	10 times	
No-load Switching Performance			1,000 times	
Rated Breaking Current			40kArms	
Rated Transfer Current			1250Arms	
Rated Current for Fuse (Fuse-Mounting Type)			Mountable up to 100A 1/5/10/16/20/25/31.5/40/50/63/80/100	
Rated Control Voltage			DC 110V / AC 110, 220V	-
Rated Control Current			5A	-
Manual Operating Cable Length			Standard 2.0m (Selection 1.5/1.8m)	
Weight			92kg	88kg
Certificate & Approval			IEC62271-103(IEC60265-1), IEC62271-105, IEC60282-1, KSC4615	

Accessories

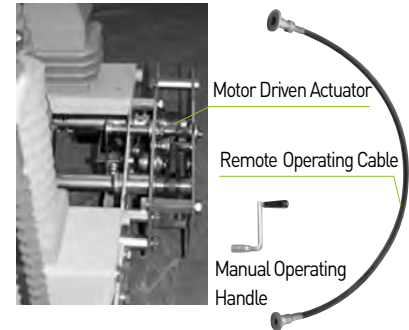
Accessories

Motor Driven Actuator

It is used for remote ON-OFF control and the standard rated voltage is DC 110V. AC 110V/AC 220V are also possible when ordered.

Manual Remote Operating Device

It is a device for manual operation at the panel door and it consists of a cable and a manual operating handle.
Cable Length: Standard 2.0 m (Option 1.5/2.6m)



Auxiliary Contact

It is a contact operated based on the operating status of the main contact of switch and it is used to display the status of the switch and to control it. 2a2b is the standard but it can be added depending on the order.



Voltage Trip Device

It is equipped with a shunt coil which enables a prompt Trip operation using a relay signal when a failure occurs.



Fuse Melting Trip Device

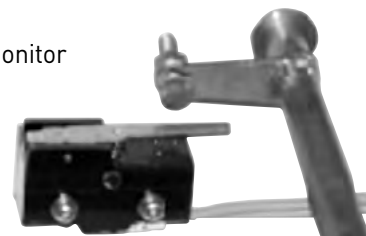
It performs a trip operation in order to prevent the open-phase operation that is generated when 1 phase fuse of 3 phases is melted due to a failure. It ensures an accurate and prompt operation due to the mechanical link.



Fuse Melting Display Contact

It is equipped with 1a contact in order to monitor the fuse melting in remote (F1-F2).

P	N	C	T	F1
A1	A3	B1	B3	F2
A2	A4	B2	B4	



Fuse Melting Display Contact

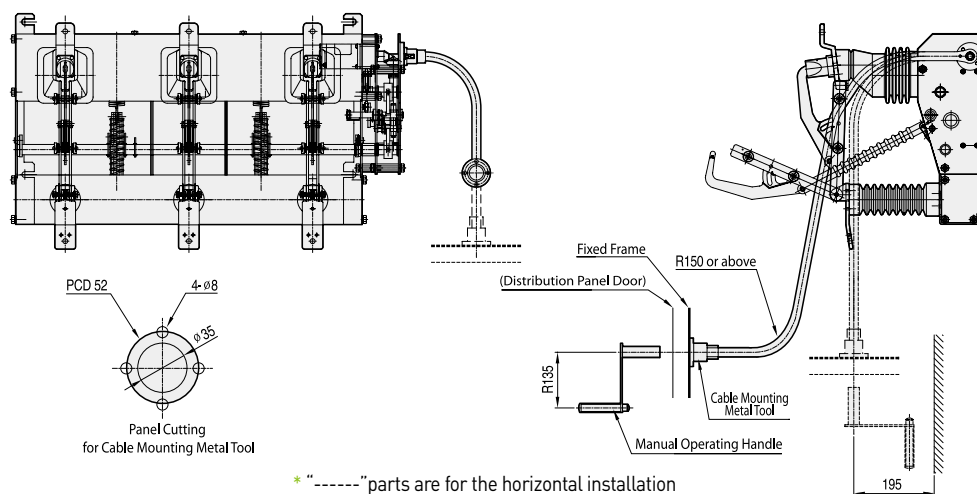
Installing Method & Structure

Body of LBS

Type	Standard Type	Fuse-Mounting Type
Installation Circuit Diagram		
Vertical Installation		
Horizontal Installation		

* Check whether the mounting part is flat so that LBS is installed without a twist.

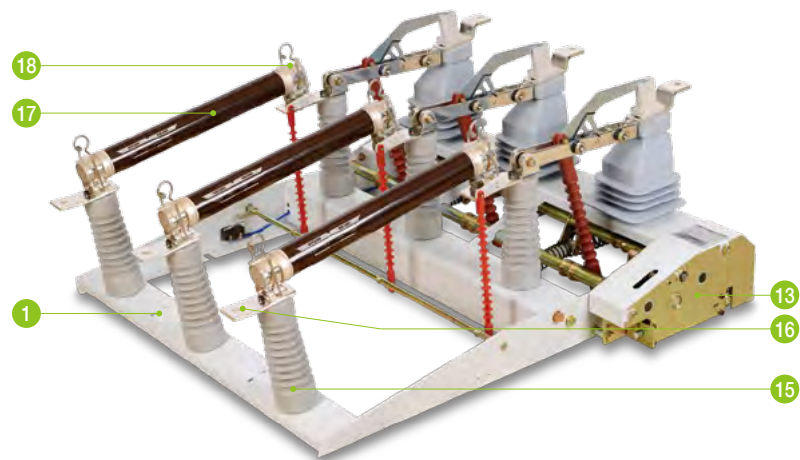
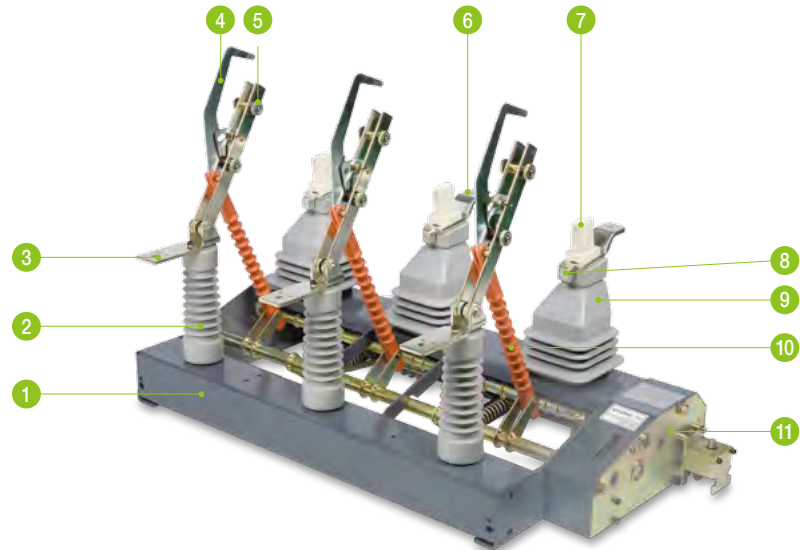
Manual Operating Device



Cable

- The standard length is 2.0m and it can be manufactured in 1.5m/1.8m when ordered.
- The cable operates smoothly if it maintains a sufficient curvature radius of R150 or above.
- It is structured to operate ON-OFF manually using the cable in one direction (right-turn).
- Use it by fixing the cable tie towards the inner wall of panel considering the insulation distance.
- Use an exclusive handle that is supplied separately for the manual operation.

Configuration



- ① Base Frame
- ② Support Insulator
- ③ Load Terminal
- ④ Arcing Blade
- ⑤ Main Blade
- ⑥ Line Terminal
- ⑦ Arc Nozzle
- ⑧ Fixed Main Contact
- ⑨ Fixed Support Insulator
- ⑩ Operating Rod
- ⑪ Operating Mechanism
- ⑫ Manual Operation Cable
- ⑬ Geared Motor
- ⑭ Manual Handle
- ⑮ Support Insulator
- ⑯ Load Terminal
- ⑰ Current limiting Fuse
- ⑱ Fuse Trip Device

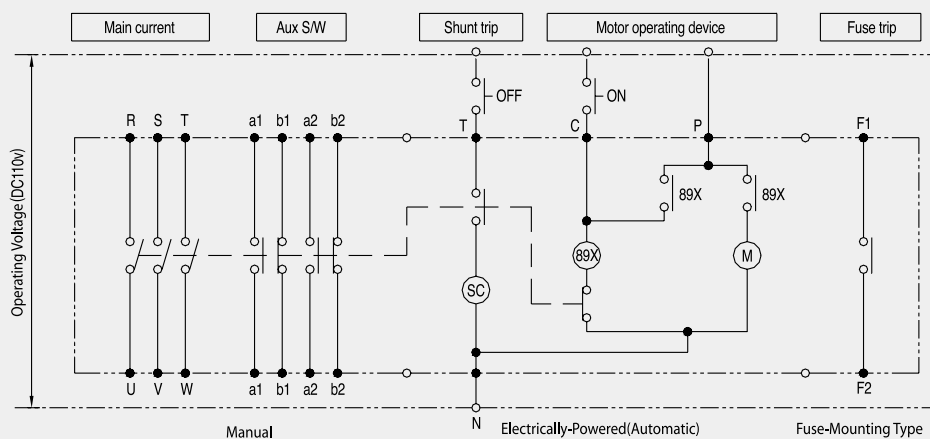


Control Circuit Diagrams & Dimensions

Control Circuit Diagrams

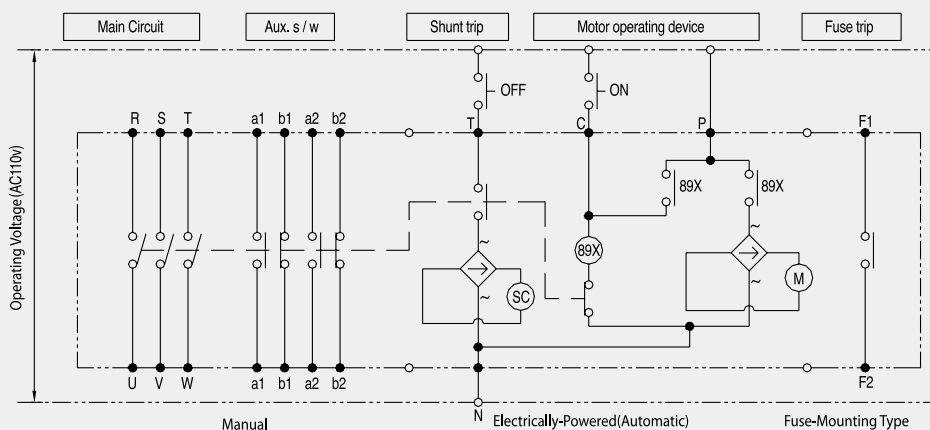
Control Circuit Diagram (In case of Motor)

DC 110V



- P : DC 110V (+)
- N : DC 110V (-)
- C : CLOSE
- T : TRIP
- SC : Trip Coil
- M : For Closing Motor
- 89X : Auxiliary Relay for Closing

AC 110V / AC 220V

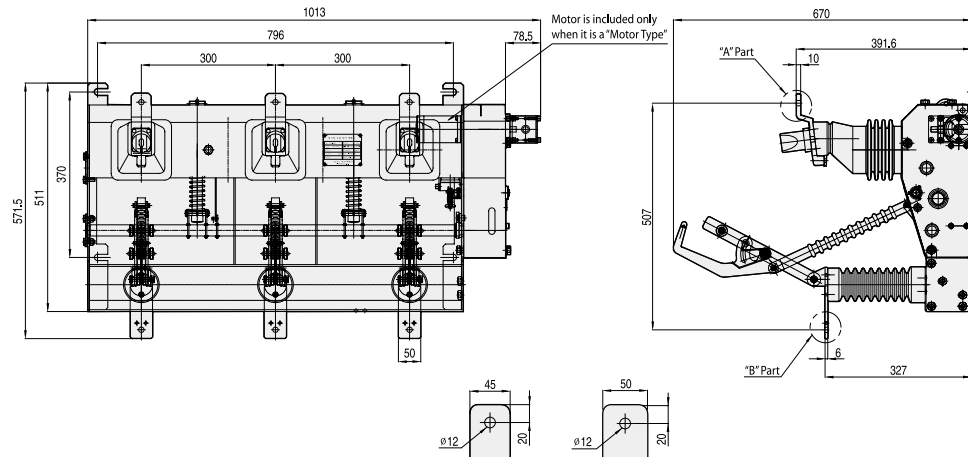


- P : AC 110V / AC 220V (+)
- N : AC 110V / AC 220V (-)
- C : CLOSE
- T : TRIP
- SC : Trip Coil (DC 110V / DC 220V)
- M : For Closing Motor (DC 110V / DC 220V)
- 9X : Auxiliary Relay for Closing

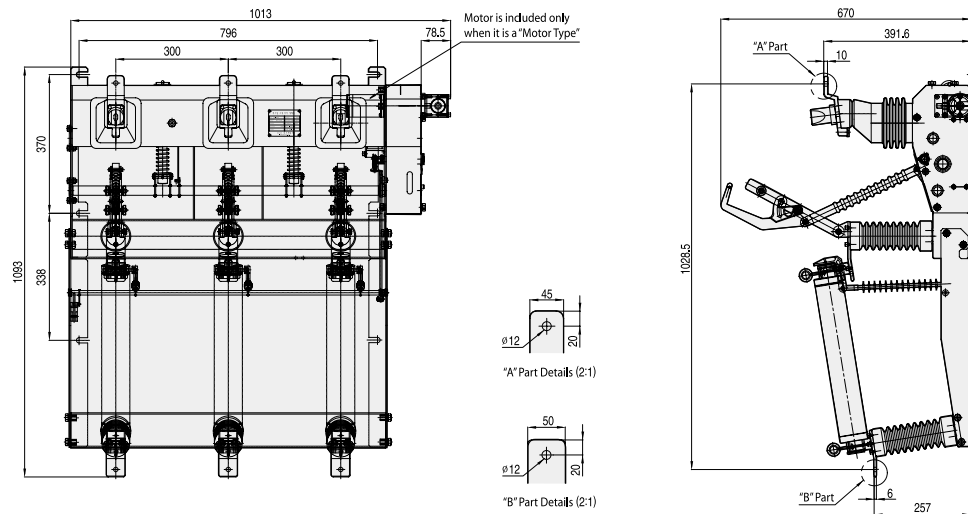
External Dimensions

VTL.....(E3 Class) New Model

Standard Type (Electrically-Powered/Manual)



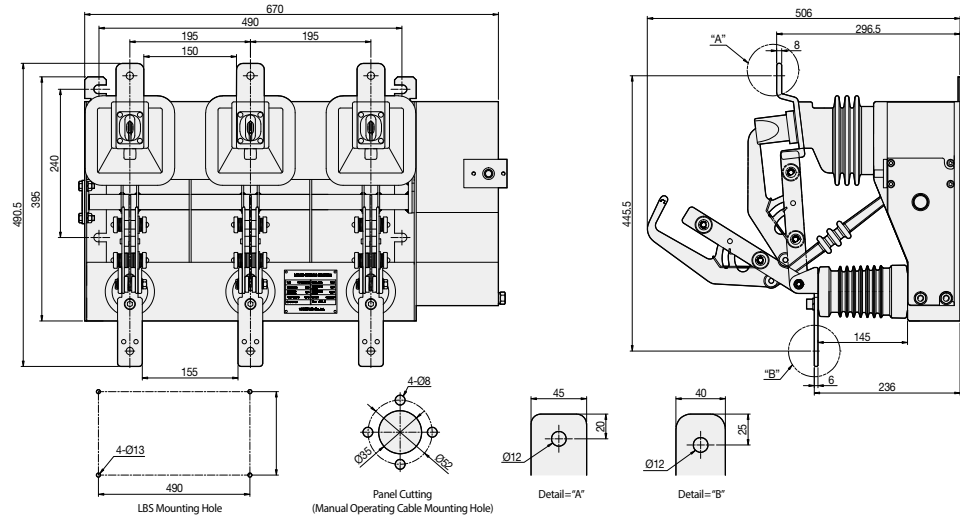
Fuse-Mounting Type (Electrically-Powered/Manual)



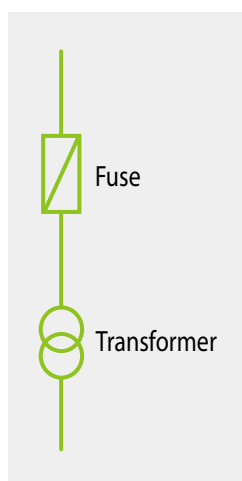
Fuse Selection Criterias

VTL 12kV
Standard
Type(Manual)

12kV Standard Type(Manual)



Fuse Selection Criteria for each purpose



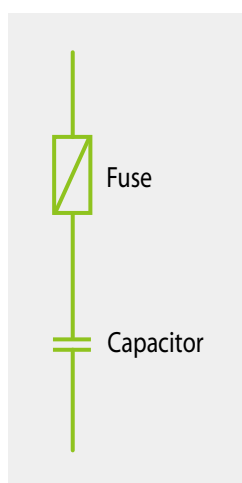
Power Fuse for Transformer Circuit Protection

Rated Voltage [kV]	Transformer Rated Capacity [kVA]		Applied Fuse Link
	1Ø	3Ø	
24	4 ~ 8	7 ~ 15	VTHF24001
	20 ~ 44	36 ~ 76	VTHF24005
	42 ~ 92	75 ~ 158	VTHF24010
	81 ~ 167	141 ~ 276	VTHF24016
	102 ~ 208	176 ~ 344	VTHF24020
	127 ~ 260	220 ~ 431	VTHF24025
	160 ~ 328	264 ~ 540	VTHF24032
	262 ~ 539	466 ~ 990	VTHF24040
	347 ~ 716	600 ~ 1238	VTHF24050
	416 ~ 916	743 ~ 1585	VTHF24063
	573 ~ 1145	990 ~ 1981	VTHF24080
	916 ~ 1527	1585 ~ 2641	VTHF25100
	1301 ~ 1908	2251 ~ 3301	VTHF24125
	2036 ~ 2443	3522 ~ 4226	VTHF24160

Detailed Selecting Conditions

1. The inrush current of transformer is selected by assuming that it is 10 times the transformer full load current for 0.1 second.
2. The rated current of fuse is selected so that it can continuously conduct 1.5 times~2 times the transformer rated current.
3. The transformer fuse is assumed and selected so that it can interrupt at 25 times of the transformer rated current within 2 seconds in case of a secondary short circuit.

Fuse Selection Criteria for each purpose



Power Fuse for Capacitor Circuit Protection

Rated Voltage [kV]	Constant	Capacitor Rated Capacity [kVA]	Applied Fuse Link
24	3Ø	~ 12	VTHF24001
		25 ~ 53	VTHF24005
		53 ~ 86	VTHF24010
		86 ~ 154	VTHF24016
		154 ~ 209	VTHF24020
		209 ~ 261	VTHF24025
		261 ~ 329	VTHF24032
		329 ~ 480	VTHF24040
		480 ~ 600	VTHF24050
		600 ~ 756	VTHF24063
		756 ~ 1200	VTHF24080
		1200 ~ 1846	VTHF25100
		1846 ~ 2500	VTHF24125
		2500 ~ 3200	VTHF24160
		3200 ~ 4000	VTHF24200

Detailed Selecting Conditions

1. The inrush current of Capacitor is selected by assuming that there is a conducting at 71 times of the Capacitor rated current for 0.002 second.
2. The rated current of fuse is selected so that it can continuously conduct 1.5 times the Capacitor rated current.
3. The transformer fuse is assumed and selected so that it can interrupt at 25 times of the transformer rated current within 2 seconds in case of a secondary short circuit.



B3 Automatic Section Switches

CONTENTS

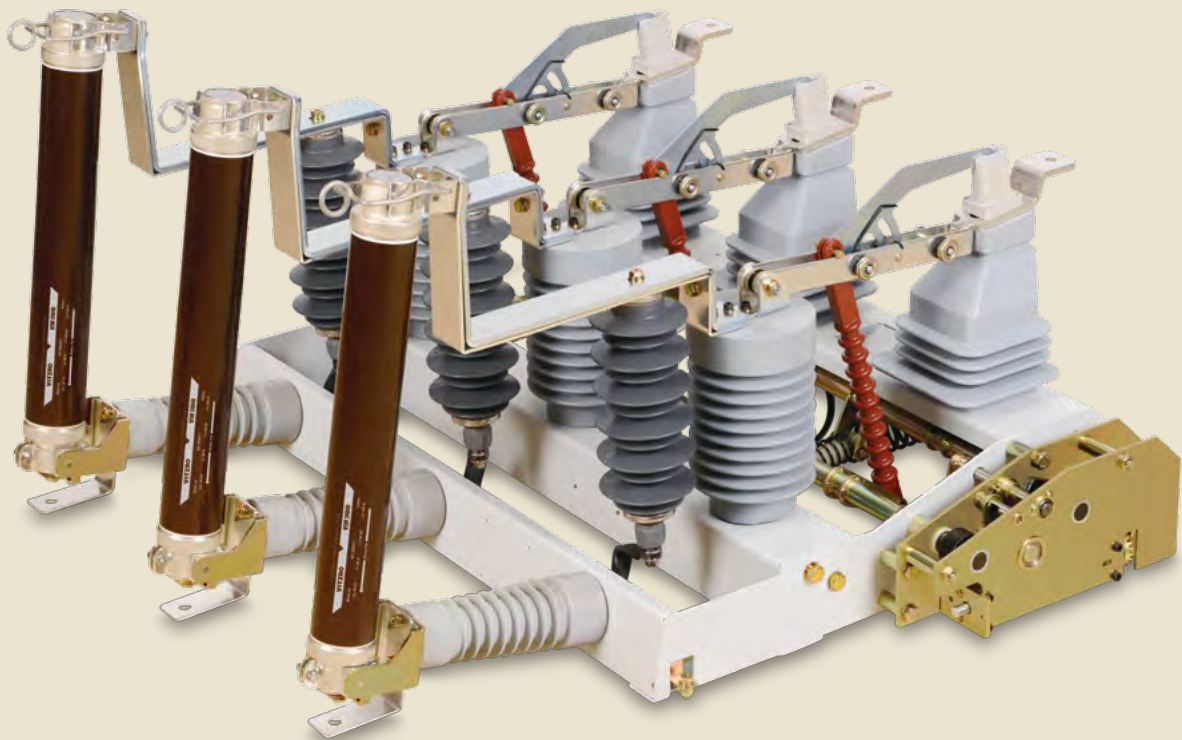
Features	B3-02
Ratings	B3-04
Performance & Installation/Dimensions	B3-06



Automatic Section Switches

25.8kV Automatic Section Switches

VITZRO EM Automatic Interrupting Section Switch is a switch applied with the first Air-Puffer type arc extinguishing structure and the base insulator type C.T. It is easy to install and operate the panel and it is a light-weight, compact product in the country equipped with the full protection function for the lightning surge of controller. It is possible to install ASS, LA, PF and MOF inside one panel. By using the breaking part that is same as our LBS which is highly recognized among our customers and the operation method, it doubled the high-performance and high-reliability.



Utility

It was internationalized and improved with the user's compatibility.

- It is a switch applied with the first Air-Puffer type arc extinguishing structure and the base insulator type C.T. It is easy to install and operate the panel and it is a light-weight, compact product in the country equipped with the full protection function for the lightning surge of controller.
- The faults of primary circuit breaker and bus faults do not influence the KEPCO lines so KEPCO can reduce the power failure time due to the faults of received organ.
- There is a disconnecting function (distinguishable by the naked eyes) when performing the maintenance or detailed inspection to prevent the safety accidents.

Convenience

It improves the safety and convenience of users.

- ASS, LA, PF and MOF can be installed in the Panel 1 side
- It is possible to easily install the manual operating handle of the controller and flexible type in the front panel.

Combination

- Polymer-type lightning arrestor and current limit type power fuse are combined to reduce the size of the distribution panel which cuts down the cost.
- It is easy to install and carry out the maintenance work for the lightning arrestor and fuse.
- It is easy to connect to the earth terminal of panel for it is equipped with the earth terminal of lightning arrestor.

Safety

It greatly improves the safety and quality by applying an excellent breaking function.

- By using the breaking part that is same as our LBS which is highly recognized among our customers and the operation method, it doubled the high-performance and high-reliability.

It ensures the safety of users by adopting the insulating materials.

- Use of Excellent Insulator
- By using a support insulator molded by polymer concrete which is an advanced insulating material that our company retains a patent for, it maintains the dielectric strength even at poor operating conditions since its electrical and mechanical strength and arc resistance are superior.

Ratings

Ratings

Type		VAS-A-A22	VAS-A-A31
		Standard Type	L/A+P/F Combination Type
Operation Method		Motor/Manual Operation	
Rated Voltage (kV)		25.8	
Rated Current (A)		200	
Rated Frequency (Hz)		60	
Power Frequency Withstand Voltage	Between Conducting Part & Earth (kV)	50 (1 min)	
	Between Fault Conducting Parts (kV)	50 (1 min)	
	Between In-phase Terminals (kV)	60 (1 min)	
	Between Operating Circuit & Terminal (kV)	2 (1 min)	
Impulse Withstand Voltage	Between Conducting Part & Earth (kV)	125	
	Between Fault Conducting Parts (kV)	125	
	Between In-phase Terminals (kV)	145	
	Between Operating Circuit & Terminal (kV)	6	
	SWC (kV)	2.5/4	
Rated Short Time Withstand Current (kA)		15/Instantaneous (Asym.)	
		10/1 sec (Sym.)	
		3.5/10 sec (Sym.)	
Rated Short Circuit Making Current (kA)		15 (Asym.)	
Rated Breaking Current (A)		800	
Min. Operating Current	Phase (A)	10/20/30/50/70/100/140/200/BLOCK	
	Ground (A)	5/10/15/25/35/50/70/100/BYPASS	
Max. Lock Current (A)		800	
Operating Circuit Control Voltage (V)		DC 24 (AC 220V : For Battery Charging)	
Inrush Current Suppression (Sec)		0.5 / 1.0	
Manual Operating Cable Length		Standard 2.6m (Other 2.0m)	
L/A & P/F		Excluded	Included
L/A Rated Current (kA)		Non	5
P/F Rated Current (A)		Non	1/5/10/16/20/25/31.5/40/50/63/80/100/125/160
Total Weight (kg)		90	110
Certificate & Approval		KEMC 1126 (2007.8), Specification of Manufacturer	

※ This switch is used at a place with temperature ranging from -25°C to +50°C and altitude of 1000m or under.

※ Maximum Load: Standard Load 4000kV, Special Load 2000kVA

Ordering Information

VAS	A	A22	H	A	I					
Type	Installation Method Combination Type		Operation Mode		Installation Method Combination Type	Manual Operating Cable Length		Auxiliary Contact		
VAS	A	Motor-Driven Operation	A21	Standard Type (Knife Method)	H	Horizontal Installation	A	1.0m	1	1a1b
	M	Manual Operation	A31	P/F, L/A Single-Body Type (Knife Method)	V	Vertical Installation	B	1.2m		
			A41	Standard Type (Perpetual Method)			C	1.5m		
			A42	P/F, L/A Single-Body Type (Perpetual Method)			D	1.8m		
			A43	P/F, L/A Single-Body Type (Perpetual Method)			E	2.0m		
							F	2.6m		

Configuration



1 Start Lamp

Lamp to check normal/abnormal operation

2 Lock Lamp

Lamp to check over-current inflow of 800A or more

3 Operating Phase Display Lamp

Displays a fault phase in case of a failure

4 Phase Current Set Button

Operating current is set based on the equipment capacity

※ Refer to Table1 for the set value
(10/20/30/50/70/100/140/200/LOCK)

5 Ground Current Set Button

Ground current is set based on the equipment capacity

※ Refer to Table1 for the set value
(5/10/15/25/35/50/70/100/BY-PASS)

6 Inrush Current Suppression Time Correcting Tab

Tab to set the time to prevent malfunctioning due to the inrush current (0.5/1.0 sec)

7 BAT State Display Lamp

Battery State (Charging, Charging Completed)

8 Closing/Opening Button

Execute closing and opening of ASS with One Touch

9 Emergency Stop Button

Button to stop the closing in urgent when the closing operation is being operated

10 Test Button

ASS is opened when pressed for about 0.5 second for the Self Test of Controller

* Note: Do not use during an operation. Use only for testing during the maintenance and inspections.

11 Lamp Test Button

Test Button to check the fault state of all lamps

12 Reset Button

Reset all states of controller to the normal states by pressing the Reset Button after the controller is operated or after the maintenance and inspection of the controller

13 Current Set Button

Button to set the phase current and ground current

14 Fault Check Button

Button to check the fault current and phase

Performance & Installation / Dimensions

Performance & Installation

Performance

- (1) Minimum Operating Current Correction
A controller tap corrects the minimum operating current of phase and ground.
(The ground current is set as 50% of the phase current.)

$$\frac{\text{Contract Capacity(kW)}}{22.9\text{kV} \times \sqrt{3}} \times 2\sim 3 \text{ times}$$

- (2) No-Load Switching : 1,000 times

Installation

- (1) Operation Check Connect the cable (discuss it with the manufacturer and the user: standard 4 m) and check to identify errors by performing the opening and closing operations for 2~3 times manually and automatically.
- (2) Precautions on Installation After it is unwrapped, check to see any transformations, damages, leakages and so forth and be careful of damages to bushing during the installation.

T-C Curve

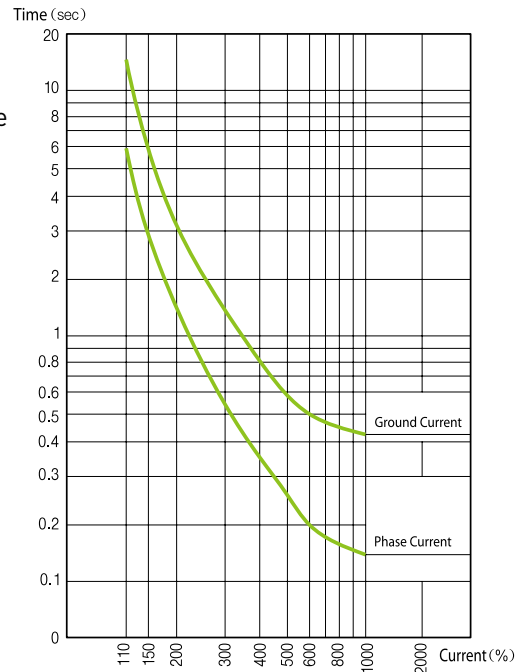


Table on Selection of Phase Current & Ground Current

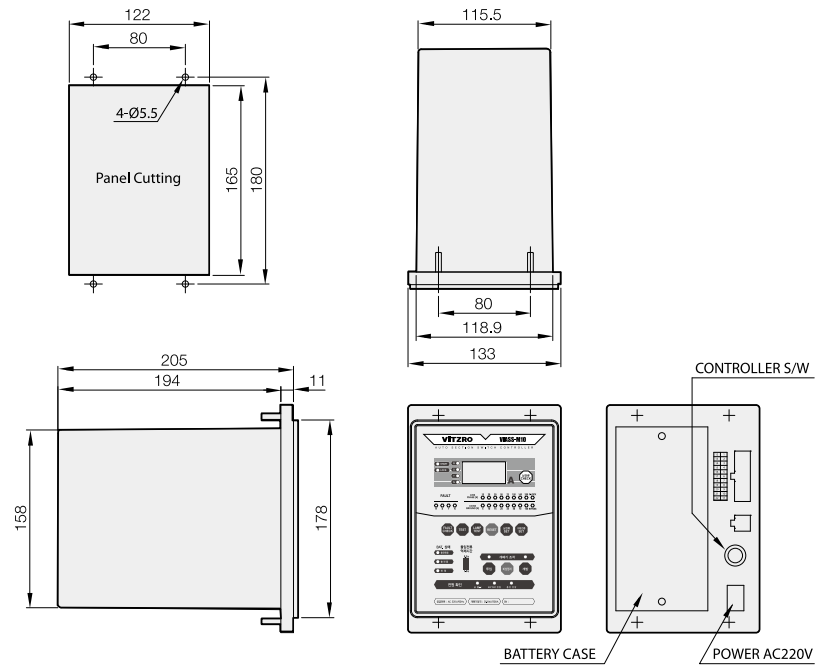
Transformer Capacity (KVA)	Phase Current Tab (A)	Ground Current Tab (A)	Calculated Phase Current (A)	Calculated Ground Current (A)
0~100	10	5	0~7.5	0~3.8
101~250	20	10	7.5~18.75	3.8~9.4
251~350	30	15	18.75~26.25	9.4~13.2
351~600	50	25	26.25~45	13.2~22.5
601~900	70	35	45~68	22.5~34
901~1000	100	50	68~75	34~37.5
1001~1500	140	70	75~113	37.5~56.5
1501~2000	200	100	113~150	56.5~75

Remarks

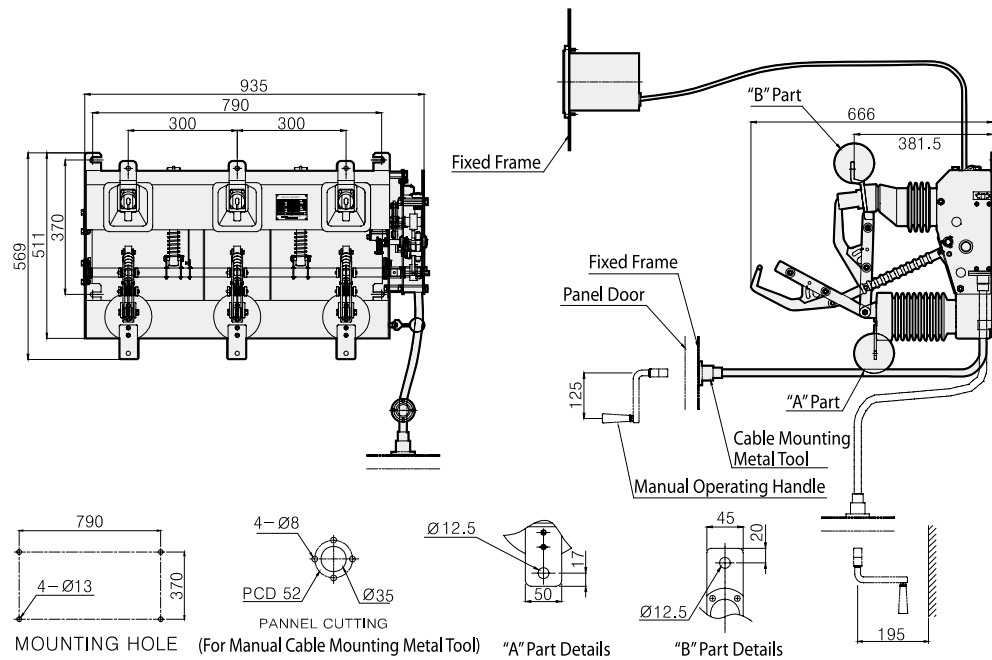
- Tab Correcting Current = (Transformer Capacity/($\sqrt{3} \times 22.9[\text{kV}]$)) $\times 3$
- Correct the ground current to 1/2 of the phase current
- Block : Opening suppressing tab based on the phase current
- By-pass : Opening suppressing tab based on the ground current

Dimension

Controller



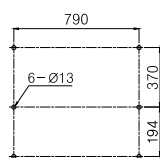
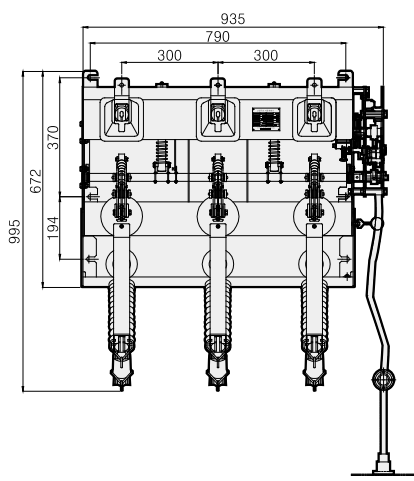
Standard Type



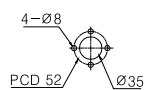
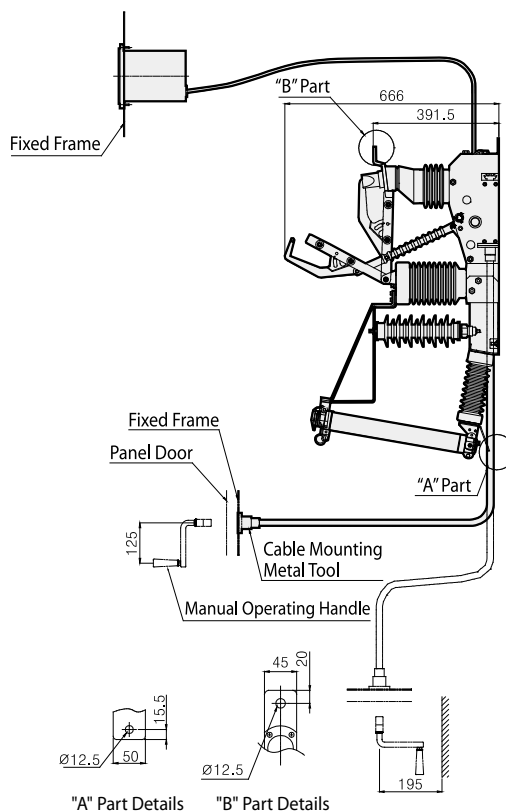
Dimensions / Certifications

Dimension

Horizontal Type



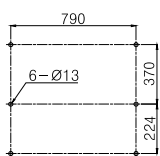
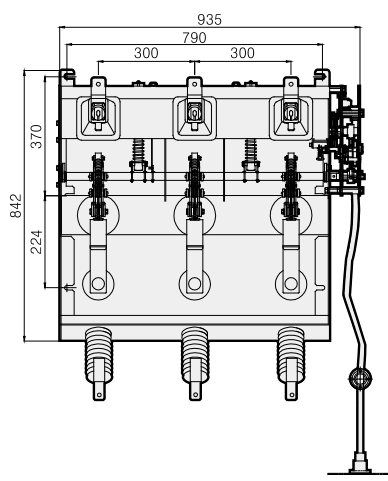
MOUNTING HOLE

PANNEL CUTTING
(For Manual Cable Mounting Metal Tool)

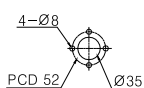
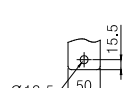
"A" Part Details

"B" Part Details

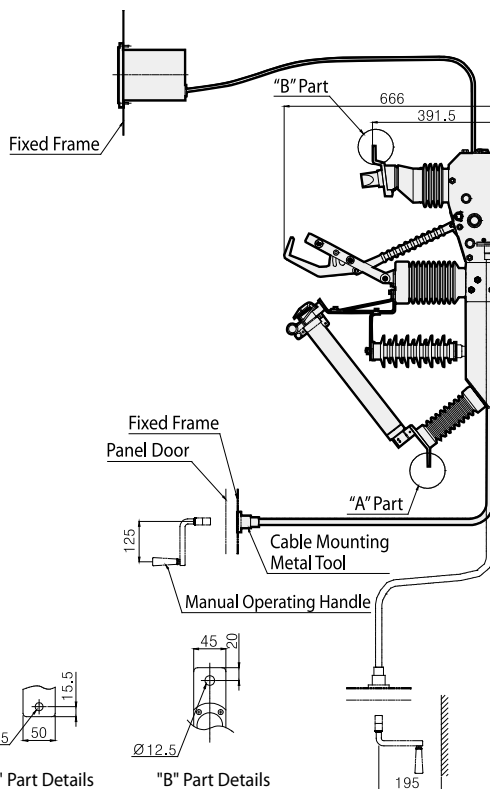
Vertical Type



MOUNTING HOLE

PANNEL CUTTING
(For Manual Cable Mounting Metal Tool)

"A" Part Details



"B" Part Details

VITZRO EM



B4 Vacuum Contactor Switches

CONTENTS

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Application & Selection/Characteristics	B4-10
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Control Circuit Diagrams	B4-19



Vacuum Contactor Switches Fixed Types



VITZRO EM Vacuum Contactor Switch is a miniature, high-performance MV VCS. It is highly reliable and stable and easy to use. There are 2 types fixed excitation mode and instantaneous excitation mode that do not require maintenance. It is a switch for medium voltage motor, transformer and Capacitor circuits and it contributes greatly to the modernization and simplification of the equipment.

Its performance was recognized through technology integration and international standard certificates.

- It is a product with the maximum short circuit capacity conforming to the international standard IEC-60470.

It improves the safety by applying an excellent breaking capability and a long-term quality warranty.

- The arc time at all areas of current is generally 0.5 cycle or below. It performs a great breaking capability during the opening and closing of Capacitor bank. The chopped current is less than 1(A) so when interrupting the load current of motor and the exciting current of transformer, a high surge voltage is not generated.
- The mechanical life cycle of fixed excitation mode is 2,500,000 times and that of instantaneous mode is 250,000 times. The electrical life cycle is 250,000 times of the load opening and closing.

It is easy and safe to use with various optional functions.

- There are 4 types of ratings - fixed type, individual draw-out type, draw-out type (standard draw-out type and external draw-out type) and mechanical interlock mounting type - with total of 36 product types. All draw-out types are mounted with a draw-out unit. However, a power fuse is mounted when ordered.

There is enough space due to its compact size and light-weight.

- It is possible to mount a distribution panel with 600 mm width and it can be loaded in 3 columns.

Vacuum Contactor Switches Draw-Out Types



VITZRO EM Vacuum Contactor Switch is a miniature, high-performance MV VCS. It is highly reliable and stable and easy to use. There are 2 types of fixed excitation mode and instantaneous excitation mode that do not require maintenance. It is a switch for medium voltage motor, transformer and Capacitor circuits and it contributed greatly to the modernization and simplification of the equipment.

Standard Draw-Out Type

- It is compatible with draw-out type power fuse.
- It can be installed with up to 2 potential transformers.
- A draw-out unit is same as the fuse-mounting type.

External Draw-Out Type

- It is compact and light-weighted so 3 of them can be loaded based in the circuit breaker within the cubicle and it can save the space. In addition, it is suitable to install an enclosed panel.

Individual Draw-Out Type

- The inner width is smaller than that of the standard draw-out type.
- A potential transformer and power fuse cannot be installed.

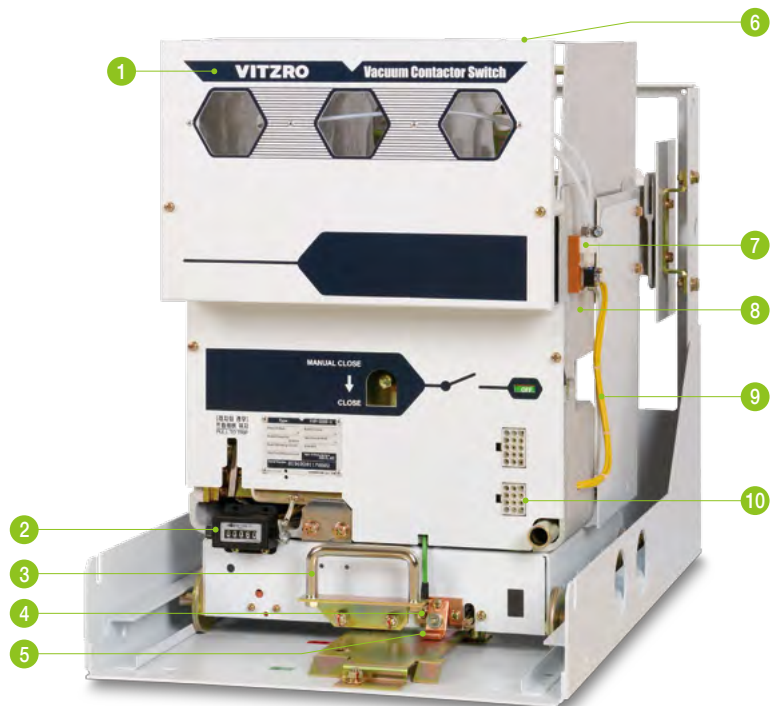
Mechanical Interlock Mounting Type

- It is used for 「commercial」 and 「emergency」 power transfer and 「power failure」 and 「reverse power」 transfer.
- It performs a mechanical interlock of 2 fixed-type contact switches using a connecting bar. (However, use VTS when disconnecting is required.)

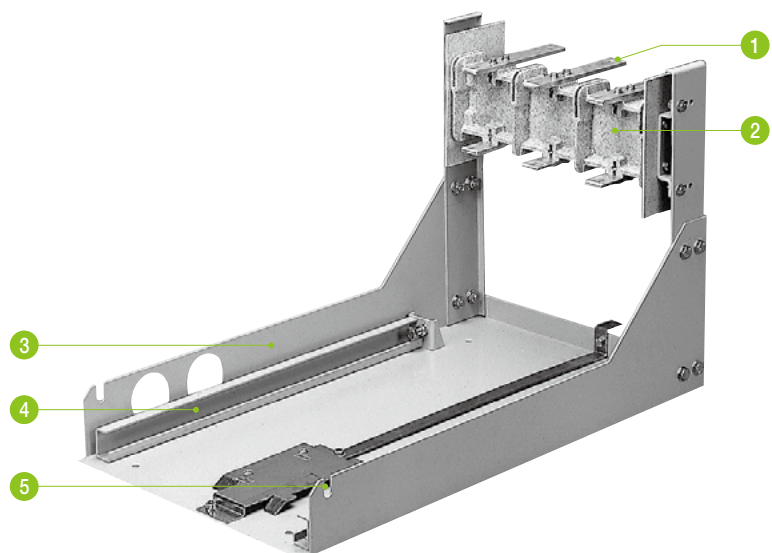
Configuration / Accessories

Configuration

- ① Protective cover
- ② Counter
- ③ Draw-out grip
- ④ Grounding contact
- ⑤ Stopper pin
- ⑥ Power fuse
- ⑦ Fuse check
- ⑧ Molded case
- ⑨ Potential transformer (inside)
- ⑩ Control circuit connector



- ① Bus
- ② Barrier
- ③ Draw-out unit
- ④ Guide rail
- ⑤ Earth



Accessories

Our VCS performs the short circuit protection at the power fuse and the general load switching is performed at high-voltage VCS. It is an optimal product as a combination starter. It can install up to 2 short-circuit potential transformers and it is fully equipped with the draw-out unit.

Standard Accessories

Item Name	Quantity	Purpose	Remarks
Manual Closing Handle	1 ea/set	For manual closing	Mounted when it is an instantaneous excitation mod
Control Circuit Connecting Cable	1 ea/set	For power connection	Standard Product (1.5m)

The following accessories are supplied based on the requirements of the demanding part.

	Item Name	Specification / Rating	Remarks
Mounted outside the Body	Draw-Out Unit		
	Position Detector	Limit Switch is operated at 「connecting」 and 「testing / disconnecting」 positions.	Cam and Limit S/W is attached to connecting main unit and draw-out unit and the wire is directly connected to the Limit S/W
	Capacitor Trip Device	AC 100 / 110V	
	Vacuum Checker	AC 110V	
Mounted on the Body	Power Fuse (PF)	3.6kV 5 ~ 250A 40kA 7.2kV 5 ~ 250A 40kA	
	Silicon Rectifier (Si-Rf)	For both AC 100 ~ 220V	Single-Phase full wave rectifier mounted with a surge absorber
	Potential Transformer (PT)	3300V / 110V, 100VA 6600V / 110V, 100VA	PF Fuse mounted, Rating 3.6 / 7.2kV. 1A, 40kA
	Counter	5 Digits (0-99999)	Mechanical counter
	Power Fuse Melting Detector	Switch (1C contact) mounted	Refer to connection diagram

Ratings & Specifications



Structure			Individual Type									
			Fixed Type				Draw-Out Type					
Type	Fixed Excitation Mode		KVP-322E	KVP-342E	KVP-625E	KVP-645E	KVPD-322E	KVPD-342E	KVPD-625E	KVPD-645E		
	Instantaneous Excitation Mode		KVS-322E	KVS-342E	KVS-625E	KVS-645E	KVSD-322E	KVSD-342E	KVSD-625E	VCI-645E		
Rated Voltage		kV	3.3 / 3.6		6.6 / 7.2		3.3 / 3.6		6.6 / 7.2			
Rated Current		A	200	400	200	400	200	400	200	400		
Rated Frequency		Hz	50, 60				50, 60					
Short Circuit Breaking Current		kA	4				4					
Short Time Current	2sec	kA	4				4					
	0.5cycle	kA	40	50	40	50	40	50	40	50		
Withstand Voltage	mpulse	kV	*45		**60		*45		**60			
	Power Frequency	kV	10		20		10		20			
Endurance	Mechanical	Fixed Excitation Mode	10,000 times	250				250				
		Instantaneous Excitation Mode	10,000 times	25				25				
	Electrical		10,000 times	25				25				
Operating Voltage	Closing Coil	V	DC, 24, 48/50, 100/110, 115/125, 200/220, 230/250, ***AC (Single phase) 100/110, 200/220									
	Trip Coil (Instantaneous Excitation Mode)	V	DC, 24, 48/50, 100/110, 115/125, 200/220, 230/250, ***AC (Single phase) 100/110, 200/220									
Auxiliary Contact			2a2b				2a2b					
Power Fuse	Rated Voltage	kV	-	-	-	-	-	-	-	-		
	Rated Current	A	-	-	-	-	-	-	-	-		
	Rated Breaking Current	kA	-				-					
Power Load Capacity	Motor	kW	750	1500	1500	3000	750	1500	1500	3000		
	Transformer	kVA	1000	2000	2000	4000	1000	1000	2000	4000		
	Capacitor	kVA	1000	2000	2000	4000	1000	2000	2000	4000		
Weight (body)	Fixed Excitation Mode	R	22	23	22	23	28	29	28	29		
Applied Draw-Out Unit Type		kg					UVSDE-3-2	UVSDE-3-4	UVSDE-6-2	UVSDE-6-4		

[Note] (1) The impulse withstand voltage between phases of in-phase main circuit marked with * is 30kV.

(2) The impulse withstand voltage between phases of in-phase main circuit marked with ** is 45kV.

(3) When the operating voltage (single-phase AC) is marked as ***, a silicon rectifier should be installed on the VC.

(4) 2 operating and potential transformers can be installed on the draw-out type VC or VC with power fuse.

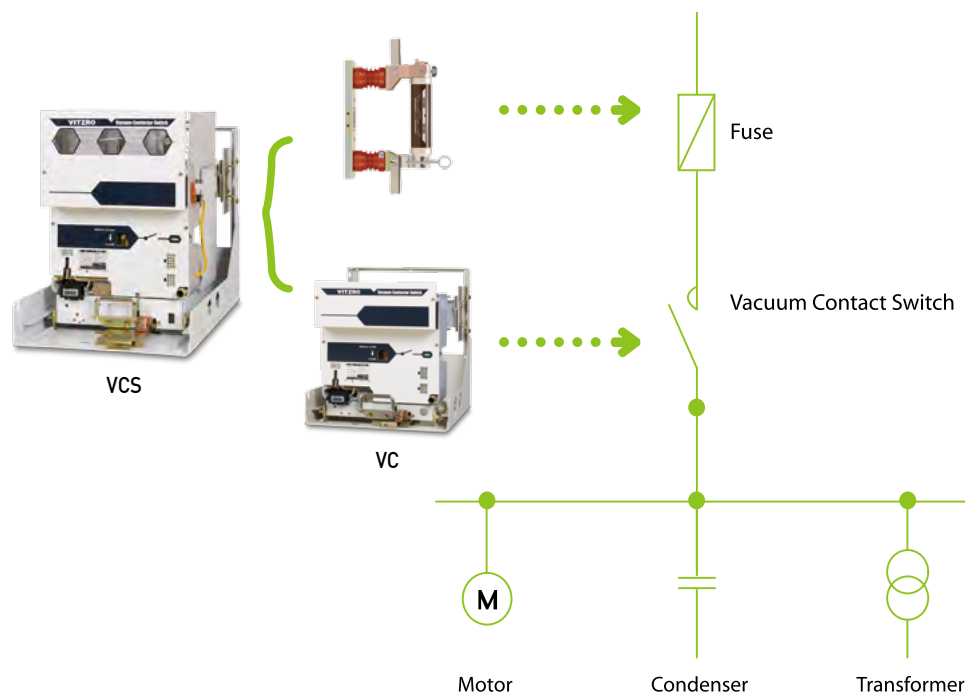
(5) The maximum weight is measured with 2 operating transformers installed and when the power fuse in the VC is the maximum rated current.



	Standard Type					fixed type of mechanical interlock installation			
	Power Fuse When not installed				Power Fuse when installed				
	KVN-322E	KVN-342E	KVN-625E	KVN-645E	WCI-625E-6	KVPM-322E	KVPM-342E	KVPM-625E	KVPM-645E
	KVR-322E	KVR-342E	KVR-625E	KVR-645E		KVSM-322E	KVSM-342E	KVSM-625E	KVSM-645E
	3.3/3.6		6.6/7.2		6.6/7.2	3.3		6.6	
	200	400	200	400	200	200	400	200	400
	50, 60				50, 60	50, 60			
	4				4	4			
	6.3(1sec)				6.3/1sec	4			
	40	50	40	50	40	40	50	40	50
	*45		**60		60	*45		**60	
	10		20		20	10		20	
	250				250	250			
	25				25	25			
	25				25	25			
	DC, 24, 48/50, 100/110, 115/125, 200/220, 230/250, ***AC (Single phase) 100/110, 200/220								
	DC, 24, 48/50, 100/110, 115/125, 200/220, 230/250, ***AC (Single phase) 100/110, 200/220								
	2a2b				2a2b	2a2b			
	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-
	-				-	-			
	750	1500	1500	3000	1500	750	1500	1500	3000
	1000	2000	2000	4000	2000	1000	2000	2000	4000
	1000	2000	2000	4000	2000	1000	2000	2000	4000
	44	45	44	45	Max.52	45	47	45	47
	UVSE3-2	UVSE3-4	UVSE6-2	UVSE3-4	UVSE6-2	-			

Application & Selection / Characteristics

Application & Selection



3.6/7.2kV Fuse Link

External	Name of Model	Rated current I_n [A]	Rated Max. Breaking Current [kA]	Rated Min. Breaking Current [A]	Weight [kg]
	VTHF07010	10	50	$4 \times I_n$	1.1
	VTHF07020	20			
	VTHF07032	31.5			
	VTHF07040	40			
	VTHF07050	50			
	VTHF07063	63			1.4
	VTHF07080	80			
	VTHF07100	100			
	VTHF07125	125			2.4
	VTHF07160	160			
	VTHF07200	200			

Characteristics

Standard	Closing, Breaking Capacity		Intermittent Duty Type				Electrical Durability	
			Fixed Excitation Mode		Instantaneous Excitation Mode			
	Range	Capacity	Class	Number of operating cycles (Cycle/time)	Class	Number of operating cycles (Cycle/time)	Operations	Number of Operations (Capacity)
IEC-470 (1974) HV AC Contact Switch	AC-4	Closing : 10 times Breaking : 8 times	-	1200	-	300	AC-3	250,000 Closing : 6 times Breaking : 1 time
BS-775 (1976) Contact Switch	AC-4	Closing : 10 times Breaking : 8 times	10Class	1200	Class-3	300	AC-3	250,000 Closing : 6 times Breaking : 1 time
AS-1864 (1976) Electric Contact Switch	AC-4	Closing : 10 times Breaking : 8 times	10Class	1200	Class-3	300	AC-3	250,000 Closing : 6 times Breaking : 1 time
VDE-660	AC-4	Closing : 10 times Breaking : 8 times	D1Class	1200	Class-3	300	AC-3	250,000 Closing : 6 times Breaking : 1 time
NEMA-ICS (1976) Part : ICS2-324 Industrial control and systems	Applied to E1 Class (Without Fuse) 2.5kV 17MVA 5.0kV 35MVA Applied to E2 Class (With Fuse) 2.5kV 150MVA 5.0kV 350MVA		-	120	-	300	-	250,000 Closing : 6 times Breaking : 1 time

Breaking Capability

An arc time is always 0.5 cycle or less. Rapid arc extinguishing and excellent insulation recovery are vital characteristics.

Capacitor Bank Switching Capability

A Vacuum Valve performs an excellent breaking operation without re-ignition of arc at the capacitor bank circuit that requires the closing/breaking at high recovery voltage and high frequency.

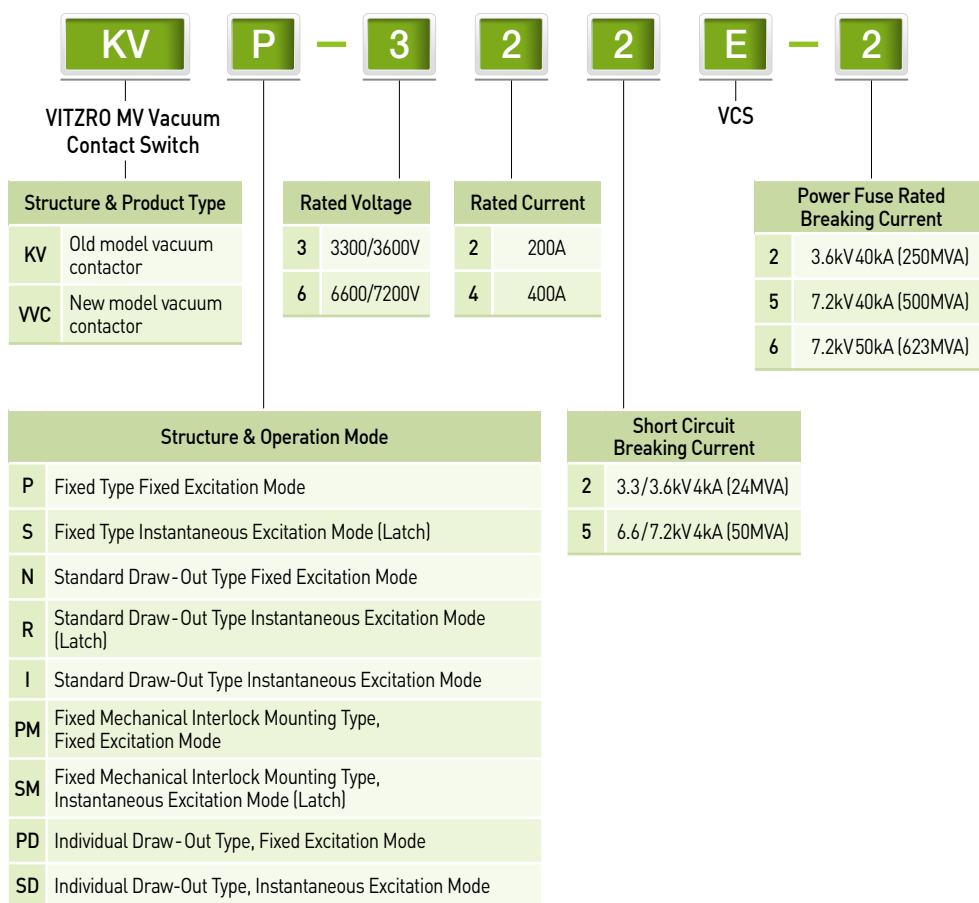
Operating Current & Operating Time

Type		Fixed Excitation Mode		Instantaneous Excitation Mode	
		Closing Current	Protective & Supportive Current	Closing Current	Trip Current
Operating Current (A)	AC/DC 100/110V	1.6	0.35	3.2	1.4
	AC/DC 200/220V	0.9	0.27	1.8	1.3
Operating Time (A)	Closed Time	150		100	
	Opened Time	50		30	

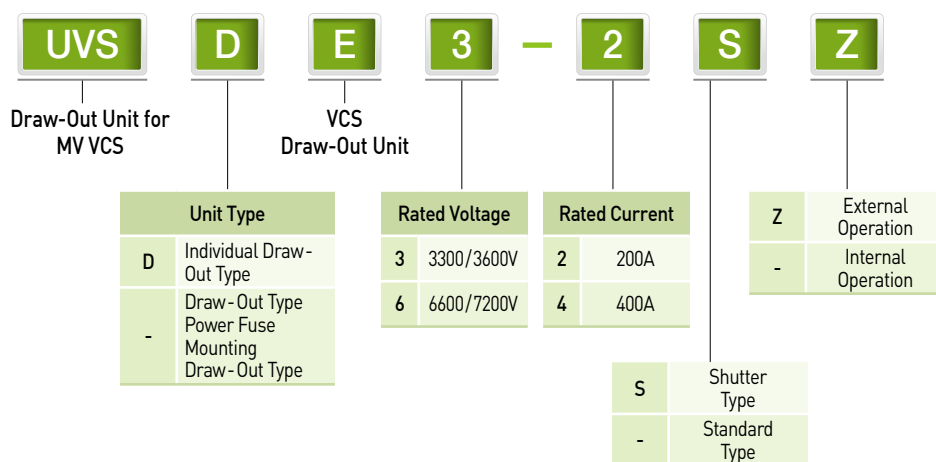
Ordering Information & Dimensions

Ordering Information

How to Display Vacuum Contact Switch Type

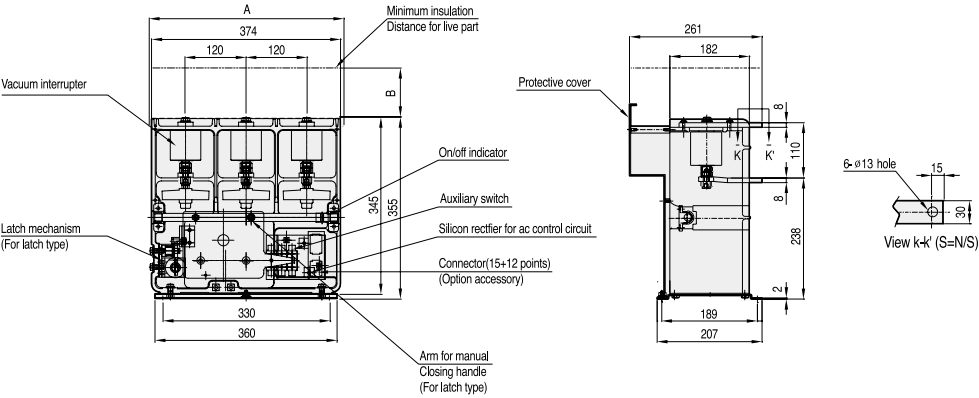


How to Display Draw-Out Unit Type



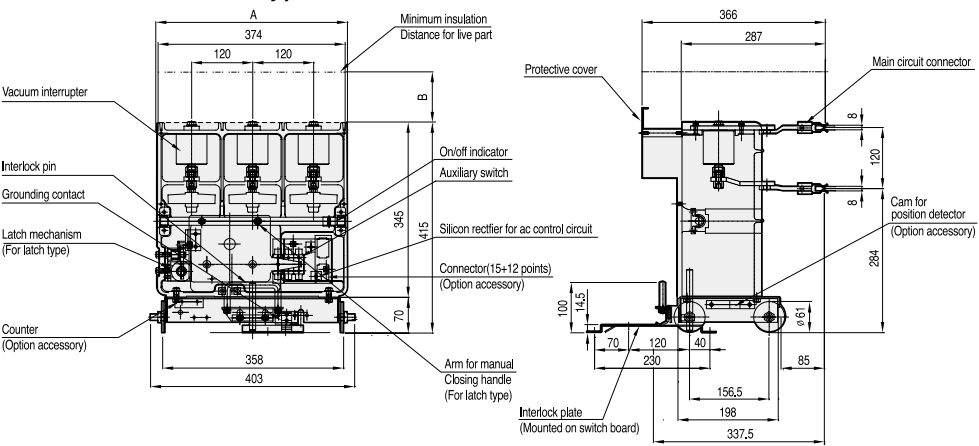
Dimensions

Fixed Type



Type	Rated	A	B
KVP. 322E	3300V 200A 4kA	390	100
KVS. 322E			
KVP. 342E			
KVS. 342E			
KVP. 625E	6600V 200A 4kA	440	120
KVS. 625E			
KVP. 645E			
KVS. 645E			

Individual Draw-Out Type

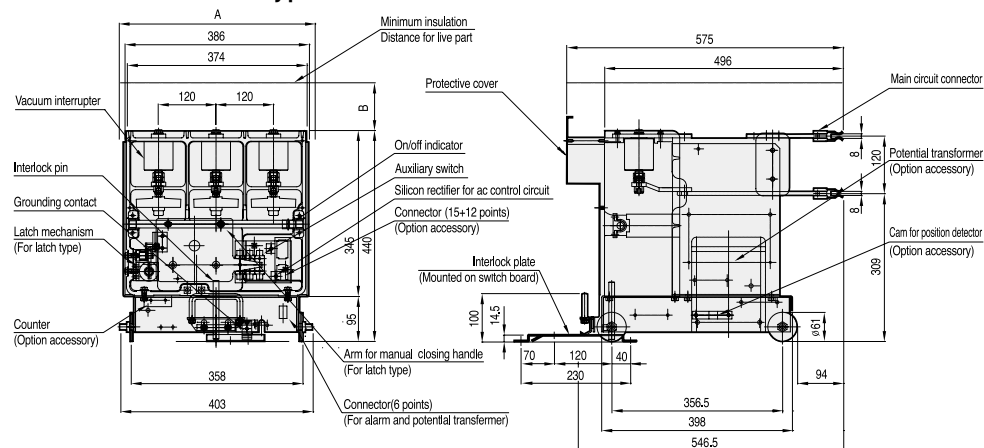


Type	Rated	A	B
KVPD. 322E	3300V 200A 4kA	390	100
KVSD. 322E			
KVPD. 342E			
KVSD. 342E			
KVPD. 625E	6600V 200A 4kA	440	120
KVSD. 625E			
KVPD. 645E			
KVSD. 645E			

Dimensions

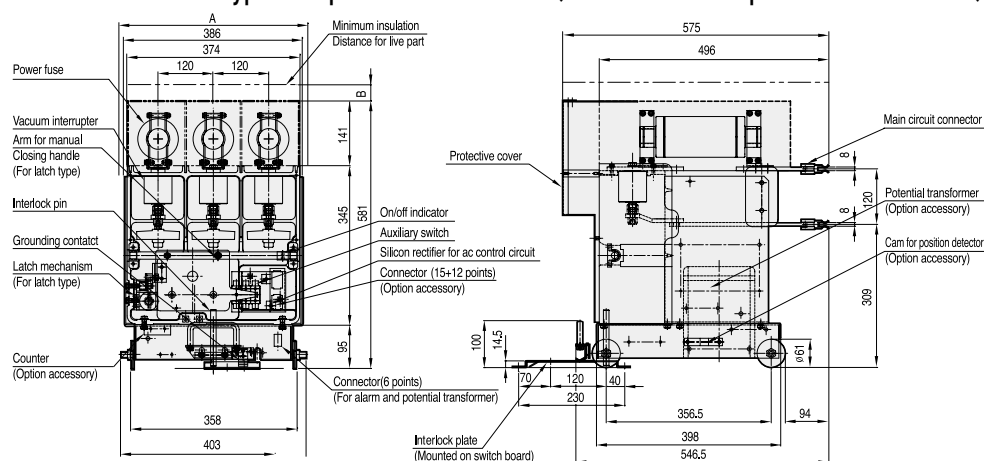
Dimensions

Standard Draw-Out Type



Type	Rated	A	B
KVN. 322E	3300V 200A 4kA	410	100
KVR. 322E			
KVN. 342E	3300V 400A 4kA	410	100
KVR. 342E			
KVN. 625E	6600V 200A 4kA	440	120
KVR. 625E			
KVN. 645E	6600V 400A 4kA	440	120
KVR. 645E			

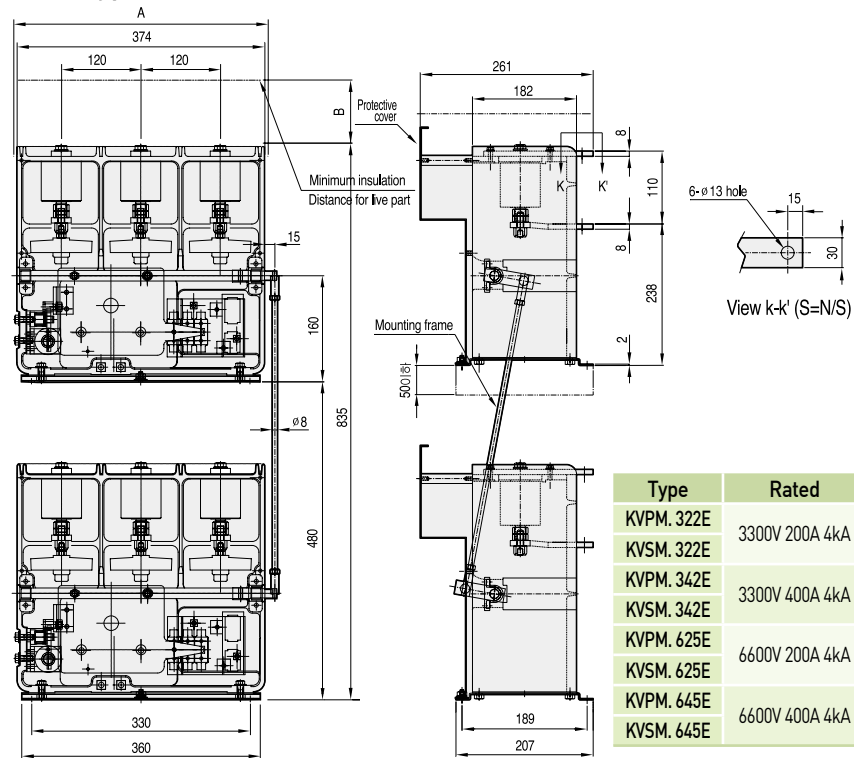
Standard draw-out type with power fuse installed (Rated current of power fuse: 10-200A)



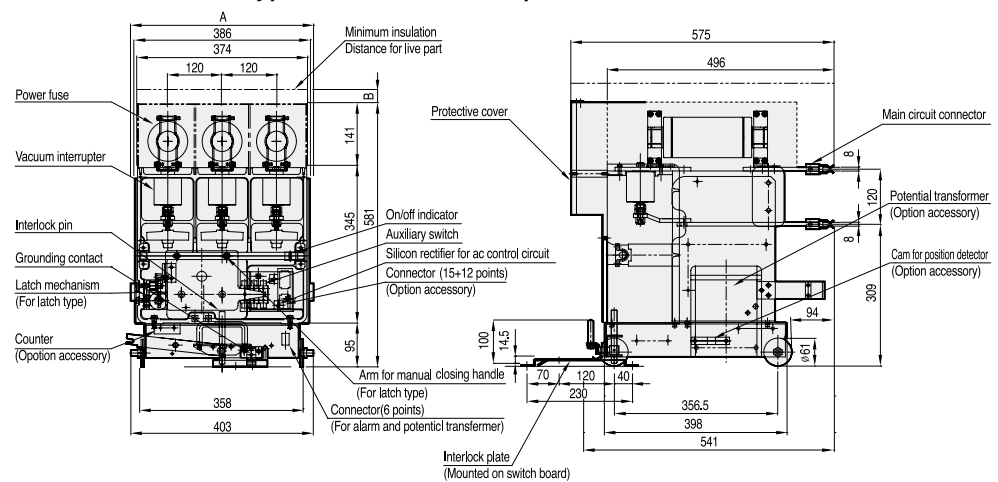
Type	Rated	A	B
VCI 625E-6	6600V 200A 4kA	440	120

Dimensions

Fixed Type mounted with the mechanical interlock



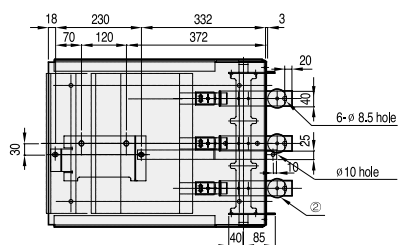
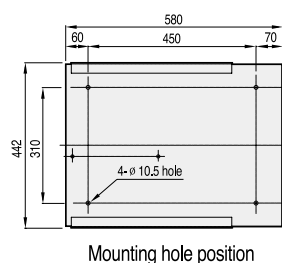
External draw-out type (Rated current of power fuse: 10-200A)



Dimensions

Dimensions

Individual Draw-Out type

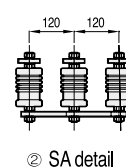
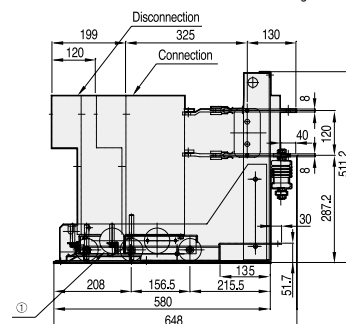
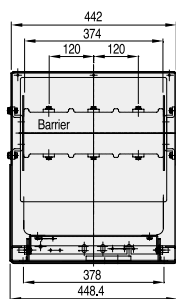
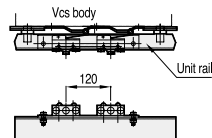


Type	Applicable to VCS
UVSDE 3-2	KVPD. 322E
	KVSD. 322E
UVSDE 3-4	KVPD. 342E
	KVSD. 342E
UVSDE 6-2	KVPD. 625E
	KVSD. 625E
UVSDE 6-4	KVPD. 645E
	KVSD. 645E

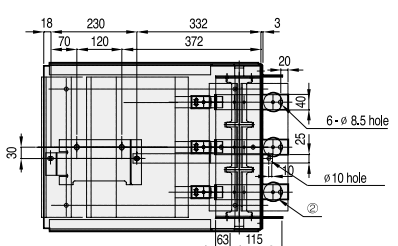
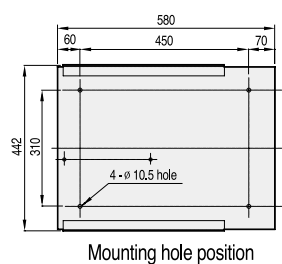
Optional parts

- ① Position detector
② Surge absorber

① Detail run test position



Individual Draw-Out Type Shutter Type

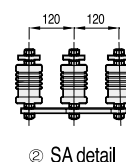
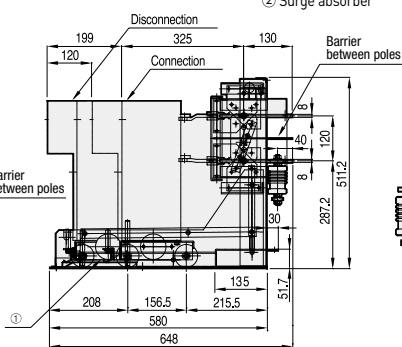
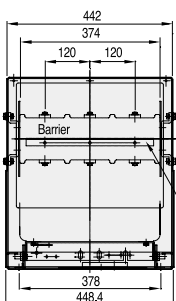
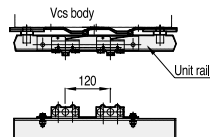


Type	Applicable to VCS
UVSDE 3-2S	KVPD. 322E
	KVSD. 322E
UVSDE 3-4S	KVPD. 342E
	KVSD. 342E
UVSDE 6-2S	KVPD. 625E
	KVSD. 625E
UVSDE 6-4S	KVPD. 645E
	KVSD. 645E

Optional parts

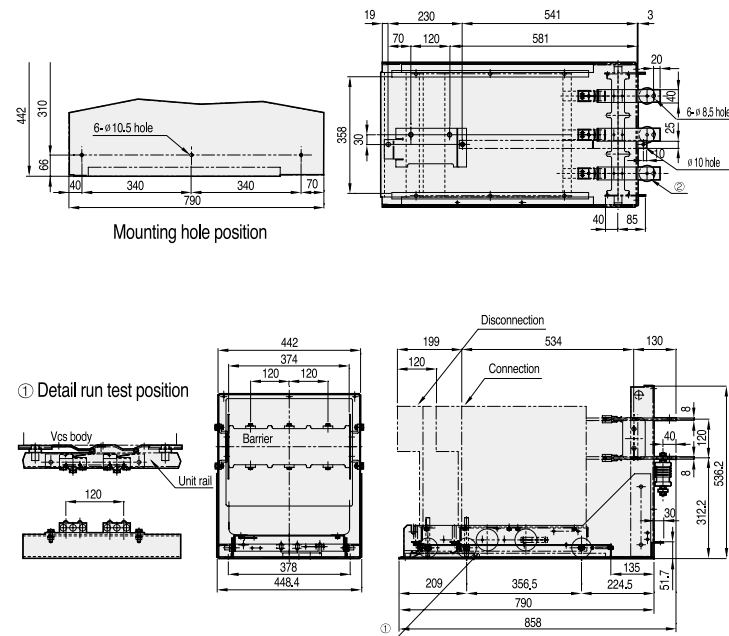
- ① Position detector
② Surge absorber

① Detail run test position



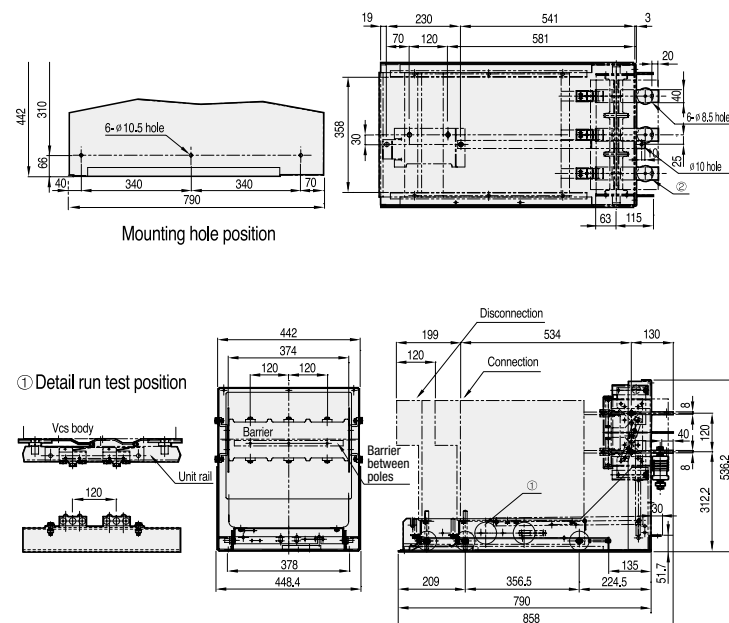
Dimensions

Standard Draw-Out Type



Type	Applicable to VCS
UVSDE3-2	KVN. 322E
	KVR. 322E
	WCI 625E-6
UVSDE3-4	KVN. 342E
	KVR. 342E
	WCI 625E-6
UVSDE6-2	KVN. 625E
	KVR. 625E
	WCI 625E-6
UVSDE6-4	KVN. 645E
	KVR. 645E
	WCI 625E-6

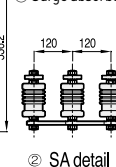
Standard Draw-Out Type Shutter Type



Type	Applicable to VCS
UVSDE3-2S	KVN. 322E
	KVR. 322E
	WCI 625E-6
UVSDE3-4S	KVN. 342E
	KVR. 342E
	WCI 625E-6
UVSDE6-2S	KVN. 625E
	KVR. 625E
	WCI 625E-6
UVSDE6-4S	KVN. 645E
	KVR. 645E
	WCI 625E-6

Optional parts

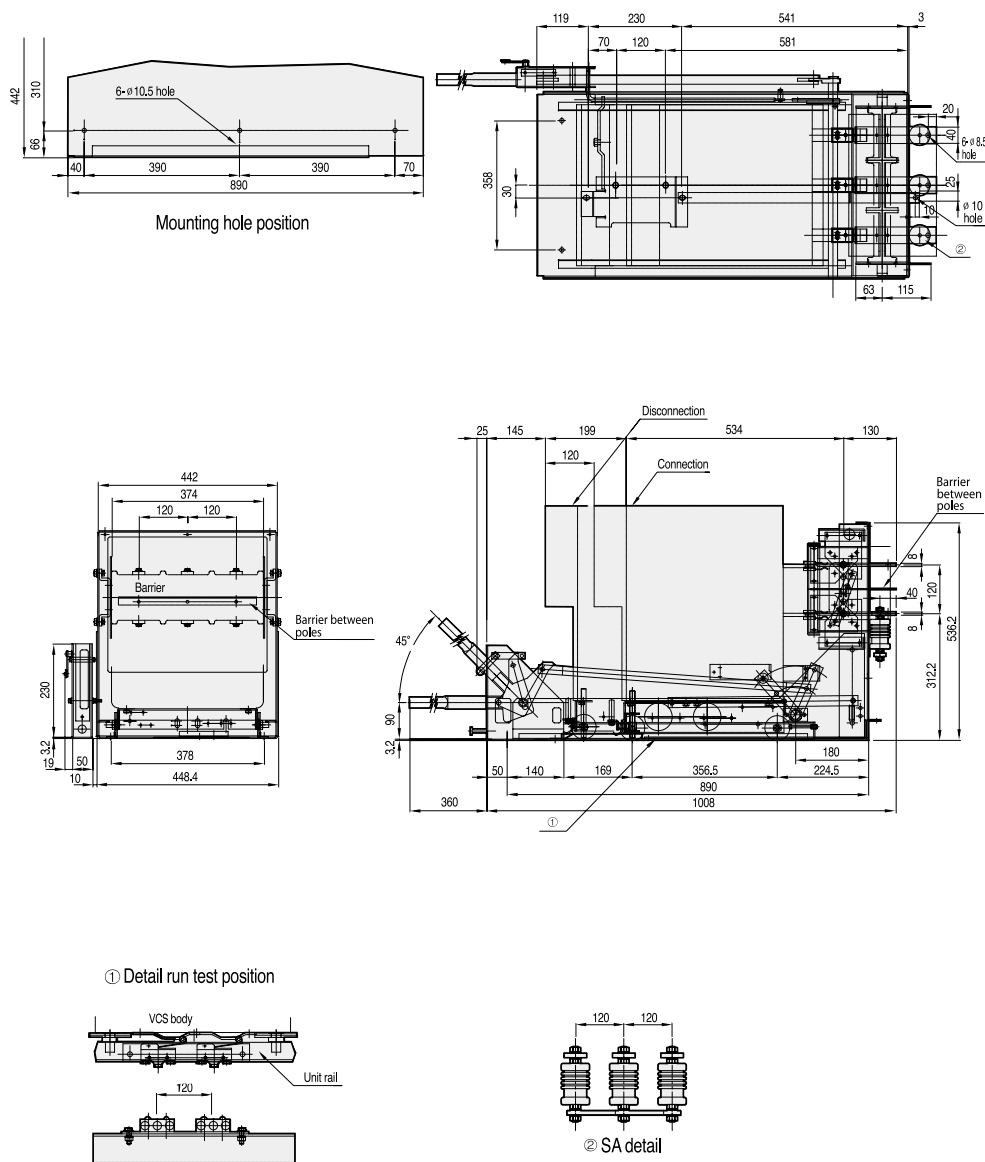
- ① Position detector
② Surge absorber



Dimensions / Control Circuit Diagrams

Dimensions

External Draw-Out Type



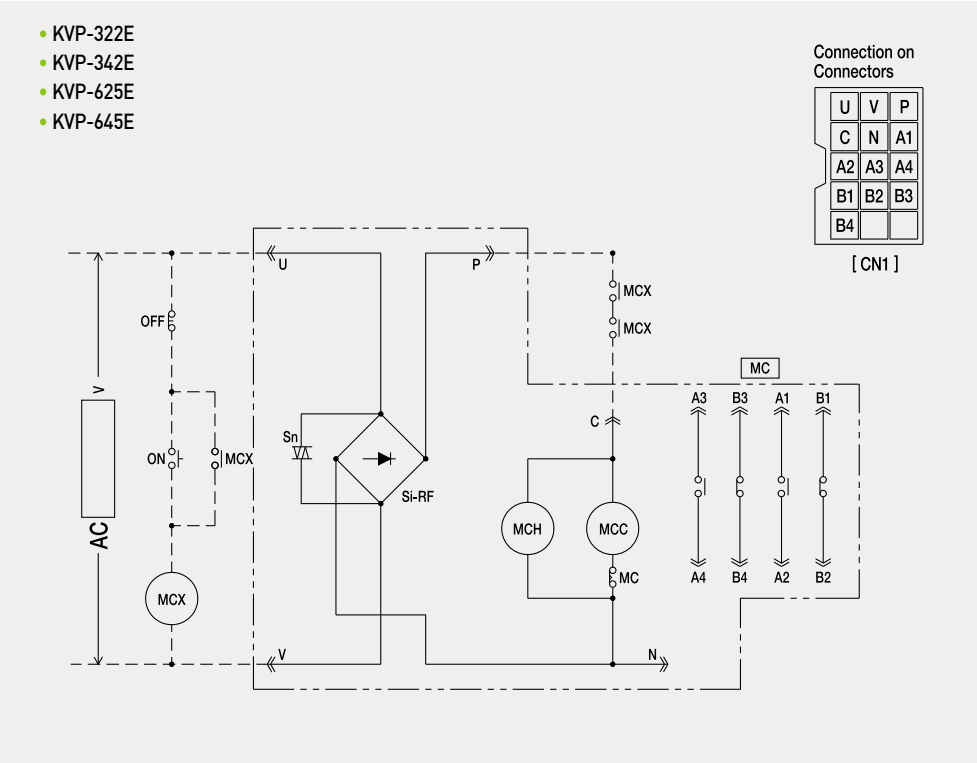
Type	Applicable to VCS	Type	Applicable to VCS	Type	Applicable to VCS	Type	Applicable to VCS
UVSDE 3-2S	KVN. 322E	UVSDE 3-4S	KVN. 342E	UVSDE 6-2S	KVN. 625E	UVSDE 6-4S	KVN. 645E
	KVR. 322E		KVR. 342E		KVR. 625E		KVR. 645E
	VWCI 625E-6		VWCI 625E-6		VWCI 625E-6		VWCI 625E-6

Optional parts

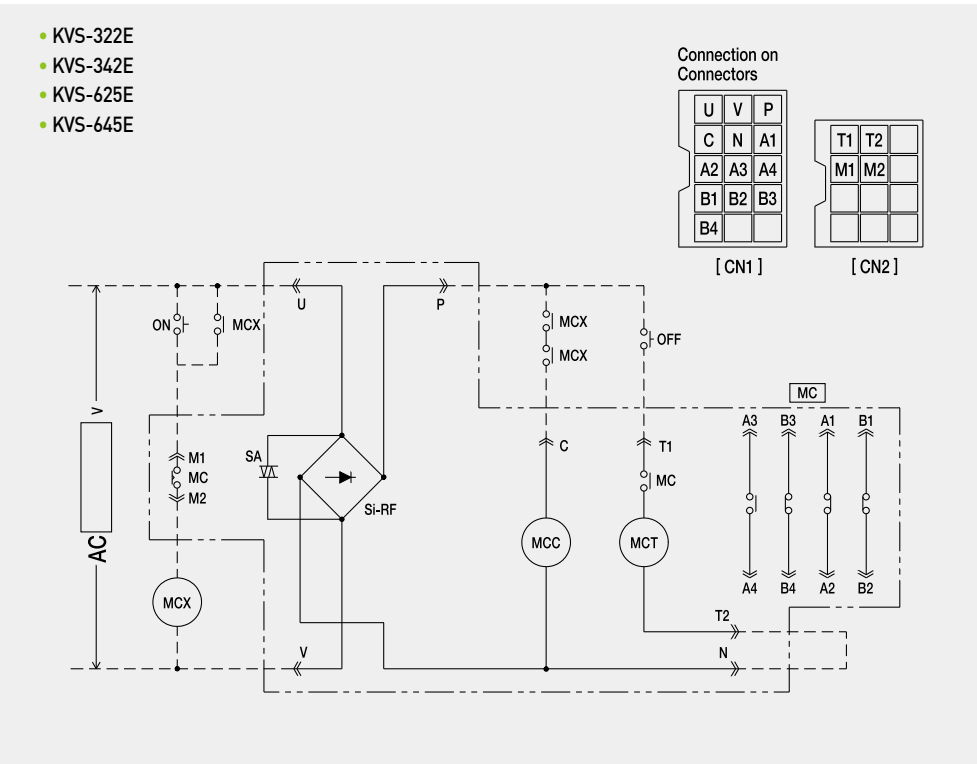
- ① Position detector
- ② Surge absorber

Fixed Type

Fixed Excitation Mode-AC Operation



Instantaneous Excitation Mode-AC Operation

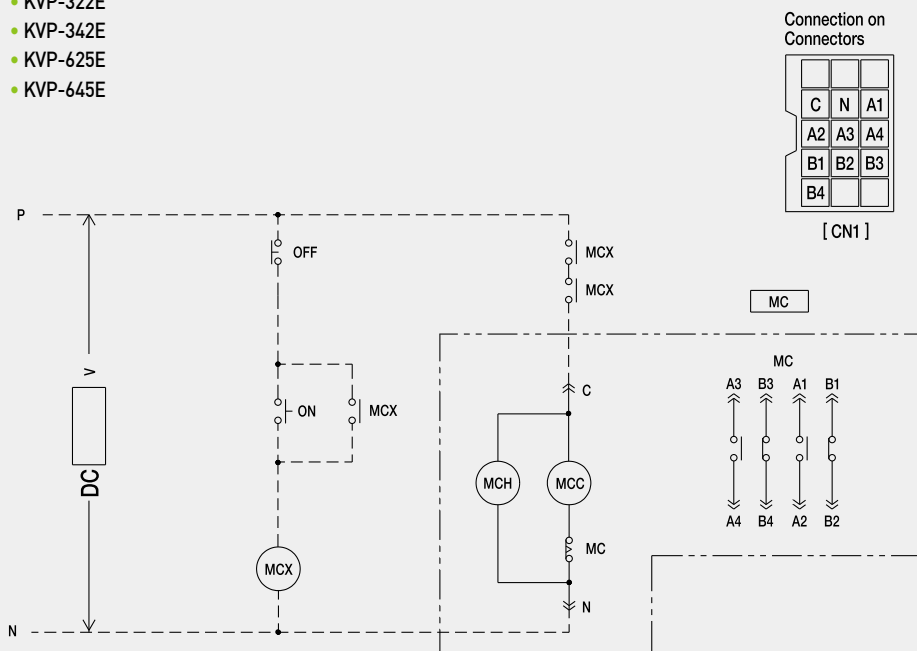


Control Circuit Diagrams

Fixed Type

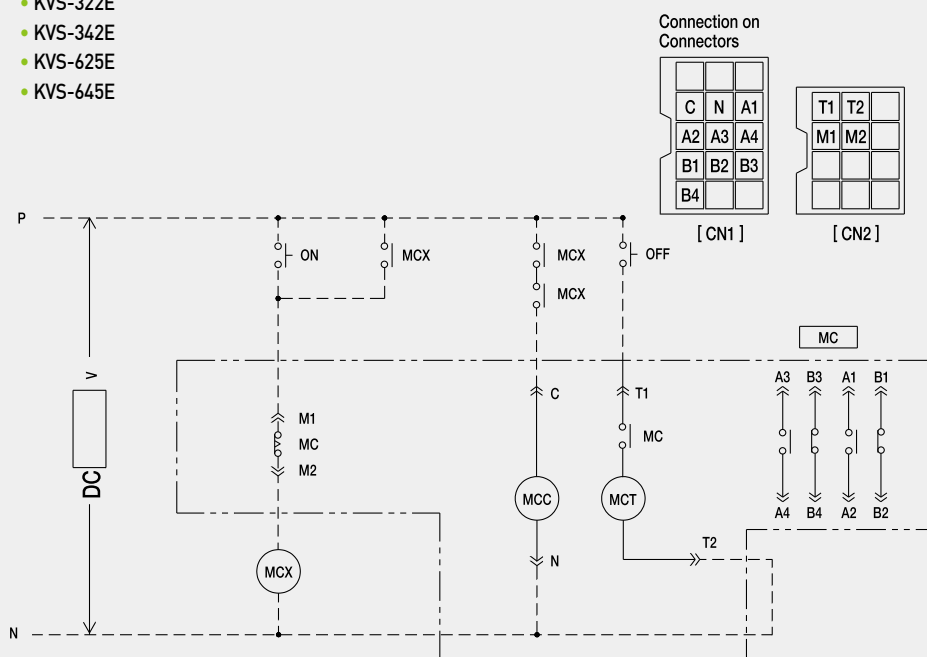
Fixed Excitation Mode-DC Operation

- KVP-322E
- KVP-342E
- KVP-625E
- KVP-645E



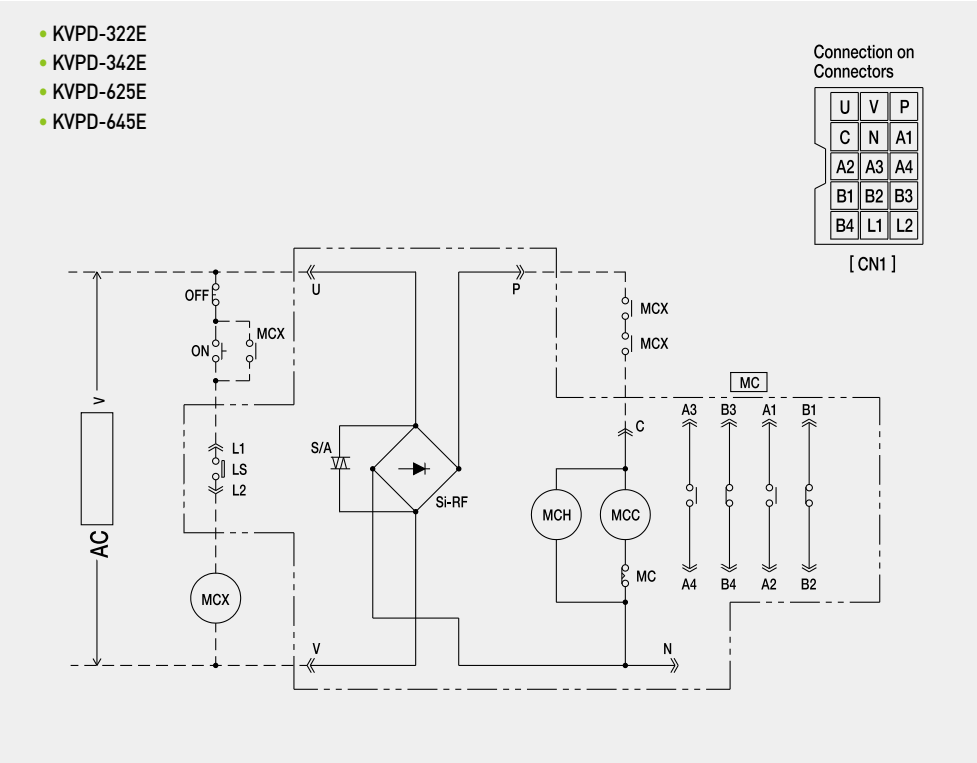
Instantaneous Excitation Mode-DC Operation

- KVS-322E
- KVS-342E
- KVS-625E
- KVS-645E

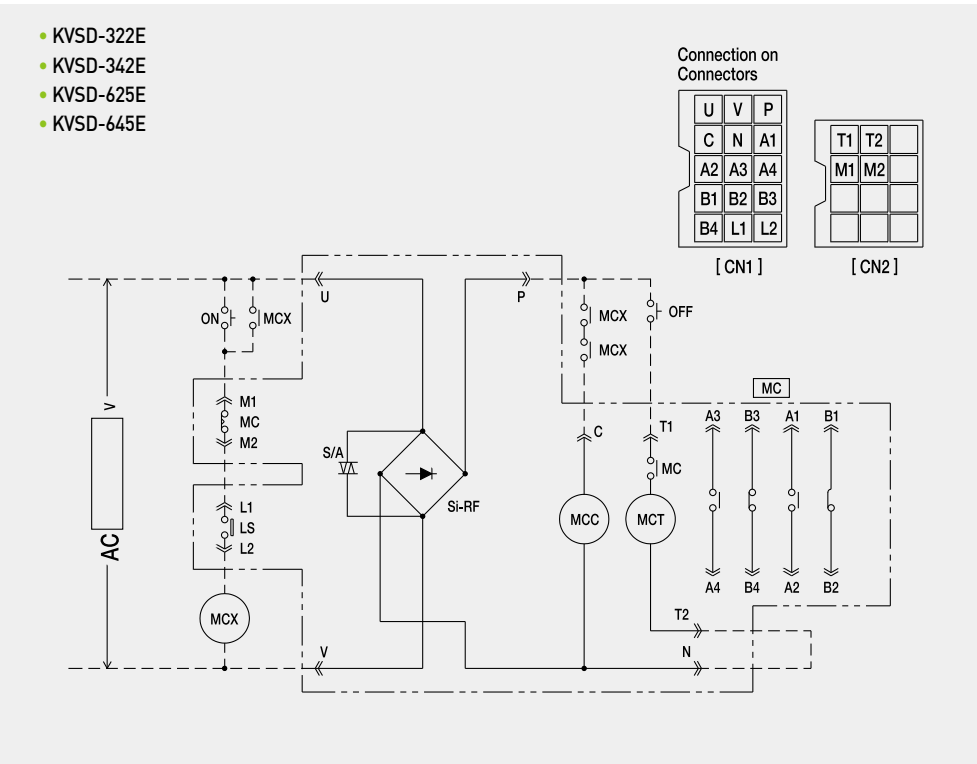


Individual
Draw-Out Type

Fixed Excitation Mode-AC Operation



Instantaneous Excitation Mode-AC Operation



Control Circuit Diagrams

Individual Draw-Out Type

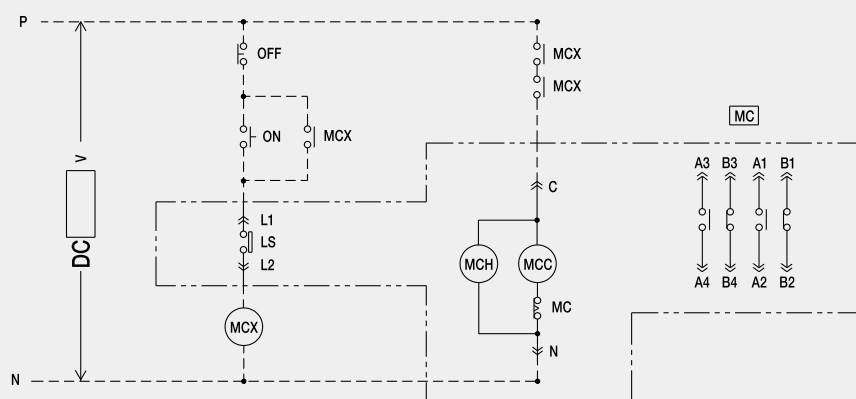
Fixed Excitation Mode-DC Operation

- KVPD-322E
- KVPD-342E
- KVPD-625E
- KVPD-645E

Connection on Connectors

C	N	A1
A2	A3	A4
B1	B2	B3
B4	L1	L2

[CN1]



Instantaneous Excitation Mode-DC Operation

- KVSD-322E
- KVSD-342E
- KVSD-625E
- KVSD-645E

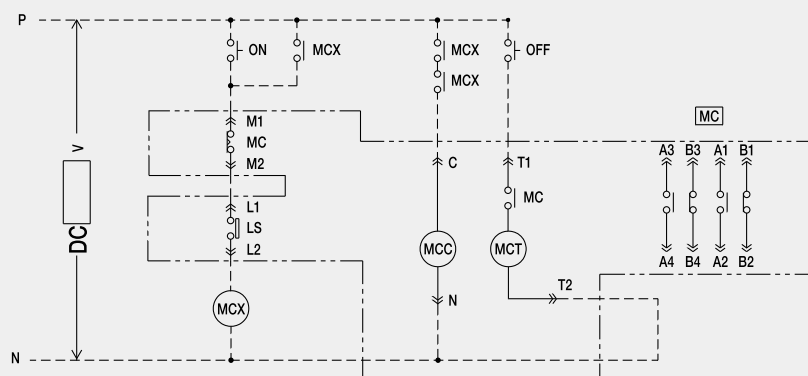
Connection on Connectors

C	N	A1
A2	A3	A4
B1	B2	B3
B4	L1	L2

[CN1]

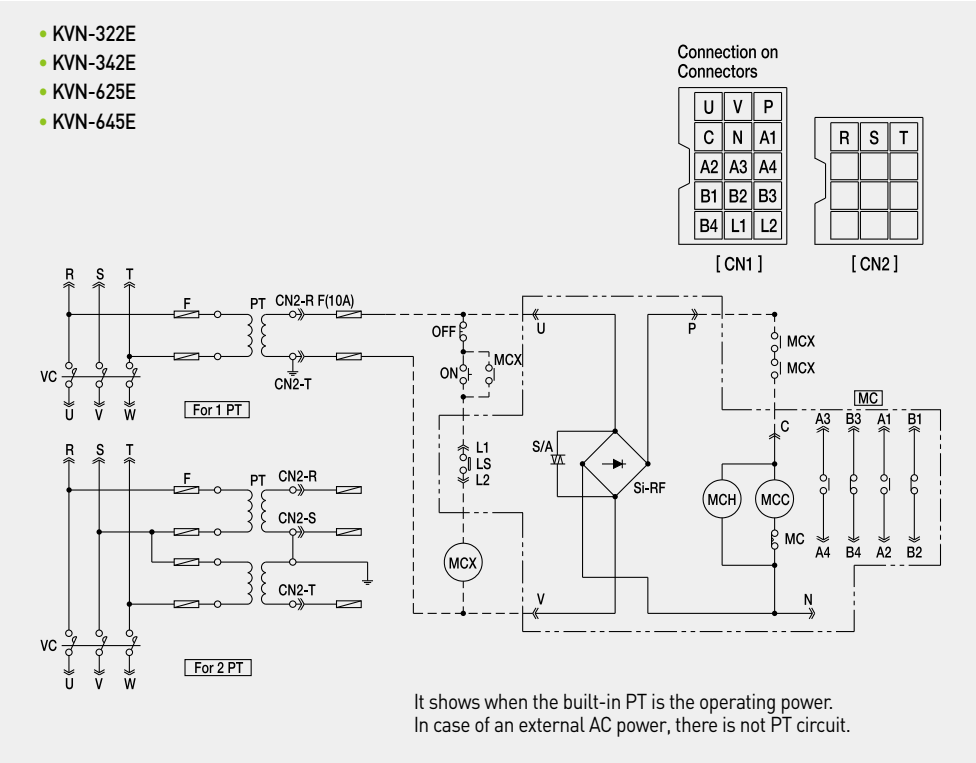
T1	T2	
M1	M2	

[CN2]

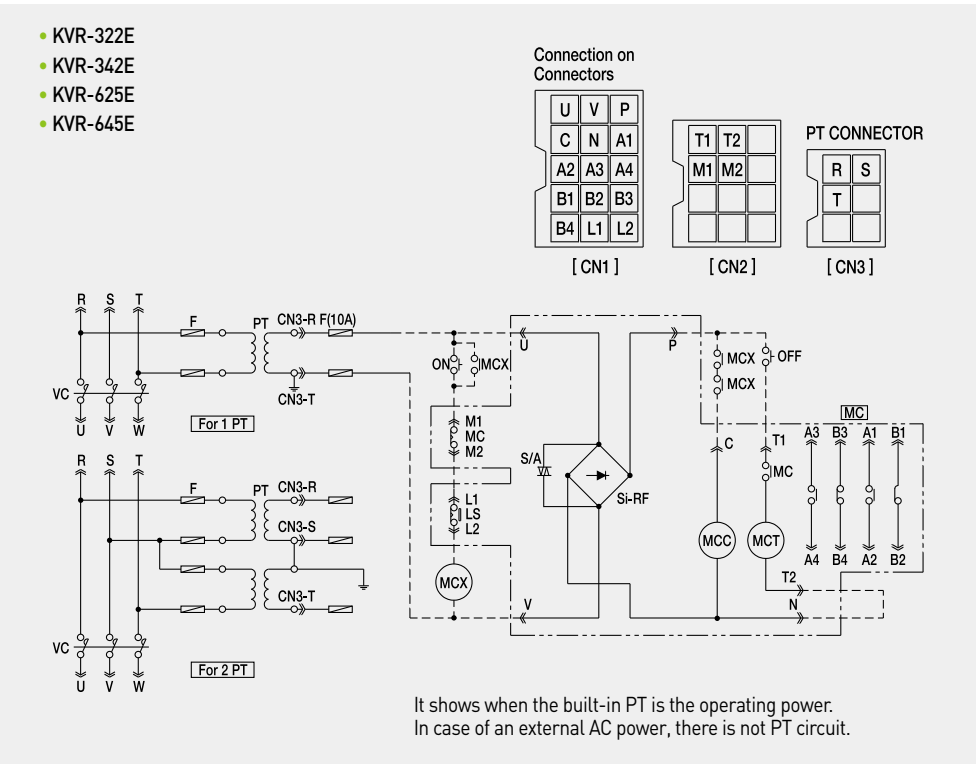


Draw-Out Type

Fixed Excitation Mode-AC Operation



Instantaneous Excitation Mode-AC Operation



Control Circuit Diagrams

Draw-Out Type

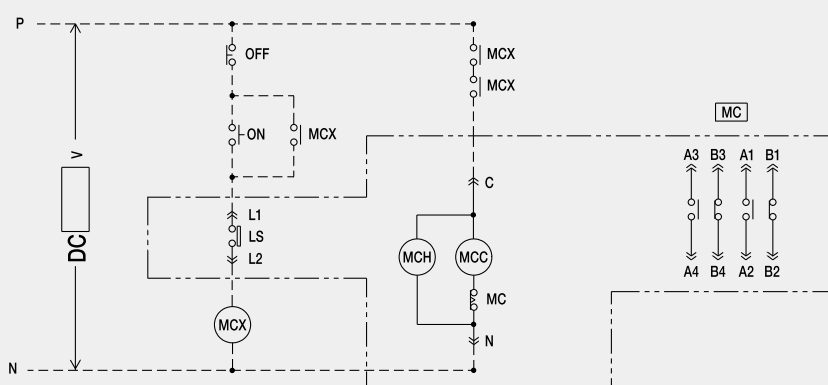
Fixed Excitation Mode-DC Operation

- KVN-322E
- KVN-342E
- KVN-625E
- KVN-645E

Connection on Connectors

C	N	A1
A2	A3	A4
B1	B2	B3
B4	L1	L2

[CN1]



Instantaneous Excitation Mode-DC Operation

- KVR-322E
- KVR-342E
- KVR-625E
- KVR-645E

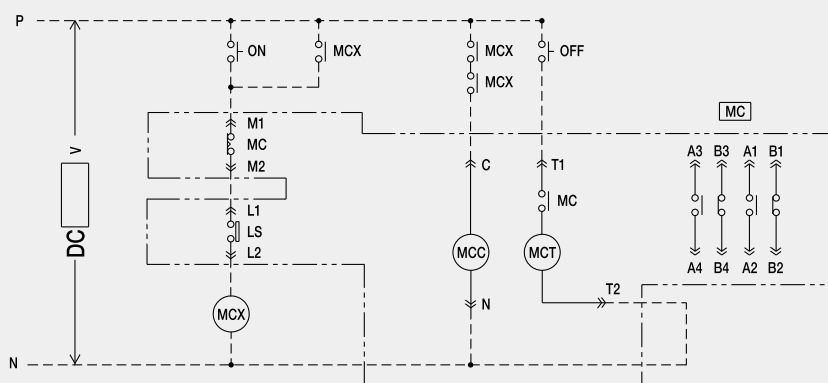
Connection on Connectors

C	N	A1
A2	A3	A4
B1	B2	B3
B4	L1	L2

[CN1]

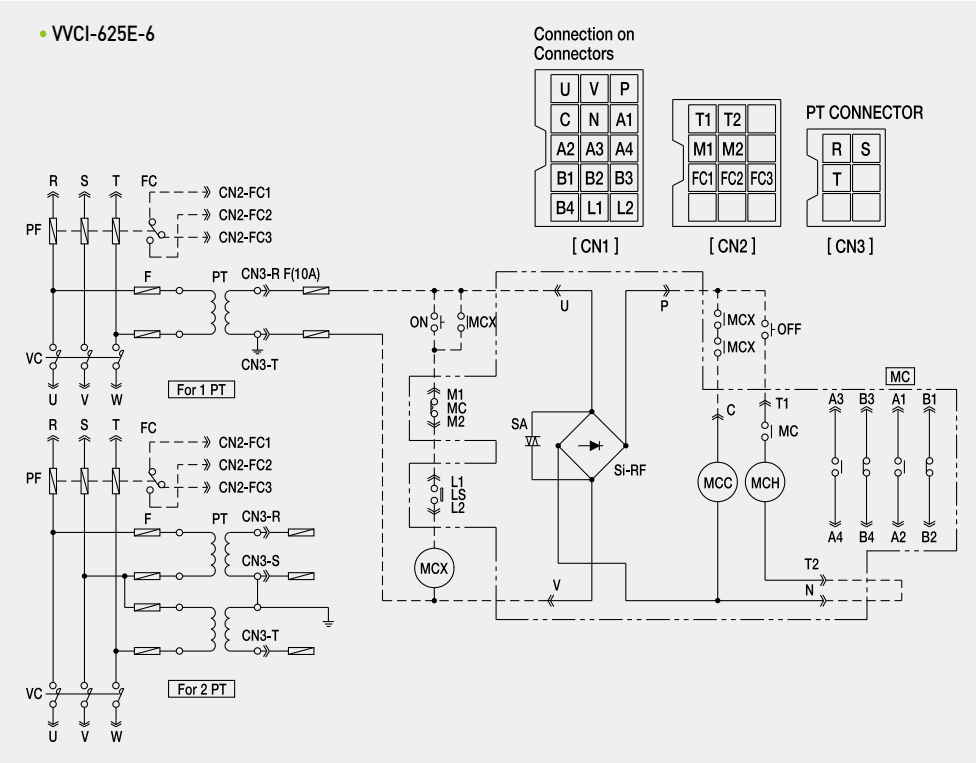
T1	T2	
M1	M2	

[CN2]

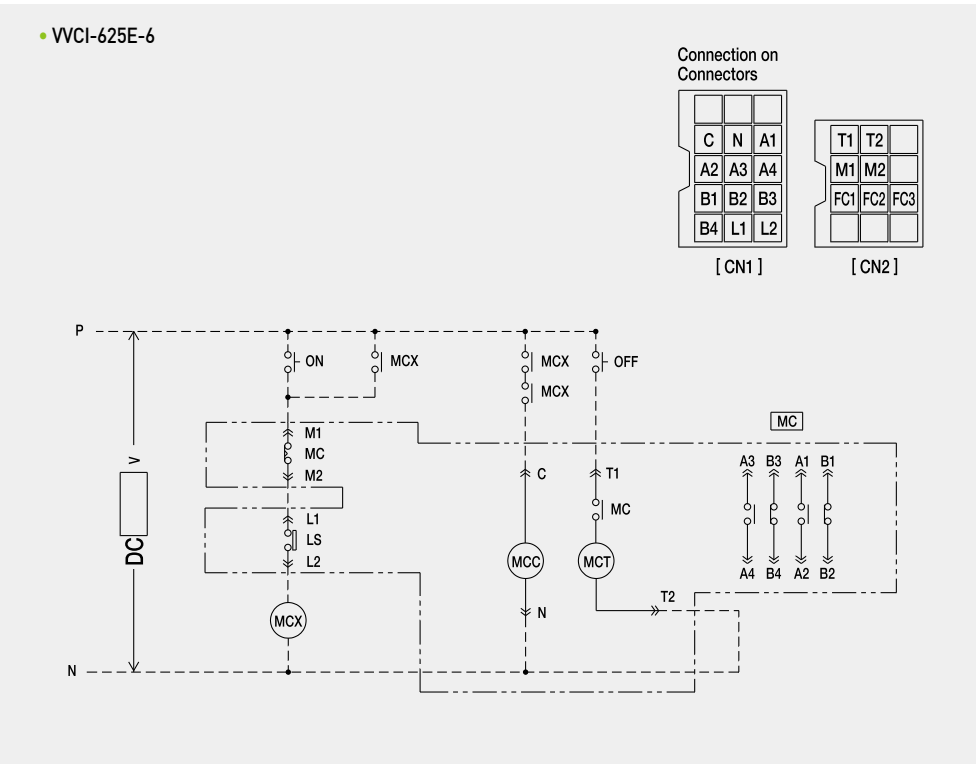


Draw-Out Type

Instantaneous excitation type, 1 power fuse mounted - AC operation



Instantaneous excitation type, 1 power fuse mounted - DC operation

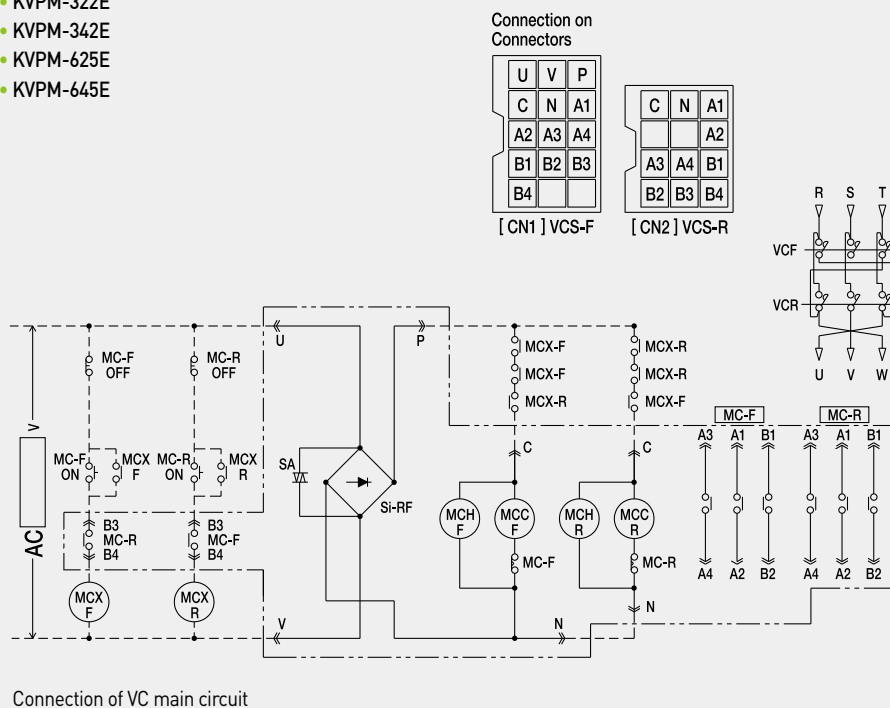


Control Circuit Diagrams

Fixed Type

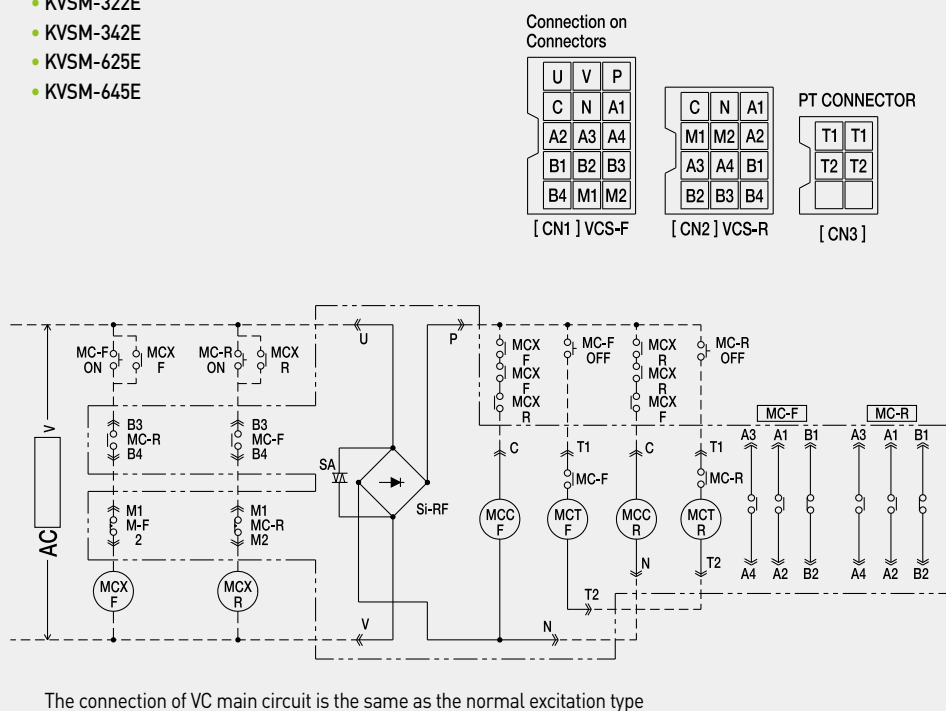
Fixed Excitation Mode, Mechanical Interlock Mounting-AC Operation

- KVPM-322E
- KVPM-342E
- KVPM-625E
- KVPM-645E



Instantaneous Excitation Mode, Mechanical Interlock Mounting-AC Operation

- KVSM-322E
- KVSM-342E
- KVSM-625E
- KVSM-645E

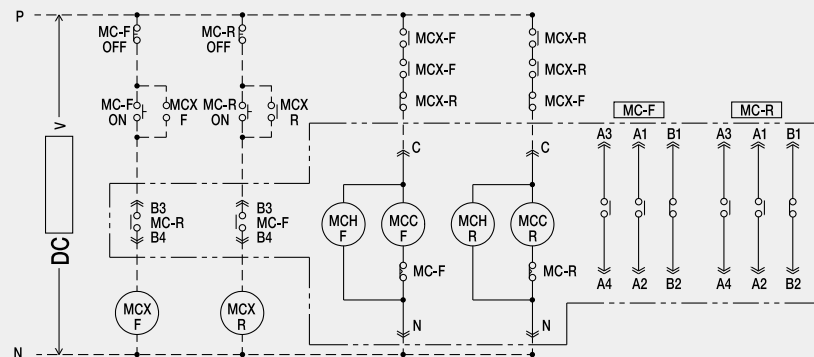
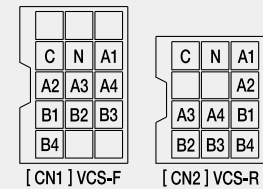


Fixed Type

Fixed Excitation Mode, Mechanical Interlock Mounting-DC Operation

- KVPM-322E
- KVPM-342E
- KVPM-625E
- KVPM-645E

Connection on Connectors

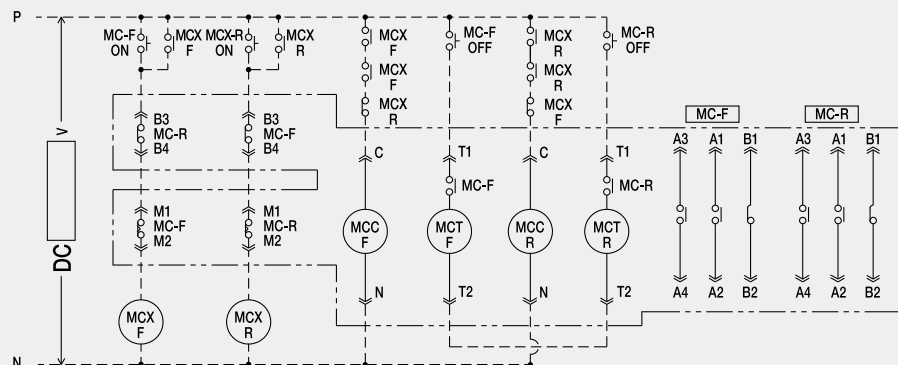
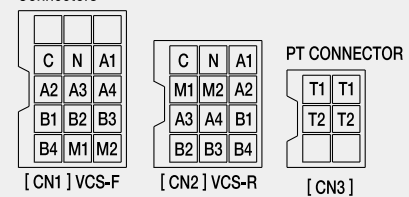


VC main circuit connection is same as the AC operation.

Instantaneous Excitation Mode, Mechanical Interlock Mounting-DC Operation

- KVSM-322E
- KVSM-342E
- KVSM-625E
- KVSM-645E

Connection on Connectors



Control Circuit Diagrams / Certifications

Fixed Type

The above circuit diagrams show some examples of the operating circuit. The connection outside the two-dot chain line is performed in separation with the panel devices. All the auxiliary switches are 2a2b. The operating circuit, auxiliary switch circuit, limit switch circuit of draw-out type interlock device, secondary circuit of potential transformer and power fuse melting display contact are connected using the Connector (CN1, CN2). In case of a DC operation, UVT terminal of the connector is not connected. The limit switch contact (LS) for the draw-out type interlock device is turned 'ON' at connecting position and disconnecting position and turned 'OFF' at intermediate position. The limit switch of the position detector (designated auxiliary) is not marked on the connection diagram in case of a draw-out unit mounting.

Circuit Diagram Mark

Mark	Name	Mark	Name
VCS	Medium Voltage Vacuum Contact Switch	Si-Rf	Silicon Rectifier
VCS-F	Medium Voltage Vacuum Contact Switch for Power Failure	SA	Surge Absorber
VCS-R	Medium Voltage Vacuum Contact Switch for Reverse Power	F	Fuse
PF	Power Fuse	LS	Draw-Out Interlock Device
T	Transformer (PT)	FS	Power Fuse Melting Display
MCC	Closing Coil	CN	Connector
MCH	Protecting & Supporting Coil	MCX	Auxiliary Contact Switch for Closing
MCT	Trip Coil	FC	Fuse checker
MC	Auxiliary Switch		





B5 Vacuum Transfer Switches

CONTENTS

Features	B5-02
Ratings	B5-04
Application	B5-05
Control Circuit Diagram & Dimensions	B5-10



Vacuum Transfer Switches, VTS 7.2kV, 400/600A



VITZRO EM Vacuum Transfer Switch uses a vacuum interrupter and BMC barrier that improved the insulation and is built-in with an electrical and mechanical interlock device and an over-current lock device. It is a power transfer switch that can prevent failures due to an interruption faults in case of a short circuit and over-current conduction.

An electrical and mechanical interlock is built-in.

- There are no malfunctions since the transfer device is equipped with the electrical and mechanical interlock.
- It is easy to design since there is no need to consider the electrical and mechanical interlock at outside.

It ensures a long operational cycle and long durability.

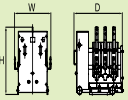
- The vacuum interrupter used at the switch part consumes very little contacts and the vacuum cycle is 20 years or more.
- The mechanical part is structured in the minimized solenoid method which is superior in its durability.

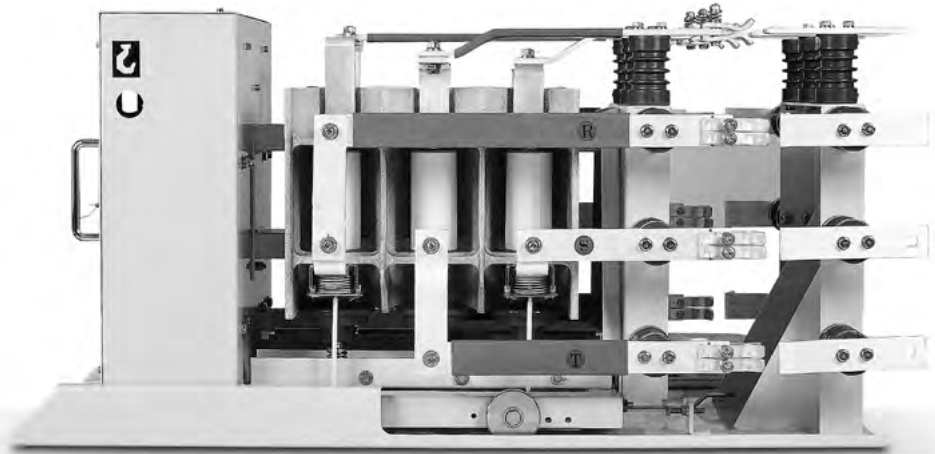
It is easy to perform a maintenance work.

- VTS is in a draw-in/out structure which enables to perform various inspections easily and the molded insulation barrier is an open-type that allows easy cleaning and inspection. The transfer operation is carried out by an instantaneous excitation mode and its power is consumed only during the transfer so it is economical.

Ratings / Application

Ratings

Type		Fixed Type	VTS-6N4		VTS-6N6		
		Draw-Out Type	VTS-6N4E		VTS-6N6E		
Rated Current		A	400		600		
Rated Voltage		kV	7.2				
Poles		P	3				
Short Time Current(1sec)		kA	12.5				
Rated Closing Current		kA	31.5				
Lock Current		A	2500				
Operational Cycle	Rated Current Switch	times	10,000				
	Continuous No-Load Switch	times	10,000				
Transfer Sequence			A ↔ off (trip) ↔ B				
Power Frequency Withstand Voltage	Main Circuit - Earth	kV	22				
	Between Phase-Shifting Main Circuits	kV	22				
	Between In-Phase Main Circuits	kV	35				
	Control Circuit - Earth	kV	2				
Impulse Withstand Voltage	Main Circuit - Earth	kV	60				
	Between Phase-Shifting Main Circuits	kV	60				
	Between In-Phase Main Circuits	kV	70				
Operation Mode			Magnetic Operation (Instantaneous Excitation Mode)				
Operating Power	Closing		DC 100/110V, 30A or below				
	Trip		DC 100/110V, 5A or below				
	Control		DC 100/110V, 0.3A or below				
External Dimensions & Weight							
Weight	Fixed Type	kg	120		130		
	Draw-Out Type	kg	140		150		
Dimensions (mm)			Fixed Type	Draw - Out Type	Fixed Type	Draw - Out Type	
			H	585	545	585	545
			W	530	592	530	592
			D	700	870	700	870
Reference Standards			JIS C4605				



Comparison on Equipment Application

Type	VTS Type Transfer Switch	Transfer using Mounting Type Switch	Two Circuit Breakers
Product Price	Built-in with an electrical and mechanical interlock, Instantaneous Excitation Mode	Built-in with an electrical and mechanical interlock, Instantaneous Excitation Mode	It requires a mechanical interlock to ensure safety when using
	Medium Price	Low Price	High Price
Panel Installation Price	It is possible to install 3 VTS+VCB at one side of cubicle which is the minimum installation space	It requires at least 2 sides since it can install 3 Mounting Type+VCB	It requires at least 2 sides since it can install total of 5 circuit breakers
	Low Price	High Price	High Price
Maintenance Cost	It is a draw-out type so it is easy to draw out from the panel and an inspection of each part can be done in a short time	It is a mounting-type so it is difficult to draw out from the panel and it requires a long time an inspection of each part	After the inspection, it is necessary to check each operation of the interlock part
	Low Price	High Price	Medium Price
General Comparison	Low Price	Medium Price	High Price

Applied Locations

- Industrial plant facilities that may suffer a loss due to a power failure
- A place that is restricted due to the dimensions of the underground transformer room
- Facilities that permit no power failure including hospitals, broadcasting stations, airports, banks and so on
- Special fire-prevention facilities that are regulated in the Fire Services Act (Department stores, theaters, hotels and etc)

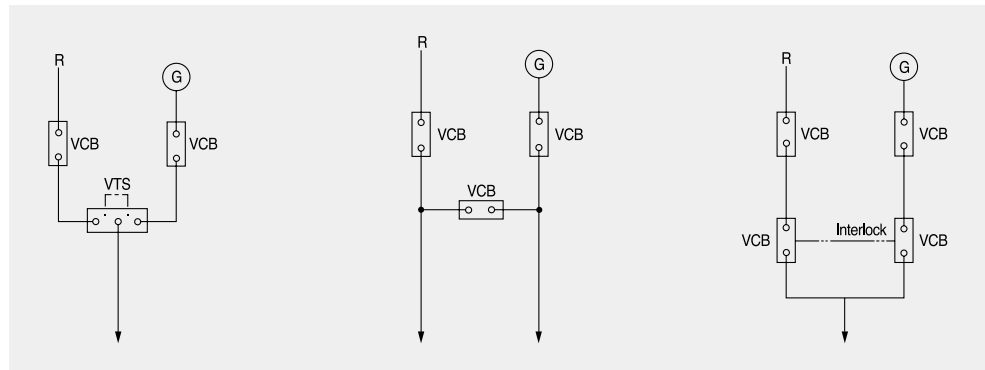
Application

On MV Power Transfer

Example on Power Transfer Circuit

Currently, there are no standardized opinions and regulations on circuit composition and equipment used for the medium-voltage power transfer (2-line circuit, power-receiving commercial power-emergency power transfer, commercial power - isolated power generation transfer) and the designers are responsible for the selection of methods and equipment, so their role is critical.

The following is an example on the power transfer circuit.



Reasons for Using a Switch for Power Transfer

According to the 「MV Power-Receiving Equipment」, it is specified that a section switch should be installed at the demarcation point for the security. A section switch refers to a switch that divides the electric lines and it has a role to prevent line mixing by increasing the withstand voltage between in-phase main circuit terminals of the equipment, higher than the other parts (for example, higher than main circuit-earth), and by performing a ground fault for the abnormal voltage from outside and inside.

Main MV Equipment Performance

(When applying short circuit current of 8kA or 12.5kA at 7.2kV power incoming point)

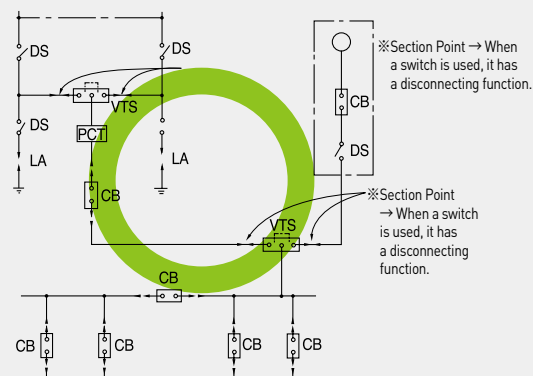
Name of Equipment			Disconnecting Switch	Switch	Circuit Breaker	Contact Switch	
Main Performance							
Section Switch (Disconnecting) Performance			○	○	×	×	
Withstand Voltage	Power Frequency	Between In-Phase Main Circuits	35kV	35kV	22kV	16kV	
		Between Phase-Shifting Main Circuits	22kV	22kV	22kV	16kV	
		Between Main Circuit - Earth	22kV	22kV	22kV	16kV	
	Impulse	Between In-Phase Main Circuits	70kV	70kV	60kV	No Regulation	
		Between Phase-Shifting Main Circuits	60kV	60kV	60kV	45kV	
		Between Main Circuit - Earth	60kV	60kV	60kV	45kV	
Load Current Breaking			×	○	○	○	
Short Circuit Current Breaking			×	× (Lock when it exceeds the breaking current of the switch)	○	×	[4.4kA is max.]
Short Time Current			○	○	○	×	[4.4kA is max.]
Closing Current			×	○	○	×	

Currently, there are no standardized opinions and regulations on circuit composition and equipment used for the high-voltage power transfer (2-line circuit, power-receiving commercial power-emergency power transfer, commercial power - isolated power generation transfer) and the designers are responsible for the selection of methods and equipment, so their role is critical.

The following figure 1 is a representative power transfer skeleton diagram. If you observe this circuit in detail by comparing with the 「MV Power-Receiving Equipment Manual」, for the transfers between commercial power (A) ↔ commercial power (B) or commercial power ↔ isolated power generation, it will be dangerous if a switch with the disconnecting function is not used.

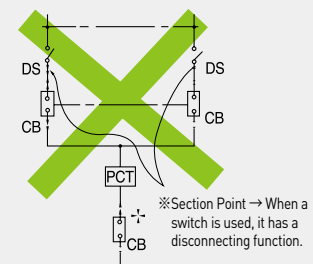
Cradle Diagram

(1) When VTS is used



* Section Point → Theoretically, it requires a section switch (disconnecting) function like the demarcation point.

(2) When 2 circuit breakers are used



* Generally, there is an electrical interlock for 2 CBs and it is very risky if there is no mechanical interlock.

Example on VTS Application

(1) Example on Commercial Power - Isolated Power Generation

When recovered to the commercial power, there is a delay time which is based on the 「Generation Facility Manual」 and when there is a commercial power failure, there is no restriction in setting the transfer time from the commercial power to the isolated power generation.

Example on Transfer Using VTS (In case of a hospital)

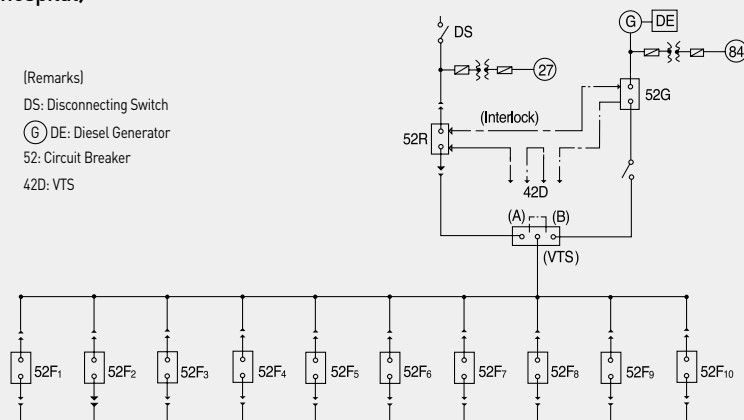
(Remarks)

DS: Disconnecting Switch

Ⓔ DE: Diesel Generator

52: Circuit Breaker

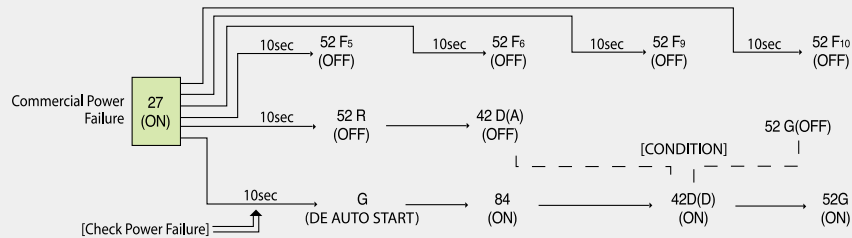
42D: VTS



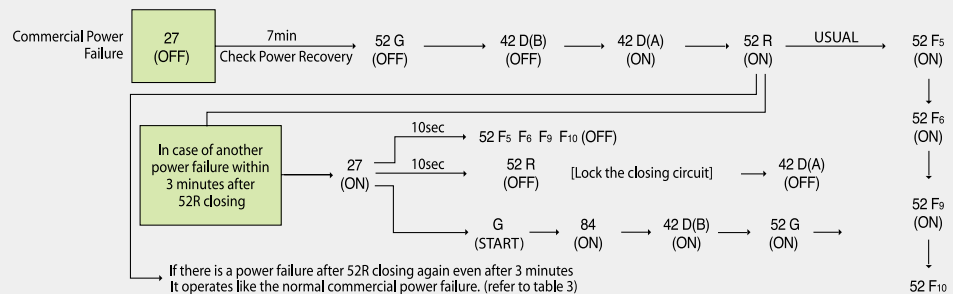
Application

On MV Power Transfer

Operation Flow in case of a Commercial Power Failure



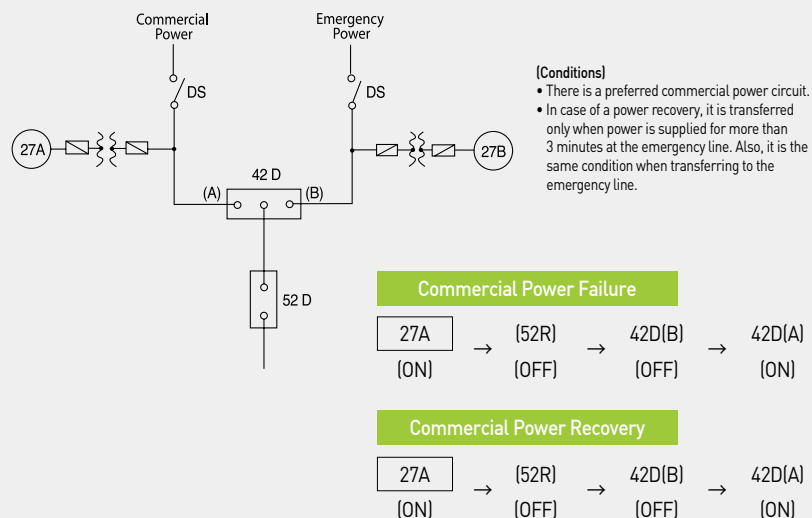
Operation Flow in case of a Commercial Power Recovery



(2) Example on Commercial Power-Emergency Power Transfer (2-line circuit power-receiving)

A commercial power-emergency power transfer circuit and its operation are marked on figure5, but it is rare in new cases, rather used by remodeling the existing installation. In this case, there are no restrictions on transfer time and so forth, but the time should be set according to the number of contact relays, section switches and so on to prevent the re-closing to the fault lines.

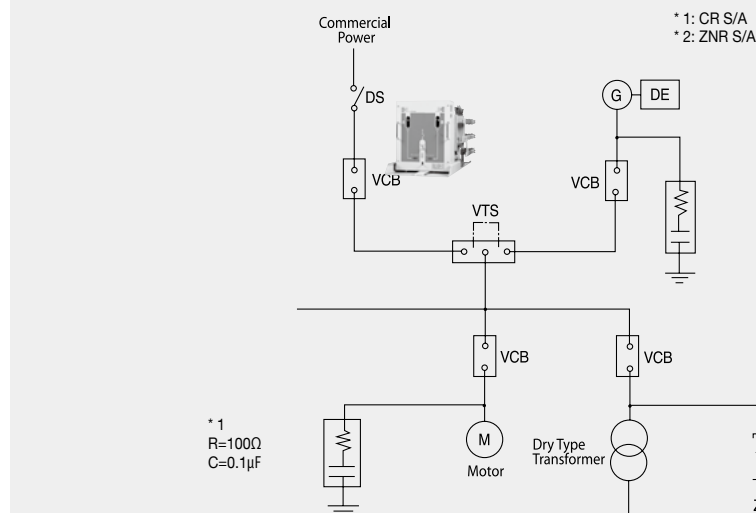
Commercial Power-Emergency Power Transfer Circuit & Operation Flow



On MV Power Transfer

Surge Protection when Using VTS

Operation Flow in case of a Commercial Power Failure



A vacuum device interrupts arc at a high-vacuum state so it has an excellent breaking capability due to the high dielectric strength of vacuum and the high-speed diffusion of arc. However, when switching the rotating machines such as no-load motors and generators or switching the transformers, the current is interrupted before it reaches a zero point. This generates an over-voltage due to the current chopping and it may destruct the insulator of motors so a surge protection is required.

VTS performs the transfer at no-voltage, so it does not require a surge protection. (However, if VCB is used as a circuit breaker, a surge protection is required.)

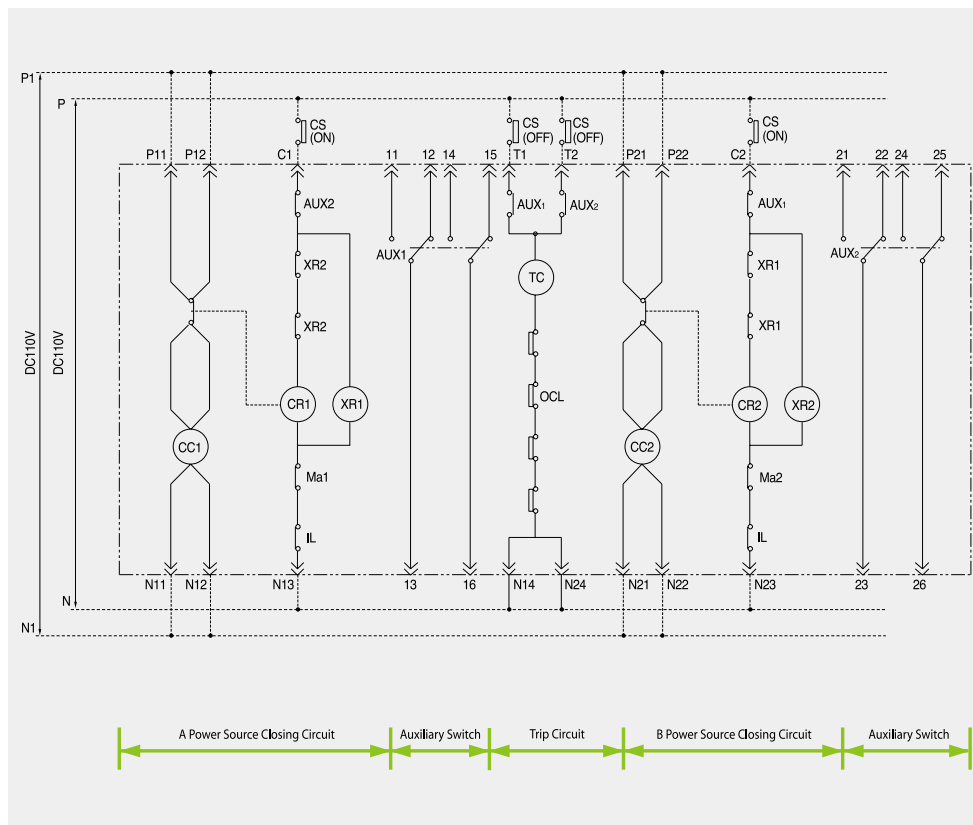
- Refer to our S/A catalogue for standard on selecting a surge absorber (S/A).

Rating of Surge Absorber

		 	
Type		KMSA-3.6	KMSA-7.2
Rated Voltage	kV	3.3	6.6
Applied Circuit Voltage	kV	3.6	7.2
Operation Starting Voltage	kV	9 ~ 10	18 ~ 20
Residual Voltage	kV	13 or below	26 or below
Classification Current	kA	5	5
Discharge Withstand Current (4×10μs)	kA	40	40
Rated Frequency	Hz	60	60
Weight	kg	0.41	0.6

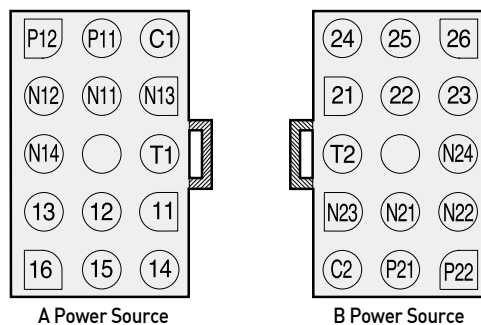
Control Circuit Diagram & Dimensions

Control Circuit Diagram



Name

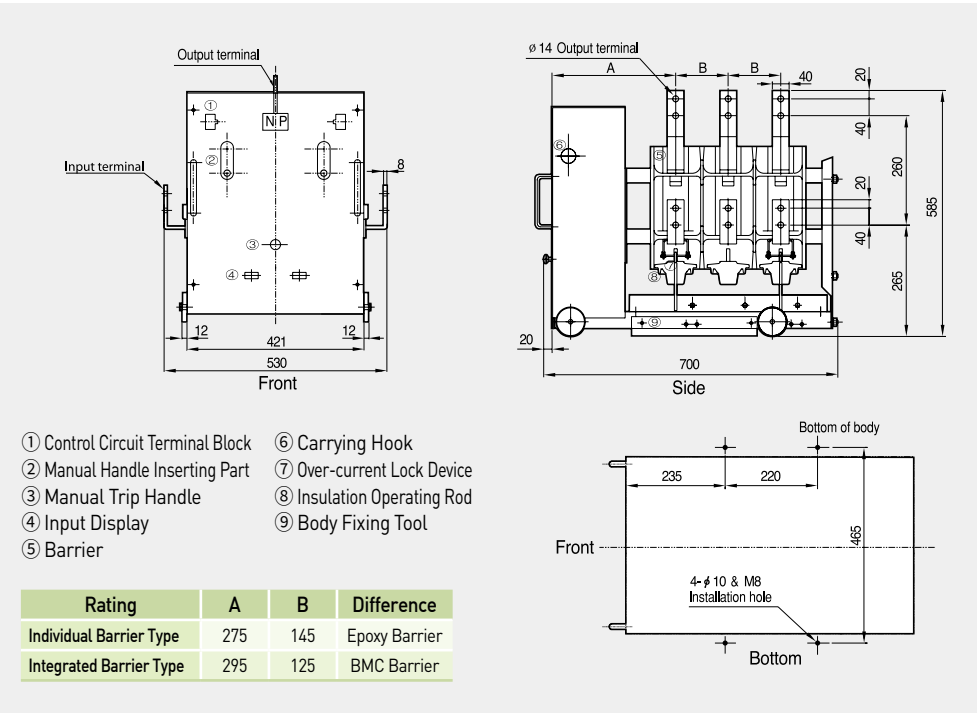
CC : Closing Coil
 TC : Trip Coil
 AUX : Auxiliary Switch
 CR : Closing Control Relay
 XR : Interlock Relay
 Ma : Check Switch
 IL : Interlock Contact (Draw-out Type)
 OCL : Over-current Lock Contact



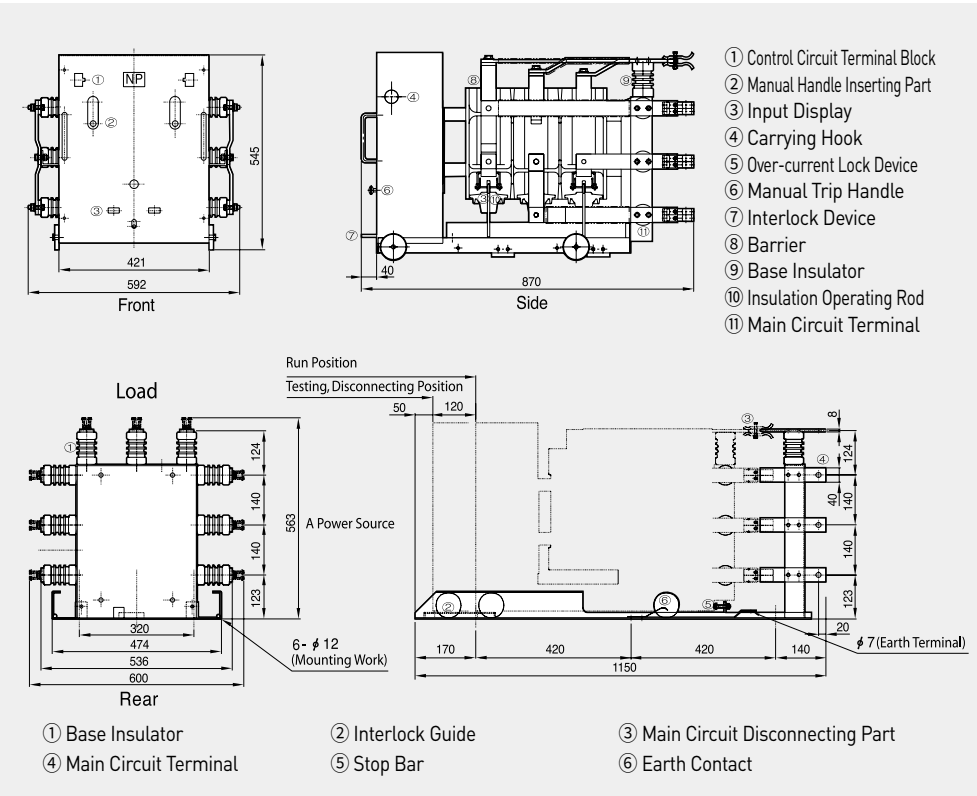
* When composing a circuit using an operating transformer at operating power, a display lamp should be connected to the AC part.

Dimensions

Fixed Type(N)



Draw-Out Type(E)





B6 Current Limiting Power Fuses

CONTENTS

Features	B6-02
Configuration	B6-04
Application	B6-06
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Fuse Selecting Conditions & Criterias	B6-10
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Characteristics Curves	B6-16
Dimensions	B6-20



Current Limiting Power Fuses

3.6/7.2kV 50kA 10~200A,
24/25.8kV 40kA 1~160A



VITZRO EM Current Limiting Power Fuse passed the development test carried out by an official authentication organization and it is recognized for its superior quality and short circuit capability. It is an advanced product designed by applying the accumulated technology and experiences in the field of current limit power fuse and its application equipment.

It ensured the maximum breaking capacity within the same rating

- It is possible to provide various fuse ratings due to the development of 7.2kV 50kA and 10A~200A, 24/25.8kV 40kA and 1A 160A
- With to the development of 25.8kV Class current limiting, it can be used at local outdoors

The size is reduced for convenience and the breaking capability and safety has been improved.

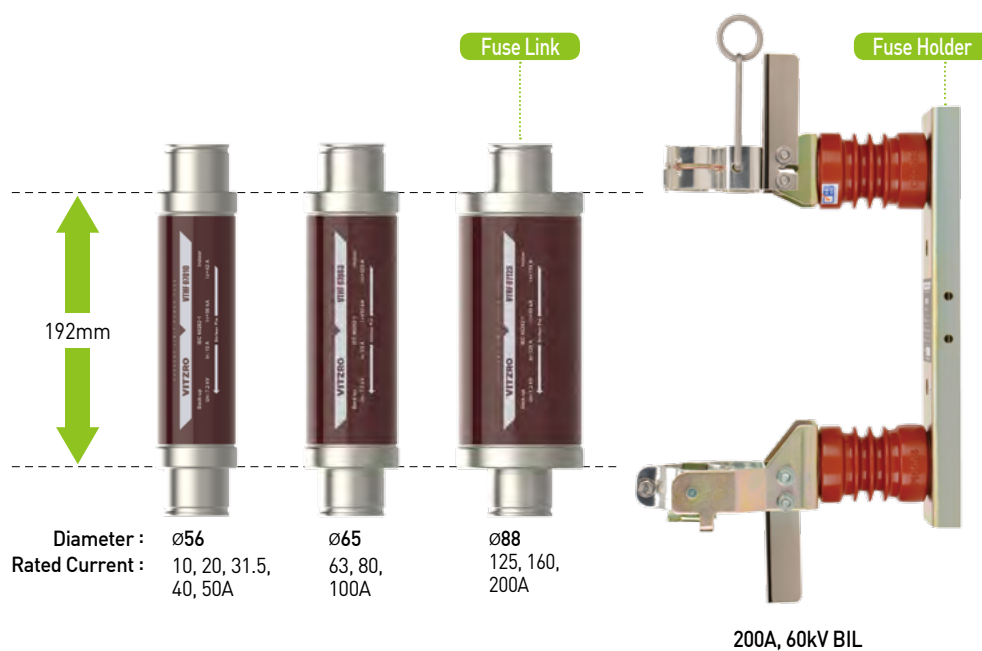
- Its external dimension is minimized within the same rating.
- It realized the optimal striker.
- It is easy to select an accurate fuse capacity due to an exact time-current melting characteristics ($\pm 10\%$ or under).
- By using a strong striker, it can deliver the maximum energy with the same rating. It is an enclosed-type so it is appropriate for small places.

Its performance was recognized through technology integration and international standard certificates.

- The external shape is standardized based on DIN international standard, so it is compatible by types and ratings and it is easy to perform the maintenance work.
- It ensures an excellent current limit characteristic, small current breaking capability and low operating voltage.

Configuration

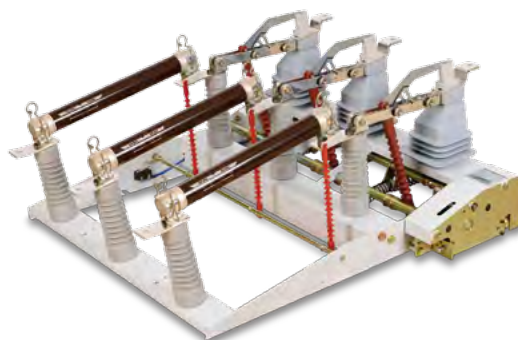
3.6/7.2kV 50kA
10~200A



Application

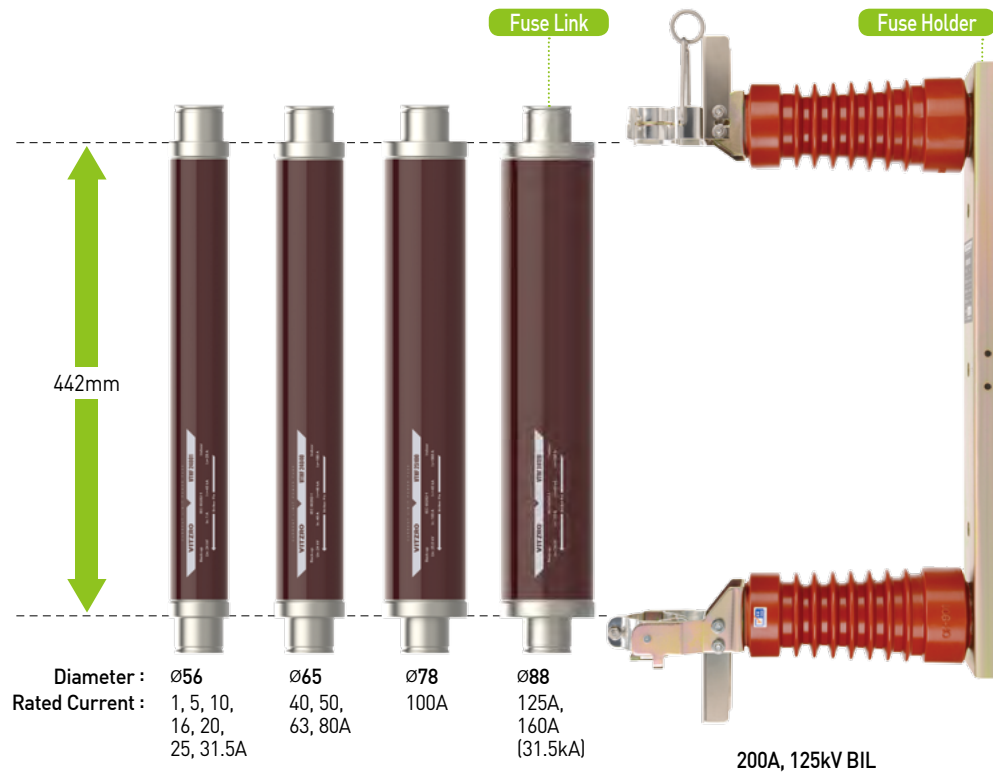


Vacuum Contactor Switch VCS
 • 3.6/7.2kV • 50kA • Indoor Type

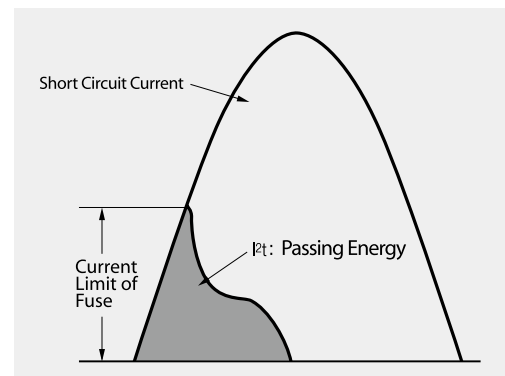


Load Break Switch LBS
 • 24kV 40kA 630A • Electric Type • Manual Type

24/25.8kV 40kA
1~160A



VITZRO EM Current Limiting Power Fuse interrupts the short circuit current within the shortest time through the current limitation that prevents the short circuit current generated by the resistance within the fuse from reaching the crest value when much short circuit current flows. It is a protection device to minimize the mechanical and thermal damages that are generated in the switch and control system circuits.



Application

Accessories

- For the transformer circuit - To interrupt the fault current of transformer secondary short circuit & transformer circuit
- For the Capacitor circuit - To interrupt the fault current of Capacitor circuit
- For the back-up protection of circuit breakers & switches - For the back-up protection if the breaking capacity of CB and Switches is not enough
- For the cable circuit - To protect the cable by interrupting the fault current of circuit
- For the motor circuit - To interrupt the fault current of circuit where much over-current flows when the motor starts and to protect the motor
- For PT protection - 1A fuse

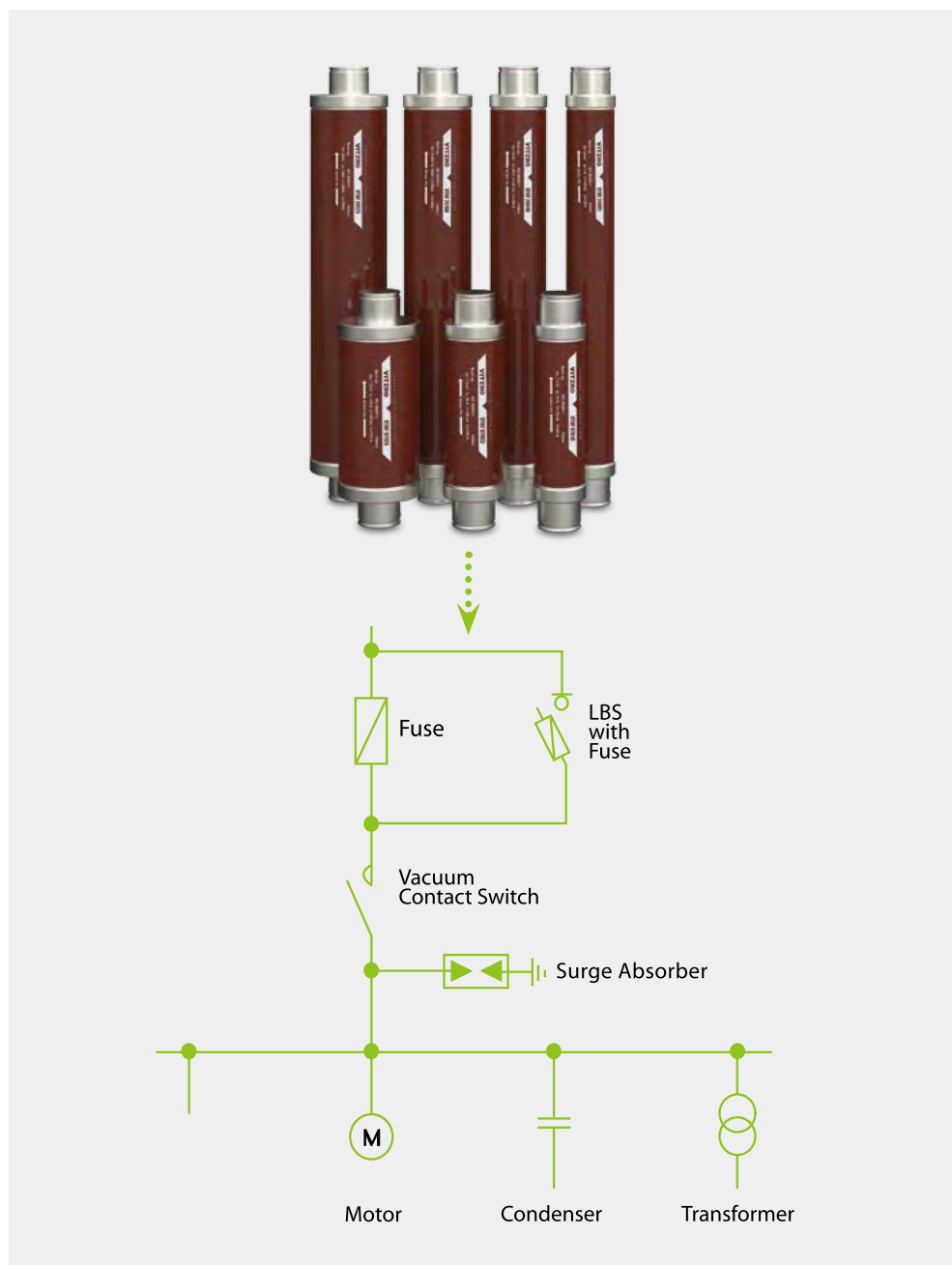
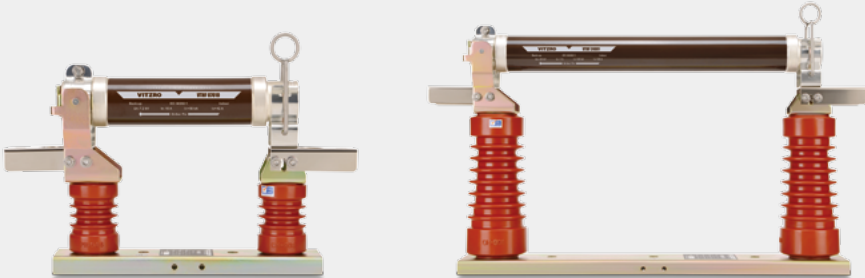


Table on Main Characteristics



Voltage		3.6 / 7.2kV	24 / 25.8kV
Rating	Max. Breaking Current	50kA	40kA
	Min. Breaking Current	About 4 ~ 5 times the rated current, fuse has expanded the protection area	
	Rated Current	Development tests on all ratings ranging from minimum 1A up to 200A completed	
Current Limiting Characteristic		Sharp decrease in the crest value of fault current in case of a fuse short circuit fault due to the excellent current-limiting characteristic	
Time-Current Characteristics		Easy to select within the maximum error range of $\pm 10\%$	
External Dimensions	Fuse Link Length	192mm	442mm
	Fuse Link Diameter	Simplified to 3 types	Simplified to 4 types
Striker	Energy Delivery	Delivers the maximum operating energy among the same-type fuses (medium - type)	
	Operating Distance	Possible to deliver the maximum operating energy through an optimal design on operating distance, minimized operating time.	
	Supporting Force	The minimum operating load is the highest among same-type fuses so it ensures a definite tripping of LBS	
	Operating Time	After the melting of fuse element, the operation ending time of striker is short which shortens to LBS trip time.	
Features of Fuse Holder		► The conductive bus bar is "C"-shaped and its conducting capability is doubled when compared to the existing bus bar. It minimized the temperature rise and power loss. ► There is a fixed part and a rotating part that enables rotation of the minimum clearance. This allows safe maintenance and replacement of fuses.	

Applied Standards

IEC 60282-1

High Voltage fuses "Current limiting fuses"

DIN 43625

High Voltage fuses; Rated voltage 3.6 to 36kV fuse links

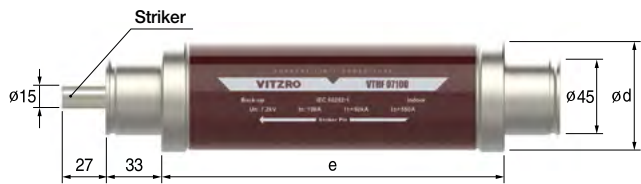
IEC 60420

High Voltage alternating current switch-fuse combination

KS C 4612

High Voltage Current Limit Fuse

Ratings



3.6/7.2kV Fuse Link Ratings

Rated Voltage [kV]	Name of Model	Rated Current In [A]	Rated Max. Breaking Current [kA]	Rated Min. Breaking Current [A]	External Dimensions		Weight [kg]
					e [mm]	d [mm]	
3.6 / 7.2	VTHF07010	10	50	42	192	56	1.1
	VTHF07020	20		100			
	VTHF07032	31.5		168			
	VTHF07040	40		235			
	VTHF07050	50		300			
	VTHF07063	63		320		65	1.4
	VTHF07080	80		435			
	VTHF07100	100		550			
	VTHF07125	125		735		88	2.4
	VTHF07160	160		770			
	VTHF07200	200		900			

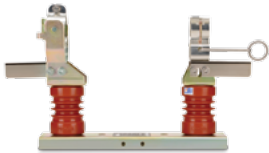
※ For both indoors and outdoors

3.6/7.2kV Fuse Holder

Rated Voltage	Name of Model	Max. Rated Current	Rated Max. Breaking Current	Insulation Class (BIL)
3.6 / 7.2kV	VTHFB07	200A	50kA	60kV

※ For indoors

※ How to order : Refer to the following product type and order type



Order Information

VTHF

Fuse Link

07

Rated Current :
Refer to the table of rating specification

000

Rated Voltage

07	24	25
3.6 / 7.2kV	24kV	25.8kV

VTHFB

Fuse Link

24

Rated Voltage

07	3.6 / 7.2kV
24	24kV

A

Rev. No

S

Existence of Striker

S	Yes
P	None

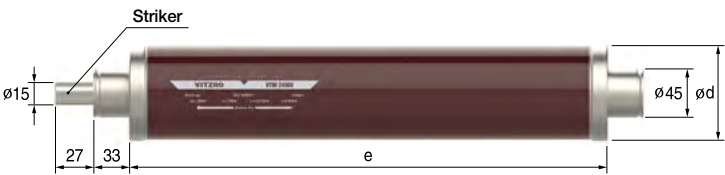
5

Diameter of Removable Hook

5	Ø56
6	Ø65
7	Ø78
8	Ø88
N	None

Removable Hook (025)

Striker



24/25.8kV
Fuse Link Ratings

Rated Voltage [kV]	Name of Model	Rated Current In [A]	Rated Max. Breaking Current [kA]	Rated Min. Breaking Current [A]	External Dimensions		Weight [kg]
					e [mm]	d [mm]	
24	VTHF24001	1	40	28	442	56	2.3
	VTHF24005	5		36			
	VTHF24010	10		-			
	VTHF24016	16		93			
	VTHF24020	20		103			
	VTHF24025	25		140		65	3.1
	VTHF24032	31.5		155			
	VTHF24040	40		180			
	VTHF24050	50		210			
	VTHF24063	63		320			
VTHF24080	80	430	78	4.1			
25.8	VTHF25100	100	560	88	5.9		
24	VTHF24125	125	760				
	VTHF24160	160	900				
	VTHF24200	200	1050				

⚠ When applying VTHF24200, please contact our company.

24/25.8kV
Fuse Holder

Rated Voltage	Name of Model	Max. Rated Current	Rated Max. Breaking Current	Insulation Class (BIL)
24kV	VTHFB24	200A	40kA	125kV

⚠ For indoors



Fuse Selecting Conditions & Criterias

Fuse Selecting Conditions & Standard

Selection based on Operating Location

There are fuses for indoors and outdoors and the insulators used, material of metal tool, coating structure and so on are different. But, VITZRO EM MV Fuse can be used both at indoors and outdoors. 2 types of base insulators - polysil and epoxy - can be used and its durability is improved by nickel coating.

Selection based on Rated Voltage

The voltage of the circuit should be same as the rated voltage of the fuse and the insulation level of the circuit should be higher than the operating over-voltage of the fuse. Moreover, it should be used at each pole of 3-phase circuit (3poles) and single-phase circuit (2poles).

Selection based on Rated Current

The rated current of the fuse should exceed the load circuit current and the overall load current of protectors. In addition, in case of a normal conduction, there should not be any heat and it should be selected by considering the short time tolerance and repetitive over-current characteristic. It should be selected by considering the exciting inrush current of the transformer, the starting current of the motor, the inrush current of the Capacitor, the lightning current and so on.

Selection based on Rated Breaking Capacity

The rated breaking capacity of the fuse should be sufficient enough to interrupt even when the short circuit current of the circuit is not much. Generally, shortage of fuse breaking capacity may lead to fuse explosions so it must be considered and VITZRO MV Current Limiting Fuse is recognized for its breaking capacity of 3.6 / 7.2kV 50kA, 24kV 40kA, 25.8kV 40kA for the first time in the country.

Protective Action Coordination with Load Circuit and Protectors

The operation characteristic of fuse should be lower than the over-current characteristic of protectors and load circuit and the generated heat quantity due to I^2t of the operating heat energy should be smaller than the short-circuit level of the load circuit or protectors.

Selection based on Operation Characteristic Type

By establishing the melting characteristic and repetitive overload characteristic that are suitable for each load operating condition, it can be selected for each type based on KSC4612 for the simple selection of fuse rated current and fuse protection coordination.

- (1) T-Type : It is for the transformer circuit and it sets the melting characteristic at 0.1 sec considering the exciting inrush current.
- (2) M-Type : It is for the motor circuit and it sets the melting characteristic at 10 sec considering the starting current of motor.
It is marked by classifying into 2 types.
- (3) T/M-Type : It is for the transformer and motor and it sets the melting characteristic between 0.1 sec and 10 sec considering the exciting current of transformer and starting current of motor.
- (4) C-Type : It is for the Capacitor circuit and it sets the melting characteristic at 0.002 sec considering the inrush current of Capacitor.
- (5) G-Type : It is for the normal load and it does not set the special melting characteristic.

Selection based on Small Current Breaking Capability

There is a limit to interruptible small current in the current limit fuse. It is required to be cautious at this area. In order to manufacture a compact, economical current limit fuse, it is normal to set the minimum breaking current as several times the rated current and the small current breaking capability should be set as the minimum breaking current at KSC4612. These are required to be guaranteed by the manufacturers and it is marked by classifying into 2 types.

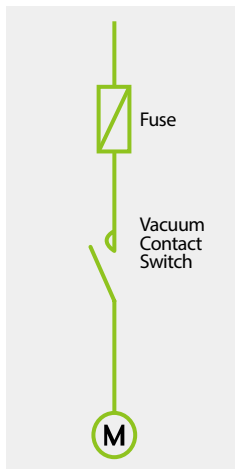
- (1) General-Purpose Fuse : It is a fuse that can interrupt for a long time at a small current and it can interrupt the current ranging from about 2 times the rated current up to the rated breaking current.
- (2) Back-Up Protection Fuse : It is a fuse that can interrupt all currents ranging from the minimum breaking current that is guaranteed by the manufacturer up to the rated breaking current.

Table on Main Characteristics

Fuse Type	Non-Fusing Current	Melting Characteristic		Repetitive Over - Current Characteristic
		10s Fusing Current	0.1 s Fusing Current	
T (For Transformer)	Non-fusing for 2 hours at 1.3 I _n	$2.5 I_n \leq I_{10} \leq 10 I_n$	$12 I_n \leq I_{0.1} \leq 25 I_n$	Non-fusing for 100 times at $10 I_n \leq 0.1$ s
M (For Motor)		$6 I_n \leq I_{10} \leq 10 I_n$	$15 I_n \leq I_{0.1} \leq 35 I_n$	Non-fusing for 1000 times at $5 I_n \leq 10$ s
G (For Normal Load)		$2 I_n \leq I_{10} \leq 5 I_n$	$7 I_n \times (I_n/100)^{0.25} \leq I_{0.1} \leq 20 I_n \times (I_n/100)^{0.25}$	100 times at $10 I_n \leq 0.1$ s (non-fuse), 1000 times at $1.5 I_n \leq 10$ s (non-fuse)
C (For Capacitor)	Non-fusing for 2 hours at 2 I _n	16		Non-fusing for 100 times at $70 I_n \cdot 0.002$ s

I_n : Rated CurrentI₁₀ : 10 s Fusing Current (Mean Value)I_{0.1} : 0.1 s Fusing Current (Mean Value)

Fuse Selection Criteria for each purpose



Power Fuse for Motor Circuit Protection

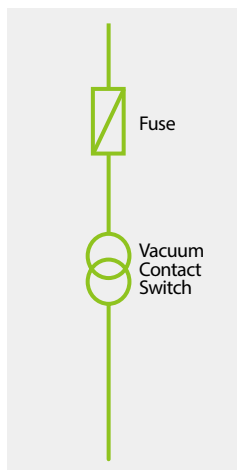
Rated Voltage [kV]	Constant	Motor Output Rated Capacity [kW]	Rated Voltage [kV]	Constant	Motor Output Rated Capacity [kW]	Applied Fuse Link
3.3	30	9 ~ 19	6.6	30	15~25	VTHF07010
		19 ~ 39			35~57	VTHF07020
		36 ~ 69			69~95	VTHF07032
		65 ~ 88			88~183	VTHF07040
		89 ~ 110			178~228	VTHF07050
		112 ~ 156			225~313	VTHF07063
		152 ~ 228			304~435	VTHF07080
		190 ~ 285			381~571	VTHF07100
		238 ~ 357			476~751	VTHF07125
		269 ~ 457			630~1015	VTHF07160
		326 ~ 519			913~1522	VTHF07200

< Detailed Selecting Conditions >

1. The starting current of the motor is selected by assuming a conduction of 5 times the motor full load current for 10 seconds.
2. The above conditions may change according to the starting time, starting current and starting counts so take note of them when selecting.

Fuse Selecting Conditions & Criterias

Fuse Selection Criteria for each purpose



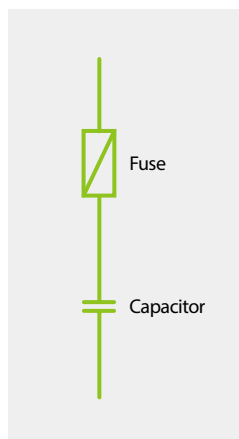
Power Fuse for Transformer Circuit Protection

Rated Voltage [kV]	Transformer Rated Capacity [kVA]		Applied Fuse Link
	1Ø	3Ø	
3.3	6 ~ 13	11 ~ 23	VTHF07010
	15 ~ 29	25 ~ 52	VTHF07020
	23 ~ 45	40 ~ 82	VTHF07032
	38 ~ 83	69 ~ 143	VTHF07040
	47 ~ 103	87 ~ 178	VTHF07050
	59 ~ 130	109 ~ 240	VTHF07063
	75 ~ 176	138 ~ 304	VTHF07080
	132 ~ 220	228 ~ 381	VTHF07100
	165 ~ 275	285 ~ 476	VTHF07125
	211 ~ 352	365 ~ 609	VTHF07160
	264 ~ 440	457 ~ 761	VTHF07200
6.6	12 ~ 26	21 ~ 46	VTHF07010
	29 ~ 57	51 ~ 99	VTHF07020
	46 ~ 90	80 ~ 156	VTHF07032
	75 ~ 165	130 ~ 285	VTHF07040
	94 ~ 206	163 ~ 357	VTHF07050
	139 ~ 277	240 ~ 480	VTHF07063
	176 ~ 352	304 ~ 609	VTHF07080
	264 ~ 440	457 ~ 761	VTHF07100
	330 ~ 550	571 ~ 952	VTHF07125
	422 ~ 704	731 ~ 1218	VTHF07160
	528 ~ 880	913 ~ 1522	VTHF07200
22.9	4 ~ 8	7 ~ 15	VTHF24001
	20 ~ 44	36 ~ 76	VTHF24005
	42 ~ 92	75 ~ 158	VTHF24010
	81 ~ 167	141 ~ 276	VTHF24016
	102 ~ 208	176 ~ 344	VTHF24020
	127 ~ 260	220 ~ 431	VTHF24025
	160 ~ 328	264 ~ 540	VTHF24032
	262 ~ 539	466 ~ 990	VTHF24040
	347 ~ 716	600 ~ 1238	VTHF24050
	416 ~ 916	743 ~ 1585	VTHF24063
	573 ~ 1145	990 ~ 1981	VTHF24080
	916 ~ 1527	1585 ~ 2641	VTHF25100
	1301 ~ 1908	2251 ~ 3301	VTHF24125
	2036 ~ 2443	3522 ~ 4226	VTHF24160

〈Detailed Selecting Conditions〉

1. The inrush current of transformer is selected by assuming 10 times of the transformer full load current for 0.1 sec.
2. The rated current of fuse is selected so that it can continuously conduct 1.5 times the transformer rated current.
3. The transformer fuse is selected by assuming that it can interrupt 25 times the transformer rated current within 2 seconds in case of a secondary short circuit.

Fuse Selection Criteria for each purpose



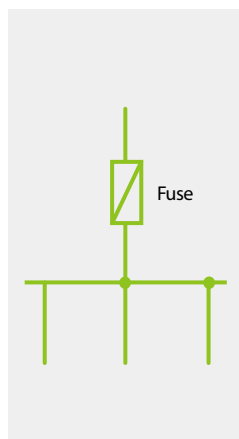
Power Fuse for Capacitor Circuit Protection

Rated Voltage [kV]	Constant	Capacitor Rated Capacity [kVA]	Applied Fuse Link	Rated Voltage [kV]	Constant	Capacitor Rated Capacity [kVA]	Applied Fuse Link
3.3	30	Less than 12	VTHF07010	22.9	30	Less than 25	VTHF24001
		12 ~ 32	VTHF07020			25 ~ 53	VTHF24005
		32 ~ 50	VTHF07032			53 ~ 86	VTHF24010
		50 ~ 63	VTHF07040			86 ~ 154	VTHF24016
		63 ~ 79	VTHF07050			154 ~ 209	VTHF24020
		79 ~ 114	VTHF07063			209 ~ 261	VTHF24025
		114 ~ 180	VTHF07080			261 ~ 329	VTHF24032
		180 ~ 225	VTHF07100			329 ~ 480	VTHF24040
		225 ~ 282	VTHF07125			480 ~ 600	VTHF24050
		282 ~ 384	VTHF07160			600 ~ 756	VTHF24063
		384 ~ 550	VTHF07200			756 ~ 1200	VTHF24080
						1200 ~ 1846	VTHF25100
6.6	30	Less than 19	VTHF07010			1846 ~ 2500	VTHF24125
		24 ~ 63	VTHF07020			2500 ~ 3200	VTHF24160
		63 ~ 99	VTHF07032				
		99 ~ 125	VTHF07040				
		125 ~ 157	VTHF07050				
		157 ~ 227	VTHF07063				
		227 ~ 360	VTHF07080				
		360 ~ 450	VTHF07100				
		450 ~ 563	VTHF07125				
		563 ~ 768	VTHF07160				
		768 ~ 1100	VTHF07200				

〈Detailed Selecting Conditions〉

1. The inrush current of Capacitor is selected by assuming a conduction of 71 times the Capacitor rated current for 0.002 sec.
2. The rated current of fuse is selected so that it can continuously conduct 1.5 times the Capacitor rated current.

Power Fuse for Wire Protection



Wire [mm²]	Applied Fuse Link		Wire [mm²]	Applied Fuse Link	
	3.6 / 7.2kV	24kV		3.6 / 7.2kV	24kV
3.5	10A	10A	80	80A	63A
5.5	20A		100		
8		16A	125	100A	80A
14	31.5A	20A	150		
22		25A	200	125A	100A
30	40A	31.5A	250	160A	125A
38	50A	40A	325	200A	160A
50			400		
60	63A	50A	500	-	200A

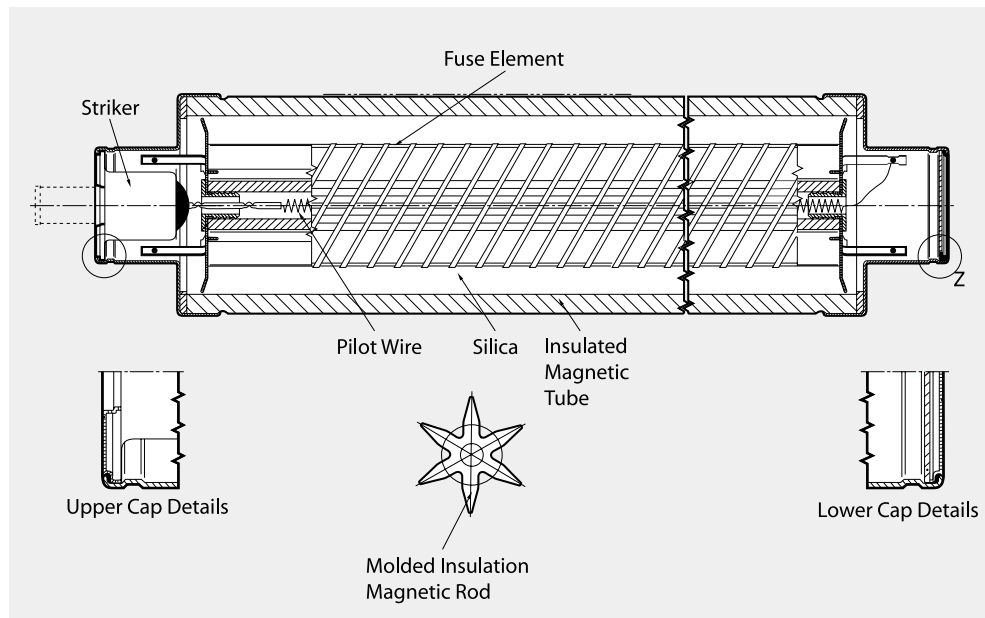
〈Detailed Selecting Conditions〉

1. The above allowable current is based on IV wire and it is selected by assuming an interruption at 5 times the rated current within 2 seconds.

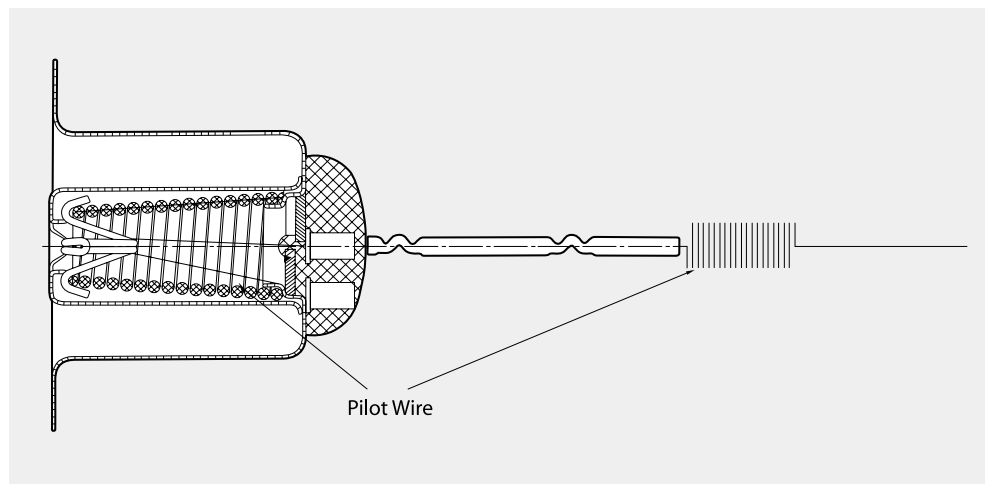
Fuse Link Structure

General Structure of Fuse Link

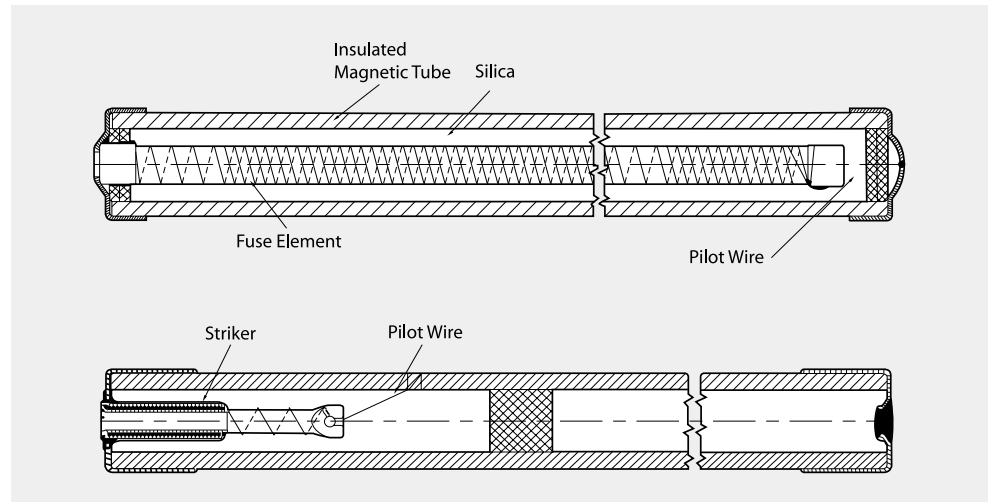
- A fuse element that is shaped to meet the characteristic required in each rating is coiled in a spiral at the molded insulation magnetic rod as shown below. It is fixed by spot welding at both-end caps and the fuse element is fully buried in the silica as the unique shape of the molded insulation magnetic rod with an excellent current limit characteristic.
- A high-resistant, pilot wire is in a spiral inside the insulation magnetic rod to improve the conductivity and breaking capability. For the prompt fusing of the pilot wire that fixes the striker spring after the fuse melting, high-conductive pin is used for fixation at the upper cap.
- The internal arc-extinguish medium is a mineral, insulating material with good thermal conductivity and a silicon with high melting point was used. To increase the charging density inside the fuse, the silicon shape, particle size and distribution were considered.



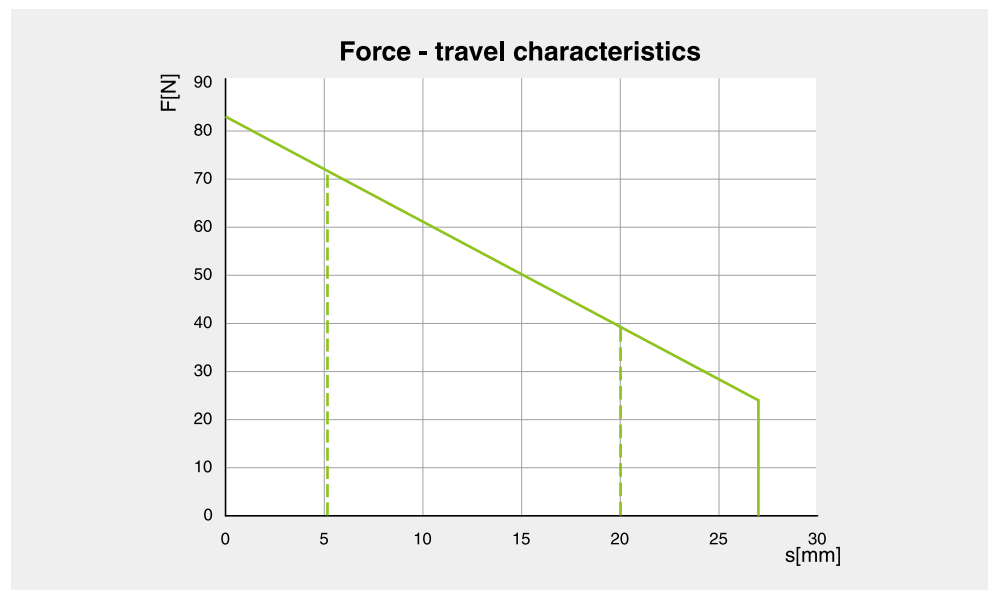
Internal Part of Striker



Internal Structure of 1A Fuse for PT



Characteristics of Striker



Characteristics of Striker

The operating load of striker (striker pin) is increased to check the operating state of fuse and the deliverable energy is the maximum when compared to other similar medium type strikers and the supporting force is maximized to prevent retroaction.

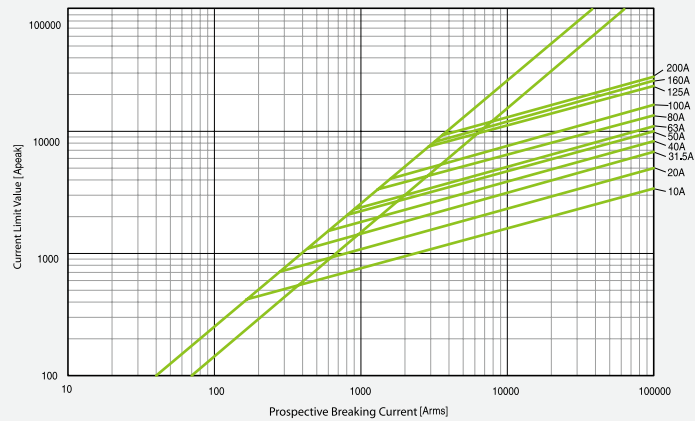
The operating time of striker after the fuse melting is minimized to strengthen the electrical signal and mechanical interlock functions. It is easy to check the operation with the naked eyes using the red indicator bar.

Characteristic Curves

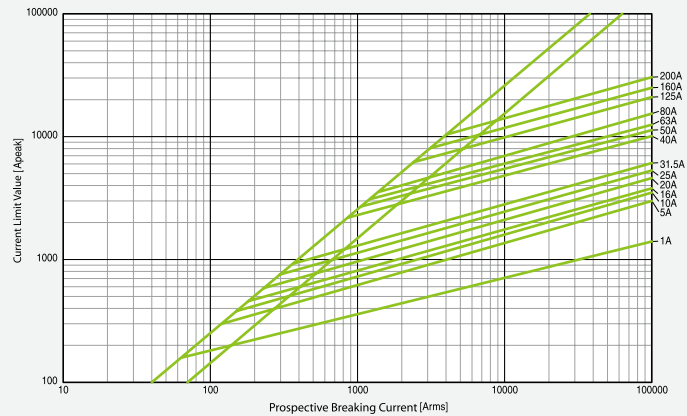
Operating Characteristic Curves

Current Limit Characteristic

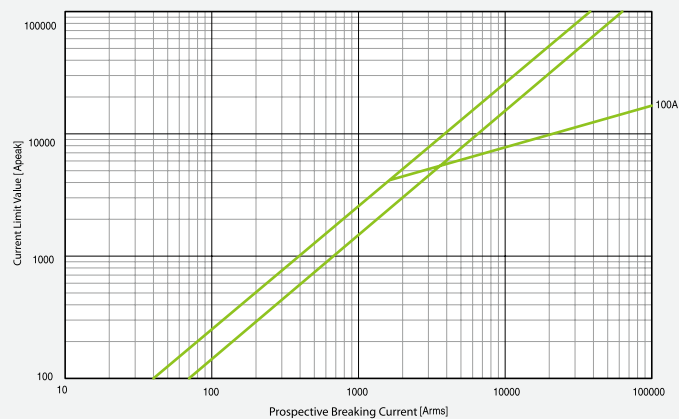
3.6/7.2kV Cut-Off Characteristics



24kV Cut-Off Characteristics



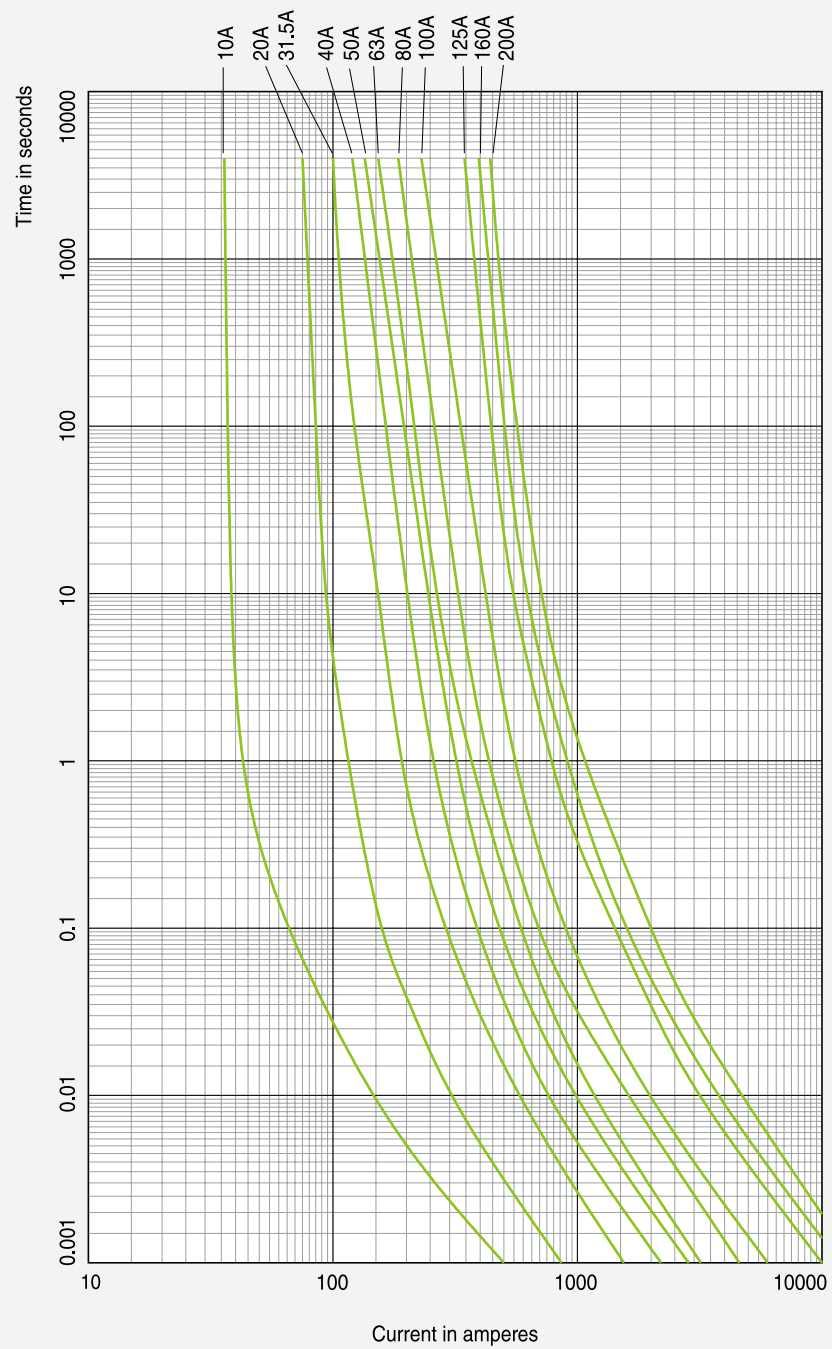
25.8kV Cut-Off Characteristics



Operating Characteristic Curves

Time-Current Characteristics

3.6/7.2kV Time - Current Characteristic

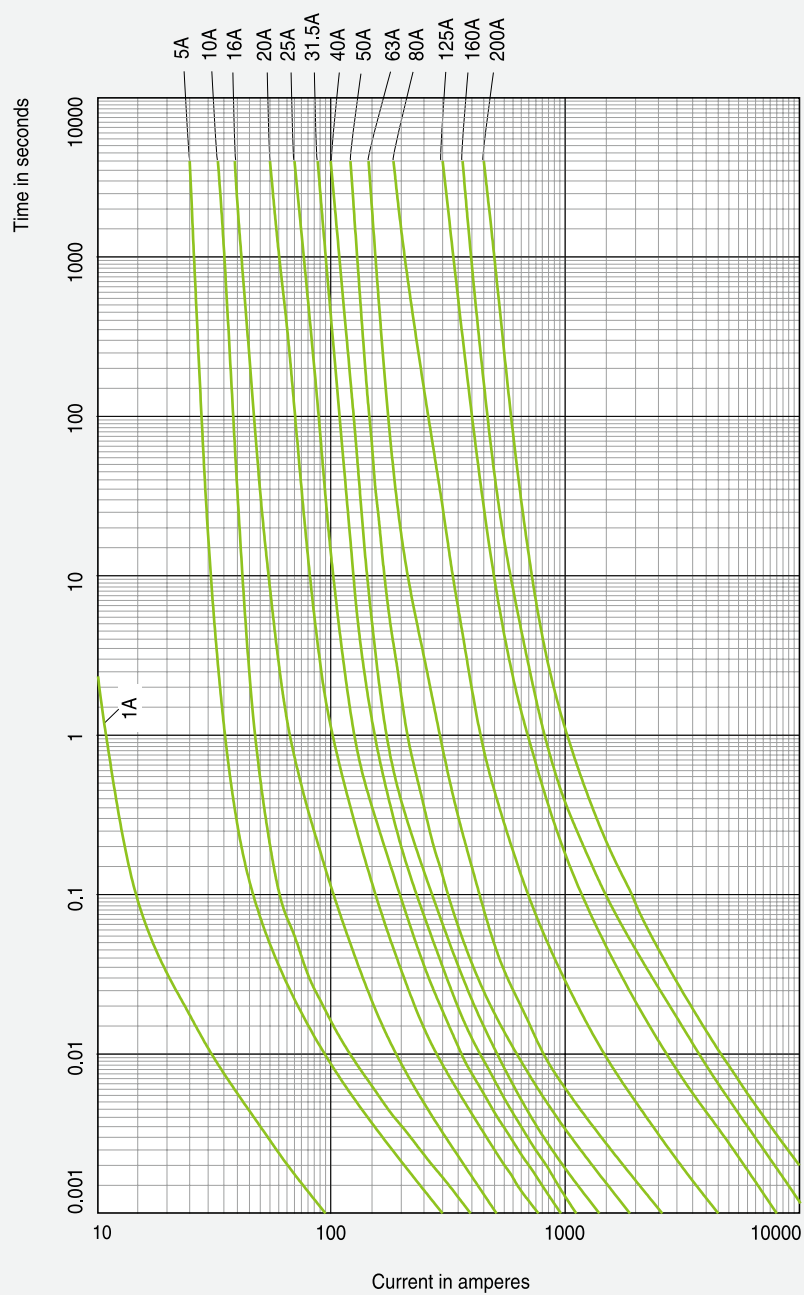


Characteristic Curves

Operating Characteristic Curves

Time-Current Characteristics

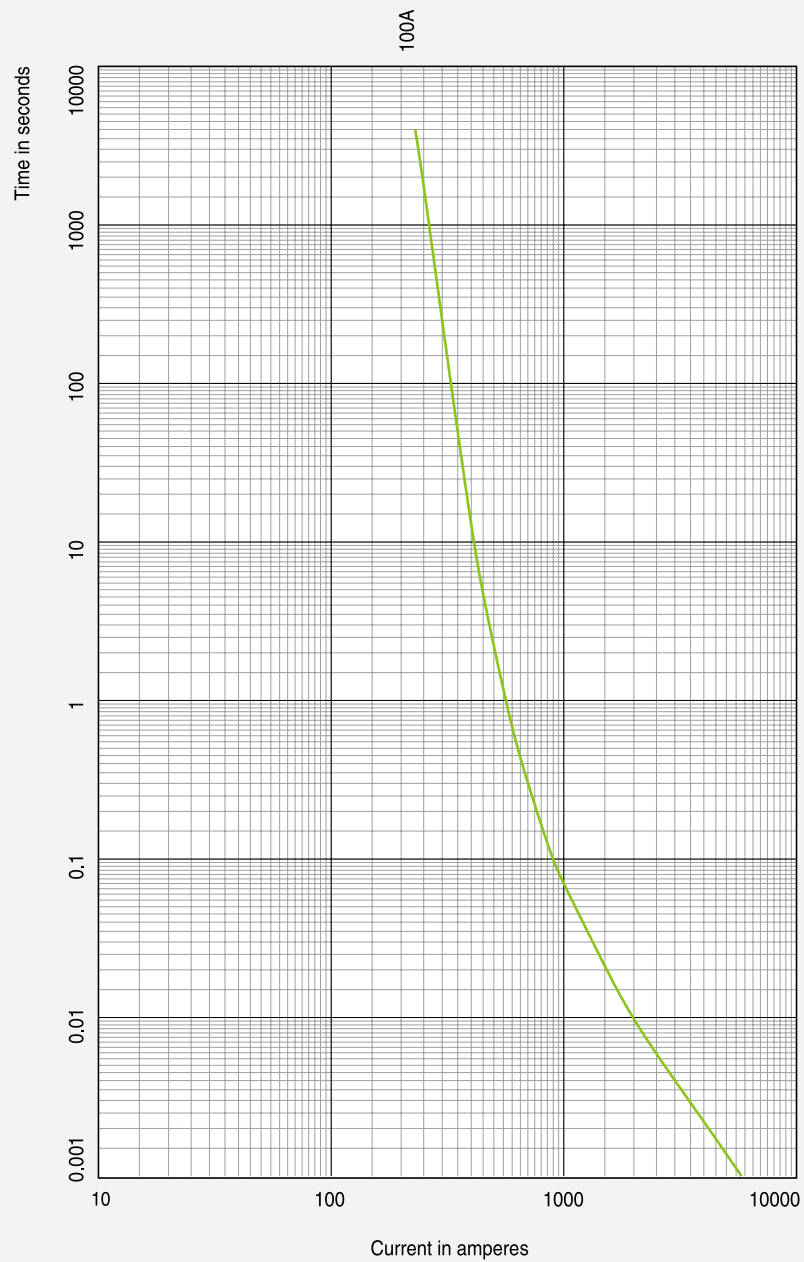
24kV Time - Current Characteristic



Operating Characteristic Curves

Time-Current Characteristics

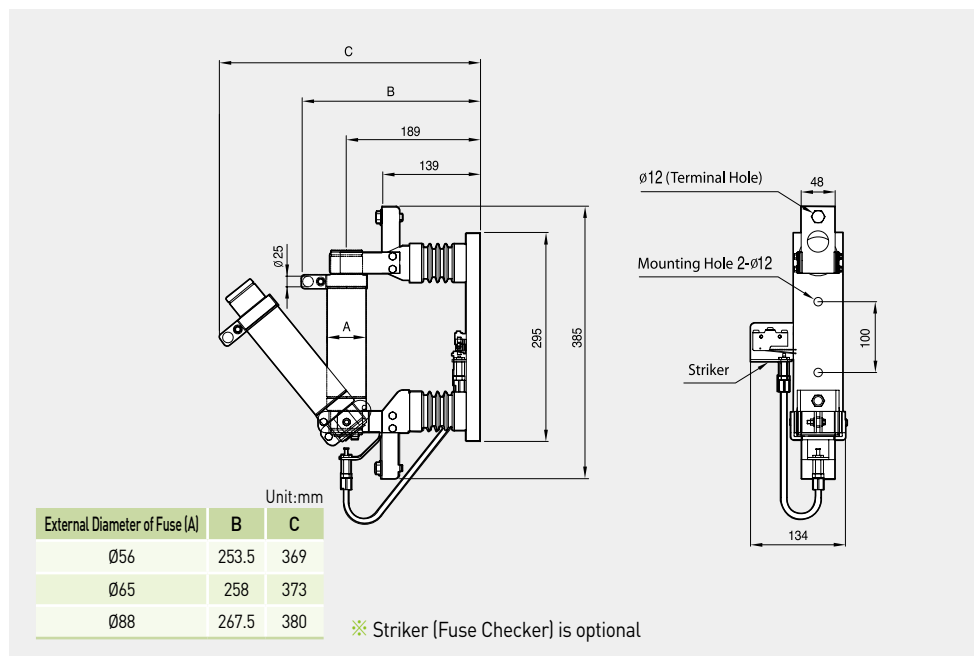
25.8kV Time - Current Characteristic



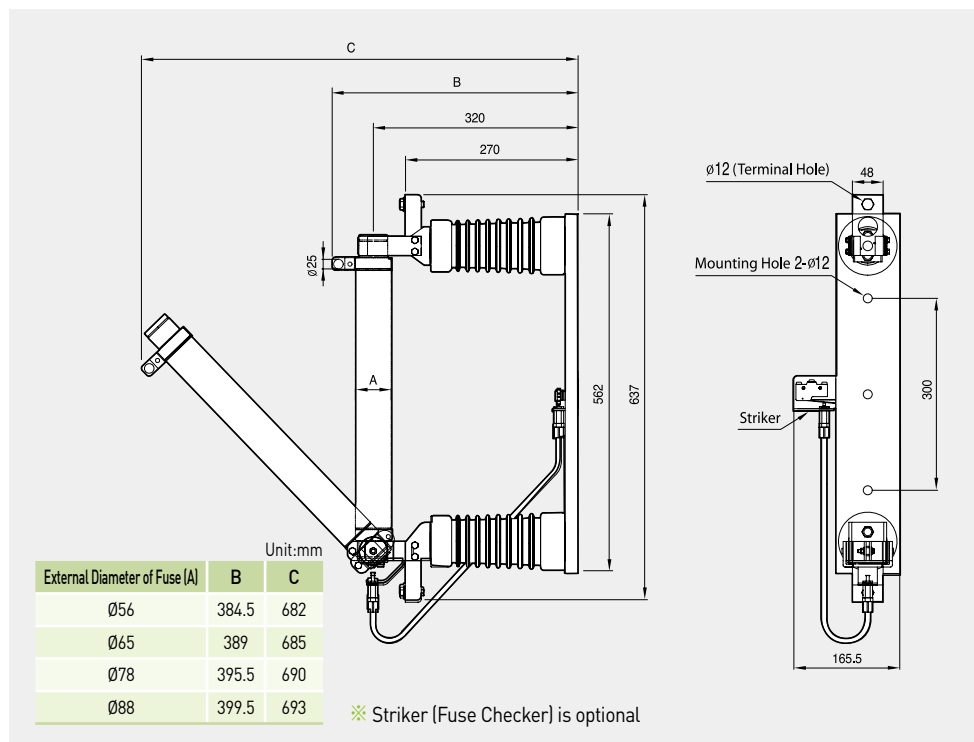
Dimensions

Fuse Holder External Dimensions

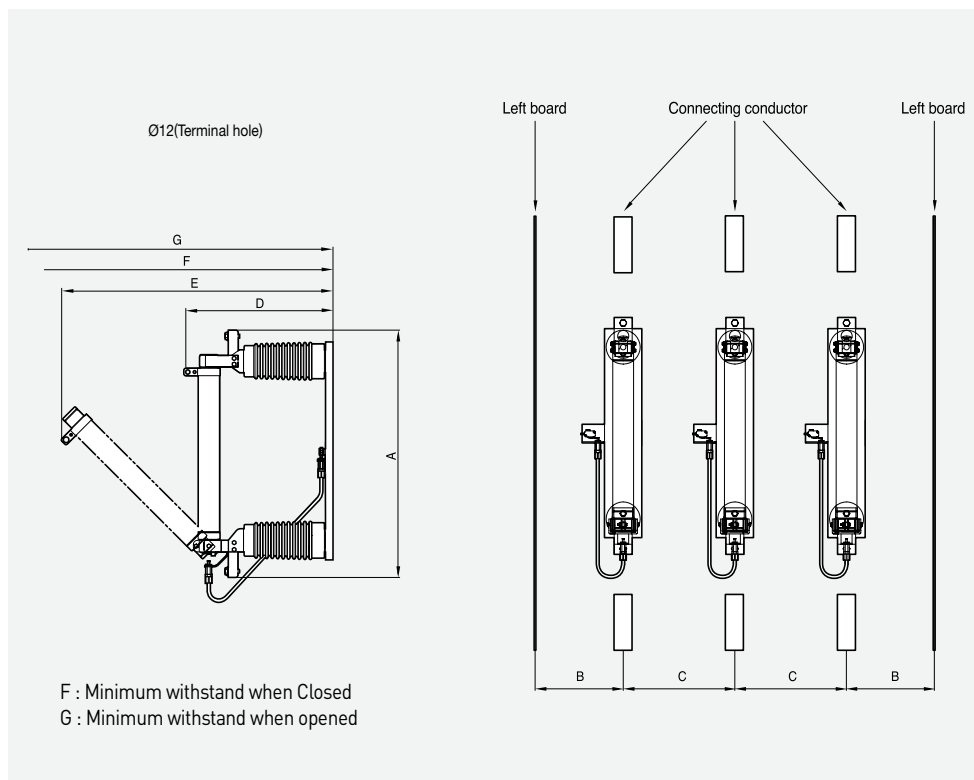
3.6/7.2kV



24/25.8kV



Fuse Mounting Index



Holder Type	Rated Voltage [kV]	Rated Current [A]	Circuit Voltage [kV]	Impulse Withstand Voltage (BIL) [kV]	Dimensions [mm]							Applied Fuse Link
					A	B	C	D	E	F	G	
VTHFB 07	3.6 / 7.2	200	6.6	60	385	-	156	253	393	350	515	VTHF 07010 07020 07032 07040 07050
								258	396	355	522	VTHF 07063 07080 07100
								270	404	367	534	VTHF 07125 07160 07200
VTHFB 24	24 / 25.8	200	22.9	125	637	-	260	385	682	608	960	VTHF 24001 24005 24010 24016 24020 24025 24032
								389	685	612	964	VTHF 24040 24050 24063 24080
								396	690	614	970	VTHF 25100
								400	693	619	975	VTHF 24125 24160



B7 Vacuum Interrupters

CONTENTS

Features	B7-02
Structure & Operating Principle	B7-04
Ratings	B7-06
Dimensions	B7-08



Vacuum Interrupter VI



VITZRO EM Vacuum Interrupter (V.I) is a core part that composes the breaking part of medium-voltage VCB. Generally, it is a satisfactory conductor to supply power and it promptly interrupts the current in case of an overload and short circuit faults to ensure the insulation. It is the most ideal, arc-extinguishing device.

Certification

It is a high-performing, highly reliable product and its electrical and mechanical cycle has improved.

- Its performance is optimized by applying the vacuum technology accumulated for more than 25 years.
- It is possible to maintain the high-vacuum state for a long time due to the brazing of vacuum furnace at a clean room and the automatic processing of vacuum exhaust unit.
- Through a single compression processing of individual contact, its mechanical strength is good and it does not transform even with more than 10,000 times of unload operations.

Its performance is improved due to a high-speed breaking and a short arc time.

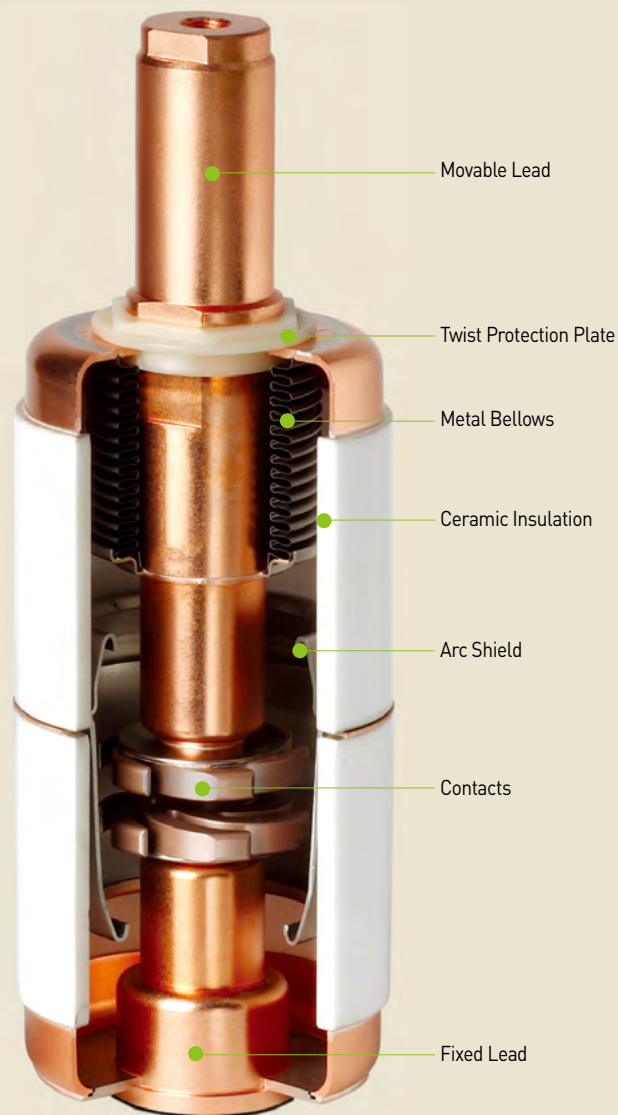
- As a quick insulation recovery characteristic in the vacuum state, after the contact opening, it interrupts the current at the zero point of initial current which shortens the arc time resulting in less damages and losses of contacts.
- It maintains high reliability by collecting and storing all information on manufacturing and by saving and managing manufacturing history of individual product.

Structure & Operating Principle

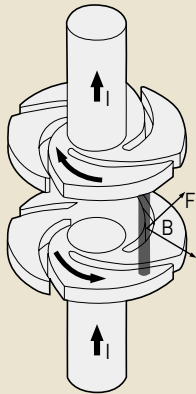
Structure

The basic structure of a general V.I is shown below and it consists of a fixed lead, a movable lead, contacts, an arc shield, metal bellows and twist protection plate.

VITZRO EM V.I maintains a highly reliable, high-vacuum state due to the automation process and its internal pressure is 5×10^{-7} torr under.



Operating Principle

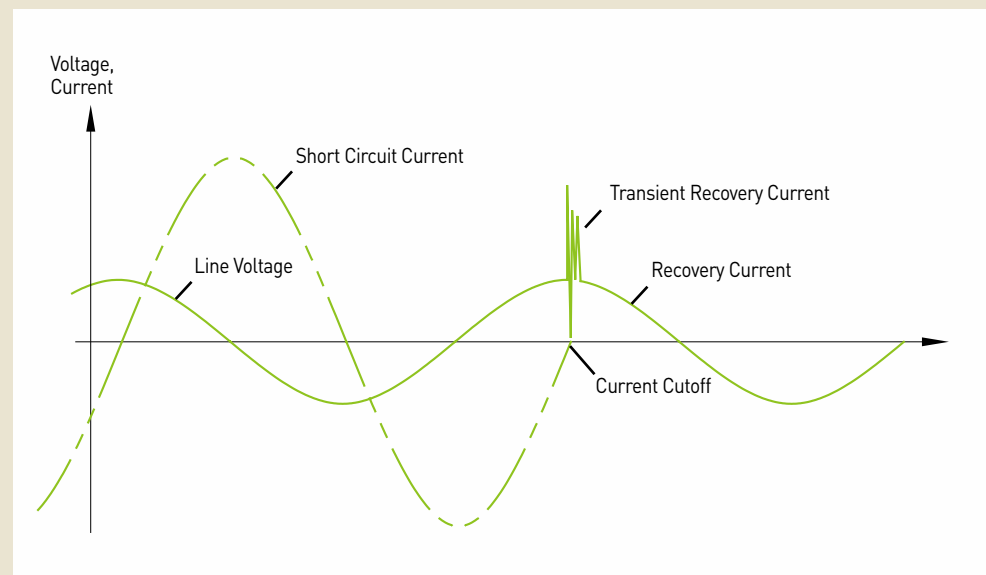


V.I Current Breaking Principle.

When the contacts that were conducting current to the inner V.I are physically opened, a vacuum arc is generated between the contacts and this continues until the next zero current point. The arc under the influence of vacuum is affected by the magnetic field that is generated by contact structure and shape and it diffuses the arc to the next zero current point or drives to the random direction.

That is, the first arc generated by the inductive magnetic field formed by the contact structure and shape forms a single contact point and then diffuses the arc to the whole surface of contacts. This prevents a sectional overheating and damages to contacts. When the dielectric strength between both contacts at the vacuum state gets higher than the power part voltage, the arc is extinguished at the next zero current point and a power voltage (Recovery Voltage) is generated between poles to complete the interruption.

Cutoff Characteristic of V.I



Ratings



Vacuum Interrupter (V.I) is a core part that mainly composes the contact part of medium-voltage VCB and it is a product that requires reliability even at high-voltage current that is generated due to the overload and short circuit faults. VITZRO EM designs and manufactures V.I and uses a fine-alumina ceramic tube that has an excellent vacuum-sealed characteristic and a mechanical characteristic for the production of highly reliable V.I. Also, Cu-Cr contacts are adopted to improve the high-voltage insulation and breaking capability.

Applied Range			A Switchgear			Circuit Breaker				
Additional insulation			Air		GAS etc.	Air				
Name of Type			5F	OK	OKPN	M20QD		M50SC	M51S	M71R
Shape										
Electrical Rating	Rated Voltage	kV	7.2	7.2	25.8	7.2		7.2	12/15	17.5
	Power Frequency Withstand Voltage	kV	20	35	60	22		22	36	38
	Lightning Impulse Withstand Voltage	kV	60	85	150	60		60	95	95
	Rated Frequency	Hz	50/60	50/60	50/60	50/60		50/60	50/60	50/60
	Rated Normal Current	A	400	630	630	400	630	3150	2000	630/1250
	Rated Short Circuit Breaking Current	kA	[4]	[4]	[4]	8	12.5	40	25	25
	Rated Short Circuit Making Current	kAp	10.4	32.5	32.5	20.8	32.5	104	65	65
	Rated Short-Time Current	kA/3sec	6.3 (1s)	12.5 (4s)	12.5 (4s)	8	12.5	40	25	25
Mechanical Rating	Stroke	mm	4±0.3	8±0.5	12-1	8±1		8±1	12±1	12±1
	Opening Speed, Average (average of first 75% of stroke)	m/s	0.5±0.1	0.8±0.1	0.9±0.1	0.9±0.2	1.2±0.3	1.5±0.2	1.7±0.2	1.3±0.2
	Closing Speed, Average (average of last 30% of stroke)	m/s	0.35±0.1	0.6±0.1	1.0±0.2	0.7±0.2		0.8±0.2	1.2±0.2	1.3±0.2
	Maximum Overtravel	mm	1	2	2	2		3	3	3
	Maximum Overtravel Duration	ms	5	5	5	5		5	5	5
	Maximum Rebound	mm	0.75	2	2	2		2	2	2
	Maximum Contact Erosion	mm	1	1	2	1.5		2	3	3
	Total Contact Force (Including Free Contact Force)	kg·f	10≤F≤18	50≤F≤65	50≤F≤65	25≤F≤40	50≤F≤60	450≤F≤550	180≤F≤220	180≤F≤220
	Free Contact Force	kg·f	7	7	7	7	7	27	16	16
	Mechanical Life (no load)	times	500,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
	Weight of Interrupter	kg	0.6	1.1	1.1	0.7	1	5.5	4.2	2

Applied Product



Vacuum Circuit Breaker, VCB



Vacuum Contactor Switch, VCS

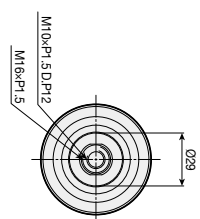
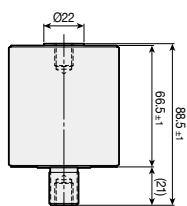
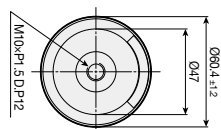


Eco-friendly Gas Insulated Switchgear, ECO-GIS

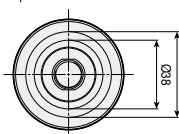
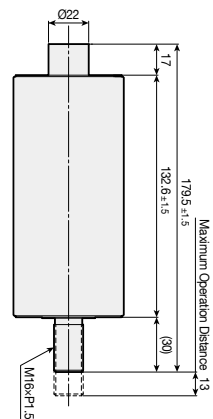
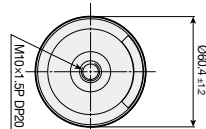
	Circuit Breaker									
	Air						GAS etc.			
	M101T	M102R	M202T	M102STR	M121T	M263T	M203R	M52Q	M102SGI	M454S
										
	4.76/8.25/15	25.8	25.8	27.5	12/15/17.5	38	36	24	25.8	72/84
	19/36	60	60	75	38	80	70	60	70	140/160
	60/95	125	150	175	95	200	170	125	150	350/400
	50/60	50/60	50/60	50/60	50/60	50/60	50/60	50/60	50/60	50/60
	3000	630/1250	3150	1000	3150	3000	1250	630	2000	2000
	50/40	25	40	20	40	40	25	12.5	25	31.5
	130/104	65	104	52	104	104	65	32.5	65	79
	50/40	25	40 (1s)	20 (1s)	40	40	25	12.5	25	31.5 (2s)
	10±1	16±1	16±1	20±1	12±1	20±1	18±1	16±1	16±1	40±2
	1.0±0.1	1.5±0.2	1.7±0.2	1.0±0.2	1.6±0.2	1.5±0.1	1.5±0.2	1.5±0.2	1.5±0.2	1.7±0.2
	1.0±0.1	1.0±0.2	1.1±0.2	1.0±0.2	1.2±0.2	1.0±0.1	1.0±0.2	0.9±0.1	1.0±0.2	1.2±0.2
	3	3	3	3	3	3	3	3	3	2
	5	5	5	5	5	5	5	5	5	5
	2	2	2	2	2	2	2	2	2	2
	3	3	3	3	2	3	2	3	3	2
	390≤F≤450	180≤F≤220	450≤F≤550	180≤F≤220	450≤F≤550	330≤F≤380	330≤F≤380	95≤F≤124	180≤F≤220	300≤F≤400
	27	20	27	27	24	27	27	10	27	27
	10,000	10,000	10,000	250,000	10,000	10,000	10,000	10,000	10,000	10,000
	7.2	4.2	9.5	7.4	6.3	11.8	6.9	2	6.3	21

Dimensions

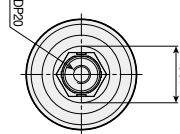
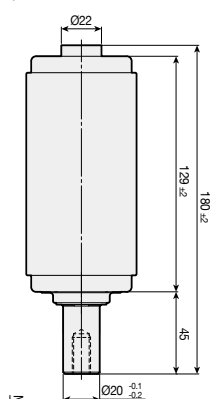
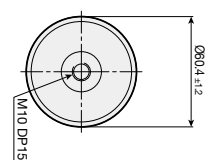
Dimensions



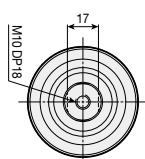
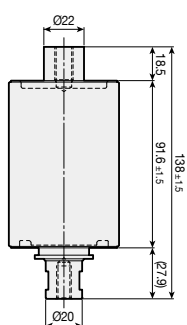
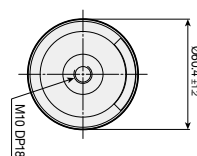
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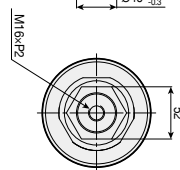
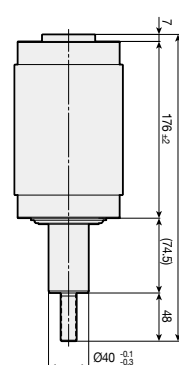
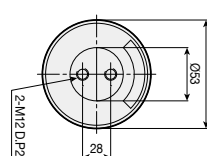
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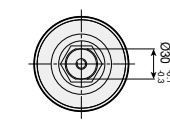
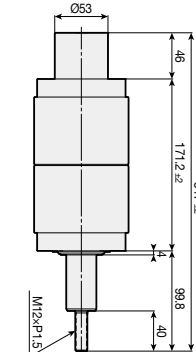
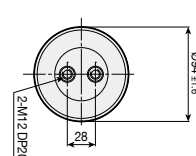
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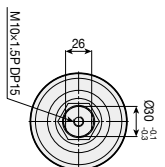
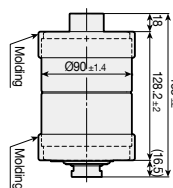
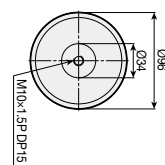


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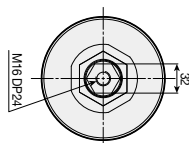
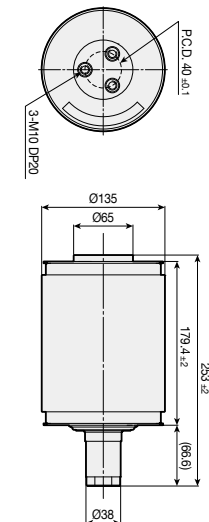


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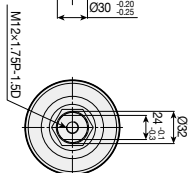
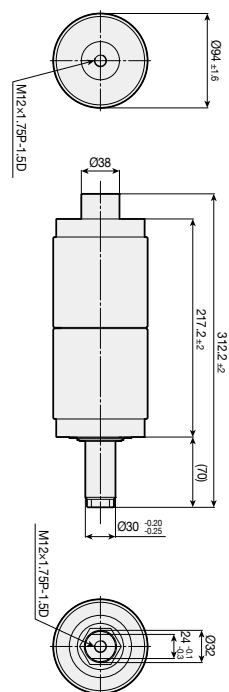
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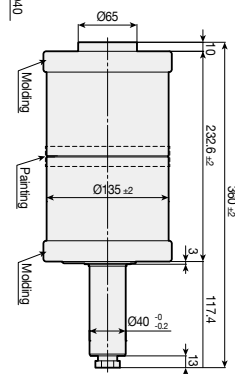
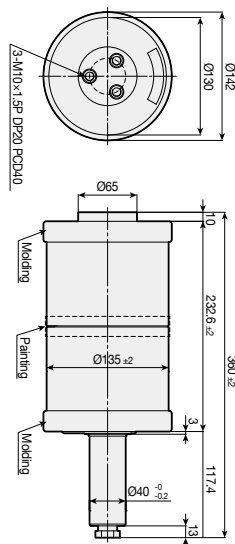
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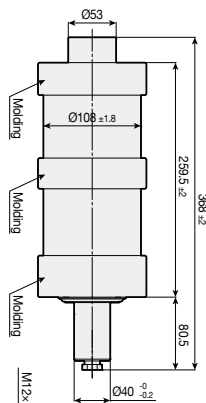
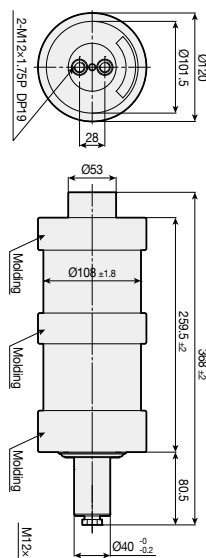
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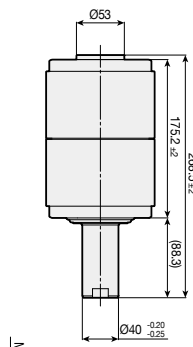
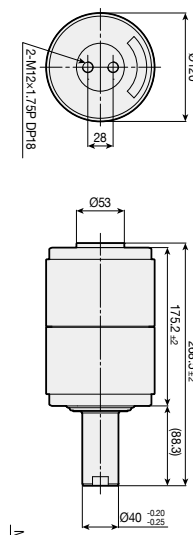
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M202T



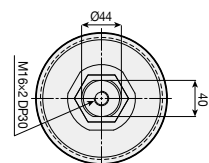
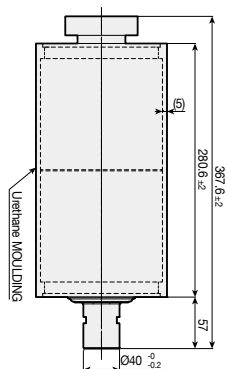
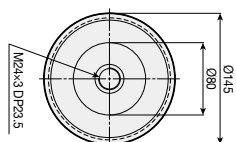
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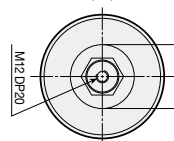
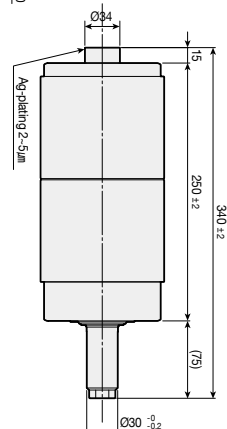
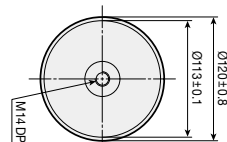
M121T

Dimensions & Certifications

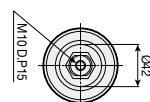
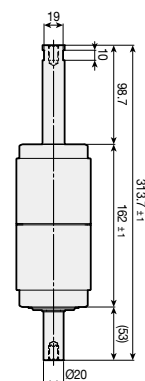
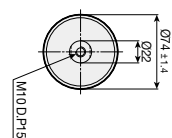
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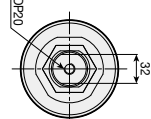
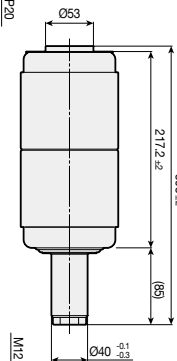
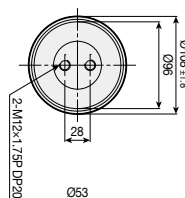
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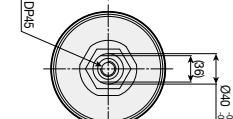
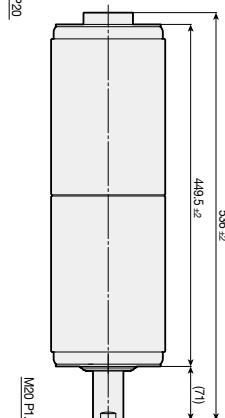
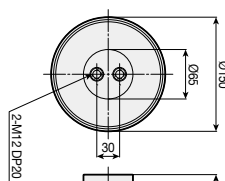
M203R



M52Q



M102SGI



M454S

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