



# Live Tank Circuit Breakers

72.5-550kV — Reliability through Technical Excellence

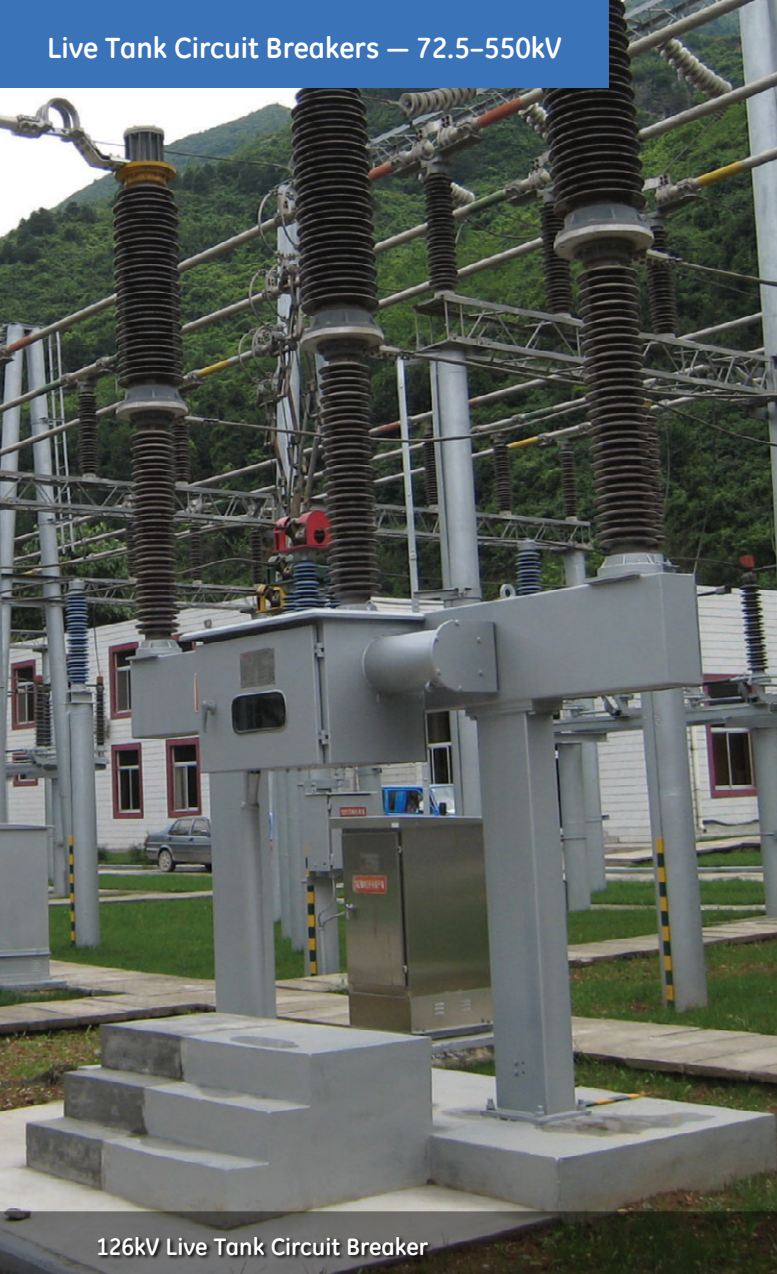


## with Primary Plus™

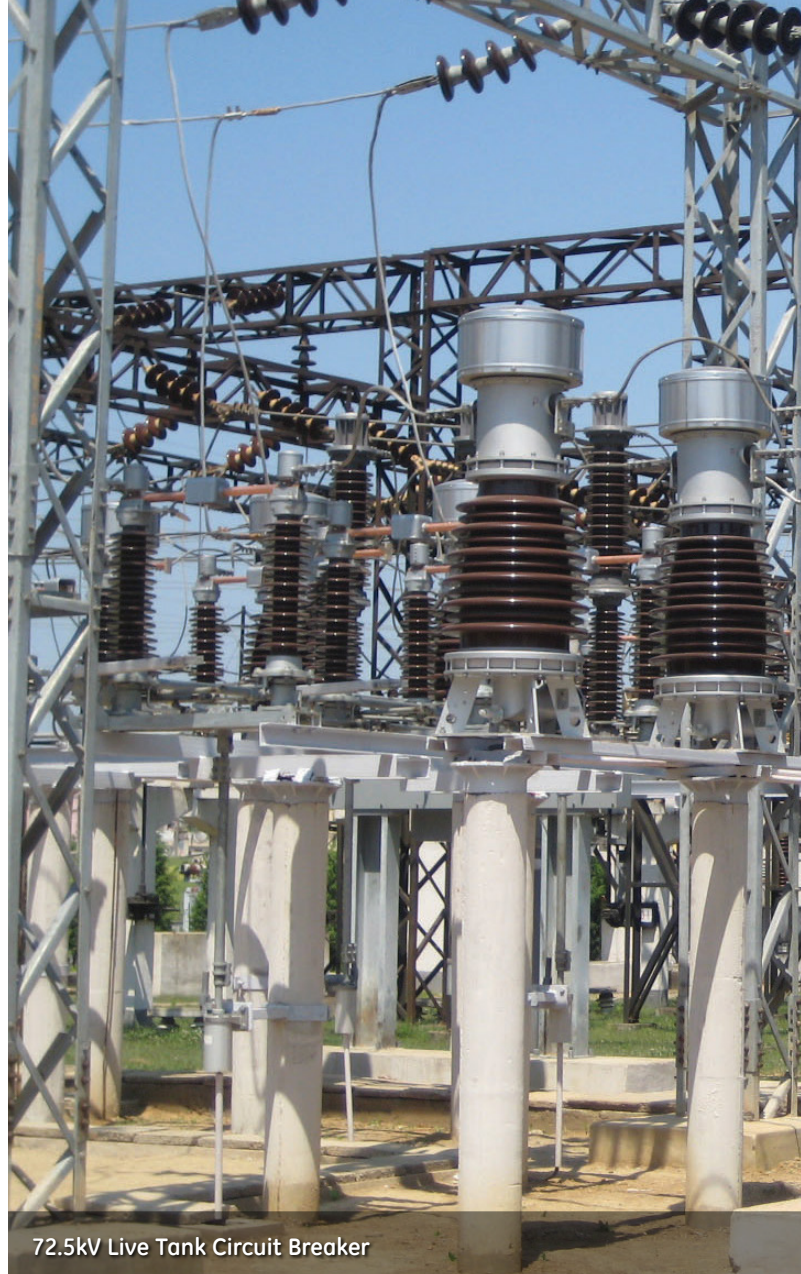
Pre-engineered solution set that digitizes XD|GE primary equipment and provides factory installed and configured protection, monitoring, diagnostics and communications.







126kV Live Tank Circuit Breaker



72.5kV Live Tank Circuit Breaker

## Robust, High Quality and Reliable Breaker Technology

For over a century, utilities around the world have relied on GE products and services to increase power system reliability and improve grid resiliency and responsiveness. As a global leader in grid infrastructure products and services, GE supports a broad set of utility applications ranging from transmission and substation automation to distribution networks and smart metering, enabling greater safety, connectivity and increased security.

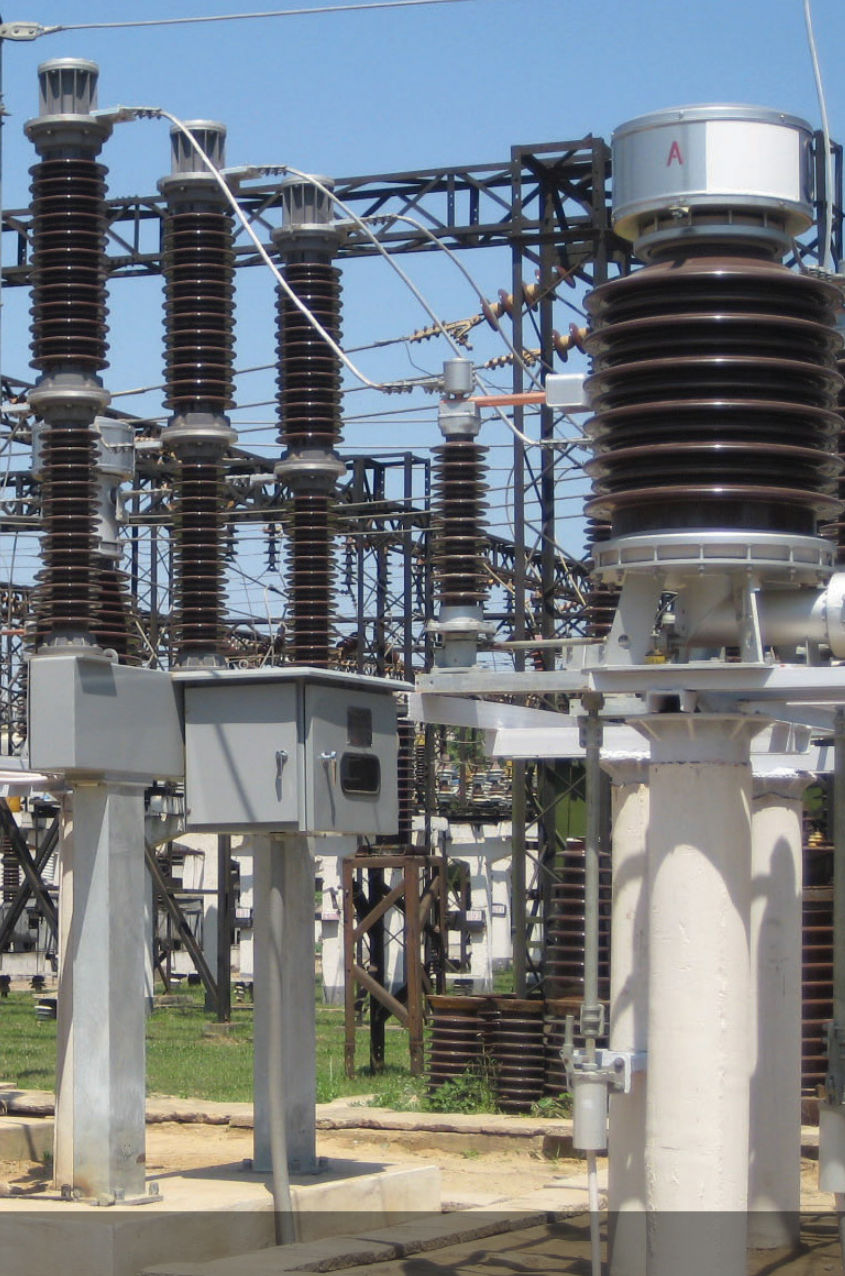
Through an alliance with XD Electric®, GE has extended its portfolio to include high and ultra high-voltage power equipment supporting the highest transmission voltage levels in the world. XD Electric is one of China's largest primary equipment manufacturers dedicated to the research, application and development of high and ultra high-voltage power transmission equipment. XD Electric has a broad range of products to transform and direct the flow of power for industrial, commercial and residential users.

The XD|GE alliance provides end-to-end transmission solutions to meet the growing demand for electricity globally. The combined portfolios of GE and XD provide a comprehensive range of technology solutions for customers in the utility sector and energy intensive industries.

The XD|GE breaker offerings are robust in design and are based on proven technology, yielding high quality products suitable for an extensive range of applications. XD|GE's breakers are compact in design and construction with advanced arc extinguishing technology and self-blast interrupting capability which significantly reduces product size and improves reliability.

Designed with a modular spring operated mechanism and an integrated hydromechanical operating mechanism, these circuit breakers improve product reliability, reduce costs, and minimize maintenance requirements.





## Key Features & Benefits

### Superior Interrupting Capability

XD|GE live tank breaker interrupters are designed to handle demanding switching duties such as clearing short line faults and out-of-phase switching operations. In magnetizing current switching applications, no restrike or re-ignition occurs during the interruption of charging currents.

### Reliable Performance

The characteristics of SF<sub>6</sub> gas provide the live tank circuit breaker and associated components with a highly reliable insulating capability. The live tank breakers are designed with a leakage rate of <0.5%/year.

### Reduced Maintenance Costs

The live tank circuit breakers have been engineered to minimize inspection and maintenance requirements. They are designed with a spring operating mechanism to further reduce maintenance costs and lower overall cost of ownership.

They are designed with spring or hydromechanical operating mechanisms to further reduce maintenance costs and lower overall cost of ownership.

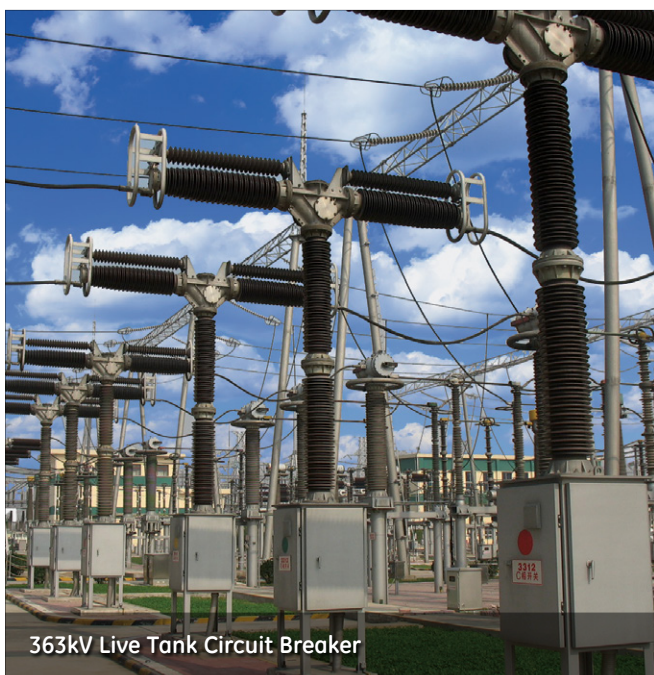
## Primary Plus



XD|GE offers Primary Plus™ for all its critical power delivery equipment. Primary Plus is a pre-engineered solution set that provides utilities and large industrial facilities with a means to reduce the time and labor associated with substation construction, expansion, and maintenance, while utilizing technologies and methodologies familiar to existing engineering resources.

XD|GE's factory installed and configured solutions include:

- Digitized primary equipment by replacing labor-intensive, individually terminated copper wires with standardized physical interfaces and open communications protocols (IEC 61850)
- Electrical protection systems optimized for each primary asset and application to monitor and react to fault conditions
- Highly secure and ruggedized communication network equipment including industrial strength wireless, fiber optic multiplexers, and Ethernet switches for an advanced and reliable communications infrastructure



363kV Live Tank Circuit Breaker

# Technology

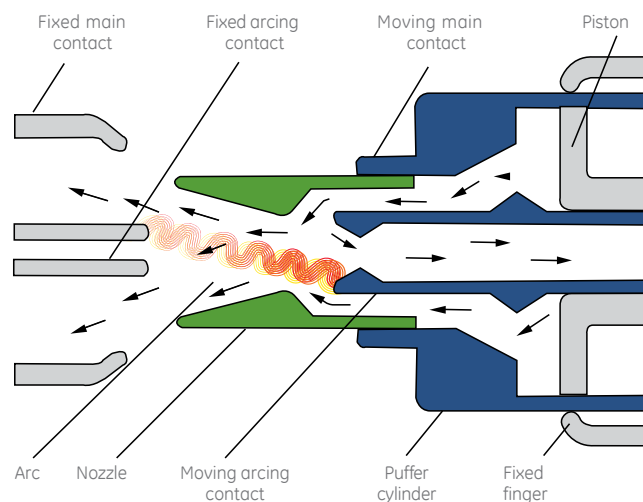
XD|GE 252kV and below SF<sub>6</sub> high-voltage circuit breakers are designed with a single interrupter (per pole), without parallel or grading capacitors. 363-550kV circuit breakers are designed with two interrupters (per pole) and are equipped with coupling or grading capacitors and pre-insertion resistors as required. Pre-insertion resistors are used to reduce over voltages that occur during the closing operation. On opening, the contacts of the pre-insertion resistor parts before the main contacts.

Spring operating mechanisms are used on 252kV and below SF<sub>6</sub> high-voltage breakers, while 252kV and above SF<sub>6</sub> high voltage breakers are designed to use a hydromechanical operating mechanism.

As its primary power, the operating mechanism uses spring force to either open or close the breaker. The breakers are also equipped with a mechanical anti-tripping device, an electric anti-pumping device and a SF<sub>6</sub> monitoring device.

## 1. Interrupter

### Inner Construction of Interrupter



## 2. Spring Operating Mechanism

The design of the spring operated mechanism provides the high performance required for reliable operation. The lever engaged with the locking device, which is released when the trip coil is energized, is rotated counterclockwise by the trip spring (Fig.1).

The cam and the ratchet wheel engaged with the locking device, which is released when the closing coil is energized, are rotated counterclockwise by

the closing spring. The lever is rotated clockwise, compressing the trip spring by torque from the cam (Fig.2).

As soon as the closing sequence is completed, the closing spring is charged by the ratchet linked to the motor (Fig.3).

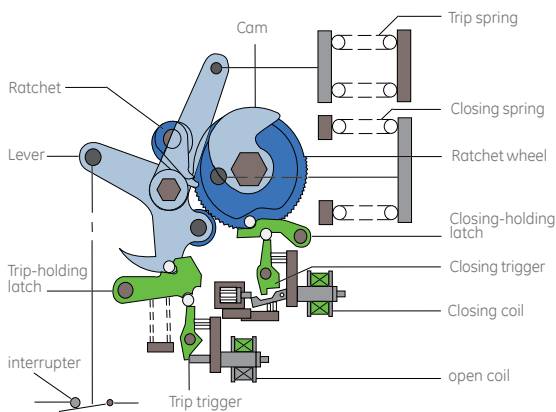


Fig1. Closed position (closing spring charged)

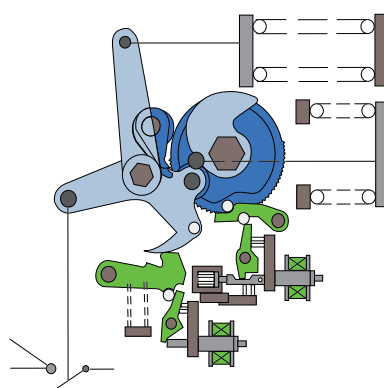


Fig2. Open position (closing spring charged)

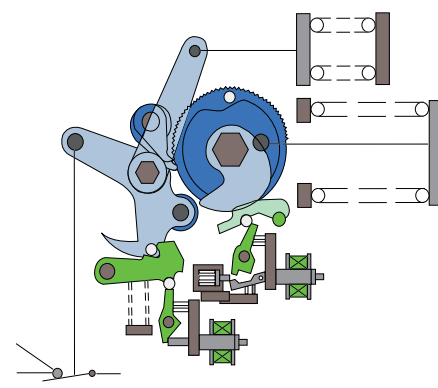
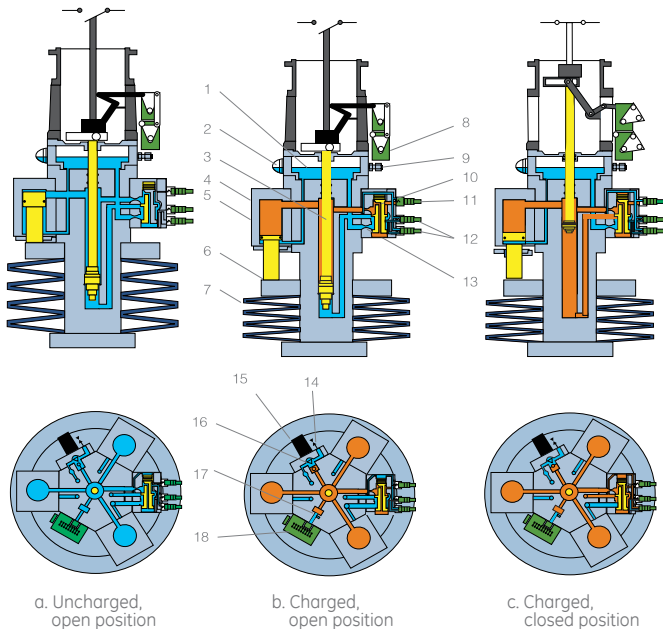


Fig3. Closed position (closing spring discharged)

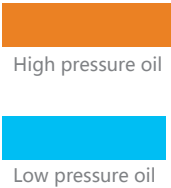


### 3. Hydromechanical Operating Mechanism for Circuit Breakers

The hydromechanical mechanism has a modular design that allows for easy maintenance. Disc springs are used to store the energy for operating the breaker. The mechanism has two independent opening control valves for reliable operation. The direct connection to the interrupter provides a 1 to 1 travel distance between the interrupter and mechanism. This mechanism can be operated either in single phase or in three phase mechanically, and can be gang-operated in three phase mechanically.



- 1. Low pressure oil tank
- 2. Oil lever indicator
- 3. Operating piston rod
- 4. High pressure oil tank
- 5. Piston for charge
- 6. Support ring
- 7. Disk spring
- 8. Auxiliary switch
- 9. Oil-filling hole
- 10. Throttle of close
- 11. Electro-magnetic valve for close
- 12. Electro-magnetic valve for open
- 13. Throttle of open
- 14. Oil drainage valve
- 15. Energy-store motor
- 16. Oil pump
- 17. Pressure release valve
- 18. Spring position switch



252kV Live Tank SF<sub>6</sub> Circuit Breaker

# Innovative Facilities and Rigorous Quality Processes

XD|GE's technology portfolio is built in state-of-the-art manufacturing and testing facilities with robust quality processes which provide customers with products that meet the critical and demanding reliability and environmental challenges of transmission applications.

## Manufacturing Excellence

XD|GE designs a broad range of switchgear in five specialized production facilities including machining, surface treatment, insulating, housing and casting.

Additionally, there are two specialized facilities that produce both the spring and hydromechanical operating mechanisms.

Final production is completed in three workshop assembly lines that total more than 50,000 square meters. Components such as aluminum enclosures, cast resin insulators, current and voltage transformers, and operating mechanisms are manufactured by XD|GE through a completely integrated manufacturing model.

The switchgear facilities are ISO® 9001 certified, ISO 14001 certified for environmental management systems, as well as OSHA® 18001 certified for health and safety management systems.

## Exceptional Quality

A focus on quality is an ongoing strategic initiative for XD|GE and that is evident throughout the manufacturing environment. The quality process begins with an incoming inspection of all materials to ensure the best possible inputs before manufacturing begins.

Throughout the production and assembly process, there are multiple checkpoints in the documented test plan, including both visual and “stop flow” inspections. The production facilities follow strict non-conforming procedures to identify, control and avoid the use and delivery of non-conforming products. Each production facility has developed strict environmental standards, including controls of cleanliness, temperature and humidity, and has controls in place to monitor and manage to the established standards.

In addition, XD|GE has a dedicated measuring and inspection department with certified, full-time inspectors in each of its manufacturing sites. The measuring and inspection department provides a secondary cross-inspection for all work in process, as well as finished products, ensuring a high level of quality is achieved throughout the manufacturing process. First Pass Yield and Cost of Quality data is maintained and analyzed, per product family, in order to drive continual product and process improvements and higher product reliability.

From raw materials acquisition and inspection to finished product, XD|GE's breakers are designed to meet rigid quality processes so the installed product provides the highest level of reliability.

## Advanced Test Facilities

XIHARI®, the Xi'an High Voltage Apparatus Research Institute, is an integral part of the XD|GE alliance. XIHARI has extensive testing capabilities at its facility sites, which include a: High Power Laboratory, High Voltage Laboratory, Artificial Climate Laboratory, EMC Laboratory, and an Operational Test Circuit for HVDC Thyristor Valves.

The testing hall meets all of the requirements of ISO/IEC® 17025 and houses some of the largest test equipment in the world, providing the capacity to test primary equipment as large as 1,100kV AC. The High Voltage Apparatus Laboratory in XIHARI is a government authorized national high-voltage apparatus quality supervision and inspection test center. It is an independent third-party laboratory for type tests, routine tests, performance tests and certificate tests for high-voltage apparatus. The testing facilities at XIHARI also include an extension environmental laboratory. Testing capabilities here include high altitude testing, high humidity testing, and temperature testing from -70° C up to +150° C.





## Support and Service

### Global Project Engineering Services

XD|GE is dedicated to helping its customers reach their system objectives and provides a suite of professional services to assist the successful deployment and maintenance of XD|GE products and solutions globally. From design to implementation to post-sales support, a team of technical and business experts are available to help customers effectively use the capabilities and product domain knowledge that are available from XD|GE.

This support infrastructure covers the entire life cycle of the product. From the coordination of transportation logistics to the completion of site acceptance testing and warranty service, the highly qualified XD|GE team is available throughout the implementation.

To ensure a high quality of service to meet the needs of each unique application, XD|GE has a global field service team of highly experienced and dedicated individuals. Coupled with a vast network of high voltage power equipment domain experts, XD|GE is able to support a broad range of applications in various environments.

Finally, XD|GE offers a 24x7 global support service to address and direct any customer application and field questions.

### Specialized Installation and Commissioning

- Logistics including coordination of ocean and inland transportation
- Installation services include receiving, rigging, unloading and labor (mechanical and electrical)
- Test commissioning
- Site acceptance testing

### Post-Sales and Installation Support

- 24x7 global customer service
- Emergency response hotline
- Several customer support access points available to ensure timely support (telephone, e-mail, fax, or web)
- Global spare parts reserve
- A global network of maintenance and repair facilities



4800kV/720 kJ Impulse Voltage Generator & ±2000kV 30mA DC Voltage Generator

## Primary Plus

### Pre-Engineering Secondary Equipment

Primary Plus, XDJGE's supplemental offering to its primary equipment, is a pre-engineered, factory installed solution set that allows utilities to reduce the time and labor associated with substation construction and commissioning. Primary Plus uses technologies and methodologies familiar to existing resources and skill sets.

- Digitized primary equipment for replacing labor-intensive, individually terminated copper wires
- Electrical protection solutions to monitor and react to fault conditions
- Secure and ruggedized communications infrastructure devices including wireless radios, fiber optic multiplexers and Ethernet switches



### Digitized Substation

#### Multilin™ HardFiber System

- Using the Multilin HardFiber system, XDJGE can deliver primary equipment with digital communications. The Multilin HardFiber system digitizes analog signals from primary assets utilizing IEC 61850 communications, reducing total life costs of protection and control through labor and resource optimization.
- This factory-installed solution reduces the amount of labor-intensive, individually terminated copper wire connections with pre-terminated copper and fiber optic cables with standard physical interfaces and open digital communications.

#### Key Benefits

- Saves up to 50% of Protection & Control labor costs
- Eliminates the majority of copper wiring to better utilize resources for the design, building, commissioning, and maintenance of power system protection and control
- Robust and simple architecture for deploying IEC 61850 process bus
- Improves employee safety by leaving potentially dangerous high-energy signals in the switchyard
- Reduces the chances for operational mistakes made during isolation and restoration after routine maintenance
- Built as an extension of the Multilin Universal Relay (UR) family of products, suitable for a wide array of protection applications
- Rugged, hardened, and secure switchyard interface enabling NERC/CIP compliance



### Electrical Protection & Control

#### Advanced Relays for Primary Substation Equipment

Primary Plus utilizes the Multilin C60 Breaker Protection system or Multilin F60 Feeder Protection system to provide primary protection of critical substation equipment. Multilin relays are substation hardened devices that provide comprehensive protection, control, automation, and monitoring of high voltage substation circuit breakers. With fast, deterministic execution of programmable automation logic, extensive I/O options, and integrated high-speed peer-to-peer communications, Multilin protection devices can receive and execute commands and at a fraction of the cost when compared to a traditional hard-wired configuration.

#### Key Benefits

- Advanced circuit breaker monitoring and control in a single platform
- Complete IEC 61850 Process Bus solution providing resource optimization and minimizing total protection & control lifecycle costs
- Modular hardware architecture allow for device configuration flexibility, meeting the needs of most circuit breaker applications
- Advanced fault and disturbance recording, including internal device health monitoring, eliminating the need for external devices and maximizing asset life
- Robust network security enabling critical infrastructure Protection and NERC/CIP compliance
- Advanced automation capabilities for customized protection and control systems
- Simplified system integration and access to information through the use of multiple communication options and protocols, including native support for IEC 61850

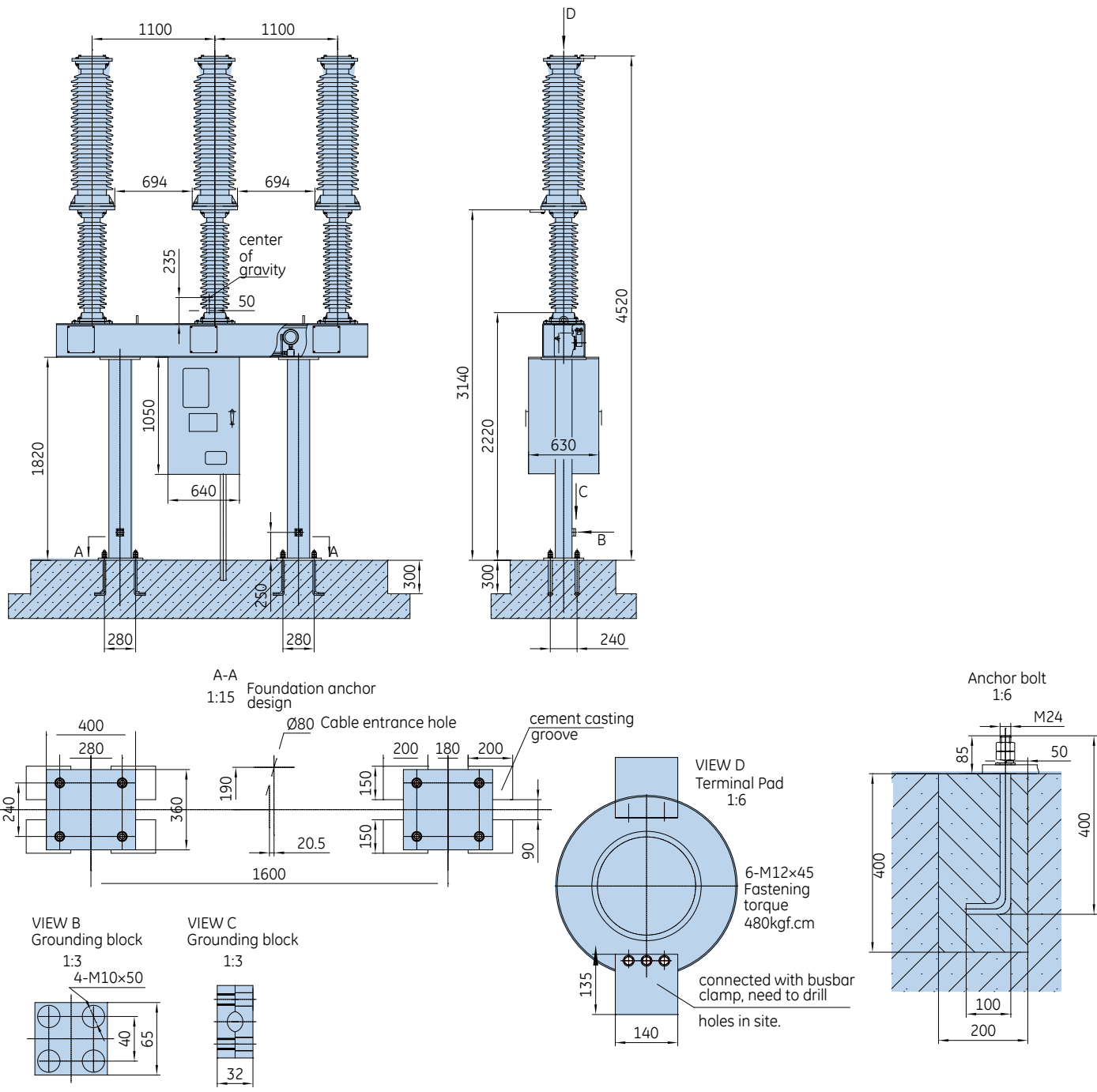




# Dimensions and Foundation

## 72.5kV SF<sub>6</sub> Live Tank Circuit Breaker

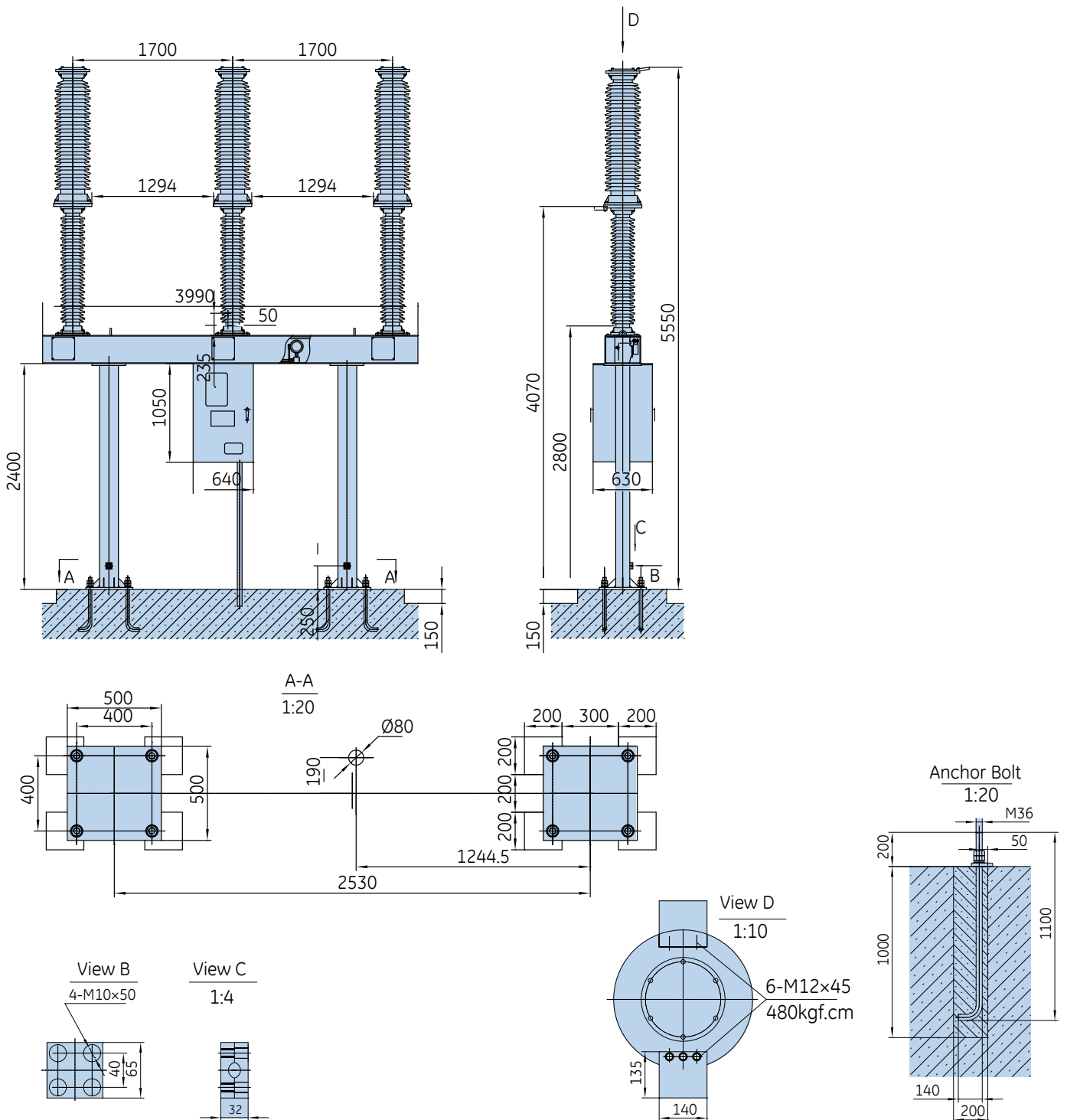
LW9A-72.5



All measurements are in millimeters (mm)

126 to 145kV SF<sub>6</sub> Live Tank Circuit Breaker

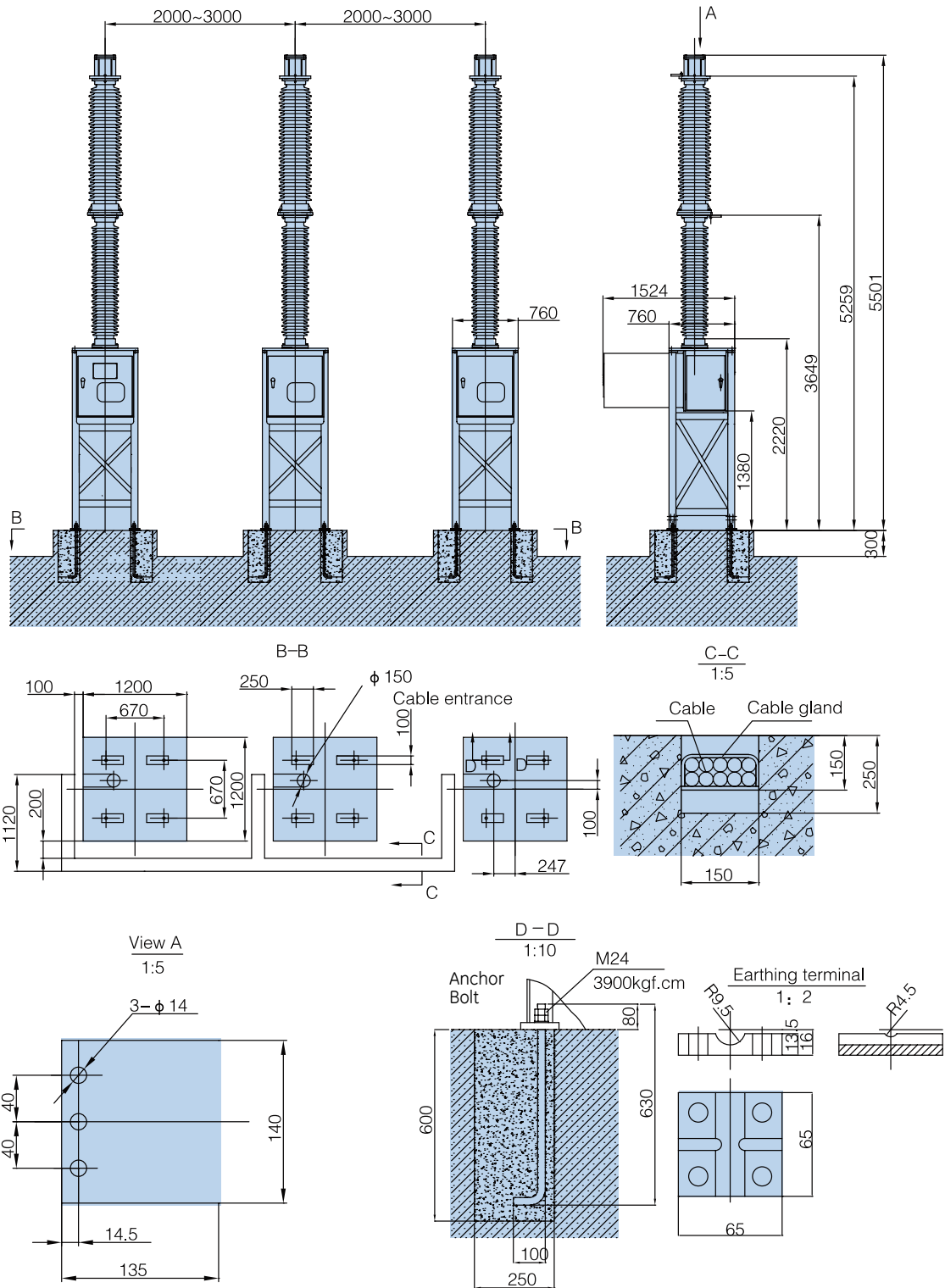
LW25A-126/LW25A-145





170kV SF<sub>6</sub> Live Tank Circuit Breaker

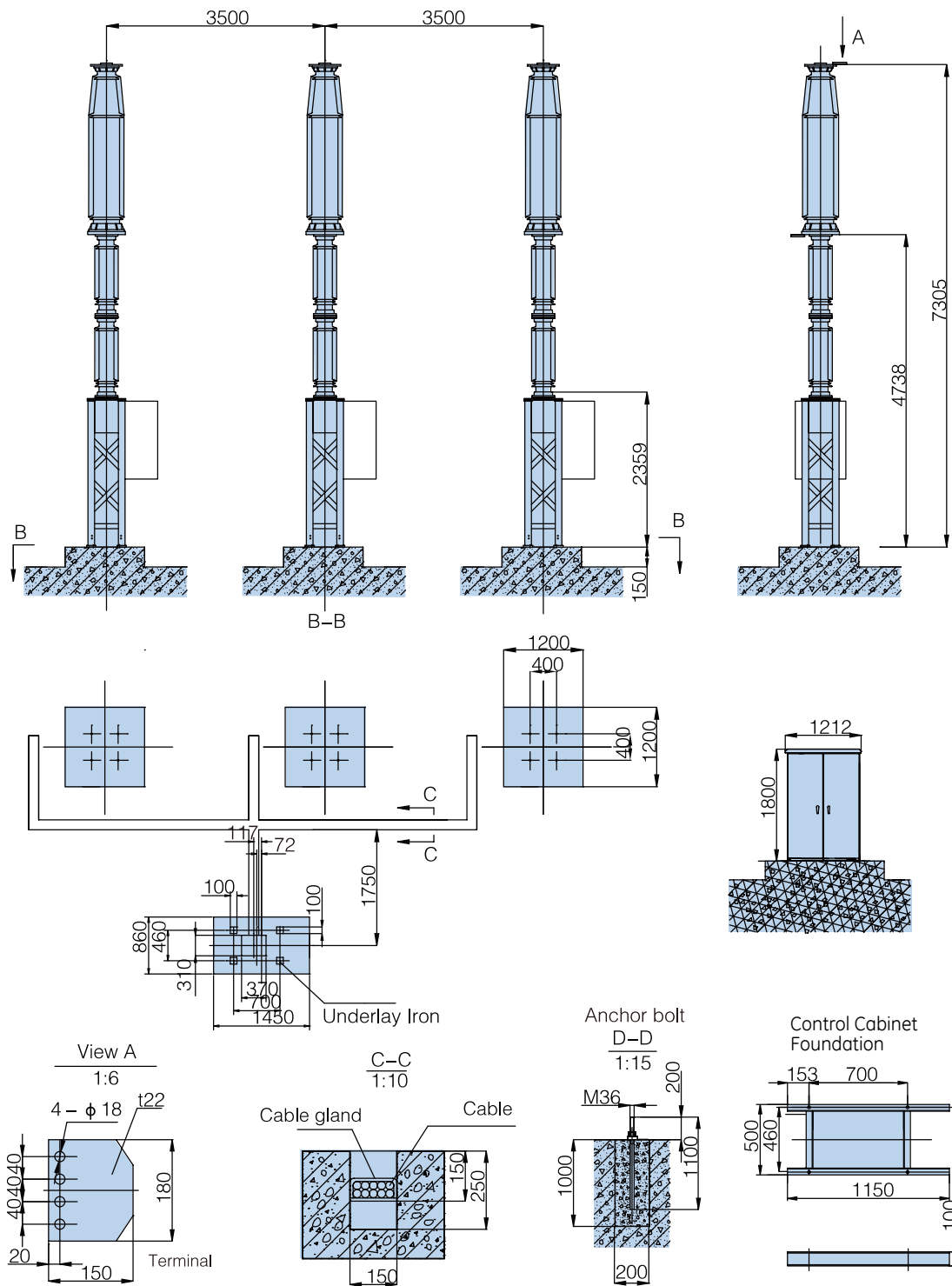
LW25-170



All measurements are in millimeters (mm)

# 252kV SF<sub>6</sub> Live Tank Circuit Breaker

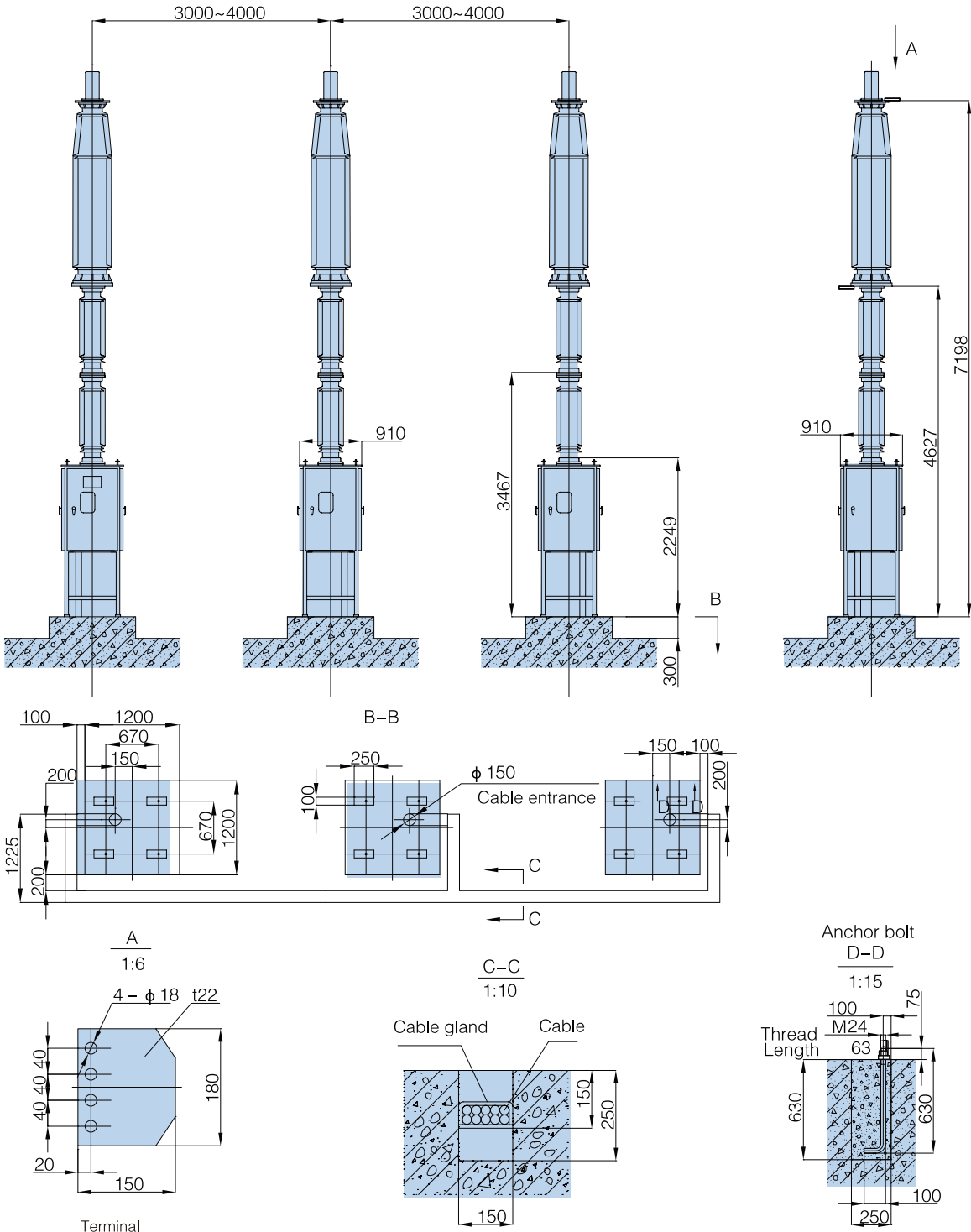
LW25-252





# 252kV SF<sub>6</sub> Live Tank Circuit Breaker

LW15C-252



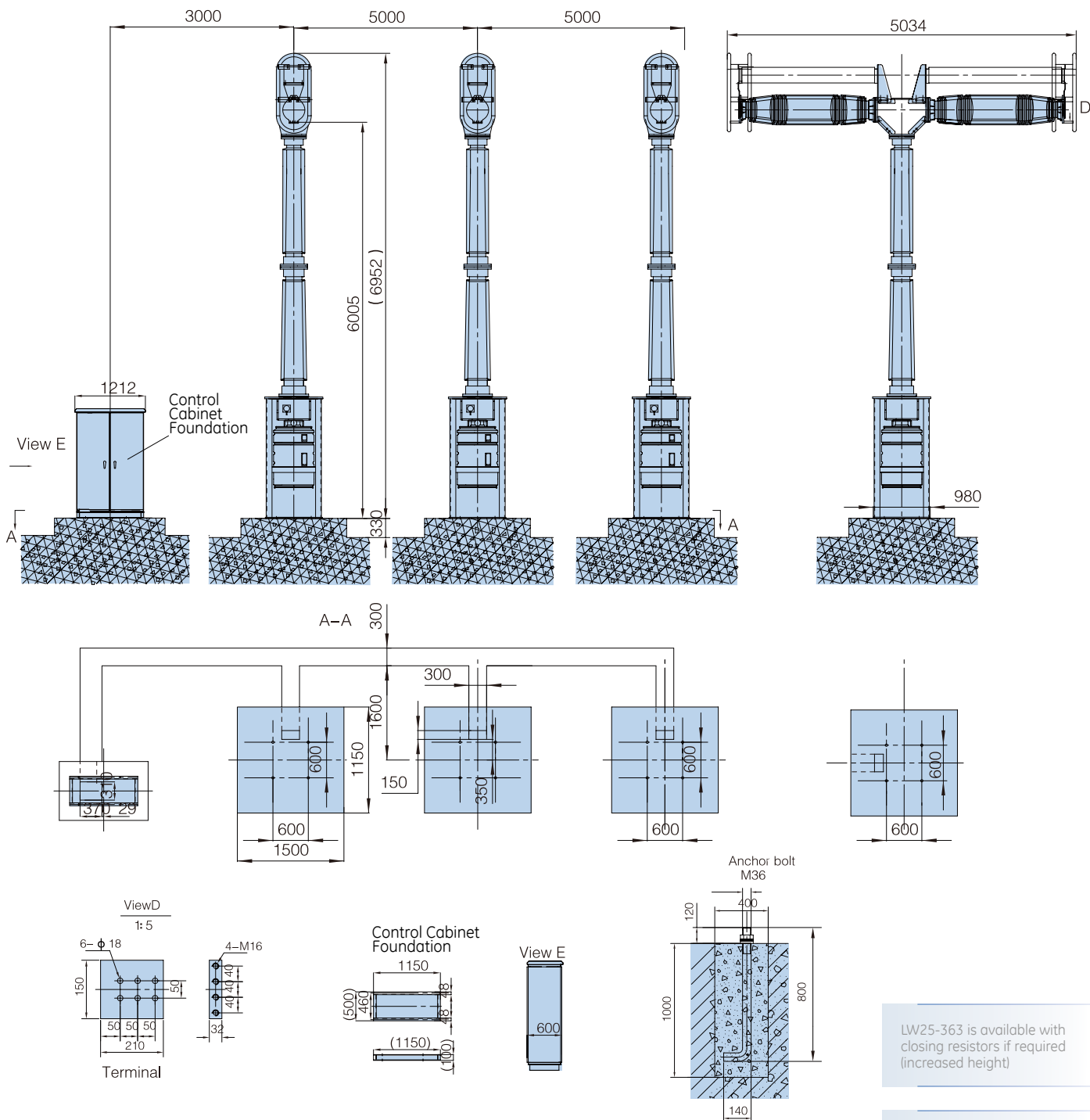
All measurements are in millimeters (mm)





# 363kV SF<sub>6</sub> Live Tank Circuit Breaker

LW15A-363

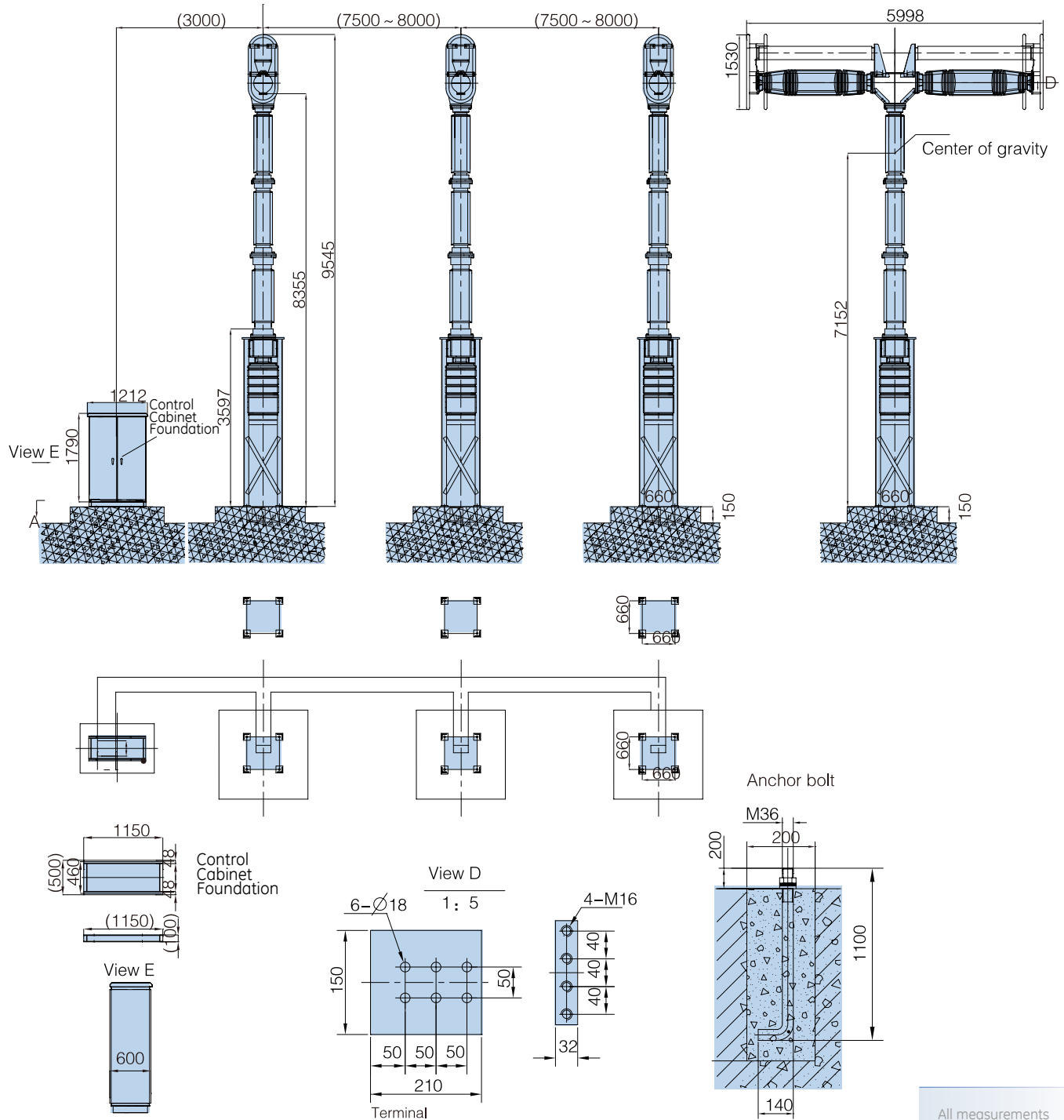


LW25-363 is available with closing resistors if required (increased height)

All measurements are in millimeters (mm)

# 550kV SF<sub>6</sub> Live Tank Circuit Breaker

LW15A-550



All measurements are in millimeters (mm)

# Technical Specifications

## Technical Data for 72.5-550kV Live Tank Circuit Breakers

PRODUCT TYPE	LW9A-72.5	LW25A-126	LW25A-145	LW25-170	LW25-252	LW15C-252	LW25-363	LW15A-363	LW25-420	LW15A-550
<b>1. Electrical Parameters</b>										
1. 1 Rated voltage (kV)	72.5	126	145	170	252	252	363	363	420	550
1. 2 Rated frequency (Hz)	50/60	50/60	50/60	50/60	50/60	50/60	50/60	50/60	50	50/60
1. 3 Rated continuous current (A)	4000	3150	3150	3150	4000	5000	4000	5000	4000	5000
1. 4 Rated short circuit breaking current (kA)	40	40	40	40	50	63	50	63	50	63
1. 5 Making current (kA)	100	100	100	100	125	160	125	160	125	160
1. 6 Rated peak withstand current (kA)	100	100	100	100	125	160	125	160	125	160
1. 7 Specific creepage distance (mm/kV)	25/31	25/31	25/31	25/31	25/31	25/31	25/31	25/31	25/31	25/31
1. 9 Short line fault breaking current (kA)	36/30	36/30	36/30	36/30	45/37.5	56.7/47.25	45/37.5	56.7/47.25	45/37.5	56.7/47.25
1.10 Out of phase breaking current (kA)	10	10	10	10	12.5	15.75	12.5	15.75	12.5	15.75
1.11 Rated short-time power-frequency withstand voltage (kV): To earth	160	230	275	325	460	460	510	510	630	740
1.12 Rated lightning impulse withstand voltage (kV): To earth	350	550	650	750	1050	1050	1175	1175	1425	1675



252kV Live Tank SF<sub>6</sub> Circuit Breaker



252kV Live Tank SF<sub>6</sub> Circuit Breaker



# Technical Specifications

## Technical Data for 72.5–550kV Live Tank Circuit Breakers

PRODUCT TYPE	LW9A-72.5	LW25A-126	LW25A-145	LW25-170	LW25-252	LW15C-252	LW25-363	LW15A-363	LW25-420	LW15A-550
<b>2. Mechanical Parameters</b>										
2.1 Type of mechanism	Spring					Hydro-mechanical				
2.2 Mechanical endurance (times)	≥5000	≥5000	≥5000	≥5000	≥5000	≥5000	≥5000	≥5000	≥5000	≥5000
2.3 Rated operating sequence	O-0.3s-CO-180s-CO									
2.4 Close time (ms)	≤100	≤100	≤100	≤100	≤100	≤100	≤100	≤100	≤100	≤100
2.5 Open time (ms)	≤30	≤30	≤30	≤30	≤30	≤30	≤30	≤30	≤30	≤20
2.6 Breaking time (ms)	≤60	≤60	≤60	≤60	≤60	≤60	≤50	≤50	≤50	≤40
2.8 Close-open time (ms)	40-50	40-50	40-50	40-60	50-70	40-60	40-60	40-60	40-60	35-45
2.9 Operating asynchronism (ms) Between poles										
Open	≤2	≤2	≤2	≤2	≤3	≤3	≤3	≤3	≤3	≤3
Close	≤4	≤4	≤4	≤4	≤4	≤4	≤5	≤5	≤5	≤5
2.10 Operating asynchronism (ms) Across break										
Open							≤2	≤2	≤2	≤2
Close							≤3	≤3	≤3	≤3
2.11 Number of breaks per pole	1	1	1	1	1	1	2	2	2	2
2.12 Three phase operation/ single phase	3p	3p	3p	3p/1p	1p	1p	1p	1p	1p	1p
2.13 Rated SF <sub>6</sub> gas pressure (Mpa)	0.5	0.5	0.5	0.6	0.4/0.6	0.6	0.6	0.6	0.6	0.6
2.14 Leakage of SF <sub>6</sub> gas per year (%)	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5
2.15 Weight (Kg)	1200	1400	1400	2500	3500	3500	6600	7200	200	10000

### Spring Operating Mechanism

Item	Unit	Ratings
Voltage of control & auxiliary circuit	V	DC110/DC220
Current of open winding	A	5.8/2/2.5
Current of close winding	A	3.3/2
Voltage of energizing motor	V	DC220/DC110/AC220
Voltage of heater	V	AC220

### Hydro-Mechanical Operating Mechanism for CB (CYA3, CYA4)

Item	Unit	Ratings
Voltage of control circuit	V	DC220/DC110
Current of trip coil	A	1.43/3.06
Current of close coil	A	1.43/3.06
Voltage of energy store motor	v	AC220/DC220/DC110
Power of energy-store motor	W	660/1100
Voltage of heater	V	AC220
Power of heater	W	100/250W
Related operating pressure of mechanism	MPa	44.9/53.1

# Ordering

	LW	*	-	*	/	*	*	-	*
SF <sub>6</sub> Circuit Breaker Outdoor	LW								
Design Sequence No.		9A 25 15A							
Rated Voltage				72.5 126 145 170 252 363 420 550					
Operating System: T: Spring Mechanism Y: Hydro-mechanical Mechanism						T Y			
Rated Current (A)							3150 4000 5000		
Rated Interrupting Current (kA)									40 50 63

Live Tank Circuit Breaker Product Line With Spring Mechanism:	Live Tank Circuit Breaker Product Line With Hydro-mechanical Mechanism:
LW9A-72.5/T3150-40	LW15C-252/Y5000-63
LW25A-145/T3150-40	LW25-363/Y4000-50
LW25-170/T3150-40	LW15A-363/Y5000-63
LW25-252/T4000-50	LW15A-550/Y5000-63

**Ordering Notes: Please provide the following information when ordering:**

- Type, description of product, and type of mechanism.
- Rated voltage, rated current, short circuit breaking current.
- Pollution class: class III or class IV.
- Control voltage of mechanism: DC220V or DC110V.
- Voltage of energy-store motor: AC/DC 220V or DC 110V.



## Grid Solutions

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